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Recent Trends In Engineering And Science

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The Boundary Layer Problem: A Fourth-Order Adaptive Collocation Approach

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Abstract – *A finite element approach, based on the cubic B-spline collocation, is presented for the numerical solution of a class of singularly perturbed two-point boundary value problems that possesses a boundary layer at one or two end points. Due to the existence of a layer, the problem is handled using an adaptive spline collocation approach constructed over a non- uniform Shishkin-like mesh, defined via a carefully selected generating function. To tackle the case of nonlinearity, if it exists, an iterative scheme arising from Newton's method is employed..The rate of convergence is verified to be of fourth-order and is calculated using the double-mesh principle. The efficiency and applicability of the method are demonstrated by applying it to a number of linear and nonlinear examples. The numerical solutions are compared with both analytical and other existing numerical solutions in the literature. The numerical results confirm that this method is superior when contrasted with other accessible approaches and yields more accurate solutions*

Keywords- *Singularly perturbed boundary value problems Boundary layer B-spline collocation Rate of convergence.*

INTRODUCTION

In this section, a fourth-order finite-element solution approach using cubic B-splines is presented for the following singularly perturbed boundary value problems:

$$-\epsilon y'' + p(x)y' + q(x)y = f(x, y), \qquad (1.1)$$

$$y(a) = \alpha \text{ and } y(b) = \beta \qquad (1.2)$$

where $a \le x \le b$, α, β are constants, ϵ is a very small positive perturbation parameter, and p(x) and q(x) are sufficiently smooth real-valued functions. Normally, additional assumptions such as roundedness are imposed on the coefficients (see [1]) in order to guarantee the existence of a unique solution and to have the layer in the neighborhood of one endpoint. This problem arises in transport phenomena in chemistry and biology (see [2,3] and the references therein) and has been studied extensively in the literature, for instance [3–5]. The problem is attractive and of special interest due to the existence of a thin boundary layer over which the solution varies quite rapidly, while away from the layer the solution behaves regularly and varies slowly, which complicates the numerical treatment of the problem and causes computational difficulties.

In recent years, there was a broad attention and increased focus by several authors on the numerical solution of singularly perturbed problems. A number of approaches were manipulated to tackle the boundary layer problem (1.1)–(1.2)and other similar or special versions of the problem. Lin et al. [3] used the B-spline collocation method to develop a numerical method for solving the corresponding homogeneous singularly perturbed boundary value problem of Eq.(1.1)that lead to a tridiagonal linear system. Wong and Yang [4] discussed the corresponding homogeneous case of(1.1)and used the method of successive approximation to show that under certain smoothness conditions on p(x) and q(x), an asymptotic solution is constructed, which holds uniformly for all x inside the given domain a x b. In a second paper [5], the same authors obtained an asymptotic solution for the same problem with new conditions imposed on the coefficients. Reddy and Chakravarthy [1] proposed a numerical patching method for the singularly perturbed two-point boundary value problem

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(1.1)where f is a function of x, using cubic splines. The method is distinguished by the following fact. The original problem is divided into two problems, namely, inner and outer region problems; the terminal boundary condition is obtained from the solution of the reduced problem. Using general stretching transformation, a modified inner region problem is constructed then both the inner region problem and the outer region problem are solved as two-point boundary value problems by employing cubic splines

The solution for such problems exhibits a multistage character, that is, the solution varies rapidly within the layer and varies slowly outside it. Piecewise-uniform Shishkin meshes (see [6,7]) played a major role to tackle these problems. These piecewise-uniform grids played a prominent role in numerical methods and presented an efficient strategy to handle the effects of the boundary layer. Lately, there has been substantial interest in implementing and analyzing methods based on these meshes and other closely related ones. Consequently the numerical method must be tailored very carefully to undertake the layer and must be robust in the sense that the error in the approximation must not deteriorate as the singular perturbation parameter ϵ approaches zero. The piecewise-uniform Shishkin meshes are not usually optimal but fairly attractive due to its simplicity and suitability in handling a wide range of singularly perturbed problems. The difficulty in the implementation of the Shishkin meshes is that one should have a priori knowledge about the nature and thickness of the boundary layer. In this paper, we present an adaptive grid technique [8], based on the B-spline collocation [9] on non-uniform Shishkin-like meshes for the solution of the boundary layer problem. The cubic B-spline finite element method (see [10–16,3,7,1]) is often used for solving nonlinear problems [17] that arise in engineering applications. The approach necessitates the redistribution of the nodes in order to have more points placed in regions of large variation of the solution, that is close to layers; the mesh is finer near the boundary layer but coarser otherwise.

The spline collocation method has been integrated with the adaptive technique to solve boundary-value problems on non-uniform meshes by mapping uniform node points to non-uniform ones such that the errors are reduced [10]. For instance, Khuri and Sayfy [11] used a similar finite element approach for the numerical solution of Troesch's problem. The method is used on both a uniform mesh and a piecewise-uniform Shishkin mesh, depending on the magnitude of the eigenvalues. This is due to the existence of a boundary layer at the right endpoint of the domain for relatively large eigenvalues. The problem is also solved using an adaptive spline collocation approach over a non-uniform mesh via exploiting an iterative scheme arising from Newton's method

The numerical solutions are compared with both the analytical solutions and the other existing numerical solutions in the literature. The convergence analysis is discussed and it is shown that the method has a fourth-order rate of convergence using the double-mesh principle. To demonstrate the performance and efficiency of the method a number of examples are considered. It is observed that the results obtained show the efficiency and superiority of this method compared to other available solutions.

The balance of this paper is organized as follows. In Section2, the cubic B-spline finite element method over a uniform mesh and the adaptive cubic B-spline over a non-uniform mesh approaches for the numerical solution of the boundary layer problem are described. In Section3, the technique is implemented for a number of special cases of the problem using the adaptive technique on non-uniform and Shishkin-like meshes. The results are compared with the exact solutions and some existing numerical solutions. Finally, in Section4a conclusion is given that briefly summarizes the results of the paper's content.

Numerical approach

In this section, the two numerical techniques are presented for solving the boundary layer problem (1.1)–(1.2) on the interval [a, b]. The approximate solution will be constructed over the node points xi, where a = x0 < x1 < ……< xN−1 < xN = b.

2.1. The B-spline collocation method over a uniform mesh

First, we will seek a finite-element solution over a uniform mesh. For this case we have xi=a+ih where i=0,1,2,3…….N Where $h=\frac{b-a}{N}$ Then let ψ(x) be a shape function that satisfies the two boundary conditions (1.2) and is expressed as a linear combination of N + 3 spline functions given by

Table value

B-spline	x_i	x_i+1	x_i+2	x_i+3	x_i+4
ψ_i	0	1	4	1	0

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ψ_i'	0	-3	0	-3	0
ψ_i''	0	$\frac{6}{h}$	$\frac{12}{h}$	$\frac{6}{h}$	0

The ai's are the unknown real coefficients and the ψi(x) are the cubic B-spline functions defined as follows:

$$\psi_i(x) = \frac{1}{h^3}\begin{cases}(x-x_i)^3, & [x_i, x_{i+1}]\\ h^3 + 3h^2(x-x_{i+1}) + 3h(x-x_{i+1})^2 - 3(x-x_{i+1})^3, & [x_{i+1}, x_{i+2}]\\ h^3 + 3h^2(x_{i+3}-x) + 3h(x_{i+3}-x)^2 - 3(x_{i+3}-x)^3, & [x_{i+2}, x_{i+3}]\\ (x_{i+4}-x)^3, & [x_{i+3}, x_{i+4}]\\ 0, & \text{otherwise,}\end{cases}$$

where h = xi+1 − xi. From (2.4), the values of ψi,ψ′ i and ψ″ i at the node points xi = a + ih are given according to the following table. We assume that the solution of problem (1.1) can be approximated by (2.3) where the coefficients {ai} are to be determined. Substituting the solution given in (2.3) into the differential equation (1.1) yields the following nonlinear system of equations.

$$-\epsilon\sum_{i=-3}^{N-1} a_i\psi_i''(x_j) + \sum_{i=-3}^{N-1} a_i p(x_j)\psi_i'(x_j) + \sum_{i=-3}^{N-1} a_i q(x_j)\psi_i(x_j) = f\left(\sum_{i=-3}^{N-1} a_i\psi_i(x_j)\right), \quad j = 0, 1, 2, \ldots, N.$$

This system consists ofN+1 equations inN+3 unknowns. The boundary conditions in (1.2) give the following two equations. For x = a we have

$$y(a) = \sum_{i=-3}^{N-1} a_i\psi_i(x_0) = \alpha.$$

For x = b we have

$$y(b) = \sum_{i=-3}^{N-1} a_i\psi_i(x_n) = \beta.$$

The values of $\psi_i(x_j)$, $\psi_i'(x_j)$ and $\psi_i''(x_j)$ at the nodal points x_j, $j = 0, 1, \ldots, N$ are determined from Table 1.
Therefore, the $(N+3)\times(N+3)$ system of equations in (2.5)–(2.7) can be written in matrix form as follows:

$$C = \begin{bmatrix} 1 & 4 & 1 & 0 & 0 & \cdots & 0\\ r_0 & s_0 & p_0 & 0 & 0 & \cdots & 0\\ 0 & r_1 & s_1 & p_1 & 0 & \cdots & 0\\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot\\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot\\ 0 & 0 & 0 & \cdots & r_N & s_N & p_N\\ 0 & 0 & 0 & \cdots & 1 & 4 & 1 \end{bmatrix}$$

$$r_j = -\frac{6\epsilon}{h^2} - \frac{3p_j}{h} + q_j, \qquad s_j = \frac{12\epsilon}{h^2} + 4q_j, \qquad p_j = -\frac{6\epsilon}{h^2} + \frac{3p_j}{h} + q_j, \quad j = 0, 1, \ldots, N,$$

given that , $p_j = p_{(x_j)}, \qquad q_j = q(x_j) \quad \text{where } x_j = a + jh,$

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$$\mathbf{f} = \begin{bmatrix} \alpha \\ f(a_{-3} + 4a_{-2} + a_{-1}) \\ f(a_{-2} + 4a_{-1} + a_0) \\ f(a_{-1} + 4a_0 + a_1) \\ \cdot \\ \cdot \\ \cdot \\ f(a_{N-4} + 4a_{N-3} + a_{N-2}) \\ f(a_{N-3} + 4a_{N-2} + a_{N-1}) \\ \beta \end{bmatrix}$$

and

$$\mathbf{d} = \begin{bmatrix} a_{-1}, & a_0, & \cdots, & a_{N-3} \end{bmatrix}^T.$$

The nonlinear system of equations given in (2.8) is solved using the computer algebra system Maple. Due to the limitation of Maple, the nonlinear system cannot be solved for fine uniform meshes (that is, for high dimensional system). On the other hand, to solve boundary value problems we need finer meshes only within the domain that is contained with the boundary layer whose length is less than the thickness of the layer. For this reason we use instead an adaptive technique bases on non-uniform meshes.

Adaptive spline collocation over a non-uniform mesh

In this subsection, we present the adapted spline collocation technique, based on non-uniform nodes, for the numerical solution of the singularly perturbed boundary-value problem (1.1)–(1.2). It is worth mentioning that this adaptive method applies exclusively for linear problems and, in the case of a nonlinearity, an iteration scheme arising from Newton's method should be applied first in order to linearize the problem.
To implement the approach, we need to opt a strictly increasing bijective function that maps the uniform nodes {xi} to non-uniform meshes with nodes {wi} which are positioned appropriately in order to reduce the error. In an ideal situation, one would like to redistribute the nodes such that we have almost the same error at each step, that is, the error is uniformly distributed along the meshes (see [10]). To achieve this, we need to carefully select a tailored grading function that redistributes the nodes with more near the boundary layer, that is to say, were quire a finer mesh in the boundary layer region
and coarser mesh in the regular region. For our problem, we chose to define the grading function [8] w := [a, b] → [a, b] to be one of the following:
Type I. Grading functions:

$$w(x) = (b-a)\left[1 - \frac{(1+k)^{\left(1-\frac{x-a}{b-a}\right)} - 1}{k}\right] + a,$$

$$w(x) = (b-a)\left[\frac{(1+k)^{\frac{x-a}{b-a}} - 1}{k}\right] + a.$$

The grading function w(x) redistributes the nodes with more nodes near x = a or near x = b according to Eqs. (2.9) or (2.10), respectively

Type II. Chebyshev–Gauss–Lobatto points (Lobatto points in short):

$$x_i = \frac{1}{2}\left(1 - \cos\left(\frac{i-1}{N-1}\pi\right)\right).$$

To de scribe the method, for the purpose of constructing an approximate solution on [0, 1], we first consider a uniform node point x0 < x1 < · · · < xN , where xi = ih, i = 0, 1, 2, . . . , N; h = 1/N. Then the above grading functions are used to redistribute the nodes over the interval [0, 1]. More specifically, we have the following.
(a) To have more nodes near x = 0 we use the Type I grading function on the interval [0, 1]:

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$$w_i = \frac{1+k-(1+k)^{1-x_i}}{k}.$$

For more nodes near x = 1 we use

$$w_i = \frac{(1+k)^{x_i}-1}{k}.$$

As k increases more nodes lie near the boundary layer.

(b) For a problem with layers at both ends, we use the Type II Chebyshev–Gauss–Lobatto function

$$z_i = \frac{1}{2}\left(1-\cos(i\pi/N)\right), \quad i = 0, 1, \ldots, N.$$

For a finer mesh near the boundaries we use the transformation

$$w_i = (1-\tau)\left(3z_i^2 - 2z_i^3\right) + \tau z_i,$$

where τ is the adjustment parameter. In case a redistribution is required on an interval [a, b], we can apply a simple linear transformation in order to map the interval [0, 1] onto [a, b].

The mesh selection strategy is based on Shishkin-like meshes [7], for which the thickness of the boundary layer is approximated first by

$$\sigma = \min\left(\frac{1}{2}, \frac{\epsilon \ln N}{a^*}\right),$$

$$\Omega = [0, \sigma] \cup [\sigma, 1],$$

or

$$\Omega = [0, 1-\sigma] \cup [1-\sigma, 1],$$

depending on whether the location of the boundary layer is at x = 0 or x = 1, respectively. Note that the thickness of the boundary layer, namely σ, will serve as the transition parameter between the two inner and outer regions. The number of points N is also divided between each part, depending on the value of σ.
where a∗ is a parameter independent of N and ϵ. Then the solution interval Ω is divided as the union of two subintervals Ω = Ω1 ∪ Ω2 where either

$$L[u(w)] \equiv r(w)u'' + p(w)u' + q(w)u = g(w),$$

where $w \in \Omega = (a, b)$, and the specified boundary conditions

$$u(a) = \gamma_0, \qquad u(b) = \gamma_1.$$

where w ∈ Ω = (a, b), and the specified boundary conditions

The adaptive technique is designed for linear problems. Thus, we will present its implementation for the numerical solution of the following linear boundary-value problem:

The solution u(w) is approximated by Ψ(w) which is a linear combination of spline functions given by

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$$\Psi(w) = \sum_{i=-3}^{n-1} c_i \Psi_i(w),$$

where $\Psi_i(w)$ is the non-uniform spline function defined by

$$\psi_i(x) = \begin{cases} \dfrac{(x-w_i)^3}{w_{i,3}\, w_{i,2}\, w_{i,1}}, & w_i \le x \le w_{i+1} \\ \dfrac{x-w_i}{w_{i,3}}\left[\dfrac{(x-w_i)(w_{i+2}-x)}{w_{i,2}\, w_{i+1,1}} + \dfrac{(x-w_{i+1})(w_{i+3}-x)}{w_{i+1,2}\, w_{i+1,1}}\right] + \dfrac{(x-w_{i+1})^2(w_{i+4}-x)}{w_{i+1,3}\, w_{i+1,2}\, w_{i+1,1}}, & w_{i+1} \le x \le w_{i+2} \\ \dfrac{w_{i+4}-x}{w_{i+1,3}}\left[\dfrac{(x-w_{i+1})(w_{i+3}-x)}{w_{i+1,2}\, w_{i+2,1}} + \dfrac{(x-w_{i+2})(w_{i+4}-x)}{w_{i+2,2}\, w_{i+2,1}}\right] + \dfrac{(x-w_i)(w_{i+3}-x)^2}{w_{i,3}\, w_{i+1,2}\, w_{i+2,1}}, & w_{i+2} \le x \le w_{i+3} \\ \dfrac{(w_{i+4}-x)^3}{w_{i+1,3}\, w_{i+2,2}\, w_{i+3,1}}, & w_{i+3} \le x \le w_{i+4} \\ 0, & \text{otherwise,} \end{cases}$$

where $w_{i,j} = w_{i+j} - w_i$. The coefficients c_i given in the definition of $\Psi(w)$ in (2.14) are the solution of the following system of linear equations:

$$\begin{aligned} &\Psi(w_0) = \gamma_0 \\ &\Psi(w_N) = \gamma_1 \\ &L\left[\Psi(w_j)\right] = g(w_j) - \mathcal{L}_p\left[\Psi(w_j)\right], \quad j = 0, 1, \ldots, N \end{aligned} \tag{2.16}$$

where $\mathcal{L}_p$ is the operator which gives optimum order [10] and is defined as follows:

$$\mathcal{L}_p[\Psi(w_0)] = \frac{r(w_0)h_0}{24}(5h_0 - 4h_1 + h_2)\frac{(h_0+h_1)\Gamma\left[S''(w_1)\right] - h_0\Gamma\left[S''(w_2)\right]}{h_1}$$

$$\mathcal{L}_p[\Psi(w_N)] = \frac{r(w_N)}{24}h_{N-1}(5h_{N-1} - 4h_{N-2} + h_{N-3})\frac{(h_{N-1}+h_{N-2})\Gamma\left[S''(w_{N-1})\right] - h_{N-1}\Gamma\left[S''(w_{N-2})\right]}{h_{N-2}}$$

$$\mathcal{L}_p\left[\Psi(w_j)\right] = \frac{r(w_j)}{12}h_j h_{j-1}\Gamma\left[S''(w_j)\right], \quad j = 1, 2, 3, \ldots, N-1$$

where

$$\Gamma\left[S(w_j)\right] = \frac{2h_j S(w_{j-1}) - 2\left(h_{j-1}+h_j\right)S(w_j) + 2h_{j-1}S(w_{j+1})}{h_{j-1}\left(h_{j-1}+h_j\right)h_j}.$$

For a uniform partition the above equations reduce to

$$\mathcal{L}_p[\Psi(w_0)] = \frac{r(w_0)h^2}{12}\left(2\Gamma[S''(w_1)] - \Gamma[S''(w_2)]\right)$$

$$\mathcal{L}_p[\Psi(w_N)] = \frac{r(w_n)h^2}{12}\left(2\Gamma[S''(w_{n-1})] - \Gamma[S''(w_{n-2})]\right)$$

$$\mathcal{L}_p\left[\Psi(w_j)\right] = \frac{r(w_j)h^2}{12}\Gamma[S''(w_j)], \quad j = 1, 2, 3, \ldots, N-1$$

where for a uniform partition $\Gamma[S(w_j)]$ reduces to the three-point central difference approximation formula for the second derivative, namely,

$$\Gamma\left[S(w_j)\right] = \frac{S(w_{j-1}) - 2S(w_j) + S(w_{j+1})}{h^2}. \tag{2.20}$$

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$$\Psi_i^{(r)} = \left[\Psi_i^{(r)}(\Psi_{i+1}), \Psi_i^{(r)}(w_{i+2}), \Psi_i^{(r)}(w_{i+3})\right],$$

for $r = 0, 1, 2$, system (2.16) reduces to the following $N + 3$ linear system:

$$\begin{aligned}
&\Psi_{-3,3}\, c_{-3} + \Psi_{-2,2}\, c_{-2} + \Psi_{-1,1}\, c_{-1} = \gamma_0,\\
&\Psi_{N-3,3} c_{N-3} + \Psi_{N-2,2} c_{N-2} + \Psi_{N-1,1} c_{N-1} = \gamma_1,\\
&r(w_j)\left\{\Psi''_{j-3,3}\, c_{j-3} + \Psi''_{j-2,2}\, c_{j-2} + \Psi''_{j-1,1}\, c_{j-1}\right\} + p(w_j)\left\{\Psi'_{j-3,3}\, c_{j-3} + \Psi'_{j-2,2}\, c_{j-2} + \Psi'_{j-1,1}\, c_{j-1}\right\}\\
&\quad + \left(q(w_j)I + \mathcal{L}_p\right)\left[\Psi_{j-3,3}\, c_{j-3} + \Psi_{j-2,2}\, c_{j-2} + \Psi_{j-1,1}\, c_{j-1}\right] = g(w_j), \quad \text{for } j = 1, 2, \ldots, N-1.
\end{aligned}$$

$$L[u(w)] \equiv r(w)u'' + p(w)u' + q^*(w)u = g^*(w, u),$$

where $w \in \Omega = (a, b)$, and the same boundary conditions

$$u(a) = \gamma_0, \qquad u(b) = \gamma_1.$$

$$r(w)u''_m + p(w)u'_m + q^*(w)u_m - \frac{\partial g^*(w, u_{m-1})}{\partial u}u_m = g^*(w, u_{m-1}) - \frac{\partial g^*(w, u_{m-1})}{\partial u}u_{m-1}$$

$$u(a) = \gamma_0, \qquad u(b) = \gamma_1.$$

$$\begin{aligned}
Lu^3_{\Delta[1]} &= g \quad \text{in } \Delta_w,\\
Bu^3_{\Delta[1]} &= \gamma \quad \text{on } T_{w\mathbf{B}},
\end{aligned}$$

and then u^3_Δ to be the spline which is forced to satisfy

$$\begin{aligned}
Lu^3_\Delta &= g - \mathcal{L}_p u^3_{\Delta[1]} \quad \text{in } \Delta_w,\\
Bu^3_\Delta &= \gamma \quad \text{on } T_{w\mathbf{B}}.
\end{aligned}$$

Here L is the operator given in Eq. (2.12), $\mathcal{L}_p$ defined in (2.17), while B is any specified mixed boundary conditions and for our case it is as given in (2.13). As for $T_{w\mathbf{B}}$, it is the set of boundary collocation points with respect to w. The next two theorems are taken from [10] (namely, Theorems 12, and 13, respectively).

Theorem 1 *([10]). If*

(A1) *the coefficients p and q, and the right-side g are* $\mathbf{C}[\Omega]$,
(A2) *the BVP* $L[u] = g$, $Bu = 0$ *has a unique solution,*
(A3) *the BVP* $u'' = 0$, $Bu = 0$ *has a unique solution,*
(A4) $u \in \mathbf{C^6}[\overline{\Omega}]$, $w(x) : \overline{\Omega} \to \overline{\Omega}$ *is a bijective map in* $\mathbf{C}^3$, *with* $w'(x) > 0$, $\forall x \in \overline{\Omega}$, $w^{-1} \in \mathbf{C^1}[\overline{\Omega}]$,

then $u^3_\Delta \in S^3_{\Delta_w}$ *defined by* (2.27) *exists, is unique, and satisfies the global error estimates*

$$\begin{aligned}
&\left\|\left(u - u^3_{\Delta[1]}\right)^{(k)}\right\|_\infty = \mathcal{O}\left(h^2\right), \quad k = 0, 1, 2,\\
&\left\|\left(u - u^3_{\Delta[1]}\right)^{(3)}\right\|_\infty = \mathcal{O}(h),
\end{aligned}$$

and the local error estimates

$$\left\|\left(u - u^3_{\Delta[1]}\right)^{(3)}(w_i)\right\|_\infty = \mathcal{O}\left(h^2\right), \quad i = 1, 2, \ldots, N.$$

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Define the Gaussian points $\delta_{ij} = x_i - \lambda_j h$; $j = 1, 2$, $i = 1, \ldots, N$, where $\lambda_1 = (3 - \sqrt{3})/6$ and $\lambda_2 = (3 + \sqrt{3})/6$. Let $w(x) : \overline{\Omega} \to \overline{\Omega}$ be a bijective function in C^3 with $w'(x) > 0$ for all x and let w_i be the set of collocation points.

Theorem 2 *([10]). Under the assumptions of Theorem 1, and the assumption that* $u'' - u^{3''}_{\Delta[1]}$ *has a smooth expansion at the collocation points* $u^3_\Delta \in S^3_{\Delta_w}$ *defined by (2.28) exists, is unique, and satisfies the global error estimates*

$$\left\| \left(u - u^3_\Delta\right)^{(k)} \right\|_\infty = \mathcal{O}\left(h^{4-k}\right), \quad k = 0, 1, 2, 3,$$

and the local error estimates

$$\left|\left(u - u^3_\Delta\right)'(x)\right| = \mathcal{O}\left(h^4\right) \quad \text{for } x = s_i \text{ and } w_i,$$
$$\left|\left(u - u^3_\Delta\right)''(\sigma_{ij})\right| = \mathcal{O}\left(h^3\right),$$
$$\left|\left(u - u^3_\Delta\right)'''(w_i)\right| = \mathcal{O}\left(h^2\right).$$

The coefficient of y″ in Eq. (1.1), which is the constant −ϵ, as well as p, q and f are assumed to be continuous; hence assumption (A1) of Theorem 1 is satisfied. We assume additional conditions imposed on the coefficients (see [1]) to ensure the existence of a unique solution of problem (1.1)–(1.2) and hence assumption (A2) is automatically valid. Since from (1.2) we have y(a) = α and y(b) = β, thus the solution of y″ = 0 subject to these two conditions is unique and is given by y = β−α b−a (x−a)+α. Thus assumption (A3) of Theorem 2 is valid.Wechose a number of grading functionsw := [a, b] → [a, b] in (2.9)–(2.11). The first one is

which is clearly a bijective map in C^3 that takes the interval $[a, b]$ onto $[a, b]$. In addition, we have

$$w'(x) = \left[\frac{(1+k)^{\left(1-\frac{x-a}{b-a}\right)}}{k}\right] \ln(1+k),$$

which is clearly greater than zero for our choice $k > 0$. Moreover, we can easily obtain the inverse function, namely,

$$w^{-1}(x) = b - \frac{(b-a)}{\ln(1+k)} \ln\left[1 + k - \frac{k(x-a)}{b-a}\right].$$

Clearly $w^{-1} \in C^1[a, b]$ and we will assume that the solution of (1.1)–(1.2) is smooth enough so that $u \in C^6[a, b]$. Thus the last assumption (A4) is satisfied and therefore the conclusion of Theorem 1 follows. Likewise for our second choice of Chebyshev–Gauss–Lobatto function

$$z_i = \frac{1}{2}(1 - \cos(i\pi/N)), \quad i = 0, 1, \ldots, N,$$

with transformation

$$w_i = (1 - \tau)\left(3z_i^2 - 2z_i^3\right) + \tau z_i,$$

the same analysis follows. We have

$$w_i' = 6(1 - \tau) z_i (1 - z_i) + \tau.$$

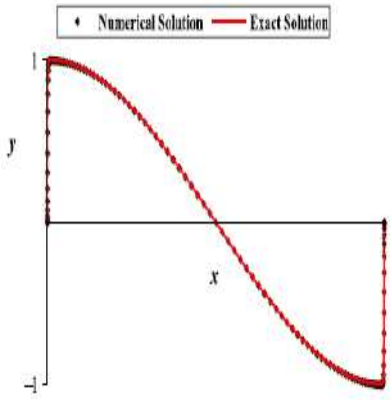

Fig. 2. Numerical solution of Example 2 for $p = 10^{-6}$ and $h = 1/128$.

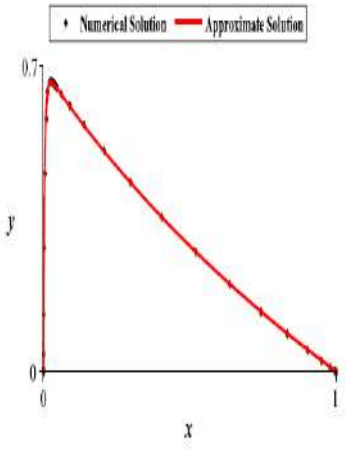

Fig. 3. Numerical solution of Example 3 for $\epsilon = 0.001$ and $h = 1/32$.

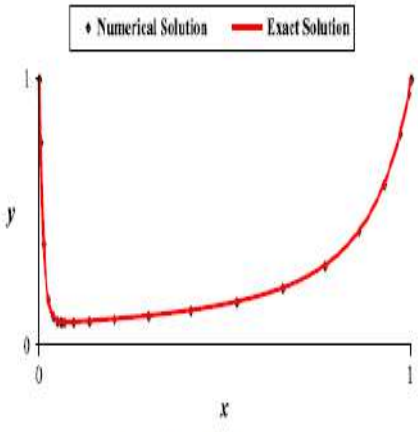

Fig. 4. Numerical solution of Example 4 for $\epsilon = 0.01$ and $h = 1/21$.

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Table 4
Numerical solution of Example 2 for $p = 10^{-6}$.

τ	h	ϵ	Maximum error (our method)	h	ϵ	Maximum error (method in [3])
0.05	1/128	10^{-2}	5.8309(−8)	1/1024	0.01	3.0(−3)
0.01	1/128	10^{-3}	4.9840(−7)	1/1024	0.0015	1.2(−3)
0.001	1/128	10^{-6}	2.5926(−5)			

Table 5
Rate of convergence of numerical solutions of Example 2 for $p = 10^{-6}$ and $\epsilon = 0.01$.

h	1/16	1/32	1/64	1/128	1/256
Max error	3.4073(−4)	2.0404(−5)	1.4916(−6)	9.5283(−8)	5.9618(−9)
Order		4.0617	3.7739	3.9685	3.9984

Table 6
Rate of convergence of numerical solutions of Example 3 for $\epsilon = 0.01$.

h	1/16	1/32	1/64	1/128
Error at $x = \sigma$	3.5685(−4)	1.8117(−5)	1.0171(−6)	5.8309(−8)
Order		4.2999	4.1548	4.1246

The layer's thickness is approximated by σ = 0.083177 and the uniformly distributed nodes are redistributed on [0, 1 − σ] and [1 − σ, 1] by using the grading function (2.10) and (2.9), respectively. The computational results are shown in Table 2 for different values of step size h and parameter ϵ, and the numerical solution for a special case is illustrated in Fig. 1. The order of the rate of convergence is presented in Table 3

CONCLUSION

In this paper, an adaptive spline collocation method over a non-uniform Shishkin-like mesh is applied for the numerical solution of the singularly perturbed boundary value problem (1.1)–(1.2). Such problems exhibit a computational complexity due to the existence of a boundary layer. Despite that, the method is robust and handles the layer with high efficiency and accuracy. As is evident from the numerical results, this method gives O h4 convergence rate and the outcomes are better than the stated existing numerical techniques. The success in the applicability of the considered algorithm, for the stated problem, suggests that the same numerical method may be applied to the solution of other singular perturbed problems, with boundary or interior layers that have rough behavior, which might arise, for example, in the modeling of chemical reactions, theory of plasma and other fields.

Numerical examples are presented to illustrate the effectiveness of using a non-uniform mesh concentrated near the boundary layer. The non-uniform mesh is constructed in such a way that the mesh is finer and more dense near the boundary and the selection depends on the value of the perturbed parameter ϵ (which is finer for smaller ϵ). The non-uniform mesh produces more accurate approximations for the solution while using less nodes than required on a uniform mesh. In addition, when a non-uniform mesh is used with nodes that are condensed in the neighborhood of the boundary layers, the error will be uniformly distributed; however the rate of convergence stays the same.

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Comparison of Ultrasound-Assisted Extraction of Estragole from Tarragon Leaves with Hydro-Distillation Method

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Abstract – *Comparative studies of ultrasound-assisted extraction (UAE) and hydro-distillation were performed to quickly extract estragole from tarragon (Artemisia dracunculus L.) dried leaves. Several influential parameters of the UAE process on estragole emissions (type of solvent, extraction cycles, solvent ratio to material, radiation time and particle size) were investigated and adjusted. It has been found that the UAE provides a faster release of estragole than hydrodistillation. The best parameters were solvent to material ratio of 8: 1 v / m, 96% (w / w) ethanol in water as solvent emitting solvent, particle size 1.18 mm, radiation time 5 min , 63 W output power, 9 pulses, and an ultrasonic frequency of 20 kHz. The detection of estragole by the UAE under optimal conditions was 44.4% based on dry discharge. The advantage of ultrasound was to reduce the extraction time (5 minutes) in relation to the classical hydrodistillation method (3 h). Experimental results also show that ultrasound-assisted extraction is an easy, quick, and effective way to extract volatile oil components from tarragon.*

Keywords- *Artemisia dracunculus L., Tarragon, Estragole, Ultrasound-assisted extraction, Essential oil, Hydrodistillation.*

INTRODUCTION

The genus Artemisia with about 800 species is important in industry because of its anti-bacterial, antifungal and insecticidal activities, and as a flavor and preservative agent in food products [1,2]. Artemisia dracunculus L. or tarragon is one of the most well-known, valuable and indigenous medicinal plants in Iran, commonly used as a spice agent or with medicinal effects such as the treatment of epilepsy and diabetes in traditional Iranian medicine [3 - 6]. There are many reports of this plant about anti-inflammatory, general tonic, wound healing, scalp relief, wound-fighting and digestive properties [7,8]. The biological properties and useful properties of tarragon are represented recently in the review [9]. Tarragon essential oil has antispasmodic, anti-inflammatory, neuromuscular and carminative effects and is used as an antifungal, antibacterial and antitumor agent [10 - 14]. Moreover, it is advised in cases of digestive problems, constipation, nausea, wind colic and flatulence [15 - 17]. Recently, the essential oil of tarragon has been used to reduce the oxidation rate of soybean oil under accelerated conditions at 60ºC (oven testing) [18]. Dry air parts for A. dracunculus L. has anticonvulsant and sedative activities due to the presence of monoterpenes in its essential oils [19]. In many studies on the composition of essential oils of tarragon, estragole (methyl chavicol or 1- allyl-4-methoxybenzene) was a major component. The chemical structure of estragole is shown in Figure 1. Estragole is used in the production of perfumes and flavors, and is found in some plants; for example, fennel, anise and basil are also found in these plants through the process of hydro-distillation [8,20]. This process takes a lot of time and energy.

Today, ultrasound-assisted extraction (UAE) is considered as an efficient method for extracting natural compounds from herbs because of allowing the penetration

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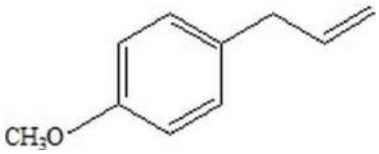

Fig. 1. *Chemical structure of estragole (methyl chavicol, 1- allyl-4-methoxybenzene).*

of solvents into molecular substances and increasing the mass transfer leading to improved output. The use of ultrasound-assisted extraction is recommended for thermolabile compounds, such as essential oils from aromatic plants such as orange blossoms [21], artemisia [22], lavender [23] or for strong residues of Salvia sp. [24]. The UAE has not only improved yields but as the method is faster and operates at lower temperatures, the final product usually shows a slight decrease in temperature than the hydro-distillation method. In addition, several studies have been completed on the extraction of fragrances from perfumes. For example, vanillin was extracted from vanilla pods [25] carvone from caraway seeds [26]. The use of ultrasound in the extraction of essential oils can reduce the risk of heat loss as demonstrated during the extraction of essential oils from the clove of fresh garlic (Allium sativum) [27]. Selection of the appropriate solvent in conjunction with ultrasound irradiation influences many transport processes and later efficient extraction efficiency. The solvent most commonly used to extract edible oils from plant sources is n-hexane, however, more recently, the use of other solvents such as alcohol (isopropanol or ethanol) has increased due to environmental concerns, health and safety [28,29] .

The purpose of this study was to hire the UAE to issue it estragole from tarragon in a short time. Various parameters such as type of solvent extraction, solvent / solid (solution) ratio, and ultrasound power and pulse number were tested and compared with the normal hydro-distillation process.

EXPERIMENTA

Chemicals and Plant Materials New leaves of Artemisia dracunculus L. are collected in June 2011 in Shahriar (Tehran, Iran), and dried in a room temperature (25-30 ºC) until continuous weight. After that, Dried tarragon leaves were ground in a laboratory by The blade mixer is then filtered with stainless steel to divide the particle size (0.15-1.18 mm) and store them labeled plastic with cap inside refrigerator at 4 ºC until use. Ethanol, Acetone, n-hexane, ethyl acetate and dichloromethane were available purchased from Merck (Darmstadt, Germany).

Hydrodistillation-

Herb substrate (40 g with particle size of 0.6 mm) was transmitted to the hydro-distillation system by use a Clevenger-type apparatus, and immersed in water 600 ml water 3 h. Essential oils are collected, dried under anhydrous sodium sulphate, and stored at 4 ºC until chromatographic gas (GC) and GC-mass spectrometric(GC-MS) analyzes.

Ultrasound-Assisted Background-

Ultrasonic probe, Sonopuls ultrasonic homogenizer HD2070 model, with MS73 probe, 20 kHz active frequency, amplitude of 70 W output, setting displayed at%10-100% off Bandelin (Berlin, Germany)was used for discharge tests. The investigation was there placed 1 cm from the top of the output cell, too then applied to 80% output amplitude and 3 pulses. Exactly 0.8 g of powdered plant powder (particle size,0.6 mm) was transferred to a 15 ml tube containing 8 ml extraction solvent. After immersing a sample of one plantat night in the solvent, it was attached to the probe in the chamber temperature. Impact of release conditions, including liquid / solid rate, ultrasound time, ultrasound power, functioncycles, the particle size of the plant powder and the type of solvent(i.e., acetone, n-hexane, ethyl acetate, dichloromethane, and50, 70 and 96% (v / v) of ethanol in water), in extraction the effectiveness of estragole was tested.

Similarly, another investigation was conducted eabsence of ultrasound radiation. All tests it was a repetition. Temperature at the end the background was about 30 ºC. After extracting and filtering,50 µl internal dose (5 mg ml-1 of thymol in methanol)added to 1 ml of supernatant extracted for GC analysis. Ethanol extraction, followed by sonication and filtration, 1ml of distilled water is transferred to 1 ml of supernatant.

Then the solution was Vortexes for 1 min and extracted per 1 ml of n-hexane. After dividing the upper layer, ithe release was repeated once again. In the end, everything the living layers were mixed again in 1 ml of this solution, similar to other samples, 50 µl of internal level added.

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GC and GC-MS Analysis-

Essential oils and ultrasound extracts are analyzed by GC-FID and GC-MS. All classification and analysiswere achieved with Thermoquest 2000 GC chromatograph with integrated silica capillary column (DB1;30 m × 0.25 mm, i.d .; 0.25 µm film thickness) followed FID. Nitrogen was used as a flowing gas average 1.3 ml min-1. The temperature of the column was the same arranged from 50 ºC to 70 ºC with 5 ºC min-1 ramp, then increase to 75 ºC (2 ºC min-1), 100 ºC (10 ºC min-1)and finally 260 ºC (30 ºC min-1). 1 µl of each release was presentinjected into a separate / non-isolated GC injection hole under separation Conditions with a separation ratio of 1: 5. Injector and detector temperatures of 250 ºC and 300 ºC, respectively. For GC essential oil analysis, aliquot 1 mgessential oil diluted with 1 ml of n-hexane again after that, 50 µl of the internal level was transferred to it.One µl of this solution was injected into the GC. Thymol, which was not in the extract, used as internal level. Mean values are defined as the relative relative value areas (estragole area / normal internal area) were used to compare different extraction methods.

C-MS analysis was performed on Hewlett-Packard HP 6890N GC Tool (Palo Alta, California, USA) combined with HP MSD 5973N quadruple mass spectrometer. Extracts and essential oils were available divided into capillary column of HP-5MS (30 m × 0.25 mm,i.d .; 0.25 µm film thickness). 0.5 µl of sample(distillate or excrete) injected at a ratio of 1:20.Column temperature was set from the beginning temperature 50 ºC to 100 ºC to 2 ºC min-1, next up to 200 ºC at 10 ºC min-1, and finally from 200 ºC to 260 ºCat a rate of 20 ºC min-1. Injector and ion source temperatures were 260 ºC and 250 ºC, respectively. Heliumit was used as a carrier gas with a flow rate of 1.1 ml1 minute. The ionizing power was 70 V. All data was available collected by obtaining a full scan spectra within the scanning range of 40-550 amu.GCchromatograms for estragolein essential oils and extracts are shown in Fig.-2

RESULTS AND DISCUSSION

Essential Oils Are Found By Hydro distillation

Compounds identified in tarragon essential oil, of course Indicators of retention and naming percentage, as well as Focusing on the most important compounds summarized in Table 1. Each of the peaks was observed in comparison to their retention indicators related to (C6-C25) n alkenes and true ones samples and literature [30] and their comparisons mass spectra in the Wiley 7 mass spectral library (NewYork, NY, USA). Variable combinations are known by GC-MS. As can be seen in Table 1, the main section states estragole (78.93%).

Ultratrasound-Assisted Extraction Enhancement

Circumstances-

Effect of solvent on estragole- release. I choosing an exhaust solvent has a huge impact on yield yield. As estragole is a little polar, the choice set of solvents, for example n-hexane, dichloromethane, ethyl acetate, acetone, and 50, 70 and 96% (v / v) ethanol water is made according to their polarities. Other test parameters are set as follows: liquid ratio to solid, 8: 1 (ml g-1); discharge time, 5 minutes in the surrounding area temperature; ultrasonic power, 80% with 3 cycles; and particle size of plant powder, 0.6 mm. The frequency of Ultrasound was adjusted at 20 kHz. As noted in Fig. 3, it the local estragole rate ranges from 0.12% to 0.84%. I the results showed that 96% ethanol is one of the best alternatives extraction of estragole from tarragon. Therefore, the subsequent tests were performed using 96% ethanol.

Impact of solvent / solid rate. Figure 4 shows thathigh yield output is achieved when solvent / solid ratio decreased from 20: 1 to 8: 1. The practice of low yield output with high solvent / solid concentrations also Vongsangnak, who discovered a great solvent volume does not lead to high saponin yields from built-in Panaxand ginseng cells in the microwave background [31].

The amount of extracted estragole was decreased at lower ratios of solvent/solid than 8:1 which may be due to the fact that when the solvent is saturated with the extracted compounds, there is not enough concentration gradient thus, the material transfer from the matrix and subsequently, the extraction process would be decreased considerably. Hence, the ratio of 8:1 was selected for further research.

Effect of ultrasound power on efficient extraction efficiency estragole. When the liquid / solid ratio (ml g-1) is adjusted to 8: 1, samples were released 5 minutes separately output power with a standard pulse value of 3. I the results showed that the

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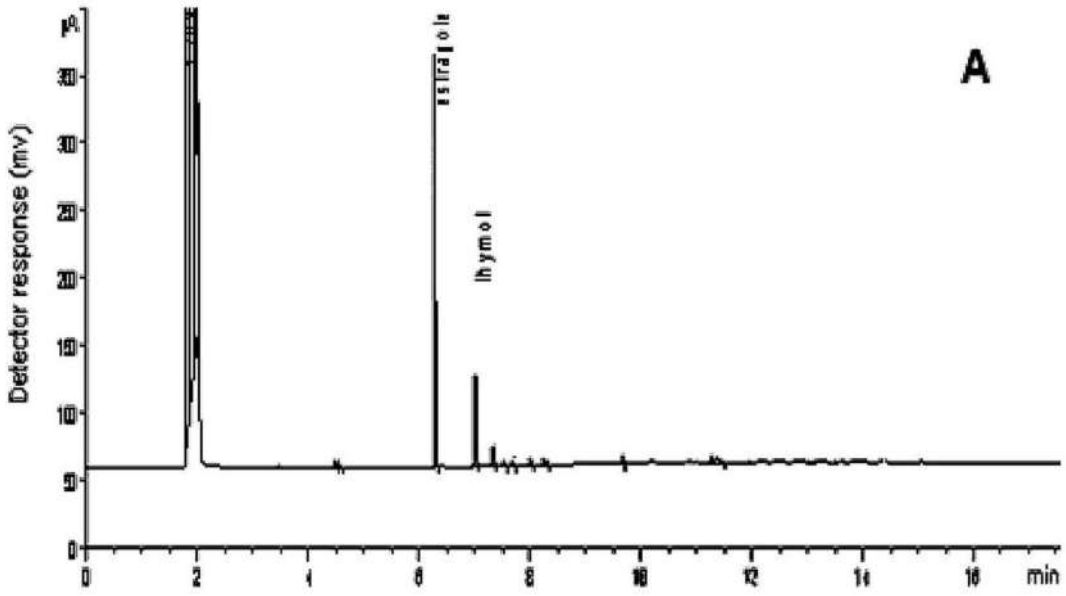
yield yield better by raising the power of ultrasound. Extending the the ability to produce additional bubbles is compacted and disturbed cell walls, leading to additional penetration of solvent in cells, further release of components from cells in solvent and enhancement in high transfer process. However, at high ultrasonic power compounds will rot; so 90% output power (63 W) was sufficient to reach the most desirable domain for estragole. Exposure mode for ultrasound and drive number. After examining the effect of ultrasound pulse number on the output efficiency, it was found that efficiency was apparently improved by increasing workload cycles up to 9. On the other hand, through continuous use radiation ultrasound probe may also be damaged energy consumption will be improved. Therefore, pulse mode may be used for safe profit better yield. These results were consistent with what previously reported by Sun [32] in improving the release the yield of all-trans-β-carotene from citrus leaves is UAE, too by Herrera [33] on the apparent influence of the activity cycle on the ultrasound background of phenolic compounds from strawberries.

Impact of ultrasound power on the effectiveness of the estragole domain: Once the liquid / solid (ml g-1) ratio was adjusted to 8: 1, the samples were extracted for 5 minutes with different extraction values with a constant pulse value of 3. The results obtained showed that the yield yield was improved by increasing the temperature. power of ultrasound. Increasing the capacity to produce more bubbles that break down and disrupt cell walls, resulting in more solvent penetration into cells, more release of components from cells to solvent and the development of a mass transfer process. However, at high power ultrasonic compounds will decompose; therefore 90% output (63 W) was sufficient to achieve the desired output of estragole.



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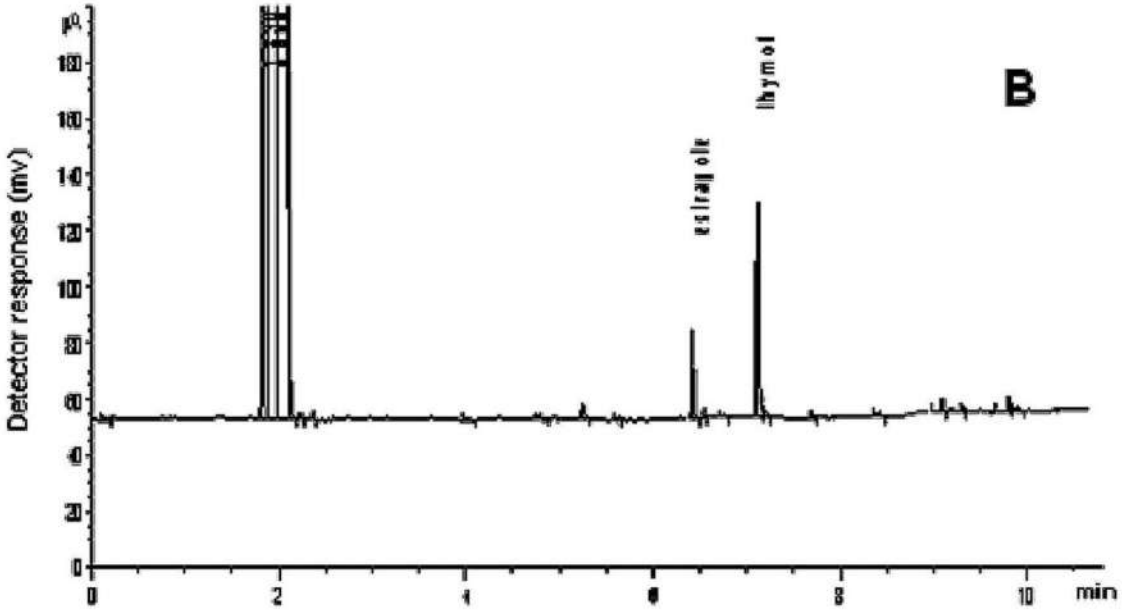

Fig. 2. *GC analysis of aromatic components tarragon essential oil (A), and in ultrasonic extracts (B).*

S.N.	Compound	Retention index	Area (%)
1.	α-pinene	938	2.50
2.	Limonene	1032	4.10
3.	β Phellandrene	1032	3.70
4.	(Z)-β Ocimene	1037	0.10
5.	(E)-β-ocimene	1050	0.33
6.	Myrtenol	1197	0.14
7.	Estragole	1199	78.93
8.	Anisaldehyde	1250	1.02
9.	Bornyl acetate	1289	0.90
10.	Eugenol	1359	0.52
11.	Metcinammate	1379	0.5
12.	Methyleugenol	1407	1.34
13.	(E)-β-Ionone	1489	0.41
14.	Anisylpropane	1512	0.58
15.	(E)ortho3Methoycimmat aldehyde	1529	0.97
16.	Germacrene D	1482	0.09
17.	Spathulenol	1578	0.21
18.	Monoterpene hydrocarbons	-	10.73
19.	Oxygenated monoterpenes	-	83.35
20	Sesquiterpene hydrocarbons	-	0.09
21.	Oxygenated sesquiterpenes	-	0.21
22.	Other compounds	-	1.96
23.	Total	-	96.34
24.	Yield (%)		0.65%

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[b]Retention indices relative to C6-C25 n-alkanes calculated on non-polar HP5MS capillary column.

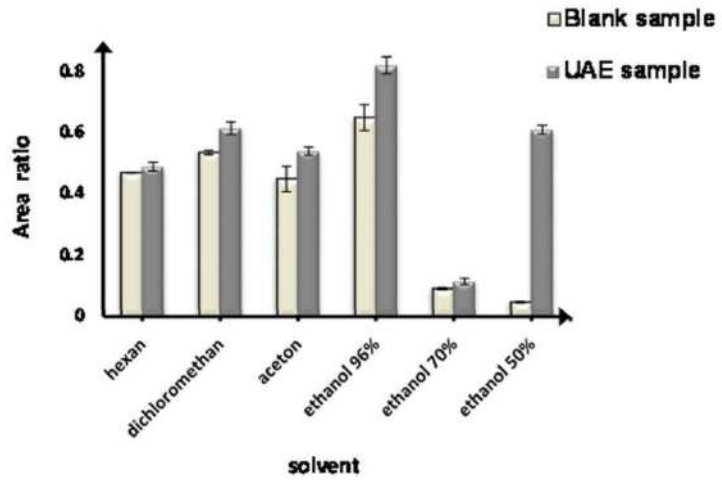

Fig. 3. *Effect of solvent on extraction yield of estragole under output power of 56 W,* 3 pulses, solid/liquid ratio of 1:8 and plant particle size of 0.6 mm, using 96% ethanol at ambient temperature for 5 min

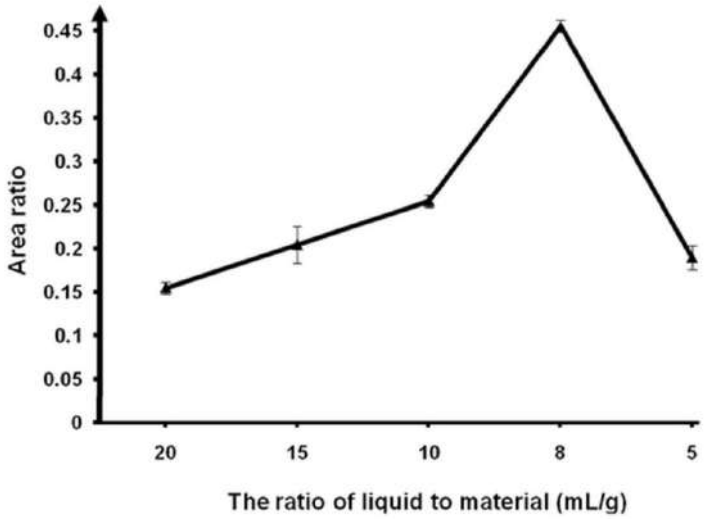

Fig. 4. Effect of liquid/solid ratio (ml g-1) on estragole extraction efficiency by UAE under output power of 56 W, 3 pulses and plant particle size of 0.6 mm, using 96% ethanol at ambient temperature for 5 min

Effects of ultrasound exposure mode and pulse number: After examining the effect of pulse ultrasound number on output efficiency, it was found that efficiency has improved by increasing the work cycles to 9. On the other hand, by means of continuous radiation the ultrasound probe can be damaged as well as the use of electrical energy. will be upgraded. Therefore, pulse mode may be used to obtain a better yield safely. These results were consistent with what previously reported by the Sun [32] on improving the yield of all-trans-β-carotene extracts from citrus leaves by the UAE, and Herrera [33] on the apparent impact of the activity cycle over ultrasound extraction of phenolic compounds from on strawberries.

Effect of ultrasound time on extraction of Estragole: The effect of the ultrasound time on the extraction efficiency was tested with 90% ultrasound power, 9 cycles, and a solvent / solid ratio of 8: 1. Figure 5 shows that the amount of estragole increases significantly by improving the release time from 0 to 5 min due to the greater transfer of estragole from cellular solvent to solvent through diffusion and osmosis. Similar effects were achieved in the extraction of all-trans-β-carotene from citrus leaves [32]. Therefore, 5 minutes was selected as the maximum ultrasound time for subsequent studies.

Effect of particle size on extraction of estragole. In a previous study, particle size was identified as one of the key factors

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that could affect the effectiveness of terpenoid extraction in solutions [34, 35], therefore, particle sizes of 0.15, 0.3, 0.6 and 1.18 mm were selected for this task. The results confirmed that by reducing the particle size, the amount of estragole in extracts decreased. Zhao reported that by reducing particle size, dispersion would no longer be an important step in the release of such small particles; therefore the yield yield will not be better [36]. However, small particles remain on top of the solvent throughout the extraction; this may result in their limited exposure to ultrasonic waves. Meanwhile, essential oils may be lost on the surface of the small particles during grinding. Accordingly, the correct size was set at 1.18 mm.

Comparison between Ultrasound-Assisted Extraction and Hydro-Distillation: Table 2 represents the best parameters obtained by the UAE. Following a 5-minute release by USE, using 10 ml of 96% ethanol and a solvent / solid dose of 8: 1, recovery was approximately 44.4%, and after 3 hours by -hydro-distillation was 85.3%. As a result, the use of ultrasound in the extraction of essential oils from dried tarragon leaves, offers significant benefits over the traditional method, namely: shorter extraction time (5 minutes versus 180 min of hydrodistillation), lower cost (as a low cost of nan- toxic solvent) compared to hydrodistillation which used a large amount of water and energy and emitted carbon dioxide into the atmosphere. Morovere, using heat and water for hydrodistillation accelerated many reactions, especially hydrolysis, trans-esterification or oxidation, so some of the essential oil compounds were degraded.

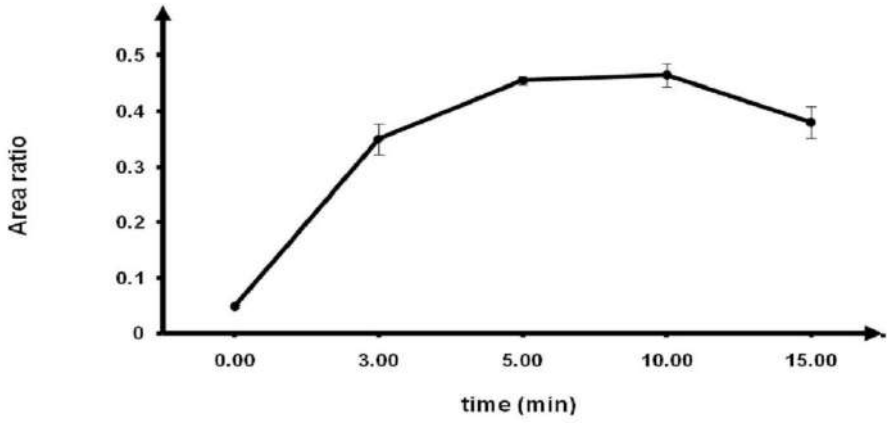

Fig. 5. *Effect of ultrasound time on extraction efficiency of estragole under output power of 63 W, 9 pulses, solid/liquid ratio of 1:8 and plant particle size of 0.6 mm, using 96% ethanol at ambient temperature.*

Table 2. *Optimization of Ultrasound-Assisted Extraction of Estragole from Tarragon Extract*

Variable	Tested range	Optimum value
Irradiation amplitude output (%)	0-70 w	63
Pulse	3-9	9
Irradiation time (min)	0-15	5
Ethanol (%)	50-96	96
Temperature (ºC)	Ambient temperature	Ambient temperature
Extracting volume (ml)	10	10
Liquid: solid ratio(mlg^{-1})	5-20	8
Probe position	1 cm	1 cm

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CONCLUSIONS

Ultrasound-assisted extraction method of Ultrasound at 20 kHz was used to extract estragole from the dried leaves of Artemisia dracunculus L. The ultrasonic wave technique was a powerful tool that successfully improved the extraction efficiency of estragole in a short time using food. solvent (96% ethanol). The effects of other experimental parameters on estragole emissions were assessed, and the appropriate conditions were 8: 1 liquid / solid (ml g-1), particle size 1.18 mm, and US radiation time of 5 minutes (output power). , 63 W; 9 pulses). Under the best conditions, the yield of estragole was 44.4%. The results obtained were more favorable for faster estragole release in a faster, less expensive and simpler way without the use of a higher amount of energy compared to conventional methods (hydro-distillation).

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Chapter No-03, PP. 20-22

A Review on an Effect of Age on Pharmacokinetics of Drug

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Abstract – *Older people have physiologic changes in organ function related to ageing or to specific diseased conditions. An aged person is characterized by impairment in the function of many regulatory processes that provide functional integration between cells and organs. Therefore, there may be a failure to maintain homeostasis under conditions of physiological stress. The change in homeostatic ability disturbs different regulatory systems. These changes can affect drug pharmacokinetics in older individuals. Pharmacokinetics is also called ADME (Absorption, Distribution, Metabolism, and excretion) study. Pharmacokinetic changes include an increase in volume of distribution and a reduction in renal and hepatic clearance. This article review focuses on the main age-related physiological changes affecting different organ systems and their implications for the pharmacokinetics of drugs.*

Keywords *: Ageing, pharmacokinetics and homeostasis*

INTRODUCTION

Ageing is the progressive accumulation of more or less random changes. Ageing is not a single entity but collective term representing the sum of cumulative local effects at the molecular cellular and tissue level. The most consistent is the time-related loss of function units. These units are small in structure but capable of performing the specific physiological activities (e.g. nephrons, alveoli or neurons.) (1) Aged persons have impairment of some of the regulatory processes that give functional integration between cells and organs. Consequently, there is a failure to maintain homeostasis under conditions of physiological stress. Ageing produces anatomical and physiological changes which might lead to decompensation of the relevant system when they progress beyond threshold. Some main age-related physiological changes are discussed. This is followed by description of the age-related changes in pharmacokinetics. (1)

PHARMACOKINETICS IMPLICATIONS

- **Drug Absorption-** Earlier studies reported some age-related effects, including reduced gastric acid secretion and gastric emptying, and reduced absorption capacity of the small intestine, probably due to the effects of disease conditions. More recent reports have not confirmed these kinds of changes in healthy people.(3)

  The absorption of vitamin B12, iron, and calcium through active transport is reduced. (4)
  Absorption of levodopa is increased.
  Transdermal absorption may be delayed in the case of water-soluble drugs. (5)

- **First-pass metabolism and bioavailability**

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Ageing is associated with a reduction in first-pass metabolism. This is probably due to the reduction in liver mass and blood flow. As results, the bioavailability of drugs undergoing first-pass metabolism can be significantly increased. (6)

Several ACE inhibitors are pro-drugs and need to be activated in the liver. Therefore, their first-pass activation might be slowed or reduced with advancing age. (7)

- **Drug Distribution**

As a result of the age-related changes in body composition, water-soluble drugs tend to have a lower volume of distribution (Vd) resulting in higher serum levels in older people. (8) Lipid soluble or non-polar drugs have higher Vd with age. The main effect of the increased Vd is a prolongation of the half-life. Increased Vd and t1⁄2 have been observed for some drugs such as diazepam, lignocaine and thiopentone.

The reduction in Vd for water-soluble drugs tends to be balanced by a reduction in renal clearance (CL). Vd is affected by protein binding. Acid drugs such as diazepam, warfarin, and salicylic acid bind to albumin. Basic drugs like lignocaine and propranolol bind to alpha1 acid glycoprotein. (9)

Although no substantial age-related chances in the concentration of both these proteins have been observed. (10)

- **Drug Metabolism and Excretion**

The primary organ is liver and its mass significantly reduced with advancing age.

The drug clearance is also depends on liver on the capacity to extract the drug from the blood passing through the organ and the amount of hepatic blood flow. (11)

The latter is dependent on the metabolism capacity of the liver

Several studies have shown significantly reduction in the clearance of many drugs metabolism by phase-1 reaction in the liver. The main factor is probably represented by the age-related changes in liver size and hepatic blood flow. (12)

Some pharmacokinetics studies have reported that factors such as cigarette smoking do not induce drug metabolism in older people to the same extent as in younger people.

Recently, it has been observed that reduction in renal function may significantly affect not only renally excreted drugs but also drugs undergoing extensive metabolism in the liver.

A decrease in liver cytochrome P450 activity, secondarily to reduce gene expression, has been observed in renal failure. Therefore, the age-associated reduction in renal function might potentially affect drug metabolism in the liver. (13)

CONCLUSION

As old age affects the whole body mechanism and drugs pharmacokinetics parameters, we need to develop a dose regimen for old age people to maximize the effectiveness of drugs and minimize the side-effect. In future, will develop different types of formulations that are based on old age Patient's needs.

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A Review on Natural and Synthetic Anthelmintics

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Abstract – *Parasitic infection is affects millions of people around the world. In this Review we discuss the use of synthetics compound and herbal plants as anthelmintics. The plants have been used the centuries. The nature is a store that gives us a cure for every disease, many synthetic anthelmintic drugs are available in the market which having many side effects on the human body. Plants always base of study to see different activity. In this paper included many plants which have the activity of anthelmintics. Natural plants have no side-effect compare to synthetic compound, so we provide a list of plants use in anthelminatics. Using research based plants to develop a new formulation with minimize side-effect.*

Key word- *Anthelminatics, Animalia ,Helminths, Nematoda.*

INTRODUCTION

Helminthatic is a major problem in developed and developing countries, aroundtwo billion people affected by helminthatic (intestinal nematodes). (1) .The disease which is caused by helminthes is chronic and debilitating in nature, they probably cause more morbidity and greater economic and social deprivation among humans and animals than any other single group of parasites. The parasitic gastroenteritis is caused by mixed infection with several species of stomach and intestinal worms, which results in weakness, loss of appetite, decreased feed efficiency, reduced weight gain and decreased productivity. (2, 3)

1.1 -Classification of worms-

The worms belongs to kingdom Animalia and phylum Nematoda .On the basis of shape nematode are round,thread,hook ,filarial and whipworm. (4)The worm changes its size accordingly with different body structure. The larva of nematode infected various human tissues. The larvae migrate through the liver, eyes, brain and so on they cause a granulomatous inflammatory reaction. These are accidental infections, and do not represent the natural life cycle of the parasite. The larvae may be spread by infected faces, water, food, and via vectors. (5).

1.2-Anthelminatic drugs- Anthelmintics are which drugs that are used in expel out the worms that are parasitic in nature by suppression them or by killing them.(6)

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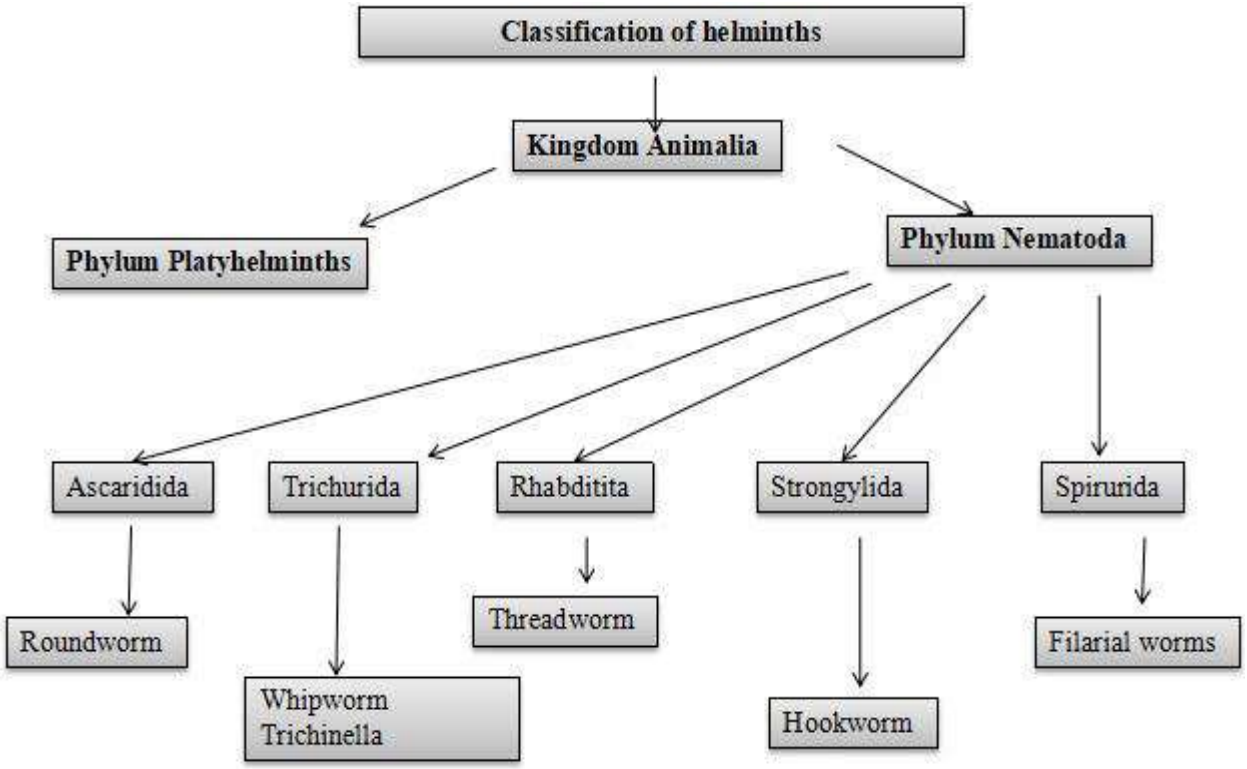

1.2.1-Synthetic anthelmintic or chemical anthelmintic- on the basis of chemical compound the anthelminatics are followed-

1. Piprazine
2. Benzimidazole
3. Imidazithazol (Lavamisole)
4. Spiroindole
5. Macrocyclic Lactones (Ivermectin)
6. cyclodepsipeptide(Emodepside)
7. Nitrozoxanide

1 .Piprazine- Piprazine is popular and readily used in the treatment of parasitic infection. It was first introduced in 1950 as anthelminatic. It is mostly used in thread worm infections in children. The mode of action of piprizine is a weak GABH –mimetic agent. It binding to muscles membrane GABH receptor causing hyperpolarization of nerve ending and worm flaccid paralysis or reversible paralysis of body wall muscle. (7)

2. Benzi-imidazole-Thiabendazole was the first benzimidazole anthelmintic agent.It was introduced in 1961. A number of benzimidazole developed with improved efficacy and extended spectrum of action. The other member of Benzimidazole is mebendazole, albendazole and flubendazole. The mode of action of benzimidazole is impairment of microtubule polymerization interference with the microtubule medated transport of secretary vesicle in parasite absorptive tissue and it inhibit of various parasite metabolic enzymes including fumaratereductase and malate dehydrogenase. This results in the destruction of cell structure and consequent death of the parasite. (8)

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3. Imidazothizole derivatives-Levamisoleis imidazothhizole derivative, it is the pure L-isomer of tetramisole. It is an agonist of nicotinic acetylcholine receptors (nAChRs), for this reason it causing muscle contractions and spastic paralysis of the worms,

Morantelis - methyl ester analogue of pyrantel, both of which target the L-subtype nAChR in Ascarissuum . Recently,morantel was shown to act as an agonist of the nAChR subtype comprising ACR-26/ACR-27 subunits from Haemonchuscontortus or Parascarisequorum, expressed in Xenopuslaevis oocytes.(9)

4. Spiroindole-Paraherquamide A and marcfortine A are both members of the spiroindolefamily.The mode of action of Paraherquamide and its family mamberinduce flaccidparalysis. Uncoupling of oxidative phosphorylation from electron transport inhibit electron transport. (4)

5. Macrocyclic Lactones

MilbemycinsAvermectins- The introduction ofMilbemycinsAvermectin was in 1980.It is a group of broad- spectrum, macrocyclic, lactone antibiotic anthel- mintics used to control nematode parasites in man and animals .The mode of action of the avermectins is to selectively paralyse the par-asite by increasing muscle CI- permeability.

Ivermectin**-**Ivermectin (22.23-dihydroavermectin Bl), a derivative of avermectin A, is a member of the family of substances produced by Strepto-mycesavermitilis .Ivermectin was introduced as an anthelmintic in the 1980s by Merck. It is a semi-synthetic derivative of avermectin which is a large macrocyclic lactone fermentation product of the micro-organism Streptomyces avermitilis. Anthelmintic Activity Ivermectin is active against many nematode species (has stage specificity), insects and acarine parasites. Preliminary tests indicate that the drug is not active against trematodes and cestodes [16-27-31]. Ivermectin has not been tested against gas-trointestinal nematodes in humans. Ivermectin appears to paralyze nematodes and arthropods (10)

6 .**Cyclodepsipeptide - Emodepside**Emodepside iscyclodepsipeptide molecule and semi-synthetic derivative.it preapread by fermentation process from the fungus, Mycelia sterilia. It has anthelminaticactivity.itscauses muscle paralysis in parasites. (6)

7 .Nitazoxanide – It is a member of the thiazolide family and effective against intestinal parasites (e.g., Cryptosporidium parvum and Giardia lamblia); Helicobacter and Clostridium-driven bacterial infections; and viral infections the mode of action of nitazoxamide is interference with the pyruvate ferrodoxinoxidoredudase enzyme dependent electron transfer reaction which is causing death of paralysis.(11,)

1.2.2- Table 1-List of drug used in type of worm infection-(4)

Sr.No	Name of drug	Type of worms causes infection
1.	Piperazine	Intestinal round worms
2	Benzimidazole	Intestinal round worms and Cestodiasis (tape worm)
3	Oxamnaquine	Chistosomiasis (blood Fluke)
4	Praziquantel	Chistosomiasis (blood Fluke and Cestodiasis (tape worm)
5.	Morantel	Intestinal round worms

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6	Pyrantel	Intestinal round worms
7	Levamisole	Intestinal round worms
8	Avermectins and milbemycins	Intestinal round worms
9	Tribendimidine	Intestinal round worms
10	Albendazole	Cestodiasis (tape worm) and Filariasis (tissue round worms)
12	Niclosamide	Cestodiasis (tape worm)
13	Triclabendazole	Fasciolasis (liver fluke)
15	Diethylcarbamazine	Filariasis (tissue round worms)
16	Ivermectin	Filariasis (tissue round worms)

1.3- Plants used in anthelminatic- In the ancient time the peoples was used plants to cure diseases. Nature is providing a complete store of remedies to cure all ailments of mankind and it's relating disease. Humane is more affect to disease compared to animals. The history of herbal medicines is as old as human civilization. The plants were used medicinally in China, India, Egypt and Greece long before the beginning of the Christian era.Today many plants used in anthelminitics drugs. . However the high costs of modern anthelminatic have limited effective control of the parasites. In some cases, wide spread use of low quality anthelmintics are used for the development of resistance and hence causes reduction in use of anthelmintics . Only few of plants are being used traditionally as anthelmintics,(6)

Table 2-list of plants used in anthelminitics-

Sr.No	Name of plant	Family	Parts used	Active against	Reference
1	Acacia albida	Fabaceae	Seeds	helminthes	Goswami et al (2013)
2	Adhatodavesica	Acanthaceae	Roots	Nematodes	MuhmmadLateef et al (2003)
3	Agrimoniaeupat	Rosaceae	Leaf and root	helminthas	Altaf H et al (2008)
4	Allium sativum	Lillaceae	Pulp	helminthes	ErolAyaz el al (2008)
5	Azadirachtaindica	Meliaceae	Cake and leaves	helminithas	NirmalaJamra et al (2015)
6	Annonasenegalensis	(Annonaceae)	bark, root	helminthas	E.Ferreira el al (2013)
7	Buteafrondosa	Fabaceae)	Seeds	Ascaris	Vinayak et al (2018)
8	Buteamonosperma	Fabaceae	Leaf, bark,root and flower	Tapeworm	D Prashanth et al (2001)
9	*calamusguruba*	*Arecaceae*	Leaves	helminthes	Sajan Das et al (2017)
10	Clitoriaternatea Linn	*Fabaceae*	Root	helminthes	Kirtikar, K.R et a (1991)
11	Carica papaya	Caricaceae	Leaf and steam	Tapeworm	Saumendu Deb Roy et al (2012)
12	Caesalpiniabonducella	Caesalpiniaceae,	Leaves	helminthes	Shyamalima el al (2016)
13	Cassia spectalis	(Fabaceae)	Roots	Round worm	Sri Wahyuni et al (2019)
14	Chenopodium album	Chenopodiaceae)	Leaves	Nematodes	AbdulJabbar el al (2007)
15.	Carumcopticum	Umbellifere	Seeds	Ascaris	Chaudhary el al (2007)
16	*Dicerocaryumeriocarpum*	Pedaliaceae	Root and leaves	Nematozoa	TeedzaiChitura et al (2019)
17	Daturaquercifolia	Solanaceae	Fruits	Ascaridia	Shaimaa et al (2016)
18	Embeliaribes	Myrsinaceae	Seed	Tape worm	PrashithKekuda et al (2009)
19	Fumariaparviflora	(Fumariaceae)	Plant powder	Helminithas	Knan et al (2014)

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20	Guazumaulmifolia Lam	*Sterculiaceae*	Leaves	helminthes	Kazuma, K et al (2003)
21	Helleborusniger	Ranunculaceae	Steam	Ascaris	Kumar et al (2017)
22	MadhucaindicaGmel	*Sapotaceae*	Leaves and flower	helminthes	Domínguez et al (1985)
23	Inularacemosa	Asteracea	Essential oil	Earth worm	Arora et al (1980)
24	Jussiaeahyssopifolia	Onagraceae, g	Leaves	Earth worm	Agrahari et al (2011)
25	Lagenariasiceraria	Cucurbitaceae	Seeds	Earth warm	Kumar et al (2012)
26	Murrayakoenigii	Rutaceae	Leaves and roots	Earth worm	Mali et al (2013)
27	Mallotusphillipensis	Euphorbiaceae	Fruit	Helminiths	Priya et al (2014)
28	Mitragynaparvifolia	Rubiaceae	Dried fruit,roots,bark and leaves	Earth worm	**R. K. Sahuet et al (2009)**
29	Ocimum sanctum	Labiatae	Leaf	Helminiths	Pandey el al (2016)
30	*Picriafel-terrae*	Scrophulariaceae.	Leaf	Helminthes	Singh et al (2016)
31	Rhus vulgaris	Anacardiaceae)	Roots	Round worm	Getachew et al (2012)
32	Swertiachirata	(Gentianaceae)	Whole plant	Ascaridiagalli	Iqbal et al (2006)
33	Uvariahookeri	Annonaceae)	Root and bark	Helminithas	Padmaja et al (1993)

CONCLUSION-

A synthetic compound of anthelminatic work fast, but have side-effect, the recent years, the importance of Herbal drugs in Medicine has extremely enlarged because of their fewer side effect. So this reason we used herbal medicine as a combination of best efficacy and less side effect. We will try to better scope of natural source. We will encourage on the study of herbal plants which gift given by nature for us and the development of instrumental analysis and this field becomes important and new for investigation.

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Review of Recent Biological Activity Pyrazoline and Thiazolidinone Derivatives

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Abstract – *Almost all of NSAIDS derivatives of unwanted, often serious, side effects as a consequence of interference with the arachidonic acid and their chemical mediators like PG, LC, PC cascade. In search for new drugs to avoid side effects, while maintaining high potency over inflammation, scientists turned their interest to the synthesis of dual COX/LOX inhibitors, which could provide numerous therapeutic advantages in terms of anti-inflammatory activity, improved gastric protection and safer cardiovascular profile compared to conventional NSAIDs. Thiazole and thiazolidinone moieties can be found in numerous biologically active compounds of natural origin, as well as semisynthetic and synthetic molecules that possess a wide range of pharmacological activities. Inflammation, Pain & to increase body temperature is a natural process that is connected to various conditions and several disorders such as arthritis, psoriasis, cancer, ulcer, kidney stone infections, etc. Based on the fact that phospolipse & cyclooxygenase isoenzymes (COX-1, COX-2), autacoids are responsible for the production of prostaglandins, leukotrienes, prostacyclin, thromboxane that play an important role in Inflammation, Pain & to increase body temperature traditional treatment approaches include administration of non-steroidal anti-inflammatory drugs (NSAIDs), which act as selective or non-selective COX inhibitors This review focuses on the biological activity of several thiazole and thiazolidinone derivatives as COX-1/COX-2 and LOX inhibitors.*

Keywords: *Aspirin, Ranitidine, Magnesium hydroxide, thiazolidinones, NNAT, NABP*

INTRODUCTION

Sickness has been men's legacy from the very outset of his reality and the quest for solutions for battle is maybe similarly old. From the previous long stretches of informal medication, we have gone into the presence of foundational present-day medication which depends on reasonable considerations and their applications. Presently endless medications have been presented and the huge number of infections that were believed to be wild isn't just really controlled, however some of them are even totally restored.

Inspite of this, there is still enormous number of illnesses where the medication treatment isn't sufficiently, frequently because of related extreme unfavourable impacts of medications and hence, there is an interest for the improvement of more current and more secure ones. Be that as it may, the pursuit is gone on for another medication isn't just cantered around frightful illness like AIDS and Cancer, yet additionally for the circumstances as Inflammatory problems, analgesic mending and ulcer problems. Antagonistic impacts like gastric disturbance with enormous gastrointestinal haemorrhages especially in patients with peptic ulcers are there with calming and pain relieving drugs1.

The course of analgesic mending contrasts in speed of recuperating from not many days to a few weeks3. It additionally varies from species to species and from one tissue to another of the equivalent species4. Subsequently it becomes important to concentrate on the cycle in different models.

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An injury might be characterized as interruption of anatomic or useful coherence of living tissue. The recovery of entire appendages as parts in lower creatures has been subbed with recovery of the cells which are answerable for the rebuilding of progression of living tissue.

The pyrazoline and Thiazolidinone derivatives which were already synthesized are now presently taken for their evaluation of their pharmacological activities are listed with their structures as –

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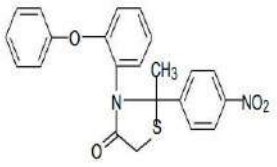
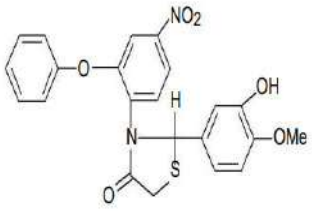


NNAT

2)



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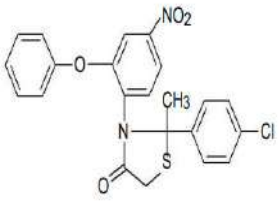

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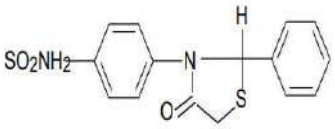

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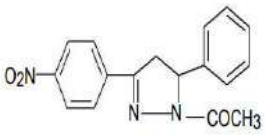

NABP

Material and Methods

Factors which alter and upgrade any of the above said components are considered as analgesic recuperating specialists. The use of medications for analgesic recuperating goes on in voluminous literary works, yet, there are number of medications which are utilized customarily for analgesic mending however not with logical proof. Pyrazolines are found to show many sorts of natural exercises going from consequences for the focal sensory system to antimicrobial and insecticidal exercises, correspondingly thiazolidinones were additionally read up for antifungal and antimicrobial activities.

Hence there is the need to search for class of medication used for analgesic recuperating. Peptic ulcer is one of the normal illnesses influencing humanity. It kills not many however

Inconveniences many. It happens in that piece of gastrointestinal lot which is presented to gastric corrosive and pepsin for example the stomach and duodenum, because of an unevenness between the forceful variables like corrosive, pepsin and Helicobacter pylori and the cautious elements like gastric bodily fluid and bicarbonate emission, prostaglandins and inborn opposition of mucosal cells.

This study was approved by Institutional Animal Ethical Committee for experiments on small animals, Maulana Azad Medical College, New Delhi.

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Animals

Wistar rodents weighing 150-200 g and pale skinned person mice of 20-25 g body weight of either sex were obtained from focal creature house and were housed in cooled climate. A hole of multi week was saved for acclimatization of creatures. They were furnished with typical rodent food pellet diet with water not obligatory.

Study design

Creatures were partitioned into six gatherings with six creatures in each gathering. Every one of the creatures got drugs through oral course. Medications and carrageenan were broken up in 0.5%CMC. For assessment of pain-relieving action, "Squirming Test", was utilized in Swiss-breed pale skinned person mice. For assessment of calming action, wistar pale skinned person rodents were utilized for the "Changed Randall-Selitto Test". Creatures in bunch 1 filled in as control and gotten typical saline. Creatures in bunch 2 were regulated diclofenac sodium alone in the portion of 10 mg/kg in mice and 15 mg/kg in rodents. Bunch 3 got Ibuprofen at the portion of 7.5 mg/kg in mice and 30 mg/kg in rodents. In bunch 4, rodents were pre-treated with paracetamol at the portion of 100 mg/kg in mice and 300 mg/kg in rodents. Bunch 5 got blend of diclofenac and paracetamol in the portion as in bunch 2 and 4. Bunch 6 was directed a blend of ibuprofen and paracetamol. Ibuprofen in the portion referenced for bunch 3 and 4 as above.

Anti-inflammatory activity: Paw oedema model (Modified Randall-Selitto Test)

After short-term fasting, on the morning of examination, rodents were gauged and standard paw volume was estimated with the guide of plethysmometer. To guarantee consistency, horizontal malleolus of left rear appendage was set apart in everything creatures so same length of paw is dunked in liquid each time. This was trailed by oral organization of medications. After 30 min of medications organization, creatures were infused with 0.1 ml of 1% carrageenan in sub planter district for prompting aggravation. Paw volume was again estimated after 3 h of sub planter infusion of 1% carrageenan. The paw volume and percent decline in paw edema was thought about between control gathering and medication treated gatherings.

Analgesic activity: Writhing test

Pale skinned person mice weighing 20-25 g were abstained for the time being. The test drugs were directed orally 30 min before infusing 0.6% arrangement of icy acidic corrosive intraperitoneally. Squirming developments were noticed. These are described by unambiguous stomach constrictions and are joined by stretching of the body with curved angling of the back as well as winding or curving of the hip along with the rear paw or potentially side moving of the body and surrounding. The quantity of squirms saw more than a 10-min period were recorded and percent hindrance of squirming was likewise determined and looked at among control and medication treated gatherings.

Statistical analysis

All results were communicated as Mean ± Standard Deviation (SD). Factual still up in the air by One-way ANOVA with post hoc test (Bonferroni) was utilized. $P < 0.05$ was viewed as huge.

Analgesic activity:

Squirming was seen in all control creatures with 0.1% icy acidic corrosive. The typical number of squirms in charge bunch was 38.3 ± 5.4. Pre-treatment of rodents with NSAIDs in every one of the gatherings showed measurably huge hindrance of squirms when contrasted with control. Decline in mean include of squirms in diclofenac pre-treated creatures was most extreme among single medication gatherings (38.3 ± 5.4 to 0.8 ± 1.3, $P < 0.05$). Pre-treatment of creatures with ibuprofen and paracetamol mix fundamentally diminished squirming in contrast with control creatures (38.3 ± 5.4 to 12.5 ± 3.4, $P < 0.05$). Decline in number of squirms were additionally critical when contrasted with ibuprofen and paracetamol-alone gatherings. In the gathering directed with blend of paracetamol and diclofenac, critical reduction in squirming was seen

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when contrasted with control and paracetamol alone gathering. Mean reduction in number of squirms with mix of paracetamol and diclofenac was not viewed as genuinely huge when contrasted with diclofenac alone gathering (P = 0.18).

Anti-inflammatory activity: Paw edema

Checked edema was delivered in rodents with sub grower infusion of 0.1 ml of 1% carrageenan. Mean paw edema in the control rodents was 708.2 ± 108.4 cu.mm. Pre-treatment of rodents with diclofenac alone showed critical diminishing in paw edema when contrasted with control (708.2 ± 108.4 to 88.6 ± 108.5, P < 0.05). The gatherings pre-treated with ibuprofen and paracetamol alone likewise showed critical lessening in edema when contrasted with control yet greatest decrease in paw edema was seen with diclofenac. Pre-treatment of rodents with blend of ibuprofen and paracetamol, essentially restrained paw edema when contrasted with control (708.2 ± 108.4 to 155.0 ± 100.0, P < 0.05). Decline in mean paw edema was likewise huge in rodents pre-treated with this blend when contrasted with NSAID alone (ibuprofen, paracetamol) gatherings. In the gathering regulated with mix of paracetamol and diclofenac, critical diminishing in mean paw edema was seen when contrasted with control and paracetamol alone gathering. Mean paw edema decrease with mix of paracetamol and diclofenac was not viewed as genuinely huge when contrasted with diclofenac alone gathering (P = 0.18).

Antimicrobial Screening

2.2.1. Test Microorganisms

Antimicrobial activity of the synthesized compounds was studied against nine microorganisms, including seven bacterial strains—*Bacillus subtilis* (MTCC 441), *Staphylococcus aureus* (MTCC 1430), *Pseudomonas aeruginosa* (MTCC 424), *Bacillus pumilus* (MTCC 1456), *Pseudomonas fluorescens* (MTCC 2421), *Escherichia coli* (MTCC 1573), and *Micrococcus luteus* (MTCC 1538)—and two fungal strains, *Aspergillus niger* (MTCC 2546) and *Penicillium chrysogenum* (MTCC 161).

2.2.2. Preparation of the Samples and Standard Solution

The compounds were dissolved in 10% DMSO at the concentrations of 50, 100, 200, 400, 800, and 1600 μg/mL, respectively. Norfloxacin and fluconazole, used as the standard drugs for antibacterial and antifungal studies, respectively, were also dissolved in 10% DMSO at the concentrations of 10 μg/mL.

2.2.3. Method

Antimicrobial activity of the synthesized compounds was evaluated by cup-plate method. Nutrient broth suspension of test microorganism (10 mL) was added to 100 mL of sterile molten nutrient agar growth media (cooled to 45°C), mixed well, and poured on to sterile petri plates. The agar was allowed to solidify and was then punched to make six wells/cups, using a 6 mm sterile cork borer (separate borer for each organism), to ensure proper distribution of wells in the periphery and one well in the center. Agar plugs were removed and 50 μL solution of test samples (each compound in six concentrations) was poured into the corresponding marked well using micropipette. Triplicate plates of each organism were prepared. The plates were left at room temperature for 2 h to allow diffusion of samples and then incubated face upward, at corresponding temperature of each organism, for 48 hrs. The diameters of zone of inhibition were measured to the nearest millimeter (the cup size also included).

2.2.4. Determination of Minimum Inhibitory Concentration (MIC)

A series of glass tubes, containing different concentrations of the synthesized compounds (in 10% DMSO), with nutrient broth was inoculated with the required quantity of the inoculums to obtain a suspension of microorganisms which

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contained 10^5 colony forming units per milliliter. One growth control tube was prepared without the addition of the compounds or the microorganisms. The tubes were incubated at 37°C for 24 h. The turbidity produced in each tube was recorded on a UV-visible spectrometer.

3. RESULTS AND DISCUSSION

4-Thiazolidinones were synthesized in two steps. In the first step, 2-aminopyrimidine derivatives were synthesized by the reaction of 1,3-dicarbonyl compounds with guanidine. Finally, the compounds (**4a**–**4f**) were synthesized by reaction of the compounds of step 1 with substituted aromatic aldehydes and mercaptoacetic acids, using DCC as intramolecular cyclizing agent.

Characteristic peaks were observed for N-H stretching, C=O stretching, and C-N stretching. The IR spectra of the 4-thiazolidinone derivatives exhibited C=O lactam amide stretching vibration in the range of 1637–1728 cm^{-1}. $[M]^+/[M + 1]^+$ peaks were observed for the synthesized compounds. ^{1}H-NMR spectra of the compounds indicated the presence of two diastereotopic protons at C-5 position and one single proton at C-2 position; doublets were obtained in the region of 3.07–3.47 ppm. A doublet integrated for one proton appeared at the δ value of 2.37–2.74 ppm. This can be attributed to the C-2 proton of the 4-thiazolidinone ring.

The antimicrobial activity was observed at 50, 100, 200, 400, 800, and 1600 μg/mL, respectively. Minimum inhibitory concentrations of the synthesized compounds were also determined, in nutrient broth by tube dilution method. MICs were in the range of 100–500 μg/mL, which were recorded as the optical density, at 530 nm.

The antimicrobial screening revealed that all the synthesized compounds possessed a wide spectrum of antimicrobial profile against the tested microbial strains. The compounds, which were active against bacterial and fungal strains, were effective at a much higher concentration than the standard drugs norfloxacin and fluconazole. All the compounds exhibited good-to-moderate antimicrobial activity against all the strains. Compounds **4b**, **4c**, and **4d** were found to be more effective against the fungal strains than the bacterial strains. On the basis of MIC values of the synthesized compounds, the order of antimicrobial spectrum was **4b > 4a > 4d > 4c > 4f > 4e**. Compound 2-(4-fluoro-phenyl)-3-(4-methyl-5,6,7,8-tetrahydro-quinazolin-2-yl)-thiazolidin-4-one (**4a**) and compound 3-(4,6-dimethyl-pyrimidin-2-yl)-2-(2-methoxy-phenyl)-thiazolidin-4-one (**4e**) were the most potent compounds of the series, exhibiting marked antibacterial activity against *Pseudomonas fluorescens* and *Staphylococcus aureus*.

4. CONCLUSION

In the present study, six new 4-thiazolidinone derivatives were synthesized, characterized, and evaluated for their antimicrobial potential. The compounds exhibited antimicrobial activity against the selected Gram-positive and Gram-negative bacterial strains and the fungal strains. Overall, 2-(4-fluoro-phenyl)-3-(4-methyl-5,6,7,8-tetrahydro-quinazolin-2-yl)-thiazolidin-4-one and 3-(4,6-dimethyl-pyrimidin-2-yl)-2-(2-methoxy-phenyl)-thiazolidin-4-one were found to be the most potent members of the series. On the basis of the antimicrobial activity studies, it may be concluded that all the compounds have a broad spectrum of antimicrobial activity.

Thus, the study provides a lead for the syntheses and evaluation of more 4-thiazolidinone derivatives for antimicrobial activity, as the same could lead to the discovery of some promising agents.

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Narrative Review: Porosity of Porous & Non-Porous Powders

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Abstract – *Porosity plays a pivotal role in the Reformulation considerations & formulation of unit dosage form viz. tablets and powders. Various studies only emphasize on the porosity of porous powders only. It has to be understood that non-porous powers also have porosity but the measurement and estimation of porosity differs from that of porous powders. This factor makes an important role in the selection of penetrating fluid.*

Keywords- *Porosity, Powders, Density, Fluid, voids*.

INTRODUCTION

Porosity or fraction of voids is the measure of empty space/spaces within a material and often represented as percentage porosity. Porosity finds its importance in the dosage form formulation as it is a very useful to predict deformation of powders during compression, penetration of moisture as well as the bioavailability of dosage form. Porosity is also a characteristic that influences the behavior of finished pharmaceutical product.

Porous and non porous materials by definition are very simple yet they are complex. Every particle whether it is a solid concrete or an iron bar do have some pores yet they are termed nonporous because individual particle does not have any pores or pore. When we consider it collectively it can be well established that the voids which are under consideration are to the spaces between the adjacent particles. Whereas by definition the in porous substances there are some open spaces in individual particles itself.

STUDY

If a porous powder is subjected to study it can be very well concluded

that every and any powder sample contains some voids which are referred to as voids. Being porous in nature individual particles contains some open spaces, crevices and often some cracks. These properties collectively are said to be attributing towards porosity.

If a nonporous powder is under consideration it is understood that the individual particle is deprived of open spaces, crevices and cracks. This makes the concept of porosity for non-porous powder a bit complex.

The solution being that if the porosity of non-porous powder is to be estimated then the powder should be considered as a single unit or a plug.

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If non-porous powder is considered as single unit powder plug then the voids in the powder plug will serve as constituent of porosity.

The fluid for the penetration into the powder for the estimation of voids also plays a vital role depending upon the factor that the powder is porous or non-porous.

Therefore for the estimation of porosity in porous powder helium is always proffered as a choice of fluid as it penetrates into all open spaces like cracks and crevices.

CONCLUSION

our approach towards the open spaces in any material or substance will decide the porosity or non porosity. Practically any or and every substance has open space but the approach of whether we are considering interparticle or intraparticle space makes all the difference in defining both these terms. The fluid penetrating the open spaces within every single particle or between two or more particles will be our fluid of choice depending upon the fact that whether we are about to estimate the porosity of porous or non porous substance.

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Effect of Different Zinc Application on Various Wheat (*Triticumaestivum* L.) Varieties in Partially Reclaimed Sodic Soil

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Abstract - *A field experiment was conducted at agriculture research farm of S.D.J Graduate College Chandeshwar, Azamgarh, (U.P.) duringrabi season- 2004-05. Experimental site is situated near the college campus on AzamgarhGhazipur road at a distance of 8 km from Azamgarh district head quarter. The experiment laid out in Randomized Block Design- factorial (RBD) with 9 treatment combination viz., three varieties in main plot [V_1 = NW-1012, V_2= PBW-343, V_3= Malviya-468] and six zinc application treatments in sub plot [ZnO= No Zinc (Control), Zn_1= Seed soaking with 0.5% $ZnSO_4$ aqueous solution, Zn_2= Seed soaking with 1.0 % $ZnSO_4$ aqueous solution, Zn3= 20 kg $ZnSO_4$ ha^{-1} (basal application prior to sowing), Zn4= 30 kg $ZnSO_4$ ha^{-1} (basal application prior to sowing), Zn5= Foliar spray of 5 Kg zinc sulphate with 2% urea in 1000 litres of water at 25 and 50 DAS (2 sprays)], total number of plots were 27 along with three replications. Among the three varieties the NW-1012 [V_1]with the application Foliar spray of 5 Kg zinc sulphate with 2% urea in 1000 litres of water at 25 and 50 DAS (2 sprays)[Zn_5] recorded the highest grain yield (42.79 qha^{-1}) but the biological yield (105.75) was highest in PBW-343 with the application Seed soaking with 1.0 % $ZnSO_4$ aqueous solution [Zn_2].*

INTRODUCTION

Wheat (**Triticumaestivum L**.), one of the major staple food grains, belongs to the family poaceae**.** Among major cereals, wheat ranks first in area and production at the global level and it is the staple food of nearly 35 percent of the world population. In India, Wheat is grown from 11°N to 30°N latitude and from sea level up to an elevation of 3658m in the Himalayas. It is grown in a wide range of soil, from sandy loam soil to heavy black cotton clay soils. In the marketing year of 2021-22, globally wheat was grown in an area of about 222.62 million hectares, producing 779 million metric tons and productivity of 3.49 Metric tons per hectare **(Anonymous 2021-22).** In India, the area was sown to wheat as the main rabi crop is up to 31.62 million hectares, and wheat production is also expected to reach the

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highest ever level of 111.32 million tonnes during 2021-22 (**Anonymous 2021-22**). Yield averaged 3.46 tons per hectare (t/ha) **(Anonymous 2021-22).** In India, rice-wheat is the major cropping system, which exhausts the soil of its nutrients limiting crop production, especially the highyielding varieties. Intensive cropping also renders deficiency ofmicronutrients in addition to major nutrients in the soil. The farmer'sperception of nutrients management until now has mostly been the useof major nutrients like nitrogen, phosphorus and potash. Thisimbalanced use of inorganic fertilizers, in the absence of organic sourcesof nutrients, has led to the micronutrient deficiency especially in riceand wheat restricting upward growth of productivity. During recentyears, Zinc deficiency has come up as one of the major problems incultivation of cereal reducing crop yield and at times leads to the virtualfailure of the crops. This problem is more serious especially in saltaffected soils which either is deficient in nutrients or nutrients get fixedand thus become unavailable to plants. The soil factors responsible forzinc deficiency in crops include, low total zinc concentrations, high pH,high calcium carbonate, organic matter, magnesium and bicarbonatecontents, salinity and waterlogging. Foliar application of different nutrients to plants is another option when deficiency of nutrient cannot be met properly by nutrients applications to the soil **[Cakmak et al., (2008)].** When the roots cannot provide the required nutrients to plant, in such circumstances foliar spraying of microelements is very helpful **Babaeian et al., (2011).** Calcareous, sandy and waterloggedsoils are the types of soil most commonly associated with zinc deficiencybut it can also occur on wider range of soils with low available zinccontents and alkaline pH. Zinc deficiency negatively affects root growth, physiological functions and uptake of nutrients, which may lead to reduction in yield and yield components [**Fageria et al.,(2004]**). Zinc deficiency in plants adversely affects flowering and fruiting formation [**Epstein et al., (2005)].** Trace nutrient including zinc reduce crop productivity may be due to their low contents in the soil [**Sharma et al., (2007)].** All cases of zinc deficiency are accompanied by loss of yield and, in many cases the quality of crop products such as grain or fruits is impaired as well. The extent of yield loss can range from around 10-20% in marginal cases, to complete crop failure. Hidden deficiency, where yields can be reduced up to 40% without distinct symptoms is of major economic importance [**Alloway, 2003**].Wheat crop growth, yield and yield attributes had positively affected with application of micro nutrients and their application methods [**Khan et al., (2006**)]. The effects of different micro nutrients including zinc as well as its application methods had positively affected on crop growth, grains yield and yield parameters [**Nadim et al., (2013**)].Keeping in view the importance of zinc and its application methods, the present experiment was conducted to investigate its impacts on yield and yield components of wheat varieties.

MATERIALS AND METHODS

During the Rabi season of 2004-05, a field experiment was undertaken at ShriDurgaJi Post Graduate College Chandesar, Azamgarh, Uttar Pradesh. The research was carried out in a randomized block design. Treatments were replicated three times. Wheat varieties (NW1012, PBW343 and Malviya 468) were assigned to main plots While different levels of Zn (Zn_O= No Zinc (Control), Zn_I= Seed soaking with 0.5% $ZnSo_4$ aqueous solution, Zn_2= Seed soaking with 1.0 % $ZnS0_4$ aqueous solution, Zn_3= 20 kg $ZnS0_4ha^{-1}$ (basal application prior to sowing), Zn_4= 30 kg $ZnS0_4ha^{-1}$ (basal application prior to sowing), Zn_5= Foliar spray of 5 Kg zinc sulphate with 2% urea in 1000 litres of water at 25 and 50 DAS (2 sprays) was assigned to sub plots. A plot size of 4×2 m^2 was used. Zinc sulphate (ZnSo4) was applied as a zinc (Zn+) source. For all wheat types, the recommended seed rate of 100 kg ha-1 was implemented at a spacing of 23 cm apart and a depth of 5 cm. Urea, DAP, and MOP were used to add nitrogen, phosphorus, and potassium at a rate of 120:60:60 (N, P2O5, and K2O) kg ha-1, respectively. Prior to sowing, half of the nitrogen, as well as full dosages of phosphate and potash, were applied as a basal treatment, and the remaining half was applied in two equal splits at active tillering and 50 percent blooming phases, respectively. Plant population,plant height, number of tillers per plant,dry matter (g/plant),days to physiological maturity, grain yield, biological yield, and harvest index were among the data obtained.

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RESULTS AND DISCUSSION

Application of zinc sulphate through seed soaking, foliar spray and soil application in different wheat varieties showed beneficial effects on growth, yield and quality components. Since zinc deficiency is one of the major constraints limiting crop production especially in sodic and calcareous soil, the yield enhancement through zinc supplement either through soil or foliar spray could be a potential strategy for improving productivity of the salt affected soils. Plant population per running metre was measured at 30 days after treatment in all three replications (Table 1). The table shows that plant population did not differ significantly in all the three. However, zinc levels had a substantial impact on plant population per running metre, particularly when pre-sowing seed soaking treatment with 1.0 percent zinc sulphate solution was used. The rest of the zinc treatments were statistically equivalent. At 1.0 percent zinc sulphate pre-sowing seed treatment, interaction effects were similarly significant, with all three kinds having a larger number of plants per running metre. Malviya 468 responded better than the other types.

Table 1 Effect of zinc application on plant population permetre square at 30 DAS in wheat varieties grown in sodic soil

Zinc level	**Variety**			**Mean**	**SEM±**	**CD P=0.05**
	VI	**V2**	**V3**			
ZnO	25.3	25.0	25.0	25.1		
Znl	27.0	27.0	27.0	27.0		
Zn2	28.6	28.3	28.7	28.6		
Zn3	26.0	25.3	25.3	25.6	V=0.270	NS
Zn4	26.0	27.0	26.3	26.4	Zn=0.382	Zn= 1.102
Zn5	25.0	25.6	25.3	25.3	VxZn=0.661	VxZn=1.909
Mean	26.3	26.4	26.3	26.3		

Data on plant height for 2004-05 and 2005-06 recorded at 30, 60 and 90 days after sowing and at maturity have been presented in Tables 2 respectively. Table 2 shows that plant height of NW1012 was substantially higher than PBW 343 at 30 and 60 DAS. Malviya 468 was also taller than PBW 343 in all growth metrics; although only at 30 and 90 DAS were the differences substantial. At maturity, the plant heights of all the types were nearly identical. At all phases, all of the zinc treatments were significantly better than the untreated control (no zinc treatment).In terms of plant height, foliar spray with 0.5 percent zinc sulphate had the best results (Table2). During the 2004-05 growing season, all of the zinc treatments produced statistically identical plant heights at maturity, with the exception of the foliar spray, which produced considerably higher plant height.At all growth stages, interaction effects between variety and zinc levels were substantial.In overall, NW 1012 had a better response than the other two kinds.Foliar spray was the most effective, followed by seed treatment with 1% zinc sulphate.

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***Table 2**. Effect of zinc application on plant height (cm) of wheat varieties grown in sodic soil (2004-05)*

Zinc level		Variety		Mean	SEM±	CD P=0.05
	VI	V2	V3			
	30DAS					
ZnO	31.28	30.73	31.83	31.28		
Znl	36.92	28.53	33.52	32.99		
Zn.2	35.82	28.95	35.58	33.45		
Zn3	37.80	31.85	33.75	34.47	V=0.361	V= 1.041
Zn4	37.23	31.46	33.35	34.01	Zn=0.510	Zn= 1.473
Zn5	36.78	36.10	32.88	35.26	VxZn=0.883	VxZn=2.551
Mean	35.97	31.27	33.49	33.58		
	60DAS					
ZnO	53.95	53.43	53.17	53.52		
Znl	56.60	56.83	57.13	56.86		
Zn.2	57.88	56.30	57.15	57.11		
Zn3	58.40	55.07	55.15	56.21	V=0.471	V= 1.360
Zn4	58.43	53.60	56.52	56.18	Zn=0.666	Zn= 1.924
Zn5	59.28	58.22	57.97	58.49	VxZn=1.154	VxZn=3.332
Mean	57.43	55.58	56.18	56.39		
	90DAS					
ZnO	61.67	62.30	64.40	62.79		
Znl	63.52	62.07	67.40	64.33		
Zn.2	67.00	62.68	66.12	65.27		
Zn3	63.72	63.90	65.33	64.32	V=0.321	V=0.927
Zn4	67.63	64.20	64.08	65.31	Zn=0.454	Zn=1.311
Zn5	72.93	67.67	72.35	70.98	VxZn=0.786	VxZn=2.271
Mean	65.58	63.80	66.61	65.33		
	At maturity					
ZnO	71.67	71.30	72.27	71.74		
Znl	75.93	74.50	73.62	74.68		
Zn.2	73.15	73.57	73.67	73.46		
Zn3	73.27	74.70	73.78	73.92	V=0.319	NS
Zn4	72.37	73.17	75.50	73.68	Zn=0.451	Zn= 1.302
Zn5	78.00	73.98	75.73	75.91	VxZn=0.781	VxZn=2.256
Mean	**74.06**	**73.54**	**74.09**	**73.90**		

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Number of tillers produced per plant were almost at par in all the three varieties at 30 DAS, but differed significantly at subsequent growth stages (Table 3). Malviya 468 produced significantly greater number of tillers than NW 1012 and PBW 343 at subsequent growth stages. It is clear from the Table 3 that in partially declined sodic soil zinc has positive role to play with respect to the production of tillers per plant. Zinc application also influences the varietal performance for number of tillers per plant. Zinc application irrespective of methods (seed treatment, basal or foliar spray) produced significantly greater number of tillers in comparison to untreated control except 1% seed soaking at 60DAS and at maturity. 30kg zinc sulphate as basal application was the best treatment followed by foliar spray. Varieties and zinc treatments showed positive interactions where Malviya 468 had better interaction in terms of tiller production. During 2004-05, Malviya 468 had better interactions at 0.5% seed soaking treatment, 20Kg/ ha basal zinc sulphate followed by 30 Kg/ ha basal zinc sulphate treatments. Basal application of zinc sulphate @30 kg/ ha showed best interactions with NW1012 and PBW343 (Table 3). Perusal of table 3 clearly indicates that tiller mortality occurred at maturity when compared to tiller number at 90DAS irrespective of the varieties and zinc treatment.

Table3. Effect of zinc application on number of tillers per plant in wheat varieties grown in sodic soil (2004-05)

Zinc level		**Variety**		**Mean**	**SEM±**	**CD P=0.05**
	VI	**V2**	**V3**			
	30DAS					
ZnO	2.33	2.27	2.10	2.23		
Znl	2.97	2.63	2.83	2.81		
Zn.2	2.90	2.77	2.87	2.84		
Zn3	2.90	2.80	3.20	2.97		
Zn4	2.97	3.17	3.17	3.10	V=0.042	V=NS
Zn5	2.27	2.60	2.50	2.46	Zn=0.059	Zn-0.171
Mean	2.72	2.71	2.78	2.74	VxZn=0.102	VxZn=0.295
	60DAS					
ZnO	5.27	6.03	6.77	6.02		
Znl	5.80	6.33	7.03	6.39		
Zn.2	6.00	6.23	6.00	6.08		
Zn3	6.67	6.63	7.00	6.77	V=0.075	V=0.218
Zn4	5.70	7.60	7.33	6.88	Zn=0.107	Zn=0.308
Zn5	6.50	7.23	6.77	6.83	VxZn=0.185	VxZn=0.533
Mean	5.99	6.68	6.82	6.49		
	90DAS					
ZnO	5.33	5.50	6.33	5.72		
Znl	6.17	5.97	6.57	6.23		
Zn.2	6.23	6.00	6.43	6.22		
Zn3	5.67	6.70	6.93	6.43	V=0.113	V=0.328
Zn4	5.50	7.07	7.00	6.52	Zn=0.160	Zn=0.463
Zn5	6.17	6.33	6.40	6.30	VxZn=0.278	VxZn=0.802
Mean	5.84	6.26	6.61	6.24		
	At maturity					
ZnO	4.80	4.83	5.33	4.99		
Znl	5.47	5.33	5.90	5.57		
Zn.2	5.17	5.00	5.50	5.22		

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Zn3	5.20	5.20	5.97	5.46	V=0.107	V=0.308
Zn4	5.67	5.83	5.83	5.78	Zn=0.151	Zn=0.435
Zn5	5.17	5.10	5.80	5.36	VxZn=0.261	VxZn=0.753
Mean	**5.24**	**5.22**	**5.72**	**5.39**		

Data pertaining to dry matter production under differenttreatments and different growth stages have been presented in Tables 4. It is clear from the data that wheat varieties tested in the presentinvestigation did not show any significant variation in dry matterproduction at 30 DAS. However, at subsequent growth stages, Malviya468 produced significantly higher plant dry matter as compared to the other two varieties during 2004-05. NW1012 and PBW 343 were almost at par in terms of dry matter productionduringthe experiment except at maturity where PBW 343 hadsignificantly higher dry matter than NW 1012.All the zinc treatments produced significantly higher dry matter ascompared to untreated control during 2004-05. Foliar sprayof zinc sulphate @ 0.5% was most effective treatment which producedmaximum dry matter per plant (Tables 4).Soil application of zinc sulphate @30kg/ha was the next best treatmentfollowed by pre-sowing seed priming with 1% zinc sulphate.Data presented in Tables 4 indicate significant interactioneffects between varieties and zinc treatments. Seed priming treatmentshowed better interaction with variety Malviya 468 followed by PBW 343and NW 1012 respectively during both the years. Once again foliar sprayproved more effective in producing greater dry matter per plantirrespective of the variety, though, better interaction was observed inMalviya 468. Soil application of zinc sulphate also showed goodinteraction with Malviya 468. It is, thus, clear that Malviya 468 is moreresponsive to zinc application in dry matter production irrespective ofmethods of application.

Table4. Effect of zinc application on dry matter (g/plant) in wheat varieties grown in sodic soil (2004-05)

Zinc level		**Variety**		**Mean**	**SEM±**	**CD P=0.05**
	VI	**V2**	**V3**			
	30DAS					
ZnO	1.62	1.44	1.84	1.63		
Znl	1.89	1.47	1.58	1.65		
Zn.2	1.99	1.99	1.48	1.82		
Zn3	1.79	1.42	1.70	1.64	V=0.064	V=NS
Zn4	2.09	2.40	1.94	2.14	Zn=0.091	Zn=0.263
Zn5	2.46	2.02	2.21	2.23	VxZn=0.158	VxZn=0.455
Mean	1.97	1.79	1.79	1.85		
	60 DAS					
ZnO	3.03	3.35	2.94	3.11		
Znl	4.35	5.12	5.50	4.99		
Zn.2	4.77	4.99	5.02	4.93		
Zn3	6.11	5.60	6.55	6.09	V=0.147	V=0.425
Zn4	5.40	6.02	6.73	6.05	Zn=0.208	Zn=0.601
Zn5	6.88	6.49	7.26	6.88	VxZn0.360	VxZn=1.040
Mean	5.09	5.26	5.67	5.34		

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	90DAS					
ZnO	4.83	5.31	5.84	5.33		
Znl	6.17	6.46	7.92	6.85		
Zn.2	6.11	6.89	8.55	7.18		
Zn3	8.16	6.98	8.26	7.80	V=0.170	V=0.492
Zn4	8.17	7.62	8.59	8.13	Zn=0.241	Zn=0.696
Zn5	8.57	7.11	9.35	8.34	VxZn=0.417	VxZn=1.205
Mean	7.00	6.73	8.08	7.27		
	At maturity					
ZnO	10.17	11.05	11.87	11.03		
Znl	11.20	13.30	13.20	12.57		
Zn.2	11.98	12.71	13.46	12.72		
Zn3	11.51	12.58	13.18	12.42	V=0.180	V=0.519
Zn4	11.87	12.74	13.57	12.73	Zn=0.254	Zn=0.734
Zn5	13.08	14.33	13.95	13.78	VxZn=0.440	VxZn=1.272
Mean	**11.64**	**12.78**	**13.20**	**12.54**		

Data recorded for days to 50% flowering clearly indicate delay in flowering Varietal differences were marginally significant during the experiment showing more delay in NW 1012 (Table 5). Among zinc treatments, 20kg/ha soil application showed maximum delay of about 3.5 to 4 days in 50% flowering. Significant interaction was also noted in Malviya 468 and NW 1012 with 20kg zinc sulphate as basal application and 1% seed treatment.Like 50% flowering, maturity also got delayed due to zinc application during 2004-05 but varietal differences were generally non-significant. Interestingly, there was no significant variation among zinc treatments probably because of forced ripening due to high temperature during maturity. NW 1012 showed more positive interaction with zinc treatments irrespective of the methods of the application during the experiment period. Maximum delay in maturity was noted in NW 1012 under 0.5% foliar spray followed by 20kg/ha basal zinc sulphate treatment. The delay in maturity might result in higher grain yield through better partitioning of photosynthates into grains.

Table5. *Effect of zinc application on days to 50% flowering and days to maturity in wheat varieties grown in sodic soil*

Zinc level		**Variety**		**Mean**	**SEM±**	**CD P=0.05**
	VI	**V2**	**V3**			
	days to 50% flowering					
ZnO	76.0	75.7	74.0	75.2		
Znl	78.3	76.7	76.0	77.0		
Zn.2	79.0	74.3	78.7	77.3	V=0.376	V=1.085

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Zn3	78.7	78.3	78.7	78.6	Zn=0.531	Zn=1.534
Zn4	76.3	76.7	74.7	75.9	VxZn=0.920	VxZn=2.657
Zn5	78.7	76.0	76.3	77.0		
Mean	77.8	76.28	76.4	76.8		
	days to maturity					
ZnO	107.3	108.0	106.7	107.3		
Znl	109.0	110.3	108.0	109.1		
Zn.2	109.0	110.0	107.0	108.6	V=0.420	V=NS
Zn3	110.7	107.3	109.0	109.0	Zn=0.594	Zn=1.716
Zn4	110.0	107.3	109.0	108.7	VxZn=1.029	VxZn=2.973
Zn5	110.3	108.7	111.0	110.0		
Mean	**109.4**	**108.6**	**108.4**	**108.8**		

Yield parameters for example, ear length, ear number per plant, grains per ear and per plant and grain weight per plant were positively affected by zinc applications in all the three varieties irrespective of the methods of application. Zinc application improved ear number, ear length, grain number and grain weight per plant in all the three varieties during both the years. However, no definite trend could be observed for yield traits as influenced by the methods of zinc application in all the three varieties. The response was variable where foliar application was superior for grain number per ear and per plant during 2004-05. Also the 30 Kg zinc sulphate also and positive influence on ear number and grain number per plant.Length of ear as influenced by zinc application varied significantlyamong varieties. Malviya 468 produced maximum ear length followed byPBW 343 and NW 1012 respectively (Tables 6). All the zinc treatments resulted in significantly higher ear lengths ascompared to untreated control during the experiment period. Among the zinclevels, 30kg zinc sulphate as basal dose was most effective followed byseed treatment with 1% zinc sulphate during 2004-05. Other zinc treatments were less effective, than theabove two treatments.Interaction effects between zinc levels and varieties were alsosignificant showing better response in Mavliya 468 and PBW 343especially at 30kg zinc sulphate basal treatment during 2004-05 (Table 6). Number of ears per plant did not show significant variation amongthe varieties during the experiment period except in Malviya 468 during 2004-05where ear number per plant was significantly higher than the rest of the varieties (Table 6). During 2004-05, zinc treatments as 0.5% seedsoaking and basal application of 20 and 30kg zinc sulphate/ha producedsignificantly higher number of ears per plant than control. Restof the treatments though seems to be beneficial but the differences overuntreated control were statistically non-significant.During 2004-05, the interaction effectswere more visible especially in Malviya 468 (Table 6). Zinc treatmentwith 0.5% seed soaking was more prominent followed by basal application of 20 and 30 kg zinc sulphate and 0.5% foliar spray (Table6).The other two varieties did not show significant interaction except30kg zinc sulphate in PBW 343.Number of grains per ear varied among the varieties where Malviya468 showed significantly higher grain number than PBW 343 and NW1012 during the experiment years (Table 6). Application of zinc sulphate irrespective of the methods ofapplication resulted in higher grain number per ear relative to untreatedcontrol. The beneficial effects of zinc application were significantlysuperior the best being 0.5% foliar sprays during 2004-05. However, during 2004-05, Malviya468 showed best interaction at 20kg zinc sulphate basal treatmentclosely followed by 0.5% foliar spray, while NW1012 and PBW 343depicted best interaction with 0.5% foliar spray and 1% seed treatmentwithzincsulphate respectively (Table 6). Data on the number of grains per plant have been presented inTable 6 for 2004-05respectively. Perusal ofTables indicates that only Malviya 468 showed significantly higher grainnumber per plant as compared to rest of the two varieties. Grain numberper plant under all the zinc treatments was significantly higher thanuntreatedcontrol during 2004-05 (Table 6). During 2004-05, very poor interaction between varieties and

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zinctreatments were observed. Only 20kg basal zinc sulphate treatment hadsignificant interaction with Malviya 468. Rest of the interactions wasstatistically non-significant.Basal treatments of 20 and 30kg zinc sulphateand foliar spray also showed significant interaction with Malviya 468depicting higher number of grains than 0.5% seed treatment. Tables 6 clearly indicate that Malviya 468 is more responsive tozinc application than rest of the two wheat varieties.

Table 6. *Effect of zinc application on yield traits in wheat varieties grown in sodic soil (2004-05)*

Zinc level		**Variety**		**Mean**	**SEM±**	**CD P=0.05**
	VI	**V2**	**V3**			
	Length of ear (cm)					
ZnO	8.17	9.07	10.00	9.08		
Znl	9.13	9.23	10.53	9.63		
Zn.2	9.00	9.67	10.73	9.80		
Zn3	8.87	9.37	10.38	9.54	V=0.080	V=0.231
Zn4	9.17	10.20	11.00	10.12	Zn=0.113	Zn=0.326
Zn5	9.07	9.70	10.30	9.69	VxZn=0.196	VxZn=0.565
Mean	8.90	9.54	10.49	9.64		
	Number of ears per plant					
ZnO	4.80	4.83	5.33	4.99		
Znl	5.47	5.33	5.90	5.57		
Zn.2	5.17	5.00	5.50	5.22		
Zn3	5.20	5.20	5.97	5.46	V=0.107	V=0.308
Zn4	5.67	5.83	5.83	5.78	Zn=0.151	Zn=0.435
Zn5	5.17	5.10	5.80	5.36	VxZn=0.261	VxZn=0.753
Mean	5.24	5.22	5.72	5.39		
	Number of grains/ ear					
ZnO	43.50	43.67	45.67	44.28		
Znl	44.17	47.00	48.00	46.39		
Zn.2	44.17	48.00	49.33	47.17		
Zn3	44.67	46.67	52.33	47.89	V=0.316	V=0.914
Zn4	44.83	47.33	49.17	47.11	Zn=0.447	Zn= 1.292
Zn5	51.33	47.00	52.00	50.11	VxZn=0.775	VxZn=2.238
Mean	45.44	46.61	49.42	47.16		
	Number of grains / plant					
ZnO	209.07	211.17	244.00	221.41		
Znl	241.33	250.50	282.97	258.27		
Zn.2	228.23	240.17	271.50	246.63		

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Zn3	232.33	243.60	312.17	262.70	V=5.722	V=16.525
Zn4	254.00	276.00	287.07	272.36	Zn=8.093	Zn=23.37
Zn5	265.27	240.03	301.60	268.97	VxZn=14017	VxZn=40.478
Mean	**238.37**	**243.58**	**283.22**	**255.06**		

BIOLOGICAL AND GRAIN YIELDS

Data recorded on harvest index of wheat varieties as influenced by different zinc sulphate treatments are presented in (Table 7). A perusal of the data indicates that there is no difference in the harvest index of the three wheat varieties evaluated in the present study during 2004-05. All the zinc treatments though improved harvest index but the data were statistically significant only with 20and 30kg/ha soil application and 0.5% foliar spray during first year (2004-05). Interaction effects were significant with 20kg basal and 0.5% foliar sprays of zinc sulphate in NW 1012 during 2004-05. Similarly, PBW 343 showed significant interaction with both the doses of soil application and 0.5% foliar spray. Foliar spray of zinc sulphate was the best interaction during both the years except the interaction of NW 1012. Biological yield per plot did not differ significantly among the threevarieties but zinc treatments increased total biomass significantly over nozinc treatment during 2004-05 (Table 7). Best responsewas noted by 0.5% foliar spray followed by 30kg zinc sulphate as basal.Pre- sowing seed treatments were least effective. Biologicalyield under Malviya 468 was also significantly higher than PBW 343(Table 7). All the zinc treatments except 0.5% seedtreatment had significantly higher biomass than control, the best being20kg basal treatment followed by 1% seed treatment and 0.5% foliarspray respectively (Table 7).Interactions between varieties and zinc treatments werestatistically non-significant during 2004-05 (Table 7). **Bagci et al. (2007)** reported positive response of zinc on grain yield and dry matter production in bread and durum wheat and triticale; both grain yield and Zn concentration of grains increased by nearly 60% with zinc application under rainfed and irrigated water regimes. PBW 343 showed best interaction with 1% zinc sulphate pre-sowing seedtreatment followed by 0.5% foliar spray and both the levels of soiltreatments respectively. Wheat variety NW 1012 on the other handdepicted best interaction with soil treatments of zinc sulphatewhileMalviya 468 did not show any significant interaction with zinctreatments.Biological yield when expressed on per hectare basis wassignificantly higher in zinc treatments than untreated control during 2004-05 (Table 7). All the zinc treatments were almost at par to eachother except seed treatment with 0.5% zinc sulphate which producedbiological yields lower than 1% seed treatment with zinc though was statistically better than control. Among the varieties,NW1012 produced significantly higher biological yields than PBW343 andMalviya 468, both of them were statistically at par to each other during2004-05. Interactions between varieties andzinc treatments were also significant showing best response in NW l012with 30Kg zinc sulphate soil application closely followed by 0.5% foliarspray while Malviya 468 had best interaction with 0.5% foliar sprayfollowed by 20kg zinc sulphate soil application and 1% seed treatment (Table 7). In case of PBw343, all the zinc treatments showed identicalresponse.Wheat variety NW1012 on the other hand, produced significantly higherbiological yield with 30 Kg and 20 Kg zinc sulphate basal treatments ascompared to seed treatments. PBW343, however, showed best interactionwith seed treatment with 1% zinc sulphate (Table 7).Grain yield per plot in wheat variety NW 1012 was higher than PBW 343 and Malviya 468 but the differences were statistically non -significant during 2004-05 (Table 7). Yield in PBW 343and Malviya 468 were almost at par during 2004-05. Withregards to zinc treatments, foliar spray at the rate of 0.5% producedmaximum grain yield during experiment year followed by soil application at20 and 30kg/ha which were almost at par to each other. Pre sowing seedtreatments were also better than control but inferior to soil and foliarapplication of zinc sulphate.Interaction effects between zinc sulphate treatments and varietywere also significant. The best interaction in all thethree varieties were observed with foliar spray of 0.5% zinc sulphateclosely followed by soil application at 20 and 30kg/ha (Tables 7). NW 1012 producedthe maximum grain yield followed by Malviya 468 during 2004-05. Grainyield in PBW 343 and Malviya 468 was almost at par (Table 7).Among the zinc treatments all were statistically superior tountreated control. Highest grain yield was obtained with 0.5% foliarspray followed by soil applications. Grain yield under 20 and 30kg zincsulphate

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were almost at par to each other indicating no beneficial effectof increasing level of zinc sulphate. Interaction effects between varieties and zinc levels were significantly superior with foliar spray and soil application relative to presowingseed treatments during first year.

Table 7*. Effect of zinc application on biological and grain yields in wheat varieties grown in sodic soil (2004-05)*

Zinc level		**Variety**		**Mean**	**SEM±**	**CD P=0.05**
	VI	**V2**	**V3**			
	Harvest index-% (2004-05)					
ZnO	38.00	36.66	38.60	37.75		
Znl	37.54	39.35	37.70	38.20		
Zn.2	40.56	36.40	37.43	38.13		
Zn3	42.91	41.95	38.95	41.27	V=0.642	V=NS
Zn4	40.91	41.99	41.16	41.36	Zn=0.909	Zn=2.624
Zn5	42.72	42.85	40.45	42.01	VxZn=1.574	VxZn=4.545
Mean	40.44	39.87	39.05	39.79		
	Biological yield q/ha					
ZnO	101.42	93.17	95.50	96.69		
Znl	104.13	103.29	102.63	103.35		
Zn.2	105.33	107.00	108.13	106.82		
Zn3	106.63	104.25	109.79	106.89	V=0.854	V=2.466
Zn4	110.58	105.50	107.54	107.88	Zn= 1.208	Zn=3.488
Zn5	109.46	106.83	110.33	108.88	VxZn=2.092	VxZn=6.041
Mean	106.26	103.34	105.65	105.08		
	Grain yield q/ha					
ZnO	38.49	34.19	36.85	36.51		
Znl	39.08	40.67	38.63	39.46		
Zn.2	42.72	38.88	40.46	40.69		
Zn3	45.73	44.34	42.74	44.27	V=0.615	V= 1.777
Zn4	45.19	44.21	44.13	44.51	Zn=0.870	Zn=2.513
Zn5	46.75	46.30	44.63	45.89	VxZn=1.508	VxZn=4.353
Mean	**43.00**	**41.43**	**41.24**	**41.89**		

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CONCLUSION

Conclusions could be drawn from current studies at agriculture research farm of S.D.J Graduate College Chandeshwar, Azamgarh, (U.P.) that Foliar application of zinc sulphate @ 0.5% + 2% urea is most effective and economical as compared to soil application and pre-sowing seed soaking treatments. Even though the zinc response was variable in different varieties for different yield traits, but increase in these parameters are common to all the varieties relative to untreated control under variable environmental conditions encountered during 2004-05.Seed soaking treatments though were also effective but were inferior to soil application and foliar spray. It indicates that the beneficial effects of seed soaking tend to diminish with time until maturity.

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Phytochemical and Analytical Evaluation Of Cordiadichotoma Linn Leaves

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Abstract – *Cordiadichotoma Linn, a plant that is significant from an ethnomedicinal perspective, is used in a number of indigenous medical practises and is popular among a diverse range of ethnic groups in India for the treatment of a wide range of conditions, including as an astringent, an anthelmintic, a diuretic, a demulcent, an anti-diabetic, and an expectorant. The ever-increasing customer demand makes it imperative that quality control measures be strictly adhered to at all times. Aims and Objectives: The primary purpose of this investigation was to establish a standard pharmacognostical, physicochemical, phytochemical, fluorescence, and HPTLC chromatographic profile of the leaves of Cordiadichotoma Linn (CD). Both the Materials and the Methods: Analyses of pharmacognostical, physicochemical, fluorescence, and high performance thin-layer chromatography (HPTLC) were carried out on CD in accordance with the standard methodology. The CD had previously been authenticated. The results and the conclusion are as follows: the last observations were written down. It was determined that the loss on drying at 105 degrees Celsius was 8.5% by weight, that the total ash value was 13% by weight, that acid-insoluble ash was 5.07% by weight, that water-soluble ash was 5.49% by weight, that water-soluble extractive was 9.2% by weight, that alcohol-soluble extractive was 5.81% by weight, and that the pH of 1 percent aqueous extract was 6.88. The phytochemical analysis of the methanolic extract revealed the presence of steroid, carbohydrate, alkaloid, saponin, cardiac glycosides, flavonoid, and phenolic components. Under UV light, the fluorescence of the CD could be seen, and depending on the solvent, it appeared to be a different colour. Analysis using HPTLC showed that there are five peaks at a wavelength of 366 nm, with maximum Rf values ranging from 0.3 to 0.93. The pharmacognostical, physicochemical, fluorescence, and HPTLC observations made in this study can be used to evaluate the purity and quality of the leaves of Cordiadichotoma or medicinal compositions prepared from them.*

Keywords- *Physicochemical parameters, HPTLC chromatogram ,Cordiadichotoma, Fluorescence Analysis.*

INTRODUCTION

Cordiadichotoma Linn is a small to moderate-sized deciduous tree that belongs to the family Boraginaceae. It has a short bole and a spreading crown, and it is found throughout India and Srilanka. 1 Commonly known as Indian cherry in English, Lasura/Bhokar/Borla in Hindi, and Vadgundo/Gunda in Spanish and Portuguese respectively (Gujarati). Ayurveda and Unani are two examples of indigenous medical practises that make use of various plant parts, such as the stem, bark, and leaves of the plant. These treatments are also popular across the many different ethnic communities that make up India.as a remedy for a wide range of conditions thanks to its properties as an expectorant, astringent, anthelmintic, diuretic, demulcent, and anti-diabetic. In the Dandakaranya region of Andhra Pradesh, India, the leaves of this plant have a long history of use as a traditional medicine for the treatment of jaundice. It has been suggested that it possesses pharmacological properties such as antioxidant, juvenomimetic, antifertility, and anti-inflammatory properties, amongst other properties. 2-4 Carotenoids, which are mostly found in their leaves and have powerful antioxidant action, are present

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in this plant. 5 The current research focuses on a comprehensive pharmacognostical investigation of the plant's leaves, as well as physicochemical testing, fluorescence analysis, and HPTLC chromatographic fingerprint profiling. Despite the availability of more sophisticated modern research tools for evaluating plants and plant-derived crude drugs, the microscopic method is still one of the easiest and most cost- effective ways to begin establishing the identity of the source materials. This is despite the fact that it is one of the oldest methods. This study will offer future scientists with standardised characteristics for the leaves of Cordiadichotoma Linn, which will help them correctly identify the plant and detect any adulteration that may have occurred

MATERIALS AND METHODS

Plant specimens are being collected and authenticated at this time.

For the purpose of the study, leaves of the plant Cordiadichotoma Linn were taken from a neighbouring location of Kukrail forest in Lucknow, Uttar Pradesh, and authenticated by the National Botanical Research Institute of Lucknow

Components and chemical substances

Soxhlet apparatus, rotavapor, CAMAG HPTLC system (Muttenz, Switzerland) equipped with Linomat5 applicator, Reprostar3, TLC scanner3, twin trough plate development chamber, Hamilton syringe (100 ul, Reno, Nevada, USA), win-CATS software, analytical grade chemicals (Fischer Scientific and E. Merck, India), and HPLC grade methanol were used in this experiment (E. Merck, India).

Pharmacognostical assessment

The evaluation of CD for pharmacognostic purposes includes organoleptic characteristics (such as colour, odour, taste, and texture) as well as microscopic analyses. Observation with the naked eyes was used to capture the organoleptic characteristics. Microscopic examinations, specifically a transverse section (T.S.) of leaf that was prepared by treating it with saffaranin and mounting it with glycerin water over a glass slide, were analysed using a Carl Zeiss microscope. Microphotographs were taken using a binocular microscope that was also equipped with a camera. 6

Physiochemical and physicochemical analysis

Physicochemical parameters, such as loss on drying, total ash value, acid-insoluble ash, water-soluble ash, pH value, and extractive values, were utilised in order to conduct an analysis of CD.

Examination of phytochemicals

The phytochemical analysis included looking for things like carbohydrates, proteins, alkaloids, steroids, and glycosides, among other things.

Examination with fluorescence

Through the use of fluorescence analysis, finely powdered CD that had been subjected to a variety of chemical treatments was investigated. In addition to that, it was carried out with each of the various extracts, but no chemical treatment was applied. 10,11

Chromatographic examination with HPTLC

The banding technique was used to highlight a sample solution of methanolic extract of Cordiadichotoma leaves (MECD).a CAMAG Linomat 5 sample applicator being used in conjunction with a Hamilton syringe that has been placed on a precoated silica gel GF 60254 aluminium plate. The mobile phase consisted of a mixture of toluene, ethyl acetate, and formic acid at a ratio of 5:4:1. Following the completion of the development process, the plate was maintained in the CAMAG Reprostar 3 and a densitometric scan was carried out using a Camag TLC scanner3 in reflectance absorbance mode at UV detection as 254 nm and 366 nm under the direction of win-CATS software. 12,13

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OBSERVATIONS AND RESULTS

Pharmacognostical assessment

The organoleptic characteristics of CD are depicted in figure 1. The leaf has a shape that is almost spherical and has a dentate border. Both the upper and lower surfaces have a rough texture and a colour and look of light green. The flavour has a mucilaginous quality, and the aroma is really delightful. Microscopy of CD revealed characteristics such as scattered vascular bundles with patches of perimedullary phloem, as well as unicellular and multicellular covering trichomes (see Figure 2 for further explanation). Powder microscopy revealed the presence of xylem vessels as well as calcium oxalate crystals.

Physiochemical and physicochemical analysis

Physicochemical parameters were utilised in order to evaluate CD. It was discovered that the pH of an aqueous solution containing one percent (w/v) of powdered leaves was 6.88, which is about neutral pH. The following are some further observations, which are reported in Tables 1 and 2.

Physicochemical parameters		***% (with reference toair dried drug)***
Loss on drying		8.3
Ash value	Totalash	12
	Acid insoluble ash	5.05
	Water soluble ash	5.42

Examination of photochemical

The methanolic extract demonstrated the presence of components including steroids, carbohydrates, alkaloids, saponins, cardiac glycosides, flavonoids, and phenols. Table 3 outlines the degree of presence that was observed.

Examination with fluorescence

Tables 4 and 5 demonstrate the fluorescence characteristics of powdered leaves of the plant Cordiadichotoma and its numerous consecutive solvent extracts under daytime and ultraviolet light, respectively.

Figure 1: Leaves of CordiadichotomaLinn

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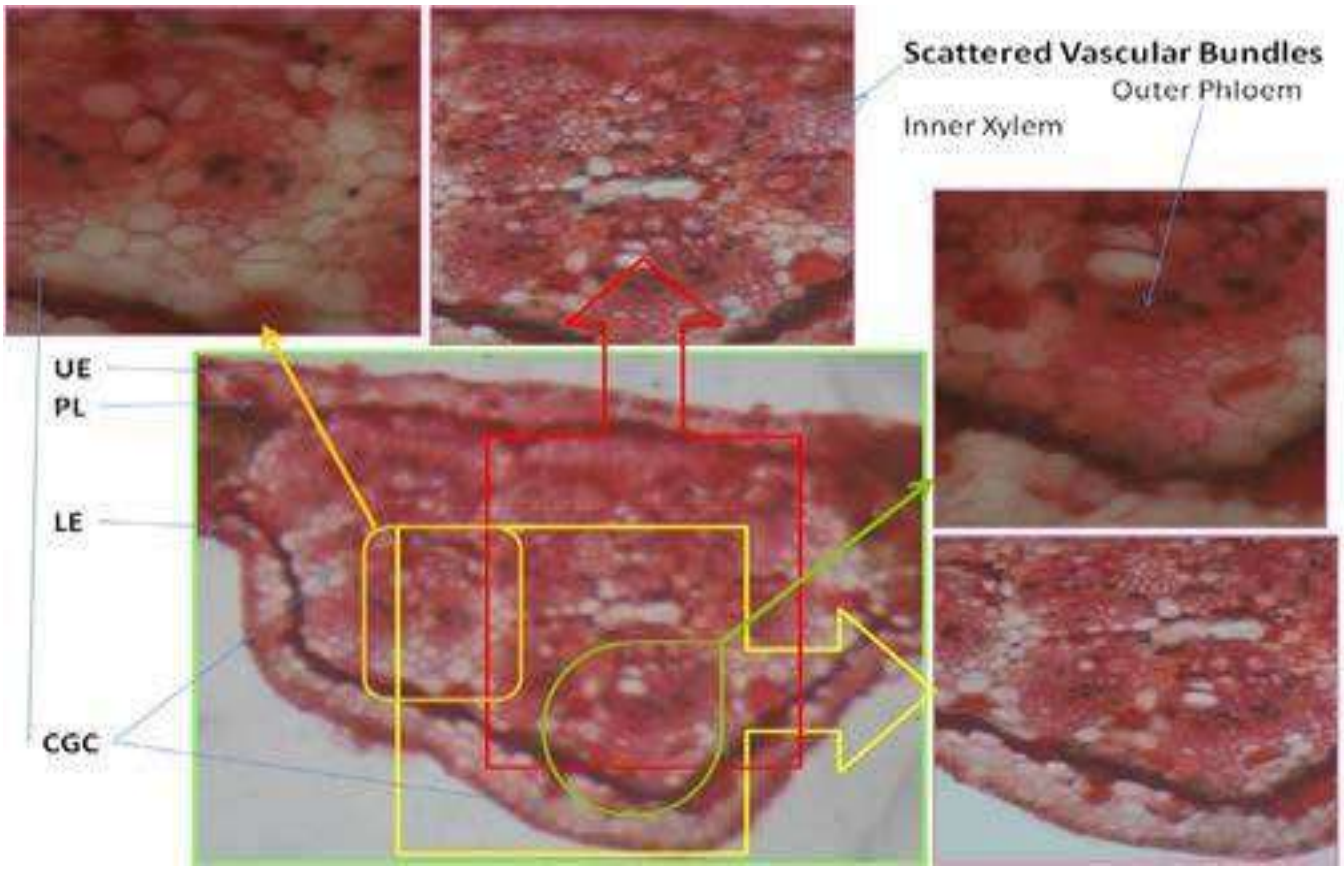

Figure 2: T.S. of leaf of CordiadichotomaLinn in midrib region under 4X, 10X and 28X views of microscope showing scattered vascular bundles [UE: Upper Epidermis, LE: Lower Epidermis, PL: Palisade Layer, CGC: Collenchymatous Ground Cells].

Table 2: Extractive values with color, consistency and solubility in water of different extracts for the powdered leaves of the plant Cordiadichotoma

Solvent extracts	*Color*	*Consistency*	*Solubility in water*	*Extractive values (% yield)*
Petroleum ether extract	yellowish green	Sticky	Insoluble	0.62
Chloroform extract	dark yellowish green	non-sticky	Soluble	0.85
Methanol extract	dark green	non-sticky	highly soluble	5.82
Aqueous extract	brown	dry powder	highly soluble	9.28

Table 3: Preliminary phytochemical screening of the methanolic extract of Cordiadichotomaleaves

Chemical Tests	Results	ChemicalTests	Results
1. Tests for phenolics and flavonoids		C. Cardiac Glycosides	
a) Lead acetate test	++	a)Legaltest	–
b) Ferric chloride test	++	b)Keller-Killiani test	+
c) Sodium hydroxide test	++	**D. Test forsteroids** Salkowski test	++
d) Shinoda test	++	**4. Test for Carbohydrates:**	
2. Test for Alkaloids		**A. Reducing sugar**	
a) Mayer's test	–	a)Molisch'stest	–

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b) Dragendorff's test	–	b)Fehlings test	+
c) Wagner's test	++	**B. Starch**(iodine test)	–
d) Hager's test	++	**5. Test for Proteins and free amino acids**	
3. Test for Glycosides:		a)Biuret test	+
A. Saponin Glycosides		b)Millions test	++
a) Foam Test	++	c) Xanthoprotein test	++
b) Sodium bicarbonate test	+	d)Ninhydrintest	+
B. Anthraquinone Glycosides Borntrager's test	–	**(++) indicates medium presence, (+) weak and (–) absence.**	

Table 4: Fluorescence characteristics of powdered leaves of the plant Cordiadichotoma chromatographic examination with HPTLC

Chemical treatment	Fluorescence		
	Day light	UV light 254 nm	366 nm
Powder as such	greenish brown	Purple	Black
Powder + water	brown	light green	Brown
Powder + 1 N HCl	brown	light green	Brown
Powder + 5% NaOH	light green	dark green	purplish brown
Powder + 1 N NaOH (Alc.)	green	Green	Black
Powder + 50% HNO_3	reddish green	Green	purplish brown
Powder +1M H_2SO_4	brown	Green	Brown
Powder +25% liquid ammonia	green	Green	purplish black
Powder +acetic acid	light green	dark green	Purple
Powder+iodine solution	yellow	dark green	Black
Powder + 5% $FeCl_3$ in ethanol	light green	dark green	Black

following examination with a densitometer at UV 254 nm and 366 nm, the HPTLC chromatogram showed the presence of many peaks (Figure 3, Figure 4, Table 6 and Table 7). At a wavelength of 254 nanometers, it showed three peaks. While doing so, it showed five peaks at UV 366 nm with maximum Rfvalues in the range ofa value in the range of 0.3 to 0.93, which indicates the presence of at least 5 distinct components in an amount of MECD measuring 5 l. It was determined that four of the components with maximum Rf values of 0.3, 0.53, 0.60, and 0.65 were prominent because the percentage area was greater for each of these four components: 30.97 percent, 13.18 percent, 26.23 percent, and 20.91 percent correspondingly. It was discovered that one of the components with a maximum Rf value of 0.93 had a percentage area that was less than 10 percent

. Table 5: Fluorescence characteristics of various successive solvent extracts of powdered leaves of the plant Cordiadichotoma

Chemical treatment	Day light	Fluorescence UV light 254 nm	366 nm
Petroleum ether extract	yellowish green	green	Black
Chloroform extract	light green	light green	greenish black
Methanolic extract	green	dark green	black
Aqueous extract	reddish brown	chocolate colored	black

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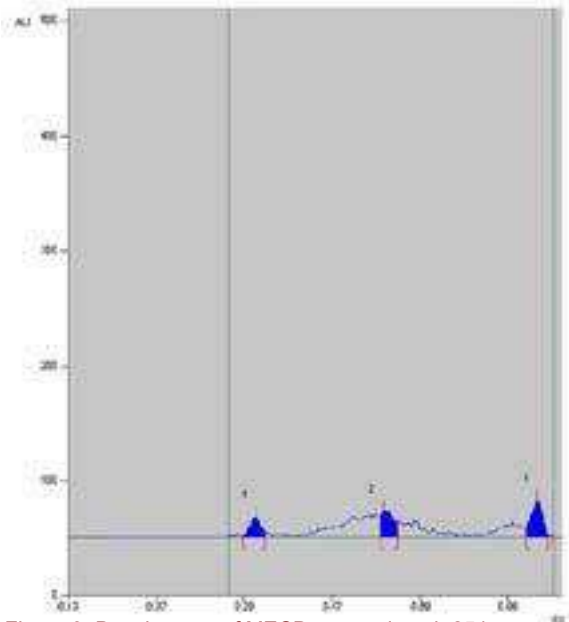

Figure 3: Densitogram of MECD at wavelength 254 nm

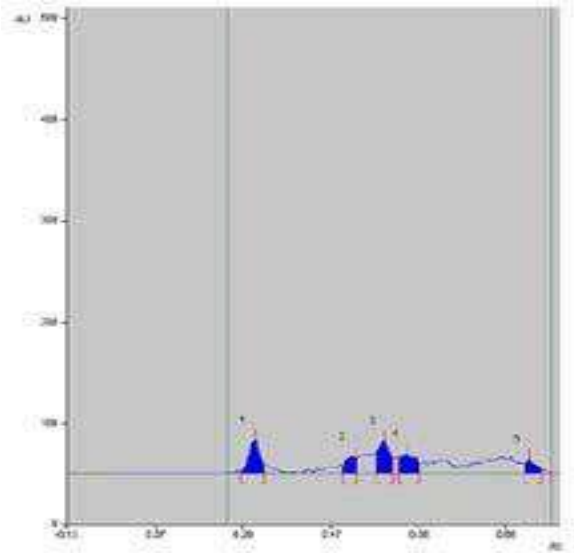

Figure 4: Densitogram of ECD at wavelength 366 nm

Discussion- The standardization of plant material is a difficult process because of the diverse composition of plant material, which might be in the form of the complete plant, a part of the plant, or extracts obtained from the plant itself. As a result, in recent years there has been a rapid increase in the standardization of many medicinal plants that have the potential to have therapeutic importance. This has been done in order to remedy the problem. The first and most important step in the process of achieving quality that can be replicated is to correctly identify and authenticate the initial material. Consequently, during the process of collecting plant material, attention was taken to gather the appropriate plant portion at the appropriate time. After that, it was validated by a specialist in the relevant scientific subject. In general, physicochemical parameters were used in order to determine the identity of the plant materials, as well as their purity and the presence or absence of any adulterants. In spite of the advances in technology, pharmacognostic evaluation and HPTLC chromatography analysis are still the most reliable methods for identifying plant materials.

Table 6: Densitogram table of MECD for measurement at wavelength 254nm

Peak	Start R_f	Start Height	Max R_f	Max Height	Max %	End R_f	End Height	Area	% Area
1	0.26	0.8	0.30	17.4	24.29	0.33	2.9	412.8	23.47
2	0.58	18.2	0.59	23.1	32.26	0.63	12.8	594.9	33.83
3	0.93	7.8	0.94	31.1	43.46	0.97	0.8	751.0	42.70

Table 7: Densitogram table of MECD for measurement at wavelength 366nm

Peak	Start R_f	Start Height	Max R_f	Max Height	Max %	End R_f	End Height	Area	% Area
1	0.27	1.2	0.30	33.5	29.10	0.34	4.0	876.9	30.97
2	0.51	6.2	0.53	16.5	14.33	0.54	14.6	373.1	13.18
3	0.56	19.6	0.60	31.7	27.50	0.62	14.6	742.8	26.23
4	0.65	15.4	0.65	20.0	17.32	0.68	9.1	592.1	20.91
5	0.93	8.9	0.93	13.5	11.75	0.96	3.3	246.5	8.71

more reliable. Evaluation of the organoleptic properties was carried out as part of the process of standardisation. An organoleptic evaluation is a method of qualitative analysis that is focused on the investigation of morphological and sensory components of substances, such as trichomes. Characteristics of the leaf's organoleptic makeup that can be used as

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diagnostic instruments The evaluations at the microscopic and physicochemical levels had been carried out. The percentage of extractives found in various solvents, such as petroleum ether, chloroform, alcohol, and water, provides information regarding the quantity and composition of the compounds found in the extracts. Extractive values are also helpful in estimating the amount of a certain ingredient that is soluble in a specific solvent. An HPTLC chromatographic analysis was performed, which is particularly beneficial since chromatographic fingerprinting is a sensible alternative to satisfy the requirement for more effective and powerful quality evaluation of traditional Chinese herbal medicine and traditional Indian medicine. The concluding observations have been written down. The loss on drying at 105 degrees Celsius was 8.5% by weight, the total ash value was 13% by weight, the acid-insoluble ash was 5.07% by weight, the water-soluble ash was 5.49% by weight, the water-soluble extractive was 9.2% by weight, and the alcohol-soluble extractive was 2% by weight. 5.81 percent by weight and a pH of 6.88 in an aqueous extract of 1 percent. Under UV light, the fluorescence of the CD could be seen, and depending on the solvent, it would have a distinct colour. Analysis using HPTLC showed that there were five peaks at a wavelength of 366 nm, and their maximum Rf values ranged from 0.3 to 0.93. This result is helpful in supplementing the information that is already available with regard to the identification and standardisation of the powdered form of the plant medication in order to differentiate it from adulterants. and identification in order to determine the identity and purity of the leaves of CD or medicinal preparations prepared from it in order to carry out additional research studies.

CONCLUSION

Based on the findings of this study, it is possible to draw the conclusion that the pharmacognostical characters, along with their physicochemical parameters, fluorescence characteristics, and HPTLC chromatographic profiling of the MECD leaf, resulted in a set of standards that have the potential to serve as an important source of information with regard to the standardisation of the MECD leaf.as well as identification in order to confirm the identity and purity of the leaves of CD or the pharmacological formulations that were prepared from it in later research studies.

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Pattern of Floristic Diversity of Sub-Tropical Forest in Shivalik Range of Doon Valley, Uttarakhand

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Abstract – *In the present study, comparison of life- forms reveals that the therophytes with 48.90% has the highest dominance. Relatively high percentage of therophytes indicates the fact that, they spend unfavorable period in the form of seeds. Therophytes (annuals) are drought evaders in the sense that the whole plant is shed during the unfavourable conditions. The higher percent of therophytes in Tons riverine system is due to the biotic disturbances like lopping and felling trees and grazing and is an indicator of influence of man and animals (Bharucha and Dave, 1944; Dayama, 1987; Ghildiyal and Srivastava, 1990). The presence of large number of therophytes is an area is often related to drier soil conditions (Dadhich, 1982). The high percentage of these shallow rooted annuals have made the maximum use of moisture from upper layers of soil thereby making a drain of soil moisture as observed by Singh and Joshi (1983). Dayama (1987) observed that overgrazing increases the percentage of Therophytes as recorded on grazed site of watershed areas and concluded that high values for therophytes is an indicator the influence exerted by men and animals. Rajwar and Gupta (1981) also observed the highest percentage of therophytes in disturbed areas of biotic influence and along the river banks.*

Keywords: *Riverine, Raus, Biological Spectrum, Life-form, Shivalik range, Doon valley*

INTRODUCTION

The floristic diversity knowledge of a plant community is a prerequisite to understand the overall structure and function of any ecosystem. It is valuable for many ecological studies such as succession and nature of plant communities which are supportive in reclamation of abandoned sites. Floristic tell us what grows, but it also speaks to understand how competing elements controlled by a particular environment balance each other to produce a relatively stable assemblage of plants within a region (Saldanha, 1980). The living world is composed of more or less distinct entities which are called species. Fundamental botanical research revolves around floristic (listing of all plants of a given area) and monographs (study of a plant group for its entire range of distribution). Flora is an important part of the ecosystem that integrates the effects of the total environment. It is predominantly a result of physico-climatic conditions of a region. In other words, floristic composition represents a true image of a terrain and variations of temperature and precipitation and provides basic information for understanding of regional development. It has a highly functional role in providing nutrients for an ecosystem and provides suitable habitat, food and shelter for other biota. It can provide information regarding species composition and structure and its functional role in the landscape as a whole.

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Floristic studies are taxonomic studies of a flora or major segment of a flora, of a given area. Several systems are proposed for the classification of floristic vegetation based on the general appearance of plants. The life forms are classified on the basis of adaptation of their perennating organs to tide over the unfavorable conditions. A life form of the plant is the sum of all life processes and evolved directly in response to the environment (Cain, 1950). Humboldt (1886) for the first time formulated the concept of the life forms for which he considered the location of perennating buds or organs. Raunkiaer (1934) used it as descriptive tool for classifying plant life forms based on the position and degree of protection of the renewing buds, which are responsible for the renewal of the plant's aerial body when the favorable season comes. Raunkiaer's (1934) life-form system is the most significant and practical one from ecological point of view and has a universal acceptability. Raunkiaer prepared a normal spectrum for the phanerogamic flora of the whole world which is still widely used for comparing biological spectra of different region. The biological spectrums of different regions of India have been determined by various workers (Meher-Homji, 1964, 1981; Sinha, 1990; Kumar and Krishnamurthy, 1933; Rajwar and Gupta, 1981; Pandey and Parmar, 1993; Sharma and Dhakre, 1993; Reddy *et* al., 2002; Rana *et* al., 2002 and Pattanaik*et* al., 2007). Thus the biological spectrum of different regions may be worked out and used to compare the widely separated plant communities in terms of their climatic adaptability. Meher-Homji (1964) compared the biological spectra of various regions of India to bring out the value of life-forms as indicators of degrees of aridity and humidity in a tropical country.

METHODOLOGY

This floristic exploration work is based on the results of intensive study of the flowering plants of the Shiwaliksriverine system between the years of 2016 and 2020. Several attempts were made for collection in different seasons. Plant specimens in flowering and fruiting stages were collected at regular intervals throughout the year. Usual method of collection, preservation and maintenance of specimens in the herbarium were followed (Jain and Rao, 1977). The field notes on vernacular names, habit, habitat, and colour of flowers, flowering and fruiting time of each taxon were regularly recorded with the plant collection. Information regarding local names and locality of the plants were recorded with the help of the local people and forest personnel. The growth form, habit and nature of the perennating buds of different plant species were recorded and classification was done as per the Raunkiaer (1934).

The plant specimens (herbs, shrubs and trees) collected during field trips were identified with the help of regional floras and confirmed after matching these specimens with authentically identified specimens preserved in the Herbarium of Forest Research Institute (DD) and Botanical Survey of India, Northern Regional Centre (BSD), Dehra Dun. After identification, all the specimens were preserved and mounted on Herbarium sheet and deposited in the Herbarium of Ecological Research Laboratory, Botany Department D.A.V. (P.G.) College, Dehra Dun.

RESULTS

The floristic exploration of present study has showed the occurrence of 193 plant species belonging to 153 genera under 54 families. Description of families, genera and species along with their growth form and life form are depicted in Table 4.1.A total 193 plant species (149 dicots and 54 monocots) belonging to 153 genera (108 dicots and 45 monocots) and 54 families (47 dicots and 07 monocots) were recorded . It is evident that dicots families are over 7 times larger than monocots, the genera are more than two times the monocots and species are also three times the monocots (Table 4.2,Fig. 4.1). The habit approach of plants revealed that out of 193 flowering plants, the biggest group was herbs with 135 species (69.9%) which is followed by shrubs with 38 species;trees with 14 species (7.3%) and climbers with 06 species (3.1%) (Fig.4.2).

Table 4.1: Taxa at Species level from the Study Site

Family	Plant Species	Growth Form	Life Form
Acanthaceae	Barleria cristata L.	Shrub	Th
Acanthaceae	DiclipterabupleburoidesNees	Herb	Th
Acanthaceae	JusticasimplexD.Don	Herb	Th
Acanthaceae	LepidagathisincurvaBuch.-Ham. ex D.Don	Herb	He

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Acanthaceae	LepidagathiscuspidataNees	Herb	He
Acanthaceae	Peristrophebicalyculata(Retz.)Nees	Herb	Th
Acanthaceae	RungiapectinataClarke	Herb	Th
Amaranthaceae	Achyranthes aspera L.	Herb	Th
Amaranthaceae	Aervasanguinolenta (L.)Bl.	Shrub	Ph
Amaranthaceae	Amaranthus viridisL.	Herb	Th
Apiacae	Bupleurum falcatum L.	Herb	Th
Apocynacece	CarissaspinarumL.	Shrub	Ph
Araceae	Arisaematortuosum(Wall.)Schott.	Herb	Cr
Araceae	Plesmoniummargaritiferum(Roxb.)Schott.	Herb	Cr
Araliaceae	Hydrocotyleasiatica L.	Herb	He
Arecaceae	Phoenixhumilis Royle	Tree	Ph
Aspargaceae	AsparagusadsendensRoxb.	Shrub	Ph
Asteraceae	Ageratum conyzoides L.	Herb	Th
Asteraceae	Bidensbiternata(Lour.) Merr.&Sherff.	Herb	Th
Asteraceae	BidenspilosaL.	Herb	Th
Asteraceae	Blainvilleaacmella (L.) Philipson	Herb	Th
Asteraceae	Blumeopsis flava (DC.) Gagnep.	Herb	Th
Asteraceae	Conyzastricta Willd.	Herb	Th
Asteraceae	EcliptaprostrataL.	Herb	Th
Asteraceae	Emiliasonchifolia (L.)DC.	Herb	Ph
Asteraceae	Inulacappa (Buch.-Ham. ex D.Don)DC.	Shrub	Th
Asteraceae	Sonchusoleraceous L.	Herb	Th
Asteraceae	Tridaxprocumbens L.	Herb	Th
Asteraceae	Xanthium strumarium L.	Herb	Th
Begoniaceae	BegoniapictaSmith	Herb	Th
Boraginaceae	CordiadichotomaForst.f.	Tree	Ph
Boraginaceae	CynoglossumlanceolatumForsk.	Herb	Th
Boraginaceae	Trichodesmaindicum (L.)R.Br.	Herb	Th
Brassicaceae	Arabidopsisthaliana (L.) Heynh.	Herb	Th
Cactaceae	Opuntia dilleniiHaw.	Shurb	Ph
Caesalpiniaceae	BauhiniavahliiW. & A.	Climber	Ph
Caesalpiniaceae	BauhiniavariegataL.	Tree	Ph
Caesalpiniaceae	Cassiaoccidentalis L.	Shrub	Th
Caesalpiniaceae	Cassia pumilaLamk.	Herb	Ph
Caesalpiniaceae	CassiaobtusilobaL.	Shrub	Ph
Cannabaceae	TremapolitoriaPlanch.	Tree	Th
Caryophyllaceae	ArenariaserpyllifoliaL.	Herb	Th
Caryophyllaceae	Stellaria cerastoideL.	Herb	Th
Commelinaceae	Cyanotisvaga(Lour.)Schult.f.	Herb	Th

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Commelinaceae	Murdannianudiflora (L.)Bruckn.	Herb	Th
Convolvulaceae	IpomoeapestigridisL.	Climber	Ph
Convolvulaceae	PoranapaniculataRoxb.	Shrub	Ph
Cucurbitaceae	Diplocyclospalmatus(L.)Jeffrey	Climber	Cr
Cyperaceae	Bulbostylisbarbata (Rottb.) Clarke	Herb	Cr
Cyperaceae	Cyperuspaniceus (Rotta) Boeck.	Herb	Cr
Cyperaceae	CyperuspangoreiRottb.	Herb	Cr
Cyperaceae	Cyperussanguinolentus Vahl	Herb	Cr
Cyperaceae	Cyperusbrevifolius(Rottb.)Hassk.	Herb	Th
Cyperaceae	Cyperusrotundus L.	Herb	Th
Cyperaceae	Eriophorumcomosum(Wall.)Wall. ex Nees	Herb	Th
Cyperaceae	Fimbristylisdichotoma (L.) Vahl	Herb	Cr
Cyperaceae	Cyperuspumilus L.	Herb	Th
Cyperaceae	CarexcondensataNees	Herb	Ph
Dioscoreaceae	DioscoreabulbiferaL.	Herb	Ph
Dipterocarpaceae	Shorearobusta Gaertn.f.	Tree	Th
Euphorbiaceae	Euphorbiahirta L.	Herb	Th
Euphorbiaceae	EuphorbiageniculataOrteg.	Herb	Th
Euphorbiaceae	EuphorbiahypericifoliaL.	Herb	Ph
Euphorbiaceae	MallotusphilippensisMuell.-Arg.	Tree	Th
Euphorbiaceae	Phyllanthusdebilis Klein ex Willd.	Herb	Th
Euphorbiaceae	Phyllanthussimplex Retz.	Herb	Ch
Fabaceae	Alysicarpusbupleurifolius (L.)DC.	Herb	Ch
Fabaceae	AlysicarpusferrugineusHochst.&Steud.	Herb	Ch
Fabaceae	Alysicarpusvaginalis(L.)DC.	Herb	Ph
Fabaceae	Cajanusscarabaeoides (L.) Thouars	Climber	Ph
Caesalpiniaceae	Cassia fistulaL.	Tree	Ph
Caesalpiniaceae	Cassia laevigata Willd.	Herb	Ph
Fabaceae	CrotalariaalataBuch.-Ham.exD.Don	Herb	Ph
Fabaceae	CrotalariamedicagineaLamk.	Herb	Th
Fabaceae	Crotalaria calycinaSchrank.	Herb	Th
Fabaceae	Crotalariaalbida Heyne ex Roth	Herb	Ch
Fabaceae	Crotalariajuncea L.	Herb	Ch
Fabaceae	Crotoalariapallida Aiton	Herb	Th
Fabaceae	CrotalariaprostrataRoxb.	Herb	Th
Fabaceae	Desmodiumpulchellum(L.)Benth.	Shrub	Ph
Fabaceae	Desmodiumtriflorum(L.)DC.	Herb	Ph
Fabaceae	DesmodiumheterocarponDC.	Shrub	Th
Fabaceae	Desmodiumvelutinum(Willd.)DC.	Shrub	Ph
Fabaceae	Indigoferalinifolia(L.f.)Retz.	Shrub	Th

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Fabaceae	Lathyrusaphaca L.	Herb	Ph
Fabaceae	Ougeinia delbergioidesBenth.	Tree	Th
Fabaceae	Sesabaniasesban(L.)Merr.	Tree	Ph
Fabaceae	Viciahirsuta(L.)Gray	Climber	Ph
Fabaceae	Viciasativa L.	Climber	Th
Fabaceae	Urariapicta(Jacq.)Desv.	Shrub	Th
Fabaceae	ZorniagibbosaSpan.	Herb	Th
Gentianaceae	Canscoradecussata (Roxb.)Schult.&Schult.	Herb	Ph
Gentianaceae	GentianaapricaDecne	Herb	Ch
Geraniaceae	Geraniumocellatum Cambess.	Herb	Th
Lamiaceae	AjugamacrospermaWall.	Herb	He
Lamiaceae	Anisomelisindica (L.)O.Kuntze	Herb	Th
Lamiaceae	CaryopteriswallichianaSchau.	Shrub	Th
Lamiaceae	Clerodendrumviscosum Vent	Shrub	Ph
Lamiaceae	Leucascephalotes(Roth.)Spreng.	Herb	Ph
Lamiaceae	Nepetagraciliflora Benth.	Herb	Th
Lamiaceae	Nepetahindostana(Roth.)Haines	Herb	Th
Lamiaceae	Callicarpa macrophylla Vahl	Shrub	Th
Linaceae	Reinwardtiaindica Dumort.	Shrub	Ph
Linderniaceae	Linderniacrustacea (L.)F.Muell.	Herb	Ch
Linderniaceae	ToreniacordifloraRoxb.	Herb	Ph
Lythraceae	Woodfordiafruiticosa(L.)Kurz.	Shrub	Ch
Malvaceae	HelicteresisoraL.	Shrub	Th
Malvaceae	Kediyacalycina Roxb.	Tree	Ph
Malvaceae	Malvastrumtricuspidatum(R.Br.)A.Gray	Sub Shrub	Ph
Malvaceae	Sidacordifolia L.	Sub Shrub	Ph
Malvaceae	Sidaorientalis Cav.	Sub Shrub	Ph
Malvaceae	Sidacordata (Burm.f.)Borss.	Sub Shrub	Ph
Malvaceae	SterculiavillosaRoxb. ex Smith	Tree	Ph
Malvaceae	Urenalagopus DC.	Shrub	Ph
Menispermaceae	Cissampelospareira L.	Climber	Ph
Moraceae	Ficusauriculata Lour.	Tree	Th
Myrtaceae	Syziguimcumini(L.)Skeels	Tree	Ph
Nyctaginaceae	Boerhaaviadiffusa L.	Herb	Ph
Onagraceae	EpilobiumhirsutumL.	Herb	Ph
Orchidacae	HabenariamarginataColeb.	Herb	Ph
Orobanchaceae	CentrantheranepalensisD.Don	Herb	Ph
Orobanchaceae	Lindenbergiaindica (L.)O.Kuntze	Herb	Th
Orobanchaceae	Strigaasiatica (L.)O.Kuntze	Herb	Th
Orobanchaceae	Strigaangustifolia Lour.	Herb	Cr

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Phyllanthaceae	PhyllanthusurinariaL.	Herb	Cr
Plantaginaceae	Mesopatesorontium L	Herb	Th
Plantaginaceae	Limnophilaindica (L.)Druce	Herb	Th
Plantaginaceae	Veronicapersica Poir.	Shrub	Ch
Poaceae	AlloteropsisangustataStapf.	Herb	Th
Poaceae	Apludamutica L.	Herb	Th
Poaceae	ArundinellanepalensisTrin.	Herb	He
Poaceae	Arundinellabengalensis (Spreng.)Druce	Herb	Ph
Poaceae	Arthraxon lancifolium (Trin.)Hochst	Herb	Th
Poaceae	Capillipedinumassimile (Steud.)A.Camus	Herb	Th
Poaceae	ChrysopogonserrulatusTrin.	Herb	He
Poaceae	Cymbopogonflexuosus (Nees ex Steud.)Wats.	Herb	Th
Poaceae	Cymbopogonmartinii(Roxb.)Wats.	Herb	Th
Poaceae	Cyrtococcumaccrescens(Trin.)Stapf	Herb	Ch
Poaceae	Digitaria longifolia (Retz.)Pers.	Herb	Ph
Poaceae	Digitariasanguinalis (L.)Scop.	Herb	Ch
Poaceae	Digitariaciliaris (Retz.) Koeler	Herb	Cr
Poaceae	Eleusineindica(L.)Gaertn.	Herb	Cr
Poaceae	Eragrostiellanardoides(Trin.)Bor.	Herb	Th
Poaceae	Eragrostisunioloides(Retz.)Nees ex Steud.	Herb	He
Poaceae	Eragrostistenella(L.)P.Beauv.	Herb	He
Poaceae	Tripidiumrevennae(L.) H.Scholz	Herb	He
Poaceae	ErianthusfilifoliusNees ex Steud.	Herb	Th
Poaceae	Hetropogoncontortus (L.)P.Beauv.	Herb	Th
Poaceae	Imperatacylindrica (L.)P.Beauv.	Herb	Th
Poaceae	Neyraudiaarundinacea Hook.f.	Herb	Th
Poaceae	Oplismenuscompositus(L.)P.Beauv.	Herb	Th
Poaceae	Oplismenusburmannii (Retz.)P.Beauv.	Herb	Th
Poaceae	Panicumpatens Hochst.exSteud.	Herb	Th
Poaceae	PaspalumscrobiculatumHook.f.	Herb	He
Poaceae	Saccharumspontaneum L.	Herb	Th
Poaceae	SetariaglaucaB.Beauv.	Herb	He
Poaceae	Sorghumhalepense(L.)Pers.	Herb	He
Poaceae	Themedaquadrivalvis (L.)O.Kuntze	Herb	Th
Poaceae	Thysanolaenamaxima (Roxb.)O.Kuntze	Herb	Th
Poaceae	Chrysopogonzizanioides(L.)Nash	Herb	Th
Poaceae	Bothriochloapertusa (L.) A.Camus	Herb	Th
Poaceae	Cynodondactylon(L.) Pers.	Herb	He
Poaceae	Desmostachyabipinnata (L) Stapf	Herb	Th
Polygalaceae	Polygalachinensis L.	Herb	Th

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Polygalaceae	PolygalafurcataRoyle	Herb	Th
Polygonacae	Polygonumbarbatum L.	Herb	Th
Polygonacae	PolygonumflaccidumRoxb.	Herb	He
Polygonacae	PolygonumplebejumR.Br.	Herb	Th
Polygonceace	RumexhastatusD.Don	Herb	Th
Portulacacae	Portulacaoleracea L.	Herb	Th
Primulaceae	Anagallisarvensis L.	Herb	Th
Primulaceae	Androsacetrifolia Adams	Herb	Ch
Primulaceae	Maesa indica (Roxb.)A.DC.	Shrub	He
Ranunculaceae	ClematisgourianaRoxb. ex DC	Climber	Ch
Rhamnaceae	HelinuslanceolatusBrand.	Shrub	Ch
Rhamnaceae	ZizyphusmauritianaLam.	Shrub	Th
Rhamnaceae	Zizyphusnummularia (Burm.f.)Wight&Arn.	Shrub	Ph
Rubiaceae	Borreria stricta G.F.W.May	Herb	Ph
Rubiaceae	SpermadictyonsuaveolusRoxb.	Shrub	Ph
Rubiaceae	Oldenlandianudicaulis Roth.	Herb	Ph
Rubiaceae	Oldenlandiacorymbosa Hook.f.	Herb	Ph
Rubiaceae	Pavettaindica L.	Shrub	Th
Rutaceae	Murrayakoenigii(L.)Spreng.	Shurb	Ph
Scrophulariceae	Mazus rugosusLour.	Herb	Th
Solanaceae	SolanumsurratenseBurm.f.	Herb	Th
Tiliaceae	CorchorusaestuansL.	Herb	Ph
Tiliaceae	Corchorus tridensL.	Herb	Ph
Tiliaceae	GrewiaglabraBl.	Tree	Th
Tiliaceae	TriumfettapilosaRoth	Herb	Th
Tiliaceae	TriumfettarhomboideaJacq.	Shrub	Th
Verbenaceae	Colebrookeaoppositifolia Smith	Shrub	Ph
Verbenaceae	Lantanacamara L.	Shrub	Ph
Vitaceae	Leeaaspera Edgew.	Shrub	Ph

Table 4.2: Diversity of Taxa of the Study Site

Plant Groups	**Family**		**Genera**		**Species**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Dicot	47	87	108	70.6	149	75
Monocot	07	13	45	29.4	54	25
Total	**54**		**153**		**193**	

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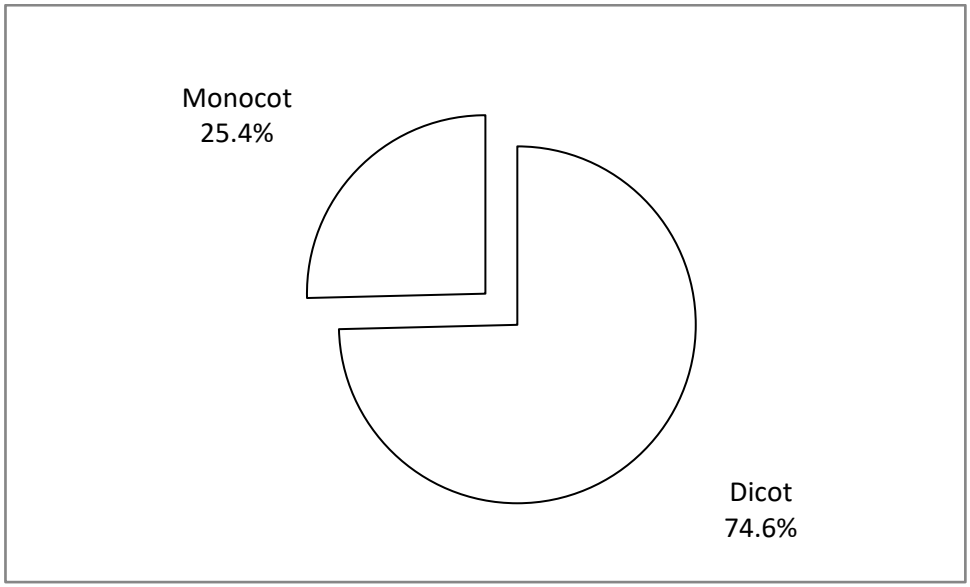

Fig. 4.1: Percentage contribution of Dicots and Monocots from the Study Area

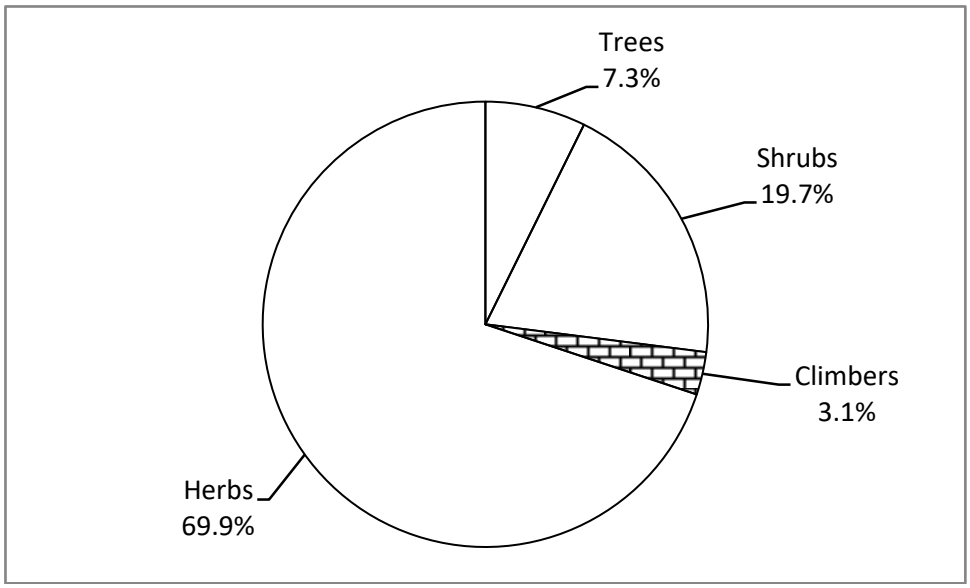

Fig. 4.2:Percentage contribution of various growth forms from the Study Area

The most dominant family of the study site as per number of genera and species was Poaceae with 35 species belonging to 28 genera. The co-dominant families were Fabaceaewith 23 species and 12 genera, Asteraceae with 12 species and 11 genera, and Cyperaceae with 10 species and 5 genera (Fig 4.3). Contribution of other families along their species and genera is listed in alphabetic order in Table 4.3

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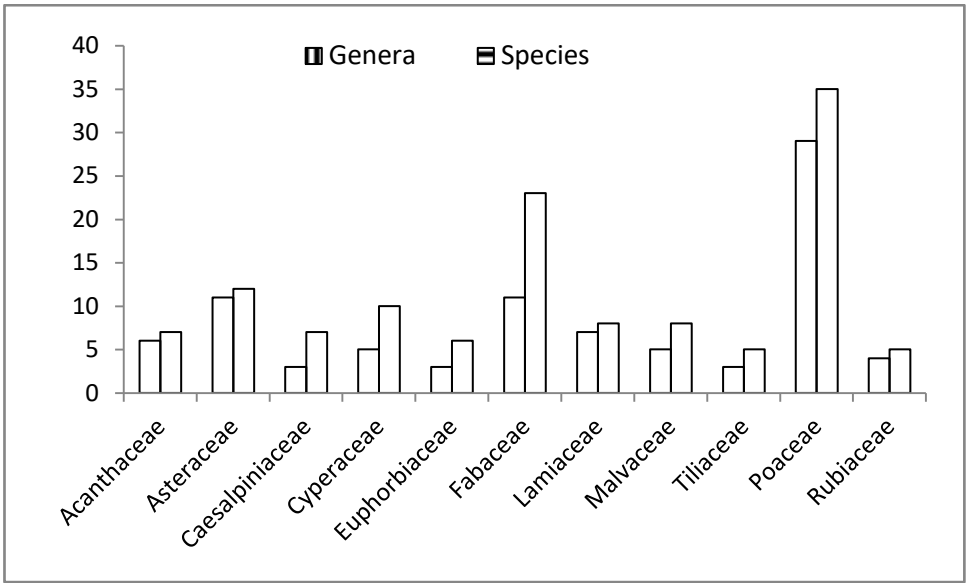

Fig. 4.3:Dominant Families of the Study Area

Table 4.3 Contribution of families with Genera and Species from the Study Area

Family	**Genera**	**Species**
Acanthaceae	06	07
Amaranthaceae	03	03
Apiacae	01	01
Apocynacece	01	01
Araceae	02	02
Araliaceae	01	01
Arecaceae	01	01
Aspargaceae	01	01
Asteraceae	11	12
Begoniaceae	01	01
Boraginaceae	02	02
Brassicaceae	01	01
Cactaceae	01	01
Caesalpiniaceae	02	05
Cannabaceae	01	01
Caryophyllaceae	02	02
Commelinaceae	02	02
Convolvulaceae	02	02
Cucurbitaceae	01	01
Cyperaceae	04	11
Dioscoreaceae	01	01
Dipterocarpaceae	01	01

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Euphorbiaceae	03	06
Fabaceae	02	04
Caesalpiniaceae	01	02
Caesalpiniaceae	09	19
Fabaceae	12	23
Gentianaceae	02	02
Geraniaceae	01	01
Lamiaceae	07	08
Linaceae	01	01
Linderniaceae	02	02
Lythraceae	01	01
Malvaceae	06	08
Menispermaceae	01	01
Moraceae	01	01
Myrtaceae	01	01
Nyctaginaceae	01	01
Onagraceae	01	01
Orchidacae	01	01
Orobanchaceae	03	04
Phyllanthaceae	01	01
Plantaginaceae	03	03
Poaceae	28	35
Polygalaceae	01	02
Polygonacae	02	04
Portulacacae	01	01
Primulaceae	03	03
Ranunculaceae	01	01
Rhamnaceae	02	03
Rubiaceae	04	05
Rutaceae	01	01
Scrophulariceae	01	01
Solanaceae	01	01
Tiliaceae	03	05
Verbenaceae	02	02
Vitaceae	01	01

The largest genus was *Crotolaria* with 7 species followed by *Cyperus* with 6 species, *Desmodium with 4 species* and *Euphorbia* ,*Crotalaria, Sida,Digitaria,, Polygonum*, *Cassia* and *Alysicarpus*each with 3 species (Table 4.4).

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Table 4.4: Dominant Genera of the study site

Genera	**Number of species**
Cyperus	6
Desmodium	4
Euphorbia	3
Crotalaria	7
Sida	3
Digitaria	3
Polygonum	3
Cassia	3
Alysicarpus	3

From the Table 4.5 it is evident that Therophytes and Phanerophytes are most dominant life-forms in the study area represented by 50.3% and 29% respectively. Other categories of life-forms in order of importance were Chamaeophytes with 6.2%, Cryptophytes 6.2% and Hemicryptytes with 8.3%. The Therophytes (50.3%) are more than three times higher that of the normal spectrum (13%). Phanerophytes (29.00%), Chamaeophytes (6.2%) and Hemicryptytes (8.3%) show smaller percentage than the normal spectrum (Fig. 4.4).

Table 4.5: Biological spectrum of Tons riverine system, compared with Raunkiaer's normal spec

Life-form	**Raunkiaer's normal spectrum**	
Categories	**% of species**	**% of species**
Phanerophytes	29.00	46
Chamaeophytes	6.20	9
Hemicryptophytes	8.30	26
Cryptophytes	6.20	6
Therophytes	50.3	13

All the 193 species collected from the study site along with their life-form, division, growth form and organ of perennation categorized based on Raunkiaer's systems as modified by Ellenberg and Muellaer-Dombois (1974) are given in Table 4.1. It is compared with Raunkiaer's normal spectrum. The phenplogical observations of the species showed that most of the species propagate by seeds. Other propagules like rhizomes, tubers, stolons are also used for propagation.A comparison of riverine biological spectra from Uttarakhand (Table 4.6) indicates that in Song riverine area and Tons riverine area the life-form percentage indicates Thero-phanerophytic climate similar to present study.

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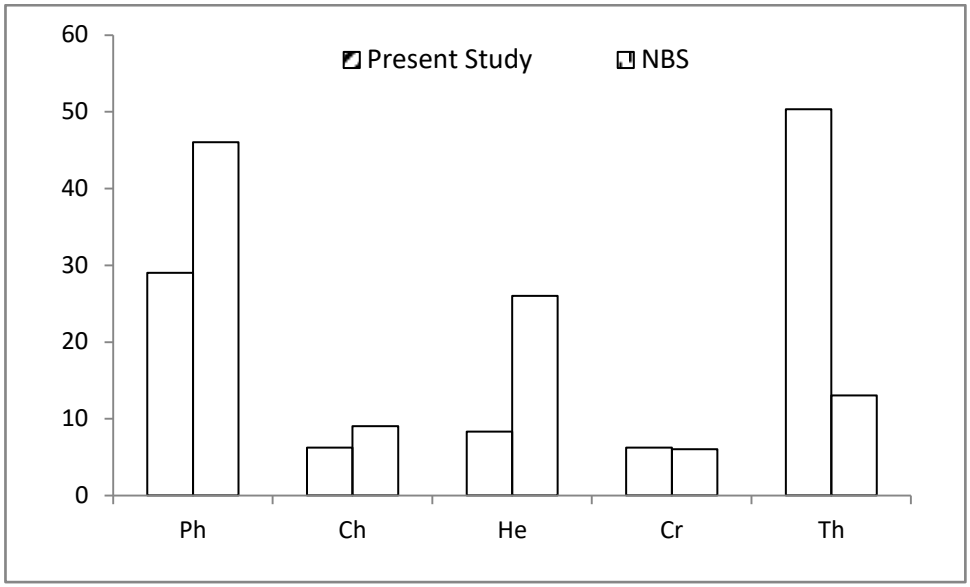

Fig. 4.4: Comparison of Life-forms of Present Study Site with Raunkiaer's Life-form

Table 4.6:Biological Spectrum of Various Riverine Areas in Uttarakhand

River	No. of Species	Life-form Classes					Phyto-climate	Source
		Ph	Ch	He	Cr	Th		
Song	341	29.33	7.33	4.68	5.87	52.79	Th-Ph	Dobhal*et* al. (2010)
Tons	341	37.00	7.05	2.42	4.63	48.90	Th-Ph	Singh & Joshi (2014)
Kheree, Son, Semal Rau	193	29.00	6.20	8.30	6.20	50.30	Th-Ph	Present Study

DISCUSSION

The higher percentage of herbs in the area could be attributed to edaphic and peculiar climatic conditions. During summer, when the temperature become severe and the soil becomes intolerable to plants, as a result only short living plants like annual herbs are favoured. Because, herbs can complete their life cycle before the commencement of the dry season and set seed during the summer, hence the proper utilization of climate and edaphic factors are often responsible for such type of distribution pattern. While studying the temperate and tropical forest types, Smith (1973) reported that an increased structural integrity of the forest will lead to the proper utilization of climatic and edaphic conditions.

Due to the prevailing dry conditions, the shrubby growth is mostly xerophytic in the area. Some common shrubs of the study area are *Berberis lycium, Indigofera cassioides, Woodfordiafruticosa, Aechmantheragossypina, Murrayakoenegii, Agave cantula Ziziphus mauritiyana, Colebrookiaoppositifolia*and *Opuntia stricta* etc. Among the most common climber is *Millettia extensa*. *Euphorbia royleana* is dominant over considerable areas in exposed dry and rocky localities.

The vast extension of pine forest (chir) as well as prevailing semi-arid condition along the Tons river are probably responsible for the low proportion of genus to species. This satisfies the general rule that within the same floral region, the smaller is the ratio of genera to species. Further, this is in accordance with Good's (1953) observation "the larger the area is the greater will its ecological diversity tend to be and, therefore, a greater number of species it will contain."
It may also be interesting to note that, certain families do not form an appreciable part of the vegetation and area represented by a single genus and one or more than one species, while others form an appreciable part containing more than 15 species. Except for the Poaceae and Cyperaceae, the monocots are very poorly represented in the area. Of the 101

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species of monocots, Poaceae is represented by 64 species and Cyperaceae by 16 species, while the remaining 21 species belonging to 8 families.

The biological spectrum or life-form spectrum is the percentage distribution of species among the life-forms of any area. It is one of the useful parameter for comparison on a geographical scale and valuable in expressing the differences and similarities among the plant communities (Meher-Homji, 1964). It indicates the adaptation of plants to environmental factors especially climatic condition. Occurrence of similar biological spectrum in different regions indicates similar climatic conditions. The life-form classes reflects the stratification of different layers the ground and further indicate how a plant passes the unfavorable seasons for growth (Rao, 1968). Besides the spatial variations in the species composition of plant communities, the composition of life forms reflects the response of vegetation to variations in certain environmental factors.

Phanerophytes, the dominance of which is a characteristic of the tropical vegetation (Raunkiaer, 1934), occupy the second position in the study area. The lower percentage of Phanerophytes is due to the human interference and other biotic factors. Phanerophytes, with 37.00% dominance are the second group that adapt to conditions of area. They adapted and developed themselves to area by using different ways such as reserving water, using ground water, reducing their water need by losing their leaves and reduction of vegetative growth. In this study, the dominance of therophytes and phanerophytes over other life forms seems to be a response to the hot dry climate, topographic variations and human and animal interference.

Generally, the above mentioned plant groups by increasing their tolerance to dryness are adapted physiological, morphologically, or anatomically to area which leads to reduction of water use. Dominance of therophytes and phanerophytes clearly indicate the adaptation of these plants to dryness of area. The present results are supported by Asri (1999), Hamzeh (1995) and Malekmohammadi*et* al. (2007) who found similar results in their studies. The low percentage of chamaeophytes, cryptophytes and hemicryptophytes shows that they are not adapted to existing climate and edaphic situations.

According to Raunkiaer (1934) the climate of a region, is characterized by life form, while in biological spectrum of the region exceeds the percentage of the same life form. However, due to biological disturbance, the proportion of life forms may be altered. Biological spectrum may be materially changed due to introduction of therophytes like annual weeds, due to biotic influences like agricultural practices and grazing, deforestation and trampling etc.

The biological spectrum of the study area, compared with Raunkiaer's spectrum in the present investigation, therophytes and phanerophytes showed maximum divergence in the study area. Based on the dominance of therophytes and phanerophytes, the flora of Tons riverine system may be called thero-phanerophytic according to Raunkiaer's terminology. The Thero-phanerophytic spectrum has also been reported by Lakshaman (1962) for Vihae Lake Forest (Bombay), Ghildiyal and Srivastava (1990) for Manu Swamp Forest (Rishikesh), Saxena (1980) for North-West catchment of Gola river (Nainital),Dobhal*et* al, (2010) for riverine forest in Doon valley (Uttarakhand) and Dabgar*et* al, (2010) for Visnagar Taluka Forest (N. Gujrat).

It is concluded that,the higher percentage of therophytes is recorded in the study area because the area is semiarid zone of Garhwal Himalaya. The therophytes were found to be more adaptive and survive in adverse season in the form of seeds are predominantly found in extreme dry, hot or cold condition. Dominance of therophytes in revenue region to biotic interference includes deforestation, intensive utilization of land for cultivation, over grazing increase in human habitation while phanerophytes is good evidence that their abundance is fact an expression of monsoonic climate. Thus these character of therophytes and phanerophytes shows dominance over other life forms.

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Comparative Study Between Micro emulsions & Nan emulsions

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Abstract – *Emulsions are biphasic dosage forms intended for oral, parenteral or topical use. Contrary to poplar belief they in principle different from monophasic dosage form. Emulsions are formulated by dispersing a liquid which is essentially in smaller quantity into another liquid in the form of droplet or globules. According to the distribution both the phases are termed as dispersed phase and continuous phase. This whole formulation is done by the help of a third agent named as emulsifying agent. Emulsifying agent does not mix the two phases rather it brings both the phases.*

Key words: ***Porosity, Powders, Density, Fluid, voids.***

INTRODUCTION

Emulsion is a biphasic liquid dosage form. These are of two type oil in water and water in oil, it is a conventional method now days novel dosage forms are used like microemulsion and nanoemulsion. These are prepared by using different process and provide better bioavailability and response. Their size are also differ and provide good result as comparison of emulsion. Novel drug delivery system is commonly used having better approach towards other dosage form. Emulsion is one of the most important system of dosage form. Applications of emulsions increased especially after micro and nano-emulsion emergence. This paper is an attempt to summarize comparative aspects like definition, theories, types, methods of preparations, advantages, disadvantages and methods of analysis of emulsion, micro-emulsion and nano-emulsion.

Microemulsions:- The term ‘‘microemulsion’’ is generally usually used to refer to thermodynamically stable isotropic liquids formed by mixing oil, water, and surfactants together. Mixtures of oil (O), water (W), and surfactant (S) can form a variety of different systems depending on their composition and the environmental conditions (particularly temperature). They may form one, two, three or more separate phases that are in equilibrium with each other. These phases may be water-continuous, oil-continuous, or bicontinuous depending on the concentrations, nature, and arrangements of the molecules present. The structures within these phases may be spheroid (e.g., micelles or reverse micelles), cylinder-like (such as rod-micelles or reverse micelles), plane-like (e.g., lamellar structures), or sponge-like (e.g., bicontinuous). Appropriate analytical methods are required to accurately identify the structures such as microscopy (e.g., light, electron, or atomic force), scattering methods (e.g., light, X-ray, or neutrons), electrical conductivity, nuclear magnetic resonance, and rheology. When using the term ‘‘microemulsion’’ one must therefore clearly state which kind of microemulsion system is being considered. In this manuscript we are primarily concerned with delivery systems that can be used to encapsulate lipophilic components in a form that can be conveniently dispersed into aqueous media, and so we focus on oil-in-water microemulsions that consist of small spheroid particles comprised of oil and surfactant molecules dispersed within water. This type of colloidal dispersion has also been referred to as a ‘‘droplet microemulsion’’ or a ‘‘swollen micelle system’’.

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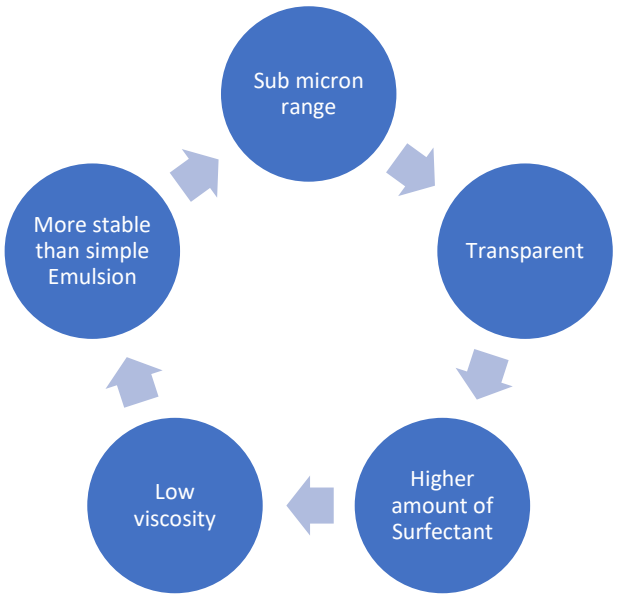
Nanoemulsion: - A nanoemulsion can be considered to be a conventional emulsion that contains very small particles. nanoemulsion may be of the oil-in-water (O/W) or water-in-oil (W/O) types depending on whether the oil is dispersed as droplets in water, or vice versa. As mentioned previously, we are primarily concerned with colloidal dispersions suitable for encapsulating lipophilic components in aqueous environments, and so we focus on oil-in-water nanoemulsion that consist of small particles comprised of oil and surfactant molecules dispersed within an aqueous medium. An oil-in-water nanoemulsion is defined as a thermodynamically unstable colloidal dispersion consisting of two immiscible liquids, with one of the liquids being dispersed as small spherical droplets ($r < 100$ nm) in the other liquid. A nanoemulsion could be formed from oil and water without using a surfactant. In practice, this system would be highly unstable to droplet coalescence and a surfactant is needed to facilitate the formation of the nanoemulsion and to ensure its kinetic stability during storage. A nanoemulsion is therefore usually prepared using the same components as a microemulsion: oil, water, surfactant and possibly a co-surfactant. The structure of the particles in a nanoemulsion are also very similar to those found in a microemulsion: the non-polar tails of the surfactant molecules protrude into the hydrophobic core formed by the oil phase, while the polar head groups of the surfactant molecules protrude into the surrounding aqueous phase (Fig. 1). The major distinction between a nanoemulsion and a microemulsion is therefore their thermodynamic stability: nanoemulsion are thermodynamically unstable, whereas microemulsions are thermodynamically stable

SIMILARITIES BETWEEN MICROEMULSION AND NANOEMULSION:



Differences between Micro emulsion and Nanoemulsion:-

S No	Parameter	Emulsion	Microemulsion	Nanoemulsion
1	Appearance	Turbid	Clear	Clear
2	Particle size	1-20 mm	1-100 µm	1-100nm
3	Formation	Mechanical shear	Phase inversion	Ultrasonication
4	Stability	Thermodynamically unstable Kinetically stable	Thermodynamically stable Long shelf life	Thermodynamically unstable Kinetically stable
5	Phases	Biphasic	Monophasic	Monophasic
6	Viscosity	High	Low	Low
7	Interfacial tension	High	Low	Ultra Low

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CONCLUSION

It can be well concluded that an emulsion whether it is macro, micro or nano in the properties of the dispersed phase differ from each other essentially due to the droplet size of the dispersed phase. These physical properties effect the other properties like zeta potential and stability.

Due to the size of the dispersed phase micro emulsions and nano emulsions are fond to have better stability because the droplets are less attracted towards the gravity.

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Different Sieving Methods for a Variety of Applications

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Abstract – *Sieve analysis is used to obtain the grain size distribution of a soil grains by determining the amount of crushed grain retained on a series of set of sieves with different sized apertures. A sample is added to the topmost of sieves arranged in decreasing size from top to bottom. As the sieves are vibrated, the sample is segregated onto the different sized sieves. The weight of sample retained on each sieve is then used to determine the grain size distribution as well as the effective diameter of the sample. This study gives an overview of the different sieving techniques and describes the necessary steps to ensure reliable results.*

Keywords- ***Effective diameter, Grain size distribution***

INTRODUCTION

Soil is a complex and heterogeneous system in this terrestrial ecosystem. Apart from establishing the correlation between other environmental elements, it also combines inorganic and biological aspects. The distribution of the Soil and its particle size influences the soil-water movement, soil erosion and soil solute migration. Therefore, the grain size or particle size distribution has been considered as a key physical parameter of the soil. Specified particle size classification of dry mass soil is referred to as Gradation, which is also termed as Particle Size Distribution (PSD). Gradation of soil is widely used in engineering and agricultural prospects. The minimum bulk volume obtainable under given conditions of compaction will be influenced by the particle size distribution. The geological and geotechnical investigationis necessity for civil engineering works to assess the stability of ground and provide suitable economic design. To attain more reliable data, in situ measurement of the soil moisture content, Bulk density, liquid limit, Plasticity Index etc., was considered essential.

STUDY AREA

Rudrapur is located in U S nagar district of Uttarakhand, India. Geographically it is located at 28.98° 98’ N latitude and 79.51° 67' E longitudes with elevation of 830 feet from the mean sea level.

METHODOLOGY

The particle size distribution of a coarse grained soil is generally determined using a sieve analysis where a prepared dry soil sample is shaken thoroughly through a stack of sieves that consist of different apertures. The mass of particles retained on each sieve is calculated as a percentage of the total dry sample mass. The grain size distribution of the fines less than 75μm is determined using hydrometer analysis where the fines are combined with distilled water to form a 1000 ml of suspension. The hydrometer is used to measure the density of this solution for specific times. This time-density data is then used to calculate the percentage of different particle sizes for the required 48 hour period where observations are required to be made. It is quite common for soils to contain both coarse and fine grains and it is necessary to undertake both a sieve and hydrometer analysis to obtain the complete particle size distribution. The percentage passing each sieve is generally treated cumulatively to determine the entire particle size distribution. An analysis of this kind express quantitatively the

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proportions by mass of the various sizes of particles present in the soil. In a soil the gravel, sand silt and clay fractions are recognized as containing particles of decreasing magnitude. The actual ranges of dimensions of the particles are given in table 2. The results of a grain size analysis may also be represented graphically inthe form of a grain size distribution curve in which the cumulative percentages finer than known equivalent grain sizes are plotted against these sizes on a semi logarithmic scale. IS 2720 (Part 4) coversthe method for the quantitative determination of grain size distribution of soil. Two methods are given for finding the distribution size larger than 75-micron. The first method, wet sieving shall be applicable to all soils and the second dry sieving, shall be applicable only to soils which do not have an appreciable amount of clay. For the determination of distribution of grain sizes smaller than 75-microns the pipette method is given as the standard method. The hydrometer method is given as a subsidiary method. This method shall not applicable if less than 10 percent of the material passes the75-micron.

Table 1: Classification of Soil as per Grain Size Analysis

Sl. No	Location	Grain Size Analysis as per IS: 1498 - 1970				Classification as per grain Size	USCS Classification asper grain Size
		C.G Sand	M. G Sand	F. G Sand	Silt / Clay		
1	L-1	13.5	16.5	21.7	48.3	Clay/ Silt	SC
2	L-2	11.2	18.7	37.4	32.7	Clay/ Silt	SC
3	L-3	15.8	22.5	15.1	46.6	Clay/ Silt	SC
4	L-4	15.4	22.3	19.8	42.5	Clay/ Silt	SC
5	L-5	15.1	26.4	19.8	38.7	Clay/ Silt	SC
6	L-6	16.7	21.1	13.6	48.6	Clay/ Silt	SC-SM
7	L-7	26.6	20.4	11.2	41.8	Clay/ Silt	SM
8	L-8	14	21.1	21.2	43.7	Clay/ Silt	SC
9	L-9	18.6	16.6	20.1	44.7	Clay/ Silt	SM
10	L-10	17.4	18	21.5	43.1	Clay/ Silt	SM
11	L-11	8.8	19.6	18.7	52.9	Clay/ Silt	SM
12	L-12	16.6	19.9	20.6	42.9	Clay/ Silt	SM
13	L-13	7.9	20.5	20.9	50.7	Clay/ Silt	SM
14	L-14	11.2	18.9	17.8	52.1	Clay/ Silt	SC-SM- MH/ML & OH
15	L-15	12.5	22	18.5	47	Clay/ Silt	SC-SM, MH& OH
16	L-16	9.2	15.9	21	53.9	Clay/ Silt	SC-SM
17	L-17	9.2	17.5	21.7	51.6	Clay/ Silt	SM

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RESULTS AND DISCUSSION

On the basis of the preliminary observation by executing trial pits and trial trench, it has been found that approximately 6 to 7 meter depth from surface is filled by medium to fine grained Silty sand and clayey Sand soil and further below that it consist highly weathered rocks showing white Silty soil. The samples dispersed in fluid, granular material, particles and powder material data or a mathematical attributes that defines the relative amount typically by mass, of the particles present according to size is known as Particle Size Distribution (PSD). Sieves are used in sieve shaker to shake the dry soil sample thoroughly to determine the total percentage of soil particles, which remained on each sieve will constitute the total mass of the soil. Hydrometer analysis is used to determine grain size distribution of the fractions contains particle of decreasing magnitude fines which is < 75µm. In soil, gravel, sand, silt and clay On an average pits and trenches are dug for a depth of about 6meters - 7meters and measured soil profile from 0.5m to 4m which consists of coarse to Fine grained clayey sand soil in L - 1, L - 2, L - 3, L - 4, L - 5, L - 8 and silty sand soil in L – 7, L – 9, L – 10, L – 11, L – 12, L – 13, L – 17. Whereas, in L – 6, L – 14, L – 15, L – 16 consists Organic clay/silt (OH), high plasticity silt (MH), silty sandy soil (SM) and clayey sand soils (SC). Further below Moderate to highly weathered gneissic and granitic rocks are underlain which are medium to fine grained white colour soil.

CONCLUSION

1. Up to 6meter -7meter depth of Rudrapur locations is filled with Silty Sand and Clayey Sand. This zone is more susceptible to soil subsidence. Hence it requires proper engineering treatment before construction of foundation in subsurface part of any civil structures.

2.Hydrometer or Pipette test can be applied todetermine percentage of Fines which is abundantly rich in between the depth of 4.0 m to 8.0 m in soil strata, this constitutes fine grained cohesive soil i.e.clay and silt type.

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A Study on Comparing the Seismic Effect on Shear wall building and Without- Shear Wall Building – A Review

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Abstract *– Earthquakes are the most volatile and distressing natural disasters. Shear walls are the most commonly used method for earthquake-resistant multistory structures. A shear wall is a structural component that can be found anywhere in a building, from the foundation to the top parapet level, and is used to protect against lateral forces that are parallel to the plane of the wall. Shear walls are structural members used to prevent lateral forces caused by earthquakes and wind. This paper provides a review of various researchers' work on the concept of multistory buildings with and without shear walls. Shear wall structures are the most commonly used type of earthquake resistant structures in India. The design and utility of these structural walls differ, and their position in any building plays an important role in resisting lateral force.*

Key Words: Shear Wall, Non- Shear wall Building, Earthquake, Lateral Forces etc.

INTRODUCTION

Earthquakes in general have a long history of wreaking havoc. Essentially, the response of the structure to ground motion is an important factor to consider when analyzing and designing any earthquake resistant structure. The loads or forces that a structure subjected to earthquake motions is required to resist, as well as the distortions caused by the movement of the ground on which it rests. Earthquakes can be measured in terms of energy release i.e. measuring amplitude, frequency, and location of seismic waves and also by evaluating intensity i.e. considering the destructive effect of shaking ground on people, structures and natural features.

A building's properties include lateral stiffness, lateral strength, and ductility. Although the stiffness of the building decreases with increasing damage, lateral stiffness refers to the initial stiffness of the building. Lateral strength is the maximum resistance that a building has offered to relative deformation over its entire history. The ratio of maximum deformation to idealized yield deformation is referred to as ductility towards lateral deformation. Except in cantilevers, the effect of the vertical component of ground motion is generally regarded as insignificant and is ignored.

Shear wall and its properties:-

A shear wall is a structural member located in various locations throughout a building, from the foundation level to the top parapet level that is used to resist lateral forces, i.e. forces parallel to the plane of the wall. Shear walls can be built from a variety of materials, but reinforced concrete (RC) buildings frequently include vertical plate-like Reinforced concrete walls (Figure 1) in addition to slabs, beams, and columns. In high-rise buildings, their thickness can range from 150mm to 400mm. Shear walls are typically installed along both the length and width of building.

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These walls are more important in seismically active areas because shear forces on the structure increase during earthquakes. Shear walls should be stronger and stiffer. Shear walls are strong and stiff enough to control lateral displacements. Shear walls serve a dual purpose in that they serve as both lateral and gravity load-bearing elements. Concrete shear wall structures are typically regular in plan and elevation.

Purpose:

These walls are mainly used

- To resist lateral loads of earthquake and wind.
- To resist gravity or vertical loads due to its self-weight and other living or moving loads.
- To resist shear as well as uplift forces on the building.
- To enhance the strength and stability of a structure.
- To provide adequate stiffness to the structure.

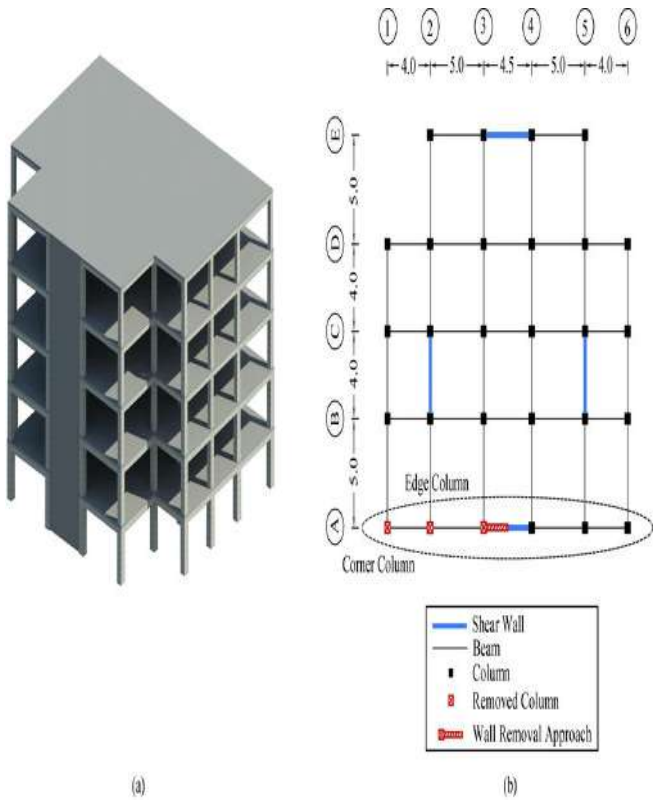

Figure 1:- Shear wall in building

Forces on Shear Wall:

These walls mainly resist two types of forces;

1. Shear Force: Shear forces are generated in buildings due to ground movement and lateral forces such as wind, waves and earthquakes. These forces act throughout the height of the wall between the top and bottom wall connections.

2. Uplift Force: Uplift forces are produced on shear walls due to horizontal forces act on the top of the wall. These forces lift up one end of the wall and push the other end down.

Advantages of Shear Walls in RC Structures:

- Shear walls are resisting to horizontal lateral force and earthquakes.
- It has high in-plane stiffness and can resist lateral loads.
- Shear walls help in the control of deflection in vertical and longitudinal directions.
- RCC shear walls are simple for reinforcement detailing

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- It reduces earthquake damage to all types of structural and non-structural structures.
- Well-designed shear walls not only provide adequate safety, but also a high level of protection against costly non-structural damage during moderate seismic events.

LITERATURE REVIEW

Concrete shear walls are the most common and useful shear wall type for any multistory building. Many researchers and scholars have studied the shear wall configuration in any building and the different types of shear walls. The resistance of a shear wall to lateral forces generated by an earthquake and wind force is studied. An effort was made to study these literatures and reach a conclusion on this topic.

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Dr.B.Kameshwari et.al[1] analyzes the impact of erosion and erosion between the floor of the building on the various configurations of shear wall panels on high-rise buildings. The blank frame is compared to various configurations such as i) Normal shear wall ii) Different shear wall layout iii) Diagonal layout of the barber window iv) Zig Zag haircut arrangement v) Impact of lifting the middle barber wall. From the study it was found that the Zig Zag shear wall improves the strength and durability of the structure compared to other models. In earthquake-prone areas the shear diagonal wall has been found to work well in the building.

B. R. Reddy et.al[2] use Stadd Pro software to analyze and design earthquake-resistant structures using Shear wall. According to their research work, the construction made of shear walls not only provides extra strength but also increases the strength limits and efficiency of horizontal loads. Shaving walls have unusual behavior on a variety of loads. The research project was approved at the VITS block college building, Deshmukhi town Hyderabad using a shear wall. The behavior of the structure was assessed for the strength of the element, the reaction, the shearing center, the shear strength and the bending moment. A shear wall solution in a multi-storey building based on both stretchable and elas- to-plastic behavior was also considered. The number of earthquakes was calculated and used in the same 3-storey building with 3 floors. The results of the models are calculated and analyzed for the effective area of the barber wall. After comparing the result it was found that the provision of a shear wall for this building would make the building completely resistant to earthquakes in zone II

Hyderabad. In addition to the fact that the manual and STAAD Pro results are almost identical, the STAAD Pro results save a significant amount of reinforcement..

P. Chandurkar et.al.[3] investigated a building with Shear wall and outside Shear wall was considered and compared. As their research work The building walls provide an efficient binding system and provide great strength to withstand side load. The structures of these seismic shear walls control the structural response; therefore, it is important to evaluate the seismic response correctly. According to their research, the main focus was on finding a solution for the barbecue area in a multistory building. The function of the barber wall was studied with the help of four different models. One model was a blank frame structure system and the other three models were a two-dimensional structure. While the seismic load is used in the construction of the ten stories found in zone II, zone III, zone IV and zone V, parameters such as Lateral migration, story flooding and the total amount of cost required for the ground floor were calculated in both column-changing cases. . E-Tabs software accepted for review. From the analysis, it is noted that in the 10-story building, building a barbed-wire building in a short corner (model 4) will be economical compared to other models. So the large size of the barber wall does not apply to 10 cases or to less than 10 buildings. It was noted that the shear wall is economical and effective in high construction. From the research work it was noted that changing the location of the shear wall will affect the attraction of energy, so that wall should be in the right condition. And if the shear wall size is large then a large amount of horizontal force is taken by the shear wall. Providing shear walls in adequate areas greatly reduces migration due to earthquakes.

M. D. Kevadkar and P. B. Kodag[4] performed a lateral load analysis of the R.C.C. Build (G + 12) by considering 3 models. In this model 1 it has no bracing and shear wall, the second model with a different shaving wall system and the 3rd Model with Different bracing system computer-assisted analysis was performed using E-TABS to determine the effective back load system during major earthquakes. places. Property performance is assessed in terms of Lateral Displacement, Storey Shear and Storey Drift, Base shear and Demand Capacity (Workspace).

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Anshuman.S et al.[5] determined the shear wall solution in a multi-storey building based on its elastic and elastoplastic behavior. The magnitude of the earthquake is calculated and applied to the 15-story building in zone IV. The elastic and elastoplastic analysis was performed using both the STAAD Pro 2004 and SAP (2000) software packages. The shear strength, bending time and scaling of the story were calculated in both cases and the location of the shaving wall was established based on results.

Romy Mohan et al.[6] presented Dynamic Analysis of RCC buildings with Shear Wall. for analysis consider the two multi storey buildings, one of six and other of eleven storeys have been modeled using software package SAP 2000 for earthquake zone V in India. Six different types of shear walls with its variation in shape are considered for studying their effectiveness in resisting lateral forces. This paper also deals with the effect of the variation of the building height on the structural response of the shear wall.

Manoj S. Mendhekar et.al.[7] mentioned ways in which the economy could be achieved to withstand the burden of the parties in a multi-storey building. In their study, seismic behavior, mechanisms of failure, and factors influencing structural responses were discussed. Many expressions were developed to measure the flexible strength of the smaller rectangular wall sections with straight reinforcement evenly distributed. In this study various aspects of the design and design of the barbers are discussed, and different types of barbers are discussed and their methods of failure. Algebraic expressions for calculating the flexibility of the shear wall sections were developed and a temporary interactive loading diagram was developed using these expressions. The results of both approaches have been quite positive. Also the details of the composite wall were also mentioned and the difference between the solid shear wall and the jointed wall (open bar wall) was investigated. And the power-calculating relationships on the shaving wall of its design are shown. From their research it became clear that parts of the wall of the shear flang were expanded to be analyzed and designed and are very suitable.

Syed.M.Katami et.al[8] presented the results of time history analysis which addressed the effect of openings in shear walls near- fault ground motions. A model of ten storey building with three different types of lateral load resisting system: Complete shear walls, shear walls with square opening in the centre and shear wall with opening at right end side were considered. From the results it was observed that shear walls with openings experienced a decrease in terms of strength. The maximum lateral displacement of complete shear wall is 17% less than that of shear walls with openings at centre whose displacement is found to be 8% less than that of shear walls with openings at right end.

Venkata Sairam Kumar.N et.al.[9] reviewed various papers on shear walls and stated that shear walls are structural systems which provide stability to structures from lateral loads like wind, seismic loads. These structural systems are constructed by reinforced concrete, plywood/timber unreinforced masonry, reinforced masonry at which these systems are sub divided into coupled shear walls, shear wall frames, shear panels and staggered walls. The paper was made in the interest of studying various research works involved in enhancement of shear walls and their behaviour towards lateral loads. As shear walls resists major portions of lateral loads in the lower portion of the buildings and the frame supports the lateral loads in the upper portions of building which is suited for soft storey high rise building. Building which are similar in nature constructed in India, as in India base floors are used for parking and garages or officers and upper floors are used for residential purposes. They have concluded with a broad note that researches was carried mainly on application of cyclic load tests and behaviour of different types of shear walls in cyclic application of loads. Researchers studied various parameters like enhancement of stiffness, drift, development forces in buildings and also to observe perfect location of shear wall location in building frame for construction. It was seen that any type of building which is tall and can be affected with lateral forces like earthquake and wind forces can be constructed with shear walls. Shear walls can be used as lateral load resisting systems and also retrofitting of structures. Internal shear walls are more efficient than external shear walls when compared with cyclic load tests by researchers.

Varsha.R.Harne[10] considered a six storey RCC building which is subjected to Earthquake loading in zone II to determine the strength of RC wall by changing the location of shear wall using STAAD.Pro. Seismic coefficient method is used to calculate the earthquake load as per IS 1893 – 2002 (Part I). Four different models like structure without shear wall, structure with L type shear wall, structure with shear wall along periphery, structure with cross type shear wall were modeled for analysis. Compared to other models the shear force and bending moment, for structure with shear wall along

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the periphery is found to be maximum at the ground level and roof level respectively. Hence the shear wall provided along the periphery of the structure is found to be more efficient than all other types of shear wall.

Bhruguli H. Gandhi[11] explored the behavior of the barber wall openings under the action of an earthquake load. In this study, it is said that barbering walls are usually found on the sides of buildings or arranged in the form of a staircase that holds stairs and elevators. Due to operational requirements such as doors, windows, and other openings, the barber wall in the building contains many holes. Most apartment building, size and openings in the shear wall are made without considering its effect on the behavior of the building structure. In this study, the study was performed on 6-story frame-shear wall structures, using a straightforward stretch analysis with the help of a limited object software, StaddPro under earthquake loads in the same vertical analysis. Six types of models were created and analyzed, from the beginning, Concentric 20% opening, 40% focus opening, 50% focus opening, 60% focus opening, Eccentric opening 20%, Zigzag opening -20%. The results reveal that the strength and vibration of buildings are affected by the size of the spaces and their locations on the barbecue wall. It is also tested that the high lateral inclination of the system can also be reduced by thickening the element in the model near the opening of the shaft wall. From a survey percentage of
Opening increases deviation up to 40% on average but after that as the opening percentage increases deviation increases much faster. At 20% opening the Eccentric zigzag has a slight deviation and the Eccentric Straight has a higher deviation and the loaded load has a smaller deviation than the Eccentric Straight. And the opening raises the lower pressures also increases equally by up to 40% and then after the Stresses increase significantly.

S.M. khatami et.al.[12] investigateted the effect of flange thickness on nonlinear behavior of flanged shear walls. Four T-shape flanged shear walls were studied and analyzed using finite element method. The total volume of each model is similar, such that when thickness decreases in the model, the length of wing increases. The results indicated that in the presence of lateral loads, the thickness has a significant effect on the shear absorption, ductility, displacement and crack pattern of the flanged shear walls. Numerical results show that shear walls with thick flanges behave more efficient than walls with thin flanges. It was found that, lateral strength resisted by shear walls with thin flanges is 1250 kN which is 14 percent decrease compared with thick flanged wall. Moreover, nonlinear behavior of flanged shear wall with thick flanges shows that strength and ductility are equivalent. Finally, the analyses indicated that while flange is in pressure, the global behavior is much more improved compared with condition which is in tension. The comparison of models indicated that finite element model used in this study is capable of predicting the nonlinear behavior of the models when these are different thickness. Results of analysis in four models and load- displacement of them indicated that model named -2500TSW had better behavior. It had resisted about 1248 kN. This load is 14% higher than other models. Also, ductility of this model showed a good agreement. Ductility in the model-2500TSW model is
4.58 which is 3% higher than model-3100TSW. Results of analysis showed that model-3100TSW had better strength after yield, which was 18% higher than model- 2500TSW. Crack pattern in all of models showed that increase of thickness could decrease crack in shear wall.

CONCLUSIONS

From the above study it can be concluded that, different researchers had studied different type of problems related to earthquake and addressed that shear wall are more prominent to resist lateral force due to earthquakes. Analysis by software's such as StaddPro, Etabs etc. are also combined along with manual studies. Models are generated and shear walls are located at different positions in building to find the least displacement of the structure due to shear walls. Openings in shear wall are also an issue of concern of study of shear wall buildings. Generally openings provided in shear walls increase displacement in building. Moreover some researches stated that change in positions of shear wall effect the attraction of forces. Location of shear wall in any building substantially reduces displacements and reduces impact on the structure. Thus building without shear wall is a subject of concern and need to be retrofitted in places of high earthquake and wind impact.

Future scope of studying this type of research work is an essential part of this review paper. Study of effect of shear wall building and without-shear wall building can be studied further by introducing a flange to column. Comparison can be made with a building without shear wall, with shear wall and with column flanges type structure. Moreover placement of shear walls at different locations is an essential aspect to be thought of for further study.

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Utilization of Fiber Reinforced Polymer materials in Reinforced Structure

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Abstract –- *This paper present a concentrate financially accessible FRP and how they work. Fiber reinforced polymer can be accomplished utilizing customary blending and proper grid syntheses. In view of this examination, the ideal fiber content was reliant upon combination plan constituents, fiber types, and blending technique. The principal fields of use of fiber reinforced polymer composite are inspected and future points of view examined and audit of different sorts of filaments and applied best procedures. it ought to likewise be conceded that the expense of fiber reinforced polymer and related innovative activity is unquestionably a snag for utilization of fiber reinforced polymer in standard Reinforced structure*

Keywords- *utilization, composite material, polymer, Reinforced, compressive strength.*

INTRODUCTION

When compared to traditional construction materials such as steel, concrete, timber, and masonry, fibre reinforced polymer composites, more commonly referred to as FRP composites, can be thought of as a new category of building material. FRP materials have a number of advantages over steel, including the fact that they are lighter while also possessing greater strength and stiffness-to-weight proportions. In order to boost the building's strength, stiffness, and ductility, the seismic retrofit plan for an RC frame may include reinforcing defective parts such as columns, beams, and beam-column joints. These materials are made up of extremely robust fibres that are encased in a resin matrix. The relatively recent and steadily expanding interest in FRP in the field of structural engineering can be traced back to the material's advantageous properties, which range from an extremely high strength to weight ratio to excellent fatigue behavior and superior durability, which includes resistance to corrosion. These properties have contributed to the material's growing popularity in this field.

OBJECTIVE The utilization of fiber-reinforced polymer (FRP) material in place of steel in reinforced concrete structures is the goal of this project. Reinforcement and repair of a reinforced concrete structure using fibre reinforced plastic materials.

INVOLVEMENT OF WORK:

- In order to improve the RC structures' axial compressive strength. to maximise the capacity of a segment by ensuring adequate orientation is provided. to restore the component of the structure that was damaged to its previous state of functionality.

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- The need to enhance the capacity of an existing building to resist seismic forces typically results from the discovery of earthquake-related damage and undesirable behaviour during a recent tremor.

- To restore the building's architectural form so that all of the building's services can be brought back online and normal building operations may be resumed as soon as possible.

ABOUT FRP:-

Fiberglass fortified plastic, usually known as fiberglass, was produced industrially after World War II. Since that time, the utilization of fiberglass has become quickly. The expression "fiberglass" depicts a thermo set plastic sap that is fortified with glass strands. In this manual, the more broad terms Fiber Reinforced Plastic/ Composites or FRP/Composites will be utilized to depict these to great degree helpful material frameworks.

MERIT COMPARISON AND RATINGS FOR FRP AND STEEL

Property (Parameter)	**Merit/Advantage (Rating)**		**Rating Scale**
	F.R.P	Steel	
Strength/ Stiffness	4-5	4	1: Very Low
Weight	5	2	2: Low
Corrosion resistance/ Environmental Durability	4-5	3	3: Medium
Ease of field construction	5	3-4	4: High
Ease of repair	4-5	3-5	5: Very High
Fire	3-5	4	1: Very Low
Transportation/Handling	5	3	
Toughness	4	4	
Acceptance	2-3	5	
Maintenance	5	3	

Structure and many "advanced" composites of Kevlar or carbon fiber.

FRP AS A REPAIRING TOOL:-

When compared to traditional building materials, composites provide a number of benefits, the most notable of which are their ease of repair and their longevity. On the other hand, despite the fact that many people not only lack the skills necessary to repair them but also find the idea of doing so to be intimidating, defective parts are frequently replaced. In the following paragraphs, we will begin with a fundamental grasp of modern composite repair, and then proceed to discuss the methods and techniques for both cosmetic and structural repairs. The procedures that are presented are applicable to all types of fibreglass. A composite material is a material system that is combined from two or more micro- or macro-components that are essentially insoluble in one other and have distinct differences in form and chemical composition. Composite materials can be characterised as a materials system. The use of composite materials is extremely significant in many different branches of engineering, including the automobile industry, the construction industry, the manufacturing industry, and goods related to new technologies. To develop greater attributes of a new material that can be produced than those of existing components is the goal of the process of creating composite materials, which is also known as composite manufacturing. The primary purpose of this research is to build an innovative and ductile version of classic composite shear walls. This new version should be able to eliminate the drawbacks that were discussed earlier. The "Rubber-shims" that are put between the concrete shear are the most essential components of invention.wall and the boundary beams and column as well as special ductile shear studs to link the concrete cover walls to the steel boundary elements. This was done in order to prevent the concrete cover walls from

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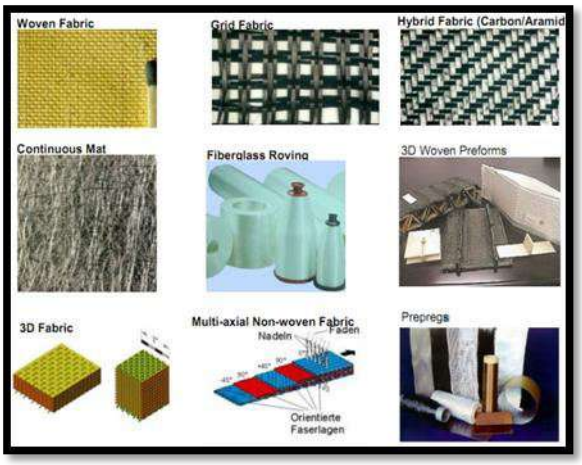
cracking. wall, as well as the beams and columns that define the boundary. The primary function of the rubber shim that surrounds the boundary is to create a gap that is elastic between the shear walls, which are rigid and relatively brittle, and the boundary steel elements, which are relatively less stiff but more ductile. This gap allows for the shear walls and the boundary steel elements to move more freely with one another. This gap is necessary for maintaining the structure's soundness as a whole. The distance between the two walls that is produced by the rubber shims has a thickness that is calibrated in such a way that, up to a particular drift, the distance between the two walls does not become narrower and the walls do not become active..



APPLICATION OF F.R.P IN STRUCTURES:-

There are three categories into which applications of FRP can be placed: architectural applications, applications for new building, and applications for repair and rehabilitation. FRPs have seen widespread application in the design of brand-new construction thanks to the work of civil engineers. It has been established that structures made entirely,out of FRP composites, such as bridges and columns, exhibit outstanding longevity and effective resistance to the effects of being exposed to the elements. Utilization of glue for retrofitting bonded FRP, has been established around the world as an effective method applicable to many types of concrete structural elements such as; columns, beams, slabs and walls. the important task of the design engineer is to seek ways of eliminating or reducing corrosion of industrial equipment. Much of the corrosive attack to industrial equipment comes from chlorides. The range of conditions at which many essential metals can be used safely in the presence of chlorides is depicted in the figure. The ranges are restricted to small bands, and anything above those bands requires increasingly rare and unusual materials. Carbon steel, stainless steel, rubber-lined steel, and premium alloys were once standard materials of construction for chemical storage tanks. However, as engineers become more aware of the benefits of fibre reinforced plastics (Fiber - reinforced polymer), carbon steel, stainless steel, rubber-lined steel, and premium alloys are increasingly being replaced by Fiber reinforcement. These advantages include increased corrosion resistance, light weight, higher strength to weight ratio, low life cycle costs, and a number of other benefits. The Clean Air Act has resulted in an increase in the need for scrubbers and collection ductwork systems that are capable of withstanding the corrosive effects of industrial fumes that are pulled from process streams. FRP is used as a primary construction material in air filtration ducts, carbon absorbers, and scrubbers in municipal waste water treatment plants. Duct and scrubbers for pulp bleach plants, ducting from clean rooms in semiconductor fabrication plants, and ducting from clean rooms in municipal waste water treatment plants all use FRP to combat corrosion.

The following are some of the applications of FRP in the form of strips:

- Increase of stiffness to the members;
- Increase in the maximum permissible bearing capacity;
- increasing of the ductility;
- Increase of resistance to fatigue;
- Limitation of cracked states

TYPES OF FIBRES

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Fibers are made of very thin continuous filaments, and therefore, are quite difficult to be individually manipulated. For this reason, they are commercially available in different shapes. A brief description of the most used is summarized as follows: Monofilament: basic filament with a diameter of about 10 μm.Tow: untwisted bundle of continuous filaments. Yarn: assemblage of twisted filaments and fibres formed into a continuous length that is suitable for use in weaving textile materials

Carbon fibres

Amid fibres'

Glass fibres'

Matrices

Epoxy resins

Polyester resins

Typical application of FRP materials in civil structures

The major use of FRP in the civil construction regards the rehabilitation of existing RC and masonry structures. The progressive ageing of the structure, the necessity of upgrading the gravity load designed structure, the necessity of support the increment of loads due to a variation of the building use, require the necessity of a structural intervention and the reinforcement of the structural elements. In all the presented cases an intervention based on the use of composite materials can be think. go in action and contribute to the resistance. The FRP can be also applied with a pretension or with a favourable impressed deformation in order to optimize the efficacy. The effect of the composite material on the cross section mechanical behaviour is to lower the neutral axis position, unload the steel rebars and implicating more compressed concrete.

Technology known is Fiber Reinforced Polymers, or FRP for short.

The engineering process has been well-established, and it continues in the same manner while utilizing FRP. It begins with process definition, moves on to materials selection, engineering design and analysis, the preparation of drawings and specifications, quality assurance inspection, and finally, throughout the service life of the equipment, preventive maintenance inspection

Resins- Resins can be divided into two broad classes: thermosetting and thermoplastic. This document discusses composite materials formed using thermosetting resins combined with fiber reinforcement. Thermoplastic resins have a definite melting point, whereas thermosetting resins cure to produce an infusible solid material that does not melt when heated. They soften, but they do not liquefy Thermosetting resins used for FRP are typically purchased in liquid form and are reacted to a solid with chemical additives. The most commonly used thermosetting resin systems:

- Vinyl ester
- Bisphenol-A fumarate polyester
- Terephthalic polyester
- Isophthalic polyester

These resin families have unique usefulness depending upon the specific corrosive process, temperature, and engineering requirements of the application.

Resin Casting Performance

Resin Performance at Elevated Temperatures

CONCLUSION:-

- To increase the axial compressive strength of RC structures. To increase the capacity of a section by providing sufficient orientation. To put the damaged element of the structure in the good condition.
- To improve the ability of an existing building to withstand seismic forces arises usually from the evidence of damage and poor behavior during a recent earthquake.
- To bring back the architectural shape of the building so that all services start working and the functioning of building is resumed quickly.

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Developing Artificial Intelligence Methods in Structural Engineering

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Abstract – *Utilization of concrete, as a material for building structures has been one of the major triumphs of mankind. Driven by increased standard of living and ever-rising population, the need for 'better' concrete is now the current trend. This in turn necessitates a representative measure of concrete quality that can be used as a benchmark. Amongst the possible alternatives, compressive strength of concrete is the main parameter used in design and assessment of quality in massive structures built with the likes of reinforced concrete, composite materials etc. Such endeavor is the challenge of the structural engineer while coming up with appropriate material and structural designs and controlling the quality of the concrete throughout the construction stage.*

Keywords- *structural engineering, artificial intelligence, machine learning, pattern recognition, deep learning, soft computing*

INTRODUCTION

Concrete is one of the most common building materials on earth. Its use in virtually all.Construction sites has made it a loyal companion for mankind. From the ages dating past the Roman Empire, concrete has helped in spearheading the development and expansion of many civilizations. Concrete is dubbed the 'magical material' not only because what was once a fluid, flowing material turns into a strong, rigid building block; its wide spread availability and affordability, its nature to be molded into any desired shape, its versatility and adaptability, its high compressive strength, stiffness and durability [1] are also its inherent characteristics short of pure magic. The area in concrete development continues to fascinate many researchers today. The prospects stretch to Reactive Powder Concrete which is still in development. Such concrete has ultra-high strength with a compressive strength range from 200 to 800 MPa[1].Hence, it is only logical to lay out a common understanding framework in which people involved in the making and utilizing of concrete could make use while describing concrete. In this regard, a measure of concrete quality can be used as a benchmark, bothwhile concrete production and construction stages. Among many of its other characteristics, compressive strength of a concrete is one of the major features to determine its quality. The need to study compressive strength stems from its importance as it directly relates to a certain technical standard requirements. The implication exhibited by compression strength on properties like durability can also be used to the advantage of the structural designer, material engineeras well as other stakeholders in the concrete manufacturing and construction industry. This signifies the need to have a standard measure for the prediction of concrete compression strength. The usual practice is to take representative samples from the mix and carryout testing in the laboratory. Third and seventh day testing is carried out to know the early-age strength gaining properties of the concrete. Concrete attains the majority of its final strength after 28 days so the samples will have to take that long to be tested. The 28th day testing is also used as a benchmark to compute the compressive strength of concrete at any other given age. Such procedures are the likes of standards specified in design codes. However, these design codes fail to grasp the real scenario when the concrete constituents are more than the conventional cement, aggregate and water. The compressive strength of concrete is thus complex, becoming more and more intricate as the constituent materials differ.Furthermore, inter-relationship of concrete constituents at a molecular level cannot be explicitly stated when the type of concrete differs (e.g. high strength concrete, high performance concrete) because unaccounted factors like pozollanic material and super plasticizers come into play. In such cases, the empirical relationship given in codes failsto grasp the real scenario as factors

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like ‘effect of plasticizers’, ‘casting temperature’ etc. get a chance to affect the outcome of the compressive strength. In fast track projects where 28-day test results are not to be waited for, a sound and reliable model capable of determining the compressive strength of a concrete sample atany age is important. This can avoid the time spent on waiting for laboratory results, which can be interpreted in auspicious monetary values due to speedy construction. In present study SVM and linear regression analysis are used to aforesaid the mechanical property of concrete (compressive strength). Then the values given by the equations (model) are compared with the results of experiments carried out on the concrete. A comparison is made between values obtained by SVM and linear regressionwith experimental data. This data is obtained by K-Structura, a reliable consultancy firm. Using this data we can obtain errors in our study. Based on the errors we can justify the study.

RESEARCH SIGNIFICANCE

This research has benefits both to the industrial construction and research community. It introduces new methods as a way to solve problems in civil engineering. These new methods, if properly utilized, have the potential to save time and cost which would otherwise be squandered using the conventional approaches. This research can shed light on the contemporary approaches being used today, to solve problems in civil engineering. Introduction of these methods will thus empower the engineer with new and better tools while modelling and computation.As this research affirms giving due attention to reaction mechanisms in concrete at a molecular level, pursuing it can facilitate a favorable environment for the study of modification of concrete properties. Structural models making use of the strength development patterns of concrete, computed through this research can also make use of prediction models forwarded by this research.

METHODOLOGY

The compressive strength prediction of concrete is studied after a thorough revision of current trends. The compressive strength of concrete is modeled according to linear regression and Support Vector Machine methods. The modeling process is used in thisstudy to develop a relation between different ingredients of concrete mix from laboratory experiments. After the modeling process (training data), results from these methods will be comparedwith the use of error portraying parameters (test data). Comparison of the linear regression and SVR models will be made and areas of application for both the construction industry and the research community will be suggested. A linear regression is one of the easiest algorithm used machine learning. It is a statistical model that shows and predicts a relationship between two or more variables. Linear regression is one of the types of regression analysis. Regression modelling is a form of predictive modeling technique which investigates the relationship between a dependent and independent variable. A regression algorithm involves graphic line overa set of data points that most closely fits the overall shape of the data.

Table 11 – Experiments (Svr)

No.	Experiment	Description (both for training and testing set)
1.	E- 1	3rd day sample, all data utilized
2.	E- 2	7rd day sample, all data utilized
3.	E- 3	14rd day sample, all data utilized
4.	E- 4	28rd day sample, all data utilized
5.	E- 5	56rd day sample, all data utilized
6.	E- 6	90rd day sample, all data utilized

RESULTS AND DISCUSSION

Table 12 – Results of SVR regression analyses

Experiment	Multiple R	R Square	Adjusted RSquare	StandardError (RMSE)	Observations

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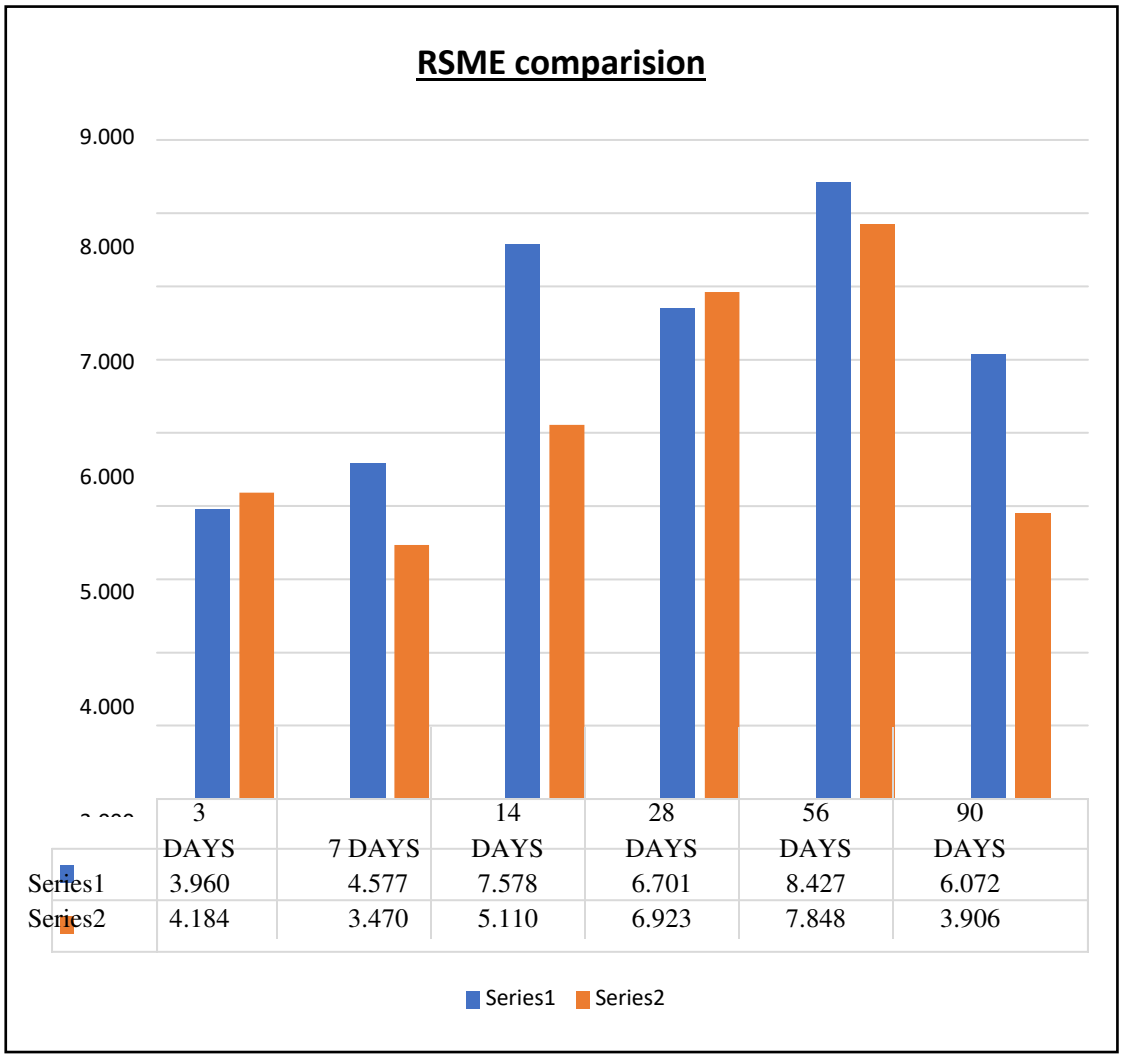
E - 1	0.820	0.673	0.664	4.184	40
E – 2	0.963	0.927	0.925	3.470	37
E – 3	0.758	0.575	0.548	5.110	18
E – 4	0.885	0.783	0.782	6.923	127
E – 5	0.835	0.698	0.685	7.848	26
E – 6	0.918	0.843	0.831	3.906	16

Comparisons of RSME (Root Mean Square Error)



1. Root mean square error explains the accuracy of the study.
2. From above comparision we can state that the RMSE values of Support Vector Machine method is lower than linear Regression method.
3. So we can clearly says Support Vector Machine algorithm is better and accurate than linear Regression method.

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CONCLUSION

- Regression models performed better when the data was refined against water to cementratio. Refining seemed to minimize the samples which behaved differently owing to varying water content in the mix. However, the prediction capacity was observed to become significantly compromised with introduction of new data.
- Therefore support vector regressions perform better than linear regression analysis. SVR analysis is based on classification data. Because of that with greater variations it givesmore satisfactory results.
- Further we can also apply different algorithm like ANN, fuzzy etc.

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"Analysis of Water Pollution and SAR Index of Different Physicochemical Parameters of Yamuna River, Dehradun by using QGIS"

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Abstract – *Water is one of the most valuable natural resources on the planet, and it is critical for flora and wildlife to survive. Water quality is just as crucial as available quantity. When evaluating the entire percentage of water on the planet, 97 percent of it is in the ocean and only 3% is fresh water, glaciers are a good example. 2 percent of this is fresh water in the form of surface and subsurface water bodies that can be consumed by humans. As a result, when we drink water, we must take quality measurements and regulate it in a systematic manner. The physical, chemical, biological, and radiological properties of water are all linked to its quality. Water contamination caused by numerous human activities has an impact on certain qualities of water. In this study, 12 Physico-Chemical parameters analyzed of subsurface source during the pre-monsoon, monsoon and post-monsoon season and derived geospatially by spatial distribution map by using QGIS Software. QGIS is a free and open source which capable of viewing, editing and analyzing geospatial data. In this study, discussed and analysis Pollution Index and SAR Index of Yamuna River, Dehradun. By using Inverse Distance Weightage, approach is one of the interpolation methods in QGIS that is used to generating interpolation maps.*

INTRODUCTION

Rivers are preferably regarded as among the crucial natural resources for the growth of mankind civilization, but they are constantly being polluted by different sources. The river Yamuna is revered as a holy river in Indian mysticism as well as at numerous pilgrimage sites Agarwal et al., 2016**.** The holy Yamuna is used for a variety of community purposes, including irrigation, sewage and commercial waste disposal, personal hygiene, and domestic water supply. River natural systems are among the most delicate and susceptible to cause by human activity interference habitats. Water quality is assessed using the Sodium Adsorption Ratio (SAR), which is also used as an indicator for irrigation water quality. Since several years ago, the Yamuna river's quality of subsurface has considerably reduced. The Yamuna river needs to be cleaned up because the water is so polluted. The state and then all the citizens must work together to make this happen. Marale, S. (2012). It is one of the main issues facing the majority of developing country, like urban centers. Any nation's natural, cultural, and economic aspects are significantly shaped by its rivers **(**Rafiq, 2016**).** In this study, we focus on trying to find out contaminants in the river, finding the water quality SAR Index and subsequently enforcing measures to curb water pollution.

MATERIAL AND METHODS

Yamuna, the largest tributary of River Ganga (Ganges), originates from Yamunotri glacier (near Saptarishi kund) at Bandar Punch in the Mussorie range of Lower Himalaya (30° 58' N, 78° 27' E) at 6,320 m above mean sea-level (MSL). The river flows south-southwest through narrow and steep valleys until Kalsi (near Dak Patthar, 45 km west of Dehradun) where it meets River Tons. Dehradun location is considered for the measurements of water quality for river Yamuna. Considered 13 Physico - Chemical for the study of river Yamuna for irrigation water quality. Data has been collected for 2017, 2018 and 2019. For a specific amount of time, the Yamuna river, a sample is taken into consideration. One of India's most famous and revered rivers is the Yamuna. The river's deterioration over time is at its peak as a result of the

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unaccounted discharge from numerous anthropogenic activities and industrialization in the basin. At various locations throughout India, the ratio of the main water constituents—Temperature, TDS, and Hardness varies unpredictably. In this study, water samples were collected on a yearly basis from the Yamuna river canal in Dehradun, Uttarakhand, India. The samples were analyzed for 12 different physicochemical attributes like pH, BOD, COD, Sodium, Temp, DO, Alkalinity, Chlorides, Calcium, Magnesium, and Hardness as Calcium Carbonate, and TDS (Tyagi et al., 2020)**.**

About 255 km separate the city from New Delhi and 168 km separate it from Chandigarh. The summertime high temperature in Dehradun can reach 44°C, and the climate is humid and subtropical. This city is also close to Nainital, which is home to the well-known Jim Corbett National Park and attracts a lot of tourists **(Bhutiani et al., 2015).**

Fig.1.1 Layout of Yamuna River

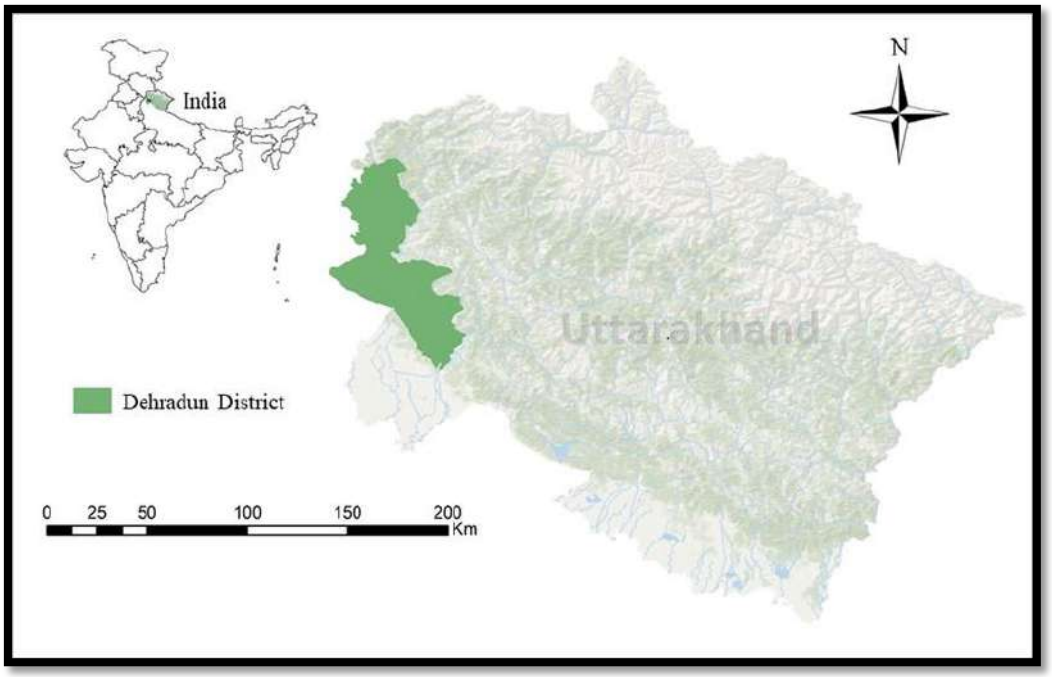

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Fig.1.2 Study Area

2. IRRIGATION WATER QUALITY

2.1 Sodium Adsorption Ratio (SAR)

The irrigation water quality is calculated by using SAR Index which is given by **(Richards U. S. Salinity Laboratory Staff, 1954).** The formula used for calculating SAR is as followed:

$$SAR = \frac{Na^+}{\sqrt{\frac{Ca^{2+}+Mg^{2+}}{2}}}$$

Where,

SAR = Sodium Absorption Ratio (mill mole/L)
Na^+ = Sodium ion conc. (meq/L)
Ca^{2+} = Calcium ion conc. (meq/L)
Mg^{2+} = Magnesium ion conc. (meq/L)
Na^+, Ca^{2+}, and Mg^{2+} are in milli equivalents per liter (meq/l).

Table 1.1: Water Quality Rating Based on the Sodium Absorption Ratio

Irrigation water quality by Richards, L. A., 1954	
SAR Index	**Quality of Water(Irrigation)**
< 10	Excellent
10-18	Good
18-26	Fair
>26	Poor

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RESULTS AND DISCUSSION

The purpose of the study is to look at how the Yamuna river's water quality changed in Dehradun. The study will make use of the water quality index (WQI) in order to track changes and variations in the Yamuna river's water quality. The 12 physicochemical parameters used in the traditional method of water quality inspection are (TDS, Chlorides, Alkalinity, DO, Temperature, COD, BOD, pH, Magnesium, Hardness, Sodium and Calcium). In this study, analysis of water quality parameters for irrigation purposes at Dehradun. By using Sodium Adsorption Ratio Index, during the year of 2017-2019, calculated values for irrigation purpose is excellent in quality. The calculated values of SAR Index are given below Table 1.2.

Table 1.2. SAR DATA (2017-2019)

2017	**Ca^{2+}**	**Mg^{2+}**	**Na**	$\frac{Ca+Mg}{2}$	$\sqrt{\frac{Ca+Mg}{2}}$	$SAR=\frac{Na}{\sqrt{\frac{Ca+Mg}{2}}}$
January	44	30	19	37.0	6.08	3.12
April	36	32	17	34.0	5.83	2.92
July	46	36	15	41.0	6.40	2.34
October	38	32	13	35.0	5.92	2.20
2018	**Ca^{2+}**	**Mg^{2+}**	**Na**	$\frac{Ca+Mg}{2}$	$\sqrt{\frac{Ca+Mg}{2}}$	$SAR=\frac{Na}{\sqrt{\frac{Ca+Mg}{2}}}$
January	40	32	11	56.0	7.48	1.47
April	40	30	13	55.0	7.42	1.75
July	46	36	16	64.0	8.00	2.00
October	40	34	15	57.0	7.55	1.99
2019	**Ca^{2+}**	**Mg^{2+}**	**Na**	$\frac{Ca+Mg}{2}$	$\sqrt{\frac{Ca+Mg}{2}}$	$SAR=\frac{Na}{\sqrt{\frac{Ca+Mg}{2}}}$
January	46	32	20	62.0	7.87	2.54
April	44	36	19	62.0	7.87	2.41
July	46	30	14	61.0	7.81	1.79
October	62	18	15	71.0	8.43	1.78

CONCLUSION

The **Sodium adsorption ratio** (**SAR**) of Yamuna river for irrigation water quality parameter used in the management of sodium-affected soils. It is also a standard diagnostic parameter for the **sodicity** hazard of a soil, as determined from analysis of pore water extracted from the soil. In this research, we have used SAR index formula to determine the irrigation water quality as a review paper. India has a special place in the world because of historical, geographical, religious, political, and sociocultural factors. Over the past few decades, pollution-related activities have led to significant changes in aquatic environments. This study aims to determine the irrigation water quality of the Yamuna River in Uttarakhand using SAR Index over a period of three years, from 2017 to 2019. The Central Pollution Control Board (CPCB), an Indian organization, installed a number of examining stations to monitor the values of the physicochemical parameters under consideration. If the irrigation water quality rating is >10 then the water quality is excellent for irrigation use.

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Evolution of Spatial-Temporal Analysis of Earthquake in Uttarakhand by using QGIS Application

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Assistant professor, J.B.I.T. Dehradun

Abstract *– Among all-natural phenomena, Earthquake is the most terrifying event. It is an unpredictable event striking without warning and seemingly coming out of nowhere, challenging our assumptions. The increasing population of India and extensive unscientific construction mushrooming all over. This study aims to analyze the Spatio-temporal distribution of seismic activities of the last decade (2010-2021), taking place in Uttarakhand, India. In this study, historical seismic activities are used as the main parameter. Using QGIS v3.16.3 Hannover application, geospatially derived the spatial distribution map by using Inverse Distance Weightage (IDW) with the help of the Interpolation method. Analysis of statistical parameters of different magnitude frequencies. Correlation analysis of spatial mappings and their values are presented along with the seismotectonic set-up to assess the seismic frequency scenario in every grid of the study region. The resulting map prepared is expected to increase the awareness of disaster prevention at the time of need and will help in the systematic and proper development of land use for community planning and mitigation policy.*

Keywords- *Spatial-temporal, Seismic even, QGIS, IDW.*

INTRODUCTION

Epicentral recordings of moderate and large/great earthquakes along the Himalayan arc are not frequent. Yet such recordings, when available, provide an image of the source which is less affected by the distortion caused by the path effect. An example is the 2015 Gorkha earthquake (Mw7.9). Epicentral continuous GPS and accelerometric data of the earthquake have permitted the image of the source in extraordinary detail (e.g., Galetzka et al. 2015). The 6 February 2017 earthquake of Guptkashi, Uttarakhand was recorded at the epicenter by a strong-motion seismograph. The event was located between the 1991 Uttarkashi (Mw6.8) and 1999 Chamoli (Mw6.5) earthquakes (Fig. 1). An analysis of this high-quality record permits us to retrieve several source parameters of the event. We complement this recording with others at larger distances to study the characteristics of Fourier spectra of the ground motion and the attenuation of peak ground motion parameters with distance. The motivation of the study comes from the fact that the earthquake occurred in a segment of the Himalayan arc which is known as the central seismic gap with a high potential for large/great earthquakes (e.g., Bilham et al. 2001). Convergence between India and the Eurasian plate along this segment of the arc is about 20 mm/year. However, the Main Himalayan Thrust (MHT), which constitutes the interface between the two plates, is completely locked over a width of ~100 km (e.g., Stevens and Avouac 2015). Since the last great earthquake in the region occurred in 1400 A.D. (Mw > 8.5), the present slip deficit is about 12 m. Khattri (1999) estimated the occurrence probability of an Mw8.5 earthquake in the next 100 years to be 0.59. It is important to study moderate earthquakes, such as the 2017 event, as they provide crucial information on the seism tectonic, and for realistic source and ground motion modeling of postulated strong earthquakes in the region. The importance of the latter in reliable seismic hazard estimation of this seismically highly vulnerable region can hardly overemphasize.

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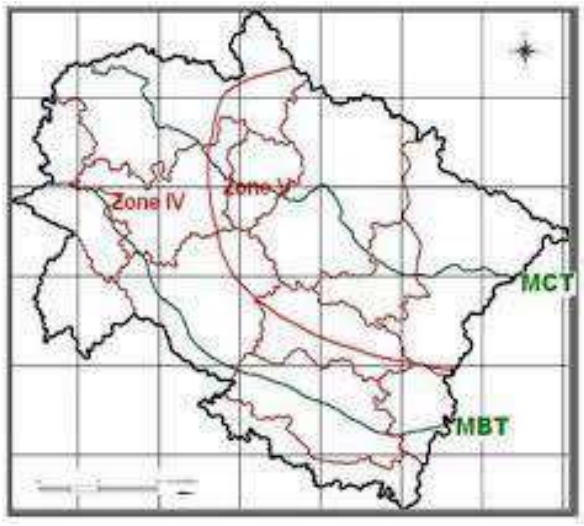

Figure 1-. Uttarakhand map showing the seismic zoning. Uttarakhand Comes under the seismic zones IV and V.

DATA AND METHODS

The Himalayas was formed and is sustained by the northward-driving Indian plate that continues to push against the Asian plate. In the process, it has created several fault systems to the south of the Indus—Tsangpo collision suture, marked by distinct lithotectonic boundaries. The Himalaya is divided into several sequences: Siwalik Group (sub-Himalaya), Lesser Himalayan Sequence (LHS), Greater Himalayan Crystalline (GHC), and Tethyan Himalayan Sequence (THS); each is bounded to the south by a major north- dipping fault, such as the Main Frontal Thrust (MFT), the MBT, the MCT (see Fig. 2). Uttarakhand Himalayas are probably one of the most seismically active areas in the world and have experienced earthquakes since historical time. As per the seismic zoning map of India, the entire state of Uttarakhand has been assigned to Zone IV or V, which are the two most seismic active areas (BIS 2002). In the Kumaon–Garhwal Himalaya, the MCT is a zone bound by the Munsiari Thrust (MT) in the south and the Vaikrita Thrust (VT) in the north (see Fig. 2). Geographically, the Kumaon and Garhwal regions lie in Uttarakhand state of India extending from the Sutlej river in the west to the Kali river in the east. Detailed geology of the region has been reviewed by Valdiya.

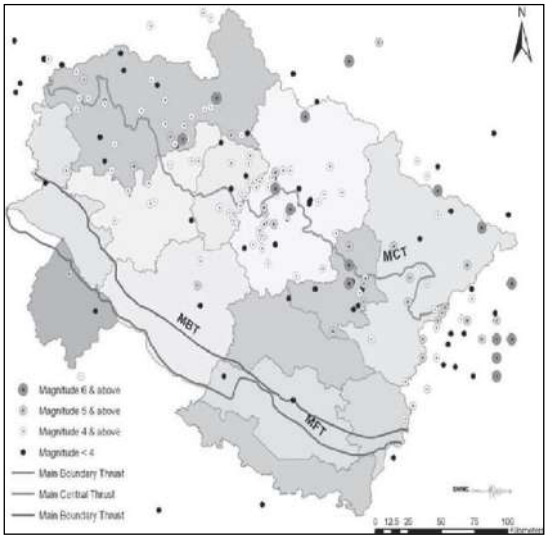

Figure 2. Epicentric points of Kumaon and Garhwal region, most earthquake zones come under the Himalayan belt region

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(1980), Yin (2006), and others. Besides these big Himalayan thrusts, several other faults and thrusts exist in the study area. Several faults and lineaments are transverse to the Himalayan trend. Important among these are Mahendragarh Dehradun Fault (MDF), Great Boundary Fault (GBF), and Moradabad fault (MF), which exists in the Delhi-Moradabad region.

The distribution of seismicity throughout the Himalayas appears to be centered around a 50-km wide belt with moderate-sized events (ML\ 6) located beneath the lesser Himalaya between the MCT and the MBT (Seeber and Armbruster 1981; Khattri et al. 1989; Khattri 1992). Most of these events are located to the south of the MCT. Medium-sized earthquakes with well-determined fault plane solutions and focal depths determined by Ni and Barazangi (1984) define a simple planar zone situated at 10–20 km depth, with an apparent dip of 15. This planar zone defines the detachment that separates the under thrusting Indian plate from the lesser Himalaya crustal block and along which the great Himalayan earthquakes occurred during the past 90 years (Seeber and Armbruster 1981). Recent investigations in other segments of the Himalayas show that apart from sporadic distributions, most of the seismicity in these segments is also clustered in a narrow zone, just south of the surface trace of the MCT (Kumar et al. 2009). However, earthquake focal depth estimates from the Nepal Himalaya (Monsalve et al. 2006; Liang et al. 2008) indicate the existence of two distinct seismogenic zones in the depth ranges of 0–25 and 50–100 km, suggesting the near absence of earthquakes in the lower crust, of possibly lower strength (e.g., Chen and Molnar 1983).

In this research, we have taken the last five years' data to study the behavior of the earthquake pattern in the Uttarakhand region as mentioned below with the longitude and latitude of the locations.

Table 1. The above data shows the earthquake of magnitude between 4 and 5 in year 2017.

Location(2017)	Longitude	Latitude	Magnitude
Tehri Garhwal	78.31	30.27	4
Pauri Garhwal	79.1	30.4	4
Joshimath	79.21	30.67	5.3
Kedarnath	79.23	30.67	5

Table 2. The above data shows the earthquake of magnitude between 4 and 5 in year 2018

Location(2018)	Longitude	Latitude	Magnitude
Chamoli	79.6	30.5	4.4
Pithoragarh	80.21	29.58	4.5
Uttarkashi	78.95	30.73	5
Rudraprayag	78.98	30.28	4.9
Dehradun	78.71	30.27	4.3

Table 3. The above data shows the earthquake of magnitude between 4 and 5 in year 2019.

Location(2019)	Longitude	Latitude	Magnitude
Joshimath	79.6	30.5	4.4
Pithoragarh	80.21	29.58	4.5
Uttarkashi	78.95	30.73	5.1
Rudraprayag	78.98	30.28	5.1

Table 4. The above data shows the earthquake of magnitude between 4 and 5 in year 2020

Location(2020)	Longitude	Latitude	Magnitude
Bageshwar	79.76	29.84	3.3
Pithoragarh	80.21	29.58	2.8
Haridwar	78.16	29.94	3.9
Chamoli	79.56	30.29	3.6
Rudraprayag	78.98	30.28	5.1

Table 5. The above data shows the earthquake of magnitude between 4 and 5 in the year 2021.

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Location(2021)	Longitude	Latitude	Magnitude
Joshimath	79.44	30.94	4.3
Roorkee	77.83	29.76	4.1
Pauri	79.26	30.43	4.7
Tehri	78.68	30.48	4.2
Kashipur	78.92	29.17	4.7
Dehradun	78.71	30.2	4.8

The above data was taken for five years i.e. 2017-21. As this data only points to the major districts of Uttarakhand of Kumaon and Garhwal region with the epicenter location having latitude and longitude. The purpose of the research was to examine the seismic activities of the most seismic-prone areas of Uttarakhand. The paper only focuses on the seismic activities between 4 to 5 magnitude as the activities of the same magnitude occurs frequently in the mentioned locations which will help in finding the future earthquakes in the desired locations and the main faults in the desired locations due to which such amount of energy is released in that particular points and the exact locations of the faults or the location from where the energy is released due to movements of the tectonic activities under the Himalayan range.

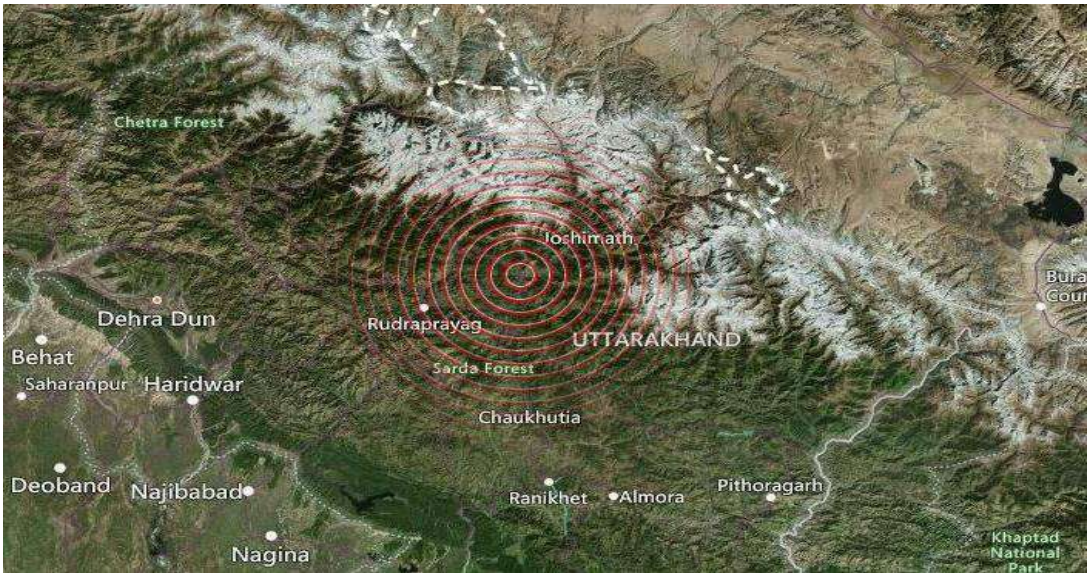

Figure 3: *The Epicentric location of an earthquake between the Joshimath region and Rudraprayag region*

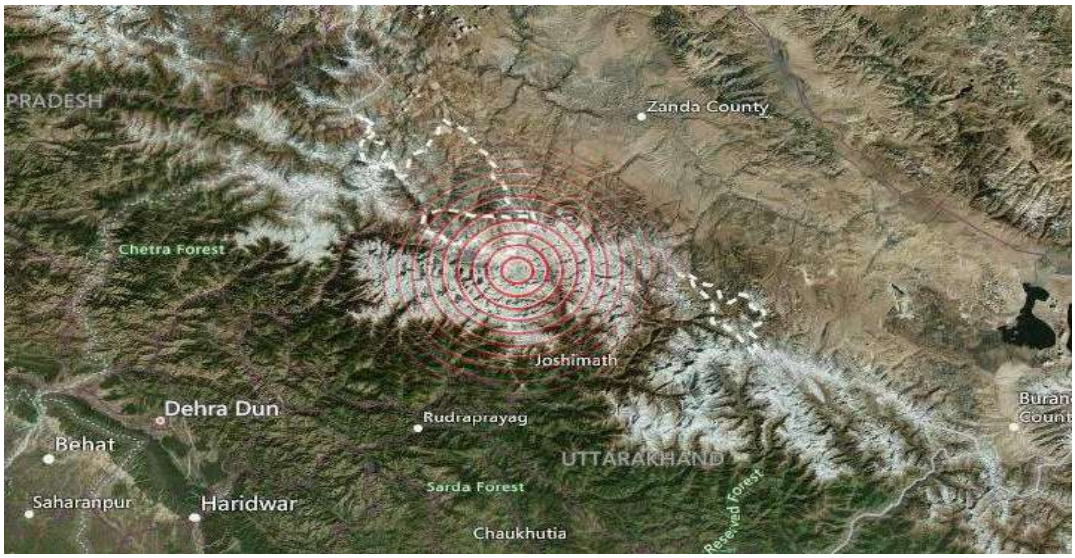

Figure 4: *The Epicentric location of an earthquake above the Joshimath region.*

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RESULTS

The QGIS program was used to conduct a spatial study of magnitude characteristics. All earthquake data were measured with SDM. The spatial distribution maps of earthquake variation of magnitude in Uttarakhand were prepared using the. IDW technique in QGIS. In IDW, the vector of points data was weighted during interpolation such that the influence of one-point relative to another declined with distance from the target created point. This method is an extension plugin available in the QGIS spatial analysis package V.3.16. (2021). Here in this study, an Inverse Distance Weighted (IDW) approach was used to spatially interpolate the data and estimate values between measurements. Recently earthquake data of Uttarakhand were interpolated over five years throughout the values given by USGS. Spatial distribution maps prepared by IDW interpolation in the study area are shown in Fig.5 to Fig. 9

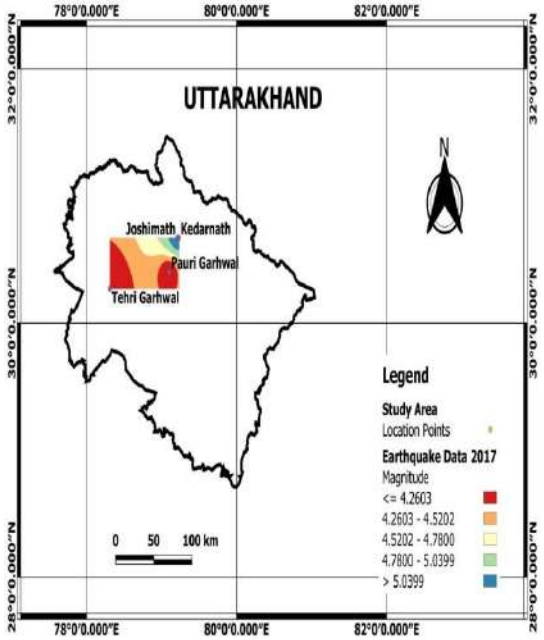

Figure 5: *spatial-temporal map of table no. 1*

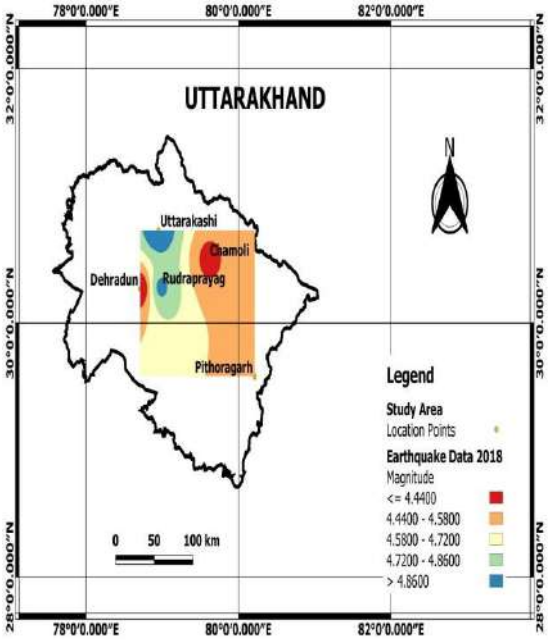

Figure 6: *spatial-temporal map of table no. 2*

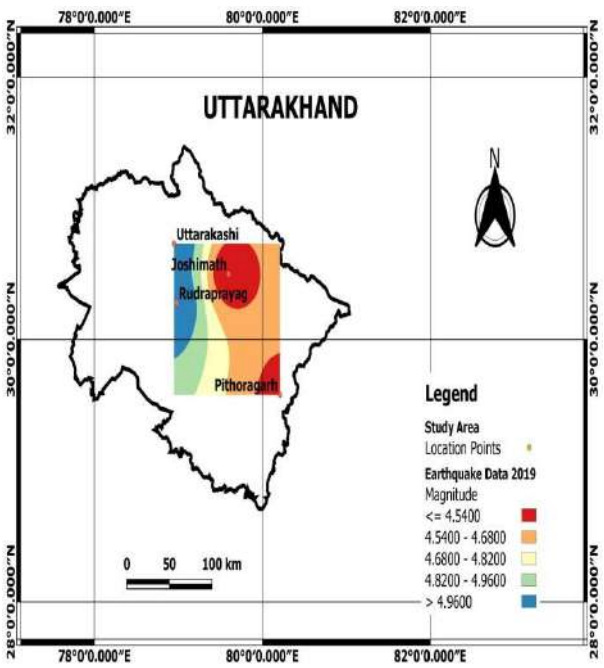

Figure 7: *spatial-temporal map of the table no. 3*

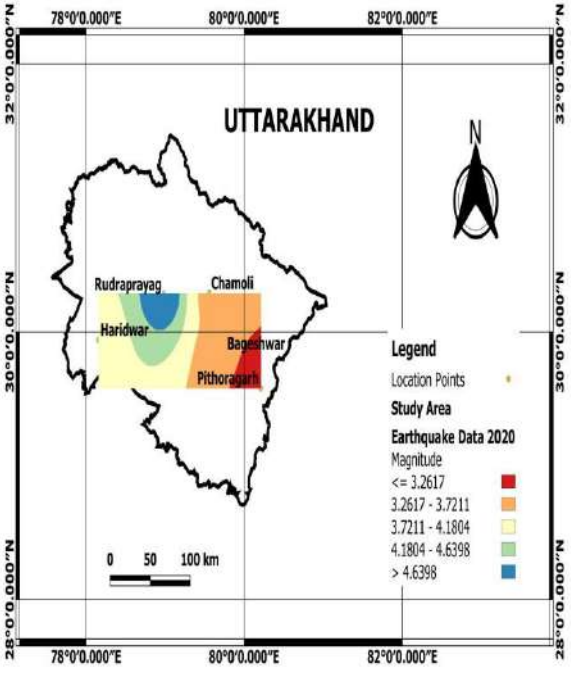

Figure 8: *spatial-temporal map of table no.4*

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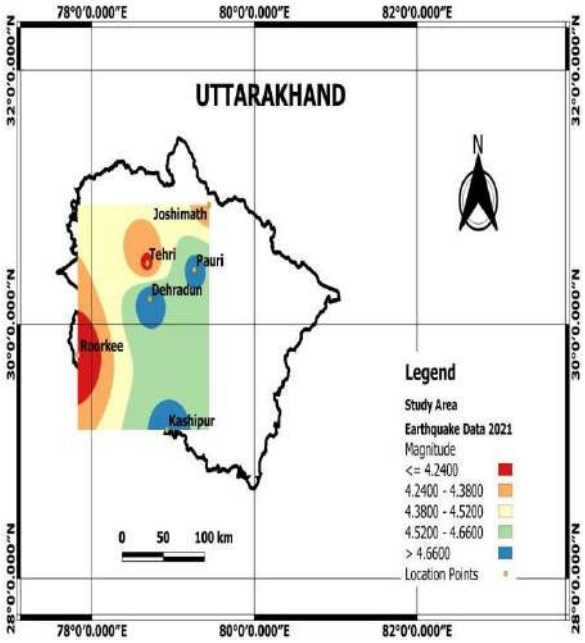

***Figure 9**: spatial-temporal map of table no. 5*

CONCLUSIONS

From the above spatial temporal map, we can conclude that the region near the Himalayan belt suffers the most earthquakes as it can be clearly seen on map mentioned above. It can be seen clearly that the areas were highlighted with different colors having different magnitudes. It could be clearly seen that the Epicentric point of the current seismic activity is too close or even same as the preceding ones.QGIS is used to represent the seismological data of earthquakes in Uttarakhand and nearby places of Himalayan belt by using the Inverse Distance Weighted (IDW) method to analyze the spatial distribution map.

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Ai-Enabled Application for Smart Transportation

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Abstract – *Artificial intelligence (AI) is the ability of machines to perform cognitive functions such as perception, reasoning, learn and solve problems that people can easily handle. Artificial intelligence has taken hold since during the last two decades around the world due to the availability of large amounts of data created through the Internet. There has been of great benefit to governments and businesses in processing this data using sophisticated algorithms in recent past. Powerful growth of mechanical algorithms supported by various technologies such as the Internet as well Objects, robotic process automation, computer vision, natural language processing have made it possible to grow AI. This article is a summary of various issues affecting the transportation industry that are classified as smart.Transportation system Some subsystems under review relate to traffic management, public transport, port, security management, production and transport of intelligent transport systems where artificial intelligence benefits are taken into use. The study addresses specific concerns in the transportation industry and related issues that have possible solutions with artificial intelligence. The method involves additional research based on available national data from various sources. Furthermore, discussions on artificial intelligence solutions to solve problems in the transport industry in various countries of the world and in the states of India it is taken.*

Keywords- *Public transport, Safety management, Logistics, Intelligent transportation systems, Traffic. management, Transport management system*

INTRODUCTION

Technologies in the past were a solution to corporate problems; Be it retail, banking, insurance, healthcare or even sports. Some of these solutions have changed the way businesses are run by reducing operating costs, improving efficiency and increasing efficiency. One of the following areas in which the latest technology has been successfully implemented is the transportation industry, which suffers from problems related to traffic congestion, unexpected delays, and routing problems which lead to financial losses in enterprises. The transportation industry has been a major contributor to the movement of people and goods across different geographies. It plays an important role in the supply chain management system as goods are moved from one place to another. Industry plays a major role in moving goods to the right place at the right time in the logistics chain. To take full advantage of commercial investment, governments and organizations have used technologies such as machine learning, artificial intelligence, the Internet of Things, and more**.**

1.1 Artificial intelligence (AI)

Artificial intelligence (AI) is a broad field of computer science that makes machines work like a human brain. AI is also known as the ability of a machine to easily perform the cognitive functions of a human being. The phrase artificial intelligence was initially coined in 1956 by John McCarthy, a computer scientist. This six-decade-old concept has recently gained popularity due to the availability of large amounts of data generated across different devices and the availability of effective hardware, software, and network infrastructure. The emergence of artificial intelligence has enabled the automation of processes that lead to innovative business solutions [47]. AI provides reliable and cost-effective solutions while addressing uncertainty in the decision-making process. The ability of advanced algorithms to handle complex data has facilitated faster decision-making in companies due to process automation [10]. With the growing concern for the

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environment, AI is becoming a solution provider for solving climate change and water problems by transforming traditional sectors and systems. These capabilities have helped governments build sustainable cities that will help protect biodiversity and human well-being [23].

The world of artificial intelligence is currently dominated by the United States (US) and China. A PwC report estimates that AI will contribute $15.7 trillion to the global economy by 2030, more than the current output of China and India combined. In the United States, the academic system has produced and incubated research related to artificial intelligence; While in China, the government provides funding and technology to harness the potential of AI. China plans to invest at least $7 billion through 2030. Canada and the United Kingdom increased investment in the technology with an announcement adapted from (Sadek Artificial Intelligence Applications in Transportation, 2007) [54]

AI FUNCTIONS AND USE

AI Function	**Use-cases**
Non-linear prediction	Traffic demand modeling
Control functions	Signal control, dynamic route guidance
Pattern recognition	Automatic incident detection, image processing for traffic data collection and crack identification in pavements or bridge
Clustering Planning	Identification of specific class of drivers based on behavior Planning AI based decision support systems for transportation planning Optimization Designing an optimal transit network, developing an optimal work plan for maintaining pavement network, developing an optimal timing plan for a group of traffic signals

1.2 AI and transport

Most of the world's major cities face problems with transportation, traffic and logistics. This is due to the rapid growth of the population as well as the increase in the number of vehicles on the roads. To create and efficiently manage a sustainable transportation system, technology can be of great benefit. As urban areas struggle with traffic congestion, AI solutions have emerged to access real-time vehicle information to manage traffic and use on-demand navigation in trip planning through a single user interface. The secure integration of AI-based decision-making, traffic management, routing, transportation network services, and other mobility optimization tools are further possibilities for efficient traffic management (Transport, 2019) [61]. Artificial intelligence is considered one of the emerging technologies by the World Economic Forum. AI methods that support transmission include Artificial Neural Networks (ANN), Genetic Algorithms (GA), Simulated Annealing (SA), Fuzzy Logical Model (FLM), and Ant Colony Optimizer (ACO). The goal of implementing these technologies in transportation management is to ease congestion, make travel time more reliable for travelers, and improve the economy and productivity of the entire system [1].

Vehicles delivered through technology improve driving efficiency by anticipating traffic conditions on the road [1]. The research article [41] addresses three points of view.

- Evaluation of accurate prediction and detection models aimed at predicting traffic volume, traffic conditions and accidents
- Public transportation as a sustainable means of transportation by exploring the various applications of artificial intelligence
- Connected vehicles with the aim of improving productivity by reducing the number of road accidents [40].

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- Various studies have been conducted around the world to overcome the problems related to the transportation industry. The result of AI-supported research activities around this industry has given hope to this important area of development.

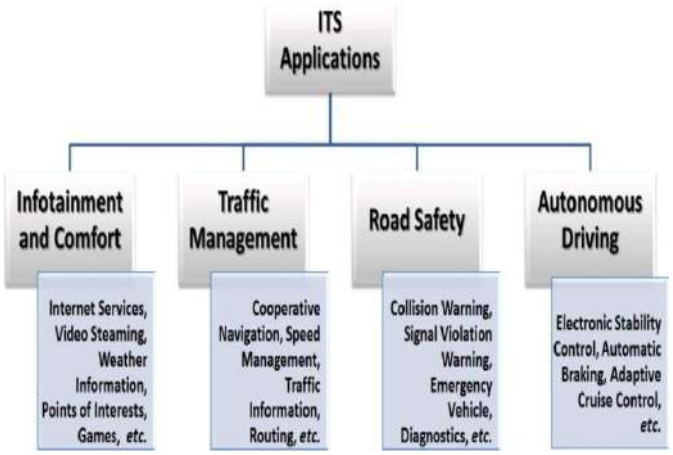

Fig 3. *Classification of ITS applications.*

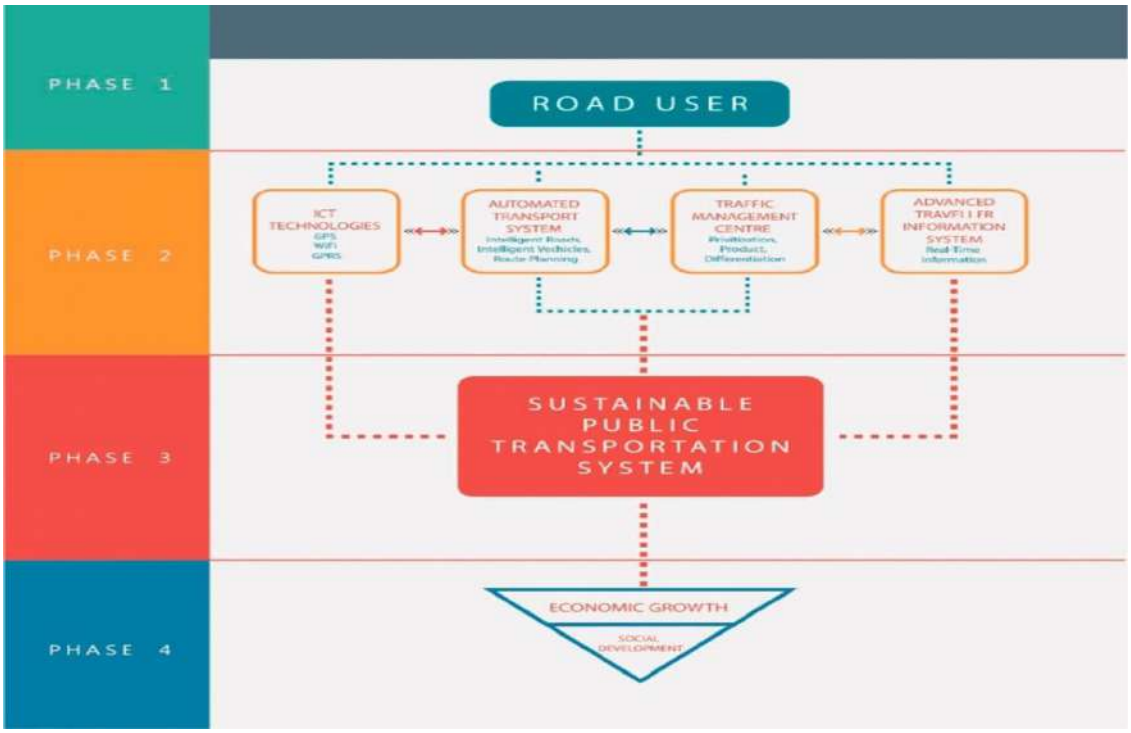

Fig 4. *ITS Framework implementation to public transportation system. (Source: Abijede O [55])*

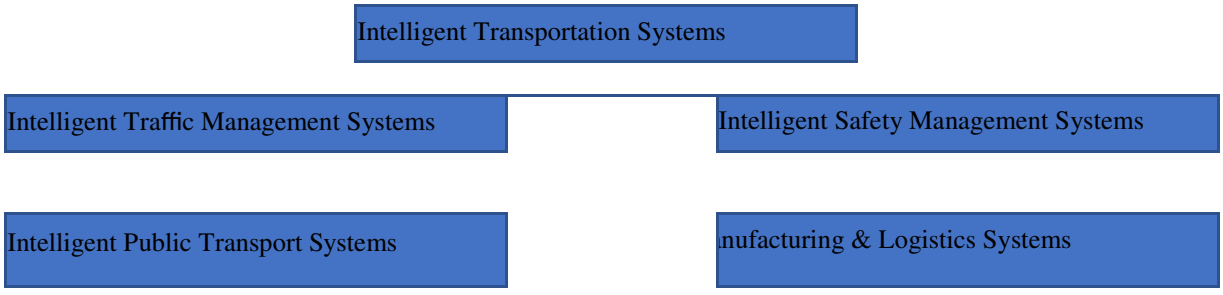

Fig 5. *Intelligent transportation systems.*

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1.3 Intelligent transportation

In recent years, huge amounts of data have been generated with the proliferation of multiple technological devices in all sectors. This data has become valuable in the decision-making process of businesses, governments, and societies. The transportation industry, which is the lifeblood of the urban environment, cannot be left in the generation and use of data. This sector plays an important role in urban development as it affects people, operations and profits. To enable data generation, automakers have been

proactive in building devices that can be installed in vehicles used to transport people and goods. The data generated by these devices is monitored remotely by experts. Governments and businesses are able to make real-time decisions based on data. Generated through the use of different applications. Many innovative applications related to transportation and technology are being created in recent years. Application developers focus on a process-oriented systems approach with a clear objective integrated with a feedback mechanism to measure the outcomes of solutions related to the transportation industry.

Transportation management systems (TMS) belong to the field of transportation management specifically in relation to transportation operations. The goal of these systems is to create efficient route planning, optimizing load, improving flexibility, and transparency in data usage. According to Gartner, this field is expected to grow at a rapid rate [42]. The city's transportation strategies are linked to an information system to improve management focused on picking up.

Processing, transmission and management of data generated in this way. Since the past two decades, due to the advent of smart technologies, various information systems for logistics, routing, mapping and planning are being developed. These systems have provided increased data processing capabilities to better plan the transport process leading to Intelligent Transportation Systems (ITS) [13].

The data generated by users and vehicles is used to build efficient intelligent transportation systems. The integration of ITS into transportation systems has ensured higher performance due to information acquisition, exchange and integration between vehicles, city infrastructure and other related activities. It should be noted that ITS support the decision-making process of city authorities and vehicle users.

The article focuses on Intelligent Transportation Systems that are part of Transportation Management Systems. The desktop method is adopted to bring together AI techniques to solve transportation industry problems towards building a sustainable transportation system. The benefits of the various ITS sub-systems are identified and discussed along with the applications of artificial intelligence that have had a positive impact on the transportation industry. Data is summarized from research papers, government reports, press articles, and advisory agency reports. Some of the frameworks adopted in previous studies are a reference point for the current study to identify subsystems. This work will help businesses and governments adopt technologies and create relevant solutions according to a specific scenario.

2-LITERATURE SURVEY

Artificial intelligence has caused major disruption in many industries including healthcare, retail, banking, insurance, entertainment, manufacturing, and transportation. Several AI use cases in transportation have been tested and approved, justifying the fact that this market is on the rise. With the technological advances associated with artificial intelligence, the transportation industry has shifted to embed user-friendly devices in vehicles. This has led to the creation of Intelligent Transportation Systems using data generated by devices.

AI in its current form has the ability to solve transportation problems in real time, thus managing the design, operation, scheduling, and management of logistics and freight forwarding systems. Some other applications include travel demand analysis, transportation regulation, and pedestrian and herd behavior analysis. AI technologies allow these applications to be used for all transportation management: vehicle, driver, infrastructure and the way these components dynamically deliver transportation services [59]. AI methods provide intelligent solutions in areas where it is difficult to understand the complex relationships between features of transportation systems [1]. The research study of [31] focuses on two areas: artificial intelligence and transportation. Although AI brings tremendous opportunities on the one hand,

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It also brings significant security challenges on the other hand. The privatization of commercial transport since the mid-2000s has opened up new research opportunities and greatly improved programs in these areas.

A research program jointly funded by the International Public Transport Association (UITP) and the Land Transport Authority (LTA) by the name "Artificial Intelligence in Mass Public Transportation" has been implemented through literature review, quantitative surveys, use cases, expert blogs, and thinking workshops. The report described different use cases for AI applications [16] in public transportation and what the future may hold for artificial intelligence in public transportation systems. Consulting firm PwC conducted a nationwide survey to understand the impact of artificial intelligence among decision makers and regular employees in a wide range of sectors such as financial services, technology and manufacturing through online mode. Young people are found to be more adaptable to transportation-related technologies [48].

Early adopters and progressive stakeholders in public transportation expect that AI will become an integral part of the future of mobility [24]. Artificial intelligence is able to access through different methods, methods and techniques to varying degrees that demonstrate logical thinking, problem solving and learning. AI can be hardware-based (bots) or software (Google Maps). Data-driven artificial intelligence combines machine learning techniques with techniques used to search for and analyze large amounts of data. AI helps identify market trends; Identify risks mitigating traffic congestion. reduce emissions of greenhouse gases and air pollutants; Transportation design and management. and analysis of travel demand and pedestrian behavior (Niestadt, Debyser, Scordamaglia, and Pape, Artificial Intelligence in Transport, 2019) [43]. Data-driven applications, services, and artificial intelligence are the cornerstones of achieving the vision of delivering optimal mobility. To build an effective and efficient mobility ecosystem in the city, a holistic approach to mobility management is required. Connected vehicles send data in real time, which results in a huge amount of data. As transfer requests continue to grow, the growth of data across devices is also on the rise; Therefore, the need arises for smarter road traffic management [57].

The study [50] focuses on the advanced monitoring, control and management systems of the Intelligent Highway System - Vehicles. The discussion here revolves around non-redundant congestion in complex networks. The study proposes an AI-based solution approach with several expert systems related to real-time knowledge in arterial traffic management. Two AI models are used: support vector regression (SVR) and state-based inference (CBR) to evaluate the network at scale.

and complex simulation models. The study [11] evaluated the results of the two models by comparing the predictions of traffic conditions. In this study, an agent-dependent control system monitors traffic, road accidents, and other transportation activities. The article [22] compares two integrated independent factors that have been deployed for intelligent traffic management systems performing decision support for real-time traffic management in Barcelona. The study [51] investigates the applicability of independent intelligent agents in urban traffic control (UTC). The systems proposed by the study can design, implement, optimize and adjust UTC for dynamic environments. The utility of this model is suggested to be in many smart intersections for traffic light agents. These clients are able to respond to traffic conditions in real time and maintain their stability and safety [7].

Technologies related to autonomous vehicles (AVs) have the potential to influence vehicle safety and travel behaviour. They ensure reduced travel time and increased fuel efficiency. Currently, these technologies are disrupted by bringing enormous benefits to the transportation system. However, there are still challenges related to adoption by a larger group of people and the high costs of adoption. Regulations regarding data responsibility, security, and privacy are uncertain by governments, resulting in low market penetration for self-driving vehicles [18]. A study evaluating the effectiveness of an autonomous emergency braking system at low speeds found that vehicles equipped with this technology were able to reduce rear-end collisions by approximately 38% [19]. In the current scenario, the main problems with transportation are congestion, safety, pollution, and the increased need for mobility. One possible solution to address all these challenges could be self-driving vehicles [36]. These vehicles collect data from their physical and digital environment through sensor technology [25] and communication solutions [68].

Connected cars can access the Internet through smart devices and can also communicate with other cars and infrastructure. They get real-time data from multiple sources that support drivers through stressful driving processes. These cars guarantee safety and reliability [12]. Pattern recognition is used with image processing to automatically detect accidents and identify

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cracks in sidewalks or bridge structures. Clustering technology is used to identify specific classes of drivers based on driver behavior (Sadiq, Applications of Artificial Intelligence in Transportation, 2007) [54].

Article [35] proposes new models, means and methods for manufacturing vehicles using technology. This has led to the building of smart vehicles with the adoption of technology in automobile manufacturing. The study analyzes the degree of impact of AI technology on various businesses and the country's economy [15]. Ford Motor Company has successfully integrated artificial intelligence into key manufacturing processes to provide a competitive advantage for the organization. The study focuses on process planning and deployment of intelligent manufacturing systems (Rychtyckyj, Ford Motor Company's Manufacturing Intelligent Systems, 2007) [52]. The study [64] indicates that the initial demonstrations of technologies used in self-driving vehicles date back to 1939. Most of the self-driving vehicles developed by Google rely on video cameras, radar sensors, laser rangefinders, and maps that they have developed themselves. . Autonomous vehicles will affect not only the performance of individual companies but also the national and global economy [63].

From the detailed background study on applications to solve transportation problems, it is clear that AI plays an important role in building efficient transportation systems using data. The current study attempts to represent different AI concepts and applications for the development of ITS as part of TMS. Among the various applications available, the study focuses on the intelligent traffic management system, the intelligent public transportation system, the intelligent security management system, and the intelligent manufacturing and logistics system to build a sustainable transportation system [53]. In each of these systems, the role of AI and corresponding advantages are discussed in Section 3. In addition, Section 4 discusses AI solutions to problems related to the transportation industry around the world and in some US states.India. The final section brings together various challenges and suggestions for the transportation industry through the application of artificial intelligence.

3-FRAME-WORK

From the above studies, it is shown that the benefits of AI in building intelligent transportation systems have not been sufficiently explored. The current study explores the applications of ITS in the transportation industry applied in different countries. The transportation industry, which is the lifeblood of the economy, appears to be dealing with various operational problems around the world. Problems with the transportation industry slowed the progress of the city, and thus the country. TMS is a boon because they are systems created to overcome transportation problems using different technologies. TMS helps companies plan, implement and improve the physical movement of goods. because of For data availability and remote monitoring, TMS ensures timely delivery of products, resulting in increased customer satisfaction. This has benefited companies by increasing sales. TMS improves fleet performance and reduces supply chain expenses with the right tools such as route optimization. As data is collected remotely and closely monitored, a comprehensive understanding of deliveries, outcomes, and returns is recorded, resulting in greater transparency. TMS uses technology to plan, implement and improve the movement of goods to help businesses thrive. These applications are used by manufacturers, distributors, retail companies and companies that work in the field of logistics. The Intelligent Transmission System consists of a set of subsystems in a .format field of public transportation, traffic information, Parking management, traffic management and control, security and emergency management, and sidewalk management (Fig. 2). This is very specific to smart cities (Agarwalet al., 2015) [3]. To build an efficient smart city through intelligent transportation systems, it is important to include the capacity of the system in the various operational activities of the city. Some of the activities in the city are public transportation, traffic management, parking management, sidewalk management, and security management. Through intelligent transportation systems, travelers, pedestrians, transport and society in general benefit.

The study by Hamida et al., 2015 [5] classifies the various applications of ITS into four main categories, as shown in Figure 3. They are:

(1) information, entertainment and convenience;
(2) Traffic Department
(3) road safety;
(4) Autonomous driving.

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4- DISCUSSIONS

4.1-AI solutions for Intelligent Transportation

The contribution of AI to the transportation industry has been enormous and wide-ranging. Solutions include autonomous vehicles, traffic management, improved routing and logistics, and providing safety for vehicles and drivers. Intelligent Transportation Systems (ITS) are designed using data generated from devices installed in vehicles through artificial intelligence techniques.The current study focuses on four sub-systems related to transportation, namely, the intelligent traffic management system, the intelligent traffic management system,Public transportation system, intelligent security management system, intelligent manufacturing and logistics system.

4.2- AI accomplishments in transportation across the globe

As noted in the discussions so far, the ability of AI to solve problems related to transportation seems naturally adequate. However, as with AI in any other industry, adoption of these applications varies across organizations and geographies. Depending on environmental and geographic factors, applications can be simple and complex, far and near, specific or potential.

1-AI applications across organizations
2-Adoption of AI by transport corporations

5-CONCLUSIONS

The article collected the potential and benefits of artificial intelligence for building intelligent transportation systems. The study proposes a framework with which ITS subsystems have been identified based on their capabilities. ITS is one of the important tools for identifying potential problems in the transportation industry and this study has suggested solutions to specific problems. It is noticeable that machine learning algorithms are largely used to predict traffic congestion and manage the route. A city-by-city analysis of the adoption of AI to overcome transportation problems shows that most developed countries have been quick to adopt these systems. This adoption requires the support of the companies and the leadership involved, as it involves investment and long-term vision on the part of senior management. Some organizations and governments are still reluctant to adopt because Two reasons: They are concerned about the risks associated with AI adoption, or that technology adoption is weak among citizens in these

Countries. It was noted that developed countries are moving forward with the adoption of technology related to transport management. To build an effective AI application, we need large amounts of data as input to process text, image, video and audio so that the decisions made are appropriate. The lack of knowledge and talent in this field remains a weak point in coming up with new solutions that meet the needs of this sector. For this reason, AI applications in logistics companies cost approximately 3-10% of sales volume, which creates a barrier to adoption.The article attempted to identify and compare different artificial intelligence techniques to solve specific problems related to the transportation industry. The outcome of this article will benefit governments and organizations that wish to invest in new technologies for specific applications related to the transportation industry in order to make a positive impact on their business. The article **will help** organizations that want to implement technical solutions to solve transportation problems. This will also help them take initiatives and investment decisions in the industry to provide sustainable solutions to businesses and communities.

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Waterproofing Materials for Building Construction

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Abstract – *A man-made structure includes drawings, scales, quality control, construction and proper maintenance, which are used to support the various benefits of human society. The level of construction is a major factor and an important task that must be addressed and avoided prior to the demolition of the building. Water-related problems are silent killers and play a significant role in maintaining and maintaining the structure. Water can penetrate deep into the stone or concrete floor of the basement by capillary action. It is possible for water to seep into the ground at any point, depending on the strength of the concrete and the fullness of the outer surface. Each building can be selected as it also deals with the care issues involved outside of natural resources. Water is a major source of degradation or damage to a building. Due to the harmful effect of water, special attention should be given to the selection of high quality waterproofing materials to provide optimal performance. The life of waterproof materials is much shorter than the life of construction. This paper covers the use of waterproofing materials and identifies the types of waterproofing materials we commonly use.*

Keywords- *waterproof materials, harmful water effect, construction quality.*

INTRODUCTION

Waterproofing is basically a process designed to prevent water from entering a building. It is the construction of an invincible barrier on foundations, roofs, walls, and other elements of a building. The function of the inert barrier is to prevent water ingress. The building's structures are waterproof and sometimes waterproof.

The waterproofing is usually done in different layers and sections to create more barriers to prevent water from entering the building. It helps to keep the building dry. Thus, it also protects the structure from damage caused by moisture and water exposure. The building is waterproofed through membranes and holes to protect the contents of the floor or inside and to protect the integrity of the building. A combination of such categories is referred to as creating a “Building Envelope”. Therefore, the compatibility of the materials, their interaction, the connection of the enclosed spaces of the buildings also judged the performance of the structure. And this performance is greatly hampered by external climatic factors, where rainwater and site flow play a major role. Therefore, protection from the weather, seepages from the ground and direct flow of water into the building can be effectively protected by the proper use of a waterproofing system.

Modern water protection systems deal with stable structures with a dual course in its operation at the well. Various and specific coats with specific chemical concentrations allow the process to perform many functions, easily. The same energy saving effect occurs due to the use of materials involved in this process. This includes coatings on the exterior and floor walls, which reduces the flow of heat to the building and thus reduces the burden of improving indoor air quality and space atmosphere. Waterproofing systems can also be referred to as "building protection and renovation" or "renewable engineering", due to their versatility and value. Waterproofing is not only a big part of the building process but also preserves the dignity of the landscape. (Grading here means extensively identifying, controlling and improving the area for

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proper construction). Therefore, the waterproofing system applies not only to the entire construction envelope, but also to certain parts of the building.

The need for waterproofing

It would not be wrong to say that a building is a living entity that needs proper care and attention. Also, problems with moisture and water should be avoided.

Water problems in a building can damage the building in the following ways:

1. Seapage using wall hangings, sill, extensions, brickwork joints, etc.
2. Absorption of groundwater in the basement and basement.
3. Explosion of pipes within the wall or under the ground floor.
4. Capillary protrudes from walls, joints, and columns.

How can you tell if your building has a waterproofing problem?

If there are any visible signs in the building, make sure we have a waterproofing problem.

1. Wet and wet walls
2. Growth of mold and mildew
3. Signs of decay
4. Mixing water
5. Water leak on the roof / roof

All of these problems can not only destroy the exterior of a building but also damage its interior and the foundation.

Benefits of waterproofing

1. It keeps the structure dry and strong.
2. The building becomes more comfortable to live in as it reduces internal humidity.
3. No damage to objects due to moisture and water vapor.
4. Sturdy and durable structure.

Types of waterproofing materials

It is important to treat your property as if you were choosing the right waterproof material. Therefore, you should analyze and understand the types of waterproofing materials for your building.

Polyurethane

This is used to prevent water from roofing. The polyurethane liquid membrane provides high flexibility, with many benefits such as:

1. Filling of capillary cracks.
2. Reduce water absorption in concrete.
3. Liquid strengthens the surface concrete.

Application Areas:

- Water tanks
- Pedestrian stairs
- The roof
- Bridges
- Parking area

Cementations waterproof coating

This app provides a very simple program. The mixture contains sand, silica, organic chemicals, and inorganic chemicals. Also, these substances are combined with the function of lime as a sealant.

Application Areas:

- Water treatment plants
- Ports and harbors
- Parking area
- Channels

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Bituminous waterproof membrane

Also known as bituminous coating, or asphalt coating, this membrane works effectively against water infiltration. Bituminous is mixed with natural adhesives. Therefore, its viscous quality makes it a very strong waterproofing material for the roof.

There are two ways to use bituminous:

1. Roll roofing material method
2. Roofing felt method

EPDM rubber

This waterproofing material is a synthetic rubber material made of propylene and ethylene. Typically, experts associate an EPDM rubber solution with a silicone compound. However, both vary depending on the chemical composition, use, and characteristics.

Also, EPDM rubber is highly adaptable and recyclable.

Application Areas:

- The roof
- Windows
- Wood

Rubberized Asphalt

Another excellent waterproof chemical, Rubberized Asphalt works effectively to protect buildings. The strength, flexibility, and resistance to moisture and the penetration of this vapor make it extremely durable and suitable for structural treatment.

Application Areas:

- The roof
- Plazas
- Parking spaces
- Terrace

Thermoplastic Waterproofing

One of the most effective waterproof materials is thermoplastic. This solid solution provides long-term protection in buildings. Therefore, its anti-inflammatory factor makes it suitable for all heavy treatments.

Application Areas:

- Decks
- Elevator pits
- Fountains

PVC membrane

This feature is often used to prevent water from roofing. Its vapor-permeable material gives it extra strength. The base of the PVC membrane uses polyester mesh or glass fiber.

Application Areas:

- The roof
- Tunnels
- Swimming pools
- Underground structures

Waterproofing paints

Waterproof paint protects the house from environmental damage and improves the health of the building. Therefore, it remains water resistant or completely waterproof. Waterproof paint can be used inside buildings in bathrooms, kitchens, basements, etc. Therefore, it could protect the bathroom and the basement from leaks and excess moisture.

The waterproof paint bathroom wall prevents moisture from entering the walls. Therefore, these paints are preferred over conventional paints as the first one will not stand firm against wet conditions as before. In addition, once moisture has penetrated the walls, mold and mildew will damage the structure and cause health problems.

Types of waterproofing paint

Epoxy paint for waterproofing

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Epoxy waterproofing paints use strong chemicals to combat very wet conditions and protect the surface. They make waterproof paint on roofs and water-repellent paints.

Masonry waterproof paint
Made of a mixture of latex and ceramic paint, waterproof masonry paint is often used for roofing. Also, this paint absorbs chemicals and other liquids easily like water and prevents them from getting inside. It also provides cement with waterproof chemicals.

Acrylic waterproof paint
This type of paint is best suited for roofs and terraces made of rectangular blocks. Also, this paint on the roof and the balcony harmonizes and drains the water on the surface. Additionally, waterproofing paint is non-toxic and easy to apply.

PROCESS OF WATERPROOFING

Waterproofing is done horizontally, above the structure, retaining respiratory equipment, to prevent the flow of water and the rise of capillary water in it. The interior displays the water content of the structure and externally forms a protective film around it. Typically, the construction of a waterproofing system is done by creating many barriers to stop the ingress of water, so that it cannot enter the building. This development of multiple layers, materials and methods in them creates a kind of "envelope" of structure around the building. This envelope can be treated as a permanent feature or measure of a green structure by avoiding the ingress of excessive heat from the atmosphere. This can be done by applying various paints, adhesives and other finishes as well as blending that helps create a transition between outside and inside temperatures. This transition between temperatures helps the structure in the following ways:

- Small differences between indoor and outdoor temperatures cause minor weather symptoms and protect the building. This is done in such a way that the effect of compaction or expansion during the various seasons in the material construction of the building is reduced, by matching the room temperature with the external temperature.
- Reduce the burden on the HVAC system, and other procedures that a building occupant often uses to keep the room temperature stable. These reductions can best be attributed to energy savings, drinking water consumption and other utilization of resources. This usually moves the building to a green place.

TYPES OF WATERPROOFING METHODS

There are some common types of waterproofing methods used in construction industry. Waterproofing in buildings/structures is generally required for:

- Basement of structure
- Walls
- Bathrooms and kitchen
- Balconies, decks
- Terrace or roofs
- Green roofs
- Water tanks
- Swimming pools

The following waterproofing methods are commonly used in construction:

1. Cementitious Waterproofing
2. Liquid Waterproofing Membrane
3. Bituminous Membrane
4. Bituminous Coating
5. Polyurethane Liquid Membrane

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1. CEMENTITIOUS WATERPROOFING METHOD:

Cementitious waterproofing is an easy way to prevent water from forming. Cement waterproofing materials are readily available in the market. This method is often used in wet indoor areas such as toilets. This method is usually a solid or flexible type that prevents water, but as it is used in indoor areas such as toilets, it is not exposed to sunlight and weather. Therefore waterproofing with cement does not exceed the contract and the expansion process.

APPLICATIONS OF CEMENTITIOUS WATERPROOFING:

Cementitious waterproofing is used in the following type of structures:

1. Water Treatment Plants
2. Sewage Treatment Plants
3. Bridges
4. Dams
5. Railway & Subway Systems
6. Marine Cargo Ports & Docks
7. River Locks/Channels & Concrete Dykes
8. Parking Structures & Lots
9. Tunnels

2. LIQUID WATERPROOFING MEMBRANE METHOD:

Liquid membrane is a thin layer that usually includes the first coat and two coats of top coat used with a spray, roller, or trowel. It offers more flexibility than cementitious types of waterproofing. The liquid heals into a rubber wall. The elongation properties of coating can reach as high as 275%. The durability of a waterproof coat depends on the type of polymer the manufacturer uses to make the liquid waterproofing.

A waterproof membrane can be a liquid-coated liquid coated with polymer-modified asphalt. Polyurethane liquid membranes for different levels of trowel, roller, or spray are also available from various manufacturers.

3. BITUMINOUS COATING WATERPROOFING METHOD:

Bituminous coating is a type of coating used for waterproofing and flexible protective coat according to its composition and polymerization stage. Its flexibility and water protection can be influenced by the polymer level and fiber reinforcement. Bituminous coating is also called asphalt coating. The most common applications for bituminous coatings include areas under wet screed. It is an excellent protective agent and waterproofing agent, especially in areas such as concrete foundations. Bituminous coating is made of bitumen-based materials and is not suitable for exposure to the sun. They become very brittle and weak when exposed to prolonged exposure to the sun unless they are prepared with flexible materials such as polyurethane or acrylic-based polymers. The flexibility of the finished products always depends on the solid polymer content added to the bitumen.

4. BITUMINOUS MEMBRANE WATERPROOFING METHOD:

Waterproofing of bituminous membranes is a popular method used for low-grade roofing due to their guaranteed performance. Bituminous membrane waterproofing has a flashlight on the lining and adhesive membranes. Adhesive composites include asphalt, polymers and fillers; in addition, certain resins and oils may be added to improve adhesion properties. The self-adhesive type has a lower shelf life as membrane binding structures shrink over time. The torch on the membrane is exposed and covered with types. Exposed membranes usually contain granular mineral aggregate to withstand the aging and degradation of the weather and other types of membrane, the contractor needs to install a single protective screed to prevent membrane perforations.

5. POLYURETHANE LIQUID MEMBRANE WATERPROOFING METHOD:

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The polyurethane liquid membrane waterproofing method is used for the flat roof area and is weatherproof. This method of waterproofing is expensive. The Polyurethane Liquid Membrane can provide high flexibility. Polyurethane is very sensitive to existing moisture, so before installing, one should be very careful checking the moisture content of the concrete slab, otherwise peeling or cracking of the membrane may occur after some time.

CONCLUSION

Water damage can be a major problem in a building. With water come moulds and a host of other problems that can damage the foundations, make building structures unsafe, and damage property inside the building. Wooden structures can decompose quickly due to water exposure, but water infiltration can also damage concrete and other building materials, especially in cold areas where water can freeze and create cracks. Insufficient waterproofing can be a problem year round, not just during the rainy season. Some permeability in a building is desired, not least because building occupants generate humidity which must be safely vented. The goal of building waterproofing is to prevent as much water as possible from entering the building, and to provide outlets and drainage so that if water does get inside, it is not allowed to sit.

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A Review Paper on Tensile Strength and Bending Property of Hybrid Fiber Reinforced Ferro cement

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Abstract – *Tensile strength and bending test were conducting on hybrid fibre reinforced ferrocement. In this paper we have taken different properties of different reinforced material in hybrid composites. Many experiments were conducting on these different hybrid composites. Based on the review of these different research papers tensile strength and bending results have shown different values . The addition of hybrid fibre to ferrocement is extremely desirable to improve tensile strength capacity and ductility, and confers strain hardening properties. Maintaining material costs at a suitable levelfor developing countries where material expenses are key factor in construction costs. This is the main reason for not increasing the packing density using additional fine materials. The effect of enhancing packing density and simultaneously increasing toughness would be great interest , particularly for the application of safety structural elements that require ultra high performance.*

Keywords *- Hybrid fibres, Reinforced Ferrocement, Hybridization ,Bending Properties, Tensile strength.*

INTRODUCTION

Reinforced concrete is the most often used construction material on Earth, but the fundamental difference between them is the use of wire meshes and a concrete binder that contains larger aggregate sizes. Constructed from hydraulic cement mortar and wire mesh that is close together, ferrocement has a very thin wall and is often used in construction. Metal or other suitable materials can be used to create the mesh. Because of its versatility, ferrocement has become a popular choice for complex architectural structures such as domes, curved building parts, water tanks, and even boats. Ferrocement can be used to build and repair structures. An entirely new type of material is created, one that is distinct from typical reinforced concrete in terms of its properties (strength, deformation, and potential applications). Thin panels or sections can be made with only a thin mortar layer covering the uppermost layers of reinforcement. Compared to ferrocement materials, conventional reinforced concrete materials are more commonly used as load-bearing elements because of a lack of extensive inquiry into the ferrocement materials and their usage as structural elements. The durability and corrosion issues of ferrocement are critical to its success. For the purposes of this definition, a hybrid fibre is one made up of both micro and macro synthetic fibres.It can be divided into the following combinations:. It is based on the fibre constitutive response, in which one of the fibres is stronger and stiffer, providing a stiffer and reasonable first-crack strength and also ultimate strength. As a result, the second type of fibre, which is more pliable, improves the post-cracking toughness and strain capacity. Combinations based on different aspect ratios are also possible. In the case of fiber-reinforced concrete, short fibre bridges tiny fractures restrict their expansion and also postpone the coalescence. Fracture toughness is improved in

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composites with long fibres because macro fractures are prevented from propagating.Hybridization is the blending of various fibre kinds. By mixing the fibres, the qualities of the concrete mix can be improved on a number of levels. This composite material outperforms plain and mono fibre in terms of behavioural efficacy. The addition of discontinuous fibres has been recommended by previous studies to boost tensile strength. By using hybrid fibres, the researchers hope to boost ferrocement's overall structural performance. The requirements of a hybrid fibre ferrocement can only be determined by conducting a thorough material investigation. As a first step, to classify the composite's behaviour, a test series employing a method designed for classifying high performance materials is required. There must be strain hardening qualities in the stress-strain connection before this can occur. An analysis of the strain capacity of a material can also be made using the tensile strength test, which evaluates the material's tensile strength as well as its composition. Hybrid fibre reinforced ferrocement.

Material description- According to Naaman (2000), the definition of ferrocement has been expanded to include the stipulation that "the fineness of the mortar matrix and its composition should be suitable with the mesh and armature system it is supposed to encase." There is a possibility that the matrix will have discontinuous fibres. This definition was intended to emphasise the compatibility of the matrix with the reinforcement that is used to build a composite, as well as to present the opportunity to use discontinuous fibres or micro fibres to improve the mechanical performance of ferrocement as hybrid composites, should this become necessary. The form of hybrid reinforcement known as fibrous ferrocement has wire mesh as the primary reinforcement and mono fibre as the secondary reinforcement.

Since the publication of Naaman's study in 2000, there have been ongoing efforts to develop ferrocement as a high performance material or, as Naaman prefers to refer to it, a strain hardening material (Naaman 2007). Due to the interaction of fibres with wire mesh, ferrocement composites benefit from an increase in their structural qualities when fibre is used (Shannag and Bin Ziyyad 2007). Both mono (meaning only one kind) and hybrid (meaning both types) variants of the fibres can be utilised. Mechanical behaviour

By enhancing the mortar mixtures with the use of additives and fly ash as a partial replacement for cement, structural standards for ferrocement have been improved. This has led to an increase in the use of ferrocement (Arif et al. 2001). Altering the type of reinforcement used and the proportion of it used has also contributed to the improvement of ferrocement's characteristics.

IMPROVEMENTS IN FE CLASSIFICATION OF HIGH PERFORMANCE CEMENTATIONS COMPOSITES

Today, several different types of cement-based composites are used in practical building applications, including the fabrication of structural parts. Because of this, it is essential to categorise the materials used in the construction of structures according to their performance. Because of material models and the material parameters that they relate to, structural engineering and materials engineering are now recognised as having a link between them. This reflects the behaviour of a material through its physical requirements, which direct its structural and mechanical behaviours.

These behaviours include: (Stang and Li 2004). Compression strength, tensile strain behaviour, flexural response, toughness, and energy absorption are the features of cement-based composites that are significant for the classification of a material's performance. Other properties include flexural response. Because of the risk of failure caused by crashes in the compression zone, compressive strength is an essential property in the design of concrete (known as brittle failure). However, because FRCCs exhibit behaviour that is either quasi-brittle or strain-hardening, compression strength is not a relevant design criterion for these materials.

Figure 2.13 illustrates the various categories of errors that can occur. When the cement paste has reached a point where it is solidified, brittle failure behaviour can develop. At the first crack, which is no longer able to resist any stress, linear stress–strain behaviour is followed by an abrupt reduction of stress (curve A). On the other hand, failure in fibre concrete and a few other fibre-reinforced cementitious materials can be described as quasi-brittle. This results in a linear stress–strain behaviour, which is then followed by a softening behaviour, as demonstrated by curve B. Strain-hardening materials, on the other hand, are defined by their capacity to withstand stress in a manner that is linearly inconsistent with their elastic behaviour. Almost immediately after achieving the first crack load, an increase in strain will take place due to the increasing levels of loading. This will result in substantial deformation (curve C).

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When compared to brittle or quasi-brittle materials, the maximum strain value of a strain hardening material is often higher (Li 1997). A transition from quasi-brittle to strain hardening failure is only possible under conditions of'steady-state' cracking, which arises under two conditions: (1) the stress at the crack must equal the first crack peak; and (2) the crack opening displacement must be less than the fibre slip caused by the bridging stress. Cement structural specifications have been made to ensure that a transition from quasi-brittle to strain hardening failure is possible. roCement structural specifications have been made to ensure that a transition

According to EI Debs and Naaman, the addition of polyvinyl alcohol mono discontinuous fibre to ferrocement with only one layer of steel mesh but with various wire spacing results in better overall performance in terms of cracking behaviour, yield, and maximum strength than conventional ferrocement does. In another set of experiments, it was found that increasing the number of steel mesh layers from two to four in conjunction with a volume percentage of steel fibres in ferrocement ranging from 1.5 to 2 percent led to an increase in the strength of the material.

APPLICATION

The advantages of flexibility in the fresh casting stage and high ductility in the hard stage have made ECCs attractive for structural applications (Li 2008), including either on their own or in the form of a composite (hybrid) to support other structural materials. This includes applications where the ECCs are used to support other structural materials (Naaman 2007). It has been demonstrated that the one-of-a-kind characteristics of ECCs as strain hardening cementitious composites (SHCCs) are capable of protecting structural elements constructed of RC from the damaging effects of an aggressive environment by narrowing the cracks that form in these elements (Maalej and Li 1995). Li et al. conducted research on the use of ECCs in concrete structures with the intention of repairing or retrofitting them (2000). According to the findings of the investigation, the use of ECCs is not limited to structures that are already in existence; rather, they are also suitable for protecting structures that have specific requirements, such as high impact resistance, crack width control, an aggressive environment, and a large damage tolerance.

Fischer (2010) had great success utilising stand-alone PVA–ECC panels in modular houses by employing them as floor slabs. The panel slabs that were put through their paces in the testing process had advantageous qualities such as relatively high flexural stiffness, ductility, maximum strength failure, and low cost.

The environmental benefits are in addition to the advantages brought about by the mechanical and economic aspects. This slab system is more appealing and sustainable thanks to the utilisation of waste materials as filler in the mixing matrix of the ECC floor slab. These waste materials may include FA or slag.

According to Li et al. 2004b, it is possible to create green ECCs for sustainable infrastructure in a variety of applications, such as pipelines, cement boards, electrical shafts, pavements, and as overlay systems in bridge decks (Zhanga and Li 2002).

MATERIAL DESCRIPTION

Because it offers the lowest coststrength ratio of all construction materials, concrete continues to be the most commonly utilised material. The issue with concrete is that it has a low tensile strength and behaves in a brittle manner. This causes failure and collapse fast after the first crack appears in the material. This issue, number 37, inspired researchers to study ways to improve the properties of concrete. Steel fiber-reinforced concrete, also known as SFRC, is a type of hybrid-reinforced cementitious material that was first developed in the early 1960s. The addition of steel fibre led to a considerable improvement in the tensile splitting strength, flexural strength, initial cracking strength, toughness, and impact resistance of the material. In addition to this, there was a decrease in fracture width, deflection, shrinkage, and creep (Tejchman and Kozicki 2010). ACI Committee 544 contains a set of guidelines that can be used for the design and specification of material properties (2002). As was mentioned before, the ASTM Standard (2011a) categorised FRC based on the type of fibre it was made of, including steel, glass, synthetic, and natural fibre.

THE BEHAVIOR AND QUALITIES OF MECHANICAL SYSTEMS

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Flexural testing was used to undertake experimental investigations of steel fiber-reinforced beams with changing fibre content (Altun, Haktanir, and Ari 2007). The fibre content ranged from 0 to 60 kg/m3 of the beam's volume. Compression, elastic modulus, and toughness were some of the qualities that were mentioned. The findings showed that the increase in the fibre content did not cause a substantial decrease in the compressive strength, and the results showed that a capacity of good flexural strength could be attained by utilising 30 kg/m3 (1.25 percent volume fraction)

Shear testing were carried out on SFRC beams utilising a variety of stirrup configurations and fibre contents. Lim and Oh (1999) conducted an experiment, the results of which suggested that further shear reinforcement is not necessary in SFRC. However, other experiments revealed that a fibre volume percentage of 1.5 percent was sufficient to obtain excellent shear strength capacities (Juárez et al. 2007).

In order to investigate the tension stiffening and cracking behaviour of SFRC specimens with conventional longitudinal reinforcement, standard uniaxial tension tests are often carried out on these samples. There was reported to be an increase in the post-load yielding capacity, in addition to the development of various fracture forming behaviours. This was in comparison to the standard RC (Deluce and Vecchio 2013). Take note that the percentage of fibres present in the mixing matrix has a major impact on the FRC's capacity for withstanding tensile stress (Sujivorakul 2012). During tensile testing, synthetic FRC showed a crack behaviour that was comparable to that of natural FRC (Wang, Li and Backer 1990).

DURABILITY OF THE MATERIAL AND ITS APPLICATIONS

The application of a material in building is based, from a structural point of view, on the mechanical performance of the material as well as its durability. According to Li and Stang (2004), cementitious materials have a strong correlation between their structural level durability and their ductility. Corrosion can occur on steel rebars if there is not enough concrete covering them or if the permeability of the cracks that form around them is enhanced. The addition of fibre to concrete increases its resistance to cracking and narrows the cracks that do appear. When compared to conventional RC, there is an observed decrease in the permeability of concrete as well as an increase in the overall impact on the environment (Banthia and Bhargava 2007; Bentur, Diamond, and Berke 1997).

A durability performance evaluation of FRC in a hostile environment employing fractured fiber-reinforced shotcrete revealed difficulties with the material's durability as a result of sulphate and salt solution attack (Kaufmann 2014). According to the results of the test, environmental conditions very comparable to those seen in tunnel construction are present. It was demonstrated that steel fibres in cracks corrode, which leads to a loss of the structure's potential for residual strength. On the other hand, 39 uncracked samples demonstrated a higher level of resistance behaviour during a specified time period. In addition to this, it was found that polymer fibre had a greater level of durability in these kinds of conditions.

There are a number of different application possibilities made possible by the production of FRC using shotcrete or pre-casting procedures. Pipeline trench applications, sewage channel applications, tunnel lining applications, railroad track beam uses for high-speed trains, and precast concrete fence panel applications are some of the places that FRCs are put to use (Banthia et al. 2012). These are the broad applications of fibre reinforced concrete; constructions that are subjected to blast or impact loading are good examples of more particular applications of matrix-modified FRC. Bindiganavile, Banthia, and Aarup (2002), for instance, investigated the influence of impact load response on ultra-high-strength compact steel fibre reinforced concrete. The matrix was experimentally investigated under drop-weight impact load, and it contained Portland cement, SF (24 percent by weight of cement), and 6 percent steel fibre volume fraction (quasi-static loading). The material demonstrated three times the strength and energy absorption of regular FRC thanks to its unique composition. This demonstrates that as a result of the material's great resistance to impact, it is appropriate for use in strategically significant structures such as those associated with high-security or the military.

CONCLUSIONS

The micro and structural levels were both accounted for in the numerical modelling. The following inferences can be made based on the findings of this section of the study:

- The results of the experiment were validated to some degree by the FEM model that simulated the RVE (micro structural model) in order to calculate the elastic modulus. The results of the FE simulation demonstrated

moderately increased values for the elastic modulus. When compared to the findings of the experiment, the differences between the obtained values and those obtained through experimentation were less than 4 percent. This was a strong indication that the elastic modulus that was empirically found is in good agreement with the FE model.

- The application of the numerical model to the HFF panel while it was being subjected to flexure produced outstanding results when compared with the experimental data utilising the elastic modules received from the nanoindentation test.
- The finite element modelling of the HFF–OWC slab demonstrated satisfactory composite action and no signs of breaking owing to horizontal shear transfer.

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Testing Compressive Strength of Concrete Using Various Curing Methods

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Abstract –*Compressive strength of concrete is often tested using a variety of curing processes. A water-to-cement ratio of 0.40 was used to make standard concrete. At 7 days, 14 days, 21 days, and 28 days, cube specimens were cast for testing the compressive strength of each using five curing methods, namely covering concrete surfaces with hessian or gunny bags, sprinkling of water; Ponding method, membrane curing; Steam curing; and Covering concrete surfaces with hessian or gunny bags, curing. Results show that water curing and sprinkling (spraying) curing are superior to membrane curing stream curing in terms of curing results. It was noticeable how quickly the specimens dried when they were cured using the membrane approach. Thus, the hydration process was hindered, which in turn reduced the hardened concrete's compressive strength. Cubes that have been completely uncured for two days have the lowest compressive strength and density, as well as the largest shrinkage limit, whereas cubes that have been completely cured have the maximum compressive strength and density.*

Keywords: *Curing method, compressive strength, concrete, membrane*

INTRODUCTION

There are many different treatments available. The specifics of the task to be done and the weather patterns must both be taken into consideration before settling on a strategy. The following strategies for ageing concrete are ordinarily employed. The process of curing.

- Wet-covering
- Covering concrete surfaces with hessian or gunny bags
- Sprinkling of water
- Ponding method
- Membrane curing
- Steam curing.
- Plastic sheet

Wet-covering

Hessian sac was utilised like a mulch to preserve water on the surface of the concrete cubes; also, it is necessary to guarantee that the full areas were covered. Wet covering material was put as soon as the concrete cubes were hardened sufficiently to prevent surface damage. Through the curing time the sac is kept moist with water.

2. COVERING CONCRETE SURFACES WITH HESSIAN OR GUNNY BAGS

This approach to curing is quite common, particularly for structural concrete, and it has a number of benefits. It is therefore necessary to cover the exposed surface of the concrete with hessian, canvas, or empty cement bags in order to prevent it from drying out. It is important to carefully fix the covering that is placed over sloped and vertical surfaces. These are

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soaked in water on a regular basis. The rate at which water evaporates will determine how long it takes between each subsequent wetting. During the curing stage, it is essential to take precautions to prevent the surface of the concrete from becoming dry for even a moment at any point. Special During the night and on holidays, special arrangements must be taken to keep the ground wet.

3. SPRINKLING OF WATER

Sprinkling of water continuously on the concrete surface provides an efficient curing. It is mostly used for curing floor slabs. The concrete should be allowed to set sufficiently before sprinkling is started. The spray can be obtained from a perforated plastic box. On small jobs sprinkling of water may be done by hand. Vertical and sloping surfaces can be kept continuously wet by sprinkling water on top surfaces and allowing it to run down between the forms and the concrete. For this method of curing the water requirement is higher. **4. PONDING METHOD**

This is the best method of curing. It is suitable for curing horizontal surfaces such as floors, roof slabs, road and air field pavements. The horizontal top surfaces of beams can also be ponded. After placing the concrete, its exposed surface is first covered with moist hessian or canvas. After 24 hours, these covers are removed and small ponds of clay or sand are built across and along the pavements. The area is thus divided into a number of rectangles. The water is filled between the ponds. The filling of water in these ponds is done twice or thrice a day, depending upon the atmospheric conditions. Though this method is very efficient, the water requirement is very heavy. Ponds easily break and water flows out. After curing it is difficult to clean the clay.

5. MEMBRANE CURING

The method of curing described above come under the category of moist curing. Another method of curing is to cover the wetted concrete surface by a layer of water proof material, which is kept in contact with the concrete surface of seven days. This method of curing is termed as membrane curing. A membrane will prevent the evaporation of water from the concrete. The membrane can be either in solid or liquid form. They are also known as sealing compounds. Bituminized water proof papers, wax emulsions, bitumen emulsions and plastic films are the common types of membrane used.

Whenever bitumen is applied over the surface for curing, it should be done only after 24 hours curing with gunny bags. The surface is allowed to dry out so that loose water is not visible and then the liquid asphalt sprayed throughout. The moisture in the concrete is thus preserved. It is quite enough for curing.

This method of curing does not need constant supervision. It is adopted with advantage at places where water is not available in sufficient quantity for wet curing. This method of curing is not efficient as compared with wet curing because rate of hydration is less. Moreover the strength of concrete cured by any membrane is less than the concrete which is moist cured. When membrane is damaged the curing is badly affected.

6. Steam Curing-In some cases, steam curing or hot water curing is used. These ways of curing concrete allow for a rapid increase in the concrete's strength. When working with pre-cast concrete, these techniques are best utilised The maximum temperature of steam used in steam curing should not exceed 750C, as the concrete may dry too quickly if humidity levels are too low. It is possible to raise the temperature of hot water curing up to 1000C. During the first four to five hours of this temperature, the growth of strength is around 70 percent of the 28-day strength. Both are true.

.**Literature review**

Thus, for complete and proper strength developments, the loss of water in concrete from evaporation should be prevented, and the water consumed in hydration should be replenished. This the concrete continues gaining strength with time provided sufficient moisture is available for the hydration of cement which can be assured only by creation of favorable conditions of temperature and humidity. This process of creation of an environment during a relatively short period immediately after the placing and compaction of the concrete, favorable to the setting and the hardening of concrete is termed curing (Gambier, 1986).

The necessity for curing arises from the fact that hydration of cement can take place only in water-filled capillaries. This is why loss water must be prevented. Furthermore A proper curing maintains a suitably warm and moist environment for the

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developments of hydration products, and thus reduces the porosity in the hydrated cements paste and increases the density of microstructure in concrete. The hydration products extend from the surfaces of cement grains, and the volume of pores decreases due to proper cases, the temperature should be fully controlled to avoid non-uniformity. The concrete should be prevented from rapid drying and cooling which would form cracks.

7. Plastic sheet

Plastic sheet materials, such as polyethylene film, were used to cure the concrete cubes. Polyethylene is a lightweight, effective moisture retarder and was used easily applied to simple cubes shapes. water lost internally by self-dedication has to be replaced by water from outside, i.e. Ingress of water into the concrete must take place. Curing of concrete is a pre requisite for the hydration of the cement content. For a given concrete, the amount and rate of hydration and furthermore the physical make-up of the hydration products are dependent on the time-moisture-temperature history (Neil Jackson et al, 1996

Concrete curing is one of the most important and final steps in concrete construction though it is also one of the most neglected and misunderstood procedures. It is the treatment of newly placed concrete during the period in which it is hardening so that it retain enough moisture to immunize shrinkage and resist cracking (Lambert Corporation, 1999). curing under appropriate temperature and moisture (Safiudeen et al,2007).

A proper curing greatly contributes to reduce the porosity and drying shrinkage of concrete, and thus to achieve higher strength and greater resistance to physical or chemical attacks in aggressive environments. Therefore, a suitable curing method such as water ponding (immersion), spraying or sprinkling of water, or covering with polythene sheet material is essential us order to produce strong and durable concrete.The study present the effect of **MATERIALS AND METHODS** Locally available crushed granite stones and fine aggregate (quartzite sand)were used as coarse and fine aggregate respectively. The fractions of different sizes of crushed granite stone and fine aggregates, as shown in Table 1 were in the ranges specified in Bs 812

Table 1: Gradation of crushed granite stone and quartzite sand Table 2: Properties of the constituent materials of concrete

SIEVE SIZE	**% FINER BY MASS**	
	Crushed Granite Stone (Fineness Modulus: 4:81)	**Sand (Fineness Modulus:4.23)**
28.00mm	100	
20.00mm	85.91	
14.00mm	19.86	
10.00mm	10.82	
6.30mm	1.28	
.00mm	0.29	99.48
3.35mm	–	99.21
2.00mm	–	98.47
1.18mm	–	93.60
850µm	–	86.97
600µm	–	75.40
425µm	–	56.62
300µm	–	43.66
150µm	–	13.53
75µm	–	10.03
Pan	–	0.00

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Table 2: Properties of the constituent materials of concrete

Materials	Properties
Crushed Granite Stone	Max. size:20mm,unitweight: 434.50kg/m^3 Specific gravity: 2.68, Absorption:0.77%, Moisture content: or 14%, void ratio: 0.46, Porosity: 9.27%
Fine Aggregate	Max. size:5mm, unit weight: 518.70kg/m^3, Specific gravity: 2.77, Absorption:2.29%, Moisture content:4.71%, void ratio: 0.45, Porosity: 0.07%
Ordinary Portland Cement	Specific Gravity: 3.15, unit weight: 1440kg/m^3
Borehole Water	Density: 1000kg/m^3, PH = 6.9

Mixture Proportions of Concrete

The normal concrete was prepared based on water cement ratio of 0.50 and a cement content of 340kg/m^{3}to obtain a compressive strength greater than 20N/mm^2 at 28 days (Immersion method of curing). Quartzite sand was used with a quantity of 33.33% of total aggregates by weight. The concrete mixture was proportioned to have a minimum slump of 48mm and also a minimum compacting factor or 0.94. The concrete mixture was assumed to be fully compacted and the proportions of the materials were determined on the basis of absolute volume of the constituents. The details of mixture proportions are given is table

Mixture Proportions of Concrete
Crushed granite stone – 1360 Kg/m^3
Fine aggregate – 680 Kg/m^3
Ordinary Portland Cement – 340 Kg/m^3
Portable Borehole Water- 170 Kg/m^3

Preparation of Test Specimens

A total of 48 cubes having dimensions 150mm x 150mm x 150mm each were cast. The specimens were molded in oiled timbers moulds using three layers of filling and each layer tamped 25 times to expel the entrapped air. The tops of the cubes were marked after a while for identification purpose. Immediately after this, the specimens were kept in a cool place in the laboratory. The specimens were removed from the wooden moulds at the age of 24+ – 2 hours.

Curing -The test specimens were cured under three types of curing until the day of testing. These were water curing(WAC), sprinkling of water (SWC) and wrapping with plastic sheeting (PSC).In water curing, the specimens were weighed and immersed in water. Portable borehole water was used

in water curing. In sprinkling method, the specimens were also weighed and kept moist by sprinkling water on the specimens 2 times daily (morning and evening) until the date of testing. In plastic sheeting, the specimens were weighed and wrapped in flexible plastic sheets until the testing date. At least 2 layers of wrapping were used to prevent moisture movement from concrete surface. The curing temperature was maintained at 27 + 2^{o}C in all the curing methods.

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COMPRESSIVE STRENGTH

The results of compressive strength have been presented in tables 4-9 and in the graphical representation of average compressive strength versus curing age for different methods of curing used in the experiment (see fig 3). In all curing methods, the compressive strength of the concrete increases with age. The highest compressive strength at all ages was produced by immersion (water) curing. The average compressive strength of water cured concrete was 13.56w/mm^2 and 20.34 N/mm^2 at 7 and 28 days respectively. Sprinkling method produced compressive strength close to immersion (Water) curing. Sprinkling method produced a compressive strength of 12.25w/mm^2 and 18.38N/mm^2 at 7 and 28 days respectively. The development of higher compressive strength in immersion (Water) curing and sprinkling method of curing is credited to sufficient moisture and suitable vapor pressure, which were maintained to continue the hydration of cement.Plastic sheeting (membrane) method of curing produced the lowest compressive strength at all ages. It caused a reduction in compressive strength of 1.89N/mm^{2}and 2.92N/mm^2 at 7 and 28 days, respectively, as compared to water curing. The early drying of concrete stopped the cement hydration before the pores were blocked by adequate calcium silicate hydrate

CONCLUSIONS

- Water curing was the most effective method of curing. It produced the highest level of compressive strength. This is due to improve pore structure and lower porosity resulting from greater degree of cement hydration reaction without any loss of moisture from the concrete specimens.
- Sprinkling method of curing produces higher compressive strength than plastic sheeting. This is attributed reduced the moisture movement from concrete specimens leading to enhanced degree of cement hydration.
- Plastic sheeting method of curing produces lowest level of compressive strength. This is because the moisture movement from the concrete specimen is higher in plastic sheeting method, which did not provide and any protection against early drying out of concrete. Hence hydration of cement reaction was abated.
- The extent of moisture movement was greatly dependent of the method of curing. Greater moisture movement occurs under plastic sheeting (membrane) method, and it significantly affected the strength property of the concrete.
- Normal concrete should be cured by water curing (immersion) method in order to achieve good hardened properties. Water curing produces no loss of moisture, and therefore enhances cement hydration reaction. In case of water shortage, sprinkling curing can be adopted instead of wrapped (plastic sheeting) curing.

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Research into the Effectiveness of Recycled Aggregate Mortar Was Carried Out Experimentally

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Abstract – *Due to the pressing problems associated with the over-exploitation of natural sand as well as the disposal of construction and demolition wastes, the use of recycled fine aggregates in the production of mortar is an effective measure that can be taken to increase the social and ecological values in today's society. Recycling fine aggregates can be done in a number of different ways. It was suggested that fluidity was the most important factor to consider while formulating the recycled aggregate mortar in order to mitigate the synergistic effects of the W/C ratio, the quality of the recycled fine aggregates, and their content. The findings of this inquiry show that fluidity has a significant impact on the mechanical and permeability properties of recycled aggregate mortar, as demonstrated by the experiments. A contrast is drawn between the results of this mortar and those of traditional mortar. The results of the experiments show that recycled aggregate mortar needs a greater quantity of water in order to achieve the same fluidity as controlled mortar. This is because recycled aggregate has inferior properties compared to controlled mortar, such as a higher initial water absorption and a greater volume of voids within the mortar. The fluidity, recycled fine aggregates quality, and its content all had an effect on the setting characteristics of recycled aggregate mortar. Additionally, the recycled mortar's setting times were significantly faster than those of controlled mortar. However, recycled aggregate mortar corresponding to the fluidity of 110 2.5 mm and 160 2.5 mm obtained weaker strength characteristics (compressive, tensile, and flexural), a lower pulse velocity value, a higher permeable void content, a higher water absorption by immersion, and a higher sorptivity than those attached to the fluidity of 135 2.5 mm. As a result, recycled aggregate mortar that has a moderate fluidity of 135 2.5 mm is practicable and has improved mechanical and permeation capabilities*

Keywords*- Recycled fine aggregates (RFA), Fluidity, Recycled Aggregate Mortar (RAM) and Mechanical Permeation*

INTRODUCTION

C&D waste is generated during the course of any construction or demolition project, including those involving highways, bridges, flyovers, subways, and other public works infrastructure projects. Debris from natural and man-made calamities, such as cyclones, floods, earthquakes, blasting, and war, are also common. Inert and non-biodegradable materials such as concrete, plastics, plaster, wood, metal, and so on dominate. India generates approximately 23.75 million tones of demolition garbage each year, according to the Hindu online edition of March 2007. Total demolition debris consists of approximately 40% concrete; 30% ceramics; 5% plastic; 10% wood; 5% metal and 10% miscellaneous mixes. Since modernity, demolished materials are thrown away and not used for anything. The fertility of the ground is severely harmed in these scenarios. C&D waste disposal has become a major issue as a result of rapid industrial growth, which has led to a critical shortage of natural aggregates (NA) for the production of new concrete, as well as a huge amount of demolished concrete created from deteriorating and outmoded structures. Concrete "trash" can be used as an alternative to natural aggregates in concrete production by using it as an aggregate. This "recycled" concrete can also be a reliable replacement for natural aggregates.The need to conserve natural resources (such as stone, river sand, soil, etc.) and energy,

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as well as the fact that C&D waste is transported over long distances only to be dumped, as well as the fact that it takes up valuable landfill space and degrades the processing of biodegradable and recyclable materials, call for increased attention to C&D waste.Construction and demolition waste generation and disposal have risen to the status of strategic issues in the industry, mostly as a result of the rapid urbanisation and industrialization taking place throughout the world. Disposing of these garbage causes serious environmental and ecological issues. Naturally, it is necessary to intervene and look for alternatives to trash disposal. Aggregate consumption is predicted to rise from 37,400 metric tonnes per year in 2010 to 51.7 billion metric tonnes in 2019 at an average annual rate of 37,400 metric tonnes. Natural aggregates (NA) are being used at such a rapid rate that it is putting enormous strain on the ecosystems around us. Because of this, the use of recycled aggregates (RA) in the construction industry is critical to reducing waste disposal and the use of natural resources, which have both social and environmental impacts. Concrete/mortar/other building components can be made using RCA and RFA recycled aggregates, two size fractions of recycled aggregates. This is an easy and sensible way to enhance sustainability in concrete/mortar/other building components.

Examine the scholarly articles.

Ping Hua Zhu has carried out a research on carbonation resistance of recycled aggregate concrete (RAC) subjected to different loading level was carried out. Three series of concrete mixtures were produced with loading level of 0.5, 0.8, and 1.2 of ultimately tensive strength of concrete. Carbonation resistance of recycled aggregate concrete reduces according with increasing water-binder ratio. There is an excellent linear relationship formed for recycled aggregate concrete between carbonation depth and square-root of carbonation.

Jodilson Amorim Carneiro has reported that the utilisation of recycled aggregate from construction and demolition waste (CDW) as replacement of fine and coarse natural aggregate has increased in recent years in order to reduce the high consumption of natural resources by the civil construction sector. In this work, an experimental investigation was carried out to study the influence of steel fiber reinforcement on the stress–strain behavior of concrete made with CDW aggregates.He concluded that the utilisation of recycled aggregate in substitution of natural aggregate increased the compressive, bending and tensile strength of the reference mixture. The inclusion of steel fiber and recycled aggregate increased all mechanical properties of the CDW-concrete and better controlled its fracture process. Further, a comparison between the analytical and experimental curves demonstrates that they are in good agreement indicating the possibility of their use to model the behavior of steel fiber-recycled aggregate concrete.

Xiaoliang Fang has investigated that in order to analyses the potential CO2 capture ability of recycled concrete aggregates (RCAs) subjected to accelerated carbonation, an empirical prediction model has been developed in relation to carbonation conditions and the characteristics of RCAs. In this research, two sources of RCAs were used: RCAs from a designed concrete mixture and RCAs obtained from crushing of old laboratory concrete cubes.He concluded that the maximum CO2 uptake of RCAs during accelerated carbonation depended mainly on the cement content as well as the initial CO2 uptake ratio (X^0_{CO2}). The particle size of RCAs played a significant role in affecting the cement content and the rate of CO2 uptake. The relative humidity (RH) during accelerated carbonation process was significant. Further, the developed empirical model may well predict the CO2 uptake of the RCAs from newly demolished concrete waste.
Sun-Woo Kim has described pullout test results on deformed reinforcing bars in natural and recycled fine aggregate (RFA) concrete. The effects of bar location and RFA grade on bond strength between reinforcing bar and recycled aggregate concrete (RAC) were analysed through the experimental program.He concluded that for higher grades of RFA, bond strength did not seem to be influenced by RFAr, at least for up to 60% RFAr. It can be noted that the location factor is influenced by the workability of concrete. Based on the cross-sections of all specimens after pullout tests, no significant differences were obtained in the amount of concrete segregation and settlement.Further, based on the RDM, no important freeze–thaw deterioration in concrete was detected after 300 freeze–thaw cycles in RAC specimens due to their relatively high air contents.

George Wardeh has presented the results of an experimental program carried out on 96 concrete pullout specimens prepared with natural and recycled aggregates using 10 and 12 mm diameter deformed steel bars. The study included six recycled concrete aggregate mixtures and two conventional concrete mixtures with C25/30 and C35/45 target class of compressive strength and S4 class of workability.He concluded that the bond strength of recycled aggregate concrete remains of the same order magnitude as that found for the reference normal concrete. In all cases, the evaluated values are

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equal to the values calculated by the formula of EC2 without safety factors and are therefore at least four times higher than the predicted values. Further, based on experimental results and data withdrawn from the literature, a modified expression was proposed to find the maximum bond stress of the recycled concretes taking into account the effect of concrete cover, the embedded length, and the replacement ratio.

Fuxing Wang has reported that recycled aggregates from construction and demolition waste after crushing, washing and grading which replace partly or all of the natural aggregates are reutilizable to form new concrete. Compared with natural aggregate concrete, mechanical performance and durability of recycled concrete are worse. The reason may be that the recycled aggregate (RFA) is formed of original aggregate and old cement adhering outer partly. In this paper, the superficial modification of recycled fine aggregate using fly ash grout,the physical attributes of RFA before and after modification and the effect on the mechanical performance of cement mortar were studied.

Wenlao Zhao has studied the use of recycled fine concrete and clay brick aggregates to respectively globally replace natural fine aggregates (sand) in the production of mixed mortar. The fundamental attributes such as the compressive strength and the shrinkage ratio of mixed mortar made of the recycled fine aggregates are tested and discussed in detail. The experimental results show that it is viable to produce mixed with recycled fine aggregate.
Joris Schoon has investigated with the aim to examine the use of fines generated out of recycled aggregates production as an alternative raw material for Portland clinker kilns with enumeration of possible limitations. Different technical set-ups were utilised to separate these fines from the recycled aggregates. In this research, it was shown that the fines fractions generated out of concrete recycling could be used as an alternative raw material (ARM) for Portland clinker production. However, a homogenisation phase adapted to the chemical variation of the recycled fines will be important. It was shown that the smaller the fines fractions are cut from the sand fraction, the better they are suited as ARM for Portland clinker production. The way these fines fractions are separated also affects the final quality of the treated sand fraction and therefore also its practical use in concrete as well as asphalt applications.Further, the use of fines extracted from recycled concrete focuses on some of the key issues identified within the Cement Sustainability Initiative, together with the already available alternative fuels and raw materials.

J.Alexandre Bogas has carried out the investigation to characterize the freezeethaw resistance of normal strength and high-strength concrete with partial or total replacement of fine natural aggregate (FNA) by fine recycled concrete aggregate (FRCA). The surface scaling, mass loss, length change, residual ultrasound pulse velocity and residual compressive strength were analysed for different FRCA replacement ratios (0%, 20%, 50% and 100%) subjected to 300 freezeethaw cycles according to ASTM C666 e Proc.He concluded that normal strength concrete was not freezeethaw resistant, regardless of the replacement rate of FNA with FRCA; the freezeethaw resistance was more influenced by the w/c ratio than by the type of aggregate used. Surface scaling appears to be more severe in concrete with FRCA, because its mortar is less resistant.In general, the internal freezeethaw resistance of concrete did not decrease with the inclusion of FRCA; the higher porosity of FRCA may better contribute to hydraulic pressure dissipation. In sum, FRCA appeared to be non-detrimental to the freezeethaw internal cracking resistance of concrete.Further, FRCA proved to be non-detrimental to the freezeethaw internal cracking resistance of concrete.

Rawaz Kurad has presented the fresh properties of concrete with supplementary cementitious materials (SCM) and recycled concrete aggregates (RCA), with emphasis on the feasibility of using high volumes of fly ash (FA) in RCA concrete. For this purpose, two mix families (0% coarse RCA and 100% coarse RCA) were prepared, both with and without superplasticizers (SP). The coarse natural aggregates (NA) were substituted with coarse RCA at 0% and 100%, respectively.He concluded that to get the same target slump, with increasing incorporation levels of RCA, both the effective and apparent w/c ratios should be increased.Further,FA decreases the water content necessary to obtain the target slump in RCA concrete and therefore it is preferable to incorporate a high content of FA to obtain the target slump and avoid in-creasing the w/b ratio (water content) significantly.

Siti Shahidah Sharipudin has made the attempt that has been placed on replacing the main ingredients in concrete mixtures with more sustainable materials with the objective to reduce the carbon footprint. One of the replacement materials is waste paper sludge ash (WPSA), a local industrial by-product produced abundantly by newsprint mills which possesses considerable cementitious properties. Parallel to this, the high amount of construction waste, especially concrete waste has

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become a difficult environmental issue to cope with in today's world. In conclusion, the replacing proportion of cement and fine aggregate with WPSA and FRCA up to 20% and 15% respectively contribute towards compressive strength by blending of WPSA and FRCA, exhibited favorable and equivalent compressive strength than those of control specimens. In this case, the alkalis released from the residual paste in FRCA together with cementitious reaction presence in the latter could be attributed to strength development.

Hawreen Ahmed has presented the effects of using supplementary cementing materials and recycled concrete aggregates (RCA) in concrete, with emphasis on the ability of using high volumes of fly ash (FA) and RCA to reduce the environmental impacts of the concrete's production process without jeopardizing most of its long-term durability characteristics. Three mix families (0% fine RCA, 50% fine RCA and100% fine RCA) were prepared and, for each of these three families, two incorporation levels (0% and 100%) of coarse RCA were used with 0%, 30% and 60% of FA without SP. In this research the w/b ratio of the concrete mixes was changed in order to maintain the workability of an equivalent conventional concrete. The worst-case scenario is obtained when fine NA were half or fully replaced with fine RCA, either with or without inclusion of coarse RCA.The best-case scenario was obtained when the coarse NA were fully replaced with coarse RCA and 60% of FA included in concrete mixes with SP.The inclusion of coarse RCA only shows better performance than that of fine RCA.Including FA in RCA concrete is advisable. However, for the combined effect of FA and RCA, the compressive strength-GWP ratio depends on optimizing the proportion of FA *versus* RCA rather than on their individual contents.

Junxia Li has carried out the research to investigate potential use of RCF as microsilica sand substitute in the production of engineered cementitious composites (ECC), a unique high performance fiber-reinforced cementitious composites featuring extreme tensile strain capacity of several percent. The results indicated that it is viable to use RCF as microsilica sand substitute in the production of ECC and the resulting RCF-ECCs possess decent compressive strength and strain capacity. The results clearly analysed the influence of RCF size and content on ECC properties. Micromechanics-based design principle can be utilised for ingredients selection and component tailoring of RCF-ECCs.

D.Pedro has carried out the analysis of the mechanical behaviour of high-performance concrete (HPC) incorporating fine and coarse recycled aggregates (FRA and CRA) was made. The recycled aggregates (RA) originated from rejected precast elements with compressive strengths of 75 MPa and were used to substitute natural aggregates (NA) in concrete mixes.To conclude,in the fresh state, it was possible for recycled HPC to have similar workability as that of the reference HPC (produced with natural aggregates only). In the hardened state, despite the decrease in performance of the RAC relative to the RC, extremely satisfactory values were obtained, which were further increased with the presence of SF. For the modulus of elasticity, it was found that the highest value recorded by a mix incorporating 100% RA was around 41GPa (C100F100C-SF10). Finally, for bond strength, only a few concrete mixes were analysed.

Abdurrahmann Lotfy has presented the fresh, mechanical, and durability performance of a structural concrete mix classified as a C1 mix, by the Canadian Standards Association (CSA) made with Controlled quality Recycled Concrete Aggregate (RCA). Seven mixes with water-to-binder (w/b) ratio of 0.40 and RCA content of 10%, 20%, and 30% by coarse aggregate volume replacement, 10%,

and 20% fine and coarse (granular) aggregate replacement by volume were produced and tested against two 0% RCA control mixes made with General Use (GU) cement, and General use Limestone cement (GUL), respectively.To conclude, using a controlled quality RCA as a replacement for virgin aggregates produced a concrete that met specifications and performed similarly to the control. All mixes showed similar slump and air content values after 15 minutes,and the control mix had the best retention after 45 minutes. However, the slump and air content for the RAC mixes did not vary greatly from the control, indicating that a 30% replacement of virgin aggregates with RCAs is a viable option. The splitting tensile strength results indicated a similar trend to the flexural strength results. The splitting tensile strength reduced as the replacement level of RCA increased.According to the control concrete, replacement of RCA by natural aggregate slightly increased water sorptivity, and chloride-ion permeability values. Moreover, the RCA mixes with more RCA resulted in higher water sorptivity and chloride-ion permeability values. In summary, the utilisation of a controlled quality RCA in structural concrete is a safe and viable option.

Ha-Seog Kim has conducted the research with the aim to chemically remove the cement paste attached to the aggregate surface using acidic substances. Sulfuric and hydrochloric acids were utilised as the acidic substances, and after analyzing the quality characteristics of the aggregates following the acid treatment, a mortar test was performed using the aggregates. The results indicated that the acid treated recycled aggregates were superior to the original aggregates and the recycled aggregates that were manufactured using natural water in terms of density, absorption ratio and solid volume percentage.

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II. MATERIALS CHARACTERIZATION

A. CEMENT

Ordinary Portland cement 43 (OPC 43) was used in this study. The chemical ingredient are exist in this type of cement which are given in the table below

S.N	ingredient	Percentage (%)
1.	Calcium oxide (CaO)	66.00
2.	Silica (SiO_2)	23.13
3.	Iron oxide (Fe_2O_3)	3.51
4.	Aluminum oxide (Al_2O_3)	4.41
5.	Sulfur trioxide (SO_3)	0.89
6.	Magnesium oxide (MgO)	0.78
7.	Others	1.27

B.AGGREGATE

Recycled fine aggregate are used in this study which are obtained from concrete waste, collected from the demolished buildings in area of Delhi.

CONCLUSIONS

The relative fluidity adjustment material (RFAM) has a higher water content requirement than controlled mortar does in order to achieve the same level of fluidity. Because of this, the fluidity and RFA content of recycled aggregate mortar both have an effect on the amount of time it takes for the recycled aggregate mortar to set. The penetration resistance of RFAM increases with the passage of time in accordance with both fluidity and RFA content. The timeframes required for RFAM to settle were far less than those required for controlled mortar. In comparison to controlled mortar, RFAM have lower strengths values, lower UPV values, lower chemically bound water contents, but higher permeable void contents. Additionally, RFAM have higher water absorption by immersion and higher sorptivity than controlled mortar. This is true regardless of the fluidity of the two materials. Under the impact of different fluidities, however, considerable differences were seen in the mechanical and permeation performances of RFAM. [Citation needed] When compared to the fluidity of RFAM, which is 110 2.5 mm, the inferiority of the mechanical and permeation properties of RFAM increases with the amount of RFA present. In relation to the RFA concentration, the mechanical and permeation properties experience a significant amount of development when the fluidity of the RFAM is increased from 110 2.5 mm to 135 2.5 mm. There was a significant decrease in the mechanical and permeation properties of RFAM as the fluidity of RFAM was increased even further, from 135 2.5 mm to 160 2.5 mm. Therefore, fluidity may be considered a factor in order to get improved performances of RFAM, which would be a substantial remedy for the large degree of RFA quality variation.

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In Order To Investigate India's Road Patterns, As Well As Concerns Regarding Road Safety And Maintenance

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Abstract – *The unpredictable congestion of roads, the lengthening of travel times, and the occurrence of road accidents are the three most significant issues facing the Indian road system today. Because of this, the roads in India require an intelligent transportation system that will make travel more convenient, save time, reduce the number of accidents, and provide many other benefits. The work that goes into the construction of roads in India is thoroughly recorded thanks to India's vast collection of technical standards, manuals, and specifications. As a consequence of this, the quality requirements for road works are extremely thorough, which ultimately results in outputs that are of a high quality and reflect the functional objectives of such rules. Regionally distinct maintenance procedures can be found across the United States. The surroundings and the patterns of traffic also display a high level of variability depending on the area. In conclusion, it is widely acknowledged that the organizational structure of the road sector, in addition to its technical and managerial resources, varies from one state to the next. Because of this, it is essential to accept that there is no one-size-fits-all strategy that can be used in order to get the best possible arrangements. Nevertheless, there are essential concerns that are universal and that call for appropriate attention in order to ensure that the maintenance of the rural road network is carried out in a sufficient and timely manner. There are a great number of factors that contribute to accidents like this, including intoxicated driving; driving at excessive speeds, driving carelessly, breaking flow traffic rules, and so on. In this theory, we are going to investigate the traffic condition of Indian roads, as well as the methods behind road maintenance, and some potential solutions.*

Keywords *–Iintelligent transportation system, patterns of traffic, breaking flow traffic rules.*

INTRODUCTION

After construction, all varieties of roads will require ongoing care throughout time. Highway maintenance is a crucial activity that contributes to the provision of better facilities, a longer lifespan, and a more aesthetically pleasing appearance of highways. There is always going to be a strong relationship between the method of road building, the design of the route, and the expense of maintaining a highway. The situation in India is becoming worse, and the number of people injured in road accidents has been on the rise over the past twenty years. This may be caused, at least in part, by a growth in the number of vehicles on the road, but it is most likely caused by the lack of a coordinated policy that is based on evidence to control the issue. According to these statistics, the number of fatalities has been steadily climbing over the past decade at a rate of approximately seven percent per year, with the exception of the last few of years. preserving and maintaining the road structure, along with the roadside amenities and any other serviceable conditions associated to the road, in the form and specification they had when the road was first created.

Road patterns -The development of a city's settlements depends on the road patterns and road patterns are very important to the development of a city. However, recent development in cities has not given importance to the study of the road pattern, which has resulted in the creation of numerous roads that are not connected to one another. This has led to the

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construction of housing schemes and commercial developments that are built far away from the core of the town, where the roads are located. Because of the growing distance between residences and the city's primary commercial district, inhabitants are becoming more reliant on their automobiles to complete the frequent travel duties that are part of their daily routine. the time it takes for emergency response vehicles to get up to a specific speed.

Types of road patterns

- Rectangular patterns
- Radial patterns
- Radial and block patterns
- Radial and circular patterns
- Radial and grid patterns
- Hexagonal pattern
- Linear pattern

Rectangular patterns- the rectangular patterns is a plan where the streets and road are in the form of grid or block running particularly into each other thus forming a grid or block. The north nazimabad area of Karachi in Pakistan is a factual example of this type of pattern where the street and road run at an angle of ninety degree into each other. Usually in this type of pattern the streets and roads are far away from each other and it takes a long time to reach the centre of the area or city.

Radial patterns- in this type of patterns the network of roads is in the form of circle emanating from the centre of the area. the paradigm of radial pattern can be found at the federal B area of karahi. This pattern may be further classified into two types depending on its layout.

Radial and block patterns- this type of patterns of network is a combination of radial and block pattern .a radial network of road radiate from the centre outwardly with bock pattern network of roads in between the radial main streets.

Radial and circular patterns- in this type of road patterns the main roads radiate from the central point are connected togrther by concentric roads that are also that radiating outwardly.

Radial and grid patterns- it is a combination of radial and grid pattern. A radial network of roads radiate from the centre outwardly. The main radial streets are then interconnected by providing grid pattern in between the main street.

Hexagonal pattern- this pattern is network of roads that grow in such a manner in various directions forming hexagons.

Linear pattern- in this type of pattern the road grow linearly in one direction possibly due to the presence of some natural force such as sea or ocean at one side of the city.

Common causes of failures in road pavement-the general causes of pavement failure in road pavement may be due to the the following reasons.

- Poor quality material
- Improper design of road structure
- Defects in construction method
- Improper quality control
- Inefficient drainage system
- Increase in the magnitude of traffic load
- Settlement of foundation or failure of sub grade
- Climatic condition
  Common type of road failure of flexible pavement-the common type of road failure occurring in flexible pavement are.
- Formation of pot holes

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- Formation of cracks
- Formation of ruts
- Corrugation or wavy surface
- Localized depressions causing surface up heaval

Common type of road failure of rigid pavement-the common type of road failure occurring in rigid pavement are.

WHY IS MAINTENANCE IMPORTANT?

Roads are among the most important public assets in many countries. Road improvements bring immediate and sometimes dramatic benefits to road users through improved access to hospitals, schools, and markets; improved comfort, speed, and safety; and lower vehicle operating costs. For these benefits to be sustained, road improvements must be followed by a well-planned program of maintenance. Without regular maintenance, roads can rapidly fall into disrepair, preventing realization of the longer term impacts of road improvements on development, such as increased agricultural production and growth in school enrollment. Postponing road maintenance results in high direct and indirect costs. If road defects are repaired promptly, the cost is usually modest. If defects are neglected, an entire road section may fail completely, requiring full reconstruction at three times or more the cost, on average, of maintenance costs.
Countries need a core road network that carries about 80 percent of national traffic, including key roads in urban areas and roads providing sufficient access to rural areas. Some part of the overall road budget thus has to be spent on construction and some part on maintaining the core network. But many countries have tended to favor new construction, rehabilitation, or reconstruction of roads over maintenance. This has led to a steady increase in the backlog of road repairs and a loss of development impact

RESEARCH OBJECTIVES AND METHODOLOGY

The Indian Roads Congress defines road maintenance as “routine work performed to upkeep pavement, shoulders and other facilities provided for road users, as nearly as possible in their constructed conditions under normal conditions of traffic and forces of nature”. Maintenance is “essential to get optimum service from the pavement structure during its life period.”

Maintenance ensures that the road remains serviceable throughout its design life. Maintenance is important because it:

- reduces the rate of deterioration, thereby safeguarding previous investments in construction and rehabilitation,
- lowers the cost of operating vehicles on the road by providing a smooth running surface,
- improves the reliability of the road allowing it to remain open for traffic on a continuous basis and thus contributes to more reliable transport services, and
- sustains social and economic benefits of improved road access.

TYPES OF MAINTENANCE

Road Maintenance operations are usually grouped according to planning, organisational and funding arrangements. They can normally be categorized aseither Routine, Periodic or Emergence maintenance operations.

- Routine maintenance
- Periodic maintenance
- Special maintenance

Routine Maintenance required continually on every road whatever its engineering characteristics or traffic volume. Routine maintenance activities are usually.

- Diver character

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- Experience of diver
- Diver vision
- Physical fitness
- Pubic standard
- Traffic Rule and regulation
- Data Collection
- Traffic Accidents

- A total of 4,96,762 'Traffic Accidents' were reported during the year which include 4,64,674(93.5%) 'Road Accidents', 2,669(0.5%) 'Railways Crossing Accidents' and 29,419 (5.9%) 'Railway Accidents'. The traffic accidents caused injuries to 4,86,567 persons and 1,77,423 deaths during 2015.
- The percentage share of deaths in traffic accidents due to 'Road Accidents', 'Railways Accidents' and 'Railway Crossing Accidents' was reported as 83.8% (1,48,707 deaths), 14.7% (26,066 deaths) and 1.5% (2,650 deaths) respectively during 2015.
- It observed that the rate of deaths per thousand vehicles has decreased from 1.0 in 2011 to 0.8 in 2015.
- Maximum number of traffic accidents occurred in the month of May (45,215) and as per time period wise analysis, maximum number of traffic accidents (80,113) were reported during 1500 hrs to 1800 hrs(day) of day.

Road Accidents

- 53 cases of road accidents took place every one hour during 2015, wherein 17 persons were killed.During 2015, a total of 4,64,674 cases of 'Road Accidents' were reported which rendered 4,82,389 Persons injured and 1,48,707 deaths.
- Deaths due to 'Road Accidents' in the country have increased by 5.1% during 2015 (1,48,707) over 2014 (1,41,526).
- Tamil Nadu (69,059 cases), followed by Karnataka (44,011 cases), Maharashtra (42,250 cases), Madhya Pradesh (40,859 cases) and Kerala (39,014 cases) have reported the maximum number of road accidents accounting for 14.9%, 9.5%, 9.1%, 8.8% and 8.4% of such accidents in the country respectively.
- Maximum fatalities in road accidents were reported in Uttar Pradesh at 12.4% (18,407 out of 1,48,707) followed by Tamil Nadu (10.5%) and Maharashtra (9.2%) during 2015.
- 29.3% victims of road accidents were riders of 'Two Wheelers'. 'Trucks/Lorries', 'Cars' and 'Buses' have accounted for 19.4%, 12.4% and 8.3% of road accidental deaths respectively.
- The National Highways accounted for 28.2% of total road accidents, followed by State Highways (25.0%).
- Most of road accidents were due to over speeding accounting for 43.7% of total accidents which caused 60,969 deaths and 2,12,815 persons injured. Dangerous/careless driving or overtaking caused 1,46,059 road accidents which resulted in 48,093 deaths and 1,51,231 persons injured during 2015. Besides, 3.7% of road accidents were due to poor weather condition.
- A total of 262 accidental deaths were reported at un-manned railways crossing during 2015.
- A total of 2,54,878 cases and 2,09,796 cases of road accidents were reported in rural areas and urban areas, accounting for 54.9% and 45.1% of total road accidents in the country respectively during 2015. Most of the road accidents were reported at a place near to residential area (24.7% in rural areas and 24.5% in urban areas).

Driver survey-Driving in most cities in India is no less than negotiating a war zone. While the lack of proper infrastructure is one of the major causes for the chaos on our roads, our driving habits aren't exactly refined either. The problem though is that most Indian drivers consider themselves to be safe and that is where the gross overestimation of driving skills and underestimation of safety hazards springs from. In a recent survey commissioned by Ford in India that took inputs from over 1,000 drivers -- both male and female – in New Delhi, Mumbai, Bangalore, Chennai, Chandigarh and Ahmedabad, 94% of the demographic asserted themselves as safe drivers but more than 70% of them also admitted to having some kind of unsafe driving habits. About 67% said they exceed the speed limit and talk on their mobile phones, while over 50% admitted to texting or accessing their emails or mobile apps. This brings to light the need for better education of safe driving practices in the country which needs to be brought about on a grassroots level. Indians are also open to adopting technology to make driving habits safer though as over 80% of those surveyed showed interest in voice-activated systems, parking sensors, collision prevention systems, seat belt reminders and automated driving vehicles in the future. While

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educating drivers on safer driving habits is of the utmost importance, one cannot neglect the fact that having advanced technology in your car can help prevent accidents to a great extent as well.

In the fast lane

Admit to dangerous driving behavior **70+%**
Exceed speed limit **67%**
Talk on hand-held phone while driving **67%**
Text while driving **55%**
Access email/mobile apps on hand-held phone while driving **52%**
Apply makeup while driving (female) **31%**

The following is an outline of some of the different policy alternatives.

Security measures for pedestrians and cyclists

- Reserving sufficient space for modes of transportation that do not include the use of motor vehicles on all routes where such modes are present.
- It is imperative that free left turns are prohibited at all signalised intersections. This will provide a period of time during which it is safe for pedestrians and cyclists to cross the street.
- The regulation of speed in urban areas requires maximum speed limits of 50 kilometres per hour (km/h) on arterial roads to be enforced through road design and police monitoring, and speed limits of 30 kilometres per hour in residential areas to be regulated through the strategic placement of speed breakers, dead-end streets, and mini roundabouts.
- Making bicycles more visible by painting them yellow, while orange

CONCLUSION

- The public was educated about the importance of safety and given safety awareness training.
- Follow traffic control devices
- If warning signs are removed or damaged, this could create a hazardous situation for the flow of traffic.
- Good rules that require people to wear safety belts and consistent enforcement are the only things that have been shown to successfully encourage the majority of drivers to do so.
- Conducting roadside inspections of drivers without proper training

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Review of a Comparative Study Carried Out On RCC and Steel Structures With Regard To Various Criteria's

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Abstract – *This study explores the composite structure, which is becoming increasingly popular in developing countries and is the subject of this study. Increases in dead weight, span restrictions, low natural frequency, and dangerous formwork make it such that reinforced concrete construction (RCC) is no longer an economically viable option for medium- and high-rise buildings. Composite buildings made out of steel and concrete are gaining popularity in today's world and are reliable over the course of their design lives. The most optimal choice for modern building construction is the combination of steel and concrete. In this study, we discuss the various outcomes of the building construction process for RCC, Steel, and composite structures taking into account the findings of numerous studies.*

Keywords*- reinforced concrete, composite structure, design lives.*

INTRODUCTION

In the construction industry of India, conventional concrete is a highly prevalent material, particularly when it comes to the construction of medium- and low-rise buildings. Additionally, steel is commonly utilised in the construction of high-rise buildings, while composite construction is not nearly as common. Despite this, it is likely that composite construction could prove to be more advantageous and helpful in the construction of medium- and high-rise structures. A steel concrete composite structure can be erected in place of a reinforced concrete structure to achieve maximum benefit from both steel and concrete, as well as to produce structures that are both efficient and cost-effective. It is dependent on the nature of the structure as well as the material that is utilised, and based on those features, the type of material that will produce the best outcomes can be chosen. When two different types of materials, such as wood and metal, are bonded together in such a way that they behave as if they were a single component in the structure, a composite construction is created. The adoption of novel techniques such as composite building is becoming increasingly common in order to reduce the overall cost of construction and to ensure that the finished structure is cost-effective.

LITERATURE REVIEW

D.R. Panchal et.al, (2011): In this study, we explored the Steel concrete composite systems that have become extremely famous in the field of civil engineering due to their advantages over conventional construction. These advantages may be found here. According to the findings, a steel construction is superior to an RCC structure, but the composite option for a high rise building is the most cost-effective of the three possibilities. The dead load of a steel structure can be lowered by 32 percent in comparison to an RCC structure, while the dead load of a composite structure can be decreased by 30 percent in comparison to an RCC structure. In comparison to an RCC construction, the axial load in a column can be decreased by as much as 46 percent in a steel structure and by as much as 7 percent in a composite structure.

Renavikar Aniket V et.al, (2013):

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For the purpose of analysis in this study, the STAAD.Pro programme was utilised. A solution to the majority of these issues in medium- to high-rise buildings may be found in the form of a steel-concrete composite frame system, which can create an efficient and cost-effective structure. As a result of the reduction in the dimensions of the steel members, the cost of a steel structure can be decreased as compared to that of an RCC construction. When compared to a steel composite structure, a reinforced concrete building will have a greater axial force, bending moment, and deflection, all of which will result in an increased cost. Because of its inherent ductility features and the ease with which its members may be connected, a steel and concrete structure will perform the best during an earthquake. This is in addition to the numerous other benefits that this type of structure offers. Result comparable to RCC constructions.

Shashikala. Koppad et.al, (2013): Composite structures, which are more suitable for economical construction, are suitable for use in medium and high rise buildings. This is because the RCC structures used in these buildings are no longer economical due to the hazardous nature of the work, less stiffness, span restrictions, and increasing dead weight. Buckling at the local and lateral levels can occur in structural elements made of steel. RCC members are prone to creep and shrinkage with regard to loads, despite the fact that they typically have more dimensions and are less likely to buckle than other types of members. Steel and concrete is a common construction material combination that is used extensively in building construction. Because of advances in overall performance in construction technologies, steel-concrete construction has become increasingly competitive in terms of its cost effectiveness.

Zafar Mujawar et.al, (2015): In Steel-concrete composite structures, faster connection technology has achieved widespread application, which saves a significant amount of time during construction and, as a result, makes it easier to finish the structure in the shortest amount of time possible. When compared to an RCC construction, the availability of internal space is greater, which not only increases the life expectancy of a composite building but also makes it easier to maintain. Based on the results of the experiments When compared to RCC structures, composite structures exhibit a 29 percent reduction in base shear, while composite structures themselves exhibit a 29 percent reduction in overall shear. When compared to an RCC construction, the axial forces exerted by a steel structure are reduced by 48%, while those exerted by a composite structure are reduced by 50%. The findings lead one to the conclusion that a decrease in the axial force exerted by the footing would result in a diminution in the size of the footing, and that composite building can be finished in a relatively short amount of time.

According to Prakarsh Sangaveet al(2015) .'s research, the use of steel structures is rather uncommon in certain of the world's nations. Because there is not enough room for horizontal development, structures in metropolitan areas such as Delhi, Mumbai, and Bangalore, among others, are almost always need to be made of steel and concrete composite.

The steel industry is one of the most successful sectors in virtually every region of the world, and composite building materials are finding widespread use in a variety of When it comes to construction, the most crucial parameters to consider are strength, time, and money. When compared to RCC structures, steel frames with infill have an enhanced maximum storey displacement of 8%, and they offer superior resistance during earthquakes without failing. When compared to RCC structures, steel framed buildings have lower bending moments in their beams and columns, in addition to lower axial forces.

According to Sattainathan.A et al. (2015), the Steel-concrete composite system has become relatively popular in comparison to RCC structure. The complexity of engineering causes a lot of engineers to lack experience in analysis and design. Because of the many benefits it offers over traditional building methods, the steel-concrete composite construction method is the one that should be implemented. According to the findings, a steel-concrete system has the potential to be a very cost-effective structural solution that also features great durability, rapid erection, and excellent seismic performance characteristics. Composite \sstructures offer optimum performance in Steel to the concrete.

According to Swapnil B. Cholekaret.al, (2015), composite steel and concrete construction is the greatest technique to generate an efficient and cost-effective design for a building system. Additionally, this type of construction is required in the current construction world. As the population of a country grows, the demand for buildings with middle- to high-level floors becomes more practical for the general public. In the case of normal constructions, steel-concrete structures are often utilised to produce construction that is both efficient and cost-effective. The joint displacement values in the structures are

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smaller in composite structures comparison to RCC structures. When compared to RC structures, composite ones have a lower "dead weight," which results in a better reaction to base shear values and an 18 percent reduction in that value.

(Varsha Patil et al, 2015). Because of the demand for the service in the market, it is essential to cut down on the amount of time and money spent on construction by employing construction methods that are straightforward and efficient. The two most important advantages of rapid construction are an early return on the money spent and a reduction in the amount of interest paid on the initial investment. The most effective exploitation of a steel concrete composite construction method will result in more usable space, and joint displacement at the top will be reduced due to higher stiffness in components when compared to an RCC steel structure.

Mohd Amir Khan et.al, (2017): This article discusses structural steel-concrete composites, which are lighter in weight in comparison to reinforced concrete structures and give inexpensive foundation construction. A better mix of properties results in structural frames that have a higher strength. When compared to an RCC frame, composite structural frames have a greater capacity to support lateral loads. When compared to an RCC frame, a Steel-concrete composite frame's lateral displacement can be kept to a minimum and its overturning moment can be reduced. Because of the reduced axial load, the frame of the steel-concrete composite structure behaves like a strong column but a weak beam. This is because the hinges are produced in the beams rather than the column elements.

This article presents an analysis and design of a multistory structure using the well-known programme STAAD.pro. It was written by Gorakh Vinit and co-authors. Beams are constructed with ISMB sections at this location. It offers a thick web that is able to carry the weight from the slab in an effective manner. In column design, wide flange sections are employed because they give excellent section behaviour in load transformation, together with high bending and buckling resistance. This makes them an ideal choice.

Because steel has a lower dead weight than RCC, axial loads in steel structures are typically lower than those in RCC structures. The final remark is that rapid building will result in increased benefits and a speedier return on the capital invested by investors.

Jyothi D. N., (2018): The findings of this study indicate that as compared to the RCC structure, the steel structure possesses greater resistance. In comparison to RCC structures, steel structures have a lower "Dead weight," as well as lower values for the bending moment and the shear force acting. The structural elements made of steel have a high strength to mass ratio. Even for high-rise projects, the size of the structural elements made of steel is relatively small, which saves space during construction and improves aesthetic view. It is possible to fabricate a steel structure in the workshop because standard sections of steel are readily available in the market, and it is also simple to transport the structure to the construction site. A rapid construction technique is yet another significant advantage offered by steel structures.

According to the research conducted by Pallavi Harish Wagh et al. (2019), steel is a ubiquitous building material that can be found in a variety of multi-story commercial buildings and factories, in addition to bridges. Steel and concrete both result in construction that is completed rapidly and has strong bonding characteristics. The two distinct materials are totally agreeable with one another and even enhance one another in some ways. Under loading, a steel-concrete composite structure behaves as a single unit since its components have nearly the same thermal expansion. This technology is more cost-effective than constructing full structures out of steel and reinforced concrete. Because of the compact structural steel section, the weight of a steel and concrete construction can be lowered when compared to that of an RCC structure. It has the effect of reducing the cost of the foundation. The Story Drift Comparison for RCC and Composite Structures might range anywhere from 22 to 32 percent. As a result of an increase in axial load, the values of bending moment and shear force in RCC constructions have increased.

In this study, the Composite structures are the latest concepts for high rise architecture, and they have resulted in speedy construction (Samadhan Jagadale et al., 2019). When compared to RCC, steel frames get a fair response, but composite frames are the better option for high-rise buildings. buildings. According to the findings, the lateral displacement of the top story of a composite frame building is 15 percent higher than that of an RCC frame building and 17 percent lower than that of a steel frame building. Maximum shear force in composite frame is almost 40.45 percent higher than in RCC frame and 112.29 percent lower than in steel frame in G+7 story beam; maximum bending moment in composite frame is 23.42 percent higher than in RCC frame and 178.83 percent lower than in steel frame. The axial stress on the footing is more for

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an RCC frame, which equates to 24 percent, than it is for a composite frame or a steel frame, which equals to 81 percent correspondingly. In conclusion, the cost of constructing a G+7 story structure using a composite frame is roughly half that of using a steel frame, while it is 15% more using an RCC frame.

According to the findings of this study by Madhav Rana and colleagues (2019), steel structures offer superior resistance to lateral and other types of combined loads.

Steel is a recyclable material that can be utilised in a variety of applications depending on the property requirements. It is common knowledge that brazing systems can raise the stiffness of any kind of construction. Typically, these systems are installed at the building's corners in order to offer resistance to loading. The 'A Arc' kind of brazing, the 'Av Arc' type of bracing, the single elliptical bracing, and the double elliptical bracing are all tested to their maximum displacement at the corner columns. The 'Av Arc' bracing system is the most efficient and has the least amount of maximum displacement of any bracing method. The 'A Arc' style of bracing produces a final result for the material quantity of steel that is lower, whereas the double elliptical bracing system produces a final result that is higher.

Kentan Patel et.al, (2019): A comparative analysis of concrete-filled steel tubes (CFTs), reinforced concrete (RC) structures, and steel buildings is carried out in this work. Columns made of steel concrete composite are widely employed in modern construction since they are thought to produce the greatest outcomes. It comes to the conclusion that the usage of CFT columns has been constantly utilised in the design of high-rise buildings due to the fact that they give an economical construction in contrast to RCC and Steel structures. The load carrying capacity of a CFT frame structure in a building with 20 or 30 stories is enhanced by 19.10 percent and 11.80 percent, respectively, as compared to a steel structure. Additionally, 27.30 percent and 22.80 percent compare favourably to RC structure. Due to the inherent ductility features that steel possesses, current materials and techniques that are available for erection will lead to the rapid completion of the structure while taking into consideration the possibility of an earthquake.

Anil S.Savadi et.al, (2019): In this article, in order to satisfy the criteria and needs of high-rise structures that are used for commercial purposes.

Other than RCC and steel constructions, the composite structure is the finest option for the growth of infrastructure as well as economic structure. When a cost comparison for a commercial building with a floor area of G+2 is carried out, the results show that the cost of a composite beam is 1.7 percent less than the cost of a steel structure and 13.7 percent less than the cost of an RC structure. The main advantage of composite frame structures is that they do not require bar bending or form work. The primary advantage of composite structures is that they have a lower overall cost compared to RCC and steel constructions. In composite structures, the amount of labour needed for erection activities like beam, column, and other similar tasks is significantly lower as compared to RCC structures. When compared to steel structures, composite structures have lower deflection criteria, while RC structures have higher deflection criteria.

FINDING FROM LITERATURE REVIEW

1. After reading the articles published in journals, a number of researchers came to the conclusion that steel is the material that is the most useful and adaptable for engineering and construction purposes.
2. It is a really challenging job to be a skilled engineer and to safeguard the natural resources. The primary constituents of cement, which are notorious for their high cost and close proximity to environmental limits. Therefore, it is of the utmost importance to locate alternate materials with respect to the associated features, such as cost, time, and strength. Additionally, because engineers lack experience with the composite material's analysis and design, they are hesitant to accept the structure made of concrete and steel.
3. It is simple to find structural steel material in stores, such as I-sections, C-sections, Z-shapes, L-angles, Rail profile bars, sheets, or plates, and so on.
4. Steel is used in composite concrete and steel structures to offer a lightweight construction. By utilising lighter-weight materials, such as precast aerated concrete walls, panels, and other such things, the structure's dead weight can be brought down. easily adaptable to alterations and additions, should they become necessary.
5. Steel structures allow for rapid construction, are extremely robust, gain strength quickly, are biodegradable and recyclable, and give a long span.

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6. As a consequence, there are less risks to people's health, fewer materials to throw away, a lower demand for energy, fewer emissions, and improved environmental work in low- to high-rise buildings.

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Corrosion Prevention In Rcc Structures

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Abstract – *In this paper , given that we are familiar with the fact that structures are the foundation of engineering, our primary goal is to build a structure that contains the fewest possible faults. Concrete and steel reinforcement are the primary materials used in the construction of the various structural components. Reinforcement is utilized as a result of its high tensile strength, whilst cement concrete is utilized as a result of its compressive strength. Structures that make use of both features of materials, namely reinforcement and cement concrete, are referred to as RCC structures. Just like anything else, reinforced concrete construction (RCC) has some limitations and drawbacks. Corrosion is one of the most significant challenges faced by RCC structures. The damage that is brought on by corrosion in an RCC structure is considered to be a significant challenge because it reduces the service life of the structures. Because oxygen is already present in water in the form of dissolved oxygen, water alone is sufficient to complete the entire requirement for corrosion reaction, which is why premature failure of RCC structures is caused by corrosion of steel reinforcement. In general, for corrosion of steel reinforcement, water is enough to complete the entire requirement for corrosion reaction. Once the chloride content reaches the steel reinforcement, it destroys the passive layer that was formed around it and corrosion begins. This causes the steel reinforcement to lose its cross-sectional area, which in turn causes the concrete to be unable to bear as much load, which leads to the failure of the RCC structure. In general, a passive layer is formed around the steel reinforcement to protect it from the harmful environment. However, the chloride content tries to penetrate the concrete. Permeability is either directly or indirectly playing a significant part in the action of corrosion in RCC structures. Simply put, when reinforcement corrodes, it becomes separated from the concrete as a result of the increasing volume of steel reinforcement. The author of this study attempted to present the mechanism by which corrosion occurs in RCC structures as well as the preventative measures that should be followed to control it. In the event that this issue is not automatically addressed, the entire structure will be compromised.*

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Keywords- RCC***, corrosion reaction, steel reinforcement, tensile strength, Permeability, preventative measures.***

INTRODUCTION

From many years, humans have taken advantage of ductile materials with high tensile strength in the reinforcement of brittle materials with high compressive strength. The ductile reinforcement transfers tensile loads in the structure, allowing the brittle material to crack without causing failure of the structure. Throughout the last two centuries, concrete has been developed into a construction material with ever increasing potential to support compressive forces. As the compressive capacity of concrete has increased and with it demands to support longer and larger and taller structures, stronger, more ductile and more tensile reinforcement has been required.

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Reinforced concrete (RC) is nowadays present in a large part of the infrastructure all over the world. The high compressive strength of concrete combined with the tensile properties of steel makes it a competitive and versatile material suitable for a multitude of applications. Existing structures made of RC include, for instance, bridges, tunnels, harbours, dams or off-shore platforms, as well as a wide range of buildings. It is precisely due to this broad variety of applications that reinforced concrete structures are often exposed to extremely severe conditions, e.g., marine environment, freeze-thaw cycles, carbon dioxide, chemical and biological attack, etc.

Corrosion, due to chlorides present in sea water and in most of the de-icing salts used to remove ice and snow from the roads, is today regarded as one of the biggest problems affecting the durability of RC structures. Corrosion of reinforcing steel is avoided in the first place because it entails the appearance of surface cracks and rust stains giving a bad aesthetic impression. However, if corrosion proceeds, it may lead to a serious loss of the local cross-sectional area of the reinforcing bars and a reduction of the bond between the concrete and the steel, both of which affect the structural behavior of the RC element and which may eventually compromise the stability and safety of the structure. During the last century a number of structural failures have occurred the causes of which have been mainly attributed to corrosion problems.

Over the past 30 years, a number of approaches have been established and followed by asset owners and managing agent contractors. All aim to stop on-going deterioration and extend the service life of the structures.

Corrosion of Steel in Concrete

In general, when metals and alloys interact with their environment chemically, biochemically or electrochemically, surface loss occurs, and they convert to their oxides, hydroxides, or carbonates which are more thermodynamically stable. This process is termed as corrosion. Along the surface of an embedded steel bar, when there is a difference in electrical potential, the concrete acts as an electrochemical cell which consists of anodic and cathodic regions on the steel, with the pore water in the hardened cement paste acting as an electrolyte. This generates a flow of current through the system, causing an attack on the metal with the more negative electrode potential i.e. the anode while the cathode remains undamaged. Thus, corrosion of rebar is initiated.

FACTOR AFFECTING REINFORCEMENT CORROSION

- **Effect of aggressive anions**

  Chloride in concrete may be present as Acid soluble chloride, chemically bound chloride with hydration products of cement and free or water soluble chloride within the pore solution of concrete. Generally, the concentration of free chloride ions (Cl-) influences the corrosion process. It is reported that the corrosion rate increases with an increase in chloride content. However, the change in pH is insignificant due to change in chloride content of concrete .The risk of reinforcement corrosion associated with the level of chloride content in both uncarbonated and carbonated concrete is presented.

- **Effect of carbonation and entry of gaseous pollutants**

  The pH of the concrete is reduced by the carbonation and entry of acidic gaseous pollutants such as SO2 and NO2. The fall in pH to certain levels may cause commencement of reinforcement of corrosion, loss of passivity of concrete against rebar corrosion and catastrophic corrosion indicated in table.

pH of concrete	State of reinforcement corrosion
Below 9.5	Commencement of steel corrosion
At 8.0	Passive film on the steel surface disappears
Below 7	Catastrophic corrosion occurs

- **Effect of Bacterial action**

Aerobic bacteria may aid in the formation of differential aeration cell which will lead to corrosion. In sewer concrete, the anaerobic bacteria produces iron sulfides which too enables the corrosion reaction to proceed even in absence of oxygen9. The bacteria decrease the amount of cover by disintegration of cementations material.

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- **Effect of w/c ratio**
  Basically w/c ratio control strength, durability and permeability of concrete and does not control the rate of Corrosion but 'permeability' which is a function of w/c ration affects the corrosion of rebar. The depth of penetration of particular chloride threshold value increases with an increase in the w/c ratio. Carbonation depth has been found to be linearly increasing with an increase in w/c ratio. The oxygen diffusion coefficient is also found to be increasing with an increase in the w/c ratio. In a study it is observed that the permeability of hardened cement paste is increased 100 fold by increasing the w/c ration from 0.35 to 0.45 and the time of initiation of reinforcement corrosion in a sample with a w/c ratio 0.4 is 2.15 to 1.77 times more as compared to a sample with a w/c ratio of 0.55, under accelerated corrosion testing.

- **Effect of cover over reinforcing steel**
  Risk of reinforcement corrosion with low cover thickness, has been reported by various researchers. The cover thickness has a remarkable effect on rebar corrosion due to penetration of chloride or carbonation. This effect of corrosion is limited within the time of casting to the time at which the rebar is depassivated and corrosion is started. The rate of corrosion, once it has started, is independent of the cover thickness.

PROTECTIVE SOLUTION AND ITS MECHANISM

The damage to concrete due to corrosion of reinforcement has been recognized as one of the most serious causes for durability problem over the last several years. Research has given rise to a variety of concrete corrosion protection measures in both new concrete and in repair of damaged concrete. Epoxy based thin coating has been found to be extremely effective except few drawbacks. The innovative method of corrosion protection is the development of a two component anti-corrosive coating of rebars which has all the positive features of epoxy coating excluding all the short comings of the same. For corrosion not to occur it is necessary that the alkalinity around the rebar is high. The various components have been so designed in this cementitious product that the alkalinity around the rebar is increased to the tune of 13. Specific reactive fillers reduce the permeability of protective coating over rebar. Selective polymer in the formulation increases the bond between coatings and rebar and also makes the coating more impenetrable to polluting gas. Thus the increased corrosion inhibiting property of the coating helps in achieving a durable and successful repair of corrosion affected concrete structures.

PROTECTIVE MATERIAL

RCC protection is a complex system. Repair is the only way to protect the corrosion affected concrete structure. In carrying out repair we attempt to create a bond between old structure and new repair materials which will restrict the shrinkage in repair material. A good repair mortar should have following properties.

- Lowest shrinkage
- High tensile creep
- Low modulus of elasticity
- Low coefficient of thermal expansion
- Impermeability.
- High tensile and flexural strength
- High chemical resistance
- Low water absorption
- High bond strength
- High flexibility

By adding accurate granulometry of aggregate, keeping water - cement ratio to the lowest possible, suitable quality of cement for the job and appropriate polymers in right proportion we may incorporate the above properties to repair mortar to achieve a durable repair system. For smaller repair job and where cement based products are either technically unsuitable or will take too long to cure, epoxy mortars are often the most cost effective solution.

A. Metallic Coatings

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The development of metallic coatings was based on their role as regards corrosion in combination with the parent metal (mild steel, in general). In view of this, two broad types of coatings have been developed. These are (i) passive film-forming coatings, e.g. Si-based coatings, Cr-based coatings, and (ii) sacrificial coatings, e.g. galvanizing. The first option is based on a passive Film formation and its adherence to the rebar. It may lead to localized attack, if broken during service, transportation, fabrication, etc. It should be noted that the parent metal acts as an anode compared to the cathodic passive film. However, in the second option, corrosion prevention is based on a sacrificial anode compared to the cathodic underlying parent metal, and, therefore, even if the coating is broken due to the above-mentioned reasons, the metal remains protected.

B. Organic Coatings

Organic coatings include epoxy coatings, polyvinyl chloride, polypropylene, phenolic nitrite, polyurethane, etc. All these coatings act as a barrier to the aggressive ions, moisture and oxygen and remain cathodic with respect to the steel. Of these, epoxy coatings have been most popular.

C. EPOXY-COATED REINFORCING STEEL

- The performance of epoxy-coated reinforcing steel is enhanced by quality concrete and adequate cover.
- Epoxy coatings lose their adhesion to steel reinforcement when exposed to moisture. Whether this adhesion loss is a direct cause of corrosion damage is under debate.
- Performance of epoxy-coated reinforcement is related to the number of defects (holidays) in the coating. These defects directly effect the electrical resistivity of the reinforcement.
- Most problems that have been reported with epoxy-coated reinforcement have occurred in environments where the concrete is continuously wet, yet oxygen is still available (splash zones on piers, or areas of high humidity). Often these environments have high average temperatures.
- There is little doubt that the time to corrosion-induced cracking is increased in many concrete structures containing epoxy-coated reinforcement over the time to corrosion-induced cracking in bridge decks with no protective measures.

D .Galvanized Reinforcement

Hot-dipped zinc-coated steel reinforcement may provide superior performance to that of uncoated steel. Zinc-coated, or galvanized, bars are produced by a hot-dip process. This consists of cleaning the steel bars by pickling, and then immersing them in molten zinc. Galvanized bars are dipped in a chromate bath after coating to passivate the zinc surface and to prevent it from reacting with the hydroxide in fresh cement paste. Like steel, zinc has corrosion products that occupy more volume than the original metal, and, as a result can cause concrete to crack. An advantage of galvanized reinforcement is that, when zinc corrodes sacrificially, a hydrated oxide[Zn(OH)2] is formed on the surface that acts as an electrical insulator. This insulator is thought to form a barrier layer at active corrosion sites that will prevent further corrosion from occurring . The study was expanded to compare epoxy-coated reinforcement to galvanized and uncoated reinforcement. Specimens were constructed using galvanized, epoxy-coated, and plain “black” steel. The specimens were then placed outdoors in a testing facility. Dikes were built around the edges of the specimens to retain water and a saltwater solution was applied to the surfaces on a regular basis throughout the winter months.

Cathodic Protection

Cathodic protection is currently becoming one of the most useful methods in corrosion protection because it controls the electrochemical corrosion process itself.

In this method, the structure to be protected is made into a cathode by supplying an electric current from an external d.c. source. The cathodic protection method may be broadly classified into two categories: (i) sacrificial anode cathodic protection and (ii) impressed current method. Pithouse has studied both types of cathodic protection systems on concrete repair work and found that the current systems have been the most successful. He found that the distributed mesh systems are the latest development and have proved to be very effective. One of the main criteria for effective cathodic protection is that the applied current should be uniformly distributed to the steel to be protected. A highly non-uniform current distribution may not only leave some of the reinforcement unprotected; it may also cause the formation of macrocells between protected and unprotected steel, as well as the danger of hydrogen evolution in the high current zones.

A. Sacrificial Anode Cathodic Protection

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This preventive method is based on the use of a sacrificial anode which is consumed during corrosion and the reinforcement remains unaffected. The standard electrode potential of the sacrificial anode must be lower than the standard electrode potential of the reinforcement so that during galvanic corrosion, the reinforcement acts as the cathode and remains unattacked. Zinc as the sacrificial anode is the unanimous choice for cathodic protection. This may be present in the form of a coating or separately, being electrically connected with the reinforcement.

B. Impressed Current Cathodic Protection

This system is more flexible but more complex than a galvanic anode system. The basic principle is the same for both systems, except that the impressed current system energizes the anode by means of an external electrical energy source. The DC current is passed into the electrolyte by means of an internal electrode like a lead-silver alloy or platinum. A number of studies have been directed towards this method. McArthur has shown through modeling that the cathodic area is initially made very alkaline immediately after switch-on, and the anodic area becomes acidic in nature. This acidic area spreads out from the anodic electrode toward the cathodic area. It is found that this alkalinity is produced at the cathodically impressed rebar as the impressed current uses up the dissolved oxygen requires the hydroxyl ions to carry the ionic current, and produces hydrogen. For cathodic protection to work effectively there must be a way for oxygen to diffuse to the cathodic area, so that it takes part in the cathodic reaction. The anodic area becomes acidic and the alkaline OH" ions are moved away from the rebar as a requirement for continuous current flow.

ANALYSIS DISCUSSION

In recent years, efforts have been made to develop reinforcement steel with better corrosion resistance. These corrosion resistant rebars do not require any special care during transportation, storage, fabrication, placement or even construction. Moreover, they do not require any skilled labour and capital investment, design changes, etc. Cathodic protection applied to steel in concrete is normally considered effective if the 100 mV decay criterion is fulfilled, i.e. if a decay of at least 100 mV is achieved during a certain period (usually 4 or 24 h). This criterio, which was developed empirically, has shown to be effective in practical applications, and is also recommended by standards. Recently, it has been suggested that the achievement of a decay of 100 mV should imply that a near passive state has been induced on the protected steel. The 100 mV decay criterion has shown to be applicable to cathodic prevention as well. Tests with very low cathodic current densities applied to passive steel in chloride contaminated concrete showed that this criterion is also reliable in evaluating the effectiveness of this technique. In fact, current densities able to achieve 4-h decay higher than 100 mV were sufficient to maintain passivity on steel bars even when chloride content up to 3% by weight of cement was reached near the steel surface. In proposed method for Prevention of corrosion of steel reinforcement in concrete is giving better result than previous research.

METHODOLOGY

Damage which was attributed to corrosion of reinforcement the repair was divided into several activities which are briefly discussed below:-

- Surface preparation: The area where corrosion of reinforcement has external sign, the area was prepared by removing the loose concrete till sound concrete was reached. All the exposed reinforcement were suitably cleaned in order to free from rust. The exposed concrete surface was repeatedly washed with water spray.
- Anticorrosive treatment to reinforcement: Anti corrosive treatment was given to derusted reinforcement for an ideal protection against removed corrosion. For this purpose 2 coats of Sikatop armatec 108 was applied followed by curing for 24 hours.
- Bonding coat: The cleaned concrete surface was made totally saturated with clear water. Cement slurry modified with polymer emulsion sikalatex was brushed in to concrete surface as bond coat.
- Polymer mortar for inner layer: While the bond coat is still tacky, the filling of inner portion was done with polymer modified sikatop 122 and was well finished. Repaired mortal was cured for 2 days and the repair was allowed to dry.
- Carbonation resistant coating: In order to present ingress of moisture and carbon dioxide a coat of carbonation protective coating with pure acrylic based sealoflex was applied.

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CONCLUSIONS

From the above discussion, it is evident that a good concrete cover in terms of quality of ingredients, mix proportion, water-cement ratio, etc., has no substitute for the prevention of reinforcement corrosion. Corrosion takes place only when a path exists for the ingress of chloride, sulphur dioxide, oxygen, etc., in the concrete cover. Steel reinforcement can also be prevented through cathodic protection. As mentioned above, a zinc-based sacrificial anode cathodic protection system is considered a better choice than the impressed-current cathodic protection method due to practical difficulties involved with the latter. These include non-uniform distribution of current due to the complex non-homogeneous nature of concrete, electrical connections to all embedded rebars, large capital investment, and suitable provision in the structural design a large number of studies are also directed towards concrete additives like corrosion inhibitor and fly ash which have been found useful in preventing reinforcement corrosion. It can be concluded that the upmost care should be taken during concrete-mix preparation and construction the choice of other protection methods will depend upon the type of structure to be protected, life expectancy, and nature of environment and cost of application.

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The Obstacles Facing Talent Management and Ways to Overcome Them

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Abstract – *When asked about the meaning of the acronym "HR," management guru Tom Peter once joked that if someone wanted to criticise an HR manager, they can inquire as to whether the letters stand for "Human Resource" or "Human Remains." Tom Peter may have made his comment in a lighter vein, but this is the harsh reality in the majority of corporate houses, where human resources does not play a strategic role and its roles are simply limited to those of a file clerk. Tom Peter may have commented in a lighter vein, but this is the harsh reality in most corporate houses. Acquisition and retention of workers have become an ongoing problem in the workplace, which has, as a result, increased the amount of strain on the available human resources. The dynamics of the business market have an effect on the company, particularly in terms of how much money and how much time it takes. The stakeholders in the company are hurt by the inadequate management strategies because of the negative impact those tactics have. In this light, the significance of making the most of the various skills already present in the company becomes clear. This paper, while exploring into the insight of such a problem, aggregates the findings of some of the research articles as regard to how the business enterprise can manage the limited talent resources in a business market that is characterised by volatility and uncertainties. Specifically, this paper looks at how the business enterprise can manage the talent in a market that is characterised by volatility and uncertainties.*

Keywords*:- Talent Management, VUCA, Interaction Jobs, Employee Engagement and Virtual*

INTRODUCTION

We live in a culture where instability and unpredictability have been institutionalized as the standard form of discipline. The business sector as an organ of society is not immune to the effects that such discipline might have on it. The United States Army War College came up with the word "VUCA," which stands for volatility, uncertainty, complexity, and ambiguity. This term is the most accurate way to characterize the dynamic and rapidly changing nature of the world in which we live today. Because the third wave of revolution has already taken place in business and society in order to connect countries all over the world, VUCA has seized control of the corporate world and is using it to its own advantage. It is important to keep in mind that the "first wave" of development, which is agricultural development, and the "second wave" of development, which is industrial development, both put a cap on the growth of nations. This calls for the "emergence of technological revolution," which Alvin Toffler aptly describes as the "third wave" (1980). It was clearly observed that there was gradual power shift from the hands of the employers to the hands of the employees, who are better described as knowledge workers in present day business. This occurred as a direct result of the third wave, which ushered the Human Resource in a different direction. The results of a poll called "What's Working" conducted by Mercer found and corroborated that, out of a total of thirteen different possible incentive aspects, Indian respondents ranked career advancement as the most important reward element. Pay as a starting point is the second most essential factor, followed by prospects for further education. According to Aleem Merchant, director of Synapse Marketing Consultancy Private

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Limited, " "eward points in today's scenario are far more complicated than they were in the good old days, when you would have a son coming home to his parents with a box of sweets, proclaiming his salary hike, followed by the entire family breaking into a song and dance of how their lives have changed for the better. In today's scenario, however, you are more likely to have a son coming home with a box of sweets, proclaiming his salary hike. The needs of today's youth are sharper, more well-planned, and more varied. When viewed from a more broad perspective, incentive systems appear to be very straightforward and may be generalised. However, when viewed more closely, rewards need to be tailored and modified to meet the needs and desires of the individual " (www.its.myascent.com, September 7, 2011) [cited from]

Career Management for Employees Becomes a Prominent Issue in HR Practices Career management for employees becomes a predominant issue in HR practises which is directly related with talent management.

Due to increased competition in the market, exceptional individuals have been presented with excellent possibilities to make use of their skills and take advantage of the highest levels of career progression. They merely choose to change professions frequently in the event that they are made disengaged or that they choose to disengage themselves. In point of fact, this leads to job discontent as well as a career plateau. Because of the new expectations placed on employees in the workplace, corporate strategists have been forced to build a new paradigm for the acquisition, development, and maintenance of their core staff.

Companies based in industrialised nations are placing a strong emphasis on enhancing the levels of productivity and organisational performance of a diverse range of occupations. Because of advances in technology and digital communications, businesses have been able to more easily incorporate automation and reengineering into their systems and outsource a significant number of operations that were formerly carried out by full-time staff at their physical locations. Traditional activities that were once carried out on production floors have been moved to offices in order to be automated by means of more sophisticated technology. In many instances, these jobs have also been outsourced to employees in countries with lower minimum wages. In spite of all this mobility, there remained a diverse range of work opportunity. work that requires considerable human connections; positions held by knowledge workers such as doctors, engineers, lawyers, and managers; and other skilled professionals who actively collaborate as the engine of the knowledge economy. mostly undisturbed. According to the findings of some research conducted by McKinsey and others, people who engage in interaction with customers and other employees are essential to the competitive performance of businesses and countries alike.

Figure 1 demonstrates how technological advancements are altering the nature of work.

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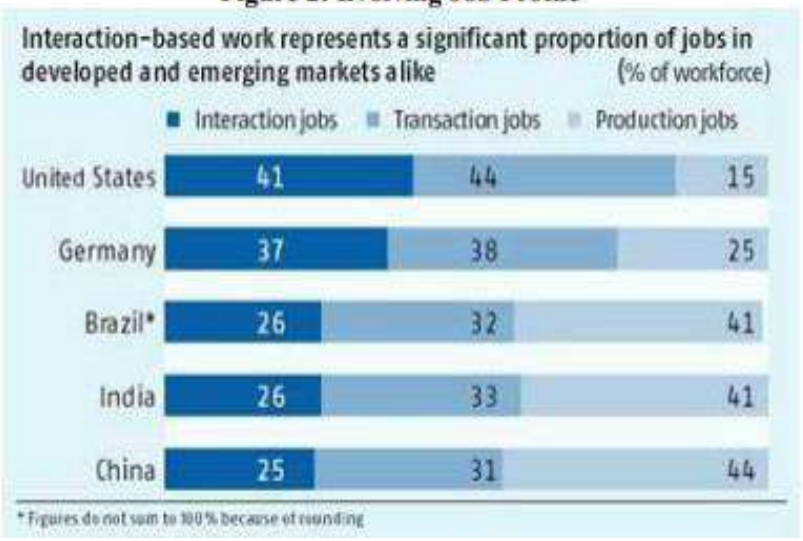
Figure 2: Evolving Job Profile



Source: McKinsay Quarterly, 2012, as quoted in Business Standard, „Managing Scarce Talent" Strategist Column, dated Dec 17, 2012

In industrialised countries, the category of jobs that involve interaction is the one that is expanding at the quickest rate. Interaction works are expected to play essential roles in the future in the wake of fast global competitiveness, emerging skill shortages, and changing demographics. These factors are going to have a significant impact on the viability of businesses. In response to this trend, businesses are being incentivized to make better use of their most highly compensated employees. This was consistent with the findings of the McKinsey Global Institute, which indicated that the education gap in the United States is anticipated to reach 1.5 million graduates by the end of this decade. This information verified the findings.

This tendency continues to be a problem in China, where many multinational corporations have seen their expansion plans stall out and there will be a lack of 23 million workers with college degrees in the year 2020. The same tendency is also seen in the case of Japan, which has had a plateau in population growth and will soon see a large number of senior management professionals retire. As a consequence of this, there is a good chance that there will be an opening at the entry level in the not-too-distant future due to the sluggish population growth. This will occur after the professionals who are currently in promotional pipelines attain senior management roles. One of the reasons for the talent crunch is the existence of the "glass ceiling" and the underrepresentation of women, particularly at executive levels in some economies, most notably in Germany. Geographic mismatches continue to be a problem for human resource planners, even with the advent of information and communication technology, which makes it more difficult to estimate HRdemand and HR supply. In the European Union, for example, there are a variety of national systems of professional certification that are not recognized all over the world. Furthermore, the linguistic and cultural barriers that exist in these countries do not make it easier to transport skills.

This is reflected not only across national lines but also inside them.

This is a clear signal for the corporate strategists to involve HR in the strategic business perspectives in order to engage the limited available human resources in order to maximize organizational excellence.

An ever-evolving world

In light of this, the Business Standard Strategist team, 2012 (BSST) conducted research on leading companies in a variety of industries, such as aviation, business services, financial services, health care, high-tech manufacturing, and others. They found that companies operating in these industries are looking into ways to revamp and effectively perform interaction work in order to enjoy greater productivity gains, greater flexibility in responding to opportunities, and better access to scarce resources. On the other hand, in order to effectively manage the workforce, the HR rules that are already in place

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need to be rethought and reevaluated. The BSST observed that companies in the United States were using the following strategies:

Deconstruct jobs: In order to better manage the limited pool of available talent, businesses are concentrating their efforts on shifting their highest-paid employees to more value-adding tasks and relieving them of routine responsibilities. One of the most prominent examples of this can be found in the United States' decision to allow paralegals to become full-fledged members of the legal profession. This decision freed attorneys from the burden of performing research and litigation support tasks, freeing them up to spend more time in the courtroom or attending to the needs of their clients and allowing them to emerge as fully-fledged law professionals. This method is also applicable to other professions, such as medicine, which has resulted in the creation of a middle-income profession in the United States that is currently comprised of more than a quarter of a million people. For example, in a research project conducted on primary care clinics in the United Kingdom, service providers investigated whether or not it was possible to increase patient satisfaction while maintaining the same level of care at a significantly lower cost by employing a workforce composition that included only forty percent physicians and sixty percent nurses and other health providers.

The fragmentation of traditional corporate line positions was another topic that was investigated in this study. The functions of human resources (HR) are currently being segmented into more specialised fields such as compensation, recruiting, and benefits administration. Because of this, opportunities arise for domain specialists to provide firms with the expertise that generalists lack, and they can typically do it at a significantly reduced cost. For example, the security software company Symantec utilises call centres in addition to an online site in order to assist with basic HR activities. This is a significant opportunity for the strategists to maximise their benefits from the specialists who have great experience in the performance of particular specialized duties, such as hiring and training people and developing long-term strategies for the workforce. In situations like these, segmenting duties into more specialized tasks helps firms make better use of the little talent they have, which in turn enables those tasks to be carried out in a manner that is both more efficient and successful.

Go Virtual: Another key activity that BSST is keeping an eye on is the transformation of organisational structure systems. When it comes to cost and time management, many multinational corporations (MNCs) favour using virtual organisation structures. Instead of conducting business in person with tangible documents and currencies, a virtual business organisation conducts its commercial activities through the use of various forms of electronic communication. Employers initially started employing remote-work agreements in virtual mode for the first time in the 1990s. This was done in part to retain the services of working mothers who preferred not to commute or who wished to work as part time. Companies like IBM have taken steps to reduce the number of permanent offices that sales representatives and other employees who deal directly with customers are required to use. This allows the company to save a significant amount of money that was previously spent on real estate while encouraging sales representatives to spend more time with clients and customers. The increasing demand for online collaboration tools to complete work from any location was aided by technological advancements such as broadband and cloud computing. Many positions, such as administrative assistants, insurance claims processors, law associates, and corporate personnel in functions such as finance or HR, were given high priority so that the system mechanism could be managed. Other jobs that were given high priority include: A poll conducted in 2011 by Business Standard among 2,000 businesses in the United States found that one quarter of those businesses stated that US multinational corporations intended to rely increasingly on remote workers in the future.

The implementation of the training programme was also impacted by the usage of technology. The majority of corporations have a preference for receiving training materials in an electronic format. Additionally, the use of social media helped bring together a large number of employees, members of remote teams, and their managers to form a network that frequently forms connections in a short amount of time.

Virtual work techniques quickly rose to the forefront of the attention of a diverse range of employees, including working mothers, elderly workers, and younger Generation Y professionals who wanted flexible lifestyles from the very beginning of their careers. Because they have grown up communicating and collaborating online, members of the younger generation of employees are frequently selected for jobs that involve working remotely and managing things by walking around. When an organization's reliance on technology grows, it is essential to shift autonomy to its workforce, who then takes on the primary responsibility of running the firm. They should be provided with sufficient opportunity to maximise the impact

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of their talents through effective involvement in the workplace. The active participation of workers has emerged as a crucial component of effective organizations.

EMPLOYEE ENGAGEMENT

Once Management Guru Tom Peter once made the joke that if you want to disrespect a human resources manager, you might ask him whether the HR in an organisation stood for human resources or human remains. It's possible that Tom Peter made his comment in a lighter mood, but the harsh reality is that this is the case in the majority of corporate houses, where human resources does not play the role of a strategic partner and its functions are instead limited to those of a file clerk. People join, and continue to be unengaged or disengaged, because of incorrect usage of their capabilities due to a paucity of adequate transparent systematic method. This causes them to join, and causes people to remain unengaged or disengaged. According to research, the majority of issues that arise in businesses are related to the people working for those businesses. These issues arise as a result of improper and insufficient planning to engage employees, which leads to low productivity, job dissatisfaction, career plateaus, employee turnover, and job burnout. According to the findings of the Gallup Employee Engagement Survey from 2010, businesses in the United States are dealing with the lost productivity of actively disengaged employees, which amounts to $ 370 billion for the annual economy of the United States.

Comprehension of the Influence That Employee Engagement Has

According to one definition of employee engagement, it is "a separate and distinctive construct that comprises of cognitive, emotional, and behavioral components connected with individual role performance" (Saks, 2005, p. 602).

Employees who are engaged in their work are more likely to exhibit attentiveness and mental absorption in their work, as well as a profoundly positive emotional connection with their employment, according to the findings of research (Saks, 2006). Employees that are highly engaged in their work typically exhibit a high level of commitment and connection to their work, which can be assessed by the amount of extra effort they are willing to put in for the To keep employees interested in their work, managers need to demonstrate a caring attitude toward the workers they supervise, often known as subordinates. According to the findings of the study, a caring manager is one of the factors that drives employee engagement. 1 Employees have the expectation that their supervisors will be concerned about their personal lives, will take an interest in them as individuals, will care about how they feel and will help them in all elements of their lives that relate to their health and well-being. The capacity of a manager to develop strong relationships with employees, foster strong interaction within teams, and lead in a "person-centered" manner is what generates an engaging workplace in which people are able to perform at the highest level possible.

One of the results is engagement. People would rather be involved in their work if they have enough opportunity and desire to use their talent and if they appreciate the environment in which they are working. This ultimately results in increased productivity, increased job satisfaction, and increased organizational citizenship behavior, all of which are beneficial to both the business and the employees. Positive word-of-mouth travels across the labour market, which helps to strengthen the brand of the company, and employees simply serve as brand ambassadors for the organization. Benefit of their employer. They consistently remain more productive, profitable, safer, and healthier, and they are less likely to leave their employers (Fleming & Asplund, 2007; Wagner & Harter, 2006). Additionally, they have a tendency to go above and beyond the core responsibilities that are outlined in their job descriptions. Despite the fact that there are many benefits, it is believed that just 30 percent of the world's workforce is engaged in their jobs (Harter, Schmidt, & Hayes, 2002; Saks,2006). According to a survey on employee engagement conducted by Gallup in 2010, actively disengaged workers in the United States experience a loss of production that costs the economy $320 per year.

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Figure 1: Employee Engagement Components

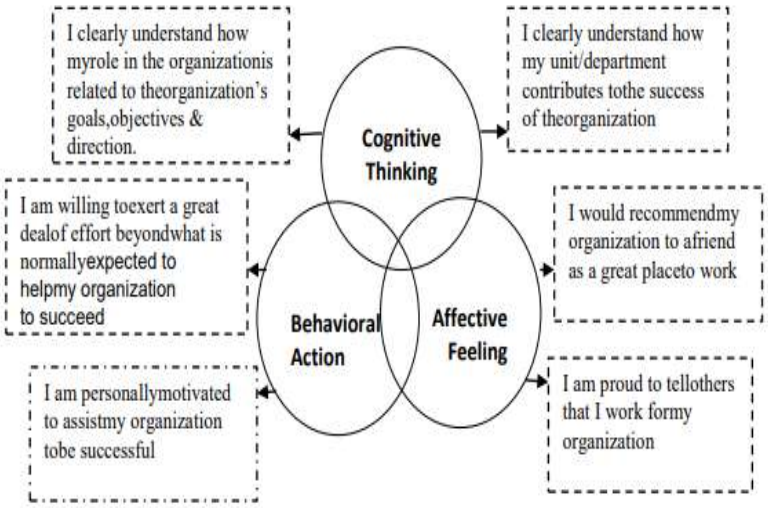
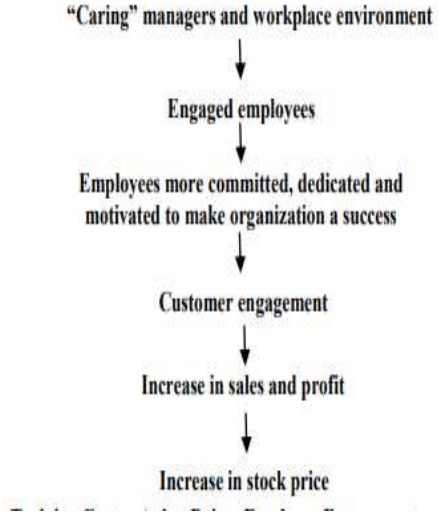


Figure 2: How can employee engagement benefits organizations



CONCLUSION

The human resources department of an organisation is quite similar to a seed, in that it needs proper soil and care in order to grow and thrive. The proactive management, which supports the establishment of policies and procedures that are suitable, transparent, and methodical in order to maximise the use of knowledge resources, is the source of the soil's resilience. This is extremely vital in order to maintain our competitive edge in a world that is constantly moving and evolving. In a knowledge economy, in which a significant amount of reliance is placed on various forms of technological advancement, business strategists need to exercise extreme caution while determining job requirements and evaluating staff profiles. They need to research the work effectively, hire and nurture employees who can drive business, and even adopt a virtual organisational structure for organisational performance in order to maximise time and cost.

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Upgraded Image Retrieval Based On Consolidation of Histograms with Texture Feature and Shape Feature

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Abstract –*In this paper, color histograms, texture using wavelet transform and shape feature using thresholding is used to retrieve images from the database .The database includes five hundred images of five different categories. Moreover success of this content based image retrieval depends on the method used to create feature vector and relativity measure, the accuracy of wavelet transform engaged. Retrieving images can be increases the accuracy of the system based on color, feature and shape relativity. For relativity measure between the database images and query image Mahalanobis, Minkowiski, Chebyshev, Cosine Relativity, Spearman correlation are used ,at the end aggregation of mean and relative deviation is done and aggregation is then arranged in increasing order i.e. minimum to maximum. This Arranging order shows images having minimum values are more accurate retrieved image. The Proposed system can better the retrieval accuracy that has been shown by the experimental results. The system is tested on five hundred images of five different categories downloaded from the internet.*

Keywords—*Histograms, Support Vector Machine; Mahalanobis, Minkowiski, Chebyshev, Cosine Relativity, Spearman correlation*.

INTRODUCTION

In new generation, very broad store of images and videos have grown speedily and increasing day by day. In equally with this progress, content-based image retrieval and querying the indexed store are required to access visional information. As a dynamic technique, content-based image retrieval systems have to provide easy-to-index data arrangements as well as quicker query execution facilities. To index and answer the queries that the users act to explore visional information, the content of the images and videos must be abstracted. Content-based image retrieval is a technique which uses visional contents to exploration images from broad scale image databases according to users' interests. Content based image retrieval uses the visional contents of an image such as shape, color, texture and spatial design to exhibit and index image. [1] In archetypical content-based image retrieval systems Figure 1.1, Multi dimensional feature vectors abstracts and describes visional contents of images in database. A

Feature database is formed by the feature vectors of images in database. The visional content, or generic content, of images and video frames can be classified as follows: spatial, morphological, and low-level.

Spatial-The spatial content of an image is the relative position of the objects residing in the image.

Morphological-The morphological content is the actual context of the image that a user obtains when anybody looks at the image.

Low-level- The low level feature composes low level content such as color, shape and texture.

Utilization-Content-based image retrieval has assorted applications in structural and engineering design, art store, criminality avoidance, geographic information and remote sensing systems, medical diagnosis, armed forces, photograph library, trade catalogs, nudism-detection filters, face searching, face identification, computer vision, content based image retrieval also used by exploration engine for exploration images from broad database.

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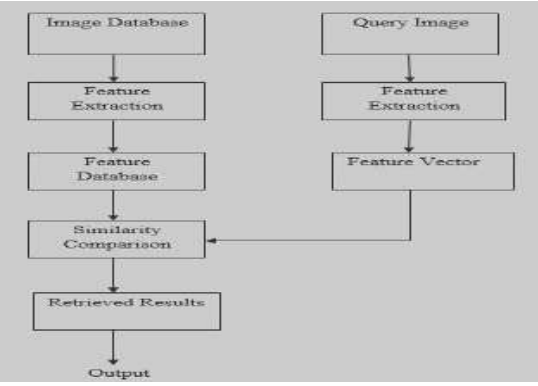

Figure1.1. Diagrammatic representation of content-based image retrieval system [2]

2. **Techniques for abstracting contents**

Following are some widely used techniques for abstracting color, texture and shape:

2.1 Color: Image retrieval used the most extensively visional content color. Its three-dimensional values make its discrimination potentiality superior to the one dimensional gray values of images. Color space must be decisive first before selecting an appropriate color description [3].

Techniques for abstracting contents: color

It has been studied from past exploration color Histogram is the good technique for abstracting color content in an image and two histograms of different images can be in comparison easily. So we decide histogram as a abstracting technique for color (i.e. visional low level feature) feature of an image and color space is finalize HSV amid (RGB, Munsell, CIE L*a*b*, CIEL*u*v*, HSV (or HSL, HSB),YCbCr, NTSC) by cause of it has been studied from past exploration that HSV color space is the good color space and gives better results.[2]

But So many techniques are available for abstracting color contents:-

- Color space
- Color Histogram
- Color Moments
- Color Coherence Vector
- Color Correlogram

Color space, each pixel of the image can be exhibited as a point in a 3D color space. So Many Color space is used for exhibited color. Some are RGB, Munsell, CIE L*a*b*, CIEL*u*v*, HSV, YCbCr, NTSC. Each color space use different process for exhibit color content. But Human can separate between images which are exhibited in RGB color space easily.

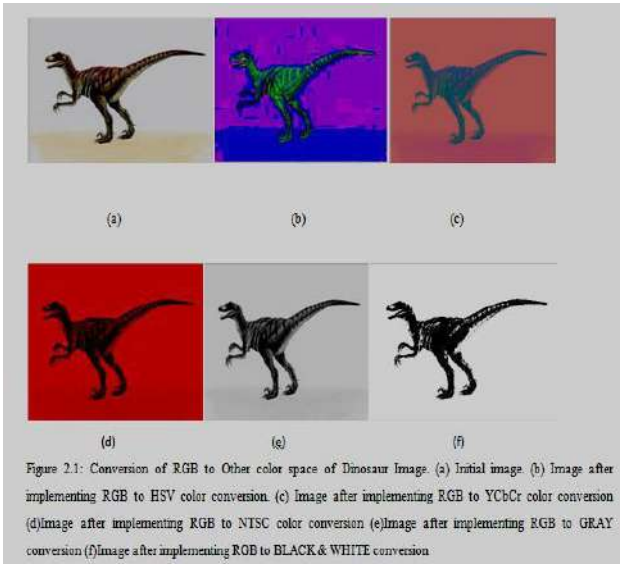

Figure 2.1: Conversion of RGB to Other color space of Dinosaur Image. (a) Initial image. (b) Image after implementing RGB to HSV color conversion. (c) Image after implementing RGB to YCbCr color conversion (d)Image after implementing RGB to NTSC color conversion (e)Image after implementing RGB to GRAY conversion (f)Image after implementing RGB to BLACK & WHITE conversion

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2.2 Texture

Techniques for abstracting contents: - texture

A Texture is periodically described as bland or harsh, soft or hard, coarse or fine, matt or glossy and etc. The word texture refers to facial attribute and actualization of an object given by the size, shape, density, adjustment, admeasurements of its elementary parts in a generic feel. [4].Texture might be divided into two categories namely tactile and visional textures. Tactile textures refer to the immediate tangible feel of a facial. Visional textures refers to the visional impression that textures produce to human viewer which are related to regional spatial fluctuation of simple stimuli like color acclimatization and intensity in an image.

But So many techniques are available for abstracting texture contents:-

- Tamura features
- Wold features
- Simultaneous auto-regressive(SAR) Model
- Gabor filter features
- Wavelet transform features
- LBP(Local binary pattern)

2.3 Shape

Techniques for abstracting contents: - Shape

Basically Shape is the geometrical property of an object or shape is the form of an object or its external boundary, outline, or external surface, as opposed to other properties such as color, texture, or material composition.
So many techniques are available for abstracting shape contents:-

- Thresholding
- Blob Extraction
- Template matching
- Hough transform

2. Techniques used for retrieval accuracy

Support vector machine – an overview: Support vector machine has become the classifier of elect of diverse examination and practitioners for certain real-world appropriation problems in practice. This is by cause of support vector machine is capable of generalizing well (anticipate the hidden or unknown patterns with a good degree of accuracy) as in comparison to many usual classifiers (neurological network, etc.) It offers convinced properties which are archetypically not found in other classifiers:

- Computationally much less speed up
- act well in higher dimensional spaces
- Loss of exercise data is often not a hard problem
- Based on decrease an evaluation of test error rather than the exercise error
- Able-bodied with noisy data
- Does not suffer as much from the curse of dimensionality and anticipate over applicable

In the context of superintended allocation, *machine learning* and *pattern recognition* is the abstraction of conformity or some sort of arrangement from a store of data. Neurological networks and bayesian classifiers are the archetypical

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examples to learn such conformation from the given data diagnosis. Support vector machine is an analogously new classifier and is based on hard base from the broad area of diagnostic learning theory. Since its inception in early 90s, it has found usage in a wide range of pattern recognition problems, to name a few: handwritten character recognition, image allocation, financial time series forecasting, face detection, bioinformatics, biomedical signal examination, medical diagnostics, and data mining.

It is the first diagnosis that exploration action in pattern recognition areas has lost out so far on this dynamic allocation method. So, an overview of Support vector machine is presented in this section .So in this paper we used Support vector machine to evaluate the retrieval accuracy. [4, 5, 6, 7, 8]

SVM (Support Vector Machine) is used to evaluate data and recognize the image class; we use the database of 500 images for testing purpose downloaded from http://wang.ist.psu.edu/docs/related/ the database include images of five different category and each category have 100 images. We form class as per five different categories.

Table 3.2:-Image Category and class of database images

S.No.	Image Category	Class
01	Africa	Class 1
02	Beach	Class 2
03	Monuments	Class 3
04	Buses	Class 4
05	Dinosaurs	Class 5

We have used Box Constraint, Kernel Function, rbf, rbf sigma to create SVM Model and train SVM Model from dataset. We have used one to one SVM to evaluate and check the accuracy. We create confusion matrix from test data, gathered from one to one SVM.

1. Create confusion matrix from test data

2. Accuracy = 100*sum (diagonal (confusion matrix))/Total Sum of Confusion matrix

We get a Confusion matrix and we are using a database of 05 different category and the total Sum of Confusion matrix is 500(i.e. Each Row).[9]

4. IMPROVED IMAGE RETRIEVAL BASED ON UNIFICATION OF HISTOGRAMS WITH TEXTURE FEATURE AND SHAPE FEATURE

4.1 OVERVIEW OF SYSTEM

Within the Structure of a diagnostic approach to the problem of text examination, a content-based image retrieval system has been implemented to query upon digital images. Recommended retrieval method is divided into four steps: feature abstraction of query and database images, relativities matching, Retrieval Accuracy and retrieving images.

(a)Feature Abstraction: In this step all the images of database as well as the query image is resized to 384x256,then HSV histogram is calculated After that colorautoCorrelogram, colormoments is calculated for color feature. For Texture Feature the query image is converted into gray scale from RGB. Then mean Amplitude and Ms Energy is calculated using Gabor wavelet, the number of scales is 4 and number of acclimatization's is 6 in Gabor wavelet. Then wavelet transform query image into wavelet moments. For shape feature thresholding is performed and the output of abstraction is stored in the form of feature vector of query image.

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(b)Matching: To calculate the difference between the query image and all the images in database we can use Mahalanobis, Minkowiski, chebychev, cosine, correlation, and spearman. Finally use relative deviation to handle the results after relativity measure.

Mahalanobis : Mahalanobis distance is a measure of distance between a point P and a circulation D, introduced by P.C. Mahalanobis in 1936.The Mahalanobis distance of an examination $x = (x1, x2, x3 \dots\dots, x_n$ from a group of examinations with mean $\mu = (\mu1, \mu2, \mu3 \dots\dots, \mu_n$ and covariance matrix S is characterized as:

$$D_M(x) = \sqrt{(x-\mu)^T S^{-1}} \quad \text{eq. 5.1}$$

Minkowiski: Minkowiski distance is a measure in a normed vector space which can be considered as a generalization of both the Euclidean distance and the Manhattan distance. The Minkowiski distance of order p between two points is given

as: $A = (x1, x2, \dots\dots, x_n$ and $B = (y1, y2, \dots\dots,) \in R^n$

Is characterized as $(\sum_{i=1}^{n} |x_i - y_i|^{1/A}$ eq. 5.2

Chebyshev: Chebyshev is a measure characterized on a vector pace where the distance between two vectors is the greatest of their differences along any coordinate. It is named on Pafnuty chebyshev. The Chebyshev distance is given by:

$$D_{Chebyshev}(a,b) := \max_i (|a_i - b_i| \quad \text{eq.5.3}$$

Where a, b are two vector or points with ai and bi standard coordinates respectively. This equals the limit of the Lp measures.

(c)Retrieval Accuracy: SVM (Support Vector Machine) is used to check the accuracy of retrieval process along with precision and recall.

(d)Retrieving images: Amid the sorted list of images, 20images with minimum relativities are displayed. These 20 images are the best suited images those are abstracted for the database or images with maximum relativities.

$$\lim_{k\to\infty} (\sum_{i=1}^{n} |a_i - b_i|$$

Cosine Relativity: -Cosine Relativity is a measure of relativity between two vectors of an inner product space that measures that cosine of the angle between them. The cosine of two vectors can be given as:

$$a.b = ||a||\,||b|| \cos\theta \quad \text{eq. 5.5}$$

Given two vectors of attributes A and B, the cosine relativity *cos (θ)*

is exhibited using a dot product and magnitude as:

$$Similarity = \cos(\theta) = \frac{A.B}{||A||\,||B||} = \frac{\sum_{i=1}^{n} A_i \times B_i}{\sqrt{\sum_{i=1}^{n} (A_i)^2} \times \sqrt{\sum_{i=1}^{n} (B_i)^2}} \quad \text{q. 5.6}$$

Spearman correlation: The Spearman correlation coefficient is characterized as:

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2-1)} \quad \text{eq. 5.7}$$

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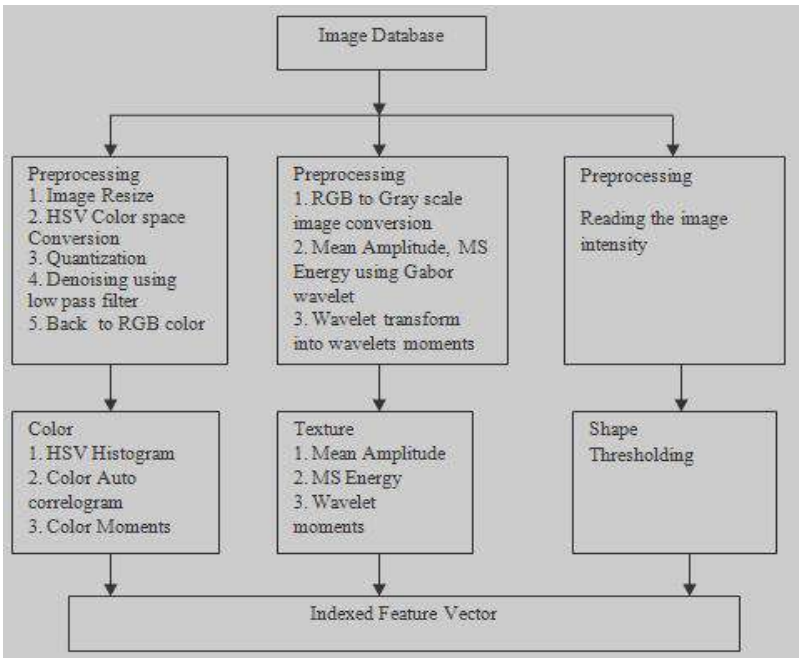
Where $d_i = x_i -$ y_i is the difference between ranks. [5]

Lastly summation of mean n relative deviation is done and summation is then sorted in increasing order i.e. minimum to maximum. This sorting order shows images having minimum values are more accurate retrieved image.



The Figure 4.1 shows block diagram which exhibits the process of retrieval *i.e.* in feature abstraction process features of image and that of query is abstracted and stored in the feature database after that matching is perform between the features of query image and all the features of database images and lastly images which are match is then retrieved.

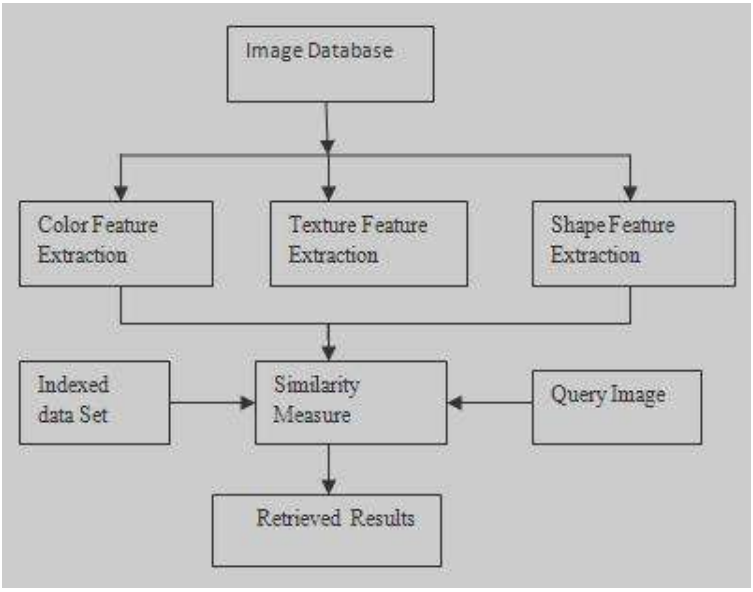


Fig: 4.2 The Architecture of the Content based image Retrieval

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The Figure 4.2 show architecture of the content based image retrieval. The color feature , texture feature and shape feature are abstracted separately from Image database then relativity measure is per compose between query image and Indexed data set which is abstracted from Image database. The retrieved results are shown after relative measure.

5. RESULTS AND DISCUSSION

To test the performance of our content-based image retrieval system on color in HSV color space, texture in Wavelet transform and shape in thresholding relativity queries, we have used database including more than 500 jpg still images. All the images of database are resized to 384 x256 jpg. In above discussed method HSV histogram (128x128) is used rather (32x32) to decrease the processing time of retrieval. However hist32 shows more accurate result but our main aim to retrieve best images with less processing time. Retrieval process applies on huge database including more than 500 jpg images different categories like Africa, Beach, Monuments, Buses and dinosaurs picture taken from http://wang.ist.psu.edu/docs/related/ [4].Figure5.1Shows the query image of each category. In the experiments, the query image is randomly picked from the database images or from the system, here we pick the query images of five categories Africa, Beach, Monuments, Buses, and Dinosaurs. And then its histogram 128x128 or 32x32 is calculated, but we prefer 128x128 since it decreases the processing time of retrieval with satisfying results. After calculating the histogram of query image Mahalanobis ,Minkowiski, Chebyshev ,Cosine Relativity, Spearman correlation is used to match the histogram from all the images in database. When relativities measure is calculated images are sorted in an increasing order and then finally first 20 images are displayed since they are the images which are best suited to the query image.

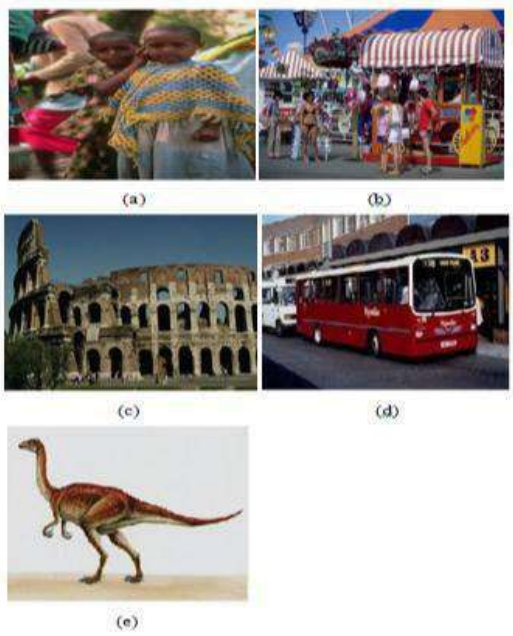

Figure5.1 Query images of different categories (a) Africa, (b) Beach, (c) Monuments, (d) Buses, (e) Dinosaurs

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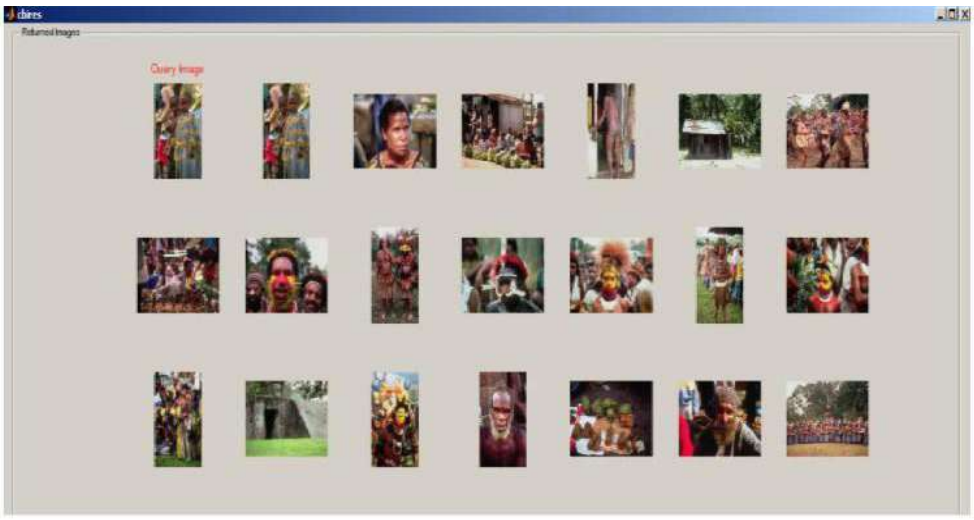

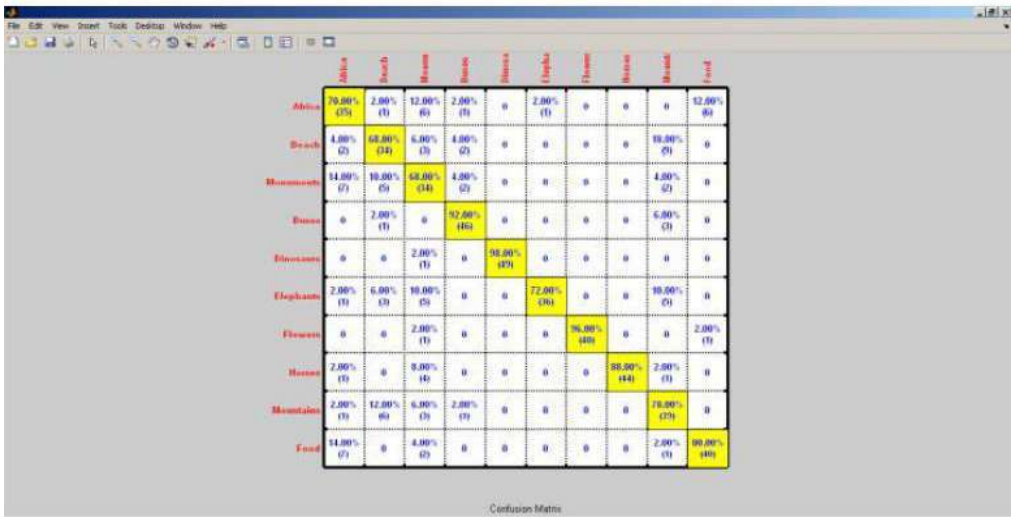

Figure5.2 Result of Africa *Figure5.3 SVM Plots of Africa*

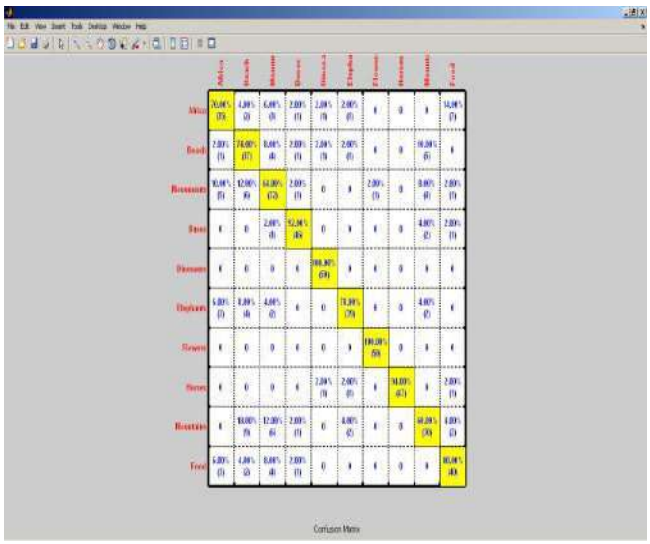

Figure5.4 Result of Beach Figure5.5SVM Plots of Beach

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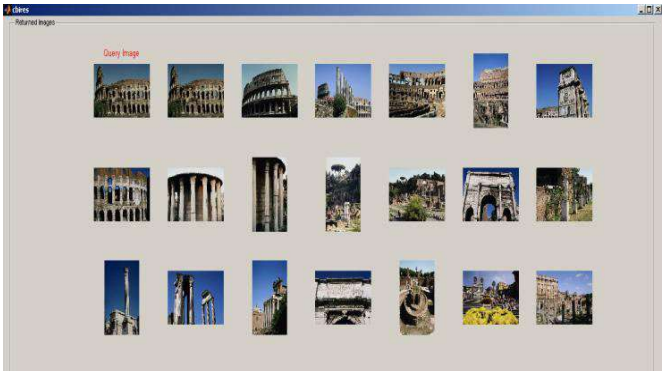


Figure5.6 Result of Monuments

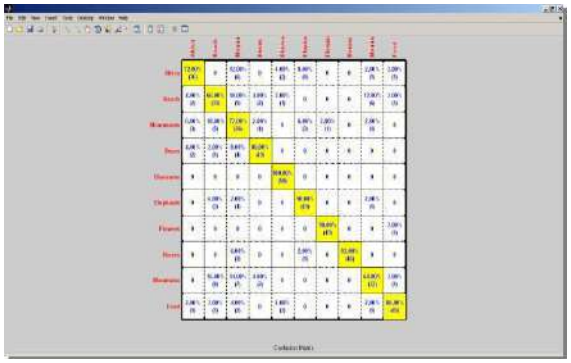
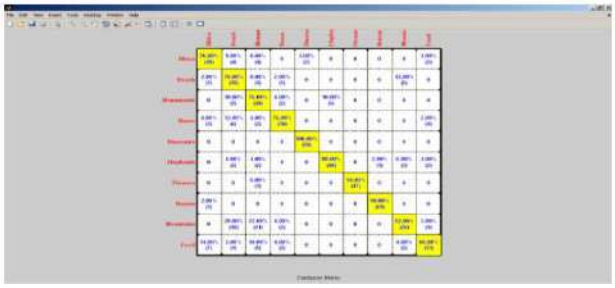


Figure5.7 SVM Plots of Monuments



Above are the results of histogram , Wavelet transform and thresholding for each correlative query image and also the plots of 20 images which shown how much retrieved images are related to the query image. Figure5.1 shows the query images of different type, fig5.2, fig5.4, fig5.6, fig5.8 and fig5.10 are results for query images of different types which are shown in figure 5.1. In fig5.3, fig5.5, fig5.7, fig5.9 and fig5.11 are the SVM plots of different query images.

5.1 COMPARISON OF ACCURACY BETWEEN CATEGORIES OF IMAGES

From the above results shown, we have examination that both of the methods given satisfying result in different category like in case of Dinosaurs ,monuments and Buses content based image retrieval gives the 100% precision and 20% recall but in case of Africa Precision is 90% and recall is 18%. In Case of Beach Precision is 95% and recall is 19%.Precision and recall is calculated as:

$$Precision = \frac{No\ of\ relevant\ images\ retrieved}{Total\ no\ of\ images\ retrieved}$$

$$Recall = \frac{No\ of\ relevant\ images\ retrieved}{Total\ no\ of\ relevant\ images\ in\ the\ database}$$

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S. No.	Image	Precision	Recall
01	Africa	90%	18%
02	Beach	95%	19%
03	Monuments	100%	20%
04	Buses	100%	20%
05	Dinosaurs	100%	20%

Table5.12:-Precision and Recall of Images from Different Category

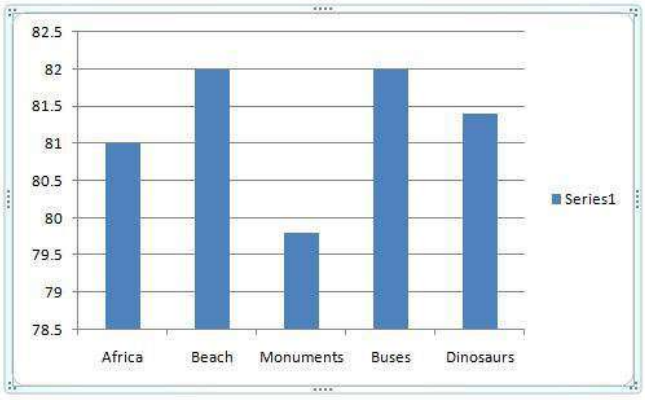

Fig5.13:-Comparison of Accuracy between different categories of Images

FUTURE ABSOLUTIONS TO EXPLORATION

This exploration solely concentrates on using color features in HSV Color space, texture in wavelet transform and shape in thresholding for Content Based Image Retrieval. Color feature can also be combined with curve let texture features to retrieve texture images. For texture features, discrete curve let can be chosen as this is found to be most effective according to new literature. Connecting discrete color features with curve let texture features may better the retrieval outcome. For shape feature Hough transformation can be used for better results but we used thresolding in this paper. In future multi feature can be used to retrieve images where more than three or four features can be used for better accuracy and better results not only mathematically as per human visional judgments also. By cause of our main aim is to build a content based image retrieval system as same as human visional system. Support vector machine is a good technique for measure the accuracy of retrieval process. Rotation invariance is an important issue to better the retrieval performance. Generically, it is assumed that the database images possess same dominant absolution. However, in reality, an image database may include related but rotated images. So, when we intend to use non-normalized features for retrieval, related images with some rotation will not be captured. Finding rotation normalized curve let features can be an important exploration issue.

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Car Mileage Prediction Using Data Science and Machine Learning Using Python

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:

Abstract – *Every year lakhs of people buy cars in India and the aim of every middle-class people is to buy the car that gives best mileage. The work proposed in this paper is to predict the mileage of the car so that user can get the idea of the mileage of his/her car before purchasing and he/she will also get which are the factors that are affecting the mileage of the car. In this paper data science and machine learning technologies are used. In machine learning MLR algorithm is used which is mostly used to make prediction and sometime classification also. In MLR technique we use one dependent and more than one independent variable and find or establish the relationship between them so as find the best fit line. Before applying MLR and OLS model to our dataset in this paper, outliers were removed which will decrease the variance in calculation and will lead us to Better prediction result which can useful for the users in future. Mileage of the car is really one of the most important factors because fuel consumption of the car affects every user in day-to-day life. So, in this paper work developed the efficient use of data science and machine learning's MLR algorithm so that the user can get a better idea of the mileage before purchasing the car.*

Keywords: *Multiple Linear Regression, OLS model, Prediction, Data Science.*

INTRODUCTION

Every year Lakhs of cars are sold in India and every customer wants that car which gives more mileage and better performance. So in this research paper proposed method is going to predict the car mileage using data science Machine Learning Multiple Linear Regression, so that the user can easily check the mileage of the car before buying that car based on the factors (cylinders, displacement,

Horsepower, acceleration, weight, model year) that affects the mileage of the car most. This will help the user to purchase the car according to his requirements [1]. In this research paper proposed method has used Data science techniques to clean the data and then Machine Learning algorithm is applied to train the data. So that he can check the mileage of the car before purchasing that car. This proposed work developed a model uses basic Linear Regression technique and data science to predict the mileage of the car. Based on some statistical values in this proposed method we can tell that how accurate the model is. MLR is also called as multiple linear regression, it is a demographic approach that utilizes many

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manipulated variables to forecast the result of output variable. The aim of MLR is to find the straight line relationship between the output and manipulated variables [2].

2. METHODOLOGY:

2.1 Machine Learning: Machine learning is a technology in which machine acts on its own automatically without being programmed explicitly. Machine Learning models improves themselves by using historical data as input to predict new output values [4].

A Machine learning model investigates the algorithm that study from data, then build model from that historical data and this model can be used for many different tasks like prediction, decision making, classification etc. learning (study) means intelligence to improve behavior based on the experience learned from historical data [5].

A machine is said to grasp knowledge from past dataset (E), w.r.t to some category of task (T), and achievement measure (P), if its achievement on task (T) as calculated by (P) enhance with experience (E).

In this research paper we have used Multiple Linear Regression algorithm.

2.2 Multiple Linear Regression: Multiple linear regression (MLR) is an advance version of simple linear regression. Unlike simple linear regression, it has more than 1 independent (explanatory variable) variable and 1 dependent variable (predictor variable).Chiefly, the explanatory variables could be perceptible or conditional. A straight line communication should be established between predictor and explanatory variable. It uses the concept of straight line to predict the value of the new output [3]. MLR is mostly used for the dataset which consist of continuous values. MLR estimate the relation between predictor and explanatory variables and tells us how those variables are correlated. This correlation can be checked by using heat maps and by seeing the numerical values of those correlations. So this is how MLR works for predicting the new values by learning from the historical data.

2.3 Equation for multiple linear regression:

$$\boldsymbol{Y = Bo + B1X1 + B2X2 \ldots\ldots BnXn + \epsilon}$$

- Y= Dependent variable.
- X= Independent variable.
- B_0= Intercept.
- B_1, B_2=Slope.
- E= Error

2.5 Dataset used for multiple linear Regression.

The dataset that has been used in this paper has been taken from UCI ML repository. This dataset is basically used here to predict the car mileage of the car in mileage per gallon (mpg). The datasetdeals with car fuel utilization in (mpg), to forecast in terms 3 multivalued and 5 continuous features.

2.6 Attributes of dataset.

- Mileage per gallon: continuous
- No. of Cylinders: multi-valued discrete
- Displacement Of the car: continuous

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- Horsepower of the car: object data-type
- Weight of the car: continuous
- Acceleration of the car: continuous
- Model year of the car: multi-valued discrete
- Origin of the car: multi-valued discrete
- Car name brand: string

2.7 OLS MODEL

OLS regression stands for ordinary least square which a statistical approach of analysis that find out the relationship between one or more than one independent variables and there is also an independent variable. This method finds out the relationship between dependent and independent variables by minimizing the sum of squares between the observed and predicted values.

In this paper proposed model OLS regression library in Python is used to establish the relationship between dependent and independent variables, and after that making predictions to find the mileage of the car.

2.8 Data Science

Data science consist of so many fields, which includes statistics, scientific methods, machine learning, and artificial intelligence, to find the hidden pattern or knowledge from the data. It includes the preparation of data for analysis, which aging includes cleaning of data, removing outliers from data, aggregating and manipulating the data to do advance data analytics. Analysis of work and data scientists can then review the results to uncover the hidden patterns and enables entrepreneurs to see informed insights. Which gives entrepreneurs the idea about the need of the users, so that they can work on that area which is more in demand and increase their business.

2.9 Important Terminologies Related to Multiple linear regression:

- **Dependent variable:** The “dependent” values is the one that is mostly of notice to the researcher and changes in respect to changes in the manipulated variables [4].
- **Independent variable:** An independent variable, as the name urge is a “stand alone” variable, and one that remains unchanged by other variables that are observed in a study [5].
- **Least Squares Estimation:** This model is used to estimate B0, B1…Bk i.e. we estimate B0 and B1 so that the sum of the differences between the observation (Yi) and the straight line is a minimum [5].
- **R-sq:** R-sq is the calculation of how close the data is to be included in w.r.t for reg. line. It is also known as the multiplicity coefficient or the coefficient [4].

  R-sq = Specified variation / total variance.

  R-sq remains between 0-100%. 0% means that the model does not define the variability of response data close to its definition. 100% indicate that the model describes all variability of response data close to its definition. The higher the R-sq model the better the data [18].
- **Analysis of variance (ANOVA):** ANOVA is group of demographic models that are used in a way to analyse the dissimilarity between group means and their associated procedure. In the ANOVA, the obtained variance in a particular variable is portioned into components attributes to different source of variation [8].

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$$\sum_{i=1}^{n(Yi-Y')2} = \sum_{i=1}^{n(Y-Y')2} - \sum_{i=1}^{n(Yi-Y')2}$$

$$\boldsymbol{Sst = SSr - SSres}$$

- **F-test:** An F-test is a demographic test that teststhe statistics depends on f-distribution under the null hypopaper. It is mostly used when contrasts demographic model that has suited to a dataset in order to recognize the model that have been fitted to dataset. The test statistic F_0 can be computed by MS_R/MS_{res}follows the F_k= n-k-1 distribution. Reject H_0, if $F_0>F_k$, n-k-1. F_0 can be obtained from ANOVA table also [5].
- **T-test (Regression coefficient):** The T-test is used to check the connotation of individual reg. coefficient in the MLR model. Adding a connotation variable to a reg. model makes the program more efficient, while summing up an un-important variable may make the model worse. The hypopaper statement to test the significance of a particular reg. coefficient [4].

$$\boldsymbol{H0: Bj = 0}$$

$$\boldsymbol{H1: Bj = ! \ 0}$$

- **P-value:** P-value or observed probability is the estimate probability of removing the null hypopaper (H_0) of a study question when that hypopaper is true [3].
- **Residual:** The difference between the observed value of the dependent variable (Y) and the predicted value (Ỹ) is called the residual (e). Each data point has 1-residual [3].

$$\textbf{Residual} = (\textbf{observed value} - \textbf{predicted value}).$$

E = Y-Ỹ.

Both the sum and the mean of the residual are equal to 0. i.e. ∑e=0 and e=0.

- **Overfitting:** When an algorithm in machine learning or in statistical analysis is used to predict future values by training itself from a training set, but in the end models itself too well. Then we say that there is an over fitting condition. Overfitting condition causes poor performance, and therefore modelling needs to be done again to get a good fit condition [4].

Underfitting: Underfitting refers to a condition when an algorithm is not able to model itself from training set, or cannot generalize itself to a new data. Since the modelling done is underfit, therefore it is obvious to say

- that the model will obviously affect the performance [3].

3. RESULT AND DISCUSSION

Scatter plots and Heat map for checking the correlation of all the independent variables with dependent variables to see the impact of those variable on the analysis.

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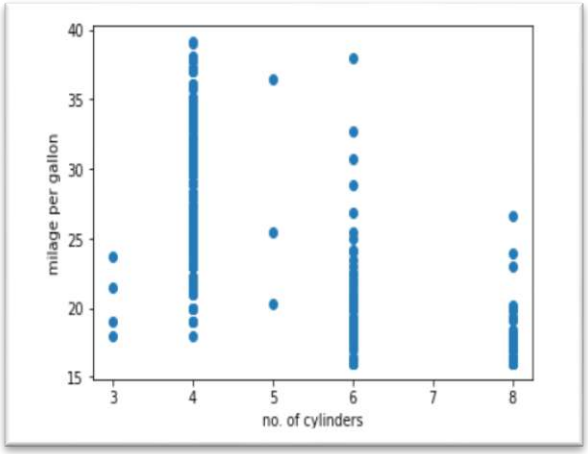

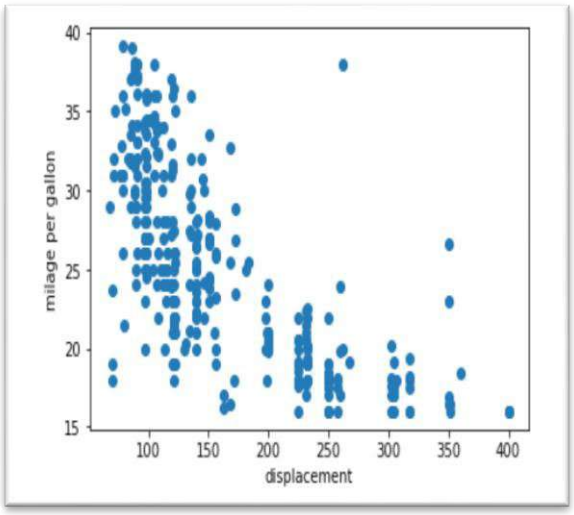

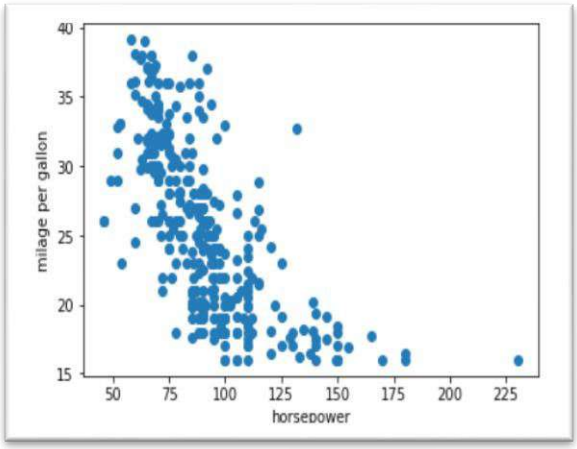

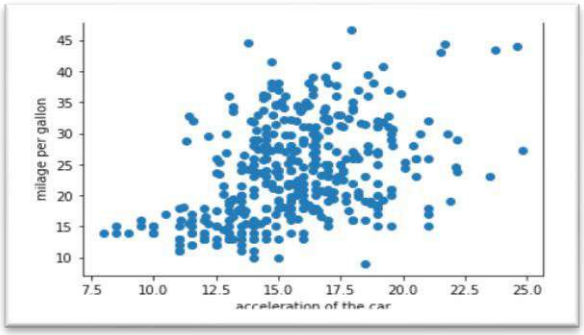

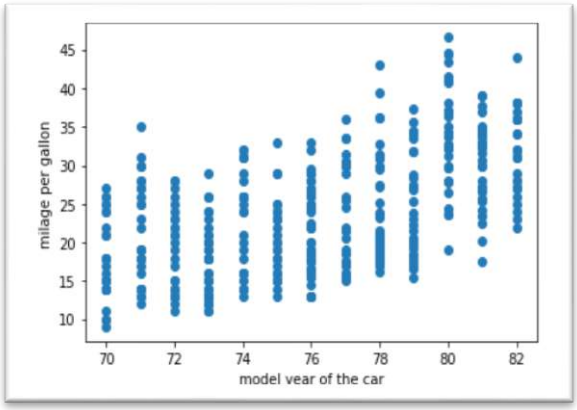

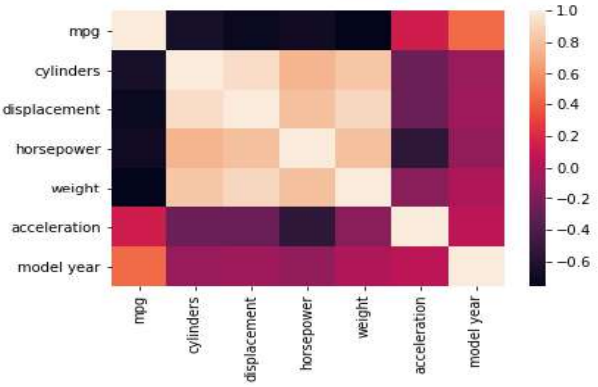

3.1 Pearson's Correlation

Pearson's correlation amongst the 'x' variables was checked (Table 2) using the "Correlation" feature available in "Data Analysis Toolpak" of Microsoft Excel-2007. According to Nivea Thomas et.al. the coefficient of correlation is a value between 0 and 1. Generally, all variables have some correlation with each other. A value close to +1 indicates a strong relationship whereas, values close to 0 indicates negligible relationship among the variables [2]. It was found that there was a high correlation (>0.9) between wheelbase and length of the car. Thus, if we run a model with these 'x' variables, the

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results could have been misleading in determining the impact of each element on mileage. Therefore, to remove the multicollinearity, the wheelbase factor was dropped. The regression model was run with these corrections [9].

$$\frac{\sum(Xi - X)(Yi - Y)}{\sqrt{\sum(Xi - X)pow2 * \sum(Yi - Y)pow2}}$$

3.2. ANOVA TABLE

ANOVA is compilation of demographicanalysis which is used in a way to analyse the show contrast between group means and their attached procedure. In ANOVA frame, the detected deviation in a specific variable is portioned in-to elements attributes to distinct source of deviation [14].

Our proposed work's ANOVA table obtained values are given below. Based from this table the selected parameter were R-square, adjusted R-square, and standard error and then made comparison bar chart.

Below the equation is also mentioned for obtaining the standard error in the ANOVA (analysis of variance) table.

$$\sum_{i=1}^{n(Yi-Y')2} = \sum_{i=1}^{n(Y-Y')2} - \sum_{i=1}^{n(Yi-Y')2}$$

$$Sst = SSr - SSres$$

OLS Regression Results

Dep. Variable:	mpg	R-squared (uncentered):	0.987
Model:	OLS	Adj. R-squared (uncentered):	0.987
Method:	Least Squares	F-statistic:	4034.
Date:	Tue, 28 Dec 2021	Prob (F-statistic):	2.21e-289
Time:	07:33:51	Log-Likelihood:	-781.36
No. Observations:	314	AIC:	1575.
Df Residuals:	308	BIC:	1597.
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
cylinders	0.1949	0.343	0.568	0.571	-0.480	0.870
displacement	0.0042	0.008	0.491	0.624	-0.012	0.021
horsepower	-0.0562	0.015	-3.868	0.000	-0.085	-0.028
weight	-0.0066	0.001	-8.550	0.000	-0.008	-0.005
acceleration	-0.2440	0.091	-2.688	0.008	-0.423	-0.065
model year	0.6599	0.024	27.669	0.000	0.613	0.707

Omnibus:	9.226	Durbin-Watson:	1.482
Prob(Omnibus):	0.010	Jarque-Bera (JB):	9.559
Skew:	0.350	Prob(JB):	0.00840
Kurtosis:	3.489	Cond. No.	5.78e+03

4. CONCLUSION

A more accurate technique is proposed in this paper for predicting the car mileage of the car using data-science and machine learning. The model proposed in this paper is accurate up to 98.7% and the standard error is also 0.350 which is very less. In the field of automobile industry this model can be of great use, even the manufactures of car will get the idea that on which factors they have to improve upon and enhance the mileage of the car that they are launching in the market.

This proposed method can be useful in other fields also like weather prediction, stock market, medical field, etc. The main conclusion of this paper is that combining data science with machine learning is the best practice for making much

accurate prediction. Data science is part of machine learning if the data is not cleaned properly and if the data is cleaned than we can directly apply our ML algorithm on the given data set.

To obtain more accurate result of prediction a proper data cleaning is also required because if the data is not processed properly it can affect our ML algorithms and instead of getting right answer we can get the answers which is not even relevant. So ML is dependent somehow on data science. Therefore in this proposed work cleaning of data is done (filling missing values, changing data type, removing outliers etc.)

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A Review of Data Mining Methods For Social Media Analysis

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Abstract – *Social Media over the past few years has received significant consideration. This is due to the accessibility of social networking sites such as Twitter, Google+, Facebook and other social networking sites and web technology 2.0. Many people are attracted and dependent on Social Media to get the knowledge and opinions of other users on various issues. It is necessary to transcribe the feelings expressed by Social Media users into useful information using data mining techniques. This underscores the importance of data mining techniques in Social Media. Data mining techniques are able to handle three important research issues with Social Media data namely size, sound and power. This paper focuses on the data mining techniques presently used in Social Mediaanalysis and looks at other data mining methods that can be considered in this field.*

Keywords- *Data Mining, Social Media, Social Networking*.

INTRODUCTION

Social media is group of Internet Based applications that has improved the concept and technology of Web 2.0 and enable the creation of exchange of user- created content. Social Media can also be linked as web services that allow users to generate public/ semi-public profile within the domain so that they can interlink with a list of other users on the network. Social Media is an important resource learning opinions, feelings, subjectivity, evaluations, approaches, assessment, influences, and observations, feelings, confirmed in the text, reviews, blogs, discussions, reports, notes, reactions or some other documents. Before the advent of Social Media, the homepages was popularly used in the late 1990s which made it possible for average internet users to share information. However, the activities on today's Social Media seem to have transformed the World Wide Web into its intended original creation. Social Media platforms enable rapid information exchange between users regardless of the location. Social Media can be characterized as a network of human interaction where communication and relationships form nodes and edges: nodes they include entities and the relationships between them form edges. Many organizations, individuals and even country governments follow suitactivities on Social Media in order to gain knowledge about how their audienceresponds to posts that concern them. Social Media enables efficient collection large scale data, leading to large calculations. However, effective mining of information obtained from themdata at scale helps discover valuable knowledge of paramount importance in various fields like marketing, banking, government anddefence. Again, efficiently mined Social Media data can be used as decision supporttool by different entities that use Social Mediacontent for different purposes.

Social Media sites are commonly known for information dissemination, opinion/sentiment expression, and product reviews. News alerts, breaking news, political debates and government policy are also discussed and analysed on Social Media sites. However, while some opinions on Social Mediaassist users and other entities to make useful decisions, some are mere assertions and therefore misleading [45]. Users' opinions/sentiments on Social Media such as Twitter, Facebook,

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YouTube and Yahoo are basically positive, negative or neutral (neutral being commonly regarded as no opinion expressed). Online opinions can be discovered using traditional methods but this is conversely inadequate considering the large volume of information generated on all Social Media sites as present in Fig.1. Reviews of works in Social Media analysis in as well as sentiment analysis on Social Media are discussed in section 2.

Fig 1

SOCIAL MEDIA BACKGROUND

In the last decade Social Media have become not only popular but also affordable and universal communication means which has thrived in making the world a global village. Social Media play an active role in publicising how people feel about certain products/services, issues and events in many aspects of life. This can be said to be as a result of the affordability of accessing the social network sites through the internet and the advances in web 2.0 technologies.

In the last decade, Social Medias have become not only popular but affordable and universal means of communication that have thrived in making the world a global village. Social Medias play an active role in publicizing how people feel about certain products/services, issues, and events in many aspects of life. It can be said that this is a result of the availability of access to social networking sites through the Internet and the advancement of Web 2.0 technologies.

Social Media bestowed upon its user unimaginable power through express your opinions and feelings on the Social Media site, whether positive or negative[4], [61]. Organizations are now realizing the importance of opinionconsumers (as posted on Social Media) to develop their products orservices Personalities try to protect their image and areaware of how they are perceived on Social Media. Organizations, political groupsand even private individuals monitor activities on Social Mediato keep upwith how their audiences respond to issues that concern them [32], [12], [17].

The representation of data on a Social Mediaconsists of nodes and links in a data graph. The Nodes are made up of entities, while links are relationships between entities as shown in Fig.3. A real example of this is individuals on Facebook, representing friends, relatives and colleagues nodes that are linked to this individual. This explains why Chi,Y et al (2009) apply graph structure to sentiment analysis on Social Mediain order make specific considerations [18].

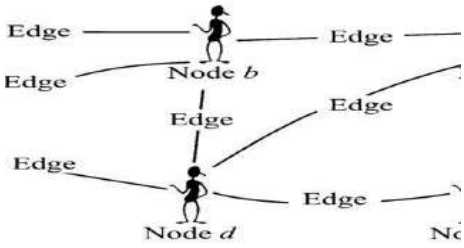

Fig 2

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SENTIMENT ANALYSIS IN SOCIAL MEDIA

After explaining the background of Social Media, we will now discuss sentiment analysis on Social Media. Sentiment analysis research has its roots in articles published by [24] and [73] where they analyzed market sentiment, and later gained more ground a year later, when authors such as [75] and [58] reported their findings. Opinions expressed by Social Mediausers are often compelling and these indicators can be used to form the basis of choices and people's decision to patronize certain products and services, or endorsement of a political candidate during elections [39], [62]. Sentiment analysis can be characterized as the discovery and recognition of positive or negative expression of people's opinions on various topics interest.

It is worth noting that the huge opinions of several million Social Mediausers are overwhelming, from the very important to the mere statement (e.g. “That's why the phone doesn't come in my favourite colour it's a waste of money"). As a result, it was necessary to analysesentiment expressed by Social Mediausers using data mining techniques for purpose create a meaningful framework that can be used as a decision support tool. This can be achieved by using algorithms and techniques discover the sentiment that is important to a topic, text, document or personality under control. Opinion research motive and sentiment. The analysis is basically to recognize the potential shift in the company if it concerns attitudes, observations, sentiment and expectations of the participants or population and make quick necessary decisions. It's more important translate sentiment expressed into useful knowledge through mining and analysis [39]. In this review, there are various data mining techniques in sentiment the Social Mediaanalysis and any new ones that can be used will be assessed in the field will be considered.

3.1 Research Issues and Challenges in Sentiment Analysis on Social Media

Many numbers of research issues and challenges are faced while implementationthe use of data mining techniques in sentiment analysis can be identified as follows:

- **Implications of social procedures from data and the problem of individual privacy protection in Social Mediaanalysis [44].** While most research conducted on Social Mediauses public data, a rich emerging source of social interaction data comes from heavily protected private data such as emails, phone conversations, and instant messaging. There is ongoing research on information seeking, community building, and gaining popularity and influence in Social Media[40], [43].
- **Link inference problem -** that's a problempredict bonds not currently present in the Social Media. The teamdo relevant upcoming links and basicknowledge of enemies and terrorist networks on Social Mediawillknow before it appears [4], [49].
- **Valence issues in sentiment categorization [63] –** Equalalthough sentiment analysis is all about positives and negativesfeelings; neutral is the centre of positive and shouldn't beneglected as the inclusion of neutral training instances in learningreinforce differences in positive and negative moods(Koppel &Schler, 2006). However, neutral in most studies to datesentiment is ignored when training classification models.
- **The query classification problem [62];** KDD Cup, [60]. Thisthe problem lies in the question of short questions and implicate subjective intentions of users. The two problems raise a question ofhow researchers will immediately understand the user's intentionwhen searching the web using search queries. Requestclassification thus becomes a problem that must be addressedby industry researchers. KDD Cup, 2005, in the yearcontest, required participants to rank 800,000 searchesqueries in 67 predefined classes. These classes were being evaluatedwith 2 levels. The top 7 categories have many second tier onessubcategories. The agreement was used for two reasons;the first is to include the main aspects in the information on the Internetspace; and the second is that competition is relevant in reality.The final result of the contest shows that: There is no directtraining data.\
- **Evaluation Inference Problem [60] -** Going furthercategorize texts or products based on positives or negatives onlyusing numerical rating (from one star to five stars). Pan and Leeevaluated human performance in the task with respect to the meta-algorithmbased on a metric labelling formulation of setback, making surethat comparable items receive the same labels by changing aoutput of the specified n-ray classifier in a clearly defined effort. Wasshowed that the meta-algorithm was capable of delivering outstanding resultsfar superior improvements to SVM multiclass and regression when a new comparison measure commensurate with the problem was used.

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TOOLS FOR SENTIMENT ANALYSIS IN SOCIAL MEDIA

Several systems have been developed in an attempt to enumerate / analyse the sentiment arising from products, services, events or reviews about the personality Social Media[29]. There are tools already used in sentiment analysis, ranging from simple counting methods for machine learning. This includes categorization Opinion-based text using the binary distinction of positive versus negative [31], [58], [75], [25]. It turns out that there is a binary distinction of positive versus negative insufficient in classifying items in terms of recommendation or comparison of the opinions of different reviewers [60] (for example, using two actors several films to decide which of them to see in the cinema). Determinant Social Mediadoc's players have also become invaluable as influencers actors are considered variables in documents [81] when applying the data Social Mediamining techniques. The idea of co-occurrence can also be seen as valid information [28].

The data mining tools examined in this paper are mainly those currently in use ranging from unsupervised, semi-supervised to supervised learning. A table listing those covered in this document is presented in section 7.

4.1 Aspect-Based/Feature-Based Opinion Mining Problem

Appearance-based analysis, also known as feature-based analysis, is the process of the client entity mining area examined [34]. This is because not all aspects / characteristics of an entity are often examined by customers. It is then it is necessary to summarize the aspects examined to determine the polarity of the general review whether they are positive or negative. Feelings expressed some entities are easier to analyse than others [51], one of the reasons being that some reviews are ambiguous.

According to [51], the problem of aspect-based opinion lies more in blogs and discussions in forums and reviews of products or services. The aspect / entity (which can be a computer device) reviewed is "thumbs up" or "thumbs up."down ', the thumbs up is a positive review while the thumbs down means negative revision. Conversely, in blogs and forum discussions both aspects and entity are not recognized and there are high levels of insignificant data that constitute noise. It is therefore necessary to identify the opinion phrases in each review to determine if indeed each opinion sentence is positive or negative [34]. Opinion phrases can be used to summarize based on aspects opinion that improves the overall extraction of the review of products or services [51].

One opinion holder [6], [42], [78] expresses both positive and negative opinion on an entity or part of it when expressing a periodic opinion nothing else [34]. However, [45] found it necessary to differentiate the two assignments to discover neutral feelings from non-neutral feelings, and also positive and negative feeling. This is believed to greatly increase the correctness of IT structures.

DATA MINING TECHNIQUES USED IN SOCIAL MEDIA

Data mining techniques are capable of handling the three dominants disputes with Social Mediadata which are size, noise and dynamism. Social Mediadata set they are very bulky and require automated information processing for analyse it in a reasonable time. Since data mining also requires huge amounts of data set to extract remarkable patterns from the data, Social Mediasites seem to be perfect sites to work on, especially where the expression of opinions / feelings is involved [22]. Social Mediadatasets are also characterized by noisy data such as spam blogs and irrelevant tweets in the case of twitter. Dynamism in Social Mediadata sets it causes it to evolve rapidly over time and data mining techniques are versatile in handling such dynamic data. The use of data mining techniques on MS data is an enabler for advanced search results in search engines and also help to better understand the data for search organizational functions [4].

Analysing opinion and sentiment on a movie review uncovered that machine learning proved to be a better technique than simple counting methods [58]. Using the combination of the Naïve Bayes classification, MassimoEntropy Classification and Support Vector Machine (SVM) reveals that SVM produced the best result. Although the views associated with these three the algorithms are clearly different; all were efficient in the previous text learning of classification. Data mining techniques capable of mining the stream data faces classification problems when managing micro-blogs like twitter due to the high data flow model used by twitter to broadcast data. Algorithm design also faces serious problems with the algorithm predict real time in a very small space of time and memory. [7]. Twitter has proven to be the most used microblogging application around today. With around 500 million estimated registered users as of June 2012, Twitter has

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evolved to be a credible medium of expression of feeling / opinion. It is also a remarkable means of information spread since it was launched in 2007. Twitter data (known as tweets) may be referred to as "live news". The network reports profits information from different perspectives for better understanding. Tweet published online include news, important events and topics that may be of a local nature, national or global interest. Several events / occurrences are actually tweeted time around the world by making the network generate data quickly.

In January 2013, the citizens of Japan set a new year record started, reaching 33,388 tweets per second. As of March 2013, Twitter the network generates 340 million tweets per day. Many organizations, individuals and even government agencies follow the activities on the network in order to do so gain insight into how their audience reacts to tweets about them. Twitter users follow other users on the network and in so doing they are able to read tweets posted by their "following" users. This is also one way to do it filtering tweets of interest from the huge tweets posted on the net on a daily basis. A common way to tag a tweet is to include a number hashtag symbols (#) that describe its content. Twitter as a social network and hashtags such as tweet labels can be scanned to detect changes to event patterns using association rules (AR). We can use Twitter posts (known as tweets) to analyse associated patterns events by detecting the dynamics of tweets. Extraction of the rules of the association (ARM) can find hashtag co-occurrence probability. In our previous one paper [1] we use ARM to analyse tweets on the same topic consecutively time period's t and t + 1. We also use rule matching (RM) to detect changes in patterns such as "emergent", "unexpected", "new" and "dead" rules in tweets. This is achieved by setting up a user-defined rule match Threshold (RMT) to match rules in tweets at time t with those in tweets at t+ 1 to detect the rules that fall within the different schemes. We have coined this method proposed Transaction-based Rule Change Mining (TRCM) as described in Fig. 4. Finally, we linked all the detected rules to real life situations such as events and news.

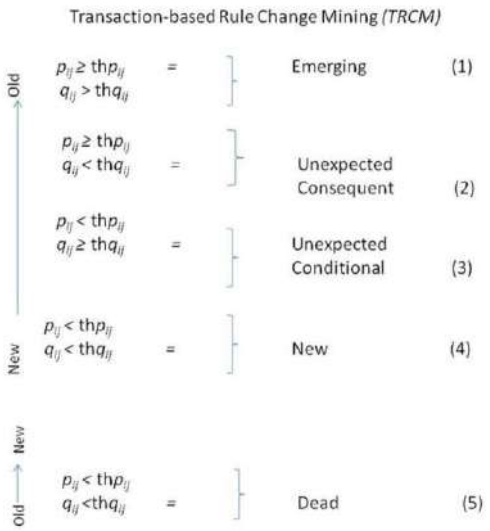

Fig 3

5.1 Unsupervised Classification

A simple unsupervised learning algorithm can be used to rate a review as "thumbs up" or "thumbs down" [75]. This can be a way to extract sentences that include adjectives or adverbs (part of the speech tag) [66]. The semantic orientation of each sentence can be approximated using PMI-IR [74] and then rank the review using the mean semantic orientation of the sentence. A previous experiment conducted to establish the semantic orientation of the adjective used a complex algorithm that was limited to isolated adjectives to adverbs or longer sentences [31]. The strength of the title, body and comments generated by the blog post was also used to group similar blogs into meaningful groups. In this case, keywords have played a very important role that can be multifaceted and bare [3]. EM-based and constrained LDAs were used to group aspect phrases into aspect categories.

5.1.1 Sentiment Lexicon

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This is a dictionary of sentimental words that reviewers often use in theirs expression. The lexicon of feeling is the list of common words that improves data mining techniques when mining sentiment is used in the document. Different lexicon of the corpus of feelings can be created for a variety of topics. For example, sentimental words used in sports are often different from those used in politics. Expanding the occurrence of the lexicon of feeling helps focus more on analysing the specific occurrence of the topic, but with the use of high labour [29]. Vocabulary-based approaches require analysis to work on simple, comparative, compound, conditional sentences and questions [26].

The lexicon of feeling can be expanded through the use of synonyms. Nonetheless, the expansion of the lexicon through the use of synonyms has a disadvantage of formulation losing its primary meaning after a few recapitulations. Feeling the lexicon can also be improved by "throwing out" neutral words that are neither expressed positively nor negatively.

5.1.2 Definition of opinion and summary of opinion

Comprehensive information, automatic summarizing. Opinion definition and opinion summarization are essential Vision recognition techniques. opinion definition a text, sentence, or topic in a document; can also reside in all document. Opinion summarization summarizes the different opinions posted on the piece emotion poles, degree and associated events [46]. This approach is examined with intermediate sentences. Ideation is vital for summarizing and for subsequent monitoring. Ideas are extracted by researching texts, topics and documents. It is necessary to summarize the opinion, because all opinions are the document is expected to be important for the publication under consideration. Idea summarization is highly beneficial for both businesses and government, [25], [55] for helping to develop policies and products, respectively. Moreover helps to remove redundant information [76].

5.1.3 Sentiment Orientation (SO)

Common products are likely to attract thousands of reviews and this can make it harder for prospective buyers to track available reviews can assist in decision making. On the other hand, vendors use SO to: Other rating standards to protect irrelevant or misleading reviews present reviewers with a 5-star rating showing the five best ratings while one means poor rating. Used to develop SO in [82] performance of mood classification. LiveJournal blog corpus dataset (previous value) used to train and evaluate the method used. The paper made a modular presentation competent hierarchical classification technique that is easily applied together With SO attributes and machine learning techniques first result due to classification accuracy was only slightly above baseline. The fact that it's the first try.

Later, a flexible mood approach based on hierarchy was included mood classification considering all possible mood tags. Final result discovers features that point to the correct classification of mood, expression can still be chosen despite the enormous amount of words located in the blog corpus of various domains.

5.1.4 Opinion Extraction

Sentiment analysis deals with the construction and classification of the subjective. Information found in a material [79]. This may not necessarily be factual as people have different feelings towards the same product or service, subject, event or person. In order to determine the target, it is necessary to extract an opinion. The full portion of the document in which the true opinion is expressed. Idea from a person on a particular subject. The individual is an authority in the subject area. Again, opinion from various organizations, both to extract opinions and to summary [51].

The more people there are, the more opinions are needed those who express an opinion on a particular issue, the more important It may be worth removing the part. The emotion/opinion may be directed towards a specific goal article can compare two or more articles. This a formal view, the second comparative [35], [51]. Opinion extraction identifies subjective sentences with emotional expressions positive or negative classification.

Other Unsupervised learning currently in use include: speech tagging. In POS, adjectives are labelled to show positive andnegative ones. Emotional polarity isit transforms the opinion document into a positive and negative opinion to a large extent [62]. Insidereview this is often referred to as 'thumping' and 'boosting' expression. The polarity of positive versus negative, a General analysis of the feelings expressed on the subject under study. Bootstrapping forms part of unsupervised approaches. Uses obtainable primary classifier to make the labelled data inspected. The process can be built on [65], [78], [37]. Another unsupervised approached an approach that has already been considered [62] is called the blank slab. Semantic orientation is also one of the currently used unsupervised approaches. Sentiment analysis in Social Media. It uses different meanings for a single meaning word - synonym. This can be positive or negative (for example, 'party bad' can actually mean that the party is fun). Direction and the density of the words used can determine the semantic direction of the words.

5.1.5 Basic Clustering Techniques

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K-means and hierarchical agglomerative clustering can be used to analyze small text documents. The k of the cluster is entered into the k-means algorithm, which detects the k reported in the document and subsequent documents [13]. The coordinate in the vector space is initially randomly clustered, then each text document entered is clustered iteratively, allocating it to the strongest cluster. The coordinate in the vector space is recalculated as the center of all documents distributed in the cluster. However, the experiment had to be repeated until a stable result was obtained. It has been resolved that even when N dimensions have only two possible values (positive and negative), the number of documents entered is always too insignificant to fill each of the 2N potential cells in the vector space. The unsupervised nature of most of this brand makes it difficult to detect a shortage of unsuitable size for similarity calculations. With its shortcomings, K-tools are far from a viable technique for mining sentiment analysis in Social Mediagiven the volume of posts generated on these sites.

5.1.6 Using Clustering for Opinion Formation

The emotions expressed by Social Mediausers are largely based on personal opinions and cannot be regarded as absolute truth, but other users' decisions on various issues. There are different Players in Social Media; while there are influential players, there are also docile ones. Opinions/reviews of influential users about Social Mediaare often important. These users by doing so may influence the opinions of other users in the media idea formation develops.

The clustering technique of data mining can be used to model the view Build by evaluating affected nodes and unaffected nodes. Users expressing the same view are connected under the same nodes and those who disagree are linked at other nodes. Behaviour Therefore, participants in each node are subject to adjustments in awareness. behaviour of participants at other nodes [39]. Idea formation begins from the first stage, which the majority of the participants did not pay attention to At this stage, an important issue is the act of recourse. This is how they are Don't think the action is feasible. When credible information is presented The opinion is cascaded and participants are either positive or negative decisions At this stage, the decision of influential participants are either efficient in their field or have communication skills. follower of the minority. At this point the first phase is converted to a warning phase filtration step It occurs when the minority is able to form a different opinion based on others. the behaviour of agents and the introduction of new information.

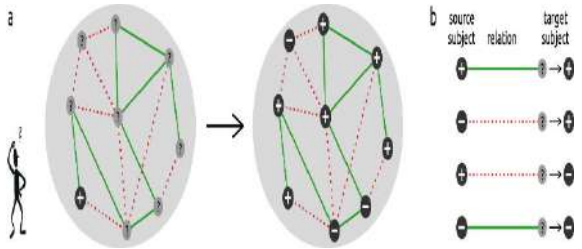

Fig 4

5.2 Semi-supervised Classification

Semi-supervised learning is a goal-directed activity, but unlike it unsupervised; can be specifically evaluated. The authors of [27] a seed mini-training set in positive and negative expressions selected for a term classifier training. Added synonyms and antonyms comparisons to seed clusters in an online dictionary. It was necessary to produce the approach extended sets of P' and N' that make up the training sets. Other students was used and a binary classifier was constructed using each glosses. Dictionary for both terms in P'∪ N' and converting them to a vector [27], [51] explore the origins of the information their approaches report. Previous techniques used for the task were absent. Semi-supervised dictionary. The classification proposed by [68] disseminating the approach to include supervised learning and unlabelled data. The cluster assumption is made by grouping two documents together same cluster mainly supports positive - negative emotion words as emotional documents, attention was drawn to the polarity of emotions the document decides the polarity of the word and vice versa.

In semi-supervised learning, [64] used polarity detection as semi supervised label propagation problem in a graph. Each node representing words whose polarity was to be discovered. The results shows label propagation progresses outstandingly above the baseline and other semi supervised techniques like Mincuts and Randomized Mincuts. The work of [30] compared graph-based semi-supervised learning with regression and [60] metric labelling which runs SVM regression as the original label preference function comparable to similarity measure they proposed. Their result shows that the graph-based semi-supervised learning algorithm as per PSP comparison (SSL+PSP) proved to perform well.

5.3 Supervised Classification

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While clustering techniques are used where basis of data is established but data pattern is unknown [4], classification techniques are supervised learning techniques used where the data organisation is already identified. It is worthy of mention that understanding the problem to be solved and opting for the right data mining tool is very essential when using data mining techniques to solve Social Mediaissues. Pre-processing and considering privacy rights of individual (as mentioned under research issues of this paper) should also be taken into account. Nonetheless, since Social Mediais a dynamic platform, impact of time can only be rational in the issue of topic recognition, but not substantial in the case of network enlargement, group behaviour/ influence or marketing. This is because this attributes are bound to change from time to time. Information updates in some Social Mediasuch as twitters and Facebook present Application Programmers Interfaces (APIs) that makes it possible for crawler, which gather new information in the site, to store the information for later usage and update.

A supervised learning algorithm [75], multiple basics of facts for labelling several adjectives that are similar or different semantic orientations. The algorithm resulted in a graph with nodes and adjectives and links representing their similarity (or difference) semantic orientation, respectively. On the other hand [58] naïve Bayes, Maximum entropy classification and Support Vector Machines Examine whether it is sufficient to treat emotion classification as just that. Positive or negative, or possibly specific subject-based categorization emotion-classification methods had to be built.

5.3.1 Classification Algorithms

Naive Bayes, SVM and Maximum Entropy classification techniques. Three main common uses when dealing with emotions analysis [9], [70], [58], Clarke et al use WEKA as standardsetting and other classification tools like Decision Tree, K-nearestBayesiannetworks of adjacent terrain to create Error Reduction (JRip).Support Vector Machine, Polynomial Naive Bayes and Maximum Entropy is used with pipeline style. Discover emotions expressed by people in Dutch, French and English tongue. The technique was used to explore their experience. Consumption of certain products. Approach approved for active use learning to label training examples provides significant improvements total results. Different attribute selection comparison, including MI, IG, CHI and DF, together with learning methods such as K-NN, Naive Bayes, SVM, Centroid and Window classifier in idea mining for Chinese Made by [70]. Their experiment proved IG Premium for collection of sentiment expressions while giving best performance for SVM emotion classification. In his studies, this emotion the classifier relies only on subjects and domain. Features of supervised learning is perhaps the most common study problem [51].

5.3.2 Support Vector Machine

The Support Vector Machine (SVM) is used on heavily tried data Mining techniques in Social Mediasentiment analysis. A kernel-based supervised learning technique DVM is still an unresolved research problem but it is a very fast technique in assessment training. It can be said in sentiment analysis is popular due to its non-linear nature. This makes it easy to evaluate both theoretically and numerically. SVM is a Machine learning model of efficient relationship between output and input-output variable that can be said to be an almost linear mixture in the input vector components. SVM has the highest efficiency in traditional text categorization compared to other classification techniques such as Naive Bayes and Maximum Entropy [67].

5.3.3 Naïve Bayes

Naive Bayes is a supervised learning algorithm used for classification tasks. Therefore, it is also called the Naive Bayes Classifier.

Like other supervised learning algorithms, pure Bayesian uses features to make a prediction on a target variable. The main difference is that naive Bayesian assumes that the features are independent of each other and that there is no correlation between the features. However, this is not the case in real life. This naive assumption that the attributes are unrelated is why this algorithm is called "naive".

5.3.4 Neural Network

Neural networks, also known as artificial neural networks (ANNs) or simulated neural networks (SNNs), are a subset of machine learning and are at the heart of deep learning algorithms. Their names and structures are inspired by the human brain, mimicking the way biological neurons send signals to each other.

Artificial neural networks (ANNs) consist of an input layer, one or more hidden layers, and a node layer that includes an output layer. Each node or artificial neuron connects to the other and has an associated weight and threshold. If the output of any node is above the specified threshold, that node is activated and data is sent to the next layer of the network. Otherwise, no data is transmitted to the next layer of the network.

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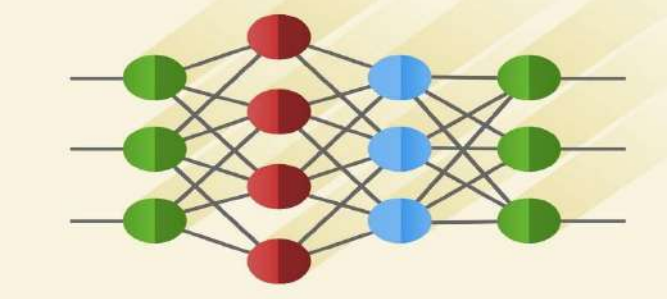

Fig 5

5.3.5 K-Nearest Neighbour

The k-nearest neighbour algorithm, also known as KNN or k-NN, is a non-parametric, supervised learning classifier that uses proximity to make classifications or predictions about the grouping of an individual data point. While it can be used for regression or classification problems, it is typically used as a classification algorithm based on the assumption that similar points can be found close together.

For classification problems, a class label is assigned on the basis of majority vote - i.e. the label that is most frequently represented around a given data point is used. While this is technically considered a "majority vote", the term "majority vote" is more commonly used in the literature. The difference between these terminologies is that "majority voting" technically requires a majority of more than 50%, which primarily works when there are only two categories. When you have more than one class—e.g. you don't necessarily need 50% of the votes to come to a conclusion about four categories, a class; you can assign a class label with more than 25% of the votes.

5.3.6 Decision Tree

The decision tree is the most powerful and popular tool for classification and prediction. A decision tree is a flowchart-like tree structure in which each internal node represents a test on an attribute, each branch represents a result of the test, and each leaf node (terminal node) carries a class label.

A tree can be "learned" by dividing the resource set into subsets based on an attribute value test. This process is repeated iteratively on each derived subset, called iterative partitioning. The recursion is complete when the subset in a node all has the same value of the target variable or the splitting no longer adds value to the predictions. Building a decision tree classifier does not require any domain knowledge or parameter setting and is therefore suitable for exploratory knowledge discovery. Decision trees can process high-dimensional data. In general, the decision tree classifier has good accuracy. Decision tree deduction is a typical inductive approach to learning about classification.

LIST OF DATA MINING TECHNIQUES CURRENTLY USED IN SENTIMENT ANALYSIS

Different data mining techniques were used in sentiment analysis. Social Mediaalternating between unsupervised, semi-supervised and supervised learning methods. So far, different levels of success have been achieved with its use. These techniques are either singly or in combination. The result of many experiments in Social Media’ssentiment analysis shed more light on the activities your Social Media. It also revealed that the opinions of Social Mediausers can take different forms either taken into account when making valuable decisions individually, at the corporate or government level. Different data mining techniques (unsupervised, semi-supervised and unsupervised) used in emotion as much Social Mediaanalysis as this review can cover.

CONCLUSION

Analysing Social Mediadata, especially opinions/emotions expressed by Social Mediausers. It has been proven to be effective and useful with data mining techniques. Research in the field so far. Because of this capacity Data mining has to process noisy, large and dynamic data. Different authors developed several algorithms that can be used to mine. Opinions

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of Social Media'sonline users. Numerous works reviewed largely Support Vector Machine (SVM), Naive Bayes and Maximum Entropy.

Although some authors consider other data mining techniques such as association Rule Mining, Decision Tree, KNN and Neural Network, these are techniques SVM, Naive Bayes and Maximum Entropy. But his reports were helpful for the swap interpretability purpose. It is expected that future studies will benefit data mining techniques, both currently used and yet to be explored, to investigate Dive deeper into the mining of the ever-increasing online data generated daily in Social Media. The results of the investigation are expected to help different organizations. Receiving vital information about Social Mediaand ultimately using that information as decision support tools.

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Trans-Play

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Abstract -*Cryptography is the technique of secret writing, from old ages. As cryptographic technique (also known as 'cipher') takes new shape & form, so as the cryptanalytic (code breaking) advanced. Every cipher is cryptanalyzed, no matter what time it took. This paves the way of new generation of cryptography called "Hybrid Cryptography". Because we know the strong area of an old armor but we don't know the vulnerabilities of the new armor. In this paper I'm suggesting the hybrid cryptography (Trans-Play) by the use of Transposition & Playfair cipher techniques. Which in my consideration is a 'tough nut to crack'? Until the key/cipher man is on wrong side/hand.*

Keywords: *Cryptography, Cipher, Cryptanalysis, Hybrid Cryptography, Transposition, Playfair, Trans-Play, Key.*

INTRODUCTION

Trans-Play Cipher technique is the Hybrid Cryptography type. This in turn is the combination of two basic cipher techniques known as 'Transposition' & 'Playfair' cipher techniques. In transposition cipher we wrote the **message (m)** of key's length. Then create the cryptogram column by column. If there's space, then it will be filled by 'x' or 'z', due to their rare use. After this the original text is sorted (alphabetically) according to the key (letters). This sorting results in a cryptogram. Let's first take a look at the technique of transposition cipher [2-5].

Transposition Cipher Technique

The sender has the **message (m)** – "**OUR COVER IS BLOWN FLEE AT ONCE**"

& the Key – **ZEBRA**

ENCRYPTION

Transposition Cipher encryption technique:

Z	E	B	R	A
5	3	2	4	1
O	U	R	C	O
V	E	R	I	S
B	L	O	W	N
F	L	E	E	A
T	O	N	C	E

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The Cryptogram (Coded **Message (m)**) results as:

OSNAE RROEN UELLO CIWEC OVBFT

We'll continue with the above cryptogram as well as the key. So it is applied to Playfair cipher technique. This is as follows:

DECRYPTION

Transposition Cipher decryption technique:

1. Write the cipher text in columnar way.

2. Try to read the letters in a meaningful way, viz. in any row.

3. Reassemble the columns in the readable format, after clearly distinguish (read) any word.

The Playfair Cipher Technique:

In this cipher [6-9] we create a grid of 5 Rows by 5 Columns. First we place the Key from first row & then the remaining letters of alphabet. At first everyone is confused about the 26 letters of alphabet, in 25 fields. The clarity is 'I/J' is considered as same, due to their pronunciation in middle & eastern-Europe. Let's create the grid first.

Z	**E**	**B**	**R**	**A**
C	**D**	**F**	**G**	**H**
I/J	**K**	**L**	**M**	**N**
O	**P**	**Q**	**S**	**T**
U	**V**	**W**	**X**	**Y**

And the **message (m)** (encrypted) from previous technique is: **OSNAE RROEN UELLO CIWEC OVBFT**

ENCRYPTION

The rules of creating cryptogram from Playfair cipher technique is:

1. The letters are paired first. If a letter remains, then it is paired with 'X'.

2. The pair is look-up from the grid. If they are in same row or column then the letter next to them is considered as replacement. If any of the letter is last in row/column. Then first letter replaced that letter in the circular way.

Q	**W**	**E**	**R**

If the pair is QR, then Q is replaced by W, while R is replaced by Q in circular way.

T
G
F
C

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If the pair is FC, then F is replaced by C, while C is replaced by T in circular way.

3. If the pair forms the diagonal of the rectangle, then the end letters of their rows will replace them.

Q	**W**	**E**	**R**
T	**Y**	**U**	**O**
P	**A**	**S**	**D**
F	**G**	**H**	**K**

If the pair is OF then the other two vertices of rectangle are TK. Then O is replaced by T, while F is replaced by K.Therefore, after applying Playfaircipher technique, the resultant cryptogram is:

PT TH BA ZS AK VZ QQ UI LU ZD PU FL SY

DECRYPTION

The rules of extracting original **message (m)** from cryptogram, created from Playfair cipher technique is:

1. The letters are paired first.

2. The pair is look-up from the grid. If they are in same row or column then the letter previous to them is considered as replacement. If any of the letter is first in row/column. Then first letter replaced that letter in the circular way.

Q	**W**	**E**	**R**

If the pair is WQ, then W is replaced by Q, while Q is replaced by R in circular way.

T
G
F
C

If the pair is CT, then C is replaced by F, while T is replaced by C in circular way.

3. If the pair forms the vertices of the rectangle, then the end letters of their rows will replace them.

Q	W	E	R
T	Y	U	O
P	A	S	D
F	G	H	K

If the pair is TK then the other two vertices of rectangle are OF. Then T is replaced by O, while K is replaced by F.

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Double Transposition Cipher Technique

ENCRYPTION

The double transposition cipher encryption technique is as follows:

1. Using key (**K_1**) on the **message (m)**, cryptogram **C_1** obtained.

(m) K_1= C_1

2. Using key (**K_2**) on the cryptogram **C_1**,cryptogram **C_2**obtained.

(C_1) K_2= C_2

DECRYPTION

The double transposition cipher decryption technique is as follows:

1. Using key (**K_2**) on the cryptogram **C_2**, cryptogram **C_1** obtained.

(C_2) K_2= C_1

2. Using key (**K_1**) on thecryptogram **C_1**original **message (m)**obtained.

(C_1) K_1= (m)

Example of Double Transposition cipher technique

Use of transpose techniques double times is 'Double Transpose', makes cryptogram strong in terms of cryptanalysis. Suppose sender has the following massage (encrypted) (famous quote from the novel ***Alice in Wonderland***):

After applying transposition with a key, say **K_1**the output is as follows:

C_1:- ISTA WAAT CXS IAW

After applying key, say **K_2** the output is as follows:

C_2:- AISX TSIC TZAZ AWWA

Try it on your own

Double Playfair Cipher

ENCRYPTION

Double Playfair cipher encryption technique is as follows:

1. Placing the key(**K_1**)into the grid and then fill it with rest of the alphabets.

2. Derive the cryptogram (**C_1**)of the **message (m)**, using the grid.

(m) K_1= C_1

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3. Placing the key ($\mathbf{K_2}$)into the grid and then fill it with rest of the alphabets.

4. Derive the cryptogram ($\mathbf{C_2}$) of the **message (m)**, using the grid.

($\mathbf{C_1}$) $\mathbf{K_2}$= $\mathbf{C_2}$

DECRYPTION

Bi-Playfair cipher encryption technique is as follows:

1. Placing the key ($\mathbf{K_2}$) into the grid and then fill it with rest of the alphabets.

2. Derive the cryptogram $\mathbf{C_1}$ from the cryptogram $\mathbf{C_2}$, using the grid.

($\mathbf{C_2}$) $\mathbf{K_2}$= $\mathbf{C_1}$

3. Placing the key ($\mathbf{K_1}$) into the grid and then fill it with rest of the alphabets.

4. Derive the original **message (m)** from the cryptogram $\mathbf{C_1}$, using the grid.

($\mathbf{C_1}$) $\mathbf{K_1}$= (m)

Example of Bi-Playfair cipher technique

Use of transpose techniques double times is 'Bi-Playfair', makes cryptogram strong in terms of cryptanalysis. Suppose sender has the following massage (encrypted) (famous quote from the novel ***Alice in Wonderland***):

After applying transposition with a key, say $\mathbf{K_1}$the output is as follows:

$\mathbf{C_1}$:-YZYSMTBTAKYBXY

After applying key on $\mathbf{C_1}$, say $\mathbf{K_2}$ the output is as follows:

$\mathbf{C_2}$:- ZRVB OIAI SLI GYZ

Try it on your own

Double Trans-Play Cipher

ENCRYPTION

The double Trans-Play cipher encryption technique is as follows:

1. First apply transposition cipher technique, using $\mathbf{K_1}$ and obtain cryptogram $\mathbf{C_1}$.

(m) $\mathbf{K_1}$= $\mathbf{C_1}$

2. On cryptogram $\mathbf{C_1}$ apply transposition cipher technique, using $\mathbf{K_2}$and obtain cryptogram $\mathbf{C_2}$.

($\mathbf{C_1}$) $\mathbf{K_2}$= $\mathbf{C_2}$

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3. On cryptogram $\mathbf{C_2}$ apply 'playfair' cipher technique, using $\mathbf{K_1}$ and obtain cryptogram $\mathbf{C_3}$.

(C_2) $K_1 = C_3$

4. On cryptogram $\mathbf{C_3}$ apply 'playfair' cipher technique, using $\mathbf{K_2}$ and obtain cryptogram $\mathbf{C_4}$.

(C_3) $K_2 = C_4$

DECRYPTION

The double Trans-Play cipher encryption technique is as follows:

1. On cryptogram $\mathbf{C_4}$ apply 'playfair' cipher technique, using $\mathbf{K_2}$ and obtain cryptogram $\mathbf{C_3}$.

(C_4) $K_2 = C_3$

2. On cryptogram $\mathbf{C_3}$ apply 'playfair' cipher technique, using $\mathbf{K_1}$ and obtain cryptogram $\mathbf{C_2}$.

(C_3) $K_1 = C_2$

3. On cryptogram $\mathbf{C_2}$apply transposition cipher technique, using $\mathbf{K_2}$ and obtain cryptogram $\mathbf{C_1}$.

(C_2) $K_2 = C_1$

4.On cryptogram $\mathbf{C_1}$ apply transposition cipher technique, using $\mathbf{K_1}$ and obtain original **message (m)**.

(C_1) K_1= (m)

Example of Trans-Play cipher technique

We are using abovementioned **message (m)**. After applying the key, say $\mathbf{K_1}$the output is as follows:

C_1:- ISTA WAAT CXS IAW

After applying key on $\mathbf{C_1}$, say $\mathbf{K_2}$ the output is as follows:

C_2:- AISX TSIC TZAZ AWWA

After applying key on $\mathbf{C_2}$, say $\mathbf{K_2}$ the output is as follows:

C_3:- BTAW PAMB MXCX SXXS

After applying key on $\mathbf{C_3}$, say $\mathbf{K_1}$ the output is as follows:

C_4:- CAYE SEAR GVNZ QYYQ

Try it on your own

Hint: Transformers Hero & Villain

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THE STUDY & OUTCOME

The cryptanalysis of Playfair is calculated as $\mathbf{e^{(dF/T)}}$, where $\mathbf{e^{(dF/T)}}$is th probability which is close to 1. This is calculated by hill-climbing algorithm slightly changed to increase the fitness. This is known as a 'simulated annealing' (SA) algorithm.

Time taken to break Playfair cipher, T_{bP}

T_{bP}= n seconds

Time taken to break Transposition cipher, T_{bT}

T_{bT}= m seconds

Time taken to break Trans-Play cipher, T_{bTP}

$\mathbf{T_{bTP}= e^{(n+m)}}$ seconds

Time taken to break Double Trans-Play cipher, T_{bDTP}

T_{bDTP}= $\mathbf{e^{2(n+m)}}$ seconds

FUTURE & SCOPE

Trans-Play is best in cloud environment. Therefore use of Transposition cipher in IoT enabled technologies [1], so Trans-Play can also use in it. I'm suggesting to use it in Blockchain. CIA can use it in daily communication with MI5 & 6, SVR, MOSSAD, ONA& allies.

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Is the World's Oldest Script "Brahmi" the Best Scripting Language for Low Level Programming?

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Abstract – *The demand for digitized documents is increasing day by day after Covid 19 due to increase in online working in all the spheres of life. Archaeologists, having no choice, have to work more in the field only, to find, analyze, and study the historical monuments which is a tedious job. Archaeologists face a lot of problems while recognizing Brahmi script available in the form of monuments on the rocks as it is not a popular script though all the popular scripts are derived from it. The time spent in the field may be reduced, if a machine is able to analyze and translate that unpopular script. For this a machine has to first understand the characters written on the monuments which can be done by feeding the image to the machine. Optical character recognition is one of the best technique available today to recognize characters by a machine. Many people have talked about different approaches used for translation of a character by a machine viz. Dictionary based, Rule based, corpus based, Knowledge based, and Hybrid. In this paper, an idea is given about the techniques available and used in other Indian and foreign languages for recognition of characters. Depending on it, the techniques may be applied and studied in Brahmi script and results can be compared.*

Keywords**:** ***Brahmi Script, DCNN, OCR***

INTRODUCTION

A language is always used as a medium of communication. Initially it has been used for verbal communication as the memory of the human has been very sharp and they remembered everything as it has been. So there has been no need to write anything to remember and to tell about it to the next generation. But as the time passed, it has been decided to write the contents so that the contents may be available to everyone after the passage of time. For that a script and some rules to design a language from that script has been required. Initially the script used was Brahmi script which was invented by "1008 Shri Aadinath Bhagwan" innumerable years back [33], [51]. He had taught this script to his daughter "Brahmi ", on which name the script got its name; and taught numbers to his other daughter named "Sundari". Whether it was used for a long time after that or not, it is not clear from the history as history is not able to give any evidence for that till now. Some old "Shila Lekh" are available which were written by "Samraat Ashoka" of Kalinga (265-238 BCE approximately) as shown in Fig. 1, and "Samraat Kharavela" of Kalinga (2nd Century B.C. approximately) as shown in Fig. 2, which put some light on the use of Brahmi Script in ancient times.

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Fig. 1: "King Ashoka", Gujarat [Source: Wikipedia]

These "Shila Lekh" are written in "Prakrit" language using Brahmi script. (Script is basically a set of alphabets or a set of characters, while language gives the rules to create words and sentences using a script.) In Jain Granths, 18 scripts are mentioned [51] and the name of the first script is Banbhi (Brahmi). Even in Bhagwati Sutra [51], a salutation to the

Brahmi script is given in the introduction using the words "Namoh Banbhiye Liviye" which means to pay salutation to Brahmi Lipi (script). Edward Thomas and Cunningham [51] have proved that the Brahmi script has originated in India.

Fig. 2: "Hathigumpha Abhilekh" by King Kharavela [Source: Wikipedia]

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LITERATURE REVIEW

The above information shows Brahmi as the oldest script available. All other scripts [51] (Devanagari, Latin, Chinese, Arabic etc.) available in the world are originated from it. According to Trautmann et al. [19] and Pal et al. [20], the number of different modern scripts originated from the Brahmi script is 198. Structural-feature similarities are found by Winskel et al. [21] in the characters of modern scripts and Brahmi scripts. Optical character recognition (OCR) provides a very good medium to understand this script.

Coded run methodology was used by Siromoney et al. [1] to recognize the machine-printed alphabets of the Brahmi script. A rectangular binary array was used for each character of the Brahmi script. In 2004, Pal and Chaudhary [4] used Optical Character Recognition Techniques on 12 Indian scripts. In 2006, thinning and thresholding methods were given by Devi [2], [3] for preprocessing of the characters of the Brahmi script. Pixel-level technique, preprocessingmethodology, was used to analyze the results. Various thinning and thresholding algorithms were used to analyze the input image.

Multilingual Optical Character Recognition was used by Manjunath et al. in 2007 for South Indian scripts as well as for English [5]. Fourier transform and principal component analysis were used to analyze the alphabets. The zone method and template matching method were used by Gautam et al. [6] for the purpose of feature extraction and classification respectively of handwritten characters of the Brahmi script. In 2010, the handwritten numbers (digits) of Gujarati were recognized by using Optical Character Recognition Technique by Desai [7].

The binarization method was used for English characters recognition using Optical Character Recognition Techniques in 2013 by Chaudhary et al [8]. Starters, minor starters, and intersections etc. were used by Gaurav et al. [9] for feature extraction of English characters using geometric methods in ANN (artificial neural network).

The geometric feature extraction method was used by Dongre et al [10] for the recognition of the handwritten digit of Devanagari in 2013. The number of endings, bifurcations and corners were the features of an English alphabet used by Akram et al [11] to recognize English language characters.

Isolated Devanagari offline characters were recognized by Dongre et al. [12] using geometric features with an accuracy of 93.17% but faced problems in recognizing compound characters. Aizawl et al. [13] used a geometric method to extract features and a neural network for the classification of handwritten characters in the Hindi language. Table 1 shows the work done in recognition of characters of Brahmi script till now.

Kituku et al [52] and Tripathi et al [53] have talked about different approaches used for translation of a character by a machine viz. *Dictionary based, Rule based, corpus based, Knowledge based,* and *Hybrid*.

Kala et al [15] have generated graphs for characters.

BRAHMI SCRIPT

This script contains 12 vowels, 33 consonants as shown in Fig. 3, and more than 10 numerals, out of which 10 are shown in Fig. 3. The consonants shown in Fig: 6are a combination of consonants and the first vowel. The consonants may be combined with other vowels and create other characters as shown in Fig. 4. There are some compound characters available in the script as shown in Fig: 5. Now to understand and recognize these characters, Optical Character Recognition may be used.

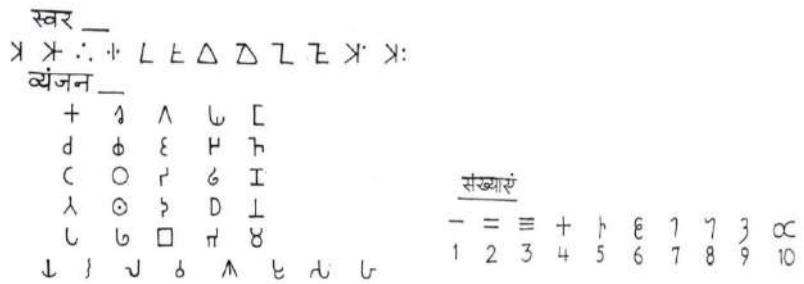

Fig. 3: Vowels, Consonants and Numerals in Brahmi script [14]

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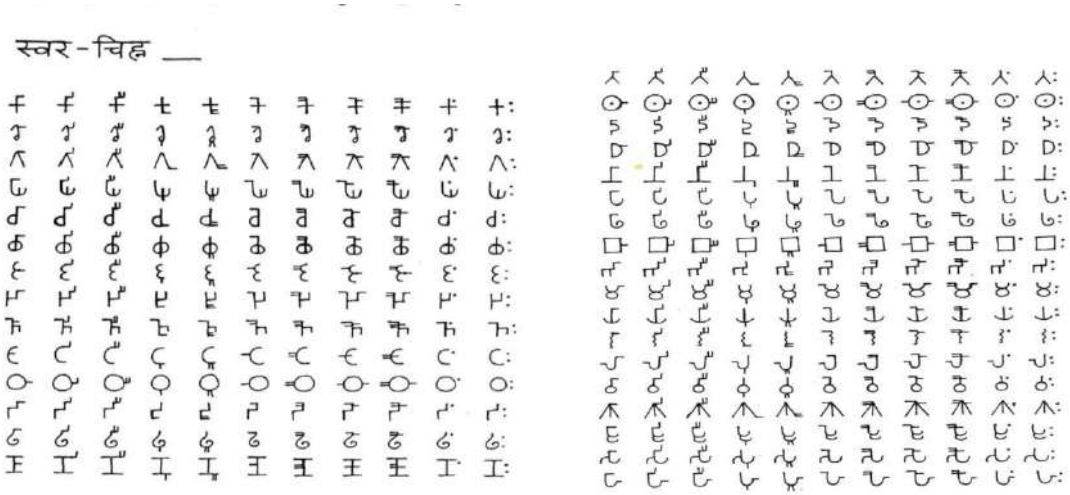

Fig. 4: Consonants with vowels as "Matra" in Brahmi script [14]

Figure 5: Compound Consonants in Brahmi script [14]

An archaeologist named James Princep (1799-1840) has deciphered a word written using Brahmi characters [51] as shown in Fig. *6*. The first character is "□□" and the second character is "□□" which means a gift to needy people.

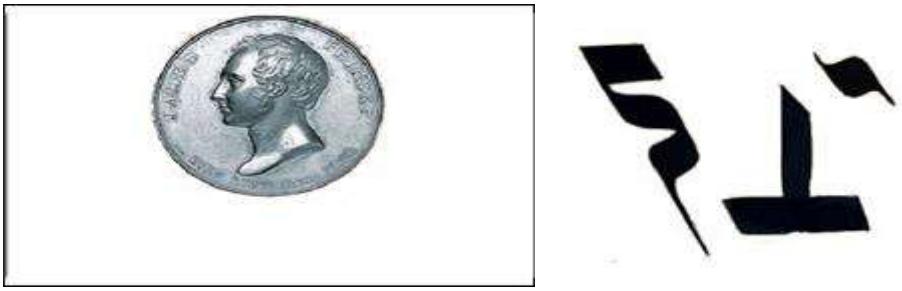

Fig.6: "The letters d and n, the word is danam "□□□□" meaning gift, the first deciphered word [51]"

According to Nagar [51], the scripts in India are divided into two groups namely Northern and Southern. The scripts included in the Northern group are Gupta, Kutila, Nagari, Sharada, and Bengali while the Southern group includes Gujrati, Telugu, Kannada, Malayalam, Tamil etc.

OPTICAL CHARACTER RECOGNITION

The Optical Character Recognition technique is used to convert handwritten, scanned, printed, typed etc. text to a machine-readable text which increases the efficiency of the recognition of a character [6]. Optical Character Recognition is used for the recognition, identification and interpretation [73] of the text. This technique was basically used initially in Japan in the early 90s [24].

Basically, two methods, template matching, and structure analysis are used in OCR and helps in providing a paperless world which is the main focus in this digital arena [16] and also helps in the recognition of characters automatically. It is

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very difficult to recognize and handle a large amount of text manually [74] but quite easier using Optical Character Recognition techniques. Development of new algorithms for OCR is the focus of researchers for the identification of scripts [17], [18] for printed as well as for handwritten characters.

Geometric properties, invariant techniques etc. are used for feature extraction which is based on the shapes of the characters [22]. Points, lines, corners, surface, curve, edge etc. are used as the elements to extract the features of characters using geometric methods [23].

It is not an easy task to separate words from the consecutive characters list available on the rocks. Vaijapurkar et al [54] have suggested an auto-completion algorithm for detecting words using conditional probabilities in the "Trie" data structure. Fernandez [55] has talked about N-grams, prefix tree, "Trie", "Ternary search tree", a minimal deterministic finite automaton for word separation by a machine.

Ahmad et al [56] has talked about detection of error (and also correction of it) in OCR using finite-state automata for the characters of the Urdu language. Detection is done using lexicon comparison [76] and correction is done using morphological analysis and minimum-edit distance.

4.1 Influences of OCR

- Important documents can be digitized, e.g. passport, credit card, pan card, adhar card etc. may be digitized which reduces the necessity of carrying the documents. Also, the documents will be available every time if stored in the cloud.
- Printed books can be digitized and made available to everyone, every time and at each location. It helped a lot in this lockdown period after March 2020.
- Consumption of paper is reduced due to digitization of documents which further reduces the requirement of cutting of the trees and saves forests in effect which is useful for increasing the level of water on earth.
- Digitally signed documents can be sent through office email which saves the time and cost of transportation.
- There are many old books available which are deteriorating with time. The contents of these books will be available in future using OCR.
- Using Optical Character Recognition techniques, the contents of a famous book in one language may be translated in other languages and can be made available to people of different languages.

4.2 Segments of OCR

Five components [24] are there in Optical Character Recognition as shown in Fig: 7:

- ❖ Optical scanning of the image
- ❖ Preprocessing
- ❖ Segmentation
- ❖ Feature extraction
- ❖ Classification

1.2.1 Optical Scanning

The scanning of an image [72] is done using a scanner and a corresponding digital image is stored in the computer.

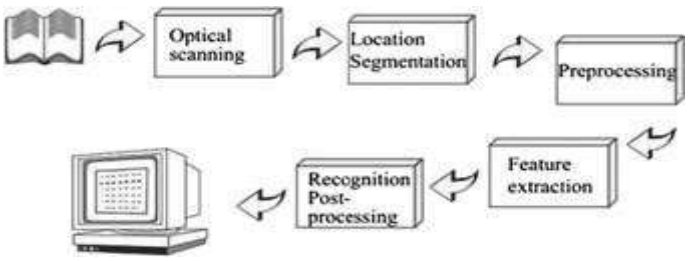

Fig: 7: "Components of an Optical Character Recognition system [24]"

1.2.2 Preprocessing

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It can be done using cropping, thresholding and thinning processes. The image is reduced to its minimum size using the cropping method. In thresholding, binarization of the image is done. Binarization means converting the image into 256 gray levels [25]. Then this gray level image is converted into black and white using some threshold value. It is useful to recognize noise in the image. A skeleton of an image is created using a thinning process [26]. The width of the pixel will be one after the thinning process [27].

1.2.3 Segmentation

The image is divided into many sub-parts known as segments depending on the number of words or characters or lines available in the image.

1.2.4 Feature Extraction

According to Jayadevan et al. [28], it plays a major part in the recognition of a character. Six entities are used to extract features in a Brahmi script [11], [28] – [32], bifurcation point, circle, ending point, corner point, intersect point, and semi-circle.

1.2.5 Classification

If the set of characters is divided into some groups then the particular character is classified in a particular group and then recognized as a particular character depending on the matching of the features. A deep convolutional neural network (DCNN) may be used for classification as used by Suresh et al.[25]

DEEP CONVOLUTIONAL NEURAL NETWORK (DCNN)

Convolutional neural network (CNN) is widely used [75] and successful in character recognition nowadays [42]. It is used in almost all languages for the classification of characters [43-49]. In convolution, basically filters are applied to the input image to extract the features of the image. DCNN [72] has one input layer, one output layer and multiple hidden layers. An activation function is used to mask the input and output of the hidden layers. There is no need to extract the features of an image or character manually while using DCNN as it will be done by

DCNN automatically. Rectified linear units (ReLU) may be used as an activation function. The computational expense of ReLU is less as compared to tanh and sigmoid [25] etc.

Neural networks are nowadays the most useful technique for the classification of characters [34]-[37]. It is gaining popularity with the advent of recurrent neural networks (RNN), convolutional neural networks (CNN) etc. Multi-level perceptron (MLP) was implemented for handwritten Optical Character Recognition of Urdu language by Samsher et al. [38]. A feed-forward neural network algorithm for MLP was proposed by researchers [39]. Farsi and Bangla numerals were recognized using MLP by Liu and Suen [40]. English numerals were recognized by Cirecsan et al. [41] using MLP.

According to Menon et al. [50], many techniques like multi-column multi-scale convolutional neural network (MMCNN), CNN, histogram of oriented gradient (HOG) and SVM, zoning, discrete cosine transformation (DCT), gradient features, k-nearest neighbors (kNN), decision tree, random forest, convolutional recurrent neural network (CRNN) with spatial transformer network (STN) layer, tesseract Optical Character Recognition and google multilingual OCR, deep brief network with the distributed average of gradients features, modified neural network with aid of elephant herding optimization, visual geometry group (VGG) with 16 convolutional layers etc. are the techniques used form 2017 to 2019 to recognize Indian scripts like Devanagari, Bangla, Hindi, Kannada etc.

Selvakumar with Ganesh [59] has used the canny edge detection algorithm, for detectingas well as for correcting areas of the image which contains an error, by preprocessing the image, and then applied that algorithm with an artificial neural network to focus on content edge pixels.

Mahalakshmi and Sharavanan [60] used the process of segmentation and contour let transform in Tamil script to segment and translate the ancient inscriptions. She used PSO (particle swarm optimization), FO-DPSO (fractional-order DPSO), DPSO (Darwinian PSO), and image enhancement module for the purpose of segmentation with MATLAB; whereas M-file is used for the recognition and translation of the characters.

Medhi and Kalita [61] have proposed a feedforward neural network for the recognition of the characters of the Assamese language. The segmentation algorithm is used for line segmentation and character segmentation, and the zoning feature

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extraction method is used afterwards. They have proposed the diagonal, slice zoning feature, and fuzzy or neuro-fuzzy concepts to increase the recognition rate of the characters.

Vellingiriraj et al.[62] proposed a zoning method for extracting the features of ancient Tamil characters, where the image to be recognized is decomposed into 64 × 64 matrices Unicode is used for recognition of characters and translation of the ancient script into the present form.

Kale et al.[63] has used the Zernike moment feature method to recognize the compound characters of the Devanagari script, and proposed classification of characters on the base of SVM and k-N. 30 × 30 pixel zones are used after preprocessing of the image, and Zernike moments are used for each and every zone of the concerned image.

RELATED WORK ON BRAHMI SCRIPT

Siromoney et al [1] has used a condensed and symbolic run method to transform the character matrix into small strings depending on the consecutive 1s and 0s. This method was successful for the recognition of printed characters of the Tamil language but failed to recognize the characters of the Brahmi script. The coded run method having row-wise and column-wise small strings for the same character was successful for the recognition of characters of the Brahmi script.

Devi [3] has used various thresholding methods (Quadratic Integral ratio (QIR) thresholding, OTSU thresholding) to get a binarized image of the colored/gray-scale image. Threshold algorithm is applied on the total mean of variance of the array containing Intensities of the pixel, using digits 0 and 1 for background and foreground respectively.

Devi [2] has used various thinning methods (ZS thinning, LW thinning, enhanced thinning) to decrease the width of the character to one pixel (skeleton). This method gave better results with thresholding as it removed the noise and distortion in the image.

Sanjoy Das et al [50] have used the Non-dominated Sorting Genetic algorithm (NSGA-II) to establish a correspondence between characters of the Brahmi script and the ancient Indus script. He has used two optimization functions and proposed a third one.

Bandara et al [48] have used the correlation function method to compare the inscription image of the character with the font image and were successful to recognize the characters of Brahmi script having noise. He has removed the tilting of the image after digitizing it and then calculated the center of the mass of the image to decide the critical position of the image.

Warnajith et al [49] have used a modified correlation function method to compare the inscription image of the character with the font image which was done by the computer automatically.

Ahmad et al [56] have used Finite state automata for error detection and error correction in the word detection from a language written using a Brahmi script having no word separator.

Nagar et al [51] have given names of more than 70 languages/ sub-languages of India and foreign countries derived from the Brahmi script.

Gautam et al [6] have got a success rate of 88.83%, 89.4%, 86% in the recognition of digits, characters of handwritten consonants, handwritten vowels of Brahmi script respectively. She has used the modified OCR for the recognition of a character.

Gautam et al [26] have got a success rate of 91.69%, 89.55%, 93.30%, and 94.40% in the recognition of characters of handwritten vowels, handwritten consonants, printed vowels and printed consonants of Brahmi script respectively. She has used the geometric method for feature extraction of a character.

Wickramarathna et al [57] has used morphological analysis, permutations generation module, min. Edit distance approach for error correction in OCR of words detected of Brahmi script having no word separator. He has achieved an accuracy of 98%, 96%, 91% and 91% for word detection, OCR error detection, OCR error correction and Sinhala translation of Brahmi sentences respectively.

According to Pandey and Jha [58], Brahmi derived scripts are neither alphasyllabic nor semi alphabetic. In fact, some unique descriptor has to be used for it like for Devanagari etc.

Singh and Kushwaha [65] have discussed different types of segmentation methods available/ used in different scripts/ languages and concluded that there is no uniform method available for the Brahmi script characters after trying to work on Brahmi script-based "□□□□□□□□□□" inscription.

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Neha et al [66] have proposed a hybrid approach of using HOG and zonal density with SVM to recognize the Brahmi words with a dataset of 6475 and 536 for training and testing respectively. An accuracy of 95.17% is received.

Neha et al [67] have proposed an automated system for the translation of Brahmi script to Pali script which can be used to convert characters from Brahmi script to English dictionary as Pali to English conversion is already available.

Neha et al [68] have proposed the steps required to create a publicly available Brahmi script dataset as there is no big dataset of Brahmi script available. This dataset includes 7011 images which are categorized in 170 classes having 4 classes for vowels, 27 classes for consonants, and 139 classes for compound characters. 6475 images are used for training and 536 images are used for testing out of 7011 images.

Nagane and Mali have designed an algorithm for the segmentation of lines, characters and special characters of the Brahmi script.

Brindha and Bhuvaneswari [64] have used novel feature extraction methods like Zernike moment and zoning feature for feature extraction of the concerned image. To check the dependency/ independence of the values of the vectors, a chi-square test is applied, and the confusion matrix shows an accuracy rate of 91.3%. It is found that less time is taken by the recognition of Tamil characters using neural networks, also higher precision is achieved.

According to Pillai [70], the Brahmi script is a hybrid invention by Indian scholars from Aramaic, and western traders language Phoenician and Greek.

Table 1: Work done in the field of Brahmi script to date

Sr. No.	Year	Reference	Main Features of the article
1.	1983	[1]	Coded run method having row-wise and column-wise small strings for the same character was used to recognize printed characters of Brahmi
2.	2006	[3]	QIR thresholding and OTSU thresholding methods has been described for preprocessing of the image
3.	2006	[2]	ZS thinning, LW thinning, enhanced thinning methods has been explained for preprocessing to get the skeleton of the image
4.	2009	[50]	Multi-objective optimization using NSGA-II has been done to establish a correspondence between the characters of Brahmi and Indus
5.	2012	[48]	Correlation function method for comparison has been used to decide the critical position of the image after removing the tilt (skew)
6.	2013	[49]	Modified Correlation function method has been used to compare the inscripted image with the font
7.	2014	[56]	Error detection and correction in Urdu language has been done using Finite state automata
8.	2016	[51]	More than 70 national/ international languages derived from Brahmi script
9.	2016	[6]	Modified OCR has been used for the recognition of the characters of Brahmi script
10.	2017	[26]	Geometric method for feature extraction has been described for recognition of printed as well as handwritten Brahmi characters

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11.	2019	[57]	Morphological analysis, permutation generation module, and minimum distance approach has been used for error correction of Brahmi script
12.	2019	[58]	Non alpha syllabic or semi alphabetic nature of Brahmi derived scripts has been given
13.	2019	[65]	No uniform segmentation process is available for Brahmi script
14.	2020	[66]	Used hybridization of HOG and zonal density with SVM to recognize the Brahmi words
15.	2020	[67]	an automated system for the translation of Brahmi script to Pali script
16.	20/20	[68]	How to produce a publicly available Brahmi script dataset, a dataset of Brahmi character images has been made available on Kaggle
17	2020	[69]	Designed an algorithm for segmentation of lines, characters and special characters of Brahmi script
18.	2021	[64]	Zernike moment and zoning feature has been used for feature extraction
19.	2021	[70]	Brahmi script is a hybridinvention of Indian scholars form Aramaic, and Western languages Phoenician and Greek

CONCLUSIONS

James Princep (an archaeologist) has recognized a word written in Brahmi in nineteenth century, still not much work has been done in this field. Siromoney has talked about a Coded Run Method for recognition of characters of Brahmi in 1983. Since 2016 Neha Gautam form Sri Lanka has been working with her team on this script. Recently (2020)she has created a dataset of approximately 7000 character images of Brahmi and made it available on Kaggle for research purpose. A lot of focused research is required in this area as it is the oldest script and may open new doors for the scientists, historians, archaelogists etc.

Artificial neural netwok, Deep convolution neural network etc. can be quite useful approaches for this script but for that a big dataset is required. Since no one is using this script in day to day life, it is a big task to create a database on which machine learning techniques can be applied.

PROPOSED METHODOLOGY FOR RECOGNITION OF THE BRAHMI SCRIPT

Methodology shown in fig. 8 may be adopted for the recognition of the characters of a Brahmi script as used by Kunhare et al [71] in the intrusion detection system of the network traffic.

Initially an image of the Brahmi script is taken as input. This image may be a photographed image, from internet, or from any available dataset of the Brahmi script. Pre-processing has to be done on that image to increase the intensity of the characters, to standardize the size of the image, and to remove the noise etc. Segmentation may not be required if the image contains only a single character, otherwise segmentation of the image has to be done in line, words and characters using horizontal and vertical projection techniques.

Template matching procedure (the degree of correlation between the unknown pattern and the ideal template pattern is used for classification) is adopted for recognition of the individual character of the Brahmi script. Features will be

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extracted, machine learning classification will be done, PSO will be applied and performance will be evaluated only if a perfect match is not found using template matching. The results will be discussed at the end to check the number of times the feature extraction was required as it will increase the execution time of the recognition of the character.

FUTURE SCOPE

Since the Brahmi script is the oldest international script available, it will open doors for better recognition of characters of all other languages if the characters of this oldest Brahmi script will be better recognizable using any of the above techniques. Research has to be done to check the results using different available techniques on the Brahmi script. The best technique for the Brahmi script may be the best one for all other languages as Brahmi is the mother of all the languages.

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Analysis and Design of Forward –Zeta Converter with High Power Factor

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Abstract – *This paper describes a parallel combination of a Forward and a Zeta converter. The Zeta sub-converter shapes the input ac current as well as regulates the output while forward sub-converter regulates the output. The magnetization energy of the forward sub-converter is transferred directly to the load by the zeta sub-converter. In the present paper, an AC input is first converted into DC and it is subsequently used to produce the output with the help of the mentioned combination. In this case, the voltage stress on the main power switch is reduced which helps reduce the volume of the converter and the switching power losses. As a result, the efficiency of the converter increases. Also the power handling capability of the converter, improves due to the combination. Simulation results are provided for a 24V, 30W converter to validate the analysis.*

Keywords— parallel combination; power factor; magnetization; demagnetization; forward sub-converter; zeta sub-converter

.

INTRODUCTION

A diode rectifier between ac line and DC DC converter draws a pulsed current from the utility which introduces harmonics in the input ac current. These affect input power factor of the converter. Various international agencies have defined standards to reduce such harmonics to the permissible values for given input power. A large number of topologies have been developed and presently the work is still going on for this purpose.

A zeta converter is a power factor corrector which works on the concept of 'loss free resistor'. Various converters are reported in literature [1]-[4]. The concept of direct power transfer [5] and flyboost cell in [6] have proved useful for power factor improvement as well as increase in overall efficiency of the converter. The combination of forward and flyback converters in [7] is very useful for battery charging and lamp drive applications. A combination of zeta and flyback topologies is employed in [8] to regulate output voltage as well as to improve input power factor.

Other converters for the improvement of power factor and efficiency are reported in [9-15]. In the present work, a zeta converter is employed to transfer magnetization energy of the forward converter to the load. The efficiency of the combination is high which makes it suitable, particularly, for low power applications. The working of the converter is explained through following sections.

Circuit description and operating principles

The proposed converter is shown in Fig.1. It consists of a forward sub-converter connected in parallel with a zeta converter. The zeta converter supplies power to the load through magnetizing winding of the forward converter. The power

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supplied to the load by each sub-converter is adjusted as desired. Any possible combination of conduction mode can be used for the power transfer to the load. The two modes of operations are described as under.

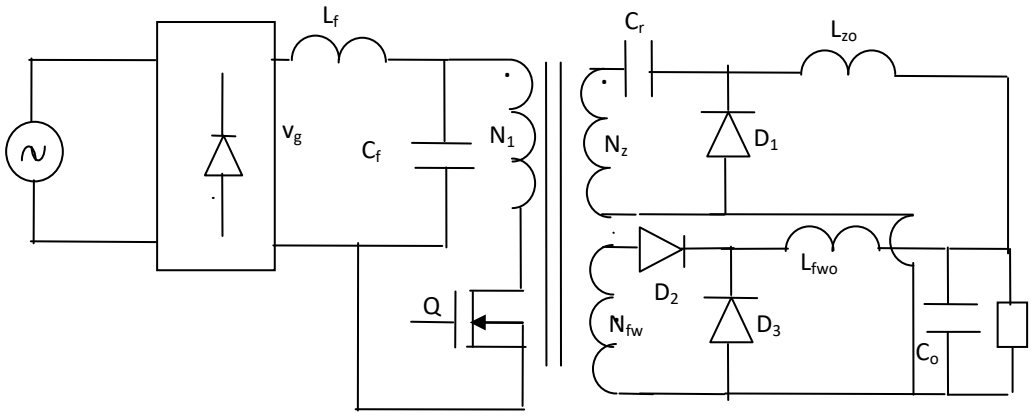

Fig. 1: The Proposed Converter Circuit

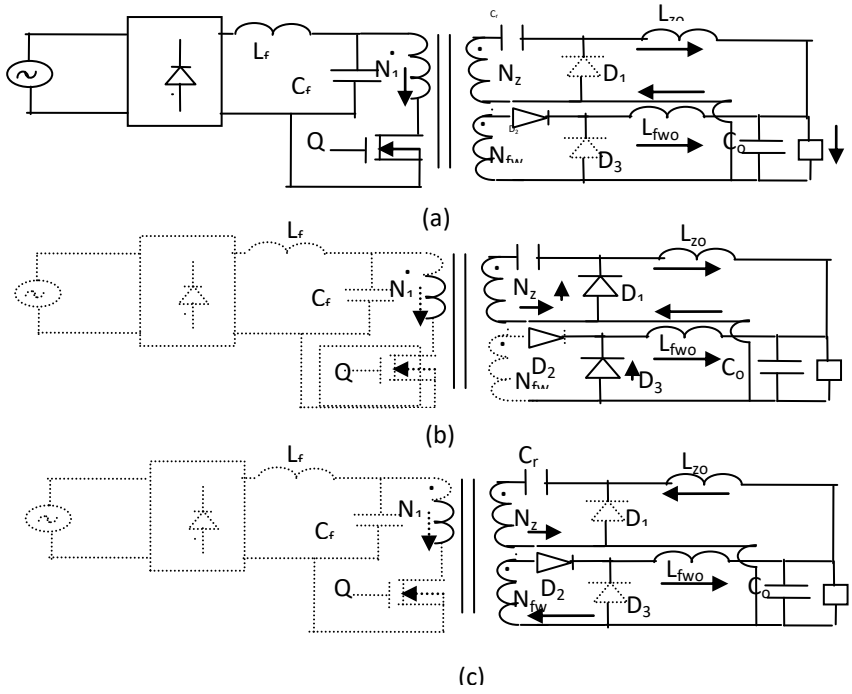

Fig. 2: Equivalent Circuits for Different Stages

DCM and CCM Operation

The converter operates through following three modes.

Mode 1 ($t_0 \leq t \leq t_1$). Mode 1 starts as the main switch Q is turned on at instant $t=t_0$.As a consequence, the power transfer takes place from input to output through the zeta- forward converter as shown by equivalent circuit shown in fig.2(a). The switch turns off at $t=t_1$ at the end of this mode.

Mode 2 ($t_1 \leq t \leq t_2$). In mode 2, the output inductors discharge energy to the load as shown in Fig.2(b).At $t=t_2$, the output filter inductor of zeta sub-converter is completely discharged.

Mode3($t_2 \leq t \leq t_3$). The magnetizing inductance of the transformer discharges through the winding for forward converter and the output inductances of the converters as the output inductor of forward sub-converter is discharged at $t=t_2$',

In CCM, the converter operates through following two modes.

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Mode 1 ($t_0 \le t \le t_1$). The main switch Q is turned on at instant $t=t_0$. The power transfer takes place from input to output in the same way as described in mode 1 of DCM.
Mode 2 ($t_1 \le t \le t_2$). This mode is the same as mode2 described in DCM operation of the converter.
The waveforms for DCM as well as CCM operation of the converter are shown in Fig.3. At instant $t=t_3$, the transformer is demagnetized. The equivalent circuits are shown in Figs.2 (c) and (d).

ANALYSIS

Let the power transferred by forward sub-converter be P_{fwo} and that by zeta sub-converter be P_{zo} .Then, total output power equals.

$$P_o = P_{fwo} + P_{zo} \quad (1)$$

As shown in Eqn. (1), the power to load is transferred by both the sub-converters. When the input supply voltage is greater or equal to output voltage reflected by forward sub-converter to the primary side of the transformer, the power distributed to the load through the two sub-converters, however, if above condition is not met, the total power is delivered to the load through Zeta sub-converter only- the forward sub-converter does not conduct.
Assuming 100% efficiency, the instantaneous input power of the zeta sub-converter can be expressed as

$$P_{zi}(\theta) = \frac{Li_{zp}^2(\theta)}{2F_s} = \frac{v_p^2(\theta)D_1^2}{2LF_s};\ \theta = \omega t \quad (2)$$

Where $i_{zp} = \frac{v_p(\theta)D_1T_s}{L}$ is the peak current of the zeta converter on primary side in a switching period, $v_p(\theta)$ is instantaneous voltage on the primary side, D_1 is duty ratio of the converter and F_s is the switching frequency. L is equivalent input inductance and is given as.

$$L = L_m||L_{zo}/n_z^2 \quad (3)$$

Here L_m is primary inductance of the converter and L_{zo}/n_z^2 is the filter inductance of zeta sub-converter referred to the primary side. The average value of the input power in a line period is given as.

$$P_{zi} = \frac{1}{\pi}\int P_{zi}(\theta)\, d\theta = \frac{1}{4F_sL}V_{pm}^2D_1^2 = \frac{V_o^2}{R_z} \quad (4)$$

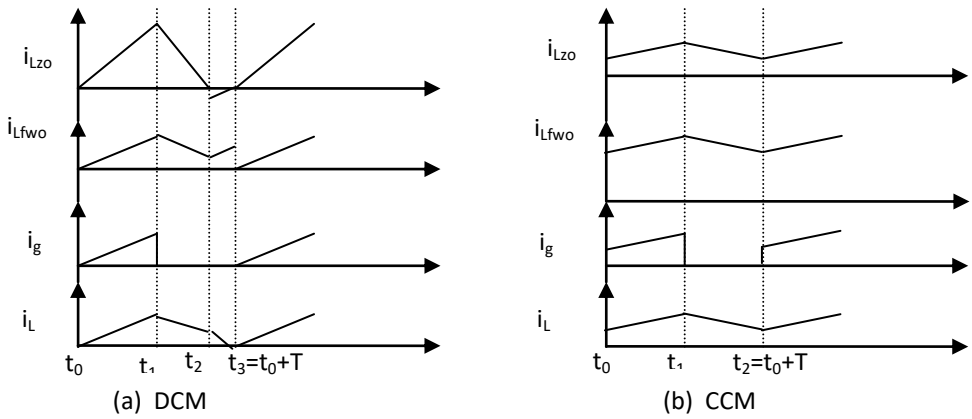

Fig. 3: Current and Voltage Waveforms

From eqn.(4), we obtain the equivalent inductance as

$$L = \frac{R_z}{4F_sM^2}D_1^2 \quad (5)$$

Where V_{pm} is the peak value of primary voltage and $M = V_o/V_{pm}$ is the voltage conversion ratio. .

The instantaneous input power of the forward sub-converter is given as

$$P_{fw} = v_p(\theta)i_{fw}(\theta) \quad (6)$$

Where $i_{fw}(\theta)$ is instantaneous value of input current drawn by forward sub-converter. Its value is given as

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$$i_{fw}(\theta) = \frac{\left(v_p(\theta) - \frac{v_o(\theta)}{n_{fw}}\right)(t_1 - t_0)}{\frac{L_{fwo}}{n_{fw}^2}}; \theta_1 \le \theta \le \theta_2 \quad (7)$$

Where θ_1 and θ_2 are as shown in Fig.4, L_{fwo} is output filter inductance value of forward sub-converter and n_{fw} is the ratio of secondary side turns of forward converter to the primary turns of the converter. The average value of forward current in a switching period is given as.

$$< i_{fw}(\theta) >_{T_s} = \frac{1}{T_s}\int i_{fw}(\theta)\ dt\ = \frac{\left(v_p(\theta) - \frac{v_o(\theta)}{n_{fw}}\right)}{2\frac{L_{fwo}}{n_{fw}^2}} D_1^2 T_s \quad (8)$$

The average input power drawn in a line cycle is given as.

$$P_{fwi} = \frac{1}{\pi}\int_{\theta_1}^{\theta_2} v_p(\theta) < i_{fw}(\theta) >_{T_s} d\theta\ = \frac{D_1^2 T_s}{\pi}\int_{\theta_1}^{\theta_2} V_{pm}\sin\theta \frac{\left(V_{pm}\sin\theta - \frac{v_o(\theta)}{n_{fw}}\right)}{2\frac{L_{fwo}}{n_{fw}^2}} d\theta \quad (9)$$

Assuming converter's output voltage having negligible ripple and $\theta_1 = \pi - \theta_2$, eqn.(9) can be written as.

$$P_{fwi} = \frac{D_1^2 T_s}{\pi}\int_{\theta_1}^{\pi-\theta_1} V_{pm}\sin\theta \frac{\left(V_{pm}\sin\theta - \frac{v_o(\theta)}{n_{fw}}\right)}{2\frac{L_{fwo}}{n_{fw}^2}} d\theta$$

$$= \frac{n_{fw}^2 D_1^2 T_s V_{pm}}{2\pi L_{fwo}}\int_{\theta_1}^{\pi-\theta_1} \sin\theta \left(V_{pm}\sin\theta - \frac{v_o(\theta)}{n_{fw}}\right) d\theta \quad (10)$$

From Fig.4, substituting $V_o/n_{fw} = V_{pm}\sin\theta_1$, we obtain

$$P_{fwi} = \frac{n_{fw}^2 D_1^2 T_s V_{pm}^2}{2\pi L_{fwo}}\int_{\theta_1}^{\pi-\theta_1} (sin^2\theta - \sin\theta\sin\theta_1) d\theta \quad (11)$$

On simplification, eqn.(11) becomes.

$$P_{fwi} = \frac{n_{fw}^2 D_1^2 T_s V_{pm}^2}{4\pi L_{fwo}} (\pi - 2\theta_1 - sin2\theta_1) \quad (12)$$

B. *CCM and DCM Boundary Conditions*

The zeta converter operates in DCM if

$$D_1 + D_2 \le 1 \quad (13)$$

The volt –second product for L_m yields

$$\frac{v_p(\theta) D_1 T_s}{L_m} = \frac{V_{cr} D_2 T_s}{n_z L_m}$$

yielding,

$$D_2 = \frac{n_z v_p(\theta) D_1}{V_{cr}} \quad (14)$$

However, since $V_{cr} = V_o$, eqn.(14) becomes

$$D_2 = \frac{n_z v_p(\theta) D_1}{V_O} \quad (15)$$

Substituting D_2 from eqn.(15) into eqn.(13), we obtain at peak input voltage.

$$D_2 \le \frac{M}{M + n_z} \qquad ;M = \frac{V_o}{V_{pm}} \quad (16)$$

For CCM operation

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$$D_1 > \frac{M}{M+ n_z} \quad (17)$$

The boundary condition for forward sub-converter is obtained by equating volt-second product for output inductor i.e.;

$$\frac{\left(n_{fw}\, v_p(\theta) - v_o(\theta)\right) D_1 T_s}{L_{fwo}} = \frac{v_o(\theta) D_2 T_s}{L_{fwo}} \quad (18)$$

On simplification and applying condition (13), we obtain at the boundary;

$$n_{fw} = \frac{V_o}{D_1 V_{pm}} \quad (19)$$

Thus, if $n_{fw} \geq \frac{V_o}{D_1 V_{pm}}$, the forward sub-converter operates in DCM, otherwise it will operate in CCM.

As the currents drawn by sub-converters are assumed to be in phase with the supply voltages, the fundamental components of the currents drawn by each of the sub-converters are given as.

$$\boldsymbol{i_{fw_1}} = \frac{\boldsymbol{P_{fwi}}}{\boldsymbol{v_{prms}}} = \frac{\sqrt{2}\boldsymbol{P_{fwi}}}{\boldsymbol{V_{pm}}} \quad (20)$$

And the fundamental component of input current drawn by zeta sub-converter is given as.

$$\boldsymbol{i_{zp1}} = \frac{\sqrt{2}\boldsymbol{P_{zi}}}{\boldsymbol{V_{pm}}} \quad (21)$$

The average value of current drawn by zeta sub-converter in a switching period is given as.

$$< i_{zp}(\theta) >_{T_s} = \frac{v_p(\theta) D_1^2 T_s}{2L} \quad (22)$$

The rms values of input currents drawn by the sub-converters are given as.

$$i_{zprms} = \sqrt{\frac{1}{\pi}\int_0^{\pi} < i_{zp}(\theta) >_{T_s}^{\,2} d\theta}$$

$$i_{zprms} = \frac{V_{pm} D_1^2 T_s}{2\sqrt{2}L} \quad (23)$$

and

$$i_{fwrms} = \sqrt{\frac{1}{\pi}\int_{\theta_1}^{\pi-\theta_1} < i_{fw}(\theta) >_{T_s}^{\,2} d\theta}$$

$$= \frac{n_{fw}^2 D_1^2 T_s V_{pm}}{2\sqrt{2\pi} L_{fwo}} \sqrt{\left[(\pi - 2\theta_1)(1 + 2sin^2\theta_1) - \frac{3sin2\theta_1}{2}\right]} \quad (24)$$

The rms value of total input current by the converter is given as.

$$i_{prms} = \sqrt{\frac{1}{\pi}\int_0^{\pi} \left[< i_{zp}(\theta) >_{T_s} + < i_{fw}(\theta) >_{T_s}\right]^2 d\theta} \quad (25)$$

The power factor of the converter is given as.

$$PF = \frac{i_{fw_1} + i_{zp_1}}{i_{prms}} \quad (26)$$

Converter Design

The primary inductance of the converter is given as.

$$L_m = \frac{2L}{D_1 r} \quad (27)$$

Where, r is per unit value of inductor current. From eqns.(3) and (27), the output filter inductor of the zeta sub-converter is obtained. The output filter inductor of forward sub-converter at the boundary between DCM and CCM is determined from the following eqn.

$$L_{fwo} = \frac{(1 - D_1) R_{fw}}{2F_s} \quad (28)$$

Where, R_{fw} is the equivalent load resistance for the power supplied by forward sub-converter. Above this load, the sub-converter operates in CCM.

The value of input filter capacitance is given as

$$C_f \leq \frac{1}{40\pi F_L R_{eq}} \quad (29)$$

In eqn.(29), F_L is line frequency and R_{eq} is minimum input resistance of the converter.

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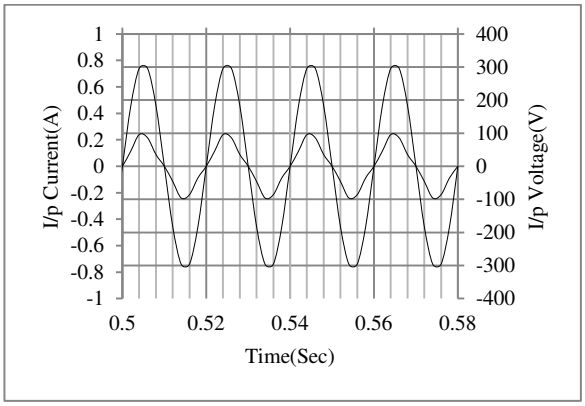
Design components for a 24 V, 24 W converter are presented in Table I. The results of the converter performance are presented in Table II.

Table I: Component value selection

Parameter	Description
v_{irms}	220V
V_o	24V
P_o	30W
C_o	9.4mF
L_{fwo}	86.4µH
L_{zo}	27.21µH
L_m	8906µH
L_f	13mH
C_f	82nF
n_z	0.05:1
n_{fw}	0.1475:1
D_1	0.55
F_s	50 kHz

SIMULATION

The simulation was carried out by using MATLAB/Simulink. The obtained waveforms are shown in Fig.4. It is observed from the waveforms that the current waveforms are in phase with the voltage waveforms. Thus the power factor remains almost same at every level of the load.



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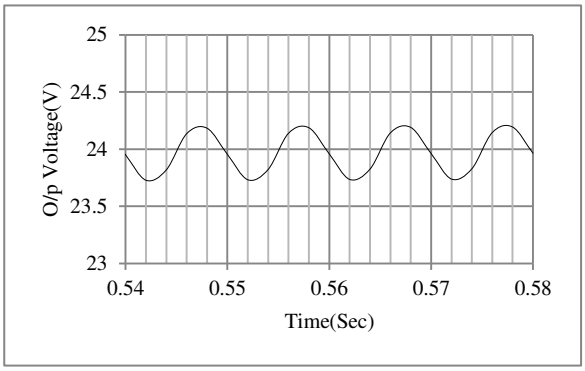

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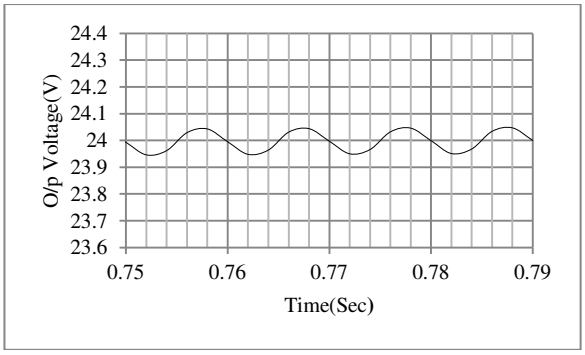

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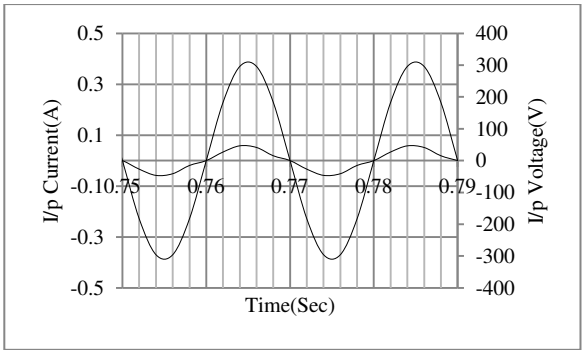

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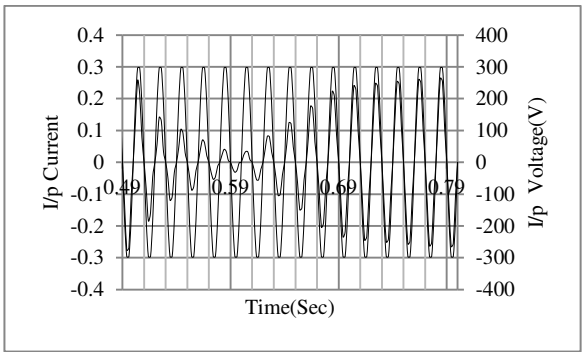

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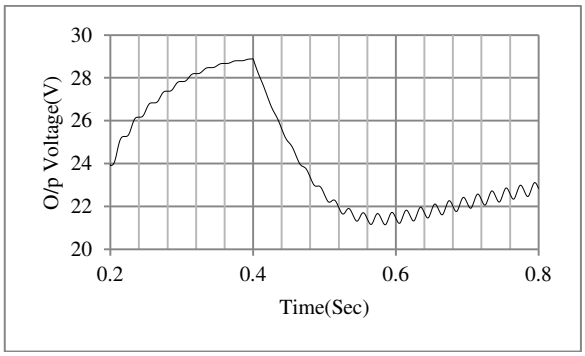

(f)

Fig.4: Simulated waveforms. (a) Input Voltage and Current (b) Output voltage and current at full load (c) Output voltage ripple at 10% load (d) Input current waveform at 10% load (e) Input current and voltage variation as the load changes from maximum to 20% and back to maximum value and (f) Output voltage variation as the load varies from maximum to 20% value and back to maximum value.

The performance of the converter is given by TABLE Ⅱbelow:

TABLE: Converter performance

Power (W)	Power Factor	THD%
30	0.987	14.85
24	0.983	17.66
18	0.979	19.92
12	0.982	18.16
6	0.98	16.15

CONCLUSIONS

A parallel combination of a forward and a zeta converter is successfully designed for appraisal of its performance. The power factor and efficiency are satisfactory. Zeta converter is a buck-boost converter which has resulted in the improvement of the power factor by way of demagnetization of the forward transformer through the load side. The simulation results thus obtained confirm the performance of the converter.

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Study of Different PAPR Reduction Techniques in OFDM system

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Abstract *– Due to advance technology in communication, there is a need of high data rate services like gaming, multimedia, voice and data over wired and wireless links. New modulation schemes are required for transmitting the large amount of data.5G technology can achieve a higher data rate, with capacity of the system more than 1000 times, cell throughput more than 25 times and spectral efficiency more than 10 times than the present 4G technologies. The Long-Term Evolution (LTE) and OFDM are the key tasks and central over previous systems. OFDM system uses the advance silicon and Digital Signal Processing for utilization of efficient Fourier transforms at the transmitter and receiver to perform modulation and demodulation respectively. The efficiency of bandwidth is very good in OFDM system because the subcarriers are orthogonal and overlap to each other.[9] These orthogonal and overlap subcarriers are easily decoded at receiver.Besides of these advantages OFDM system suffers from a big disadvantage that this system has a large value of Peak to Average Power Ratio (PAPR). This large PAPR occurs due to addition of data symbols in various subcarriers at the output of Inverse Fast Fourier Transform (IFFT) in the transmitter section of the system. This paper gives different techniques to reduce PAPR in OFDM systems. There are many techniques to reduce this high PAPAR, this paper give the details of these technologies.*

Keywords-*Orthogonal Frequency Division Multiplexing Technique (OFDM), Selective Level Mapping (SLM), Partial Transmit Sequence (PTS), Peak to Average Power Ratio (PAPR), Inverse Discrete Wavelet Transform (IDWT) and Discrete Wavelet Transform (DWT).*

INTRODUCTION

OFDM modulation scheme is performing the better result in last few yeras. OFDM [1] offers a very high data rate transmission in wireless communication system. OFDM is advance version frequency division multiplexing scheme used as a digital multicarrier modulation method. Various modulation schemes at low symbol rate are used to modulate subcarriers in order to maintain total data rate equal to single carrier modulation scheme within the same bandwidth. OFDM technique is being considered as the important technique for the 5G, 4G mobile communication systems. OFDM has been used for Digital Audio Broadcasting (DAB) and Digital Video Broadcasting (DVB) in Europe. OFDM [1] has many properties better than the existing single carrier communication system and the prime property is the immunity to frequency selective fading.[11] In OFDM the wideband channel are divided into a series of narrowbandchannels and these all narrowband channels experience flat fading Therefore only one tap equalizer is required at receiver side inorder to recover original signal, so by this method the complexity of receiver is reduced.

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The efficiency of bandwidth is very good in OFDM system because the subcarriers are orthogonal and overlap to each other. These orthogonal and overlap subcarriers are easily decoded at receiver. OFDM system also does not suffer from the basic transmission problems as large attenuation, noise, interference, time variance andnonlinearities.

OFDM system suffers from a big disadvantage [1, 2] of large value of Peak to Average Power Ratio (PAPR) or large Envelope Fluctuation due to addition of data symbols in various subcarriers at the output of Inverse Fast Fourier Transform (IFFT) in the transmitter section of the system. Dueto this high value of PAPR the linear amplifier switches into non linear region and saturates as a result of this orthogonality between subcarriers is lost.

Also a high value of PAPR can saturate the high power amplifier due to which out of band radiations are produced. These radiations affect adjacent channels and degrade the Bit Error Rate (BER) at thereceiver. There are many techniques to minimize this high PAPR problem. The Clipping and Filtering is the very basic technique to reduce the PAPR. Other techniques like Coding, Companding, Tone Reservation (TR), Tone Injection (TI), Selected Mapping (SLM) [3, 4] and Partial Transmit Sequence (PTS) are also being used to reduce the high valueof PAPR. The PTS technique provides better PAPR reduction performance than SLM but transmitter and receiver complexity is very high in the PTS technique also this needs [4] transmission of side information about selected sequence to the receiver in order to cancel the rotation of OFDM sub carriers. The concentration of this paper is especially upon the Selected Mapping (SLM) and Partial Transmit Sequence (PTS) techniques. Wavelet transforms instead of conventionalFast Fourier Transforms are being used in these techniques. Out of these two techniques the Partial Transmit Sequence (PTS) technique has low value of PAPR

PEAK TO AVERAGE POWER RATIOIN OFDM SYSTEM

The PAPR is the ratio of peak power and average power for the envelope of baseband complex signals (t).

$$PAPR = 10log10 \frac{\text{Peak Power}}{\text{Average Power}}$$

The input to the amplifier in OFDM system in analog signal, from the IFFT the time domain samples of output can be written as under.

$$[n] = \frac{1}{\sqrt{N}} \sum_{i=0}^{N-1} X(i)\, e^{(j2\pi in)/N}, \quad 0 \le n \le N-1 \qquad (2)$$

2.1 Probability Distribution Function ofPAPR

The cumulative distribution function (CDF) of the PAPR is one of the most frequently used performance measures for PAPR reduction techniques. In the literature, the complementary CDF (CCDF) is commonly used instead of theCDF itself. The CCDF of the PAPR denotes the probability that the PAPR of a data block exceeds a given threshold The CDF for the amplitude of a signal sample is

$$F(z) = 1 - \exp(z) \qquad (3)$$

The CCDF of PAPR of data block is used to compare the output of various reduction techniques is given by

$$P(PAPR > z) = 1 - P(PAPR \le z)$$

$$= 1 - F(z)^N$$

$$= 1 - (1 - \exp(-z))^N \qquad (4)$$

PAPR REDUCTION TECHNIQUES

Thereare many techniques to reduce the high value of PAPR in OFDM systems, techniques vary according to the need of

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the system and dependent on various factors [8]. These factors are as PAPR reduction capacity, increase in power of transmit signal, loss in data rate, complexity of computation and increase in BER at receiver. These techniques can be explained as follows.[2]

3.1 Signal Distortion Techniques

3.1.1Clipping is the simple technique in OFDM system used to reduce the high value of PAPR. In this technique the higher peak of the signal coming in outside of allowed region is clipped [7, 10].But interference becomes high and BER is also reduced.

3.1.2 Peak Windowing Peak windowing is another method to reduce the PAPR in OFDM systems. In this method the large peaks are multiplied by a Gaussian shaped window
[10] in order to reduce out of band radiation. Any window that contains good spectral properties can be used for this purpose. The window should be narrowband as possible to reduce the radiations. But this should not be too large in time domain because this affects many signals and BER is increased due to this large size of window. The example of window which fives good PAPR reduction of PAPR in OFDM system are Kaiser, Cosine and Hamming window.
3.1.3 Peak Cancellation Peak cancellation can be employed digitally after the generation of OFDM signal. Incoming data is first being coded and the serial data is converted to blocks of N complex samples. After this IFFT operation is performed on these blocks and cyclic prefix is also being added to this data. After the parallel to serial conversion the peak cancellation process is applied to reduce the PAPR.

3.2 Coding Techniques

3.2.1 Linear Block Coding

The main aim of this coding scheme is to choose the code which has low value of PAPR for transmission [10]. The input data is split into the Encoder and Mapper blocks and outputs of these blocks are applied to an IFFT block. This operation gives an original OFDM symbols, and PAPR of these OFDM symbol is calculated. After this the calculated PAPR is compared with some threshold value β. If the PAPR value is less than threshold then this data is passed to output without any operation but if PAPR value is high to threshold than some algorithm is applied to OFDM symbol until PAPR is reduced below to threshold. But selection of this type of threshold is typical as this chooses the low PAPR value so much calculations are required which increase the computational efficiency.

3.2.2 Turbo Coding

The turbo codes are exploited to reduce PAPR by implementing SLM approach with the candidates generated by turbo encoder and various interleavers [10]. The candidate which has the low value of PAPR is selected for the transmission purpose. This method does not require any side information so BER performance is not lowered which is due to incorrect recovery of side information in normal SLM approach. The turbo coding reduces the PAPR and simultaneously this turbo coding can reduce the errors by its error correction capability.

3.3 Signal scrambling Techniques

In the signal scrambling techniques the scrambling of input sequence is done by some scrambling sequence and this is done for each OFDM symbol [6]. After this the signal having lowest PAPR is selected and transmitted.

3.3.1 SLM Technique

This is the most promising technique for the reduction of PAPR in the OFDM systems. The first SLM technique was given by Bauml, Ficsher and Huber in 1996. The basic concept of this technique is based on phase rotation. From a number of different data blocks having same information at the transmitter the block of lowest PAPR is selected for the transmission [5]. Original input data is being multiplied by independent phase sequence after the multiplication process the IFFT operation is applied to each phase sequence in order to covert the signal from frequency domain to time domain. . In the last step the PAPR of different independent data blocks is compared and the data block having lowest PAPR is selected for the transmission. The OFDM signal which is selected at transmitter will have to be detected at receiver and to do this

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receiver should have the knowledge of multiplied phase sequence used to generate that particular OFDM symbol at transmitter side. So in order to accomplish this task perfectly some side information (SI) is being transmitted with the selected OFDM signal

3.3.2 PTS Technique

The second scrambling technique is known as Partial Transmit Sequence (PTS) used to reduce PAPR in OFDM system. This method is based on the two main steps [6]. In the first step the original OFDM signal is divided into number of sub blocks and in the second step each sub block is multiplied by a phase factor and then the phase rotated sub blocks are added together in order to generate the number of candidate signals and among these candidates the lowest PAPR signal is selected for the transmission.[10]

WAVELET TRANSFORM

A wavelet is a small wave or wavelet can be defined that this is an oscillation which decays quickly [12]. A wavelet can also be defined as this is a small wave which concentrates its energy in the time and gives a tool for the analysis of transient or time varying phenomena. Sinusoidal wave oscillate with equal amplitude over $-\infty \leq t \leq \infty$ so this wave has infinite energy but wavelet has its finite energy which is concentrated around a point. The wavelet transform provides the time and frequency representation of the signal. The wavelet transform was introduced by Jean Morlet in 1982 and this was a new mathematical tool for seismic wave analysis [12]. The first consideration of Morlet was that wavelets are a family of functions constructed by translation and scaling of a single function and this single function is called the "mother wavelet" ψ (t). These can be defined as follows [21].

$$\Psi_{a,b}(t) = \frac{1}{\sqrt{a}}\,\psi\left(\frac{t-b}{a}\right), \qquad a,b \in R,\ a \neq 0$$

Here 'a' is the scaling parameter or scale which measures the degree of compression. The parameter 'b' is the translation parameter which finds the time location of wavelet. So wavelet transform was proposed as an alternative of the FFT systems. The wavelet transform decomposes the desired signal into the set of basis waveforms which are called wavelets. In the wavelet transform the multi resolution analysis is performed in which an input signal is decomposed into different frequency components and after this study of each component with the resolution matched to its scales is done. This is the same process which is done in Fourier transform but the difference is that here the basis functions are not the sine or cosine waves. Due to finite duration the

wavelet has both time and frequency localization and can combat the effect of ISI in a great manner without using CP. At higher frequencies the wavelets offer good time resolution and poor frequency resolution and at lower frequencies wavelets offer good frequency resolution and poor time resolution. The wavelet transforms are of two types one is continuous wavelet transform (CWT) and other is discrete wavelet transform (DWT).

2. Proposed Wavelet Transform PTS Technique

This method is based on the two main steps. In the first step the original OFDM signal is divided into number of sub blocks and in the second step each sub block is multiplied by a phase factor and then the phase rotated sub blocks are added together in order to generate the number of candidate signals and among these candidates the lowest PAPR signal is selected for the transmission. Figure 5.1 shows this scheme. This proposed scheme uses the Wavelet Transforms (IDWT and DWT) instead of Fast Fourier Transforms (IFFT and FFT).

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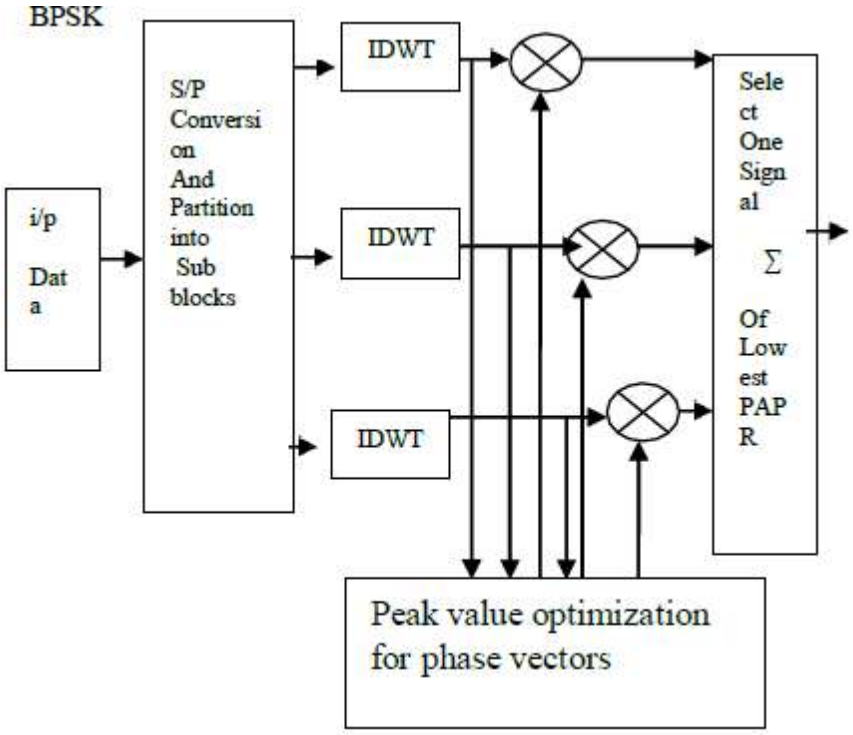

Figure5. 1 Block diagram of PTS transmitter using Wavelet Transform

SIMULATION AND RESULT

In this section the performance of the proposed techniques (WPTS) of PAPR reduction will be evaluated.. The simulation results show that the PAPR has been reduced in a great manner by the proposed techniques

6.1 PAPR Reduction with BPSKModulation

This section describes the simulation results of proposed techniques for PAPR reduction with BPSK modulation.Figure 6.1 shows the frequency spectrum of original OFDM signal to be transmitted and this figure also shows the signal with additive white Gaussian noise (AWGN). As this can be seen from the figure 6.1 that OFDM signal consists high peak to average power which is due to the addition of subcarriers in coherent manner with the same phase. This high PAPR is important factor because it reduces the efficiency of RF power amplifier and resulting in inter carrier interference.

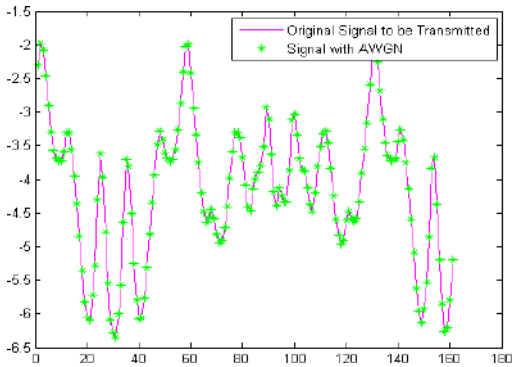

Figure 6.1: Frequency spectrum of transmitted OFDM signal

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Figure 6.3 shows the PAPR reduction using WPTS technique atreceiver side of an OFDM system using BPSK modulation.

Table 6.1 lists the PAPR values of WPTS and original signal with various parameters used in the simulation namely PAPR reduction technique, modulator, and modulator order 'M' andsub-band 'SB'.

PAPR values comparison at different parameters using BPSK				
Technique Used	Modulation Order' M'	Oversampling Factor 'L'	Sub-bands 'SB'	PAPR in dB
WPTS	4	4	64	-2.15
Original signal	4	4	64	-2.10

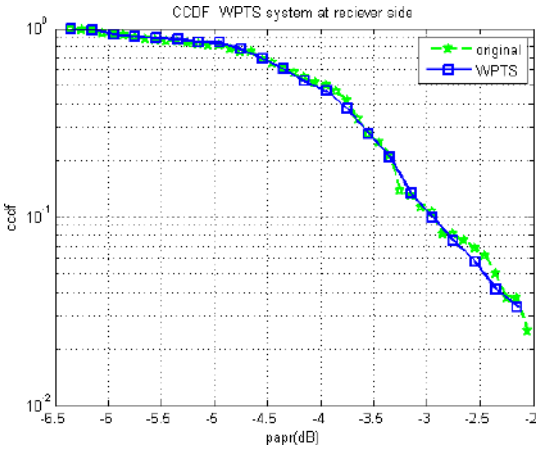

Figure 6.3: CCDF curve of WPTS technique using BPSK modulation

CONCLUSION

WSLM and WPTS techniques were in the main focus of this paper. Both techniques were explained in this paper with different modulation methods. The wavelets were also being explained and the IDWT and DWT transforms were utilized in the system to get good results. The proposed WPTS techniques used the wavelet transforms. This technique has vast scope to be used in 5 generation wireless communication system.

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Machine Learning Algorithms and Real World Application

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Abstract – *In the current Era of Fourth Industrial Revolution (Industry 4.0), the considerable information is in the form of digital data. To extract some useful information and intelligently analyze the information for automated applications on large scale, Integral part of AI i.e. Machine learning is used. Machine learning (ML) is a branch of artificial intelligence (AI) that provides computer systems the ability to automatically learn and improve from experience without being explicitly programmed. ML focuses on the algorithms and uses the data to imitate the way that humans learn, gradually improving its accuracy. This paper show the brief of machine learning algorithms and the real world application of the different ML algorithm.*

Keywords: *Machine Learning (ML), Supervised learning, Unsupervised Learning, Reinforcement Learning, Real world data*

INTRODUCTION

Machine learning is an Integral part of artificial intelligence .i.e, all types of machine learning counts as artificial intelligence, but not all AI counts as ML. By using Machine leaning any system can have the ability to learn automatically and improve from the past experience without being explicitly programmed. The process of learning begins with observations of data, such as examples, direct experience, or instruction, in order to look for patterns in the data and make better decisions in the future based on the examples provided. The primary focus is on the development of programs which allow the computers to access data and use it to learn without any human intervention or assistance. Machine learning learns faster than human learning and the result is more accurate. A machine learning algorithm affects and benefits human life in many unnoticeable ways. Machine learning algorithms typically consume and process data to learn the related patterns about individuals, business processes, transactions, events, and so on.

In the current Era, electronic world has various kinds of Digital data, such as the Internet of Thing data, cyber security data, smart city data, business data, Smartphone data, social media data, health data, agriculture data, e-commerce data and many more To analyze these data in a particular problem domain, and to extract the useful information from the data for the real-world intelligent applications, different types of machine learning techniques can be used according to their learning capabilities.

I. Types of Real word data

Data can be of various forms, such as structured, semi-structured or unstructured and metadata.

- Structured: This type of data is highly organized and easily accessed and easily used by a computer program, it has a well define structure and schemes, structured data are stored in a tabular format.

  For instance, addresses, names, dates, credit card numbers, stock information, geolocation can be considered as structured data

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- Unstructured: This type of data has no pre-defined format or pre define organization, which makes the data more difficult to capture, process, and analyze, unstructured data mostly contain text and multimedia material.

  For instance, video files, audio files, sensor data, emails, blog entries, PDF files, images, presentations, web pages, and many other types of business documents can be considered as unstructured data.

- Semi-structured: Semi-structured data are not stored like the structured data, but it does have certain organizational properties that make it easier to analyze.

  HTML, XML, JSON documents, NoSQL databases, etc., are some examples of semi-structured data.

- Metadata: The basic difference between data and metadata is that data are simply the material that can classify, measure, or even document something relative to an organization's data properties. On the other hand, metadata describes the relevant data information, giving it more significance for data users. A basic example of a document's metadata might be the author, file size, date generated by the document, keywords to define the document, etc.

TYPES OF MACHINE LEARNING TECHNIQUES

Machine learning algorithms are organized in different taxonomy based on the required outcome. Supervised, Unsupervised and reinforcement are the three main categories of learning.

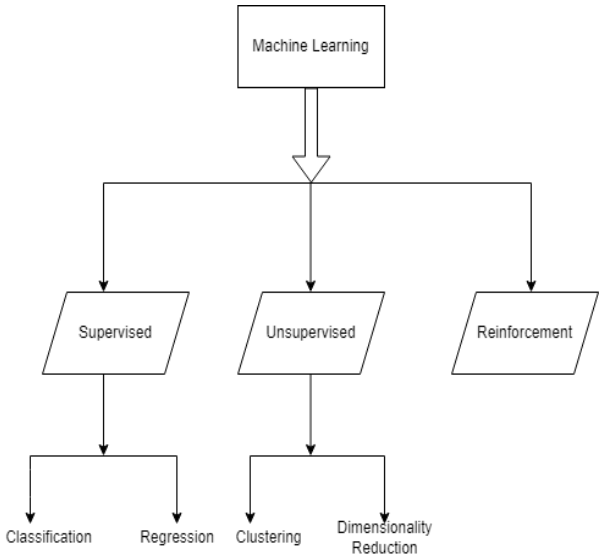

Fig: 1 Types of Machine Learning

II.1 Supervised learning: Supervised learning is typically the task of machine learning to learn from the two sets of data i.e. a training set and a test set .It uses labeled training data and a collection of training examples to infer a function. Supervised learning is carried out when certain goals are identified to be accomplished from a certain set of inputs.

The most common supervised tasks are "classification" and "regression"

- **Classification (separates the data)**: This type of supervised learning method uses an algorithm to accurately assign test data into specific categories. For example by using this learning algorithms system can classify that email is spam or not.
- **Regression (Fits the data):** is another type of supervised learning method that uses an algorithm to understand the relationship between dependent and independent variables. Regression models are helpful for predicting numerical values based on different data points, like sales revenue projections for a given business.

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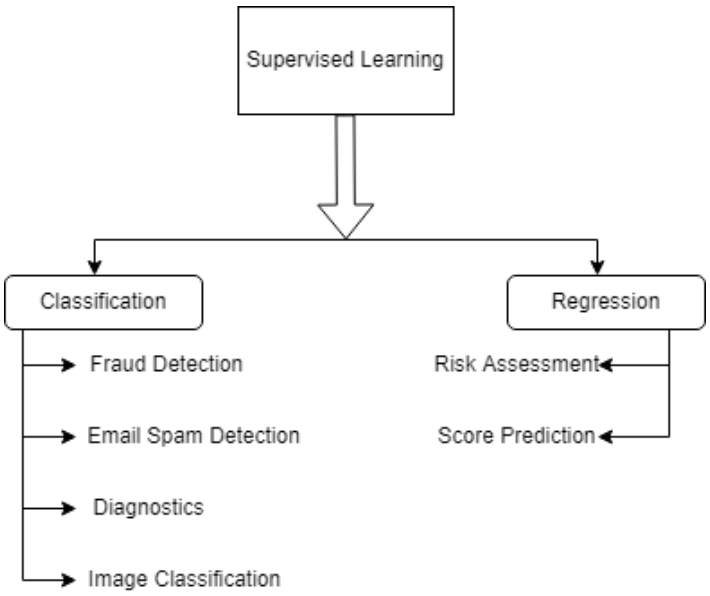

Fig: 2 Supervised Learning

Applications of Supervised Learning

- Image- and object-recognition: Supervised learning algorithms can be used to locate, isolate, and categorize objects out of videos or images, making them useful when applied to various computer vision techniques and imagery analysis.
- Predictive analytics: A widespread use case for supervised learning models is in creating predictive analytics systems to provide deep insights into various business data points.
- Customer sentiment analysis: Using supervised machine learning algorithms, organizations can extract and classify important pieces of informative data from large volumes of data—including context, emotion, and intent—with little human intervention. This can be incredibly useful when gaining a far better understanding of customer interactions and can be used to improve brand engagement efforts.
- Spam detection: By using supervised classification algorithms database will be train for recognize patterns in new data to classify spam or non spam related correspondences.

II.2 Unsupervised learning uses machine learning algorithms to analyze and cluster unlabeled data sets. These algorithms discover hidden patterns in data without the need for human interference, i.e., a *data-driven process*

Unsupervised learning is widely used for extracting generative features, identifying meaningful trends and structures, groupings in results, and exploratory purposes. The most common unsupervised learning tasks are clustering, density estimation, feature learning, dimensionality reduction, finding association rules, anomaly detection, etc.

Unsupervised learning models are used for three main tasks: clustering, association and dimensionality reduction:

- **Clustering** is a data mining technique for grouping unlabeled data based on their similarities or differences.

  This technique is useful for market segmentation, image compression, etc.

- **Dimensionality reduction** is a learning technique used when the number of dimensions in a given dataset is too high. It reduces the number of data inputs to a manageable size while also preserving the data integrity.

  Often, this technique is used in the preprocessing data stage, such as when auto encoders remove noise from visual data to improve picture quality.

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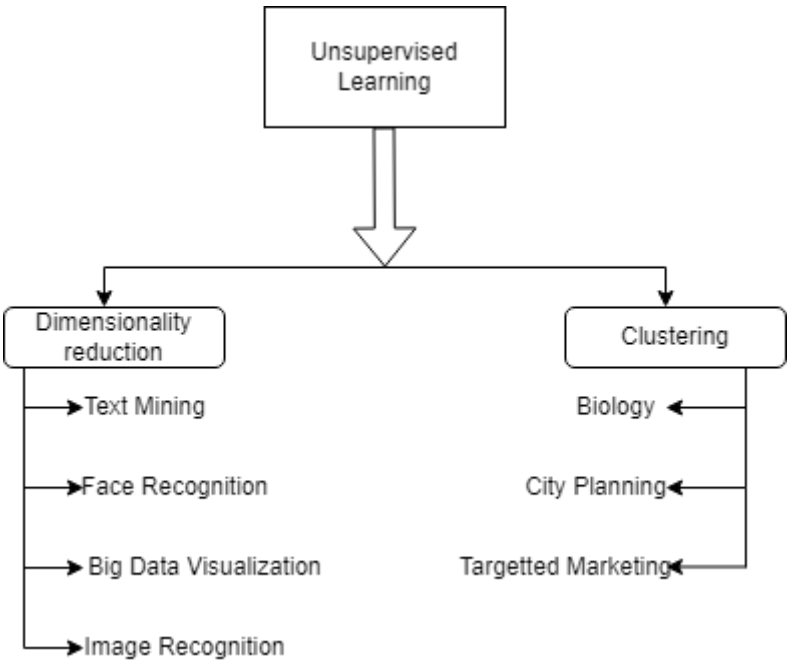

Fig: 3 Unsupervised Learning

Applications of unsupervised learning are:

- News Sections: Google News uses unsupervised learning to categorize articles on the same story from various online news outlets.

  For example, the results of a presidential election could be categorized under their label for "US" news.

- Computer vision: Unsupervised learning algorithms are used for visual perception tasks, such as object recognition.
- Medical imaging: Unsupervised machine learning provides essential features to medical imaging devices, such as image detection, classification and segmentation, used in radiology and pathology to diagnose patients quickly and accurately.
- Anomaly detection: Unsupervised learning models can comb through large amounts of data and discover atypical data points within a dataset. These anomalies can raise awareness around faulty equipment, human error, or breaches in security.
- Customer personas: Defining customer personas makes it easier to know common traits and business clients' purchasing habits. Unsupervised learning allows businesses to create better buyer persona profiles, enabling organizations to align their product messaging more appropriately.
- Recommendation Engines: Using past purchase behavior data, unsupervised learning can help to discover data trends that can be used to develop more effective cross-selling strategies. This is used to make relevant add-on recommendations to customers during the checkout process for online retailers

II.3 Reinforcement Learning: Reinforcement learning is a type of machine learning algorithm that enables software agents and machines to automatically evaluate the optimal behavior in a particular context or environment to improve its efficiency. In reinforcement learning software agent learns automatically using feedbacks without any labeled data. i.e, an environment-driven approach.

This type of learning is based on reward or penalty, for each good action, the agent gets positive feedback, and for each bad action, the agent gets negative feedback or penalty. The primary goal of a software agent is to improve the performance by getting the maximum positive rewards.

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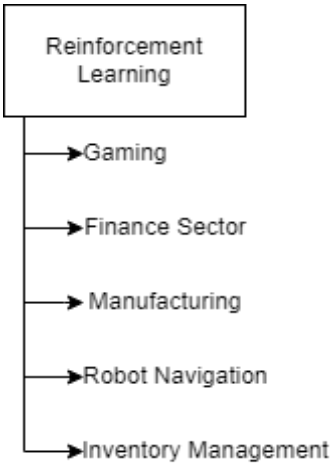

Fig: 4 Reinforcement Learning

Applications of Reinforcement Learning are:

- Reinforcement Learning solves a specific type of problem where decision making is sequential, and the goal is long-term, such as **game-playing,** etc.
- Reinforcement learning algorithm enhance robot for learning, improve, adapt and reproduce different tasks.
- In health care by using reinforcement performance of existing care can improve, by observing how the patient responds to the treatment and based on the feedback the process repeated.

CONCLUSION

This paper illustrates the brief study of machine learning, algorithms, tasks and its application in real world. The paper has offered the different features and algorithm of Machine learning and also highlights the various types of real world data and machine learning such as supervised learning, unsupervised learning and reinforcement learning. And based on their advantages these techniques can be useful in different domains.

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Data Transmission Using LI-FI Technology

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Abstract – *Visible light communication (vlc) is an optical wireless technology that transfers data using the Visible light spectrum as a medium.li-fi or light fidelity refers to bidirectional communication By light. The infrastructure for such technology already exists, allowing light to be used for both Illumination and communication. Wifi, which combines radio frequency for data transfer and it is the most versatile and successful wireless technology, on the other hand ,wifi has number of challenges including capacity, availability, efficiency, and security due to the many access points. Wifi emits radio waves that are particularly harmful for patients or increases the danger of diseases issues for normal people and radio waves interpret the medical instruments. So, the wifi is restrict such as airplanes hospitals and in some research facilities due to use of radio waves. The purpose of this paper is to create and evaluate a light fidelity (li-fi) based system. Li-Fi outperforms Wi-Fi in terms of bandwidth, connectivity, and security, and has already attained rates over 1 Gbps in the lab. There are numerous chances to leverage this medium by utilizing the low-cost characteristics of LEDs and lighting components. Li-Fi is the transfer of data through light by taking fiber out of fiber optics and sending data through LED light bulb.*

Keywords: *Visible Light Communication (VLC), Light Fidelity (Li-Fi).*

INTRODUCTION

Harald Haas came up with the name LI-FI in 2011 based on the concept of delivering data through the hardly detectable flickering of LED light. The on-off series of Morse code occurs so quickly that it is imperceptible to the human eye. It is generally anticipated that VLC technology, also Known as light fidelity Li-Fi, will replace Wi-fi for indoor communication. Currently, the 802.11 wireless fidelity standard is used in all settings with electronic communication and data transfer (Wi-Fi).Wi-Fi is widely accessible and extremely scalable, but its advantages are also its drawbacks. This is so that data may be sent from one location to another using Wi-Fi, which employs radio waves. There are several restrictions on this radio wave spectrum.

WORKING OF LI-FI:-

Since LEDs operate at speeds of less than 1 μs, they can be turned on and off quicker than the human eye can notice, giving the impression that the light source is always on. Binary coding are used for data transmission through this stealthy on-off process. Binary "1" denotes turning on an LED, while binary "0" denotes turning it off. By changing the rate at which LEDs turn on and off to produce distinct strings of 1s and 0s, it is feasible to encrypt data in light. Humans are unable to detect modulation because of its rapidity. The signal is subsequently captured by a photo detector, which transforms it back into its original form.

EXISTING SYSTEM:-

Our IR Remotes have been transmitting data through photodiodes for a very long time. The IR LED in the television remote pulses rapidly every time we push a button, transmitting information that is subsequently decoded by the television when it has received it. However, this antiquated technique is extremely slow and cannot be used to transfer any valuable data. The two reliable wide-range sources utilised by many applications nowadays are Wi-Fi and Bluetooth. The signal

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noise in these methods, which utilise radio frequency spectrum, is extremely high.These techniques also require specialised equipment, use a lot of power, and are expensive. Here, secure data transfer is not possible. Since WPS uses radio wave communication, it is unhealthy and may easily be hacked. WPS key encryption is available.

PROPOSED SYSTEM:-

A novel form of data transmission uses visible light.

Li-Fi uses light intensity modulation to send data, which is subsequently picked up by a photo-sensitive detector. A light source serves as the transmitter for VLC, and a detector serves as the receiver. The LED will shine more then the voice is louder. The solar-powered light is interpreted by the receiver portion, which then uses a speaker to translate the signal into audible sound. Therefore, employing many LEDs and transmitting multiple data streams at once with Li-Fi makes this system more complicated. By doing this, more information can be transmitted, which allows for faster data exchange.

BLOCKDIAGRAM:-

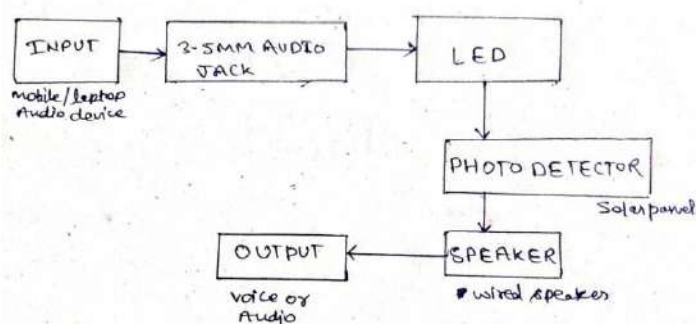

Fig 1: BLOCK DIAGRAM OF PROPOSED SYSTEM

An audio signal (such as any music from a mobile device) is used as the input signal on the transmitter side of an audio communication method using visible light. The LED is supplied with this signal. Depending on how loud an audio signal is, the LED's light signal changes. A light-dependent resister at the receiver side will pick up the light signal and produce an electrical signal that is proportionate to it. The audio signal that was at the transmitter side's input is created by processing this electrical signal in a low voltage audio power amplifier before being sent to a speaker.

HARDWARE REQUIREMENTS:-

1. INPUT:-

Analog signals are used as input and are typically obtained through the audio output of a mobile device, laptop, or other musical instrument.

2. AUDIO JACK:-

It is a mobile connector that is used to link mobile phones to audio equipment.

Here, it is utilised to link the mobile device or any other device with a Li-Fi audio signal input, such as an IPAD, MP3 player, etc.

Fig : 3.5mm Audio Jack

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3. LEDs:-

The ability of a light source to repeatedly flip on and off over very brief periods of time is the most crucial prerequisite for Li-Fi transmission (in ns range). Since LEDs have a relatively short switching time, we use them. Based on the pulse signal, these LEDs switch ON and OFF in nanoseconds. Since the switching occurs at a higher rate, the human eye cannot see it.

Therefore, even if they are blinking, it will appear to be lighting. As a result, modulated signal is conveyed to receiver via visible light.

Fig 3: LED

4. PHOTO DETECTOR:-

The LEDs' sent signal needs to be recognised, demodulated, and detected. So we utilise a photo cell or a solar cell (which consists of numerous photo cells connected in series) to detect the message signal from the blinking LED light.

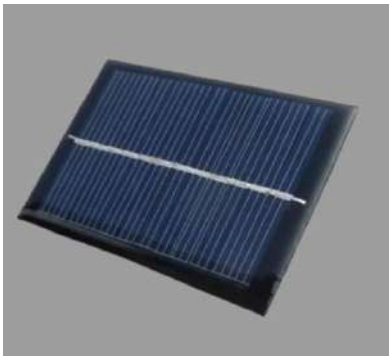

Fig 4: Solar panel

Since blinking may be easily observed and the solar cell's output is an analogue message signal, the solar cell simply detects variations in light. Thus, we were able to detect and demodulate the delivered communication signal utilising solar energy.

5. SPEAKER:-

Speaker can amplify the audio output receives from the solar panel that can input to the LED.

Fig 5: Speaker

From speaker to final location, the demodulated audible signal is sent. The message that has been transmitted from the source can now be heard by the audience.

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6. BATTERY:-

Battery is using to give a power to LED and it can help to complete the circuitry. Here, we are using a 9 volt battery.

Fig 6: Battery

7. PROPOSED SYSTEM:-

Proposed system which is using in the experiment is given below :

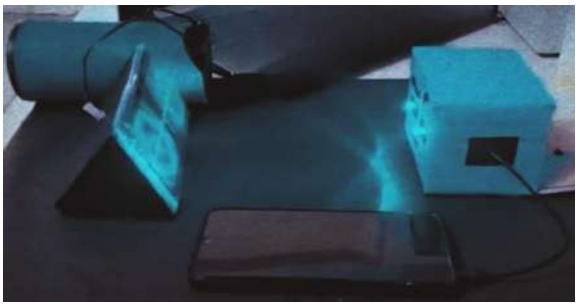

Fig 7: using system

ADVANTAGES:-

- Faster Data Transmission than Wi-Fi.
- Easy and Inexpensive to Deploy.
- Security Due to the Limitations of Light.
- Immune from Electromagnetic interference.
- Low Cost.
- Portability.
- Low bit error rate.
- High efficiency.
- Consumes less energy.

APPLICATIONS:-

Li-Fi technology has many uses, such as enabling public Internet access using current lighting (LED) and enabling autonomous vehicles to communicate through their headlights (LED based). Applications of Li-Fi can be expanded into places where Wi-Fi technology does not yet exist, such as aeroplanes, hospitals (operation theatres), power plants, and numerous other places where electromagnetic (Radio) interference is a major concern for the safety and security of both people and equipment. Li-Fi may be utilised safely in these places or situations because it just requires light. With the development of Li-Fi, all street lamps will eventually be able to serve as Li-Fi connection sites for data transmission. Because of this, any public space and roadway will have internet connection.

Following are some potential uses for Li-Fi in the future:-

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a) Education systems:- The newest technology that can deliver the quickest speed for Internet connection is called Li-Fi. In order for users to utilise Li-Fi with the high speed, it can supplement or replace Wi-Fi in businesses and educational institutions.

b) Medical Applications:- Wi-Fi is not permitted in operation theatres (OTs) because to radiation safety issues. The signals for monitoring equipment are interfered with or blocked when Wi-Fi is used in hospitals. As a result of the medical equipment's malfunction, the patient's health may be put at risk. Li-Fi can be used to access the internet and also to manage medical devices as a way to get around this and make OT tech savvy. For doing robotic operations and other automated procedures, this will be advantageous.

c) Cheaper Internet in Aircrafts:- Aircraft passengers can get Internet at a very high cost and at a very low speed. Wi-Fi is not used either since it can obstruct the pilots' navigational systems. Li-Fi can be used for data transfer in aircraft. Li-Fi can simply deliver high-speed Internet access using any internal light source, including ceiling reading lamps, etc.

d) Underwater applications:- Remotely operated vehicles (ROVs) that operate underwater are powered by sizable cables that also enable them to receive signals from their pilots above. However, ROVs' tethers are too short to let them travel farther in their explorations. They would be much more free to roam if their wires were replaced with light, such as from a submerged, high-powered lamp. Additionally, they could interact with one another using their headlights, processing information on their own and periodically relaying what they learned to the surface. Li-Fi can even function underwater, where Wi-Fi is entirely unusable, creating countless options for military activities below the surface.

e) Traffic management:- Li-Fi can be used at traffic signals to communicate with passing cars (through their LED lights, for example: which can aid with improved traffic management, leading in a smoother flow of traffic and a decrease in accident rates. Additionally, LED car lights can warn drivers when other cars are approaching too closely.

f) Mobile Connectivity:- Tablets, computers, smartphones, and other mobile devices can all simply connect to one another. Li-short-range Fi's network can produce extraordinarily high data rates and greater security.

g) Replacement for other technologies:- Radio waves are not used for Li-Fi to function.
Therefore, it may be utilised simply in locations where Bluetooth, infrared, Wi-Fi, etc. are prohibited.

CONCLUSION:-

There are several options that can also be investigated further. Every bulb might function as a Wi-Fi hotspot to transfer wireless data if his technology can be made usable, and we will get closer to a cleaner, greener, safer, and brighter future. Li-Fi is currently the subject of a lot of discussion, not the least of which is the possibility that it will provide a true and highly effective wireless radio alternative. The airways are getting increasingly congested as more people and their numerous devices use wireless internet, making it harder and harder to receive a dependable, high-speed connection. This may address difficulties like the lack of radio-frequency bandwidth and provide internet access in places where conventional radio-based wireless is prohibited, such as aeroplanes and hospitals.
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Chapter No-35, PP. 236-239

Comparison Between Band Noteched UWB Microstrip Patch Antenna

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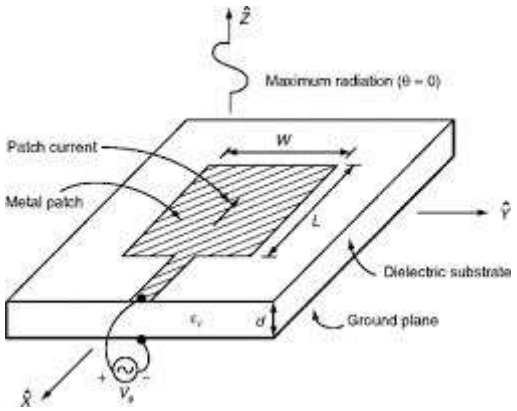
Abstract – *In this paper, presented the survey of different types of microstrip patch antenna for ultra-wideband with notched cutting. Ultra-wide band technology has advantages like high data rate (>100mb/s), low power utilization, small size, low cost, hardware simplicity and great immunity to multipath interference. It has a wide range of applications such as military applications, medical applications, radar applications, navigations, wireless communications and many more.*

Keywords *Ultra-wideband (UWB),MPA(Microstrip Patch Antenna), WLAN*

.INTRODUCTION

Antenna act as the transducer device which converts electrical signal into radio frequency signal at transmitter end and radiates them; at receiver end it receives radio frequency signal converts into electrical signal. A micro strip patch antenna be made up of of a rectangular patch on a ground plane detached by dielectric substrate [1].The patch is made by a conducting material Copper or Gold. Patch can be of any shape rectangular, circular, triangular, elliptical or some other common shape. In the basic form, a MPA as shown in fig 1 consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side. The radiating patch and the feed lines are usually photo etched on the dielectric substrate. Micro-strip can be choose as square, circular or rectangular in shape for the ease of analysis and fabrication. The following image shows a micro-strip or patch antenna.



Due to enormous advantages of planar monopole antenna such as wide bandwidth, simple structure and omnidirectional radiation pattern, the UWB antenna designers find it as a most promising candidate for UWB wireless communication applications. Thus, various UWB antenna designs have been developed [1]–[5] since the allocation of frequency band from 3.1 to 10.6 GHz for unlicensed UWB services by the Federal Communications Commission (FCC). Due to its excellent performance in communication systems, it has been widely adopted for short range wireless communications. However, due to its wide operational frequency range (3.1 GH to 10.6 GHz), it undergoes interference with other communication systems that operates on same frequency bands such as, WLAN (5.2/5.8 GHz), WiMAX (3.5/5.5 GHz) and ITU (7.9 GHz)

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bands. Therefore, a filtration technique is required to remove the interfering bands without any additional circuitry. UWB antennas with band-notched characteristics are in huge demand now a days. For designing the band-notched UWB antennas, in-depth knowledge of various problems incurred during the designing phase has to be studied properly. This review paper, shows the some of the previous year results that various antenna design methods for ultra-wideband range have like slot cutting U-shape, UWB V-shaped antenna, miniaturized micro-strip-fed tapered-slot antenna and square patch with square slots and a ground plane truncated with two mirror L-shaped notches designed for ultra UWB applications.

COMPARISON OF THE VARIOUS REPORTED ANTENNAS

Multiple resonant frequencies are excited to form a UWB by properly loading a notch to the open-ended T-shaped slot and extending a small section to the microstrip feed line [1]. In [2], the hexagonal shaped radiator and two vertically extended ground planes are used to save space around the radiator and enhance the impedance bandwidth. A CPW rectangular monopole of M-shaped notched at the bottom, a taper CPW ground and a T-shape ground in notch are used to enhance the impedance bandwidth [3]. A novel octagonal-shaped UWB antenna that is designed to have a minimum radar cross section [4] and a novel M-Shape monopole-like slot UWB antenna [5] are other reported techniques to obtain ultra wide bandwidth. Nowadays, the research on the UWB antennas has turned towards miniaturization and band-notched characteristics. Many antennas with band-notch characteristics at WLAN band have been reported in the literature [6]–[13]. For an inverted U-shaped slot antenna dual band-notched properties are obtained by etching a C-shaped slot on the radiation patch and extruding an L-shaped stub from the ground plane [6]. In stepped slot antenna, a second-order notched band is obtained by slitting an open-ended quarter-wavelength split slot on the back of the feed and a short-ended half-wavelength split-ring slot near the stepped slot [7]. In a multiband and compact UWB antenna [8], the dimensions of the square slots etched into the microstrip feedline have been used to tune the antenna's band-notch and bandwidth characteristics. In [9], a good band-notched performance is achieved by using high permittivity and low dielectric loss substrate, and inserting quarter-wavelength horizontal/vertical stubs or alternatively embedding quarter-wavelength open-ended slots within the feed line. The band-notched property is achieved by etching two split-ring resonator (SRR) slots on the radiators, respectively [10]. In [11], UWB operation with a notched frequency band have been obtained by inserting an Archimedean spiral-shaped slot into a microstrip open-circuit circular stub of microstrip-slot line transition. Ultra wide bandwidth is obtained by using a star like-shaped radiator and a defected rectangular ground plane and band-notched functions which are obtained by attaching L- and I-shaped structure on the ground and a capacitive-loaded loop (CLL) resonator on the patch [12]. The self-similar fractal property is used in the U-shape monopole to obtain a good impedance matching over a wider bandwidth, and complementary split ring resonator in the ground plane are used for band-notched property. Recently, a small band-notched monopole UWB antenna is proposed in which the band-reject is achieved by attaching a strip to the hollow centre of a wing-shaped monopole [13]. However, size of this antenna is very small (11×15 mm2) but covers only 5 GHz to 15 GHz bandwidth. Which may limit its practicability. Table I listed the comparison of the proposed antenna with recently reported antennas. In this study, a novel miniaturized design is proposed for enhanced ultra-wideband operation using a square shape radiator patch with a triangular cut, two L-shaped ground.

Table 1- Performance Comparision

Ref. #	Size (mm× mm)	Operating BW(GHz)	Fractional BW(%)
[1]	28× 14.5	3.1–11.45	114
[2]	25× 23	2.71–12.61	129
[3]	45× 30	3.15–32	164
[4]	70× 60	2.5–18	151
[5]	36× 36	2.38–12.40	135
[6]	20× 27	2.89–11.52	111
[7]	22× 8.5	3.2–10.6	107
[8]	27× 30.5	3.1–10.6	109
[9]	28× 28.5	2.8–11	118
[10]	48× 48	2.5–12	131
[11]	50× 50	2.4–11.2	129
[12]	25× 20	2.63–13.02	132
[13]	11× 15	5–15	100
Proposed	**15× 15**	**4.1–30**	**152**

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In this study, a novel miniaturized design is proposed for enhanced ultra wideband operation using a square shape radiator patch with a triangular cut, two L-shaped ground planes on the same side to provide CPW feed. Further, two rectangular slits are etched in the rectangular patch to restrict the interference at WLAN frequencies from 5 to 6 GHz having the centre frequency at 5.5 GHz while maintaining the UWB bandwidth. Although the lower operating frequency of the conventional UWB applications starts from 3.1 GHz, but for the proposed design, due to its small size, it starts from 4.1 GHz. However, the lower operating frequency of 3 GHz can be easily achieved by increasing the antenna size by a fraction. Here, the goal of this design is to demonstrate that the proposed technique can be used for compact devices. Thus, the compact size of the proposed antenna with enhanced impedance bandwidth is chosen.

CONCLUSION

This paper shows comparison of different techniques and design of the microstrip patch antenna for ultra-wide band frequency range. Using one of any technique of designing antenna some of disadvantages or limitations of conventional microstrip characteristics were improved. All discussed antennas work for UWB and after this work author feels that further research and more work is needed in these areas. Design of microstrip patch antenna has been reviewed in this paper based on HFSS, CST. However compact square shape monopole antenna with band-notched characteristic is proposed. The fabricated antenna showed good agreement between measured and simulated results with a wide bandwidth of 23.4 GHz from 4.1 to 27.5 GHz and notched band in a small size. The antenna is thus suitable to be integrated within the portable devices without EMI interference at the WLAN band.

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Automatic Smart Street Light

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Abstract- *Street lights are the major requirements in today's life of transportation for safety purposes and avoiding accidents during night. In today's busy life no one cares to switch on/off street lights as per the requirement. This project focuses on saving electricity by detecting the intensity of lights and automatically switches on/off street light partially .Initially the circuit will be in off status, but when the intensity of lights around the LDR getting low or we can say when the darkness of night increasing, the circuit will get on and street light starts glow. As the intensity of darkness increases the intensity of street light will get increases and after sometimes the light will glows at its high intensity.*

INTRODUCTION

To save or conserve energy becomes very essential because most of the energy sources in which we depend, like coal and natural gas that can't be replaced. Once we use it up, they are gone forever. Saving power is become very important, instead of using of power in unnecessary time should be switched off. In many city "STREET LIGHT" is one of the major power consuming factors. Maximum time we see street lights controller has an LDR (light dependent resistor) which are used to detect the presenceof light. If the ambient light is below a specific value the lights are get turned ON. Automatic light control system is very simple and powerful concept, in which it uses transistor (asswitch). By the useof this system, all theworks that are done by manually will 100% removed. It automatically switches ON the lights when the light (sunlight) goes down the visible region of our eyes. These are done by a sensor called LDR(Light Dependent Register) which detect(sense) the light actually like our eyes. It automatically switches OFF lights whenever the light(sunlight) comes visible to our eyes.

COMPONENTS REQUIRED:

- LDR
- Battery
- LED
- Transistor(2N2222A)
- Resistors(1K)
- Wires

1.LDR

A photoresistor (light dependent resistor) is an electronic component that are sensitive to light. When lights fall on it, then the resistance will vary. The value of the resistance of the

LDR can change over the many orders of magnitude.The value of resistance reduces as the light level increases.

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It is common for the values of resistance of an LDR to be several megohms in darkness and then reduce to a few hundred ohms in bright light.

With such a very wide variation in the resistance, LDR are easy to use and also there are many LDR circuits available. The sensitivity of LDR (light dependent resistors or photoresistors) also varies with the wavelength of the incident light (sunlight).

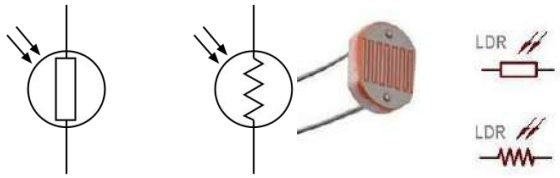
LDR are made up from semiconductor materials to enable it to have their light sensitive properties. For thismany materials can be used, but one popular material for these LDR is cadmium sulphide, CdS, although to use of these cellsrestricted in Europe because of environmental issues by the using of Cadmium.

Similarly based on cadmium other semiconductor materials like cadmium CdSe are also restricted. Other materials that can be used include lead sulphide (PbS) and indium antimonide, (InSb).

Although a semiconductor material is used for these LDR, these are purely passive devices because of they do not possess a PN junction, and this separates them from other LDR (photoresistors) like photodiodes and phototransistors.

1.1 LDR symbol

The LDR symbol are used in electronic circuits is based around the resistor symbol, but shows the light, in the form of arrows shining on it. By this way it's following the same convention used for photodiode and phototransistor circuit symbols where the arrows are used to show the lights are falling on these components.



The light dependent resistor circuit symbols are shown for both the newer style resistor symbol, a rectangular box and the older zig-zag line resistor circuit symbols.

Often the light dependent resistor, LDR symbol may be shown without the circle around it. This is often done on the electronic circuit schematic to save space and reduce the number of lines and circles onthe diagram to reduce complication.

2. Battery

9volt battery is an extremely common battery that was first used in transistor radios. Its features are, a rectangular prism shape that utilizes a pair of Snap connectors which are situated at the top of the battery. A wide array of both large and small battery manufacturers produces versions of the 9volt battery. Possible chemistries of primary non-rechargeable 9voltbatteries include alkaline, carbon zinc, lithium. Possible chemistries of secondary rechargeable 9volt batteries include nickel-cadmium(NiCd), Nickel metal hydride(NiMH), and Lithium ion. The performance and application of the battery can vary greatly between different chemistries, meaning that some chemistries are better suited for some applications over others.

2.1 Use of 9volt battery

The use of 9volt battery are in many different applications. 9volt batteries can frequently be seen used in radios, smoke alarms, wall clocks, walkie-talkies, portable electronics, and much more. In the American prison system inmates have even been known to utilize the 9volt battery to fired cigarettes by fixing a steel wool or wire to create an extra hot contact point. This is not recommended as it can cause harm to you and your battery but goes to show many uses 9volt batteries can have.

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3. LED

A light emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.

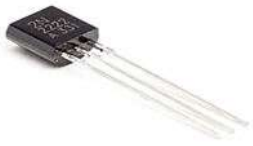
Light emitting diodes are heavily doped of p-n junctions. Based on the semiconductor material used and the amount of doping, an LED will emit a coloured light at a particular spectral wavelength when forward biased. As shown in the figure, an LED is encapsulated with a transparent cover so that emitted light can come out.

4. Transistor

A transistor is a miniature semiconductor that regulates or controls current or voltage flow in addition amplifying and generating these electrical signals and acting as a switch/gate for them. Typically, transistors consist of three layers, or terminals, of a semiconductor material, each of which can carry a current.

4.1 2N222A Transistor

The 2N2222A transistor is a common npn bipolar junction transistor& it's used are in mainly the applications of switching & amplifying with less power. The transistors are mainly designed by keeping in mind of some keys points like for low power, low to medium current, medium voltage &can works at fairly high speeds.
In the 2N2222A NPN transistor, a single P-dopped layer is embedded among two N-doped layers. The transistor contains three terminals that are Base, Emitter & Collector. The symbol of 2N2222A transistor is given below:



4.1.1 Pin Configuration of 2N2222A

The pin configuration of the 2N2222A transistor is given below. This transistor includes three pins & its each pin functionality discussed below.

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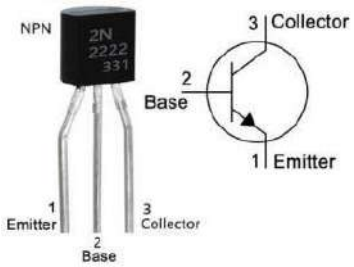


- **Pin1(Collector):**It is the first pin of the transistor & from here we get output. The main function of this pin is to provide transistor current toward the o/p load.
- **Pin2(Base):**It is the second pin of the transistor & also control pin. The main function of this pin is to control the current from emitter to base.
- **Pin3 (Emitter):** This is the third pin of the transistor & it is used to drain out the complete current of the transistor.

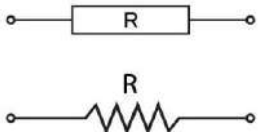
5. Resistor

The resistor is a passive electrical component that creates resistance in the flow of electric current. It can be found in almost all electrical networks and electronic circuits. It is measured in ohms(Ω). An ohm is the resistance that occurs when a current of 1 amperepasses through a resistor with drop of 1voltacross its terminals. The current is proportional to the voltage across the terminal ends.

We use resistors for many purposes. Some of the examples like limiting electric current, voltage division, heat generation, matching and loading circuits, gain control and setting time constants. These are commercially available with resistance values over a range of larger than nine orders of magnitude. These can be used as electric brakes to dissipate kinetic energy from trains, or be smaller than a square mm for electronics.

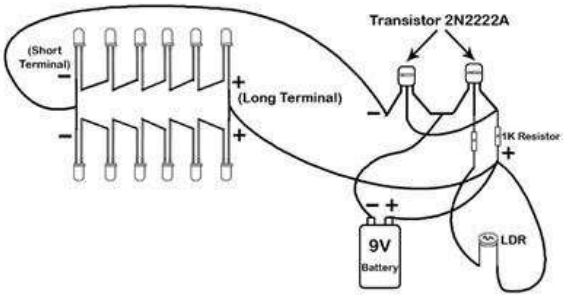
5.1 Resistor Symbol

The international IEC symbol is a rectangular shape with leads at each end as shown in the figure in top. In the USA, the ANSI standard is very common and represents a fixed resistor as a zigzag line (shown at the bottom).



CIRCUIT DIAGRAM

The circuit diagram of the components we have used in the project is given below.



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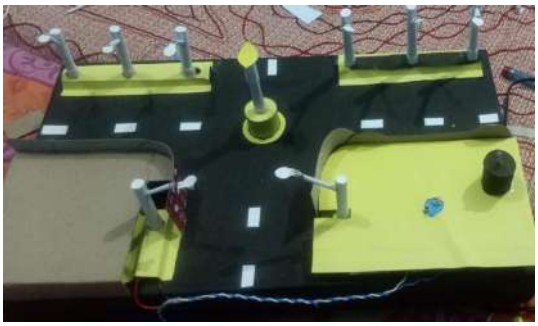
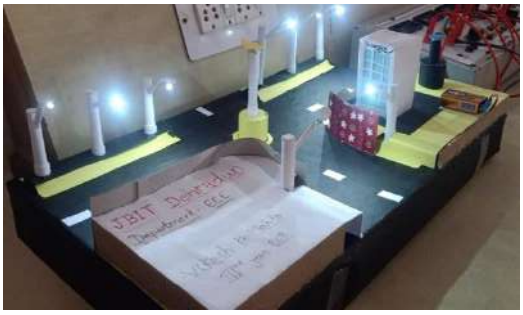
REALIZATION OF THE PROJECT

Power is provided by a battery. Here the LDR we have used having the resistivity high during the presence of light and having resistivity low during the absence of light. So, on absence of light, power is supplied to the LED and starts glowing. Figure out of the smart street light project is shown below.





CONCLUSION

Thus by using the concepts of LDR sensor we can make highly efficient, low power consuming automatic smart street light. There is ease of maintenance and no labour required for regulating the system.

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Speed Control of Buck-Boost converter Driven Dc Motor Based on Smooth Trajectory Tracking

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Abstract – *Speed control is a common requirement in the industrial drives in the presence of varying operating conditions ie. load disturbance . Conventional controllers with fixed parameters are not successful in the real time applications because of the drift in the plants operating conditions This paper presents the detailed account on the control design of a buck converter driven dc motor Proportional-Integral (PI) and Proportional-Integral-type Fuzzy Logic controller (PI-type FLC) are the Techniques proposed in this investigation to control the speed of a dc motor. Complete analyses of simulation results for PI and PI-type FLC technique are presented in frequency domain and time domain, respectively. Performances of the controller are examined in terms of duty cycle input energy, armature current and angular velocity. Finally a comparison assessment of the impact of each controller on the system.*

Keywords- Fuzzy–logic controller, PI, DC motor etc

INTRODUCTION

A common actuator in control systems is a dc motor and is obvious choice for implementation of advanced control algorithms in electric drives, due to the stable and linear characteristics associated with it. It is also ideally suited for tracking control. From a control system point of view, the dc motor can be considered as a SISO plant eliminating the complexity associated with multi-input drive systems. The speed of a driven load often needs to run at a speed that varies according to the operation it is required to perform. The speed in some cases (such as fluctuating loads like rolling mills) may need to change dynamically to suit the conditions, and in other cases may only change with a change in process.

This paper describes the rejection of deviation in speed caused by load disturbance for a separately excited dc motor under various load-disturbing situations, parameter uncertainties and measurement noise with an adaptive control approach resulting in an improved performance. Dc motors are most commonly driven by PWM signals with respect to the motor input voltage. However, the underlying hard switching strategy causes unsatisfactory dynamic behavior. The resulting trajectories exhibit a very noisy shape. This causes large forces acting on the motor mechanics and also large currents which detrimentally stress the electronic components of the motor as well as of the power supply.

Present a control for the entire system of buck-converter/dc motor. The combination of dc to dc power converters with dc motors has been reported. In particular, the composition of a buck converter with a dc motor has been proposed. The buck type switched dc to dc converter is well known in power- electronics. Due to the fact that the converter contains two energy storing elements, a coil and a capacitor, smooth dc output voltages and currents with very small current ripple can be generated. In this respect, an important issue is the circuit design of the converter in order to obtain, at any time, a high power conversion rate when tracking smooth reference trajectories of the angular velocity.

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DESIGN OF DC MOTOR

Resistance of the coil windings R_a =Armature winding resistance [ohms];

L_a =Armature winding inductance [Henry];

i_a = Armature current [amps];

i_f =Field current [amps]=a constant;

V_a =Applied armature voltage [volts];

E_b = Back emf [volts];

ω_m = Angular velocity of the motor [rad/sec];

T_m = Torque developed by the motor [Newton-m];

J_m =Moment of inertia of the motor rotor [kg-m^2 or Newton-m/(rad/sec^2];

B_m =Viscous friction coefficient of the motor [Newton-m/(rad/sec)];

T_w =Disturbance load torque [Newton-m];

The input voltage V_a is applied to the armature which has a resistance of R_a and inductance of L_a .The field current supplied i_f supplied to the field winding is kept constant and thus the armature voltage controls the motor shaft output. The moment of inertia and the coefficient of viscous friction at the motor shaft being J_m and f_m respectively .The speed of the motor is being ω_m radian per second. The related dynamics equation

$$V_a = R_a i_a + L_a \frac{di_a}{dt} + E_b \quad (2.1)$$

$$E_b = K_b.\omega_m \quad (2.2)$$

$$V_a = R_a i_a + L_a \frac{di_a}{dt} + K_b \omega_m \quad (2.3)$$

$$T_m = K_T i_a \quad (2.4)$$

$$T_m = J_m.\frac{d\omega_m}{dt} + B_m.\omega_m \quad (2.5)$$

Taking the Laplace transform of equation (2.1)-(2.5), assuming zero initial conditions, we get

$$T_m(s) = K_T I_a(s) \quad (2.6)$$

$$E_b = K_b \omega(s) \quad (2.7)$$

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$$E_a(s) - E_b(s) = (L_a.s + R_a)I_a(s) \quad (2.8)$$

$$(J_m.s + B) = T_M(s) - T_L(s) \quad (2.9)$$

Equation (2.6)-(.9) gives the transfer function between the motor velocity $\omega_m(s)$ and the input voltage $E_a(s)$ is given as below.

$$\frac{\omega(s)}{E_a(s)} = \frac{K_T}{(L_a s + R_a)(J_m s + B_m) + K_T K_b} \quad (2.10)$$

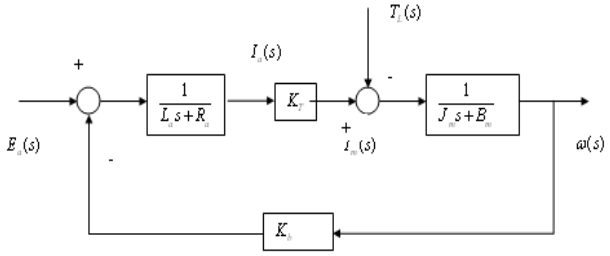

Figure 1 Block diagram of a DC motor (armature controlled) system

STATE SPACE REPRESENTATION [5]

Let the armature current ($i_a = x_1$) and angular velocity ($\omega_m = x_2$) be the state variable and the angular velocity be the output variable. Therefore the following state space model can represent the dynamics of dc motor.

$$\frac{di_a}{dt} = -\frac{R_a}{L_a}.i_a - \frac{K_b}{L_a}.\omega_m + \frac{V_a}{L_a} \quad (3.1)$$

$$\frac{d\omega_m}{dt} = \frac{K_T}{J_m}.i_a - \frac{B_m}{J_m}.\omega_m - \frac{T_w}{J_m} \quad (3.2)$$

$$\dot{X} = Ax + Bu + Fw \quad (3.3)$$

$$y = Cx \qquad \text{Where } x = \begin{bmatrix} x_1 & x_2 \end{bmatrix}$$

State vector

$$A = \begin{bmatrix} -\frac{B_m}{J_m} & \frac{K_T}{J_m} \\ -\frac{K_b}{L_a} & -\frac{R_a}{L_a} \end{bmatrix}; B = \begin{bmatrix} 0 \\ \frac{1}{L_a} \end{bmatrix}; F = \begin{bmatrix} -\frac{1}{J_m} \\ 0 \end{bmatrix} C = \begin{bmatrix} 1 & 0 \end{bmatrix}$$

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For the design of MRAC controller the triple (A, B, C) are assumed to be completely controllable and observable. The load changes are considered as changes in motor rotor inertia and viscous-friction coefficient as practically seen in most control applications. Hence plant parameter changes in the simulation studies reflect abrupt load changes of the system.

4. Model of buck converter

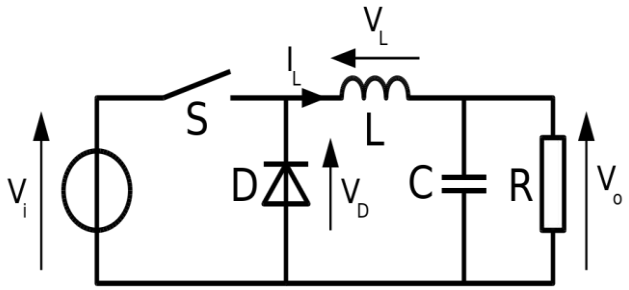

Figure 2: Basic structure of BUCK CONVERTER scheme

REFERENCE MODEL

The objective of control system is to find a direct controller that is differentiator free and the output of the plant should follow the output of the pre-specified reference model. The model is chosen in the form of $W_m(s) = k_m \frac{Z_m(s)}{R_m(s)}$ 5.1)

Where $Z_m(s), R_m(s)$ monic polynomials and km are is constant gain and r is the reference input assumed to be a uniformly bounded and piecewise continuous function of time. The following assumptions regarding reference model are assumed to hold:

M1. $Z_m(s)$, $R_m(s)$ are monic Hurwitz polynomials of degree q_m, p_m respectively, where $p_m <= n$.

M2. The relative degree $n_m^* = p_m - q_m$ of $W_m(s)$ is same as that of $G_p(s)$, i.e., $n_m^* = n^*$. $u = \theta^T \omega + \dot{\theta}^T \phi$ (5.2)

$\dot{\theta}$ is available from the adaptive law, the control law given by the above equation can be implemented without the use of differentiators.

Considering the Lyapunov like function as in the previous case for generating adaptive law

$$V(\tilde{\theta}, \bar{e}) = \frac{\bar{e}^T P_c \bar{e}}{2} + \frac{\tilde{\theta}^T \Gamma^{-1} \tilde{\theta}}{2} |\rho^*| \qquad (5.3)$$

Where $P_c = P_c > 0$ satisfies the MKY Lemma.

$$\dot{\theta} = -\Gamma e_1 \phi \operatorname{sgn}(k_p / k_m) \qquad (5.4)$$

The signal vector ϕ is expressed as

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$$\phi = \frac{1}{s+p_0}\begin{bmatrix} (sI-F)^{-1}.g.u_p \\ (sI-F)^{-1}.g.y_p \\ y_p \\ r \end{bmatrix} \qquad (5.5)$$

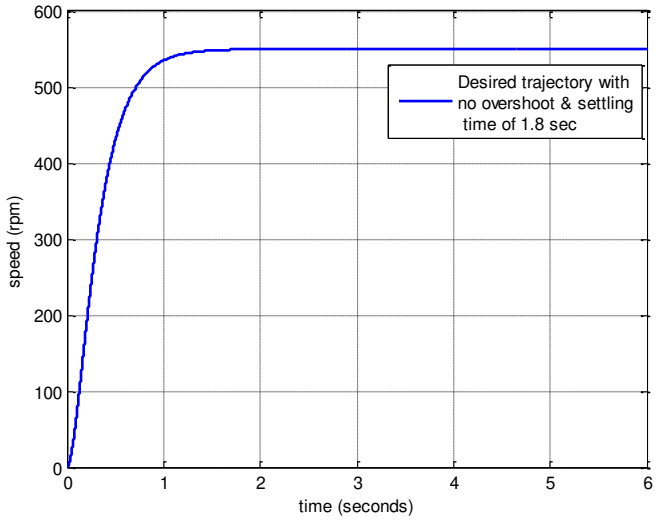

Figure 2. Tracking performance at full load (12.95 Nm) applied at t=3 sec

K_T=3.475Nm-$A^{-1.}$

K_b=3.475 V/rad/sec.

In this work the adaptive control scheme (MRAC) is simulated for various loading conditions, parameter uncertainties and measurement noise. The performance of the dc motor is studied from no load to full load and open loop to adaptive closed loop. To test the system performance the data of the dc motor are taken from **[6]**.In the design maximum control input limit is kept 250 volts and the maximum motor current is 1.5 times of full load current. The adaptation gain of 0.0008 is selected after number of trials, which suits to the rating of the dc motor.

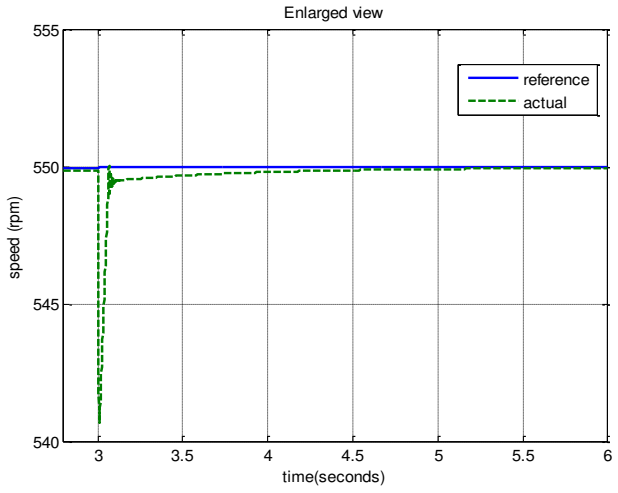

Figure 4. Tracking performance at 125% of full load applied at t=3 sec.

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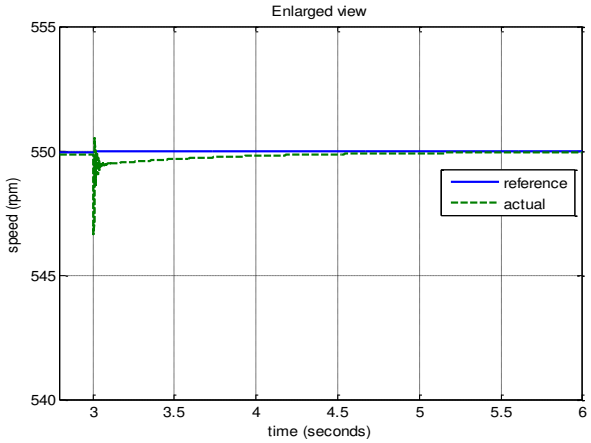

Figure3. Tracking performance at 75% of full load applied at t=3 sec.

DISCUSSIONS AND CONCLUSION

From the simulation results it is inferred that for the limiting value of the control input, the value of adaptation gain can be varied up to certain maximum value. If it is further increased controller parameter does not converge to some constant value. Although as the adaptation gain is increased (within that max value) the adaptation becomes faster on account of becoming control input violently high this may not be compatible to the system.

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Cyber-Physical Power System (CPPS) on Modeling, Simulation, and Analysis with Cyber Security Applications

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Abstract – *Cyber-Physical System (CPS) is a new kind of digital technology that increases its attention across academia, government, and industry sectors and covers a wide range of applications like agriculture, energy, medical, transportation, etc. The traditional power systems with physical equipment as a core element are more integrated with information and communication technology, which evolves into the Cyber-Physical Power System (CPPS). The CPPS consists of a physical system tightly integrated with cyber systems (control, computing, and communication functions) and allows the two-way _flows of electricity and information for enabling smart grid technologies. Even though the digital technologies monitoring and controlling the electric power grid more efficiently and reliably, the power grid is vulnerable to cyber security risk and involves the complex interdependency between cyber and physical systems. Analyzing and resolving the problems in CPPS needs the modeling methods and systematic investigation of a complex interaction between cyber and physical systems. The conventional way of modeling, simulation, and analysis involves the separation of physical domain and cyber domain, which is not suitable for the modern CPPS. Therefore, an integrated framework needed to analyze the practical scenario of the uni_cation of physical and cyber systems. A comprehensive review of different modeling, simulation, and analysis methods and different types of cyber-attacks, cyber security measures for modern CPPS is explored in this paper. A review of different types of cyber-attack detection and mitigation control schemes for the practical power system is presented in this paper. The status of the research in CPPS around the world and a new path for recommendations and research directions for the researchers working in the CPPS are finally presented..*

Keywords- Cyber-physical power system (CPPS), CPPS modeling, CPPS simulation, cyber-physical social system (CPSS), cyber-attack, cyber security, smart grid*.*

INTRODUCTION

In the past years, the power and control system engineers are working very hard to develop the tools and techniques for improving the performance of monitoring and control of the physical power system. At the same time, computer science and electronics engineers are working on the cyber system to enhance the performance of the computing and communication systems. It leads to the development of computing ubiquitous. In our day to day life, every gadget and electronic devices are integrated with low-cost computing and communication networks. There is no doubt it will going to create a signi_cant impact on the energy system [1]. The integration of physical and cyber system evolves into a new digital technology called Cyber-Physical System (CPS). Nowadays, CPS increases its attention in all sectors
like agriculture, energy, medical, oil & gas industries, and transportation, etc. The CPS is de_ned as a heterogeneous multi-dimensional system with integrated cyber part (control, computing, communication) to attain the characteristics of stability, robustness, ef_ciency, and reliability in physical

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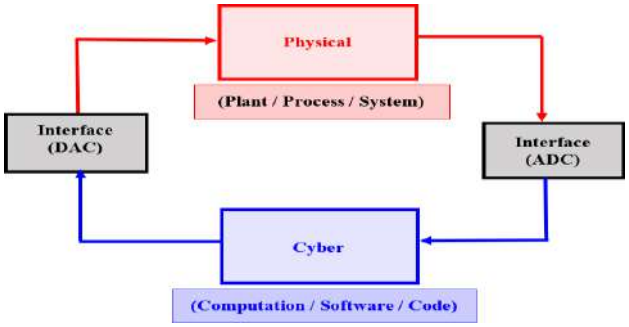

Power systems applications. In the CPS, the cyber system acquires the data from the physical system by the sensor and fed back the control signal to the physical system to attain the common goals, as shown in Fig. 1. To maintain the ef_cient and secure operation of the power systems, it is necessary to integrate the
physical power system with a cyber system [2]. The integration of the physical power system with a cyber system [3], [4] evolves into a strongly coupled cyber-physical power system (CPPS). The CPPS covers all the domains of the electric power systems like Generation, Transmission, Distribution, and Utilization, as shown in Fig. 2. A Cyber Physical Power System (CPPS) is a system that combines and coordinates
the internet and physical power system elements. These systems are distributed networks executing in unpredictable environments and built from control systems and embedded systems to monitor and regulate the physical power system in real time. CPPSs are designed as a structure of interacting ele- ments with physical input and output. This is not about adding computing and communication techniques to conservative inventions where both sides maintain distinct individualities. This is about the integration of computing and networking with physical power systems to generate novel innovations in science, technical skills, and creations. *Cyber* is an inte- gration of communication, computation, and control systems. *Physica*l means natural and human-made power systems that are governed and managed by the physics regulations and functioning in constant time. In CPPSs, the cyber and phys- ical systems are those firmly incorporated at all stages and dimensions. CPPS uses embedded computers and networks to compute, communicate, and organize physical power system actions. Simultaneously, a CPPS receives feedback on how physical power system events impact computations and vice versa as shown in Fig. 1. Just as the Internet facilitates a way for the humans to interact with each other, CPPSs will transform in a way, how we interact with the physical power system world around us. To enable standard communication link between heterogeneous systems, CPPS-Interconnection Protocol is used. This protocol is mainly designed for spe- cial CPSs such as CPPSs, which require overall instruc- tion and performance guarantee for cyber physical interac- tion. The main objective of this protocol is to offer CPPSs heterogeneity at three different levels: function interoper- ability, policy regulation, and performance assurance. Later, the transport protocol services used in the design of CPS- Interconnection Protocol. As an intellectual challenge, CPPS is about the intersection, not the union of the physical power system and the cyber. It is not adequate to indi- vidually understand the physical power system components and the computational components. We must instead under- stand their interaction as shown in Fig. 2. The design of such systems, therefore, requires understanding the joint dynamics of computers, software, networks, and physical power systems.

There are three levels of interactions in the CPPS. The first level of interaction occurs between the generator, transformer, transmission line, and dynamic load, etc. with the power system controller. The power system controller senses the information from the power system core components and calculates the control signal, then fed back to the power system core components for the optimized operations of the power grid. The effect of delay in transmitting the generator status information to the power system control center on power system stability is investigated in [5], [6]. The evaluation of the impact of the delay on the power system stability by eigenvalue sensitivity and eigenvalue tracing method is pre- sented in [7]. The calculation of the time-delay margin to determine the maximum delay time that the system can sustain without losing its stability is presented in [5], [8].

The compensation of time delay using fuzzy logic based wide-area damping controller method [9], linear matrix inequalities & Lyapunov stability method [10], and Lyapunov based time-varying multiple delayed systems methods are presented in [11]. The modelling of different types of time delays in a wide-area closed-loop control system is presented in [12]. The time-delayed power system stability analysis by integral quadratic constraints method [13], multiple time-delayed signals methods [14], and realistic delay modelling method [15] are investigated.
The second level of interaction occurs between the power system control and the communication infrastructure. The

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communication infrastructure acts as a backbone that coor- dinates all the functions of the subsystems (sensor, actu- ators, interfaces, control, computing, and communication units) in CPPS. The communication effects like data loss, bad data, time-delay, etc., severely impacts the performance of the CPPS. The authors in [16], [17] demonstrated the impact of time-varying communication delay on the sta- bility of the practical large-scale CPPS in the transmission domain. The impact of asynchronous communication delays between the distributed phasor data concentrators for oscil- lation monitoring application of a wide-area power system is investigated in [18]. The impact of coordinated physical and cyber uncertainties (communication delay and packet dropout) on closed-loop control of a wide-area power system application is presented in [19]. The modelling of differ- ent types of delayed CPS for stability analysis and control using Delayed Differential Equation (DDE) method [20], Solution Operator Discretization with Linear Multistep and Implicit Runge-Kutta (SOD-LMS/IRK) method [21], Partial and Explicit Infinitesimal Generator Discretization (PEIGD) method [22], Pseudo-Spectral Discretization of Solution Operator method [23], Time integration-based Discretization of Infinitesimal Generator (IGD) method [24], and the com- parison of different types of stability analysis method for the delayed cyber-physical system is investigated in [25].

The third level of interaction occurs between the communication infrastructure and the cyber system. The components of cyber systems are master and slave system, master server, communication server, bidirectional communi- cation structure, high-performance computing stations, intel- ligent control application software, cyber-attack security and defence mechanisms, etc. The primary function of the cyber system is to perform the advanced operations in the power grid like load forecasting, state estimation, var optimization, voltage control, oscillation monitoring, wide-area monitoring & control, operations planning, model validation, stability analysis, etc. As the size of the power grid networks is growing day by day to meet the load demand, the size of the cyber system also growing in the same manner, and no longer will it be a conventional electric power system. Due to this, CPPS is becoming a complex system with strong interactions between physical and cyber systems with the deployment of a huge number of Intelligent Electronic Devices (IEDs) in the electric power grid. The secure operation of the power grid does not only depend on power flow in the physical system but also depends on information flow in the cyber system, i.e., Information and Communication Technology (ICT). Even though the cyber system ensures efficient, safe, and secure operation for the power grid, the power blackouts occurred in the power grid history is mainly due to the failure of the cyber system.

The main drawback of CPPS is the cyber-attack and cybersecurity problem. The CPPS is a big heterogeneous networked transmission and distribution system with a huge load that has a chance of entering of a cyber-attack. The components of the cyber systems are severely vulnerable to external cyber threats and cyber-attacks through cyber connections due to the flaw in cybersecurity features. Since the cyber-attack does not damage the physical power system directly, but once coordinated with a physical attack, it creates the same impact as physical damage and leads to system instability. Therefore, it is necessary to review the various cyber-attacks and cybersecurity measures in CPPS.

Researchers around the world have conducted various research on CPPS from different perspectives [26]–[28]. The main characteristic of CPPS are the strong interdependency between the cyber and physical systems. The authors have investigated the impacts of various cyber contingency on a physical system using the model-based method [29]–[31]. With the development of synchrophasor technology for wide-area monitoring and control of CPPS, the cyberattacks are increasing nowadays [32]–[34]. The authors did extensive research on the analysis of different types of cyber-attacks like denial-of-service attack, false data injection attack, and man-in-the-middle attack in CPPS and shown the jeopardize of stability [35]–[37]. To protect the complex power grid con- trol networks of CPPS, it is necessary to perform the risk and vulnerability assessment under cyber-attacks [38]–[40]. The various methods of risk [41]–[44] and vulnerability assess-ment [45]–[48] from the component level to system-wide impacts, with cyber model assessment and physical model assessment, are performed. Substantial work on cyber-attack detection and mitigation for CPPS by monitoring the net- work traffic of the Supervisory Control and Data Acquisition (SCADA)/Phasor Measurement Unit (PMU) system in the power system control centre was performed in [49]–[52].

It forms the overall cybersecurity feature for the CPPS, which is entirely different from the traditional information security with advanced data analytics and machine learn- ing algorithms. It can able to distinguish the normal and attack activities in the cyber systems. The research inter- est of designing Wide-Area Damping Controller (WADC) for damping inter-area oscillations in the large-scale CPPS considering the cyber-attack on the physical power sys- tem is increased nowadays [53]–[55]. The cyber-physical attack resilient Wide-Area Control (WAC) technique aims to enhance the stability of CPPS at an earlier stage before the system reaches the blackout condition [56], [57]. It is designed to be adaptive to the continuous expansion of the modern CPPS considering the cyber contingencies on the physical power system with its high dimensionality and com- plex interconnection structure.

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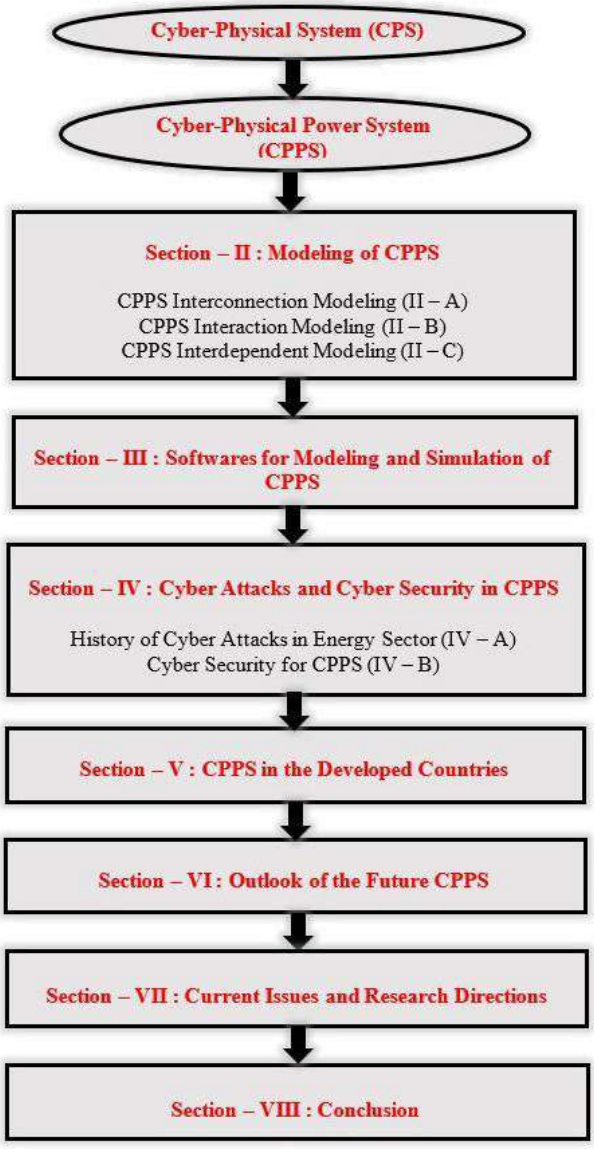
Nowadays, more researchers working in the field of CPPS, especially to analyze the stability of CPPS in the control sys- tem point of view. It is necessary to analyze the electric power grid as a whole cyber-physical social system, i.e., integrated physical and cyber (control, communication, and computing) part with cybersecurity features. The traditional method of modelling, simulation, and analysis of electric power system operation is entirely based on the physical part of the power grid. This no longer supports the future CPPS research and development. Also, it is difficult to assess the impact of cyber contingency on physical power systems for the safe operation of CPPS. The integration and the unification of cyber and physical systems are needed to optimize the configuration of the cyber side for ensuring the safe and secure operation of the electric power grid. In recent years it is difficult to see the literature survey on different types of modelling, simula- tion, and analysis methods with cybersecurity applications for CPPS. Therefore, it is necessary to review the different types of modelling, simulation, and analysis methods available for reflecting the characteristics of cyber and physical systems in CPPS. In this review paper, different types of cyber and phys- ical system integrated modelling methods, and simulation software packages are presented. The different types of cyber- attacks and cybersecurity measures for CPPS also reviewed. The status of CPPS in the developed countries and research directions & recommendations in CPPS are finally presented. Fig. 3 shows the structure of this survey



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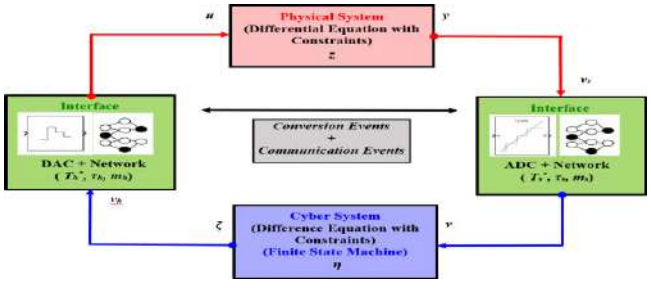
MODELLING OF CPPS

The main characteristics of CPPS modelling are the tight interaction between the physical and cyber systems at differ- ent time, space, and scales. The physical system is dynamic that consists of a generator, transformer, transmission line, load, etc. are physically connected with energy flow. In con- trast, the cyber system is a static system that consists of cyber components connected through a communication network with information flow. The complex interaction between the physical and cyber system in CPPS act as a critical point of failure with both the systems are in different topolo- gies. In the large-scale CPPS, the failure of one system leads to catastrophic cascading failure in the overall sys- tem. The performance of the one system heavily depends upon another system, i.e., interdependent nature of cyber and physical systems.

Both physical and cyber system has its uncertainties independently. The integration of renewable energy into the physical system, which is stochastic in nature, affects the steady-state operating condition of the power flow in the system. In cyber systems, the cyber-attacks on control, com- puting, and communication functions alter the information flow. These uncertainties are unpredictable, which increases the risk of safe and secure operation of the power system. The interaction characteristics of the physical and cyber sys- tems complicate the modelling of CPPS. Therefore, it is necessary to develop the modelling framework for a critical understanding of complexity and interdependency in CPPS and analyze in terms of both qualitative and quantitate

CYBER SECURITY FOR CPPS

The CPPS needs cybersecurity at multiple levels, namely information security, ICTs infrastructure security, and application-level security [180]. From the past research works it is identified that the traditional information tech- nology (IT) security features are not suitable for CPPS and certain research areas in cybersecurity for CPPS is iden- tified as: (i) Cyberattack risk modelling and risk mitiga- tion, (ii) Attack-resilient monitoring, protection and control algorithms, (iii) Defence against coordinated cyber-attacks, (iv) AMI infrastructure security, and (v) Simulation models. The cybersecurity of the power grid consists of Cybe.



CURRENT ISSUES AND RESEARCH DIRECTIONS

- The impact of the communication network effects such as latency, outliers, missing data, etc on performance, reliability, and security of the CPPS may be considered. This area of research is emerging and likely to see more contributions in the near future.

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- The traditional CPPS communication networks have been designed to cover separate parts rather than the whole power grid. Therefore an interconnected com- munication network for generation, transmission, and distribution to be designed and its network topology should be optimized considering 5G technology.
- The traditional deterministic type N-1 contingency anal- ysis was not suitable for CPPSs. Therefore stochastic cyber-physical contingency analysis should be devel- oped and analysed for the CPPS. More research is needed in this area.
- In cybersecurity for CPPS, fast authentication is an open problem and there is a wide scope for this research work. Developing the testbed for CPPS to analyse the effects of cyber events such as communication failures and cyber-attacks due to single or coordinated failures on the physical power system for the specific application is another emerging research area. The testbed 5G tech- nology can be demonstrated for future CPPSs and also we can include other types of energy systems such as heat, gas, etc.
- Estimating the cost of cyber attacks on CPPS at the national level for critical infrastructure protection is an important research area in the economic analysis of power systems.

An advanced data-driven method with machine learning applications for CPPS in power system control area is emerging. It includes the hybrid data fusion of cyber and physical systems to monitor the stability of CPPS.

Analysing the impact of the integration of renewable energy systems and electric vehicles in CPPS. Based on this a cyber-physical security analytics should be devel- oped for the holistic cyber-physical transactive energy systems. Cyber resilience is the ability of CPPS to prepare, respond, and recover when cyber attacks happen. In addition to power system resilience the cyber sys- tem resilience also should be considered for developing control and operation methods and planning strategies to improve power grid resilience against physical and cyber events. A cyber-physical resilience metrics, eval- uation methods, development of universally accepted standard definitions are needed for CPPS and there is a wide-scope for this research topic.

CONCLUSION

CPPS is a new technology that integrates cyber systems and physical power systems to achieve high efficiency and perfor- mance. In recent years, research studies on CPPS modelling, simulation, and analysis have gained considerable attention. A grand challenge in CPPS research is the development of models that elegantly interface the continuous-time charac- teristics of the physical system with the discrete-time charac- teristics of the cyber system. A review on modelling methods, simulation tools, cyber-attack types, cyber-attack detection and mitigation countermeasures in CPPS .

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Power System Security with Cyber-Physical Power System Operation

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Abstract – *Cyber-attacks on a cyber-physical power system could lead to significant data failure, false data injection and cascading failure of physical power system components. This paper proposes an advanced approach based on a ternary Markovian model of cyber-physical components interactions to capture the subsystem layers' interactions of the cyber-physical power system and to quantify the interdependency impacts on physical power system security. The approach models cyber-physical interactive operation based on interactions and characteristics of three subsystem layers of the system with the presence of random and unforeseen contingencies, load demand variations and then quantify the impacts with Monte Carlo simulation. The viability of the approach is investigated by simulating a set of scenarios, representing realistic physical power system operating conditions with the cyber network interactions. Findings justify the presence of cyber-attacks in a cyber-physical power system components operation could lead to severe insecurities. However, the impact on physical power system security does not always correlate with the severity of cyber-attacks.*

Index Terms - *Cyber-physical power system, cyber-physical power system reliability assessment Interdependency, Markov model, Monte Carlo simulation, power system security, reliability assessment, smart grid, subsystem layers' interactions, ternary Markovian model*

INTRODUCTION

Growing reliance on information and communication technology (ICT) and advanced automation systems in power systems has created cyber physical power (CPP) system paradigm. A CPP system is a series of components connected by power infrastructure, information and communication infrastructure and decision-making infrastructure. CPP sys- tem is a sophisticated intelligent power system architecture that integrates advanced control and modern communication technologies applicable to a power system. It is a modern-day smart power system with various systems and component interactions. In a CPP system, the normal operation of one subsystem depends on the interactive functions of other com-ponents or subsystems within the CPP system.

The information, communication and decision-making infrastructures execute the monitoring, control and decision- making processes. The communication and decision-making infrastructures are to ensure that a better reliability of CPP system is achieved. Authors in state that com- munication and decision-making infrastructures support the transfer of power from generation to end-users in a reliable and secure manner. Also, authors in argue that use of real-time communications support dynamic flow of power and information data to ensure a reliable power supply.

However, growing reliance on cyber systems makes CPP system more susceptible to component failure, cyber network failure, software failure and human errors. These failures could cause failure propagation that could affect interde-pendencies within the CPP system, adversely, impacting power system security. References state that extensive reliance of the power system on cyber systems may leads to new threats and makes the CPP system more vulnerable to malicious attacks, information and data failure. State that any failure can transmit or spread more rapidly and extensively, and as a

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result the system reliability could be reduced. argues that loss of monitoring and control of power system components may influence the real-time operation of the whole power system. Argues that communication system failures may cause lack of con- troll ability and observability of a power system which may result in succession of failures in the system. For instance, accidental shutdown of a power station in (2003 black- out) led to failures of the communication network nodes and the supervisory control and data acquisition (SCADA) system of the power grid. This incident led to more failures in the power grid and subsequently led to a sequence of tragic cascading failure in the system .The combination of power components failures, lack of real-time information and diagnostic support, local decision-making without regard to interconnectivity, computer and human errors that resulted in cascading failures eventually led to the huge blackout. The blackout affected almost 50 million customers in seven The blackout caused a sudden shutdown of over 100 power plants at a localized generating plant. Considering the likelihood of failure propagations and interdependency failure due to uncertainties and umpire- disability in a CPP system, interdependency assessment and system modeling are important in order to assess true impacts. Relevant studies on interdependencies in a CPP system has been proposed in for reliability assessment of the system. Reference develops a mathematical model to evaluate the impacts of interdependencies in a cyber- physical system quantitatively. It concludes that the intelligent devices of the cyber-physical network could experience failures in two ways: direct and indirect interdependencies that might have effects on the reliability of a power system. An interdependency Markov-chain framework is proposed in to investigate and forecast resilience to cascading failures and to study interdependency impacts on system reliability. It concludes that interdependencies among systems with reliable systems may lead to an unreliable system. A mathematical model to assess interdependency in power and communication systems of smart grid components is pro- posed in for system vulnerability analysis. The model reveals interdependency between components and system vulnerabilities induced by system dynamics. Reference proposes an analytical reliability model to capture effects of cyber-physical interdependencies and effects of failures from both physical and cyber components in a smart grid system. The results argue that cyber infrastructure can have less reliability than a conventional power grid. An analytical reliability assessment considering both power and cyber component failures are proposed in to investigate impact of direct cyber network failures on a power network. The results show that is very important to consider cyber negative impacts on power grid for reliability assessment. Though impacts of interdependency in CPP system reliability have been explored, a unified framework that reflect characteristics of three subsystem functional layers' interactions of the CPP system is missing.

Other frameworks have been established in CPP system modeling to analysis CPP system operation. A analyze electrical cyber-physical systems operation by modeling communication network associated in a power transmission grid using a mesh topology to characterize the networks interdependency based on various types of information channels. The model investigates vulnerabity of electrical cyber-physical systems under various cyber- attacks. Reference proposes a CPP system equivalent model to quantitatively evaluate effect of improper control commands due to cyber contingencies on the power system of CPP systems. Hierarchical control systems of cyber net- works were designed as directed branches and directed graph with data nodes. The model effectively evaluates the impact of cyber contingencies without entire system simulations. An hierarchical CPP model based on flocking theory considering transient stability associated problems is proposed in to maintain a transient stability during severe disturbances. The model facilitates identification of distributed control approaches that improve resiliency in power grid operation. An hybrid simulation model of CPP system considering time delay in predictive control model with low frequency oscillation damping controller is proposed in to simulate CPP system operation. The model demonstrates good performance with improved cyber control systems. Lastly, a dynamic transmission model and a static connection model are proposed in to evaluate effect of cyber components failure and quality of information transmission on CPP distribution system. These two models are developed to create CPP model based on service restoration, fault location and isolation of the CPP distribution system operation. The results show significant failure rates of the cyber components causing considerable impact on the CPP distribution system reliability.

Most CPP system modeling focuses on a single dynamic characteristic of the CPP system operation. The CPP system model proposed in is based on delay, dynamic routing and communication error. The approach in is an hierarchical control system of a cyber network based on directed branches and directed graph with data nodes. Reference models a unified electrical cyber physical system framework considering information flows and routers. These studies implement dynamic of the communication network in the CPP system modeling, the dynamic characteristics of the decision-making layer and power network are missing.

Some approaches explore the CPP system modeling as separate models. CPP system operation in is modeled as two

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separate models: the static connection model and the dynamic transmission model based on service restoration, fault location isolation and of the CPP distribution system operation. This study does not reflect a single unified frame work modeling. The framework proposed in models cyber physical electrical power systems with integration of both power grids and communication networks, based on power transmission grid characteristics: high-voltage levels, long transmission distances and node importance in transmission grids. This approach models the communication network as a meshed topological network with each node linked to a physical node within the power transmission grid. The hierarchical CPP model in is based on flocking theory considering transient stability associated problems. However, each of these studies does not reflect the characteristics of the three subsystem functional layers' interactions of the CPP system. As stated by authors in , it is very important in CPP system modeling to establish single unified model that combine series of consequences of events from the decision-making subsystem layer, the communication and coupling subsystem layer to the power subsystem layer. Therefore, the aim of this paper is to investigate the CPP system modeling as a single unified model considering interactions and characteristics of the three subsystem functional layers of the CPP system and then to propose an advanced algorithm to assess global impacts of the power system interacting with the cyber network processes. The three subsystem layers are decision-making layer, communication and coupling layer and power layer.

Taking into account the gap from the state of the art of the problem, this paper proposes a unified ternary Markovian model based on interactions and characteristics of three sub- system layers of the CPP system to capture dynamics of sub- system layers' interactions in the system for the assessment of interdependency impacts on power system security under various cyber-attacks and foreseen contingencies. The approach models impact of interdependency of CPP system operation through state transitions using non-sequential Monte Carlo simulation The key contributions of this paper are as follows: Firstly, this paper establishes a single unified ternary Markovian model of CPP system operation based on three subsystem functional layers: decision-making layer, communication and coupling layer and power layer. Secondly, the model reflects dynamic operation of subsystem layers' interactions of com- munication and coupling layer, decision-making layer and power layer. This is demonstrated as an embedded three subsystem layers interactions that capture each operation of subsystem layer in the CPP system. Each of the subsystem layer is characterized as three states to capture time varying behavior under various cyber-attacks or unforeseen contingencies.
This paper is organized as follows: Section II presents different CPP system layers; Section III presents the proposed approach in detail; The implementation of the approach, results and analysis are detailed in Section IV; and conclusions are given in Section V.

CYBER PHYSICAL POWER SYSTEM

A CPP system integrates advanced control, intelligent electronic devices (IEDs) and ICT to advance the performance of the composite system to achieve prime and other objectives. CPP system is an interconnected and complex cyber-physical system which forms a multi-dimensional heterogeneous system. The complex interconnections and interactions in CPP system is considered as a system with three subsystem functional layers (FL) (see Fig.1): FLI is the decision-making intelligent subsystem layer, FLII is the information, communication and coupling subsystem layer is the physical power subsystem layer. Both the decision-making intelligent layer and the information, communication and coupling layer make up the cyber layer.

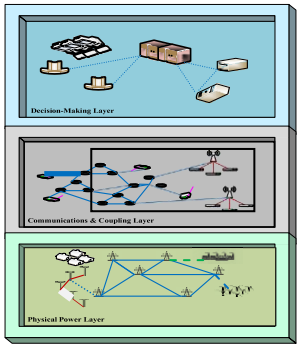

Figure 1- Cyber-physical power system representation.

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DECISION MAKING INTELLIGENT SUBSYSTEM LAYER

Generally, the decision-making intelligent layer determines the smartness of a CPP system. The decision-making intelligent subsystem layer (DISL) is made up of various programs or functions; substation automation system, control centre, control of renewable power generation, energy and demand management system of computer programs for relays, IEDs etc. These functions are for continuous operation of the power system. They process information received from sensors or disseminate information from the communication infrastructure to others. Control directives or business process decisions exhibited in the physical layer is achieved in this layer. Malfunctioning in the DISL such as DISL tools failure (including servers), incorrect decision-making and malicious intention might generate incorrect state estimation. Various malicious intention could introduce cyber-attacks through sensor(s) hacking and measurement distortions This may lead to decision errors that could cause failures or lead to a blackout.

A. COMMUNICATION AND COUPLING SUBSYSTEM LAYER

The communication and coupling subsystem layer (CCSL) contain communication networks and interface devices such as remote terminal units (RTU). The communication networks are generally categorized into three: wide-area network, field area network and home area network. They consist of various communication devices. The interface devices convey control directives and decision programs from DISL to the power layer and measurements from the power layer to the DISL. The communication networks connect the interface devices and the links between them. Any malfunction or error in the communication networks or interface devices will affect the accuracy of the DISL functions. However, communication networks and links are susceptible to wrong data injection attacks which may alter measurements during data transmission. This might also cause wrong decisions from DISL and invariably could cause system malfunctions or lead to a blackout.

B. PHYSICAL POWER SUBSYSTEM LAYER

The physical power subsystem layer (PPSL) is simply the physical power network consists of all physical devices generally, the power generation, power transmission and distribution assets including protection systems, power electronic interface devices, and storage technologies, and traditional and smart grid loads. The power system is usually grouped into three functional zones of generation, transmission and distribution. Power devices are connected to the communications and coupling layers via state awareness sensors and program execution devices

III. THE APPROACH

A.INTERDEPENDENCY IN CYBER PHYSICAL POWER SYSTEM

Interdependency in a CPP system is a mutual reliance of components or subsystems thin a system. The states of a component or a subsystem in a system can potentially in_uence the performance of other subsystems. The successful operation of a power system with a ignescent integration of cyber infrastructure depends on the cyber network security. Consideration of interdependency of cyber and power system is extremely important [1]. Moreover, loss of interdependency due to uncertainty, unpredictability and failure in the CPP system could affect effective operation of the power system thus, the power system security could be jeopardized.

B. FAILURES IN CYBER PHYSICAL POWER SYSTEM

In a CPP system either the cyber system or the power system could be the source of failure from failures of their components, software failures, human errors, etc. All these failures may be categorized into three: component failure, cyber unavailability, and cyber intrusion. Component Failure is the loss of functionality in component(s) of the decision-making and intelligent layer, information, communication and coupling layer or power layer such as routers, servers, generators, etc., may malfunction or fail. This might cause interruption in communication networks or incorrect decision-making which could affect the security of the whole system. Cyber Unavailability is the loss of functionality in information and communication networks as a result of interruption such as link unavailability, packet loss, packet delay, etc., which may affect the decision-making process thus, jeopardizing the power system security. Cyber intrusion is the loss of functionality due to malicious attacks, false data-injection attacks, etc. which may affect the decision-making process.

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C. MARKOV APPROACH

Markov process is denned as a stochastic process. Markov chain is a form of Markov process with sometime states (V1, V2, V3. . . . Vn) which make the process to occur at any given time. Transition probability is the probability of the process moving from state Vi to state Vj. Transition probability is the probability of the process remaining in the same state. Markov processes is utilized in the analysis of systems' reliability, maintainability and availability A typical system consists of n components with one or all the components operating effectively or ineffectively at any given time. The entire system successful operation depends on the availability or unavailability of its components.

F. FAILURE FREQUENCE INDEX

It is important to understand effects of individual subsystem on the whole system for operational system security, hence, indented some measures that quantify the effect of subsystem activities on CPP system operation. Thus, power layer failure, cyber failure and error frequency index and their corresponding ENS and VoLL are considered as an indication of unreliability that could jeopardize power system security. Specific definitions of those indices are as follow: Average Power Layer Failure frequency Index: This is measure of interruption or disturbance on the CPP system due to failure of the power layer as a fraction of the total processed
Power layer failure include all uncertainties and failure in the physical power layer
Average Cyber Failure Frequency Index: This is measure of lost decisions on the CPP system due to failure of cyber layer (CCSL and DISL) as a fraction of the total processe. Cyber failure is any uncertainties that affect the functionality of cyber layer such as, malicious intention, cyber tool failure, etc.

Average Cyber Error Frequency Index: This is measure of lost decisions on the CPP system due to error in the cyber layer as a fraction of the total processed Sample Cyber error is any error that affect the functionality of cyber layer such as incorrect decision-making, wrong data injection, etc.

V. CONCLUSION

The paper proposes a united ternary Markova model (TMM) based on interactions and characteristics of three subsystem layers of the CPP system to capture the dynamics of subsystem layers' interactions in a CPP system. The results suggest that the TMM effectively captures the dynamics of subsystem layers' interactions in a CPP system.
The extended investigations suggest that the presence of cyber-attacks in a CPP system can miserably impacts the security of the physical power system. The verity of the attacks that lead to component outages does not necessarily correlate with the level of security impacts on the physical power system. Non-linearity of power system operating characteristics could make barriers for attackers in targeting power system stations that could lead to severe disturbances in the physical power system. The p opposed approach provides holistic assessment of interactions in the decision-making layer, information, communication and coupling layer and power system layer in a CPP system and offers innovative pathway to quantify the security impacts of interdependency of components in a CPP system effectively.

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Discrete Dynamic Modelling and Analysis of Open Loop Microprocessor Based Static Slip Power Recovery Control of Three Phase Slip Ring Induction Motor Drive

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Abstract – *In this paper discrete dynamic model (z-domain Model) of microprocessor based static slip power recovery (SPR) control of 3-phase slip ring induction motor in open loop has been developed using dc equivalent circuit. The dynamic behaviour of the drive at different values of load torque (constant)for the perturbation in firing angle of the controlled converter and load torque have been predicted. The predicted dynamic performances have been verified by using another discrete dynamic model using synchronously rotating reference frame model of three phase slip ring induction motor. The good degree of agreement of dynamic performances justifies the validity of developed dynamic model based on dc equivalent circuit.*

Key words: Induction motor, Microprocessor, Modelling, Dynamic performance, Slip Power

INTRODUCTION

The schematic diagram of µ- based static SPR controlled slip ring induction motor driveis shown in Fig.1. The drive consists of a 3-phase slip ring induction motor, 3-phase uncontrolled and controlled bridge converter, smoothing inductor, 3-phase step-up transformer, µ-based control circuit. All electrical transients, such as, instantaneous variations/disturbances in voltage/current, stator frequency and load torque are neglected in steady-state operation of ac drives, but such variations/disturbances arise in industrial applications. Hence, there is need to develop the dynamic model to evaluate the dynamic performances of the drive system for small perturbation in variables around the steady state operating point. Asµ-based system has been considered hence, the dynamic performances predicted using analog model will not be accurate hence, there is a need to develop the discrete dynamic model to predict the dynamic performance accurately. The dc equivalent circuit model[1,2,3] and the synchronously rotating reference frame (SRRF) model[4, 5, 6]of induction motor have been considered for developing the dynamic model because the predicted steady-state behaviour using these models have been found closer to experimental investigation of the drive.

1. Development of Analog Model

A set of non-linear differential equations of the drive at steady-state operating point is obtained using dc equivalent circuit model. By applying KVL, the non-linear differential equation of dc link current is obtained as follows:

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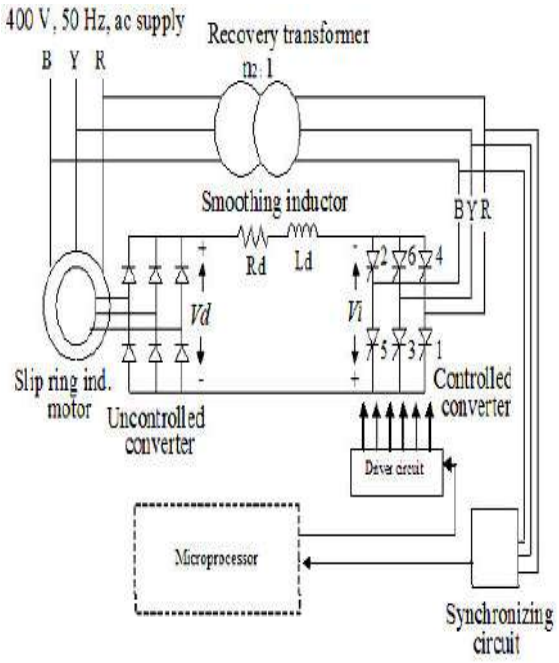

Fig.1. Schematic diagram of μ-based static slip power recovery drive

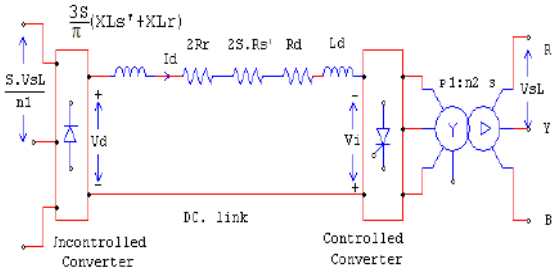

Fig.2. Dc Equivalent Circuit

$$Ld\frac{d(id)}{dt} = -rs.S.id - Re\,q\,.id + \frac{3\sqrt{6}}{\pi}\frac{VsL.Cos\alpha}{n2} + \frac{3\sqrt{6}SVsL}{\pi.n1} \quad (1)$$

where,

$$rs = \frac{3}{\pi}(XLs' + XLr) + 2Rs' : Re\,q = 2Rr + Rd$$

The expression of electromagnetic torque developed is given as:

$$Te = \frac{\frac{3\sqrt{6}.VsL}{\pi\ \ n1}id - \mathrm{rs}.id^2}{\omega s} \quad (2)$$

The torque balance equation of the load is expressed as:

$$Te = J\frac{d\omega rm}{dt} + B.\omega rm + TL \quad (3)$$

After substituting from equation (2), the equation (3) is modified as:

$$J\frac{d\omega rm}{dt} = \frac{3\sqrt{6}}{\pi}\frac{VsL}{n1.\omega s}id - \frac{rs.id^2}{\omega s} - (B.\omega rm + TL) \quad (4)$$

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Using small signal perturbation technique, the non-linear equations (1) and (4) are linearized around steady-state operating point ($Id0$, $S0$,$\alpha 0$,$\omega rm0$, and $TL0$). The variables ofdc link current, per unit slip, delay angle, angular rotor speed and load torque after small perturbation are respectively given as:

$id = Id0 + \Delta id: S = S0 + \Delta S\alpha = \alpha 0 + \Delta\alpha : \omega rm = \omega rm0 + \Delta\omega rm : TL = TL0 + \Delta TL$

The slip variable "S" in terms of angular rotor speed is expressed as:

$$S = 1 - \frac{\omega rm}{\omega s} \tag{5}$$

At steady-state operating point the above equation is modified as:

$$S0 = 1 - \frac{\omega rm0}{\omega s} \tag{6}$$

Substituting and manipulating variation in slipΔS can be written as:

$$\Delta S = -\frac{\Delta\omega rm}{\omega s} \tag{7}$$

After substituting and manipulating the terms, the non-linear equation (1) is linearized and given as :

$$Ld\frac{d(\Delta id)}{dt} = -(rsS0 + Re\,q)\Delta id + (rs.Id0 - \frac{3\sqrt{6}}{\pi}\frac{VsL}{n1})\frac{\Delta\omega rm}{\omega s} - \frac{3\sqrt{6}.VsL.Sin\alpha 0}{\pi.n2}\Delta\alpha \tag{8}$$

Similarly, after substituting and manipulating the terms, the non-linear equation (4) is linearized and is given as:

$$J\frac{d\Delta\omega rm}{dt} = \left[\frac{3\sqrt{6}}{\pi} - \frac{2rs.Id0}{\omega s}\right]\Delta id - B\Delta\omega r - \Delta TL \tag{9}$$

Taking Laplace transform of equation (8) and re-arranging the terms, the linear equation of dc link currentin the simplest form is given as follows:

$$\Delta Id(s) = \frac{K_1/Ld}{(s+R/Ld)}\Delta\omega rm(s) - \frac{K_2/Ld}{(s+R/Ld)}\Delta\alpha(s) \tag{10}$$

where,

$$K_1 = (rs.Id0 - \frac{3\sqrt{6}}{\pi}\frac{VsL}{n1})\frac{1}{\omega s}$$

$$K_2 == \frac{VsL.Sin\alpha 0}{n2} \;;\; R = Re\,q + rs.S0$$

Similarly, the equation of rotor speed in simplified form is written as:

$$\Delta\omega rm(s) = \frac{Kj}{\left(s+\frac{B}{J}\right)}\Delta Id(s) - \frac{\left(\frac{1}{J}\right)}{\left(s+\frac{B}{J}\right)}.\Delta TL(s) \tag{11}$$

where,

$$Kj = K/J \quad ; \quad K = \frac{3\sqrt{6}}{\pi}\frac{VsL}{n1.\omega s} - \frac{2.rs.Id0}{\omega s}$$

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Using equation (10) and (11), the transfer function block diagram of the drive at constant load torque is developed and shown in Fig. 3 as below:

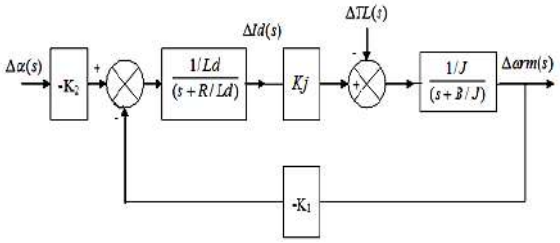

Fig. 3. Transfer function block diagram of drive system at constant torque load

Considering the small perturbation only in the firing angle, at$\Delta TL = 0$, the simplified transfer function block diagram of the drive system is given in Fig. 4

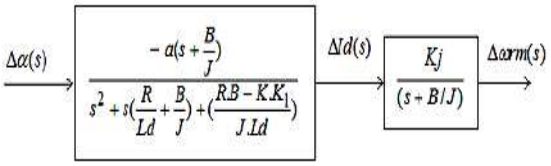

Fig. 4. Transfer function block diagram at constant torque load for perturbation only in firing angle

Where, $a = \frac{K_2}{Ld}$

Similarly, the simplified transfer function block diagram of the drive at constant firing angle ($\Delta\alpha = 0$) for the perturbation in Load Torque is given in Fig. 5.

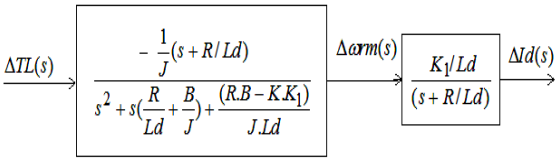

Fig. 5. Transfer function block diagram of drive system for the perturbation only in load torque

1. Discrete Dynamic Model

As the drive system is microprocessor controlled, it can be treated as a discrete data system if it has a sampler [7] followed by a zero-order hold (ZOH) with the delay circuit. Since a discrete/digital signal is applied to the continuous system [8], therefore, in the discrete model of the system, a zero-order hold is required between continuous and discrete/digital system. The transfer function of ZOH is given as:

$$Goh(s) = \frac{(1-e^{-sT})}{s} \qquad (12)$$

The delay to the controlled converter is provided through the driver circuit by loading the count value in the programmable Intel-8253. The count value is decrementedin synchronization with the supply frequency of 50 Hzat the rate of 1.53 MHz/second. The counting starts from zero crossing of ac supply. The gain of the delay circuit is given as:

$K\alpha = \frac{2.\pi.50}{1.53x10^6} = 0.00021$ rad/count (13)

The firing angle is corrected at the sampling instant T second and held constant till the next sampling. Thus, the firing circuit behaves as zero order hold. The transfer function of firing circuit is given as:

T.F. of delay circuit=$K\alpha \frac{(1-e^{-sT})}{s}$ (14)

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The pulse transfer functions $\frac{\Delta Id(z)}{\Delta \alpha_c(z)}$ and $\frac{\Delta \omega rm(z)}{\Delta \alpha_c(z)}$ of the drive with constant torque load at $\Delta TL = 0$ are obtained using transfer function block diagram as shown in Fig. 4as follows:

$$\frac{\Delta Id(z)}{\Delta \alpha_c(z)} = Z[K\alpha Goh(s)G1(s)] = Z\left[\frac{-K\alpha.a.(s+\frac{B}{J})(1-e^{-sT})}{s\{s^2+s(\frac{R}{Ld}+\frac{B}{J})+(\frac{R.B-K.K_1}{J.Ld})\}}\right] \quad (15)$$

The equation is simplified as:

$$\frac{\Delta Id(z)}{\Delta \alpha_c(z)} = (\frac{z-1}{z}).Z\left[\frac{-K\alpha.a.(s+z_1)}{s(s+\sigma_1)(s+\sigma_2)}\right] \quad (16)$$

where,

$z_1 = \frac{B}{J}; \sigma_1 + \sigma_2 = \frac{R}{Ld} + \frac{B}{J}$

$\sigma_1.\sigma_2 = \frac{R.B - K.K_1}{J.Ld}$

Carrying out partial fraction expansion of equation (16)is written as:

$$\frac{\Delta Id(z)}{\Delta \alpha_c(z)} = (\frac{z-1}{z}).Z[\frac{k_{11}}{s} + \frac{k_{12}}{(s+\sigma_1)} + \frac{k_{13}}{(s+\sigma_2)}]$$

$$= [\frac{k_{11}}{1} + \frac{k_{12}(z-1)}{(z-e^{-\sigma_1.T})} + \frac{k_{13}(z-1)}{(z-e^{-\sigma_2.T})}] \quad (18)$$

Similarly, the pulse transfer function $\frac{\Delta \omega rm(z)}{\Delta Id(z)}$ is obtained using transfer function block diagram as shown in Fig. 4

$$\frac{\Delta \omega rm(z)}{\Delta Id(z)} = Z[Goh(s)G2(s)] = Z\left[\frac{Kj(1-e^{-sT})}{s(s+\frac{B}{J})}\right] = \frac{(z-1)}{z}Z\left[\frac{Kj}{s(s+\sigma_3)}\right]$$

Now carrying out partial fraction expansionthe above equationis written as:

$$\frac{\Delta \omega rm(z)}{\Delta Id(z)} = \frac{(z-1)}{z}Z[\frac{k_{21}}{s} + \frac{k_{22}}{(s+\sigma_3)}] \quad (19)$$

where,$\sigma_3 = \frac{B}{J}$

Now, the overall pulse transfer function$\frac{\Delta \omega rm(z)}{\Delta \alpha_c(z)}$is determined by multiplying $\frac{\Delta Id(z)}{\Delta \alpha_c(z)}$and $\frac{\Delta \omega rm(z)}{\Delta Id(z)}$ and is given as follows:

$$\frac{\Delta \omega rm(z)}{\Delta \alpha_c(z)} = \frac{\Delta Id(z)}{\Delta \alpha_c(z)} * \frac{\Delta \omega rm(z)}{\Delta Id(z)} \quad (20)$$

Similarly, the pulse transfer functions $\frac{\Delta \omega rm(z)}{\Delta TL(z)}$ and $\frac{\Delta Id(z)}{\Delta TL(z)}$ of the drive for the perturbation in load torque at constant firing angle $\Delta \alpha = 0$ are obtainedusing transfer function block diagram as shown in Fig. 5 as follows:

$$\frac{\Delta \omega rm(z)}{\Delta TL(z)} = Z[Goh(s)G3(s)] = Z\left[\frac{-\frac{1}{J}(s+\frac{R}{Ld})(1-e^{-sT})}{s\{s^2+s(\frac{R}{Ld}+\frac{B}{J})+(\frac{R.B-K.K_1}{J.Ld})\}}\right]$$

$$= (\frac{z-1}{z})Z\left[\frac{\frac{-1}{J}(s+z_3)}{s(s+\sigma_1)(s+\sigma_2)}\right] \quad (21)$$

where, $z_3 = \frac{R}{Ld}$

The pulse transfer function $\frac{\Delta Id(z)}{\Delta \omega rm(z)}$ is also obtained as follows:

$$\frac{\Delta Id(z)}{\Delta \omega rm(z)} = Z[Goh(s)G4(s)] = Z\left[\frac{\frac{K_1}{Ld}(1-e^{-sT})}{s(s+\frac{R}{Ld})}\right] \quad (22)$$

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where $\sigma_4 = \frac{R}{Ld}$

The overall pulse transfer function $\frac{\Delta Id(z)}{\Delta TL(z)}$ is obtained by multiplying $\frac{\Delta Id(z)}{\Delta \omega rm(z)}$ & $\frac{\Delta \omega rm(z)}{\Delta TL(z)}$ and is given as follows:

$$\frac{\Delta Id(z)}{\Delta TL(z)} = \frac{\Delta Id(z)}{\Delta \omega rm(z)} * \frac{\Delta \omega rm(z)}{\Delta TL(z)} \quad (23)$$

1. Performance Evaluation

The dynamic performance of dc link current and speed of the drive operating in open loop have been evaluated atfour number of steady state operating points considered at two different torque loads(TL = 2.94 N-m and 7.14 N-m) and two different delay angles ($\alpha = 100^0 \; and 109^0$)of the controlled converter.At all the operating points, different constantsand constants of partial fraction of equations are calculated. Using these constants, discrete transfer functionsat different steady-state operating points for the perturbation in delay angle and load torque are evaluated and given as follows:

At TL=2.94N-m, α=100^o, Nr=1163 rpm

$$\frac{\Delta Id(z)}{\Delta \alpha_c(z)} = \frac{-0.0072(z-0.999)}{z^2 - 1.676z + 0.706}$$

$$\frac{\Delta \omega rm(z)}{\Delta \alpha_c(z)} = \frac{-0.0011}{z^2 - 1.676z + 0.706}$$

$$\frac{\Delta \omega rm(z)}{\Delta TL(z)} = \frac{-0.173(z-0.707)}{z^2 - 1.676z + 0.706}$$

$$\frac{\Delta Id(z)}{\Delta TL(z)} = \frac{0.035}{z^2 - 1.676z + 0.706}$$

At TL=2.94N-m, α=109^o, Nr=0919 rpm

$$\frac{\Delta Id(z)}{\Delta \alpha_c(z)} = \frac{-0.0068(z-0.999)}{z^2 - 1.6488z + 0.6790}$$

$$\frac{\Delta \omega rm(z)}{\Delta \alpha_c(z)} = \frac{-0.001}{z^2 - 1.6488z + 0.6790}$$

$$\frac{\Delta \omega rm(z)}{\Delta TL(z)} = \frac{-0.173(z-0.679)}{z^2 - 1.6488z + 0.6790}$$

$$\frac{\Delta Id(z)}{\Delta TL(z)} = \frac{0.034}{z^2 - 1.6488z + 0.6790}$$

At TL=7.17 N-m, α=100^o, Nr=1097 rpm

$$\frac{\Delta Id(z)}{\Delta \alpha_c(z)} = \frac{-0.0072(z-0.999)}{z^2 - 1.671z + 0.699}$$

$$\frac{\Delta \omega rm(z)}{\Delta \alpha_c(z)} = \frac{-0.001}{z^2 - 1.671z + 0.699}$$

$$\frac{\Delta \omega rm(z)}{\Delta TL(z)} = \frac{-0.173(z-0.699)}{z^2 - 1.671z + 0.699}$$

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$$\frac{\Delta Id(z)}{\Delta TL(z)} = \frac{0.034}{z^2 - 1.671z + 0.699}$$

At TL=7.17 N-m, α=109^o, Nr=0851 rpm

$$\frac{\Delta Id(z)}{\Delta \alpha_c(z)} = \frac{-0.0068(z - 0.999)}{z^2 - 1.6443z + 0.6716}$$

$$\frac{\Delta \omega rm(z)}{\Delta \alpha_c(z)} = \frac{-0.001}{z^2 - 1.6443z + 0.6716}$$

$$\frac{\Delta \omega rm(z)}{\Delta TL(z)} = \frac{-0.173(z - 0.6716)}{z^2 - 1.6443z + 0.6716}$$

$$\frac{\Delta Id(z)}{\Delta TL(z)} = \frac{0.0331}{z^2 - 1.6443z + 0.6716}$$

For evaluating the dynamic performance of the drive, the perturbation in the delay angle of -1^0 and that in load torque of 0.2 N-m. have been considered.

DISCUSSION OF RESULT

The dynamic behaviour of the drive at constant load torque using developed discrete dynamic model based on dc equivalent circuit are shown in Fig.6 (a) to Fig. 6 (d) These predicted results have been compared with those using discrete dynamic model based on SRRF model for small perturbation in the delay angle by -1^0 at different load torque of 2.94 N-m and 7.14 N-m.

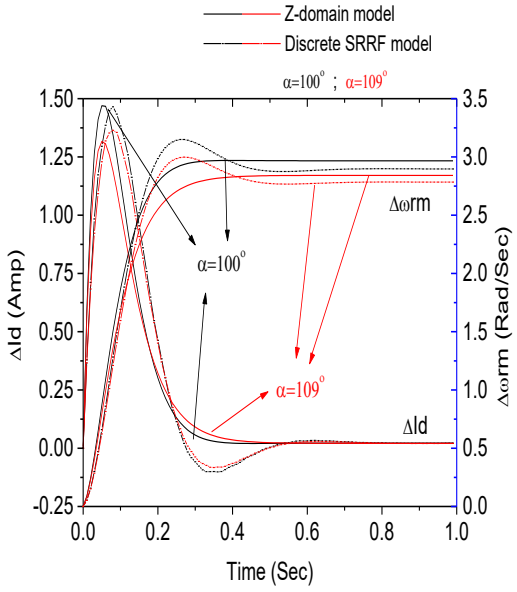

Fig. 6 (a) Dynamic response of Dc link current and speed of the drive at TL = 2.94 N-m, for Δα=-1^{0}at delay angle of α = 100^0 and 109^0

The figures Fig. 6(a) and 6(b) show the dynamic behaviour of the dc linkcurrent (ΔId) and speed ($\Delta \omega rm$) of the driveboth at delay angle of 100^0 and 109^0

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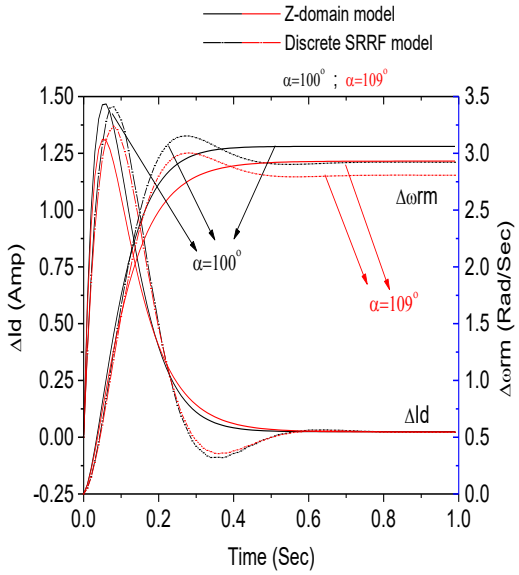

Fig. 6 (b) Dynamic response of Dc link current and speed of the drive at TL = 7.14 N-m, for Δα=-1^0 at delay angle of α = 100^0 and 109^0

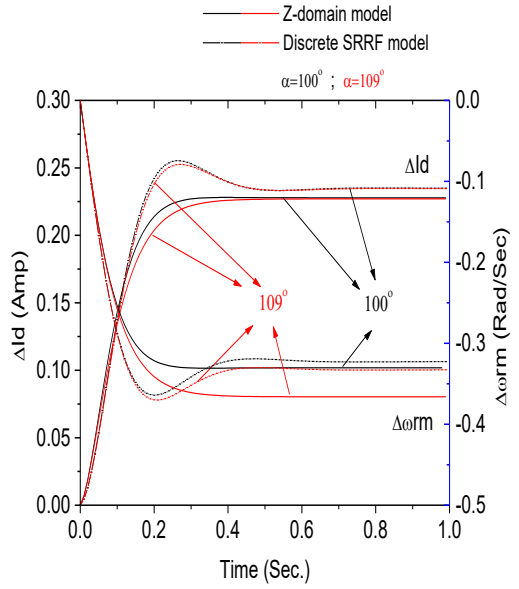

Fig. 6 (c) Dynamic response of Dc link current and speed of the drive at TL = 2.94 N-m, for ΔTL= 0.20 N-m at delay angle of α = 100^0 and 109^0

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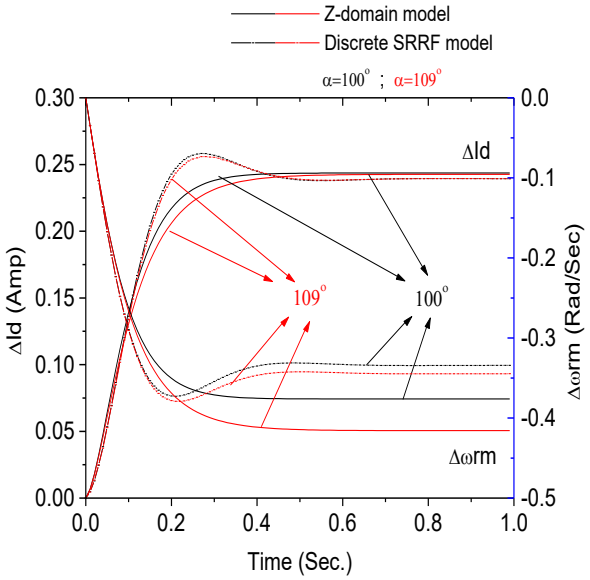

Fig. 6 (d) Dynamic response of Dc link current and speed of the drive at TL = 7.14 N-m, ΔTL= 0.20 N-m for α = 100^0 and 109^0)

It is observed that the responses of dc link current obtained by z-domain modelling approach have close agreement with the SRRF model ones, but the speed responses differ slightly in terms of overshoot. While there is no steady state error in the current response but an error of 2.0 to 2.4 percent and 4.2 to 4.6 percent is seen in the speed response at the load torque of 2.94 N-m and 7.14 N-m respectively. The settling time is observed as 0.6 seconds at all the operating points. It is revealed that the ΔId attains the same steady state value irrespective of the operating conditions and depends only on the perturbed value of the delay angle. There is no overshoot in the dynamic responses predicted by the modelling approach while 7.0 to 9.0 percent is seen in speed response using the SRRF model ones. It is also observed that as the load is increased from 2.94 N-m to 7.14 N-m, the magnitude of overshoot decreases from 8 to 7 percent.

The figures Fig. 6(c) and Fig. 6(d) show the results of dynamic responses of dc link current and rotor speed of the drive with constant load torque of 2.94 N-m and 7.14 N-m for small perturbation in the load torque by 0.2 N-m. The settling time is also seen here as 0.6 seconds. There is close agreement in the responses of dc link currenthaving steady state error less than 3.5 percent in both the models. Similar types of overshoots are also seen in the responses of dc link current androtor speed. However, steady state error in the response of rotor speed using z-domain modelling approach is seen 2.3 percent at light load and 11.1 percent at high load in comparison to those of SRRF model.

CONCLUSION

The following conclusions are made as per the discussion of results:

- The prediction of dynamic responses using z-domain models with good degree of agreement with the discretized SRRF
- models proves the validity of the z-domain model.
- The z-domain models are very simple and require small memory area for the program.
- The smaller time is required for the execution of the program. Therefore, z-domain model can be used for predicting dynamic performance of the drive.
- The small deviation in the results may be because of inclusion of voltage drop due to commutation overlap in the modelling of dc equivalent circuit, whereas it is neglected in the SRRF model. Also, the magnetizing reactance has been considered in SRRF model but not included in the dc equivalent circuit model.
- A high overshoot about 10 times to its steady state value but dying out very fast is seen in the dynamic response of the dc link current for perturbation in the delay angle.

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Design and Implementation of CFNN based SVPWM Technique for Power Quality Enhancement

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Abstract – *In this paper, a three-phase, two-stage high-power factor converter is presented with a layered forward neural network (CFNN) based space vector pulse width modulation (SVPWM). CFNN obtains the amplitude and angle of the reference vector to calculate the duty cycles of different space vectors in different directions.The CFNN significantly reduces the computational efforts of the modulation technique and allows the space vector modulation algorithm to be implemented much faster without losing accuracy compared to the conventional SVM algorithm implementation. The performance of the converter based on its power quality on the input and output side is explored by computer simulations and the results are better detected.A mathematical model of the editor was also developed. A comparative analysis of the converter without CFNN activation and using space vector modulation is also provided to verify the effectiveness of the CFNN function of the space vector modulation. The policy may be extended to multi-level converters with some modifications.*

Keywords: Space Vector Pulse Width Modulation, Two Level Voltage Source Inverter, Neural Network, CFNN.

INTRODUCTION

Multilevel improved power quality AC/DC converters have gained popularity in recent years for medium and high power applications at high voltages due to the ease with which power devices can share voltage and the superior harmonic quality of input current compared to conventional two-level improved power quality converters operating at the same switching frequency [1–3]. In comparison to the traditional sinusoidal pulse-width modulation (PWM) technique, space-vector pulse-width modulation (SVPWM) has recently become very popular for such converters because it offers the advantages of improved power quality at the same switching frequency and better utilisation of DC-bus voltage. The problem with space-vector modulation of three-level converters is that it necessitates extensive and time-consuming on-line computation by a digital signal processor (DSP) [4], which often restricts its operation to a few kHz and is expensive. This difficulty can be handled by using an artificial neural network to implement SVPWM (ANN).

Artificial intelligence (AI) approaches, particularly neural networks, have a big impact on power electronic controllers' performance. In fact, neural networks have ushered in a new era of progress in the large field of power electronics. In the fields of power electronics and drives, the use of neural networks is rapidly expanding. In power electronics, the feed-forward back-propagation type neural network is most typically utilised. It uses an error back-propagation supervised training approach and is computationally highly powerful. The transfer function of the hidden layer neurons is normally hyperbolic tan (tan-sigmoid), whereas the output layer has a linear transfer function.In the same way that synaptic junctions of neurons give memory or intelligence in a distributed fashion in a biological neural network, neural network

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synaptic weights contribute distributed intelligence in the system. This enables the neural network's basic input–output mapping or pattern recognition property. It's worth noting that when enormous parallel computing is done with the help of application specific IC (ASIC) processors, one particular aspect of the neural network is that it's incredibly fast. A non-linear mapping phenomena can be seen in a feed forward carrier based-PWM technology like SVPWM, where the command phase voltages are sampled at the input and the appropriate pulse width patterns are established at the output. As a result, it is reasonable that an SVPWM algorithm can be implemented by a feed forward back-propagation type ANN with high computing capabilities. Unlike the traditional look-up table method, the ANN provides better precision through interpolation because it has an intrinsic learning capability. For three-phase two-level [5] and three-level inverters [6–9], the ANN-based SVPWM modulator has already been reported. The computation burden is partially reduced in the case of three-level converters, as the reported ANN-based modulator requires initial space-vector computations for the determination of magnitude and angle of reference vector, and a multi-layer neural network is used, which requires a larger number of neurons and is more difficult to train. Higher switching transitions are introduced due to selected switching sequences for training data, which necessitates the employment of an additional up–down counter and sophisticated logic circuit.

Figure 1 shows a three-phase, two-stage high-power factor boost converter based on space vector pulse bandwidth modulation using a cascade forward neural network (CFNN) (SVPWM). With back propagation, a multi-layer feed forward neural network is used. To compute the duty cycles of different space vectors in different fields, ANN uses the amplitude and angle of the reference vector. When compared to traditional algorithm implementation, the CFNN considerably reduces the computational work of the modulation approach and allows the space vector modulation algorithm to be done much faster without sacrificing accuracy. Computer simulations are used to assess the performance of the converter (input power factor, input current THD, regulated and reduced-DC output voltage) based on the power quality on the input and output sides, and the results are better detected. To verify CFNN performance, system simulations utilising MATLAB / Simulink and SIM Power Systems software are utilised.

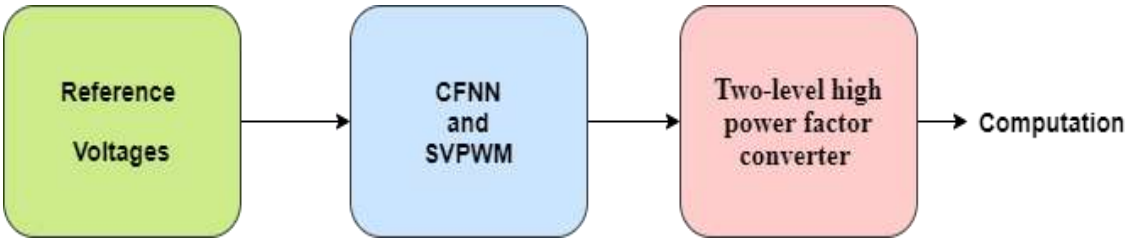

Figure 1: *Proposed System model of CFNN and SVPWM for PQE*

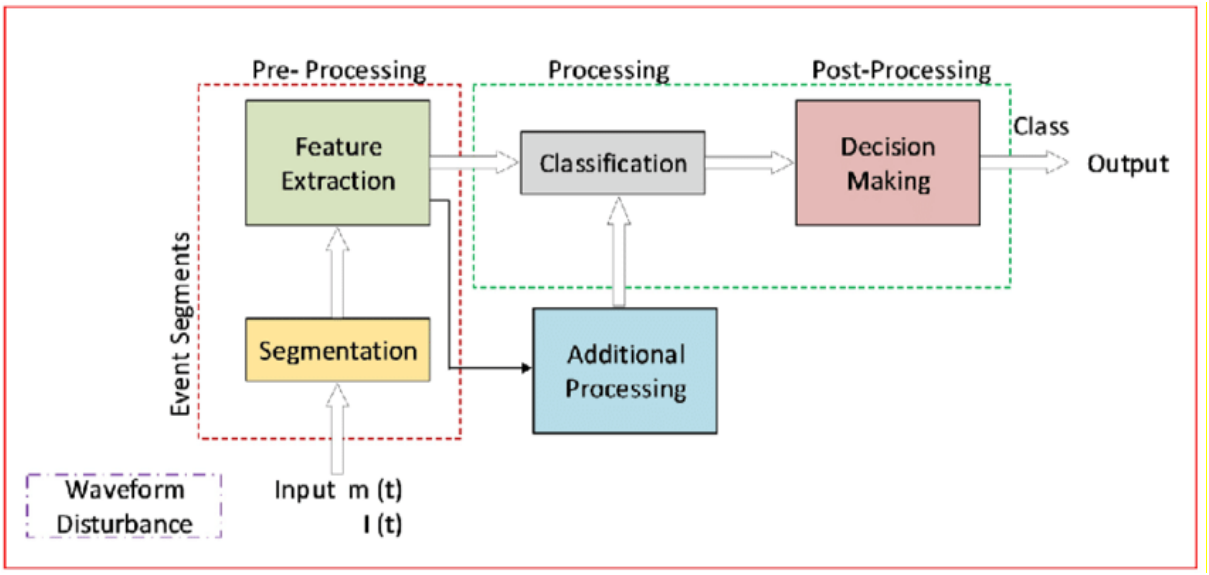

Figure 2: *Bock Diagram of Power Quality Enhancement*

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The objectives of this paper are as follows:

- To maintain a steady voltage profile at the load end.
- To eliminate the harmonic content in distribution system during unbalanced and nonlinear load condition.
- To develop control techniques for overcoming the previous problems related to voltage deviations.
- To compensate harmonics currents, unbalanced nonlinear load currents.

The rest of the paper is organized as follows: Section 2 discussed the power quality improvement. In Section 3as literature review has discussed the previous power quality enhancement models. Section 4has discusses the problem formulation of proposed model. In Section 5 proposed model algorithm and its description explained. Section 6 shows and describes the test results of the proposed work. Finally, Section 6 completesandconcludes the proposed work.

I. POWER QUALITY IMPROVEMENT

The electric power industry is shifting from a few large concentrated generation centres to a more distributed and dispersed power generation infrastructure due to a combination of technology innovation in power electronics, electricity deregulation, economics, customer value, and energy demand [10]. The high penetration level of harmonics in DG systems causes voltage profile disruption, which leads to power quality difficulties. Harmonic issues are linked to switching device technology, the nature of characteristic harmonics, equipment ratings, and the host distribution feeder's loading conditions. The quality of the voltage supplied is the responsibility of the electrical supplier under the current IEEE 519-1992 framework. End-users must limit harmonic current injections based on the amount of the end-use load in relation to the system's capacity [11].

The potential harmonic current contributions of power electronic inverters to the utility system are a key source of worry. This risk stems in part from the use of inverters based on Silicon Controlled Rectifier (SCR) technology. They are line-commutated and pump large amounts of harmonic current into the system. The majority of new inverter topologies are based on Insulated Gate Bipolar Transistors (IGBTs) that generate the injected sine wave using pulse-width-modulation (PWM) technology. They are capable of producing substantially cleaner output and, in most cases, fulfil IEEE 519-1992 [12] specifications.

A distributed generator is commonly converter-inverter type equipment, and can thus be viewed as a non-linear load injecting harmonics into the distribution feeder in terms of harmonic modelling and simulation [13]. The following equation can be used to compute harmonics in output line-line voltage of three phase voltage source inverters.

Harmonics emerge as a result of inverter switching and micro-grid transitions between grid-connected and islanded modes. They must be compensated in order to optimise the voltage profile at the loads and improve power quality. Furthermore, considerable harmonics can be present in the system during gird-connected operation, depending on the design of the generator windings (pitch of the coils), core non-linearity, grounding, and other considerations [14]. In the neutral, triple harmonics are additive, with the third harmonic being the most common. Synchronous generators with a 2/3 pitch for the windings produce significantly less third harmonic than those with different pitches. Unfortunately, a 2/3 pitch machine has a lower third harmonic impedance, which could result in greater harmonic current flowing from other sources connected in parallel with it [15]. The grounding layout of the generator and step-up transformer limits harmonic feeder penetration.

LITERATURE SURVEY

This section elaborates the various issues using different techniques of neural network based SVPWM for power quality enhancement modules.

In [16], a new compensation approach based on a PQ type compensator was introduced. Their compensation strategy improves system power quality by utilising entirely DC–bus energy storage and active power sharing amongst PQ converters, both of which are not available in DVR and D–STATCOM compensators. The PQ's internal control approach is based on active and reactive power management in series and shunt converters, as well as power exchange between converters through PQ DC–Link. In comparison to the commonly used backward/forward sweep approach for weakly meshed networks, they demonstrated that their suggested algorithm was efficient, stable, and robust.

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In [17], a control technique for a three-phase four-wire PQ was developed for the improvement of various PQ difficulties. The PQ is achieved by combining series and shunt active power filters (APFs), with a common DC bus capacitor shared by both APFs. A three-phase, four-leg voltage source inverter (VSI) is used to implement the shunt APF, whereas a three-phase, three-leg VSI is used to implement the series APF. The reference signals for series APF were obtained using a unit vector template technique (UTT) based control approach, while Shunt APF was controlled using the ICos theory. In a three-phase four-wire distribution system with a diverse combination of linear and non-linear loads, the performance of the implemented control algorithm has been evaluated in terms of power-factor correction, load balancing, source neutral current mitigation, voltage and current harmonics mitigation, mitigation of voltage sag and swell, and voltage dips. The current/voltage regulation in the control system has been applied to fundamental supply currents/voltages rather than fast changing APF currents/voltages, reducing the computational time and the number of necessary sensors. The simulation results were produced using MATLAB/Simulink, and they show that the suggested control system is capable of maintaining the PQ's functionality.

In [18] suggested a design for combining PQ and PV array functioning. In both islanding and interconnected modes, their suggested system consists of series and shunt inverters, a PV array, and a DC/DC converter capable of mitigating voltage sag, swell, interruption, harmonics, and reactive power. The advantages of their suggested system are that it 1) minimises the cost of a PV interface inverter connected to the grid by employing a PQ shunt inverter, and 2) it can compensate for voltage interruptions caused by connecting PV to DC link via PQ. To obtain the maximum power point of the PV array in the proposed system, the P&O technique was applied. The PSCAD/EMTDC programme was used to analyse the suggested system's functioning, and the simulation results showed that their proposed system works properly. To improve the power quality of the power distribution network, K S Ravi Kumar et al. developed FL and ANN controllers for PQ. In comparison to the PID controller, the proposed FLC and ANN were capable of offering good static and dynamic performances. The accuracy and speed with which reference signals were obtained are the most important factors in PQ performance. The principle reference signals were developed utilising traditional Akagi's principles. A FLC was tuned with a high number of data points using typical compensator data. The traditional compensator was then replaced with a fuzzy logic controller, and the R-L load utilising an unregulated rectifier was simulated using Matlab/Simulink. They demonstrated that the PQ performed better using FLC's recommended approach, effectively eliminating both voltage and current harmonics. The ANN controller functions similarly, albeit with significantly improved voltage adjustment. It was also discovered that as accuracy improved, the response time for deriving compensating signals decreased dramatically. They also demonstrated that it had a long response time when it came to providing adequate compensation in the network.

[19] Reported the use of Wavelet Packet Transform (WPT) and Support Vector Machines to automatically classify power quality events (SVM). WPT was used to extract the features of the disturbance signals, which were then sent to the SVM for effective classification. Genetic algorithm and simulated annealing were two optimization approaches employed in their suggested categorization system. In a totally automated manner, their suggested approach discovered the best discriminative features and calculated the optimum SVM kernel parameters. The efficiency of their proposed detection approach was compared to traditional parameter optimization methods such as grid search, neural classifiers such as Probabilistic Neural Network (PNN), and fuzzy k-nearest neighbour classifier (FkNN). They've demonstrated that their proposed strategy is trustworthy and routinely generates better results.

Because of its quick responsiveness, great dependability, and low cost, PQ is an effective CPD for improving power quality. It can be utilised to solve current and voltage-related PQ problems in power distribution systems at the same time. Two inverters are used in PQ, which are coupled to a shared DC link through an energy storage capacitor. Shunt and series inverters, DC capacitors, low pass and high pass filters, and a series transformer are the essential components of PQ [20].Shunt inverters are used to compensate for current-related disturbances by delivering opposing current that cancels the disturbance, whereas series inverters are used to compensate for voltage-related disturbances by injecting opposite voltage in the line. Harmonics in system voltages and currents can be reduced using low and high pass filters [21].

PROBLEM FORMULATION PROPOSED APPROACH

Because of their importance in power-operating electronics, PQ-related concerns are a hot topic these days. PQ issues were caused by nonlinear loads such adjustable speed drives (ASD), programmable logic controllers (PLC), energy efficient lighting, and rectifiers. Voltage sag, voltage spike, voltage swell, harmonic distortion, voltage swings, voltage unbalance,

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and interruptions are all common PQ issues. If the system maintains the PQ, it will operate in a stable manner; otherwise, it will operate in an unstable manner. As a result, sustaining PQ in a power functioning device is critical. According to the results of the literature review, intelligent approaches are used in a variety of electrical and electronic applications. Intelligent approaches have been applied in previous works to improve the PQ problem compensating performance of PQC. The output of the NN, which sends the PQ disturbance in terms of voltage to the bias voltage generator, increases the performance of PQC in PQ problem correction. The bias voltage generator replaces the DC link capacitor, which serves as a DC voltage source for the PQC's two active power filters. Because of the extended discharge period of the DC connection capacitor, full compensation of voltage disturbances is not possible and is delayed. In this research, a machine learning technique based on CFNN is proposed, which is an improvement over current problems, as well as CFNN and SVPWM for increasing the PQC's compensatory performance.

PROPOSED MODEL ALGORITHM AND DISCRIPTION

This section explains the proposed model system and its description.

a) ***Space Vector Pulse Width Modulation (SVPWM)***

Space vector pulse width modulation is a high-performance, computation-intensive PWM approach that may be the best for multilayer inverters. For multilayer inverters, there are several approaches for implementing space vector modulation. Among those two ways, a simplified low computational space vector algorithm and sector selection based space vector modulation are used to traditional diode clamped multilevel inverters [8]. SVPWM is set up in such a way that by the end of the three-phase system, there are only two independent variables. Because of vectors, neighbouring co-ordinates in a phasor diagram are primarily utilised to depict the three phase system voltage. Figure 1 shows a total of eight switching patterns (V0 to V7) that indicate reference voltage (V_{ref}). (V_1 to V_6). There are six sectors on the plane. Each sector forms a 60-degree angle. $V_{ref.}$ Corresponds to the product of two zero vectors and two non-zero vectors [22].

From the definition of space vector,

$$V = \frac{2}{3}[Vp(t) + pVq(t)p^2Vc(t)] \quad (1)$$

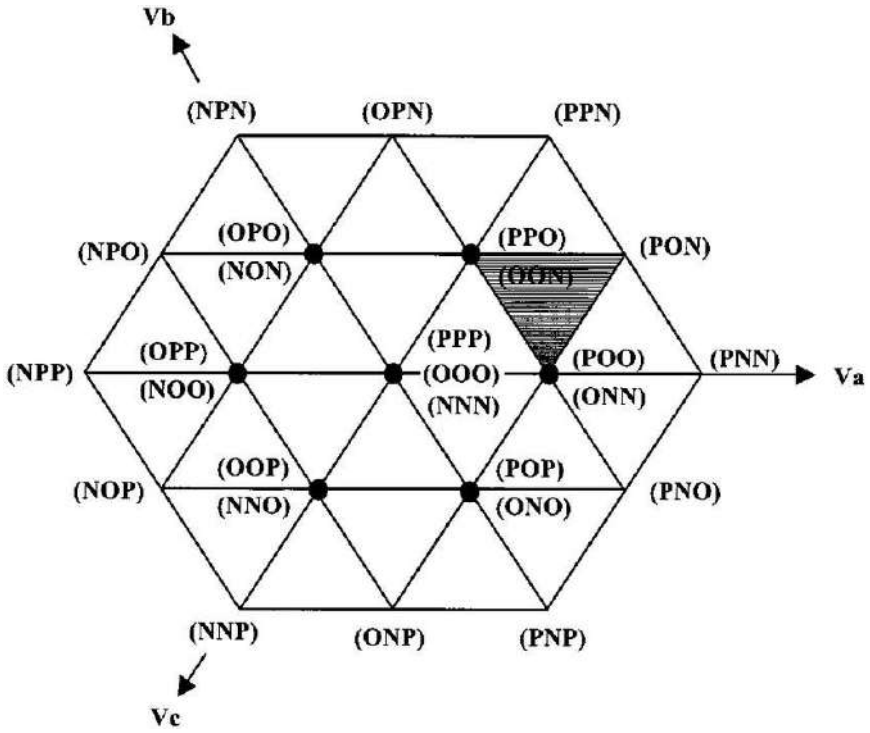

Figure 3: *Switching vector of 3-level inverter*

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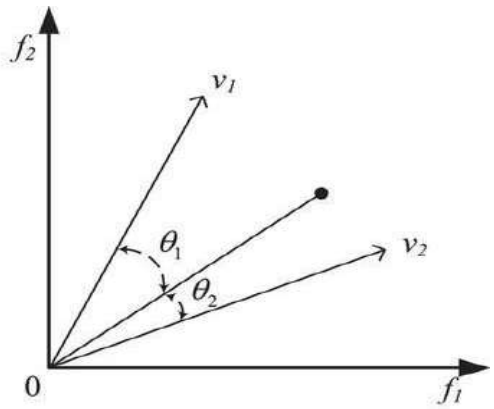

Figure 4: *Reference vector*

Table 1: *2-level inverter voltage vector*

S. No.	Sa	Sb	Sc	Van	Vbn	Vcn
1	1	0	0	V_{dc}	0	0
2	1	1	0	V_{dc}	V_{dc}	0
3	0	1	0	0	V_{dc}	0
4	0	1	1	0	V_{dc}	Vdc
5	0	0	1	0	0	V_{dc}
6	1	0	1	V_{dc}	0	V_{dc}
7	1	1	1	V_{dc}	V_{dc}	V_{dc}
8	0	0	0	0	0	0

The active state provides +Vdc and –Vdc output line voltages, whereas the null state does not contribute to any output line voltage in a 2-level inverter. In table 1, "1" corresponds to the ON state and "0" corresponds to the OFF state of the switches, respectively.

When $V_{ref.}$ falls into sector 1 as illustrated in figure 4, it can be arranged by V1, V2, and V0 using three neighbouring switching vectors as reference vectors. Any sector's switching time length is

$$T_1 = \frac{\sqrt{3}.T_s|V_{ref.}|}{V_{dc}}\left\{\sin\left(\frac{\pi}{3} - \propto + \frac{n-1}{3}\pi\right)\right\} \quad (2)$$

$$T_2 = \frac{\sqrt{3}.T_s|V_{ref.}|}{V_{dc}}\left\{\sin\left(\propto - \frac{n-1}{3}\pi\right)\right\} \quad (3)$$

$$T_0 = T_s - T_1 - T_2 \quad (4)$$

Where Ts is the time period of switching cycle, T1 and T2 are switching time of the vector V1 and V2 similarly calculation is applied to sector II to IV.

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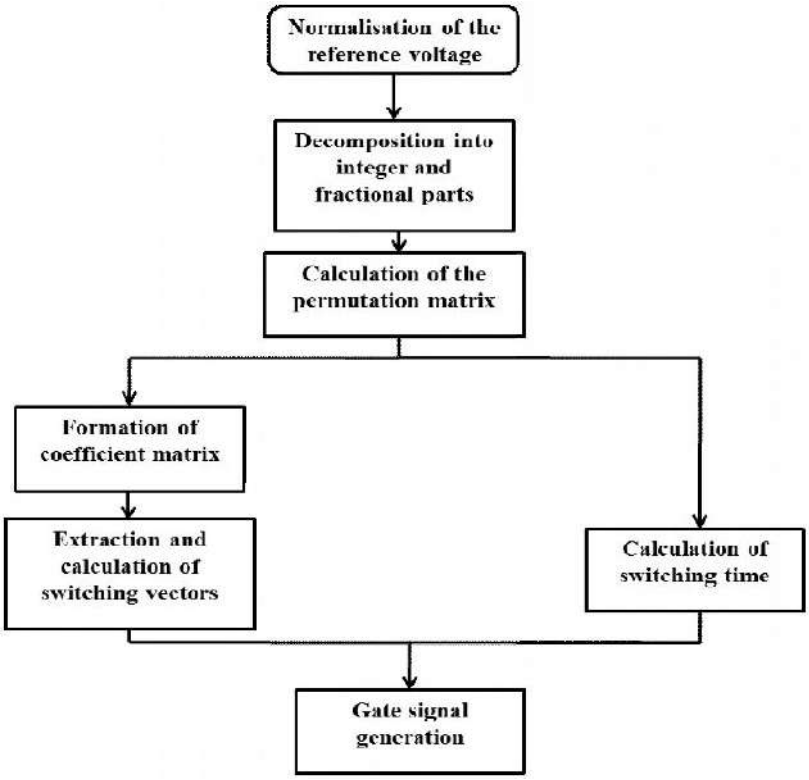

Figure 5: *Flow chart for the SVPWM implementation*

By lowering the number of switching states, the inverters' performance can be increased. The multi-phase modulation technique produces a sorted switching pattern with fewer switching states, and its lower computing complexity makes it ideal for real-time application [23]. Figure 4 depicts the flow chart for the low computational space vector approach.

b) ***CFNN based SVPWM***

Figure 5 shows a cascade forward back propagation model, which is similar to feed-forward networks but includes a weight link from the input to each layer and from each layer to the next. While two-layer feed forward networks may learn almost any input-output relationship, feed-forward networks with more layers may learn complex relationships faster. Cascade forward back propagation is used to update weights, however the key symptom of this network is that each layer is related to the layers before it [24]. The developed CFNN-based SVPWM (CFNN-SVPWM) for a two-level inverter based TIM drive is shown in Fig. 1. The duty ratios (Ta, Tb, Tc) are created by feeding V and V voltages to the CFNN. To construct the switching pulses for the inverter, these duty ratios are compared to the waveforms during the switching time (Ts).

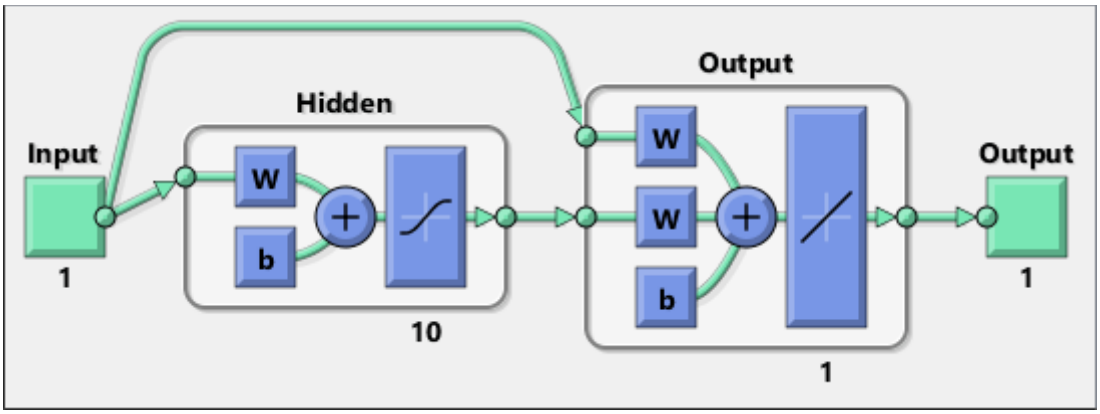

Figure 6. *Cascade Forward Neural Network based SVPWM*

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- ***Algorithm for CFNN based SVPWM:***

Step 1: Normalize the inputs and outputs with respect to their maximum values. It is shown that the neural networks work better if the inputs and outputs lie between 0-1. There are two inputs given by {P} 2X20 and one output {O} 1X20 in a normalized form.
Step 2: Enter the number of inputs for a fed network.
Step 3: Enter the number of layers.
Step 4: Create a new feed forward network with 'tansig and poslin' transfer functions.
Step 5: Train the network with a learning rate 0.02.
Step 6: Enter the number of epochs.
Step 7: Enter the goal.
Step 8: Train the network for given input and targeted output.
Step 9: Generate simulation of the given network with a command 'gensim'

RESULTS AND DISCUSSIONS

A practical implementation was carried out in our laboratory and using our own resources to confirm the obtained simulation findings and validate the performances supplied by the suggested technique (CFNN-SVPWM). The simulation is carried out using the MATLAB Simulink software, and the observations are carried out under various conditions. The system's description is noticed in a specific condition, which is discussed further down.

Case 1: Sample power system with PWM firing based CFNN and dynamic nonlinear load.

When the SVPWM firing based CFNN is used with a sample power system model and a dynamic non-linear load, we perform a fast Fourier transformation (FFT) analysis of the sample power system to determine the harmonic across each of the three bus voltages. Dynamic nonlinear load has a total harmonic distortion (THD) of 67.59 percent. The power quality problems related to dynamic performance of the non-linear loads this is time-varying in nature by introducing a nonlinear load variation. Here a non-linear load is considered to be a diode rectifier with R-L load.

Table 2: *Percentage of odd harmonic with PWM based CFNN*

Harmonic	Frequency	PWM based CFNN
Fund	60Hz	100%
H3	180Hz	35.89%
H5	300Hz	21.76%
H7	420Hz	16.81%
H9	540Hz	13.23%
H11	660Hz	12.85%
H13	780Hz	10.23%

The percentage of odd harmonic table and bar diagram is shown in table 2 and the percentage of even harmonic table and bar diagram is shown in table 3.

Table 3: *Percentage of even harmonic with PWM based CFNN*

Harmonic	Frequency	PWM based CFNN
H2	120Hz	51.67%
H4	240Hz	26.51%
H6	360Hz	19.68%
H8	480Hz	15.41%
H10	600Hz	13.25%
H12	720Hz	10.02%

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Case 2: Sample power system with SVPWM firing based UPFC and dynamic non-linear load

When the space vector pulse width modulation (SVPWM) firing based CFNN is used in conjunction with a sample power system model and a dynamic non-linear load, we do a fast fourier transformation (FFT) analysis of the system to determine the harmonic across each of the three buses voltages. When compared to SVPWM firing based CFNN, the total harmonic distortion (THD) is lower (i.e. THD is 59.32 percent). The system's harmonics may be reduced utilising SVPWM firing based CFNN.

Table 4: *Percentage of odd harmonic with SVPWM based CFNN*

Harmonic	Frequency	SVPWM based CFNN
Fund	60Hz	100%
H3	180Hz	26.52%
H5	300Hz	5.17%
H7	420Hz	3.49%
H9	540Hz	2.32%
H11	660Hz	1.69%
H13	780Hz	1.20%

The percentage of odd and even harmonic in the system is shown table 5 and 6.

Table 5: *Percentage of even harmonic with SVPWM based CFNN*

Harmonic	Frequency	SVPWM based CFNN
H2	180Hz	47.50%
H4	240Hz	16.28%
H6	360Hz	8.95%
H8	480Hz	5.26%
H10	600Hz	3.92%
H12	7200Hz	2.82%
H14	840Hz	2.20%
H16	960Hz	1.01%

Table 6: *Comparison of odd harmonic with PWM-CFNN and SVPWM-CFNN*

Harmonic	Frequency	PWM based CFNN	SVPWM based CFNN
Fund	60Hz	100%	100%
H3	180Hz	35.89%	26.52%
H5	300Hz	21.76%	5.17%
H7	420Hz	16.81%	3.49%
H9	540Hz	13.23%	2.32%
H11	660Hz	12.85%	1.69%
H13	780Hz	10.23%	1.20%

Table 7: Comparison of even harmonic with PWM-CFNN and SVPWM-CFNN

Harmonic	Frequency	PWM based CFNN	SVPWM based CFNN
H2	180Hz	51.67%	47.50%
H4	240Hz	26.51%	16.28%
H6	360Hz	19.68%	8.95%
H8	480Hz	15.41%	5.26%
H10	600Hz	13.25%	3.92%
H12	7200Hz	10.02%	2.82%

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Table 8: *Comparison of Performance Indices of SPWM and SVPWM*

Modulation Index	SPWM THD (%)		SVPWM THD (%)	
	Line Voltage	Line Current	Line Voltage	Line Current
0.3	73.33	17.05	31.73	1.83
0.4	71.02	15.53	29.88	1.50
0.5	62.72	13.73	28.72	1.40
0.6	57.67	11.78	26.44	1.30
0.7	52.14	12.42	23.88	1.10
0.8	51.10	11.04	22.07	0.77

Table 9: *Dynamic Performance Indices for SVPWM*

Performance Indices	Three-Level Converter
	Control Techniques used
	SVPWM
Settling Time	0.10 sec (increase load)
	0.15 sec (increase load)
DC bus voltage undershoot	≈2.4% undershoot (decrease in load)
	≈18% undershoot (increase in load)
DC bus voltage undershoot	≈18% undershoot (decrease in load)
	≈0% undershoot (increase in load)

CONCLUSION

The implementation of highest performance in terms of power quality and overall harmonic degradation is provided by a neuro-network based space-vector modulator. CFNN generates return times, which are then translated to pulse width using a simple logic circuit. In comparison to the normal SVPWM, the CFNN dramatically decreases the computational work of the modulation approach and greatly improves the space vector modulation algorithm without sacrificing accuracy. In fact, the need of DSP can be eliminated, and PWM pulses can be generated using simple logic circuits. A three-phase voltage source inverter with CFNN activation is also supplied, as well as a comparison analysis of the inverter using space vector modulation vs traditional SPWM to demonstrate the effectiveness of the CFNN function of the space vector modulation. The SVPWM model's CFNN implementation not only speeds up the algorithm but also reduces the computational burden on the DSP, resulting in better inverter performance in terms of THD than the SPWM algorithm.

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Recent Trends in IoT based VANET

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Abstract – *Vehicular Ad-Hoc Network (VANET) is an important key in the field of Intelligent Transportation System (ITS) which providesa wide variety of services. Its applications range from crash avoidance and safety to multimedia and internet access. Vehicular networking was perceived to overwhelm the delay and extreme use of radio resources that need to access the cloud. It comprises the bandwidth optimization and reduces the latency in fetching the cloud of the network edge. Recently this perception has been widely used in the new paradigm of vehicular networks named the internet on vehicles. The innovation in the internet of things and wireless technology has brought a substantial expansion in vehicular ad-hoc networking. Internet of Things (IoT) and Vanet are the key components in the current ITS. To attain the benefits, researchers have explored the effectiveness of IoT-based Vanet in the intelligent transportation system. In this paper, our aim is to explore and demonstrate the key challenges and drawbacks in terms of security, routing protocols and privacy experiences by VANET respectively. The main contribution of this review lies in the brief explanation of Vanet and IoT, the challenges suffered by vanets and IoT. This study may help various researchers in understanding new challenges in designing the IoT-based VANET.*

Keywords —*Intelligent Transportation System, Intenet of Things, Routing Protocol and Vehicular Ad-hoc Network.*

INTRODUCTION

In a Vehicular Ad-Hoc Network (VANET), all vehicles are participating in networking fitted out with wireless transceivers which allowed the sharing of their information with other vehicles. Also, route the packets in the network where the destination vehicles are not in the direct communication range of the source vehicle. The external infrastructure for one-hop connectivity is not necessary, even if the fixed roadside units possibly will take part in a VANET. Such an approach potentially may help the development of applications in VANET ranging from enhanced traffic safety and jamming prevention to vehicle information and entertainment system. VANETs operate in a stimulating communication environment, in which the deployment of technology have limited in practical. The hidden node problem, limited radio resources like inadequate spectral bandwidth and channels affected by both mobile and stationary obstructions and intrusion sources are particularly vulnerable to VANET. Ad-hoc network has an insignificant advantage over the infrastructure-based networks in such an environment. Infrastructure base network, distribution of the network resources and optimally scheduling of channel access are allowed in a relatively simple manner through the access point. A large number of access point needs to deploy throughout the large coverage area. The researcher has inspected the new approaches of clustering in VANETs for taking the profits of infrastructure-based networks deprived of the essential for the fixed infrastructure [1].In recent years, amazing advantages have been accomplished in VANET which is considered the explicit type of mobile ad-hoc network with a predominantly motion (speed and direction). Vehicles traveled according to a well-organized configuration-based mobility model, which is particularly built on the predefined environment like roads, buildings and intersections, etc. [2][3]. The distinguishing of the VANET nodes are two types: fixed nodes recognized as roadside units and mobile nodes recognized as

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vehicles. The deployment of the roadside unit is very critical and it is solely responsible to provides services like internet access and also providing some data aggregation services. The vehicle and roadside unit exchange their message with destination nodes via inter-vehicle communication and vehicles to roadside communication. The vehicle-to-vehicle and vehicles to infrastructure communication have been established by wireless technology like IEEE 802.11p. Recently, a new project under the umbrella of the 3rd generation partnership project(3GPP) provides a wireless standard for vehicle-to-everything communication that supports the communication of the vehicle with each other's and with fixed structures i.e vehicle to vehicle and vehicle to infrastructure [4]. The vehicles are fortified with wireless communication technologies to offer Ad hoc connectivity in VANET. For the scalability of the VANET, the architecture has efficient and effective routing is essential for the data dissemination. The security and safety of vehicles are primarily aimedat the VANET environment [5]. For the optimum information communication in VANET, several clustering routing information are investigated also clustering algorithms used the intelligent approaches. With the initiation of the internet of things (IoT) in many industries, communication among vehicles can be possible through the internet of vehicles [6]. It may help to enhance the safety and traffic management policies implementation which makes smart vehicles' communication. The vehicles connected to an Ad-Hoc network and also connected to the internetare also known as the Internet of Vehicles (IoV). [7] With the resolution of new connectivity and communication technologies, the inventive model in mobile and wireless communication sectors industrialized the IoT. VANET offered the key development to rise in IoV. IoVdenotes to the network of distinct things in road transport as roads, vehicles, city infrastructure, parking lots, foot travelers and deals in realtime communication between them. IoT-based VANET provides a solution for secure communication and traffic flow control under real-time management based on recent technology [8]. The number of vehicles connected with IoT creates the larger formation of the IoV network.

The Concept and motivation of review the IoT-based VANET are explained in section II. The challenges and issues in the construction and function of IoV are discussed in section III. Also highlights the recent techniques to solve these issues in section IV. IoT-based VANET recent trends are elaborated in section V and finally, section VI concludes the review work.

CONCEPT AND MOTIVATION

IoT and the VANET concept are combined to represent the idea of the Internet of Vehicles (IoV). Many researchers focused on these concepts for enhancing the efficiency and safety of vehicles in real-timescenarios. To review these features, it is necessary to study the basic concept ofIoT and VANET technologies for providing better services through vehicles and fixed infrastructure.

VANET:

Due to the rapid development in technology expansions in wireless communication, the traditional ITS has advanced towards vehicular communication. In the last decades surely, ITS attracted the automotive industries, researchers and governments. The different projects have been conducted by governments and research institutes from the whole of the world. ITS integrate innovative technologies of electronics, sensing & detecting multiple objects and real-time communications, in all kinds of transportation system. This integration improves efficiency, safety, services and traffic situation by the exchange of real-time information [9]. There are four integrated components of ITS. These components include Intelligent Infrastructure, Smart Vehicles, Transportation Users and Information Services, as shown in Figure 1.

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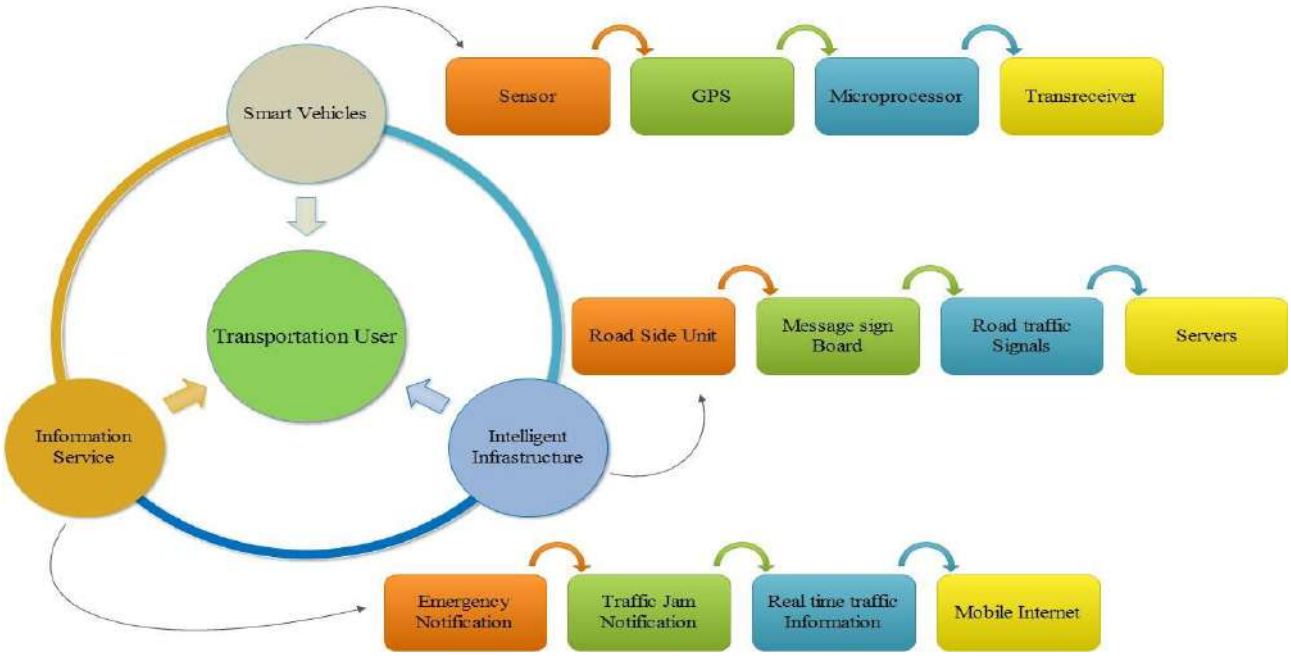

Fig.1: The components included in ITS.

- **Intelligent Infrastructure**
  Intelligent transport system's backbone is infrastructure. Intelligent infrastructure utilizes the advances in servers, road traffic signals, message sign-board and efficient roadsideunit. The key is to use the information exchange with a vehicle to infrastructure that is relevant to help obtain the full potential of both old and new infrastructure.
- **Smart Vehicles**
  As the traffic density is increasing, the information exchange between vehicles to vehicles becomes more difficult. Therefore, smarter vehicles utilize advanced sensors, GPS and Data communication technology.
- **Information Services**
  One of the essential objectives of ITS is to have enhanced services, efficiency and security. It also provided movement circumstances data information to the transportation user in real-time. Information Services include mobile internet, Emergency notification real time traffic information and traffic jam/accident notification.

The concept of V2V (Vehicle to Vehicle) and the V2R (Vehicle to Roadside unit) communication come close to existence in research and development as an alternative communication network known as VANET. The communication in VANET includes WAVE (wireless access in vehicular environments), Wi-Fi-based communication and Ad-hoc based communication.Thus, VANETs help ITS in accepting V2V and V2R communications which are standardized by IEEE WAVE, and identical for short-range communication.

IoT:

The combination of a physical object or things makes a network thathasthe capability of collecting data from the outside world and sharing this data across the internet. The sensors, software and electronic hardware must be embedded in these physical objects. This concept of IoTwas announced by members of the radio frequency identification development community in 1999.Due to real-time communication, growth in mobiles, cloud computing and advancement in data analysis technology, it is very popular. When vehicles are associated to the Internet and work as an ad-hoc fashion, it is known as the IoV (Internet of Vehicles). It will encourage the integration of information technology and automotive technology that shall minimize the lack of communication and coordination between connected vehicles and improve services, products, and experiences.The internet of vehicles is a dispersed network that supplies the use of data produced by an associated car and vehicular Ad-Hoc networks. An important goal of the internet of vehicles is to allow the vehicle to communicate in real time with drivers, pedestrians, other vehicles, roadsides infrastructure and fleet management system [10]. The IoV supports five types of network communication as shown in figure2:

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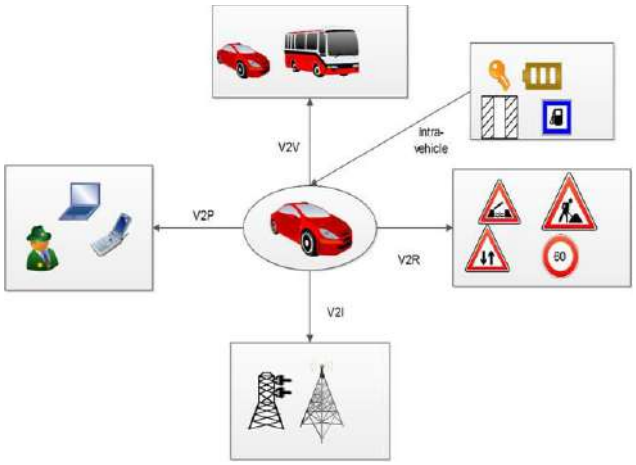

Figure 2 Five types of network communication in IoV.

1 Intra-vehicle communication: In an intra-vehicle communication system that monitors the vehicle's internal performance throw-on board unit.

2 Vehicle to vehicle communication: It supports the wireless conversation of information about the speed and position of neighboring vehicles.

3 Vehicle to Infrastructure: It supports the wireless conversation of information among a vehicle and associates roadside units via wifi or LTE/4G/5G.

4 Vehicle to Pedestrian: It supports awareness of full road users such as pedestrians and cyclists.

5 Vehicle to Road: It supports the wireless exchanges of info between a vehicle and a fixed roadside unit via WAVE.

CHALLENGES AND ISSUES IN IOT-BASED VANET

The main objective of the IoT-based VANET is to offer secure and safe communication, connect different users with vehicles, sensor devices and networks and make the network efficient and reliable. The combination of such things/objects makes its construction a complex system. The use of IoT-based VANET is less diverse associated to other networks and as a result, there are some specific requirements.These issues need new tests in research and development and new technological challenges of IoV. The researchers found many challenges and issues in the construction and function of IoV are:

1. Mobility and dynamic Topology: Generally, sensors are embedded in vehicles and mobility of vehicles is high in the VANET scenario. The cluster made by the vehicles and the cluster head is selected among the vehicles in the existing cluster based on some parameter. The cluster head exchanges the information of cluster vehicles with roadsideunits. The roadside unit is connected to the internet. Due to the high mobility nature vehicles need a dynamic topology, so they can connect with the internet for sharing information with a sufficient amount of data rate.
2. Communication standards: The IoT-based VANET required a communication standard, so inter-operability and regularization areessential for rapid selection. The communication standards frequently used are short-range communication as Dedicated Short Range Communication (DSRC) and long-term communication as Long Term Evolution (LTE). These standards need to improve, so they can fully utilize IoT-based VANET.
3. Vehicles Reliability: The network sensor and vehicle sensors may be power failures or physical damage that can cause the system to deal with inadequate data. Also, malicious node sensor attacks can reduce the reliability of vehicles. For avoiding these, some technologies can be deployed to protect against denial of services. We essential to ensure that vehicles cannot contradict the faithfulness of another vehicle.
4. Network size: Due to changes in traffic conditions, the network size is dynamic in nature. For example, the entries of vehicles in urban areas can be low as compared with the metropolitan area. In any case, IoT-based VANET can cover the entire area without any fail, which causes road accidents.

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5. Security and privacy: When data is shared in the network, it must verify the identities of nodes/Vehicles. Also, transmitted and receiving data need to be verified for correct delivery. Data must be secure in IoV network for transmission between different vehicles that are participating in the network of IoV.
6. Data processing in IoT: The biggest challenge of IoT-based VANET scenarios is the big data processing and stored in clouds. The autonomous vehicle is large in number which causes a large amount of data is generated in IoV. Therefore, it is the biggest issue for data controlling in smart connected vehicles via cloud networks and IoT analysis.

IOT-BASED VANET

VANET is a fast-growing field that uses advanced electronic technologies. The advances in communication and information processing technologies are used for enhancing vehicular efficiency and safety. A vitalrole in smart vehicles application is information collection and communication .In VANET, network distribution is the most useful application in information sharing services. Many researchers believe that the Agent-based approach is one of the most impotent technologies which can be used for network distribution in traffic and transmission systems [11]. An Agent system has two types of agents: stationary and mobile agents. This algorithm provides mechanisms for agent communication, supervision and directory maintenance. It also supports the relocation and implementation of mobile agents. This technology is used in ITS, such as roadway systems, transportation systems, and railway systems. Today, traffic congestion is the most important social issue for humans. The various researcher works for reducing congestion. Traffic congestion can be reduced by:

a) Improve the existing infrastructure,

b) Sharing the resources,

c) Notification or variable message sign on the roadside

d) Reliable communication.

In fact, vehicular traffic continually increases the whole world, especially the urban area. The existing infrastructure of traffic surveillance, traffic flow maintenance and traffic control are not capable in terms of cost-effectiveness, better performance and easy maintenance .In the last decade, the reputation of the Internet of Things, several research struggles shows the growing IoT application scenarios. The availability of heterogeneous devices, spanning from a smartphone and a wireless sensor, network enable physical devices such as radio-frequency identification etc. made a platform for globally integrated communication [12][13]. [14] L. Foschini et al., 2011 proposed a pioneering architecture for the combination of a Wireless Sensor Network (WSN) with IP multimedia system. This opens the door for context-aware applications such as healthcare, environmental monitoring, and so on. The key [15] components of this architecture are the WSN/IMS gateway which provides an interface between WSNs and IMS, and the IMS which is liable for the controlling of context information in the core network.The integration of WSN and IoT are well-matched for durable environmental information acquisition [16]. The generic-based WSN can be used in the wide application of IoT. Examples of IoTapplications like environmental monitoring, which requires low deploying cost, multiple nodes, easy distribution, and less maintenance. These features are well-matched with integrated WSN capabilities. The latest development of smart cities, which helps to make improvements in quality of life is further a new research scenario in IoT application. [17] P. Bellavista et al., 2013 proposed a method for fast collection of urban data by integrating WSN, Mobile Ad-hoc Networks and IoT for smart city scenarios. The integration of WSN with IoTseems different security requirements, like making a secure network set up amongst the sensors and internet-based host. [18] F. Li & P. Xiong, 2013 proposed a heterogeneous online/offline signcryption scheme for providing the network security between the sensors and the internet host.

In smart Cities, all things need to be embedded with new technologies of wireless communication and smart processors so they are capable to communicate with each other. These increasingly smart thing/object, provides a safe and convenient path through developing interoperability and interconnection, which leads to IoT. The objective of IoT lies to make smart vehicles, that play an important role in the convenient and safe path for humans. Also, the IoT-based VANET aim is to equip the vehicles with communication and computing capability so that can interact with each other for social goods. Here social good is related to machine-to-machine vehicular social networks.IoV has been rapidly developed in this regard and makes vehicles so smart that they can easily exchange comfort-related information, and safety and improve the efficiency of the present network. The safety and efficient travel of the vehicles is key for real-time application, where offline data

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certifies the smart behavior of the vehicles and transport authorities applied the data analysis techniques. [19] Authors recognized the social configurations of IoV components, their associations, and the collaboration types. They have plottedVANET components into the IoT architecture reference model to bid better incorporation of IoV with other IoT domains. [20] Authors recognized to reduce the traffic congestion using IoT-basedvanet by smart and secure communications. IoV is areal-time application where real time communication between V2X (vehicles to everything) uses wireless communication technologies like Fog or cloud computing. This approach considers the CPS (Cyber-Physical System), which is a combination of a cyber and physical system or real system. The CPS system is capable of computational and networking capabilities. The CPS system is trained with artificial intelligence and machine learning technologies, which shows the betterment in security and fast communication. [21] authors recognized another challenge of routing protocol in IoT base VANET. The network topology in IoV is highly dynamic. The network stability in a dynamic environment can be possible with clustering. Thus the authors focus on vehiclelifetime and end-to-end delay parameters for the network stability. The mobility-aware dynamic clustering-based routing protocol (MADCR) consists of different approaches to cluster formation and cluster head selection for making the network stable. [23] Authors recognized another challenge of communication standard protocols in IoT-based VANET. The ERTP-IoV (Efficient real-time protocol for IoV) is a new protocol for real-time data propagation protocol. This protocol behaves like a network protocol integrated with DSRC/LTE in the IoV environment. In this approach, DSRC technology is used for communication between V2V and LTE technology is used for communication between vehicles to infrastructure.[24] the author recognized another challenge in big data processing in IoT-based VANET. The extensive advancement in IoV in which big data can be exploited for effective processing and appreciated results. However, big data processing and analytical method in Iov are essential for the management of bigdata sets. Due to the heterogeneous and multi-variate data rate format of data collection, a diverse data storage and processing platform are needed to manage IoV data.In a real-time application, the user requires an instant response and alert message from the system. Thus providing development with IoV will involve an open involvement from a different angle in the real world.

DISCUSSION

Different kinds of research papers go through in this study which contains conference papers, articles, workshops, preceding and journals. Many of these focus on challenges in IoT-based VANET. Table-I characterizes the distribution of works studied. The majority of them are journal papers, about 86.7% are recognized as journal papers while about 13.3% of papers are conference/article papers. The distribution arrangement of papers can be openly seen in Fig.3.

Table I
Distribution of Papers considers

Types of Papers	No. Of Counts	Percentage of Paper per type
Conference/ Proceeding/ workshop	4	13.3
Journals	26	86.7

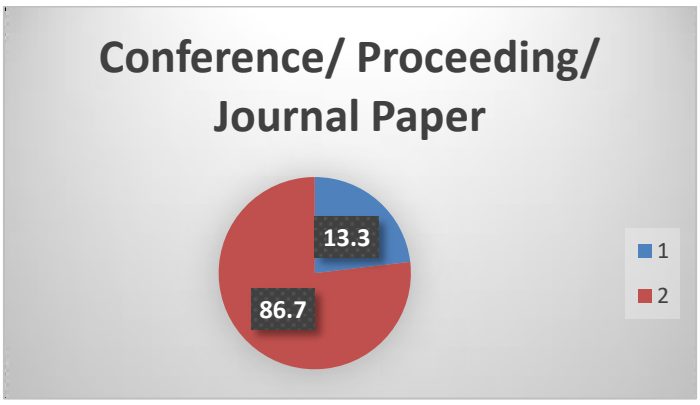

Fig.3: The Percentage of Paper in each type.

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Furthermore, In Table-II provides the recent trends in IoT-based VANET based on scalability, QoS, mobility, data communication, energy efficiency and network performance parameter. Road safety, traffic flow control and reliable communication are the important requirements that can be used to classify VANET applications based on their primary purpose. However, road safety and traffic flow control are not completely separated from the reliability of a network. For instance, a collision of two or more vehicles can lead to a traffic jam. The information of this event conveys a safety warning for nearby drivers for event awareness. The same information is broadcast in the VANET network with reliable infrastructure via the internet which may be used for different purposes. For example, we can use this information for road congestion management which can provide drivers with the best routes to their destinations and also determine the best time schedule for smooth traffic along the overall routes.

CONCLUSION

In this paper, we conclude the design challenges and issues and their solution which are presented the requirements of the IoT-based VANET. The main objective of designing the IoT-based VANET is to intelligence processing of data and sharing among users in real-time scenarios. For increasing the lifespan of the network, each node in IoT-based VANET needs to be embedded with new technologies of wireless communication and smart processors so they are capable to communicate with each other. These increasingly smart thing/object, provides a safe and convenient path through developing interoperability and interconnection, which leads to IoT. The objective of IoT lies to make smart vehicles, that play an important role in the convenient and safe path for humans. Also, the IoT-based VANET aim is to equip the vehicles with communication and computing capability so that can interact with each other for social goods. Here social good is related to machine-to-machine vehicular social networks. IoV has been rapidly developed in this regard and makes vehicles so smart that they can easily exchange comfort-related information, and safety and improve the efficiency of the existing network. The safety and efficient travel of the vehicles is key for real-time application, where offline data certifies the smart behavior of the vehicles and transport authorities applied the data analysis techniques embedded For each of these categories, we have discussed a few sample techniques in VANET. Finally, we summarized and made a table that includes the recent trend in IoT-based VANET with their strength and weakness. Confidently, by impression on this paper, the beginners can better understand the design requirement and countermeasures in IoT-based VANET. Also, the researchers can be motivated to design intelligent infrastructure, smarter vehicles and more robust secure information systems.

Table II
Recent trends in IoT-based VANET

References	Considered Factor	Description	Strengths	Weakness
[25]	Scalability and high network performance	Review on multilayer design challenges and their solutions in VANET	Cross-Layer issues in VANET presented and their importance in desine the QoS based IoVarchitecture	Explain in detail but it is too comprehensive and theoretical
[26]	QoS, mobility scalability	Review on QoS supporting routing protocol and its effect in VANET	The challenges and issues of routing protocol with respect to QoSare discussed in VANET	Not discussed in terms of possible solutions to these challenges
[27]	Data communication	Presented the usage of 5G technology in data communication	The review is deep and insightful as it stated the challenges and usages of 5G technology and compares to present technologies in data communication	Not Discuss the deployable technique in context with IoV.
[28]	Network latency, energy efficiency, delay	The use of mobile edge computing with AI devices for reducing network delay	The challenges of mobile edge computing like energy crisis, security and privacy are discussed. Also, proposed the intelligent processing of data using artificial intelligence	Although, AI with MEC is still open to research

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[21]	Network lifetime, end-to-end delay	The use of MADCR protocol in IoV to maximize the lifetime of the network and reduce the end-to-end delay	Worked on MADCR protocol for efficient cluster formation and CH selection.	However, the authors not discuss about security and privacy.
[22]	Energy efficiency, Trust factor	Presented the vTrust-based secure wireless energy sharing mechanism	The sharing of energy among nodes and identifying the malicious node is based on the trust factor.	Authors highlight the energy sharing among vehicles, but it is too comprehensive and theoretical.
[29]	RSU deployment	A detailed review of the RSU deployment design issues and their solutions in IoV	The review stated the issues of RSU deployment with respect to QoS	The Static and dynamic RSU deployment in IoV is still open to research.
[30]	IoV architecture, security	Discussed the existing architecture, their application and security solution in IoV	This concept is sure to help to design a secure IoV architecture	The authors not discuss the hybrid architecture which solves the real-time IoV issues

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Harmony Search Algorithm and Performance on Rastigin Function

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Abstract – *The heuristic optimization technique is used to find optimal solution of complex large-scale nonlinear realistic based problems. Harmony search algorithm is one of that optimization technique founded by W.H. Geem and then applied successfully in different practical problems.The theoretical and functional aspects are discussed here in details. The performance is tasted on benchmark function i.e. Rastig in function. The optimal solution is found satisfactory and number of iteration is also analyzed.*

Key words- Optimization Technique, Harmony Search Algorithm, population, dimension, rastrigin function

INTRODUCTION

Harmony Search Algorithm (HSA) is music enlivened public type optimization strategy. The way toward making the best music is similar to searching the ideal answer for given target work. In one side, bit of music is created with flawless harmony whose standard is controlled by sound tasteful norm. Thus on opposite side best arrangement accessible to the issue is discovered under the given goals and restricted by limitations. The music is formed by utilizing the instrumental tune whose quality is changed utilizing distinctive melodic note. Distinctive melodic note is made by utilizing pitch alteration in existing note, which is done to improve the music quality. Thus in optimization method, there are factors of given issues, which framed the ideal arrangement. The modification in these factors is done so acceptable arrangement can be discovered. There exists a relationship among music and optimization: every instrument compares to every choice variable; melodic note relates to variable worth; and harmony compares to arrangement vector [1]. Most importantly W.H. Geem et al. had discovered the connection among music and optimization and proposed another optimization method known as HSA in 2001. From that point forward HSA has been effectively applied in different optimization issue, for example, benchmark work optimization, building optimization, structure of water dispersion systems, groundwater displaying, vitality sparing dispatch, support plan, vehicle steering and so forth. Hybridization of HSA with other meta-heuristic cycle, for example, molecule swarm optimization, hereditary algorithm and so on has been accounted for in different research work.

Terms of HSA

The various terms associated with HSA are discussed in following sub sections. The importance and the function of these terms in HSA are also explained.

A. Harmony Memory (HM)

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The memory area putting away the arrangement vectors and the wellness of target work is called HM. Utilization of HM is critical in HSA on the grounds that it guarantees that great arrangement is a piece of new arrangement. The existed arrangement put away in HM might be best arrangement or not. In the event that the arrangement isn't ideal, at that point the arrangement vector is changed by utilizing pitch modification rate and data transfer capacity so the put away arrangement combines to best one. For the compelling use of HM, a boundary harmony memory considering (or tolerating) rate (HMCR) is taken, which is examined later. All the existed arrangement put away in HM and with evolving these, ideal arrangement can be discovered.

B. Harmony Memory Size (HMS)

Total number of solution vectors in HM is known as Harmony Memory Size (HMS). With increasing the number of solution the possibility of finding the best solution is increases. But when the value of HMS is high then the time taken for iteration will be more.

C. Harmony Memory Consideration Rate (HMCR)

Application of perfect already made harmony is very important in composing best music. In harmony search the already made harmonies or solution vectors are stored in HM. The solution vector whose fitness is better than the current solution should be taken into account. The number of solution vectors would take into account is decided by HMCR. The more the value of HMCR more solution vectors are taken from HM and vice-versa. The range of this parameter is taken from 0 to 1. When the value of HMCR is near about 0 that's mean the only few solution is taken from HM and the result converge too slowly. If this value is near about 1 then the almost all value is taken from HM. But the other ones solutions from HM are not explored well, leading immature solution and thus good solution may not found out. The solution can stuck into local optimal point. Generally the value of this parameter is taken from 0.7 to 0.95. HMCR improves the rate of convergence for the optimization.

D. Pitch Adjusting Rate (PAR)

The second significant part in HSA measure is pitch modification which is finished by utilizing parameters transmission capacity go (bw) and pitch changing rate (PAR). The significance of contribute modification music is to change the recurrence for example make a somewhat extraordinary music. For search the best music there is change in existing music with the goal that the nature of music improves. Also in HSA there is little worth included or deducted from existing worth so the enormous pursuit zone will be looked with the goal that best arrangement discovered. In HSA the new arrangement component is made by including and taking away some incentive as indicated by data transfer capacity taken exposed to models which is characterized by PAR. In other word how much component ought to be pitch balanced is characterized by PAR and how much worth is included and deducted is characterized by data transmission. PAR is relegated to control the level of the alteration. A low pitch altering rate with a restricted data transmission can hinder the intermingling of HS in light of the impediment in the investigation of just a little subspace of the entire inquiry space. Then again, a high pitch-altering rate with a wide data transfer capacity may make the arrangement spread around some potential optima as in an arbitrary hunt. Normally the estimation of PAR taken in many applications is from 0.1 to 0.5 [2]. Both direct and nonlinear change should be possible in principle, yet by and by straight alteration is utilized.

E. Bandwidth

The value included and deducted from existing arrangement is called transmission capacity (bw) in HSA. Little the estimation of bw little changes in existing arrangement vectors will happen. Thus in like manner change will occur in wellness. Also, consequently, all potential purposes of the pursuit space are examined. Yet, when its estimation is high then the all conceivable arrangement territory may not looked and consequently the arrangement could trap in nearby minima.

F. New Harmony Vector (NHV)

All the arrangement vectors are put away in HM. In act of spontaneity measure the arrangement vectors are changed by the rationale of HSA. The changed arrangement vectors are put away in NHV. At the point when the put away

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arrangement is better than the as of now existed arrangement vector then the arrangement vector will put away in HM in any case not. During the creation of HM from NHV, there is change in arrangement vectors which is put away in D3 variable. Actually in pitch adjusting process some solutions of problem are added and subtracted and so new solution is stored in D3.On the off chance that the limit conditions are fulfilled by arrangement vector put away in D3, at that point this arrangement is put away in NHV in any case some alteration is done so the limit condition will be satisfied. So the satisfactory pitching is done here and the perfect harmony can be found.

I. Steps of HSA

The steps involve in HSA process are explained below.

A. Initialize the problem and algorithm parameters

In this progression the target work and the parameters of calculation are characterized. The enhancement issue is characterized as follows:

Limit f (x) (1)

Subject to xi ∈ Xi, I = 1, 2… , N (2)

Where f(x), xi, Xi are the goal work, estimation of every choice factors and all conceivable arrangement set separately. N is number of choice factors. With characterizing the target capacity and limitations the parameters of HSA are likewise indicated in this progression. The primary parameters of HSA are HMCR, HMS, PAR and number of cycle (NI). These parameters are talked about above.

B. Formation of harmony memory

In this progression the factors of target work are created arbitrarily inside their cutoff points. The quantity of lines of lattice is equivalent to the HMS and segment equivalent to number of factors. These factors with relating yields are put away in the framework supposed concordance memory lattice as demonstrated as follows.

$$HM = \begin{bmatrix} x_1^1 & x_2^1 & \dots & x_M^1 \\ x_1^2 & x_2^2 & \dots & x_M^2 \\ \vdots & \vdots & \dots & \vdots \\ x_1^{HMS} & x_2^{HMS} & \dots & x_M^{HMS} \end{bmatrix} \quad (3)$$

C. Improvise a new harmony

In the act of spontaneity measure the new amicability vectors, x'= (x1',x2'… … , xN') are shaped dependent on the accompanying three guidelines: (1) memory thought, (2) pitch change and (3) randomization. Hence by utilizing these three cycles extemporization is finished.

In the memory thought, the estimation of first new factor (x1') is browsed any estimation of first section (x11 to x1HMS) of HM. Estimation of other new harmonies (x2' to xN') are picked in comparative way. New factor esteem is taken from HM or not is chosen by HMCR. The HMCR, which differs somewhere in the range of 0 and 1, is the pace of picking one incentive from the verifiable qualities put away in the HM, while (1 − HMCR) is the pace of arbitrarily choosing one incentive from the conceivable scope of qualities [3],

$x_i' \leftarrow x_i' \in \{x_i^1, x_i^2, \dots, x_i^{HMS}\}$ w.p. HMCR
$x_i' \in X_i$ w. p. (1-HMCR)

For example when the value of HMCR is 0.8 then 80% of already existed variable value in HM is taken and remaining (1 - HMCR) i.e. 20% is generated randomly within possible range. These 80% taken is examined further for pitch adjustment which is decided by PAR parameter.

Pitch adjusting decision for

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$$x_i = \begin{cases} \text{Yes w. p. } PAR \\ \text{No w. p. } (1 - PAR) \end{cases} (5)$$

In the event that the pitch modification condition is fulfilled, at that point the new worth will be the somewhat not the same as existed an incentive as follow:

xi' = xi ± bw*ε (6)

where xi is the current arrangement of target work in HM and xi' is the new conceivable arrangement after pitch change. Here ε is the irregular number from 0 to 1 with uniform appropriation inside its range. In the event that the pitch alteration condition isn't fulfilled, at that point previously existed an incentive in HM will be taken. For instance, on the off chance that the estimation of PAR is 0.3, at that point the 30% of taken an incentive as per HMCR is pitch balanced with half of expansion and deduction. In other word the level of pitch modification is given by

Level of pitch modification = HMCR*PAR (7)

for instance on the off chance that the estimation of HMCR and PAR are 0.7 and 0.3, at that point 0.21 (0.7*0.3) is the likelihood of pitch change. In other word it very well may be said that 21% of HM will be pitch balanced.

Along these lines in this progression HM thought, pitch alteration and randomization measures are applied to every factors. The HMCR and PAR parameters presented in this progression help the calculation find all around and privately improved arrangements, separately [3].

D. Update the HM

Subsequently new vector arrangement x' (x1',x2',… ,xN') is framed by previously mentioned advances. In the event that the wellness, which is assess by target work is better than the current arrangement in HM than there will trade between old arrangement and new arrangement. In this manner refreshed HM is shaped which contain preferable arrangement over effectively made arrangement and the outcome will be meets at ideal point.

E. Check the stopping criterion

Steps 3 and 4 will be repeated till the stopping criteria will not satisfied. The stopping criterion is number of iteration (NI) or all solution vectors have same fitness. The flowchart of HSA is shown in Fig.1.0.

I. Simulation Result

Above all else HSA is tried on Rastrigin work for testing the adequacy and proficiency of it. The outcomes acquired by applying HSA on the Rastriginfunction for different components of capacity factors for 100 preliminaries are organized in Table 1. The estimations of best wellness, most exceedingly terrible wellness, mean and standard wellness are acquired for populace size equivalent to the component of capacity variable. HMCR and PAR parameters of HSA for 10 measurements are 0.7 and 0.3 separately. These parameters for 20 and 30 measurements are 0.8, 0.25 and 0.9, 0.2 separately. The data transmission for all measurements is 0.01. The calculation is created on MATLAB, and reenacted on a PC with Intel Core 2 Duo, 2.20 GHz, 4 GB RAM. Rastrigin capacity can be portrayed as:

F(x) = 20 + x12 + x22 – 10(cos2πx1 + cos2πx2); where x ∈ [–5, 5]. (8)

The table shows that the created calculation is working agreeably on Rastrigin work. Result got is compared with Bat Algorithm (BA). From the table it is effortlessly presumed that aftereffect of HSA is awesome compared to BA. Best wellness just as deviation from it for example mean of best wellness decide by HS is extensively acceptable compare to BA. As the component of variable increment, more emphasis is required for intermingling. 2000 cycle is taken for 20 measurement and likewise 3000 for 30 measurement. The best wellness in 20 measurement is slightly below average on the grounds that the emphasis and populace size is fixed by result acquired by BA. Anyway the outcome is comparable acceptable as for BA.

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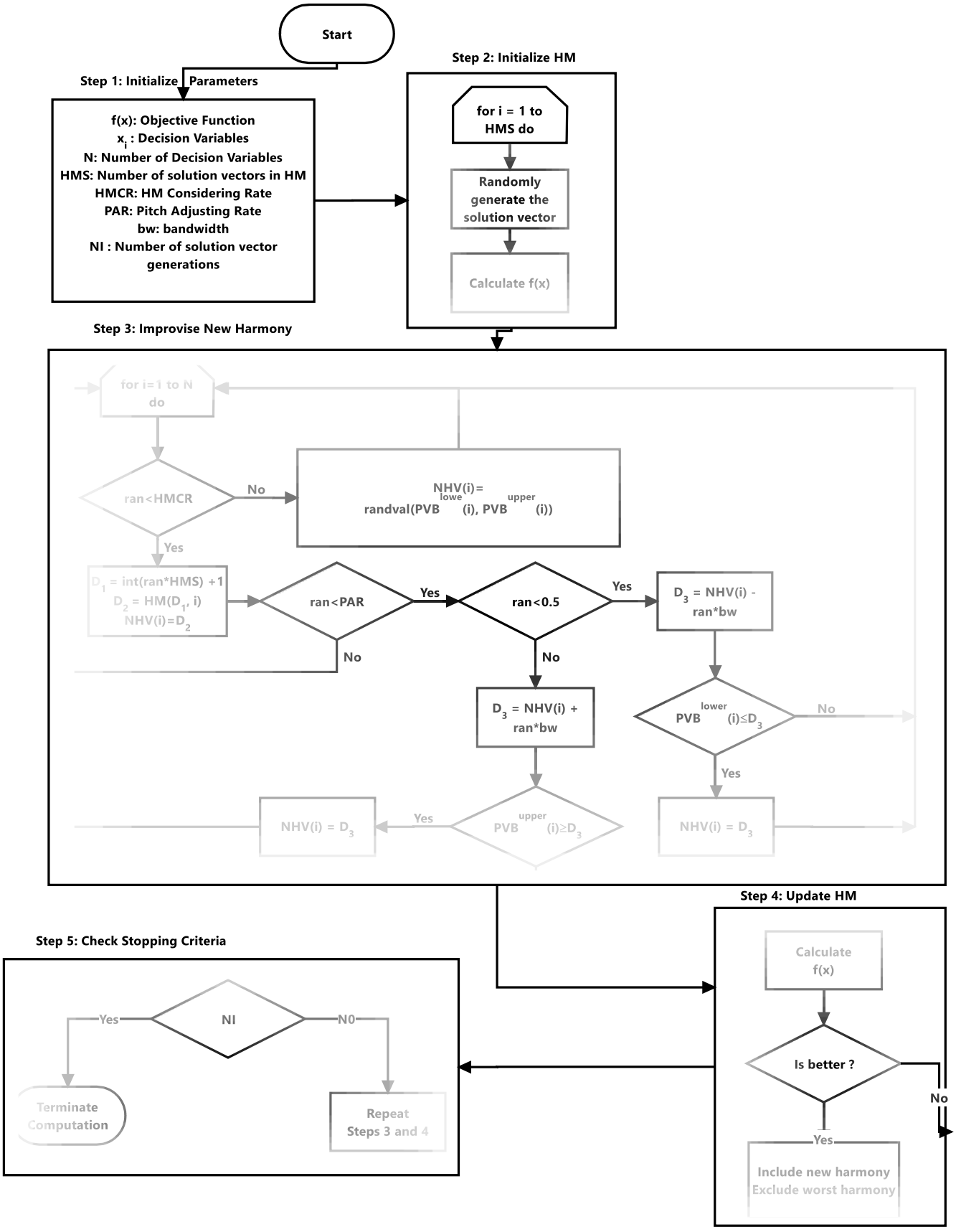

Fig-10 Flow Chart of HSA

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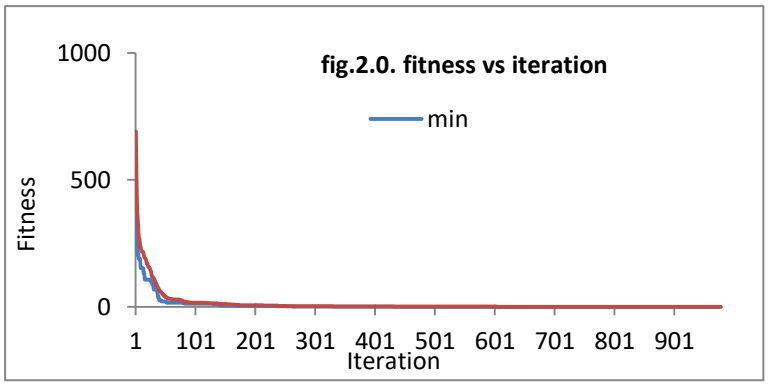

TABLE – 1: RESULT OBTAINED BY HSA ON RASTRIGIN FUNCTION.

Dimension	Iterations	Value	HS
10	1000	Best fitness	0
		Worst fitness	4.706
		Mean of fitness	0.504
		Median of fitness	0.019
		Standard Deviation	0.858
20	2000	Best fitness	5.074
		Worst fitness	20.151
		Mean of fitness	11.896
		Median of fitness	11.841
		Standard Deviation	2.571
30	3000	Best fitness	32.405
		Worst fitness	73.768
		Mean of fitness	53.854
		Median of fitness	53.779
		Standard Deviation	7.682

The convergence characteristic of HSA for 10 dimensions and 1000 iteration is shown in Fig. 2. Both minimum and mean of fitness is shown in figure. The termination criterion adopted is when all fitness of objective function will be equal then algorithm will be terminated. This termination condition occurs at iteration 977 in figure below. From figure, it can be concluded that HSA has fast convergence. Nearby 400 iterations all population converges to optimal for 10 dimensions and 10 population size.

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CONCLUSION

This optimization technique is applied on Rastrigin function with different dimensions and found satisfactory result. This technique is emerged as robust and effective optimization techniques among different optimization techniques. The result for 10 dimensions is shown above. It can be concluded that HSA has fast convergence as discussed above. The parameters of this optimization technique is adjusted and concluded that for different dimensions different values of parameters are suitable.

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Production of Biodiesel

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Abstract – *Bio-diesel can also prepare from fruit seed oil. Mamey Sapote are easily available and nonedible to all human being. Since the majority of the biodiesel were gotten from consumable oils like soybean, sunflower. Rapeseed, palm and so on these oils are basically eatable in India and other emerging nations and use in biodiesel prompts food emergency on account of the non-consumable oil having high free unsaturated fat substance, which isn't appropriate for ordinary trans-esterification process. Consequently a two stage catalyzed technique was embraced to set up the biodiesel. Therefore, this research mainly concentrates the non-edible oil as a feed stock biodiesel production to reduce the cost of bio-diesel. The results showed that this bio-fuel can be produced at a yield of 92.48% with a 0.760% of catalyst, 6 methanol equivalents in excess with respect to oil, at 60^0C, and 90 minutes of reaction time. Bio diesel from Mamey Sapote seed oil is mainly composed of methyl esters of oleic, steartic and palmitic acids. Consequently could be thought of as a reasonable substitute for fossil diesel in unmodified diesel motor applications.*

Keywords- *Biodiesel, Carbon Neutral Fuel, Emissions, Second Generation Biofuel, Non-Edible Oils.*

INTRODUCTION

Fossil fuels are currently the dominant global sources of CO_2 emissions and their combustion is stronger threat to the environment. Expanding of the industrialization, energy interest, restricted stores of petroleum derivatives and expanding natural contamination have mutually requiring the investigating of an option in contrast to the customary fluid fills, vegetable oils (consumable and nonedible oil) have been considered as fitting options in contrast to the ordinary fluid powers, vegetable oils have been viewed as suitable option because of their common fuel properties. It was considered doable choice very before. Anyway regardless of the specialized possibility, vegetable oils as fuel couldn't get acknowledgment, as they were more costly than petrol energizes.

This prompted the hindrance in logical endeavors to examine the further worthiness of vegetable oils as substitute fills. Later, due to numerous factors as stated above created resumed interest of researchers in vegetable oils as substitute fuel for diesel engines. In view of the potential properties, large number of investigation has been carried out internationally in the area of vegetable oils as alternate fuels. Some of the vegetable oils from farm and forest origin have been identified. India imports the petroleum products at an annual cost 45-50 billion USD in the year 2012-2013. Just by replacing 5-6% of petroleum fuel by bio fuel could enable India to save 2.5-3.0 billion USD. According to latest documents from April 2013-Feb 2014 got an import of 57335.97 million USD but from April 2014-Feb 2015 got an import of 53739.04 million USD. We come to know that the demand of importation of petroleum products decreased by 6.21%.

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Scientific Name : Manikara Zapota

Availability : India, South Florida, Pakistan, Bangladesh, Thailand, Central America.

Chemical Composition of Sapote: Sugars, Proteins and minerals like Iron, Copper, Calcium and Potassium.

METHODOLOGY

Many Sapote seeds were collected and pure analytical grade methanol and potassium hydroxide (KOH) in pellet form of were used for the biodiesel production. Just seeds that were not harmed were picked and put away under cool dry stockpiling conditions until required. The exploratory arrangement comprises of a half liter four-necked clump type circular glass reactor with a water-cooled condenser in one of the necks, a speed controlled mechanical stirrer and a temperature controlled warming mantle and a thermometer.

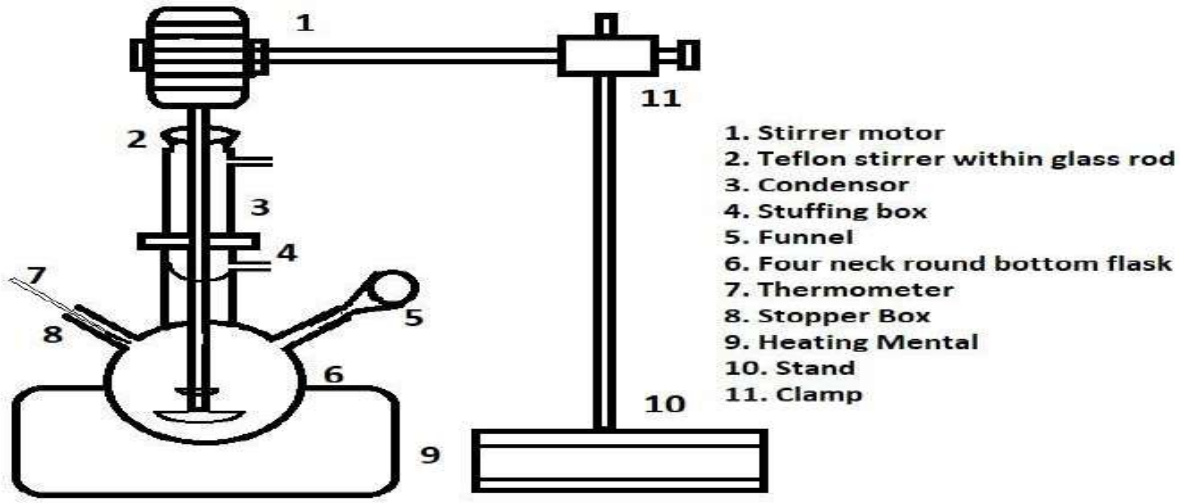

Figure 1 Experimental setup used in batch type trans-esterification reaction

TRANS-ESTERIFICATION PROCESS

The non-edible oils having high free fatty acid content, which is not appropriate for normal trans-esterification process. If the free fatty acid content of the oils less than 2.45%, then one step trans-esterification process with a base catalyst should be used and if it exceeds 2.5%, two step trans-esterification process should be the choice. In this study as the FFA content of MSO was 3.26%, single step base catalyst trans-esterification method has been adopted. In the current examination the accompanying parameters are picked for the creation of biodiesel.

In batch reactor Mamey Sapota oil 100 gm was placed and heated it up to 60^0C temperature. The stirrer speed was kept up with at 500 rpm for consistent blending. The methoxide arrangement was ready by dissolving the precisely estimated amount of strong impetus (KOH) in premeasured amount of methanol. When the oil arrived at up to 60^0C temperature, the pre-arranged meth oxide was gradually filled the reactor. The fruition of pouring moment was taken as the beginning of response. The condenser was introduced on one of the four necks to catch and reuse any disintegrated methanol. Upon reaching the predefined time of reaction, the reactor was taken out of the heating mental and the products of the reaction were shifted to a 500 ml separating conical funnel. After 24h of settling, the heavy glycerol layer settled down at the bottom of the funnel was removed through a drainage valve.

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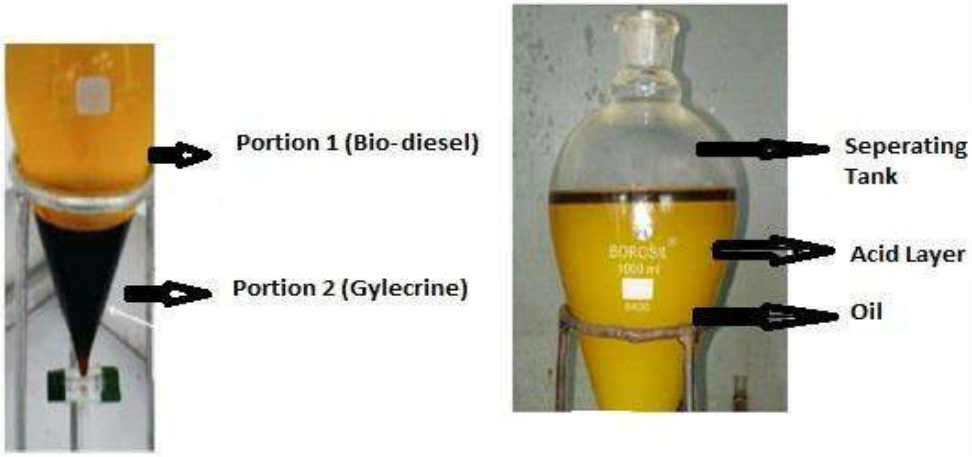
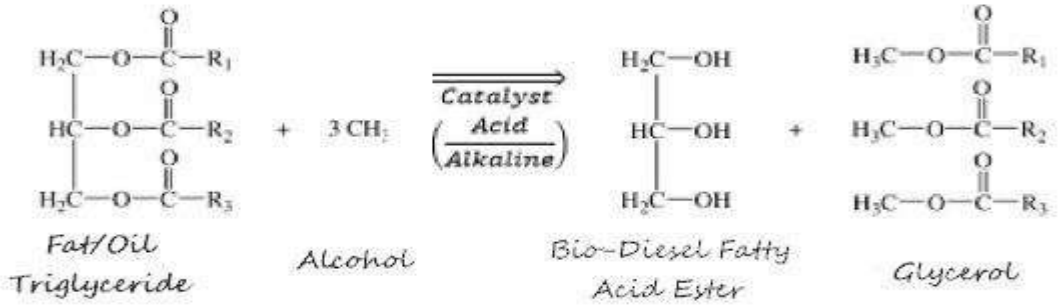


Figure 2:- Etherification Trans-etherification

The remaining crude biodiesel produced from MSO was gently washed with distilled water at 40^0C in order to remove the unreacted methanol, catalysts and impurities. The percentage yield of biodiesel has ben calculated using the formula

Biodiesel yield % Y = (grams of methyl ester produced / grams of oil used in reaction) X 100



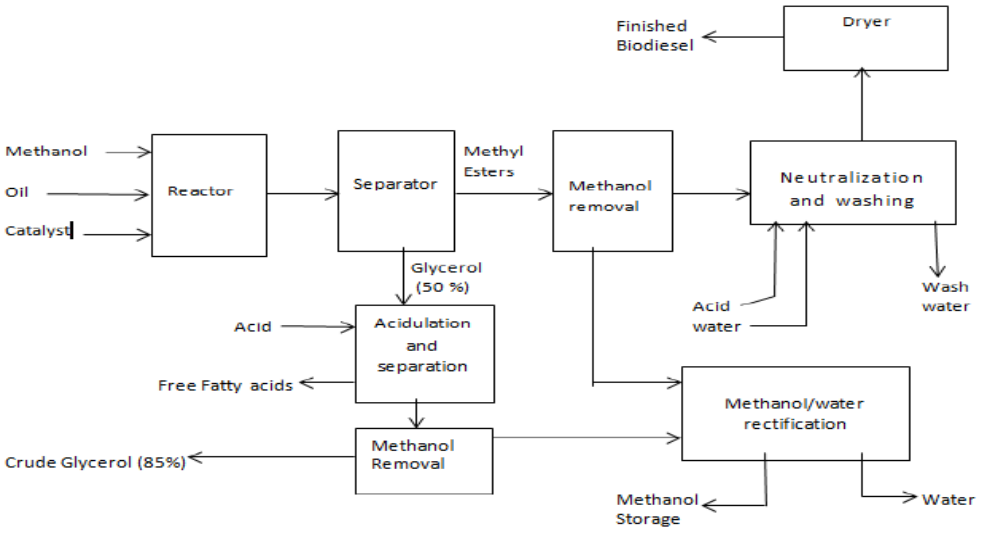


Figure 3 Process flow chart of biodiesel production from Mamey Sapote Oil

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I) PURIFICATION OF BIODIESEL:-

After trans-esterification, the ester layer may contain unreacted catalyst, methanol and residual glycerol. These impurities were removed by warm water treatment. During the washing system, delicate disturbance is expected to keep away from the emulsion. After partition of the layer for 30 minutes, the wash water layer was emptied off out of the lower part of the isolating channel. The water washing strategy was proceeded (2-3 times) until the water layer turns out to be clear. For this interaction, equivalent measure of hot refined water ease used to eliminate the pollutants.

II) DRYING OF BIODIESEL:-

After the completion of purification process, the ester layer may contain some amount water and methanol. This should be removed because methanol reduces the flash point of fuel and it has corrosive nature to fuel hoses. Water content is responsible for the growth of biological organisms and it increases the acid value of fuel. Hence the ester layer was subjected to distillation at 100^0C for 16 to 32 minutes to remove the water and methanol content present in the product (biodiesel). Final biodiesel product after purification is obtained acid catalyzed trans-esterification followed by alkaline catalyzed trans-esterification. Finally, the biodiesel fuel was saved for further analysis if required.

RESULTS AND DISCUSSION:

In the present investigation crude Mamey Sapota oil has been used for the production of biodiesel and its physicochemical properties and fatty acid composition have been studied to find the suitability as feed stock for biodiesel production. Based on its properties and fatty acid content, suitable production process was selected. Table 2.1 shows the composition and the percentage weight content of different types saturated and unsaturated fatty acids of MSO. The highest content of unsaturated fatty acid was found to be oleic acid (64.62%) and the next one was linoleic acid (17.78%). Palmitic acid tops the list with saturated fatty acid content. The total unsaturated and saturated fatty acid content of MSO was found to be 84.13% and 15.87% respectively. Major properties of Mamey Sapote were estimated using ASTM standards and reported in Table 2.2 and Table 2.3. The results show that all the properties of MZME are meeting the requirements of EN14214 biodiesel standards and hence MZME could be a potential substitute to petro diesel.

Table 2.2: Major properties of Mamey Sapote oil as per ASTM standards

S.No.	Property of Mamey Sapota Oil	Value	UNITS
1	Density at 15^0C	0.875	Kg/m^3
2	Boiling Point	160	^{0}C
3	Acid Value	6.57	mg KOH/gm
4	Free Fatty Acid	3.26	% of mass
5	Specific gravity	0.902	------
6	Kinematic viscosity	64.75	CSt.
7	Percentage of oil content	23 – 30 %	-----
8	pH	3.25	-----

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Table 2.3: Mamey Sapote bio-diesel properties as per the EN 14214 biodiesel standards			
S.No.	**Property of Biodiesel**	**Values**	**UNITS**
1	Gross Calorific Value	37.120	MJ/Kg
2	Ash content	0.6	% mass
3	Carbon residue	0.16	% mass
4	Kinematic viscosity	4.5	Mm^2/s
5	Flash Point	174	^0C
6	Pour point	-6	^0C
7	Acid Value	0.16	Mg KOH/g
8	Cetane Number	52	------
9	Glycerol	0.165	% mm

SCOPE FOR FUTURE WORKS:-

Some components are identified with the prevailing paintings and are offered under:

Biodiesel manufacturing era wishes further take a look at in the components of elimination of biodiesel purification system by means of using newly advanced heterogeneous base catalyst like Zeolites, MgO and ZnO etc. In preference to homogeneous catalyst (H_2SO_4 & NaOH).

The residences of mixture can be further progressed to utilize better percentage of Manikara Zapota oil within the combination by preheating the combo.

Further examine of low volatility of Manikara Zapota oil need to be investigated to recognise the effect on engine.

CONCLUSIONS

MZOME satisfies the essential gas houses as per ASTM specification of Biodiesel.

The existing petro-diesel engine performs satisfactorily on biodiesel fuel with none tremendous engine adjustments.

Most of the principal exhaust pollutants including HC are reduced with the usage of biodiesel and the mixture in comparison to petro-diesel gas. This is one of the most important drawbacks of biodiesel.

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Analysis of Fly Ash Polymer Composite

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Abstract – *Industrial waste like fly-ash and dust which is creating environmental problems is mainly used as a building material due to its economy and easy availability. But the main disadvantage of these bricks is its low strength. So, quite a few studies go directly to boom the power of those bricks. The present research work is finished to develop a brand new systematic process to supply fly ash composite bricks so one can have better compressive power. Here the fly-ash is mixed with Cold putting resin at extraordinary proportions and water handled at specific temperatures to discover a approach to the brick industry. The compressive energy, Hardness, water absorption, Density and thermal conductivity of the fly ash-resin powder bricks obtained underneath most reliable check situations are eleven.24 MPa, 14.37HV, 19.09% 1.68 g/cm3, and 0.0.5 W/mK respectively. The sliding put on behavior is likewise investigated. The structure-belongings correlation of those composites is studied the use of X-ray diffraction, FTIR evaluation and scanning electron microscopy.*

Keywords- fly-ash, bricks, eco- friendly, resin powder.

INTRODUCTION

The entire development of a country depends on the production value of power and consequently its consumption as energy. Our country, India needs huge power resources to meet the expectation of its occupant as well as its aim to be a developed nation by 2025. Fossil gas plays an essential part in assembly the call for power era .Coal is considered to be one of the global's richest and widely dispensed fossil gas. Around the sector, India dominates the third role in the biggest production of coal and has the fourth biggest coal reserves approx. (197 Billion Tons). It has been estimated that 75% of India's total installed power is thermal of which the share of coal is about 90%. Nearly about 600 Million tons of coal is produced worldwide every year, with Fly ash generation is about 500 MT at (60-78 %) of whole ash produced [1, 2].In India, the current generation of FA is nearly about 217.04 MT/year and is probable to increase about 320 MT/year by 2025 and 400MT/year by 2032 [3] .No doubt Indian coal has high ash content and low heat value. In order to meet the increasing challenging needs, many coal primarily based thermal electricity vegetation have been built. As a result of which huge amount of combusted residue in the form of Fly ash (80 %), and Bottom ash (20%) has been produced. The finely dispersed particle from the burnt coal is discharged out through the flue gases which are detached mechanically through electrostatic precipitators and separators which are then collected together in the field of hoppers. The rate of production of FA is high and it goes on increasing day by day. The harmful impact on the surroundings suggests the necessity for appropriate dumping of fly ash and justifies full utilization of FA when feasible. Waste merchandise which can be commonly poisonous, ignitable, corrosive or reactive has negative surroundings outcomes. This major issue requires an effective, economic and eco- friendly method to tackle with the disposal of the residual industrial waste products. The problem with safe disposal of ash without affecting the environment, disturbing ecological balance and the large storage area required are major issues and challenges for safe and sustainable development of the country. Hence needful efforts are being made continuously by making stringent regulations by the government to fully utilize the ash. Currently only 50% of the fly ash is being profitably utilized in India [4]. The most common and feasible ways to utilize these industrial wastes products is to go for construction of roads, highways and embankments. The Problem with

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environmental pollution can be greatly reduced if these wastes products be effectively utilized in construction of roads, highways and embankments. But sufficient amount of soil of desired quality is not available easily. So these industrial wastes not only used as an alternate for natural soils in the construction rather it also solve the problems of disposal and environment pollution. This will offer some of good sized blessings to the constructing enterprise as well as to the United States of America as an entire by means of conservation of natural resources, through reduction of quantity of waste to landfills, by means of reducing the fee of construction materials, and by means of lowering waste disposal prices. With the help of a few suitable stabilizers like lime, thermosetting resins or cement, the homes of fly ash can be improved and it can be further used as a creation material. FA shows self -hardening behavior that is why it is used in construction broadly.

FLY ASH: AN OVERVIEW

Fly Ash is an Industrial waste which is accepted as an environmental pollutant, generated during the combustion of coal for energy production. When the coal is fired inside the grate of a boiler, Carbon and volatiles materials completely burnt off. But nonetheless, a few inorganic impurities of earth elements (sand, Feldspars and so forth.) are bonded together and are discharged out thru flue gases. When these fused materials are allowed to solidify, it results in the formation of fine and spherical particles called Fly ash. These FA particles are tiny spheres enclosed in a big sphere called plerospheres. Hollow spheres are also called cenospheres. The morphology of FA particles is sphere due to the bonding which takes place during suspension of released flue gases from chimney or boiler. These high-quality fine particles mainly consist of oxides of silicon, aluminum and iron.Some elements like P, Mg, K, Ca, with small traces of Cu, Zn, Mn, Fe, B, and Mo are also found. The properties of FA vary from different sources, from the same source but with time and with the techniques used for handling, storage and variation in load generation [5].

Fly Ash can also be known by its different name such as Coal ash, Pulverized Flue ash, and Pozzolona. FA is characterized by its light weight, Silicate glassy appearance, spherical in shape, grey colored, polymeric, alkaline and refractory in nature. In addition, FA has a pozzolanic property [6]. The FA forms a hard and cementitious compound like calcium silicate hydrate and calcium aluminates hydrate in the presence of moisture. The hydration reactions of fly ash and Portland cement are nearly comparable resulting in comparable homes compared to every different. It is high quality to use FA as a alternative of cement inside the concrete, imparting a few wonderful functions. Some of the essential characteristics shown through fly ash concrete are better textural consistency and detail of sharper. Fly ash indicates similarity with volcanic ashes which turned into used to provide hydraulic cements almost 2,Three hundred years before .The term "pozzolans" turned into named after a small Italian metropolis of Pozzuoli where those cements have been made. A pozzolan is a silica and alumina wealthy material which paperwork a tough and cementing compound inside the presence of moisture. The features of Pozzolans and lime binding capacity of fly ash makes it possible for the production of high strength bricks, cement and aggregates [2]. One of the best pozzolans in the world is fly ash and that is why it is best known with this. Now a day's fly ash can directly be taken from coal fired power generation plants, so Fly ashes coming from volcanoes are of no use. Before combustion, those power plant life grind coal to powder fineness. After burning the coal massive quantity of exceptional residue can be accrued from the exhaust of energy plant life and these can be used in addition. Both Fly ash and Portland cement seems to be structurally comparable however can be prominent beneath optical microscope. Fly ash debris is almost round, and may be allowed to transport and mix freely in any admixtures.Fly ash possess excellent physicochemical and mechanical properties which includes low dense structure with high strength, negligible porosity and shrinkage, excellent thermal stability and durability, high surface hardness, and better fire and chemical resistance. Owing to these characteristics characteristic of FA, it could be used in different civil, mining and metallurgical applications like architectural zone, transportation and aerospace industry, as avenue sub base fabric, put on resistant ceramics and tiles, Geopolymers and lots of others. There is an extensive variation in the physical and chemical configuration of Indian FA. These variations are mostly due to the combustion chamber or incinerator efficiency. All the thermal related plants of India are governed and accomplished by a single unit i.e. NTPCs. Unavailability of decent quality of coal, below standard maintenance and non-renewal of different parts of combustors even after the completion of its ideal life are some of the features accountable for low incinerator efficiency.

Fly Ash Bricks

Bricks has been used as a major construction and building material. Since long Aluminous –silicate and silica bricks are selected as refractory substances in lots of commercial applications, because of their high wear resistance, durable, robust and cargo bearing capacity at high temperatures [7]. Due to the limitation of clay resources, china has partially restricted

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the use of conventional fired bricks produced from clay [8]. Therefore the ultimate aim is to find raw materials for brick production alternative to clay. These days energy savings has become a very important environmental and economic issue. The consumption of energy from buildings comprises about one third of the total consumption, with nearly half of its energy lost through the walls [9].One of the effective approaches to reduce energy consumption is to decrease the thermal conductivity of wall material, such as brick. Organic residues such as saw dust, polystyrene, paper sludge, coal, coke and inorganic products are commonly used to decrease the thermal conductivity of the brick. These residues used as a pore forming additives to obtain highly porous bricks. Numerous studies have been conducted on fired brick made of Fly ash [10, 11]. FA bricks display better mechanical and physicochemical residences which includes low dense structure with high electricity, negligible porosity and shrinkage, superb thermal balance and durability, excessive surface hardness, fire and chemical resistance than traditional earthen bricks [12].These bricks are an surroundings pleasant value saving building product. Fly ash bricks are durable, have low water absorption (8-18%), less intake of mortar, economically solid and no emission of greenhouse gases. These bricks stay static and are not affected by environmental conditions, therefore making sure longer life of the structure. The bricks manufactured from FA are three instances resilient and more potent than traditional bricks with consistent electricity. Due to the presence of loose lime the energy of compacts is extended at high rate. Hence these bricks are flawlessly healthy for inner and outside load bearing and non-load bearing walls. To determine the compressive electricity and microstructure of the cracked samples, compacts of Fly ash and bloodless setting resin together with hardener with various probabilities are organized and handled in water at 110^0 C -180^0C for twenty-four hours.

Salient features of FA bricks:-

(1) Practically no damage can be seen during transport and use, due to their high strength.

(2) Owing to uniform size of bricks mortar required for joints and plaster reduces through almost 50%.

(3) The seepage of water through bricks substantially reduces due to its low water penetration.

(4) Like conventional clay made bricks, FA bricks are not soaked in water for 24 hours before use. Only sprinkling of water is sufficient.

(5) No need of Plastering.

MATERIALS USED

3.2.1 Fly ash

The Fly ash used in this project was collected from electrostatic precipitators of the captive power plant (CPP-II) in dry condition. The fine powders were oven dried at 110^0C-160^0C and kept in air tight bottle for later use.

3.2.2 Cold setting Resin and Binder

The resin powder and hardener used in the present study was supplied by Geosyn private Ltd. Kolkata.

3.3 Experimental Methods

3.3.1 ByPreparation of Samples:

The samples were prepared by Powder metallurgy route.

3.3.1.1 ByMixing

3.3.1.2 ByCompaction

3.3.2 By Water treatment

Three samples from each composition were cured in water at 110^0C -180^0 C for 48 hours.

Determination of Mechanical properties

3.4.1 Hardness

Vickers hardness tester (LECO, LM 248AT) was used to find the hardness values of all the dry and wet samples using 20 gf Load for a dwell time of 15 seconds. At least seven to eight measurements were taken at different position for each sample in order to get constant results.

3.4.2 Compressive Strength

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In order to degree the compressive power of dry and wet samples INSTRON 1196. Prior to test, gauge length and gauge diameter of the dry and moist specimens were measured individually through the useful resource of Vernier caliper .The assessments have been finished at room temperature (three hundred K) with a regular crosshead pace of 1mm/min and the total scale variety load of 50kN.This computer integrated machine gives the Load vs displacement signals directly when the specimens were subjected to tests.

3.4.3 Wear resistance and Friction

In this study computerized Ball on Plate Wear Tester (TR-208-M1) was used to evaluate the wear performance and sliding contact resistance of the Fly ash compacts. The experiment was carried out with the help of 4 mm diamond indenter keeping the different track radius of 4 and 8 mm respectively. Prior to wear, constant normal load of 10 and 20N was applied. The indenter rotates on fly ash compact with a constant speed of 20 rpm for different time period of 600s. At the end of each test, loss in weight of the samples was noted. Results obtained have been expressed in terms of wear depth, and friction co-efficient.

Thermal conductivity

To measure the thermal conductivity of Fly ash and resin powder mixture, KD2 Pro analyzer was used and it follows ASTM Standard D5334-08 [13]. It incorporates of a hand held controller and a various sensors that operator can embed into very nearly any material. Single probe of 6cm lengthy and 0.127 mm diameter turned into inserted in a small plastic bottle full of FA & resin powder to discover the conductivity cost .At least ten values of each composition changed into recorded to get the perfect result. KD2 Pro makes use of the brief line warmth source mechanism to assess the conductivity and diffusivity of the given mixture. A restrictive calculation fits time and temperature information with exponential capabilities through nonlinear least squares technique.

The cylindrical compacts had been tested for water absorption in line with ASTM C642. The weights of all the samples were taken .The compacts had been first dried in an oven at 100^0C -125^0C making sure elimination of moisture and subsequently allowed it to cool at room temperature. The weights had been taken after drying and the variation in weight become less than 5-6%, taken into consideration it as dry. Now the compacts of various composition changed into immersed in a beaker filled with water and changed into stored in an oven at 110^0C-180^0C for forty eight hours. Compacts have been floor dried after removal and final weight changed into measured. The amount of water absorbed (%) changed into calculated the use of equation-1.

$$((M2-M1)/M1)*100$$

Where;

M1 and M2 are the mass of dry and wet sample respectively.

3.4.6 Density

On the basis of Water absorption test, the density of dry and wet compacts was calculated.

CONCLUSIONS

On the basis of present study following conclusion can be drawn:

1) Water dealt with compacts shows effective consequences at the hardness values. Out of all dry compacts, FA with 85 wt. % possesses a higher hardness fee of 44.10 HV. Much improvement within the hardness fee is done while the composites are treated in water at 110^0- 180^0C and this value rose to 47.40 HV. This increment in hardness value is due to the presence of CSH and CASH in the presence of moisture as obtained from XRD analysis.

2) With an increase in polymer addition (resin powder), the compressive strength of dry compacts decreases to a lower value of 6.5 MPa. Composition of 75 wt. % FA shows lower value. No large discount in Compressive power is achieved in the case of moist compact.

3) Wear has a look at of various composites can without difficulty be correlated with the hardness fee. In each the dry and wet state, FA with 84 wt. % composition suggests better resistance to put on than different compositions. Wear resistance increases with increase in FA content. The co-green of friction decreases with increase in FA percent and follows a linear fashion all through the time of testing.

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4) Thermal conductivity of FA increases with increase in temperature, whereas in case of resin powder FA mixes, the conductivity of composite decreases with boom in temperature. A whole lot decrease conductivity fee is obtained and subsequently can be used as a substitute material with appreciate to clay.

5) Water absorption will increase with boom in FA content. Maximum of nineteen% water is absorbed in case of 84 wt. % FA.

6) Density of dry compacts decreases with boom in FA content. While in case of wet compacts, it will increase with boom in FA content material.

7) SEM analysis revealed the morphology of FA particles that are mostly spherical in shape. With decrease in polymer addition i.e. increase in FA content the interface bonding becomes better and less amount of cracks were found at the interfaces.

8) XRD analysis revealed that FA particles mostly consist of Silica and alumina with less percentage of Fe_2O_3, Cao and others.

The Fly ash –resin powder composite produced in the present study seem to be appropriate for use as construction material. The production of this type of composite will certainly contribute to the use of fly ash for value added products. On the opposite hand, the reduction in clay utilization for the manufacturing of traditional clay bricks will help to protect the surroundings.

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Unique Design & CFD Analysis of High Volume Heat Exchanger for Dairy Application

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Abstract – *The intensity exchanger for 'dairy' requires a cunning plan for pivoting the high volume of milk in limited ability to focus time. This work will zero in on deciding the plan choices for the intensity exchanger. The ongoing requirements are met with a shell and cylinder type heat exchanger with help presented for volume of around 5,000 liters of milk each day. Numerical demonstrating combined with computational philosophy will be investigated for sloping up the volume more than 20,000 liters. ANSYS Fluent will be conveyed for finding arrangement while numerical model will offer elective procedure for approving the arrangement.*

Keywords- – Heat Exchanger, Shell & Tube, Dairy Application, Material change, CFD Analysis .

INTRODUCTION

Heat exchangers are used to transfer heat between two process streams. Heat exchanger can be used for cooling, heating, condensation, boiling or evaporation purpose. They are named according to their application e.g. heat exchanger being used for cooling are called as condensers and similarly heat exchangers used for boiling are known as boilers. The performance and efficiency can be measured through the amount of heat transfer using least area of heat transfer and pressure drop. The required amount of heat transfer provides an insight about the capital cost and power requirement of the heat exchanger.

Heat Exchanges are of Two types-

Direct Contact Heat Exchanger- wherein both media between which heat is exchanged are in direct contact with each other.

Indirect Contact Heat Exchanger- wherein both media between which heat is exchanged are separated by a wall so that they never mix. Shell and tube type exchanger are indirect contact type exchanger. It consists of a series of tubes, through which one of fluid runs. The shell is container for shell fluid. Generally it is a cylindrical in shape with circular cross section, but shell with different shape can be also used. The tubes may have single or multiple passes, there is one pass on shell side, while the other fluid flows within shell over the tubes to be heated or cooled. Plate heat exchangers are used for achieving high heat efficiency. They are easy for maintenance and disassembly. Plate heat exchangers are used for HTST (High Temperature Short Time) pasteurization due to their excellent thermal characteristics.

Baffles are used to support the tubes for rigidity, to prevent vibration, sagging and to divert the flow across the bundle to obtain a higher heat transfer coefficient. Helical baffles give better performance than single segmental baffles but they involve high manufacturing, installation and maintenance cost. The effectiveness of heat transfer and cost are two important parameters in the design of heat exchanger. ‘Computational Fluid Dynamics’ is now an established industrial

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design tool offering many advantages. CFD model of shell and tube heat exchanger is being considered in this scope. The flow structure and heat distribution is obtained by modelling the geometry.

PROBLEM DEFINITION

The collection center at a typical dairy processing unit records around twenty thousand liters of milk in a day. The same needs to be processed immediately upon receipt from the vendors since the perishable nature of milk makes it mandatory to pasteurize the same on priority. The volume dictates the nature of heat exchanger to be engaged for processing needs. Smaller volumes have been handled in the past using shell & tube heat exchanger with tubes made of steel. The existing heat exchangers pose limitations for handling the increased volume of the milk. Multiplying the units of the current design of heat exchanger does not seem to offer an efficient solution to the problem.

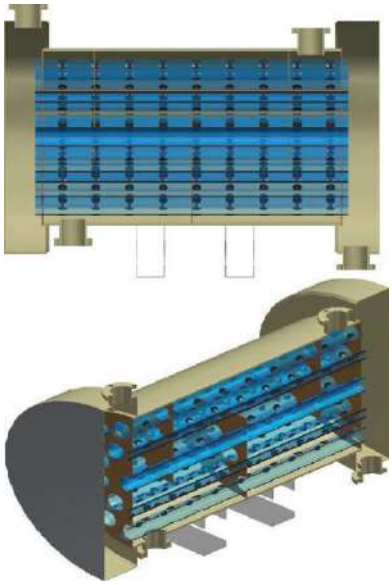

Fig.1-Shell and Tube Heat Exchanger for this work

LITERATURE REVIEW

After studying the Literature it can be concluded that a lot of work has been done in the field of Design & analysis of heat exchanger. Pramod S. Purandare et al. [2014] In this paper An experimental analysis is carried out to study the heat transfer phenomenon in conical coil heat exchanger with cone angle 90 degree. M. Ghazikhani et al. [2013] the experimental investigation of the effect of wedge-shaped tetrahedral VGs (vortex generator) on a gas liquid finned tube heat exchanger was studied using irreversibility analysis. Dillip Kumar Mohanty et al. [2012] In that paper the statistical analysis is used as an invaluable tool for investigation of performance of a shell and tube heat exchanger under fouling condition. A. I. Zinkevich et al. [2010]. In this paper shown that non uniform distribution of liquid flow among the tubes of a shell and tube apparatus has to be taken into account in determining the efficiency of heat transfer. The authors of this paper have proposed a method for taking this non uniformity into account and for analyzing its effect on the intensity of heat transfer. LIU Wei et al. [2009] in this paper heat transfer enhancement in the core flow, and with the analysis of the disturbance mechanism of longitudinal flow, a new type of high efficiency and low resistance heat exchanger with rod-vane compound baffler was designed and investigated numerically. Seong Yeon Yoo et al. [2009] The heat transfer rate of the external tube surface of the heat exchanger for a closed wet cooling tower can be divided into sensible and latent heat transfer rates. These in turn are expressed by heat and mass transfer coefficients.

SCOPE

Input data in the form of CAD geometry for the current heat exchanger shall be secured from the Sponsoring Company. The scope outlined for this work shall encompass activities involving the pre-processor for ‘Analytical’ software followed for solving and post-processor. The material properties for the working fluid and the input conditions applicable for the

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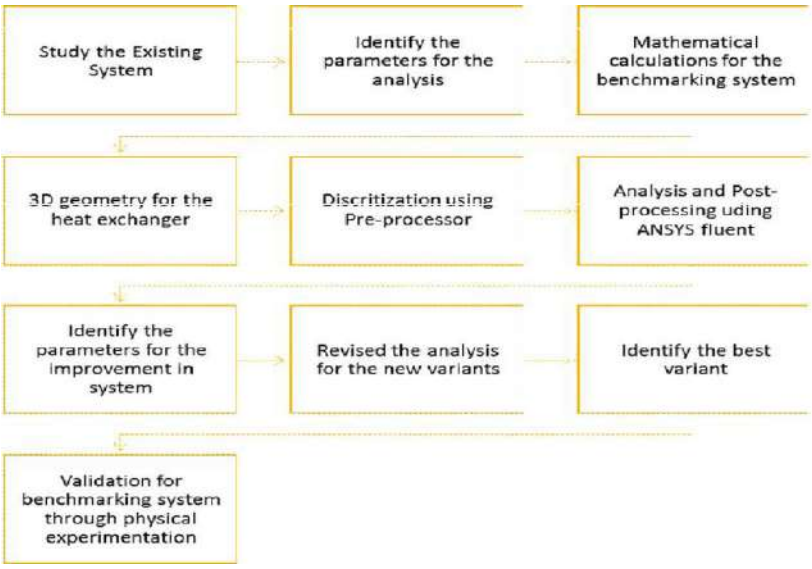
problem case shall be administered while working on the CAD interface. Mathematical modelling is considered for alternative methodology to validate the results obtained by computational techniques.

OBJECTIVES

- Review current process and design aspects of the heat exchanger.
- Benchmark the performance for reference, the same shall be validated with mathematical modelling.
- Propose design alternative/s for the type or construction of heat exchanger.
- Analyse the proposed variant/s using CFD software.
- Recommend the solution.

METHODOLOGY



EXPERIMENTATION

Upon reviewing the 'Analytical results' for the benchmark (existing) facility of the shell and tube heat exchanger, an experiment is planned to validate these results. The analytical results for the existing setup shall be compared vis-à-vis the experimental results for the same benchmark (existing) setup. Thermocouples shall be deployed for measuring temperature, while suitable instruments like 'flow meter' shall be used for assigning the requisite mass flow rate of the working fluid and the milk. The temperature shall be recorded at a steady state expected in about an hour from the assignment of correct operating conditions as per the input data used for problem solving in the mathematical model and/or the analytical/computational solution.

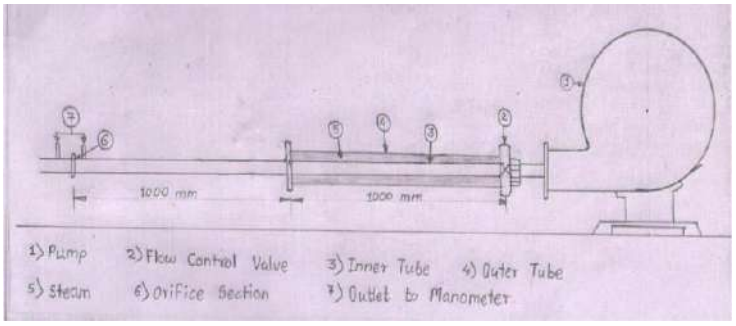


Fig.2- Schematic Diagram for experimental setup

EXPECTED OUTCOME / CONCLUSION

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The study over the topic reveals that the rate of heat transfer can be enhanced using alternative material or incorporating a change in the geometry of the tube. The provision of fins or protrusions to increase the surface area of contact can result in enhanced performance. This work shall mainly focus on arrangement of tubes while varying with pitch and/or the diameter. The requisite mass flow rate shall be calculated to achieve the given temperature (72^0C) in the specified time.

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A Review on the Failure load and fracture pattern on 'U' Notched Beams of Different Metals

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Abstract *– The behaviour of the notch in any material plays a crucial role in various application and it varies its properties in different fashion. The position of the notch, its depth and length are the important parameters that effect its strength. In the present work, a review has been performed to comprehend the behaviour of multiple cracks using different methods. It was observed that the multiple cracks behaviour under different loading conditions and their propagation behavior by using stress intensity factor (SIF) equations has been most frequently used and results were optimized based on that. The studies conducted on the interaction of multiple cracks using the different methods have found that the mechanical properties of the specimen depend upon the geometric parameters like the crack tip distance, crack offset distance, angle of inclination and crack length.*

INTRODUCTION

The identification of a notch on a beam is the subject of many investigators. Identifying the notch means to find its position and depth. In many cases there is more than one notch on a beam. Then the solutions, or the combinations of parameters characterizing the notches are more and the problem becomes more complicated particularly when the notch must be identified using one more parameter, the relative each other angular position. The behaviour of a U notched beam with two transverse U notches is studied. Each notch is characterized by its depth, position and its length. Notches are considered to lie at a particular position with respect to the transverse crack at the center of the beam and at any distance from the left end.

The Havilland Comet, placed in service in 1952, was the world's first jetliner. Pressurized and flying smoothly at high altitude, the Comet cut 4 hours from the New York to London trip. Tragically two Comets disintegrated in flight in January and March 1954 killing dozens. Tests and studies of fragments of the second of the crashed jetliners showed that a crack had developed due to metal fatigue near the radio direction finding aerial window, situated in the front of the cabin roof. This crack eventually grew into the window, effectively creating a very large crack that failed rapidly, leading to the crashes. A great deal was learned in the investigations that followed these incidents and the Comet was redesigned to be structurally more robust. However, in the four years required for the Comet to be re-certified for flight, Boeing released its 707 taking the lead in the market for jet transports. However, Boeing was not to be spared from fatigue fracture problems. In 1988 the roof of the forward cabin of a 737 tore away during flight, killing a flight attendant and injuring many passengers. The cause was multiple fatigue cracks linking up to form a large, catastrophic crack. The multitude of cycles accumulated on this aircraft, corrosion and maintenance problems all played a role in this accident. Furthermore, the accident challenged the notion that fracture was well understood and under control in modern structures.

This understanding was again challenged on 17 November 1994, 4:31am PST, when a magnitude 6.7 earthquake shook the Northridge Valley in Southern California for 15 seconds. The damage was severe: 57 people lost their lives, 1500 were

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injured and 12,500 buildings were damaged. That damage occurred is no surprise, however, what did surprise structural engineers were the fractures in many welded beam-column joints in steel framed buildings. These joints, designed to absorb energy by plastic deformation, instead fractured in an almost brittle fashion. Due to such fractures over 150 buildings were damaged. In one the damage was so severe the building was demolished; others had to be evacuated.

Multiple cracking is one of the most common problems in ageing aircraft, pressure vessel and piping components. Such cracking often occurs in localized patches or colonies owing to various types of material failure, such as in stress corrosion cracking **(5),** fatigue **(8)** and corrosion fatigue **(9).** The coalescence and mechanical interaction of multiple cracks play an important role in the cracking behavior due to degradation of components, especially in stress corrosion cracking (SCC) and fatigue (**13**). The coalescence of multiple cracks causes an abrupt increase in crack size and accelerates the crack growth, and it was pointed out that, in small crack growth, the growth due to coalescence is predominant rather than growth of individual cracks.

The proposal of mode I dominance in crack problems was suggested first by **(2)** when dealing with cracked plates under in-plane tension and transverse shear, according to which the crack grows in the direction almost perpendicular to the maximum tangential stress in radial direction from its tip.

The application of numerical techniques for the solution of problem of multiple cracks started in the 70's.Plane strain problem of a multi-layered composite with parallel cracks was considered by **(14)** .Their main objective was to study the interaction between parallel and collinear cracks. The problem was formulated in terms of a set of simultaneous singular integral equations which were solved numerically. They also demonstrated effect of material properties on the interaction between cracks.

A solution technique based on a singular integral method which uses distribution of edge dislocations to represent the cracks in the mathematical model was developed by **(6).** They investigated the effect of plane strain multiple crack problems on the stress intensity factor due to the elastic interaction between multiple cracks. The results obtained show that interaction between microcracks can produce either an enhancement or a shielding effect on the stress intensity factor depending on the positions and orientations of the microcrack.

The problem of crack identification in structures or in rotors is a very interesting and crucial problem. Complete state-of-the-art reviews are presented **(15)**. Many parameters altered by the existence of a crack have been used for identification. Such parameters are the natural frequency of the structure that decreases as the crack depth increases, due to the change of the local stiffness. On the other hand the existence of a crack in a structure alters all the mode shapes and the response of the forced vibration at any point. Then the difference of the parameters between the intact and the cracked structure has to be correlated with the crack depth and location, to give the solution by minimizing the objective functions based on the differences of these observed parameters and the expected ones.

(21) developed a new technique for solving fracture problems involving multiple cracks. The hypothesis is that, for structures with interconnected load paths, fatigue loading does not have to result in failure. Each computer model consisted of a plate with notches (flaws) subjected to biaxial tension, which creates a fracture hazard. The original prototype structure was a steel plate with a symmetrical diamond pattern of circular holes commonly used in pressure vessel design. The computer models were used to simulate the plate exactly. Results from the literature corroborated the computer models. Prediction of stress intensity factors and flaw shape factors were within negligible error. In addition, test cases produced crack trajectories that were qualitatively correct.

A numerical approach to model a general system containing multiple interacting cracks and voids in an infinite elastic plate under remote uniform stresses was presented by **(12)**. By extending Bueckner's principle suited for a crack to a general system containing multiple interacting cracks and voids, the original problem was divided into a homogeneous problem (the one without cracks and voids) subjected to remote loads and a multiple void-crack problem in an unloaded body with applied tractions on the surfaces of cracks and voids. Thus the results in terms of the stress intensity factors (SIFs) were obtained by considering the latter problem, which was analyzed easily by means of the displacement discontinuity method with crack-tip elements (a boundary element method) proposed recently by the author. Test examples were included to illustrate that the numerical approach is very simple and effective for analyzing multiple crack/void problems in an infinite

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elastic plate. Specifically, the numerical approach was used to study the micro defect-finite main crack linear elastic interaction. In addition, complex crack problems in infinite/finite plate were examined to test further the accuracy and robustness of the boundary element method.

(29) developed a new approach based on the Kachnov's method and the alternating iteration technique to deal with the problem of strongly interacting multiple cracks. Unlike the Kachnov's method which neglects the interaction of the traction of non uniform components, the interaction of the traction of the non uniform components on the crack surfaces were considered.

Regarding mode II failure, several criteria have been applied mainly to sharp V-notched samples but also to U-notches showing a different degree of accuracy with respect to the experimental results. Dealing with mixed mode loading a number of experimental data. (**26**), who tested at room temperature cracked specimens made of PMMA. By means of a new test configuration, called 'diagonally loaded square plate', they were able to provide pure mode I, pure mode II and any mixed mode loading conditions in between. A good agreement is shown to exist between the theoretical predictions and the experimental results for various notch opening angles and different notch radii.

Fatigue crack propagation tests were performed using specimens with multiple parallel edge notches at regular intervals. Fatigue pre-cracks of uniform length were successfully introduced by eccentric tension–compression loading. Fatigue crack propagation tests were carried out under four-points bending loading. Obtained crack propagation behavior was simulated by using newly developed stress intensity factor equations for multiple parallel edge cracks with alternately different lengths. Simulated results showed a good agreement with the experiment for specimens with relatively broad crack intervals, while for specimens with narrow crack intervals showed a different tendency from the experiment when crack lengths became long(**19).**

Ganguly et al. [36] **(17)** studied effects of multiple cracking on the residual strength behavior of shocked functionally graded ceramics. They studied the multiple surface crack effect on the thermal shock behavior of ceramics. They developed a thermo fracture mechanics model to investigate the effect of multiple cracking on the thermal shock resistance behavior of fatigue crack growth .They focused on the effect of crack density and thermal property gradients on the thermal shock resistance strength behavior of fatigue crack growth.

The stress fields in proximity of notches characterized by different shapes (**24**). It collaborators with the final aim to assess the fatigue life of structural components. Dealing with static loading of pointed V-notches, he also provided many factors as under mode I loading, one of the first and more complete set of experimental data as a function of the notch opening angle. The results of an experimental analysis on PMMA notched beams are reported and discussed .The experimental evaluation of the shape-function for generalized stress-intensity factors is carried out on statistical bases by assuming non-linear combinations of LEFM function and ultimate strength function.

Maximum loads and initial crack angles were measured as a function of notch root radius and loading mixity. Such results can help in evaluating numerical models of the fracture of notched components. He also deals with the suitability of the cohesive crack concept for predicting fracture loads under mixed mode. Comparison of experimental results with numerical predictions was significantly accurate. Diagrams of fracture loci for notched components loaded under mixed mode are discussed.(**23**).

A modified maximum tangential stress criterion has been developed to predict the fracture toughness and fracture initiation angle in U-shaped notches under mixed mode loading or prevalent mode II loading(**1**). A result is compared analytically and practically to find the error.

The main purpose of the paper is twofold. First, to provide a new set of experimental results on fracture of U-notched samples, made of two different materials; second, to apply a fracture criterion based on the strain energy density (SED) averaged over a control volume to assess the fracture load of blunt-notched components under three point bending. Two different materials are considered in the tests: a composite material (Al–15%SiC) tested at room temperature and a steel with a ferritic–pearlitic structure tested at_40 _C. All samples are weakened by U-notches characterized by different values of notch root radius and notch depth. The theoretical loads to failure as determined according to the SED criterion are compared with the experimental data from more

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than 40 static tests and with a SED-based scatter band recently reported in the literature for a number of materials exhibiting a brittle behavior under static loads **(27).**

(22) studied the problem of N cracks interaction in isotropic elastic solid, which is decomposed into a sub problem of a homogeneous solid without crack and N sub problems with each having a single crack subjected to unknown tractions on the two crack faces. The unknown tractions, namely pseudo tractions on each crack are expanded into polynomials with unknown coefficients, which have to be determined by the consistency condition, i.e. by the equivalence of the original multiple cracks interaction problem and the superposition of the N+1subproblems. In this paper, Kachnov's approach of average tractions is extended into the method of moments to approximately impose the consistence condition. Hence Kachnov's method can be viewed as the zero-order method of moments. Numerical results of the stress intensity factors are presented for interactions of two collinear cracks, three collinear cracks, two parallel cracks, and three parallel cracks. As the order of moment increases, the accuracy of the method of moments improves.

An efficient method for simultaneous estimation of the mixed-mode stress intensity factors and T-stresses using finite element computations was suggested (**18).**

The multi-site damage problem of aging aircraft which has raised the issue of obtaining accurate stress intensity factors of interacting collinear cracks under external load was studied by (**20)**. The simple approximate technique proposed by Kachnov's (1987) is specialized in this work to arbitrary length collinear cracks with arbitrary spacing under far field tension. This approach yields simple formulas that can be used to quickly and accurately assess the mode I stress intensity factors of any number of collinear cracks in an infinite body under far field tension considering interactions between all cracks. The advantage of this approach over others is that it is simple, has good accuracy, and is very efficient. Kachnov's method is further enhanced here such that a repeating subpanel of cracks of arbitrary number, size, and spacing can be modelled implicitly with resulting efficiency gains. The effect of interaction cracks can be used to build up stress intensity factor solutions for more complex geometries. Several numerical examples and timing studies are used to demonstrate the efficacy of this approach.

The crack-tip stress fields and fracture mechanics assessment parameters for a surface crack, such as the elastic stress intensity factor or the elastic-plastic *J*-integral, can be affected significantly by the adjacent cracks. Such a crack interaction effect due to multiple cracks can alter the fracture mechanics assessment parameters significantly. There are many factors to be considered, for instance the relative distance between adjacent cracks, the crack shape, and the loading condition, to quantify the crack interaction effect on the fracture mechanics assessment parameters. Thus, the current assessment codes on crack interaction effects (crack combination rules), including ASME Sec. XI, BS7910, British Energy R6 and API 579-1/ASME FFS-1, provide different rules for combining multiple surface cracks into a single surface crack.

The main purpose of this research is to re-analyse experimental results of fracture loads from blunt V-notched samples under mixed mode (I + II) loading considering different combinations of mode mixity ranging from pure modes I to II. The specimens are made of polymethyl-metacrylate (PMMA) and tested at room temperature. The suitability of fracture criterion based on the strain energy density (SED) when applied to these data is checked in the paper. Dealing with notched samples, characterized by different notch angles and notch root radii, the SED criterion used in combination with the concept of local mode I, valid in the proximity of the zone of crack nucleation, permits to provide a simple approximate but accurate equation for the SED in the control volume. This proposal unifies predictions for the experimental results obtained under modes I, II and mixed mode loading (**28).**

A numerical solution of a finite plate containing multiple cracks using the coupled integral equations was developed (**25**). After using the principle of superposition, the problem of multiple cracks in a finite plate can be converted into two problems (a) the multiple crack problem in a finite plate & (b) the usual boundary value problem for the finite plate. For the former problem the Fredholm integral equation is used. For the later problem a BIE based on a complex variable is suggested in which a Cauchy singular kernel exists. For the proposed BIE, after using the inverse matrix technique, the dependence of the traction at a domain point from the boundary tractions is formulated indirectly, this is a particular advantage of the present technique.

(30) studied multiple site damage which is the occurrence of small fatigue cracks at several sites within aging aircraft structures. Focusing on this typical structure, an analytical method for calculating the stress intensity factor of an infinite plate containing multiple hole-edge cracks was introduced in this paper. The properties of complex variable functions were used to evaluate the

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stress function. The approximate superposition method was applied to solve stress intensity factor problems on multiple holes. The equivalent crack was introduced to modify the method. Some numerical examples of an infinite plate containing two hole edge cracks were examined by the method. By comparing the analytical and finite element analysis results it was realized that the analytical results are accurate and reliable. This modified analytical method is easier to apply than some traditional analytical methods and can provide stress intensity factor solutions for an infinite plate containing a random distribution of multiple hole-edge cracks.

(16) Studied the interaction between multiple cracks in crack growth direction in an aluminium alloy under static and fatigue loading. Self similar as well as non-self similar crack growth was observed which depends on the relative crack positions defined by crack offset distance and crack tip distance. On the basis of experimental observations, the criterion for crack coalescence and crack growth direction have been expressed in terms of the crack positions defined by crack offset and crack tip distances. The criterion presented in this study can be used to determine the limiting value of crack tip and crack offset distance and to determine the mode in which cracks coalesce during their growth process. Experimental results and crack interaction criterion presented under various crack positions and size conditions could be used to derive a new evaluation method of crack growth in multiple crack geometry.

CONCLUSION

In several applications, the behaviour of the notch in any material is significant and alters its qualities in various ways. The critical factors that affect the strength of the notch are its position, depth, and length. In the current work, a review has been conducted to better understand the behaviour of many cracks when approached from various angles. Stress intensity factor (SIF) equations have been most frequently utilised to study the behaviour of numerous cracks under various loading circumstances and their propagation behaviour. The mechanical properties of the specimen are found to be dependent on geometric parameters such as the crack tip distance, crack offset distance, angle of inclination, and crack length in investigations on the interaction of many cracks using various methodologies.

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Recent Advances in Digital Image Correlation

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Abstract – *Strain and displacement are such parameters within engineering projects which are difficult to determine. However, measuring such parameters outside the lab requires a lot of efforts and difficult conventional techniques, as accuracy and cost must be balanced for efficient results. Digital Imaging Correlation (DIC) is a technique which may be ideally suited for the study of crack propagation and material deformation in real-world application, as it have a cheap setup yet accurate results. Now a days we are also expanding its use into challenging areas, such as enabling DIC to be used over a period of time without the need for a permanent set up, or in hard-to-reach areas via small helicopters and relocation equipment. This method has continued to expand internationally and their use has begun to grow in fields where there was less activity in the past. This paper begins with a brief overview of digital image correlation methods, followed by an analysis of recent trends with the use of digital image correlation methods in academic research, government laboratories, and industries. Three areas where DIC methods have seen rapid growth are discussed at the end of the article. The first is the use of Stereo DIC (three- dimensional DIC) (3D-DIC). Second is to use Volumetric DIC or Digital Volume Correlation (DVC) to quantify the internal response of a specially designed composite material. Third is to determine crack propagation and deformation in various applications using DIC.*

INTRODUCTION

Experimental techniques in solid mechanics rely heavily on surface displacement field measurements. Several optical methods, such as moiré interferometry, holographic interferometry or speckle pattern interferometry have long been used in experimental solid mechanics to study mechanical deformation of solids and the mechanics of fracture. Among them, digital image correlation technique, which can obtain the deformation of a surface by comparison of digital images of the unreformed and deformed configurations, is becoming popular and widely used. Since this method does not need a complicated optical system, the measurement can be performed easily. In addition, unlike other methods which utilize the interference of light waves, phase analysis of the fringe pattern and subsequent phase unwrapping process are not required.

Digital image correlation (DIC) is an effective and practical tool for full-field deformation measurement, which has been commonly accepted and widely used in the field of experimental mechanics. DIC is an image-based deformation measuring technique based on digital image processing and numerical computation. Digital Image Correlation (DIC) is an innovative non-contact optical technique for measuring strain and displacement. DIC is simple to use and cost effective compared to other techniques such as speckle interferometry, and more accurate and subjective than manual measurement methods, leading to a huge range of potential applications.

However, there are not only advantages but also drawbacks of this method. In this method, it is difficult to obtain reliable results around regions near boundaries such as around a crack surface since a subset, typically about 30 × 30 or 40 × 40 pixels in an image, is used to detect the deformation. For example, at a crack surface that subsets overlap with crack

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faces, the displacements are determined by areas on each side of the crack surface that have opposite displacements. The difficulty is found near stress concentration regions since it is assumed that the subset is deformed uniformly. Thus, the possible smallest size subset should be used to overcome these difficulties. An accurate digital image correlation method exists by taking the second order displacement gradients into account. However, the difficulty is still remaining since their method cannot reduce the subset size. Other efforts to improve the accuracy and the resolution have been made by several researchers.

The technique has been improved by many researchers to increase resolution, to improve accuracy, and to overcome above drawbacks. Nowadays, many applications of this method to various problems can be found, such as in studies of fracture mechanics, high-temperature deformation measurement, bio-materials, wood products and inverse stress analysis. In recent years, this technique begins to be applied to the deformation measurement using images from Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) and X-ray micro tomography.

HOW DIC IS BEING USED?

DIC works by comparing digital photographs of a component or test piece at different stages of deformation. By tracking blocks of pixels, the system can measure surface displacement and build up full field 2D and 3D deformation vector fields and strain maps. For DIC to work effectively, the pixel blocks need to be random and unique with a range of contrast and intensity levels. It requires no special lighting and in many cases the natural surface of the structure or component has sufficient image texture for DIC to work without the need for any special surface preparation.

Software techniques have been developed to obtain sub-pixel resolutions and allow efficient execution of the algorithms. These allow high-resolution measurements to be made such that with commercially available digital photography, surface deformation can be measured down to one part per million of the field of view. Images can be obtained from a wide variety of sources including conventional consumer digital cameras, high-speed video, macroscopes, and microscopes, including scanning electron and atomic force microscopes. The DIC correlation process is not restricted to optical images and can also be applied to other datasets such as surface roughness maps and 2D surfaces of structures like tunnels.

DIC is simple to implement providing cost effective unambiguous results leading to a huge range of potential applications. It has been used at National Physical Laboratory to examine a diverse range of material specimens including examining the evolution and uniformity of strain in materials testing, crack tip and crack propagation studies, detecting damage development in composites, structural deflections, high temperature strain mapping and dynamic vibrational analysis. NPL has worked with a range of partners, including Airbus, AWE, Stress craft and British Energy, to implement a DIC solution appropriate for the measurement of residual stress from incremental hole drilling in small structures. Other projects have included the application of DIC for measuring thermal expansion and distortion of electronic components, measuring the mechanical properties of nuclear graphite, 3D shape measurement on air bags, damage development in silk print screens and strain development during the processing of chocolate. NPL's DIC expertise is being engaged as part of IMPACT (Innovative Materials, Design and Monitoring of Power Plants to Accommodate Carbon Capture), a major carbon abatement project that aims to help carbon intensive industries reduce their CO2 emissions. The aim is to develop in-situ monitoring of power plant components to increase service life and help reduce emissions. NPL is using DIC to characterize the new steels being developed in the project to improve the high temperature capability of welded thick section high alloy steel components, leading to novel advanced in-service monitoring techniques to enable plant to operate at highest temperatures under challenging design conditions. NPL is working actively with UK industry to develop and promote the use of DIC through participation in relevant government funded and collaborative projects as well as through consultancy and measurement services to industry. The focus of the NPL DIC work is to provide a practical technique that can be used in a wide range of applications, such as monitoring displacements in rail and road bridges and for measuring crack opening in civil engineering components particularly in the nuclear industry. Initial feasibility studies indicate the technique has great potential in these areas. There are many areas where DIC methods have seen rapid growth, some of which are discussed in is article.

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In two-dimensional digital image correlation, displacements are directly detected from digital images of the surface of an specimen. The plane surface of an object is observed usually by a CCD camera with an imaging lens. Then, the images on the surface of the object, one before and another after deformation, are recorded, digitized and stored in a computer as digital images. These images are compared to detect displacements by searching a matched point from one image to another. Here, because it is almost impossible to find the matched point using a single pixel, an area with multiple pixel points (such as 20 × 20 pixels) is used to perform the matching process. This area, usually called subset, has a unique light intensity (gray level) distribution inside the subset itself. It is assumed that this light intensity distribution does not change during deformation. The displacement of the subset on the image before deformation is found in the image after deformation by searching the area of same light intensity distribution with the subset. Once the location of this subset in the deformed image is found, the displacement of this subset can be determined. In order to perform this process, the surface of the object must have a feature that allows matching the subset. An example of reference and deformed specimen is shown in Figure 1 and its subset tracing is shown in Figure 2.

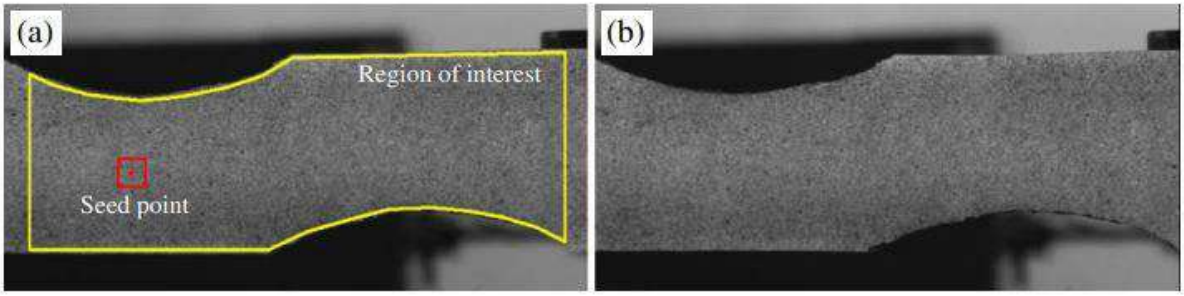

Fig 1. Images of a specimen subjected to uniaxial tensile loading: (a) reference image, (b) deformed image.

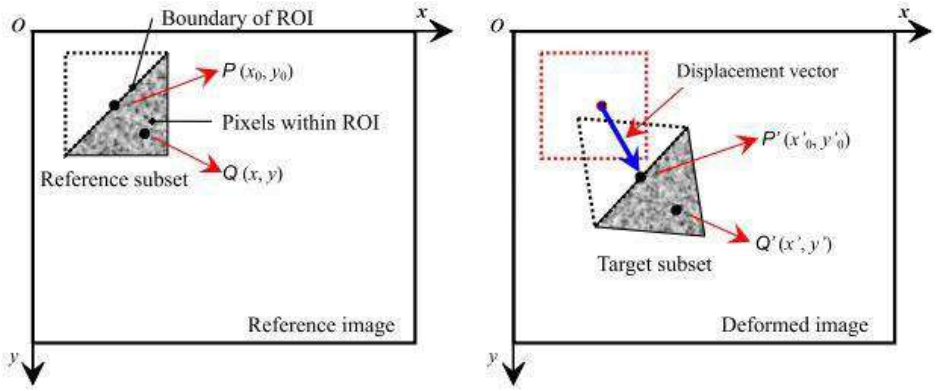

Fig. 2 Example of tracking a subset centered at a boundary point.

THREE-DIMENSIONAL (3D) DIGITAL IMAGE CORRELATION OR STEREO DIC

Three-dimensional (3D) digital image correlation (DIC) is a popular image-based non-contact measurement technique. 3D DIC is generally implemented in a stereo vision system. Based on the triangulation principle, a novel method is proposed to compute the 3D position which can minimize the re-projection deviation. The proposed 3D DIC method is employed to measure the profile of a mask model and evaluate the loading response of a tensile specimen made from say aluminium. The epi-polar geometry-based searching strategy can enhance the searching efficiency. The re-projection deviation of the 3D point derived by the proposed method is less than that of the 3D point obtained from the conventional method. The measured Young's modulus is close to the standard reference value. The proposed method is also utilized to measure the in- and out-of-plane displacements and strains of the loaded specimen.

3D Digital image correlation as a non-contact optical technique is becoming increasingly popular for engineering measurement. It is widely used for non-contact shape and displacement measurement and motion tracking. Unlike the conventional gauges and extensometers, DIC is able to make full-filed non-contact measurement of the

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mechanical properties of materials. Compared with other popular non-contact full field measurement techniques, such as digital speckle shearing interferometry (DSSI), electronic speckle pattern interference (ESPI), and digital holographic interferometry (DHI), the measurement conditions for DIC are much less stringent. DIC works well under normal environment. Since 3D DIC was first proposed by Luo et al., it has been studied extensively and has obtained great progresses in the aspects of measurement accuracy, efficiency. 3D DIC has been successfully applied in various applications, such as the study of mechanical properties of material, biomedical engineering, structure monitoring, vibration measurement and shape measurement. Recently, there have also been some attempts to perform 3D DIC in multi-camera systems. In this way, it can be applied to a large surface. Additionally, many attempts have also been conducted to implement 3D DIC using a single camera. The hardware cost can be reduced and the synchronization problem can be solved well. 3D DIC is generally implemented in the stereo vision system consisting of two cameras. At the beginning of measurement, calibration is required to obtain the intrinsic parameters of the cameras and their pose relationship. Before we compute the 3D position of the point of interest, corresponding points should be located between the images captured by the two cameras. Usually, the left camera coordinate system is often regarded as the world coordinate system. The computed 3D position in the 3D DIC methods is described in the left camera coordinate system. However, when measuring the in- and out-of-plane displacements of a loaded object, the XOY plane (Z = 0) of the world coordinate system should be set on the test surface before loading. 2D DIC is often employed to measure the in-plane displacement. 3D DIC is able to measure both in- and out-of-plane displacement with higher accuracy.

VOLUMETRIC DIC OR DIGITAL VOLUME CORRELATION (DVC)

Over the past years, we have been developing new algorithms and approaches for robust, efficient and accurate internal displacement and strain field measurements using digital volume correlation (DVC). Four major aspects that gives the better results are advanced three-dimensional inverse compositional Gauss-Newton (3D IC-GN) algorithm for sub voxel registration with enhanced accuracy and efficiency, self-adaptive DVC algorithm with optimal calculation parameters, practical and effective strategies for DVC analyses of high-resolution volumetric images and deformed volumetric images encoded with large deformation and quantitative analysis and correction of thermal errors in DVC measurements due to self-heating effect of X-ray CT scanners. With the rapid development and popularity of advanced volumetric imaging devices and continuous refinement of 3D image registration algorithms, DVC has gained more attention and been increasingly used in various fields including biomechanics, experimental mechanics, biomedical engineering and material science. The core of the DVC technique lies in tracking (matching or registering) the same voxel points in the volumetric images of a test object recorded at different stages by a volumetric imaging device. Each DVC algorithm has its own strengths and weaknesses. In using sub volume based local DVC, the displacement vector of each calculation point is individually computed by matching the reference sub volume with the target counterpart in deformed volume images. To this end, a correlation criterion should be defined as a measure to quantify the similarity (or dissimilarity) of the two sub volumes. The correlation criterion is subsequently optimized using a non-linear optimization algorithm (also known as sub voxel registration algorithm) to detect displacement components at each measurement point. The same process is repeated on other calculation points to obtain full-field displacements. Despite the basic principle of DVC is simple and straightforward, practical implementation of the DVC algorithm faces several major challenges in improving its measurement accuracy, computational efficiency, flexibility and applicability. Specifically, the sub voxel registration algorithm dominates measurement accuracy and therefore is considered as the key technique in DVC. Some of the existing sub voxel registration algorithm (e.g., Gauss-Newton algorithm, Newton-Raphson or iterative least-squares algorithm) can provide high accuracy and wide applicability. The forward additive matching strategy inherent to these sub voxel registration algorithms, however, not only contains large redundant calculations but also makes these algorithms sensitive to random noise of the volumetric images. In DVC measurement, sub volume size and shape function are the two critical user-defined parameters that have significant influences on the accuracy and precision of detected displacements. In general, the sub volume size should be large enough to ensure the unique registration of reference sub volumes in target volume images. In the meantime, the defined shape function should precisely depict the underlying local.

CONCLUSION

It was concluded that Digital Imaging Correlation (DIC) technique is suitable for the study of crack propagation and material deformation in real-world application, as it have a cheap setup yet accurate results. Areas where DIC

methods had rapid growth were discussed. It was seen that 2D DIC is often employed to measure the in-plane displacement whereas 3D DIC is able to measure both in- and out-of-plane displacement with higher accuracy. Another area of growth of DIC is the core of the DVC technique. DVC lies in tracking (matching or registering) the same voxel points in the volumetric images of a test object recorded at different stages by a volumetric imaging device. Hence, compares the results on different time intervals with deformation. The crack growth resistance behavior of functionally graded materials (FGMs) can also be investigated using the full-field measurement technique of digital image correlation (DIC). Edge crack fracture specimens can be loaded such that stable quasi-static crack growth occurred. It can be observed that the results when used to extract stress intensity factors and generate resistance curves for the specimen, a crack growth resistance behavior of continually increasing toughness with crack extension can be observed. The results when compared to stress intensity factor values obtained using crack face profile shape measurements, good agreements can be found.

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A Insect Free-Flight Simulation of Flapping

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Abstract *– In insect flapping flight, non-equilibrium flight situations inclusive of takeoffs and uncoordinated turn are hard to investigate with experiments or quasi-constant analysis. Here we expand a simplified rigid body dynamics solver with 6 tiers of freedom (DOF), by using utilizing unit quaternion's. A unfastened-flight simulator of an insect flapping flight is then constructed up by way of coupling the dynamics solver with an in-residence CFD solver, that's targeted for simulating unsteady flapping-wing aerodynamics. Simulation of the soaring flight of a fruit fly (Drosophila melanogaster) is executed through manually manipulating 3 kinematic parameters, wingbeat amplitude, imply positional attitude, and stroke plane angle relative to frame (anatomical stroke aircraft attitude).*

Keywords *— flapping-flight, insect flight, free-flight, computational fluid dynamics, rigid body dynamics*

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INTRODUCTION

In numerical simulations of the flapping flight of animals or MAVs (micro air vehicles), improved quasi-steady aerodynamic modeling is sometimes employed [1-3]. However, solving full Navier-Stokes equations is necessary to obtain higher fidelity flow field information around an insect, from which we can directly compute the aerodynamic forces and torques (moments) acting on the insect. Liu and colleagues [4-6] carry out several numerical simulations on insects flapping flight using such a computational fluid dynamic (CFD) solver. All of the researches, however, treats tethered-flight conditions; that is, the body of the insect is fixed in space. If numerically investigate a maneuver called saccade, a sharp turn, of fruit flies. The unsteady aerodynamic forces and torques are computed, but the wing and body kinematics are prescribed from observed behavior. So it isn't always viable to recognize, as an example, "after that" flight sequences or "what if" situations.

We avert this trouble through coupling fluid dynamics and rigid body dynamics. However, considering the fact that their solver has most effective 3 ranges of freedom (DOF), their work is limited to both longitudinal [9] or lateral movement [10]. Therefore, if one wants to numerically check out non-equilibrium flight conditions together with take-off [11-12] or flight in a gusty surroundings [13-14], an unsteady, 6 DOF loose-flight simulator is needed. We have evolved a simplified inflexible frame dynamics (RBD) solver in phrases of 6DOF, wherein we utilized unit quaternion for attitude description. By combining the RBD solver with an *in-house* CFD solver [17], we have established a 6 DOF free-flight simulator, which is capable to simulate transient flight dynamics and aerodynamics in insect flapping flight. The overall formulation is similar to that of Kawamura *et al.* [15].

In this paper, we briefly explain the theory and research of the simplified RBD solver and coupling method. As a preliminary computation, the free-flight of a fruit fly hovering is realized by adjusting three kinematic parameters manually.

METHODS

The simulator consists of two major components, a fluid dynamic solver and a simplified rigid body dynamic solver.

A. Flow solver

Flow fields are computed using the unsteady 3D incompressible Navier-Stokes solver developed by Liu *et al.* [16-17], which utilizes pseudo-compressibility and gird oversetting method. The information of the float solver are supplied someplace else [17].

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There are dimensionless numbers used within the computation, namely, the Reynolds quantity Re and the decreased frequency k, which represent the glide field.

B. Simplified inflexible frame dynamics solver

A simplified inflexible body dynamics (RBD) solver turned into advanced to acquire insect frame movement.
Several simplifications were delivered which make the equations of motion less difficult and the implementation of the programming code less complicated. Translational equations of movement are described inside the inertial frame of reference and rotational equations of motion are described with respect to the essential axes of inertia of the flier (Fig. 1). Coordinates within the inertial body of reference are hereafter called "worldwide coordinates." The essential axes of inertia are approximated by using the frame axes and are hereafter referred to as "frame coordinates." Since an insect flaps its wings, a time-averaged fee is used for the instant of inertia, which is given in body coordinates, around the middle of mass (CM) of the flier. Unlike the work of Sun *et al.* [8], both the translational and rotational movements are described around total center of mass, not the body center of mass. Therefore, the body oscillation due to flapping does not appear in the equations of motion. Instead, the oscillating motion is implemented separately.

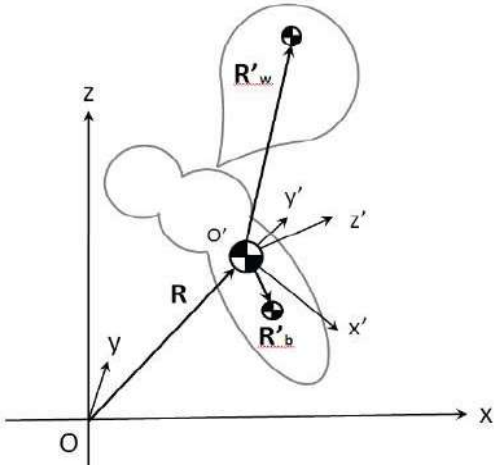

Figure 1 Schematics of frames and vectors. (x, y, z), inertial frame of reference, "global coordinates" in short. (x', y', z'), principal axes of inertia, "body coordinates" in short. R is the position vector of the flier's center of mass in global coordinates.

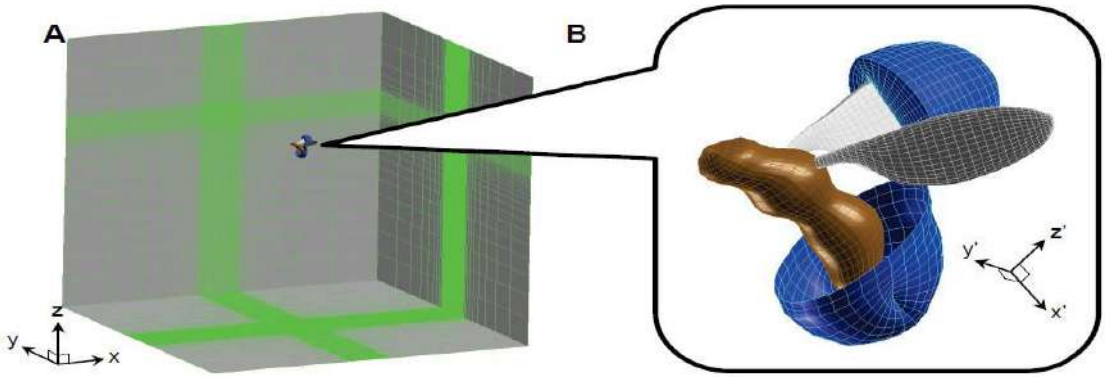

Figure 2 Grid system. (A) Background grid block. The axis marker indicates global coordinates. (B) Local grid blocks. The axis marker indicates body coordinates.

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C. Coupling of the two solvers

Aerodynamic force is received by way of integrating the pressure and shear strain over flier surfaces. Similarly, aerodynamic torque around the center of mass of the flier is received.The force and torque are then introduced into the dynamics solver, together with the gravitational contribution to the force. The equations of motion (EOM) are solved and the boundary of the flier grid is set to the new position of the flier. The above cycle is iterated. As already mentioned, when solving rigid body dynamics, dt_{dyn} is set to be a fraction of dt for flow field calculation and the EOM are solved several times until the same period as flow solver (*i.e.* dt) passes. For example, if $dt_{dyn} = dt/10$, then RBD part is computed 10 times with the same aerodynamic forces and torques as inputs. Formerly, the stroke aircraft angle (SPA) and the frame perspective (BA) of the flier have been set independently. However, inside the modified solver provided here, both BA and SPA are decided with the aid of the aerodynamic torque. Instead, anatomical stroke aircraft attitude (ASPA), the SPA relative to frame, is selected for each wingbeat cycle. See Fig. 3 for the definitions of angles.

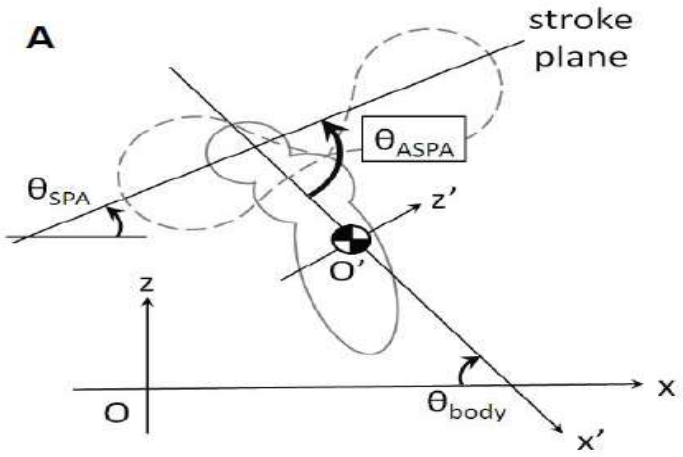

Figure 3 Kinematic parameters. Left view (A)

D. Grid system

Based on Liu [17], the grid system was modified. Four grid blocks are prepared. Local blocks, which consist of a body grid block and two wing grid blocks, are embedded in a Cartesian background grid block (Fig. 2). The global block is a cube and each side has 60 times the mean chord length. The central region of the global block has uniform spacing and distal region has non-uniform spacing. The flier blocks are placed inside of the same mesh region.

The origin in global coordinates locates in the middle of the xy-plane and 40 times the mean chord length above the lower plane. During free-flight computation, if the CM is going to cross the face of the global-grid cell it is in, re-meshing occurs so that the flier blocks are always kept Interior of the uniform mesh vicinity, therefore preserving the exceptional of interpolation among neighborhood and global blocks.

RESULTS

A fruit fly (*Drosophila melanogaster*) model was used for simulation. The body and two wings were assumed to have uniform density. The number of grid points and basic parameters are listed in tables 1 and 2. Of them, mean chord length, wing length and wingbeat frequency are taken from Hedrick *et al.* [13]. At time $t = 0$, flow velocity and pressure are zero everywhere. A no-slip condition is applied to the flier surface and zero-gradient condition is taken for velocity at the background grid block outer boundary.

The body of the insect was fixed in space until the end of the fifth wing beat cycle, when it was released. In practice, this was done as follows. At first, best the flow field become solved even as the frame is constant in space (tethered-flight). At the end of fifth wing beat cycle (t/T = five.0), the drift discipline facts changed into saved up. The saved statistics become then used as the preliminary condition of the brand new computation, wherein fluid dynamics and rigid frame dynamics are coupled (free-flight). The free-flight computation lasted seven wing beat cycles.

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Here we show the results of two free-flight cases. Both of them used the same stored data of the tethered-flight. In Case 1, the kinematic parameters are unchanged from the tethered-flight computation. In Case 2, on the other hand, the parameters are adjusted manually in some cycles, in which the parameter manipulation was determined in a manner of trial-and-error. Since the flight condition was hovering and wing kinematics was symmetric, the motion of flier was confined to the xz-plane (as well as the x'z'-plane), although the RBD solver itself has 6 degrees of freedom.

The history of forces and velocities at the CM (x- and z- components), and aerodynamic torque and angular velocity (y'-component) around the CM are shown in Fig. 4. CM position (x- and z-components) and pitch angle are shown in Fig. 5. Fig. 6 shows the body positions and attitudes at $t/T = 5$ and $t/T = 10$ for both Case 1 and Case 2.

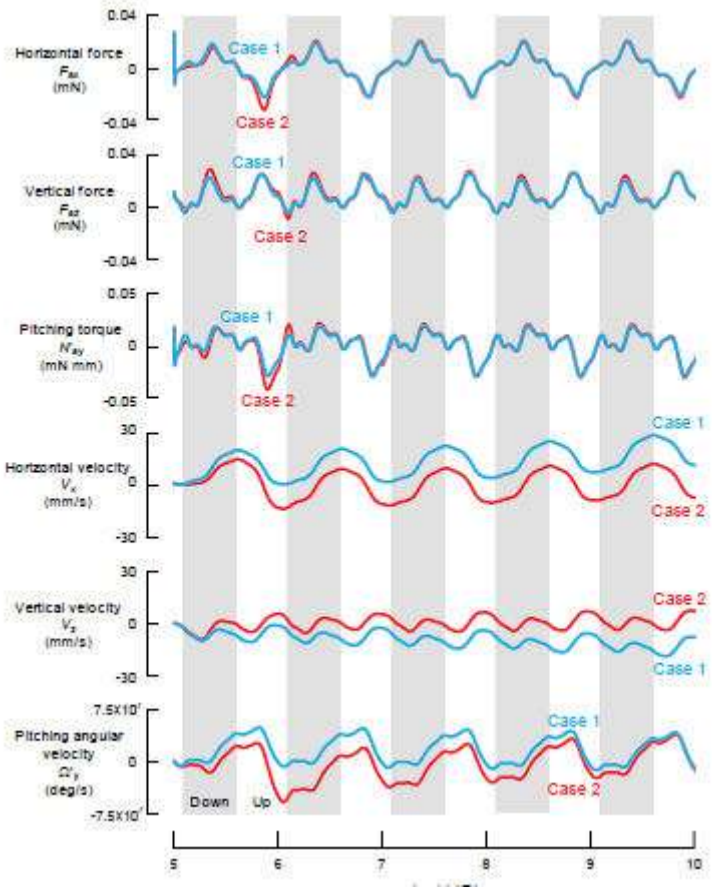

Figure 4 Time series of flier's performance in Case 1 (blue) and Case 2 (red). The x- and z-components of aerodynamic forces, Fax and Fax, the y'-component (pitching) of aerodynamic torque around the flier's center of mass in body coordinates, N'ay, the x- and z

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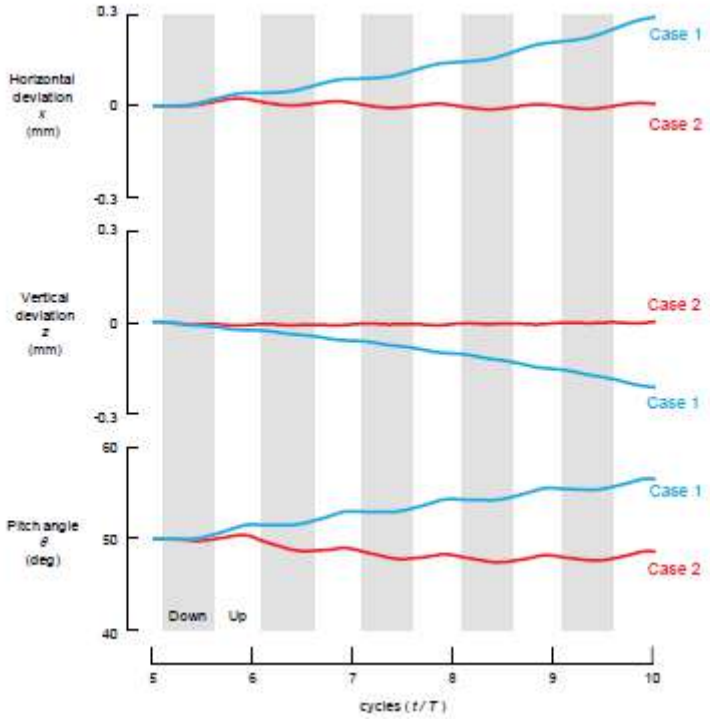

Figure 5 Time series of flier's motion in Case 1 (blue) and Case 2 (red). The position of center of mass x-component, that of z-component, and the pitch angle around the center of mass. Note that the pitch angle is essentially the same as the body angle with current definition

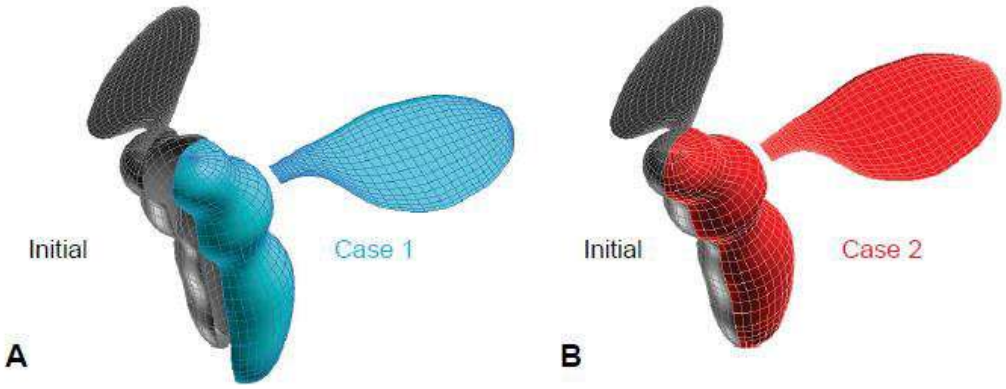

Figure 6 Body position and attitude. In either (A) and (B), right half of the flier (black) is at t/T = 5.0, the beginning of free-flight. In (A), left half of the flier (blue) is at t/T = 10.0 in Case 1. In (B), left half of the flier (red) is at t/T = 10.0 in case 2

DISCUSSION

Although the difference in aerodynamic forces and torques between Case 1 and Case 2 does not seem to be large (Fig. 4), the resultant body trajectories and attitudes differ substantially (Figs. 5 and 6). At $t/T = 10$ in Case 1, uncontrolled case, the deviation from the original position is approximately 50 % of the mean chord length with respect to both x- and z-directions. On the other hand, in Case 2, the manipulated case, overall change in body position was smaller, although pitch angle at first decreased, and then increased back to the original value. This suggests that a cycle-by-cycle manipulation of just three parameters is very likely sufficient to maintain stable hovering for a fruit fly. This finding is consistent with the study on the free-flight of a fruit fly by Fontaine *et al.* [7], where it is discussed that the wing kinematics may be adjusted for each wing beat cycle.

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The simulation platform developed in the present study may be a useful tool in investigating the flight performance or obtaining the flight envelope of an insect, or a flapping wing micro air vehicle (MAV).
In future, work may also encompass the development of a greater practical RBD solver for larger wing-body mass ratio fliers consisting of butterflies, or the combination of a fluid shape interplay (FSI) solver to enable passive deformation of the wings.

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A Personal View of Macroscopic Equilibrium Thermodynamics

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Abstract *– It is argued that the usual way of teaching thermodynamics to students today perpetuates the difficulties that engineers and scientists in the nineteenth century had in understanding how heat engines work. A new theory is outlined that aims to be clearer than the traditional approach.*

INTRODUCTION

The title of this paper may seem to be a contradiction in that the term *Equilibrium* suggests that the systems studied are at rest and the term *Thermodynamics* suggests that they are in motion produced by heat. The reason for this is that the subject was developed by engineers and scientists in the nineteenth century studying engines that produced mechanical power from heat with theories using the properties of the working substances in the heat engines in equilibrium. The term *Macroscopic* indicates that the theories referred only to the bulk properties of the working substances without considering the behavior of the atoms and molecules of which they are composed.

The thermodynamics taught in high schools and universities today is still influenced by the roundabout way in which the subject was developed in the nineteenth century. The students are taught the zeroth, first, and second laws in their old formulations. In advanced courses a third law may be added when it is needed in special areas of chemistry and low temperature physics.

It is a strange fact in the history of thermodynamics that the zeroth, first, and second laws were formulated in the reverse order of their numbering. There were contributions by many authors, but the principal landmarks were as follows. The second law was first stated by Carnot in 1824, the first law was stated by Joule in 1840, and it was not until 1935 that Fowler felt the need to formalize the concept of thermal equilibrium in the zeroth law.

2. Comments on the Traditional Laws of Thermodynamics.

It is my view that the traditional presentation of thermodynamics perpetuates the problems that the early researchers had in formulating the concepts of the subject in the past, and this makes it difficult for students to understand the subject today. A few of my opinions on these matters are given below.

2.1 Comments on the Zeroth Law

The zeroth law is more pedantic than necessary. The law states that if two systems are both in thermal equilibrium with a third system, then the two systems will be in thermal equilibrium with each other. Based on this fact we can devise a temperature scale for indicating the thermal equilibrium of systems. But this kind of equivalence relation holds for any measurement. For example, if on a laboratory balance two weights are both in balance with a third weight, then the two weights will be in balance with each other. Surely it is enough to acknowledge the concept of balancing weights without

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elevating it to the status of a physical law. Likewise it seems enough to acknowledge the concept of thermal equilibrium without calling it another law of thermodynamics.

Moreover, the temperature scales devised on this basis can only be empirical. They are not the same as the thermodynamic (Kelvin) scale. Even the so called "absolute temperature" of an ideal gas is not conceptually the same as the thermodynamic temperature implied by the second law of thermodynamics.

It can also be argued that the zeroth law is a consequence of the second law. If in Fig. 1 systems 1 and 2 are both in thermal equilibrium with system 3, but systems 1 and 2 are not in thermal equilibrium with each other, violating the zeroth law, then it is possible to use a heat engine to produce work from the combination 123 without rejecting heat to the environment, violating the second law. It follows that the second law implies the zeroth law.

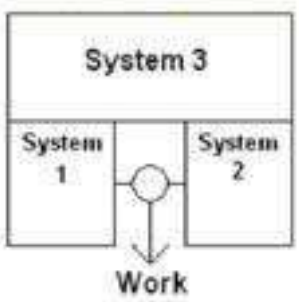

Figure 1. *How a violation of the zeroth law would violate the second law.*

2.2 Comments on the First Law

It is sometimes said that the first law is the law of conservation of energy in thermal systems. This is only a half truth. The conservation of energy is a more general law independent of thermodynamics. It arises from the fact that the laws of physics are independent of time (Noether's theorem).

The early researchers did not understand correctly the nature of heat. They believed that hot bodies contained a fluid called *caloric* which tended to spread out into other bodies making them hot also, and causing them to expand. This theory was replaced only when the mechanical equivalent of heat had been determined and it was seen that thermodynamic systems have internal energy.

2.3 Comments on the Second Law

The second law was formulated in two ways: by Kelvin, saying that it is impossible for any cyclic device to convert heat completely into work, and by Clausius, saying that it is impossible for any cyclic device to transfer heat from a cold body to a hot body without the expenditure of work. These two formulations were shown to be equivalent, and the reversible Carnot cycle was found to be the most efficient way of operating these machines. The concepts of thermodynamic temperature and entropy were then derived by mathematical arguments from the Carnot cycle.
Understanding the physical meaning of entropy derived in this way from engineering concepts is difficult. Entropy is said to be increased in irreversible processes. Why? This is not implied in the derivation of the entropy concept from the Carnot cycle. Something more is needed. Explanations that fall back on statistical arguments, saying that entropy is a measure of disorder, are improper ways of patching up holes in the macroscopic theory.

2.4 Methods of Reasoning

Some of the concepts and methods of reasoning used by the fathers of thermodynamics can be questioned, such as transfers of heat without a temperature difference, or changes in the state of the working substances while remaining infinitesimally close to equilibrium. A new conceptual framework designed to avoid such questions is described below. A complete account of this theory is given in my 2014 paper listed in the bibliography.

3. Outline of a New Macroscopic Theory

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Every logical theory begins with undefined terms introduced by descriptions and examples. Other terms may then be defined from them. These terms represent the entities of the theory and the relations between them. In a physical theory postulates based on induction from experience show what general facts are accepted about these entities and relations. In the basic theory described here important terms are printed in bold type and the postulates are printed in italics.

3.1 Thermodynamic Systems

The theory is restricted to a **simple closed system**, which is a quantity of matter separated from its **environment** by the walls of a container. The system has a set of stable **equilibrium states** Z. Each state has a pair of non-thermal variables: pressure *P* and volume *V*.

To illustrate the theory we take dry air modeled as an ideal gas. This model is satisfactory for air under the ordinary conditions found in meteorology and air conditioning.

The environment may be **hot**, such as a bath of boiling water, or **cold**, such as a bath of melting ice. If the walls of the container are **thermally conducting**, then a change in the environment from hot to cold or from cold to hot will cause the equilibrium state of the system to change. If, however, the walls are **thermally insulating**, like the double walls of a vacuum flask, then a change in the environment from hot to cold or from cold to hot will not cause any change in the equilibrium state of the system.

When the state of the system is caused to change and the walls of the container are thermally insulating, the change of state is called **adiabatic**. Experience shows that the following postulate is true.

Postulate 1. *For any pair of stable equilibrium states Z1 and Z2 of a simple closed thermodynamic system an adiabatic change of state is possible from Z1 to Z2 or from Z2 to Z1.*

3.2 Energy and the First Law

Energy can be transferred between the system and its environment by methods such as those shown in Fig. 2. If the walls of the container are thermally insulating the change of state is adiabatic, and the amount of energy transferred to or from the system can measured entirely by mechanical work done in the environment.

We note in passing for future reference that work done by a movement of the wall is **reversible** because the volume may be reduced or increased, so energy can be transferred to or from the system. If, however, an electrical current is passed through the resistor or the weight falls, energy is transferred to the system, but these processes are **irreversible**. It is impossible for energy in the system to make an electrical current flow in the resistor or to lift the weight.

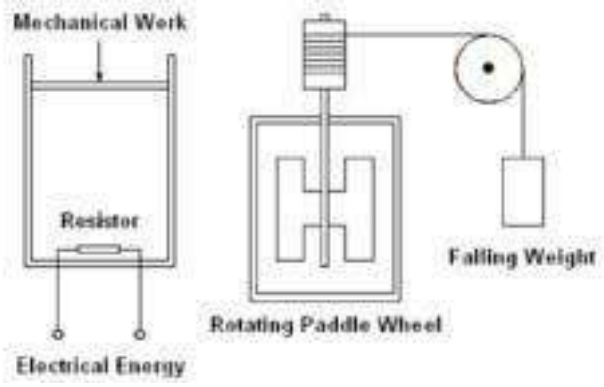

Figure 2. *Adiabatic energy transfers between a system and its environment.*

The **First Law of Thermodynamics** can now be stated as follows:

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Postulate 2. *The amount of energy transferred to or from a thermodynamic system in an adiabatic change of state, measured by work in the environment, depends only on the initial and final states.*

It follows from Postulates 1 and 2, and the Principle of Conservation of Energy, that we may define an **internal energy** potential E on the set of equilibrium states with a reference state Z0 chosen to have the zero energy potential. The internal energy function must be found by experimental measurements.

Example
The internal energy of air is given by

$$E = 2.5PV.$$

This formula is acceptable under normal conditions, but it cannot be used at low temperatures where the ideal gas laws fail.

The pressure and volume of a simple closed thermodynamic system do not always specify the state of the system uniquely. For example, water at a pressure of one atmosphere has a minimum volume per unit mass just above the melting point of ice. In the neighborhood of this minimum there are different states with the same pressure and volume but different internal energies. Ambiguities such as this are resolved by **The State Principle**, which we present as a third postulate:

Postulate 3. *The stable equilibrium state of a simple closed thermodynamic system is specified uniquely by its volume and its internal energy.*

It follows from this postulate that there is a one-one correspondence between the equilibrium states of a simple thermodynamic system and the points on a two-dimensional E-V diagram.

We now assume that paths, which we call **quasistatic paths**, can be drawn through successions of neighboring equilibrium states, and that differentials defined on the equilibrium states can be integrated along these paths.

We define the differential of **quasistatic work** along a quasistatic path as the energy change produced by a change in volume thus

$$dW = -PdV.$$

But the internal energy can be changed by other means, such as an electrical current in the resistor shown in Fig. 2. To account for this we define the differential of **quasistatic heat** as the difference

$$dQ = dE - dW.$$

Example
For air the differential of the quasistatic heat is

$$dQ = 3.5PdV + 2.5VdP.$$

It follows that

$$dE = 2.5d(PV).$$

This completes our treatment of the first law of thermodynamics. The concept of a measurable temperature has not been used because this belongs to the second law of thermodynamics.

3.3 The First Part of the Second Law: Entropy and Temperature The second law of thermodynamics may be divided into two parts. The first part is concerned with the definitions and
properties of entropy and temperature.

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If an adiabatic change of state from Z1 to Z2 is **reversible** we write Z1 ↔ Z2. This is an equivalence relation that divides the states of the system into equivalence classes which we call **isentropic sets** Σ.

If the adiabatic change of state is **irreversible** we write Z1 → Z2 and for the two isentropic sets that contain these states we write Σ1 → Σ2. This defines a total ordering of the isentropic sets.

Example
The isentropic sets of air satisfy the equation $PV^{1.4} = constant$, where the constant is different in different isentropic sets. An adiabatic change of state is possible only if the constant in the new state is equal to or greater than the constant in the old state.

If two states Z1 and Z2 are both in thermal equilibrium with the same environment through a thermally conducting wall we write Z1 ≡ Z2. This is another equivalence relation that divides the states of the system into equivalence classes which we call **isothermal sets** Θ.

When two states Z1 and Z2 have the same volume and Z1

→ Z2 we say Z2 is **hotter than** Z1 and for the two isothermal sets that contain these states we write Θ1 → Θ2. This defines a total ordering of the isothermal sets.

Example

The isothermal sets of air satisfy the equation $PV = constant$, where the constant is different in different isothermal sets. An isothermal set with a higher value of the constant is hotter than an isothermal set with a lower value of the constant.
The following two postulates allow us to define thermodynamic temperature and entropy.

Postulate 4. *On a quasistatic path in an isentropic set the quasistatic heat is zero.*

Postulate 5. *Let two environments be given. Choose any thermodynamic system and any pair of isentropic sets Σ1 and Σ2 in the system. Let Θ1 and Θ2 be the isothermal sets in thermal equilibrium with the two environments. Then the quasistatic heats Q1 and Q2 on quasistatic paths in the two isothermal sets from one isentropic set to the other are always in the same positive ratio Q1/Q2.*

It may seem that Postulate 5 is excessively complicated. However, it is easy to understand if it is compared with the theorem in affine geometry illustrated in Fig 3. Let two parallel lines and a fixed point O on one side of the parallel lines be given. Choose any pair of lines through O meeting the parallel lines as shown. Then the lengths *QS* and *PR* are always in the same positive ratio *QS/PR*.

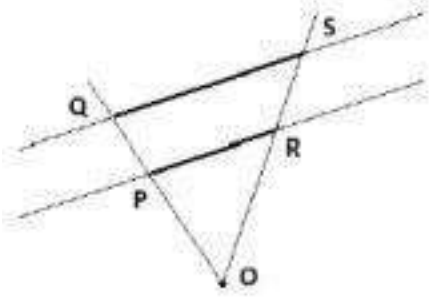

Figure 3. *The ratio of lengths QS/PR is the same for all pairs of lines through O.*

We now define thermodynamic **temperatures** *T1* and *T2* for the two environments by the equation

$T1/T2 = Q1/Q2$

with a standard value $T = 273.16$ K at the triple point of water. We also define **entropy** potentials *S1* and *S2* for the two isentropic sets so that

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$$S2 - S1 = Q1/T1 = Q2/T2.$$

In what follows the word "temperature" will always mean "thermodynamic temperature", and the word "entropy" will always mean "entropy potential".

Example

At a pressure of one atmosphere an environment of melting ice has a temperature 273.15 K, and an environment of boiling water has a temperature 373.15 K.

Example

In air the temperature is $T = PV/R = E/2.5R$, where $R = 0.287$ kJ/(kg K), and the entropy is

$$S/R = 3.5 \ln(V/V0) + 2.5 \ln(P/P0),$$

where $V0$ and $P0$ specify the reference state with entropy potential zero.

Postulates 4 and 5, and the definitions of temperature and entropy, imply that the differential of the quasistatic heat on a quasistatic path is $dQ = TdS$, and the differential expression for the internal energy (Section 3.2) is

$$dE = TdS - PdV.$$

This shows that S is a function of V and E, in accordance with the state principle (Postulate 3), with $P = -(\partial E/\partial V)S$ and $T = (\partial E/\partial S)V$.

Example

The basic thermodynamic properties of one kilogram of air modeled as an ideal gas are shown on an E-V diagram in Fig 4. The isobars are sloping straight lines given by $E = 2.5PV$, the isotherms are horizontal straight lines given by $E = 2.5RT$, and the isentropic curves are given by

$$S/R = \ln(V/V0) + \ln(E/E0)^{2.5}.$$

The reference state for zero entropy is $V0 = 1$ m^3/kg and $E0 = 100$ kJ/kg.

Two more postulates are still required to say whether the entropy increases or decreases in an irreversible adiabatic change of state, and whether the temperature of a hotter state is greater than or less than that of a colder state.

Postulate 6. *Let S1 and S2 be the entropies of the isentropic sets Σ1 and Σ2 respectively. Then S1 < S2 if and only if Σ1 → Σ2.*

It follows from this postulate that the quasistatic heat cannot be negative on any feasible quasistatic path in a system enclosed by thermally insulating walls.

Postulate 7. *Let T1 and T2 be the temperatures of the isothermal sets Θ1 and Θ2 respectively. Then T1 < T2 if and only if Θ1 → Θ2.*

It follows from Postulates 6 and 7, and the definition of the *hotter* relation, that the quasistatic heat $Q12$ on a constant volume path from a state Z1 to a state Z2 is positive if and only if $T1 < T2$.

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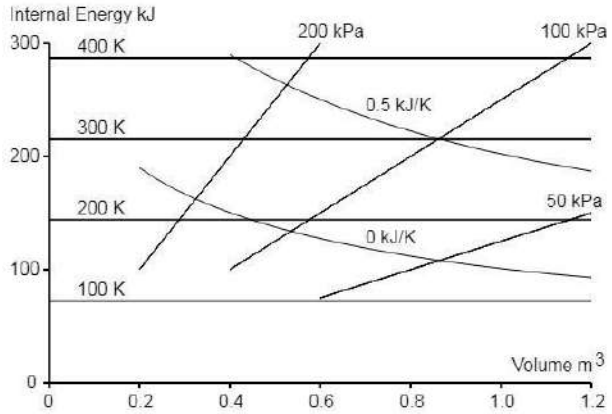

Figure 4. *Properties of one kilogram of air modeled as an ideal gas.*

3.4 The Second Part of the Second Law: The Principle of Increase of Entropy

Here we discuss the spontaneous changes of state that occur when a system is put in contact with an environment with which it is not initially in equilibrium. The environment is assumed to have a constant pressure *Pe* and a constant temperature *Te*. Suppose the initial pressure of the system is *Pi*, the initial temperature is *Ti*, the final pressure is *Pf*, and the final temperature is *Tf*. There are four possible ways in which the walls of the container determine how the system is put in contact with the environment.

Fixed thermally insulating walls

In this case there is no mechanical or thermal contact with the environment and no change of state occurs.

Movable thermally insulating walls

If $Pi \neq Pe$ a spontaneous change in the volume of the system occurs until $Pf = Pe$.

Fixed thermally conducting walls

If $Ti \neq Te$ a spontaneous change in the temperature of the system occurs until $Tf = Te$.

Movable thermally conducting walls
In this case spontaneous changes in both the volume and the temperature of the system occur until $Pf = Pe$ and $Tf = Te$.
It can be shown by arguments based on the foregoing definitions and postulates that in the last three spontaneous changes of state listed above the sum of the changes in the entropies of the system and the environment is positive. The proofs are rather long; details are given in my 2014 paper. These results lead to the following statement:

When a closed thermodynamic system which is not initially in equilibrium with its environment is put in mechanical or thermal contact with the environment a spontaneous change of state occurs in the system to a final state in equilibrium with the environment and the sum of the changes in the entropies of the system and the environment is positive.

The **Principle of Increase of Entropy** is a generalization of this result for all natural processes where coupled systems move spontaneously from states of disequilibrium towards states of mutual equilibrium and the total entropy of the coupled systems increases.

4. Concluding Remarks

This paper has presented only the basic concepts required in the new theory. It is possible to develop from them all the usual results given in conventional textbooks and the theory can be extended to other systems such as magnetic materials

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and electrochemical cells. My way of looking at thermodynamics may seem strange at first, but I hope that once you have grasped the ideas you will find them clear and easy to understand.

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Effect of Sample Size on Micromagnetic Properties of Mild Steel

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Abstract – *This thesis work was undertaken to extend the understanding and the effects of excitation field parameters on the nature of Barkhausen noise profile in order to improve the validity of Barkhausen results. The experiment has been performed on total of twenty-five samples of five different thickness and five different sizes of mild steel sheet. First, all samples of base metal were cut into different sizes and later, all samples are subjected to heat treatment process annealing. The Barkhausen test has been performed in two steps; first frequency varied and magnetic field intensity kept constant, and second magnetic field intensity varied, frequency remained constant. In the second part of the work, Barkhausen noise technique has been applied to analyze the surface integrity of the work sample mild steel after annealing process. Object of current study is to analyze the effect of frequency, magnetic field intensity, and waveform on the hysteresis loop and Barkhausen Noise signals. As the property of ferromagnetic material especially the hysteresis loop and BN depends on the microstructure, MFI and frequency. In this study, the HL and BN of the work sample mild steel sample were experimentally measured by varying the frequency, MFI and waveform using magnetic Barkhausen noise analyzer. Barkhausen noise analysis frequency were applied from 20 Hz, 30Hz, 40Hz, 50 Hz and magnetic field kept at 800 Oe constant and MFI varied from 250 Oe, 500Oe, 750Oe, 1000 Oe at 25 Hz frequency kept constant whereas for sinusoidal and triangular waveform frequency varied from 0.1 Hz to 0.4 Hz and MFI 500 Oe kept constant and MFI varied from 150Oe, 300Oe, 400Oe, 600Oe at 0.1 Hz frequency kept constant. The result for magnetic Barkhausen noise of base sample and annealed samples of mild steel of different thickness and size were observed by graphical variation with frequency xii and MFI. The result shows that RMS value of Barkhausen noise increases with an increase in both frequency and magnetic field intensity. Small size sample had greater value of RMS and bigger size sample had lower value of RMS. Coercivity increase with the increase in frequency and magnetic field intensity, coercivity has a small variation on the sample size and thickness.*

Keywords *Magnetization, Barkhausen noise, Magnetic field intensity, Magnetic Barkhausen noise*

INTRODUCTION

Properties of material (especially mechanical) depend on its chemical composition, crystal structure defects, shape, etc. thus the study of these parameters and the relation between these and the property of the material is necessary. Material characterization refers to the processes that are used to determine material properties and structure. It is a fundamental process in the field of material science and engineering, without which no specific understanding of materials could be achieved. There is various kind of material characterization methods/technique can be classified into two categories [1-2].

1. NDT(non-destructive testing)
2. Destructive testing

The term “non-destructive testing” (NDT) is used for material testing methods that can be applied without compromising the usefulness of the material. Tests can be applied to materials, parts, assemblies or structures. Most non-destructive methods are indirect, producing an estimation of the quality, strength or serviceability of the tested object.Destructive methods can also be applied to material testing. It is, however,the tested object is lost in such a testing scheme and thus cannot be applied to objects that are later used in service.

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Non-destructive methods offer many advantages to the industry. These advantages mainly fall into four categories: increased productivity, increased serviceability, safety and identification of materials. There is a wide variety of non-destructive testing methods utilizing different physical phenomena. Test methods can be divided into visual, pressure and leak, penetrant, thermal, radiography, acoustic, magnetic, etc. Conventional testing methods such as Optical microscope, Scanning electron microscope (SEM), X-ray diffraction (XRD) and hardness measurement are time-consuming and cannot be used for online testing [3]. But these methods are very time consuming and expensive. In opposite to these time-consuming laboratory methods, Magnetic barkhausen noise turns out to be the best alternative. It is a fast, reliable and practical method to detect mass production volume. It is a very important tool for non-destructive characterization [4-6] of ferromagnetic materials.

Barkhausen noise analysis is one such non-destructive technique which is based on magnetic properties of the material which is fast and can be integrated intothe manufacturing environment for online testing of produced parts or working machine parts etc. Barkhausen Noise was discovered in 1919 by H. Barkhausen when he wound a ferromagnetic specimen with a wire and hooked it to an external speaker. He found that by changing the magnetic field around the specimen, he could induce a rushing sound in the speaker. This rushing sound was the result of many small abrupt changes in magnetic flux that was occurring within the confines of the coil. These step variations in magnetic flux occur randomly and are what is commonly known as Barkhausn Noise. It is an advanced material characterization technique which has many advantages over other NDT's.Table 1.1 shows a comparison between different Non-Destructive material characterization techniques.

Table 1.1:*Comparision between different material characterization technique and Barkhausen Noise technique*

Property	Technique used	Cost (approximately)	Time (approximately)
Microstructural state	Optical microscope Scanning electron microscope (SEM)	acs INR	1 - 2 hour
Microhardness	Microhardness tester	15-20 lacs INR	0.5 - 1 hour
Surface roughness	Roughness tester	3 – 10 lacs INR	10 minute
Nature of residual stresses	X-ray diffraction (XRD)	1 Crore INR	1-2 hour
Phase analysis	X-ray diffraction (XRD)	1 Crore INR	1-2 hour
All of the above	Barkhausen Noise analysis	15-20 lacs INR	10 minute

The above table clearly shows that the barkhausen noise technique is faster and economically preferable than the other technique mentioned and it also covers more material properties. The major limitation of BN technique is that it can be applied to only ferromagnetic materials.

Since BN technique is a magnetic characterization technique hence to understand the BN technique we must first understand magnetism and the behavior of magnetic material under the influence of an external magnetic field.

2. BARKHAUSEN NOISE BACKGROUND

2.1Magnetism

Magnetism is a complex phenomenon. It is caused by and affects electric currents. These electric currents can be of any scale, down to the scale of electron spin, as this can also be seen as moving electric charges and thus as an electric current. In order to understand the background of using magnetic properties to evaluate the microstructure, some aspects of magnetism are explained in this chapter, starting with the most important definitions, related to this topic.

2.2 Ferromagnetism

When a material is kept in an external magnetic field it can respond in many ways. Some materials have a tendency to repel the flux line from their core and as a result, it experiencesa small force of repulsion from the magnetic field, such

materials are known as diamagnetic materials. While some materials show the tendency to concentrate the flux lines to their core, as a result, it experiences attraction force from the external magnetic field, these materials are classified as paramagnetic materials. Ferromagnetism is based on the extent of attraction force they experience from the external field. The force that occurs in diamagnetic and paramagnetic materials are much weaker, and materials exhibiting such behavior do not spontaneously produce their own magnetic field. While ferromagnetic materials show strong attraction towards the external field and are easily magnetized in the external field. In general, language when we say the material is magnetic we usually mean it exhibits ferromagnetic behavior.

2.3 Magnetic field (H)

One of the most fundamental ideas in magnetism is the concept of the Magnetic Field. A magnetic field can be produced by a permanent magnet. In a permanent magnet, there are the orbital motions and spins of electrons within the permanent magnet material which lead to a magnetization within the material and a magnetic field outside. A magnetic field can also be produced whenever there is an electrical charge in motion This can be due to an electrical current flowing in a conductor for example, As become first determined by means of Oersted in 1819 [1]. The strength of this area is proportional to the current that is handed through the sphere winding inside the sensing device or sensor. In the commercial Barkhausen Noise products, this is a common system parameter setting or control, which is used to control the field winding current. Often this term will be used to refer to the magnetizing current, which is the current that is used to generate the time-varying external magnetic field around the inspection specimen.

2.4 Excitation Field

The excitation field term refers to the magnetic field that is used to excite, or influence, the ferromagnetic specimen. This excitation causes emission of Barkhausen Noise as the field is changing from one polarity maximum to the other. This field has to change with time to cause the Barkhausen emission to occur.

2.5 Magnetic Domains

Magnetic domain names are normally discussed in the articles relating Barkhausen Noise technology. A domain is a region in a ferromagnetic cloth that is defined through a magnetic polarity boundary. As an outside area is carried out to the fabric, the boundary of the magnetic area will transform toward an equilibrium function. The transition of this domain shift is semi-predictable and is commonly a single part of a series of changes at once. The effect within a material can be described as an avalanche, which is usually the term used in the technical literature.

2.6 Irreversibility

With magnetic types of inspection and phenomenon, there is an aspect that one frequently encounters. The factor of irreversibility is displayed in a ferromagnetic cloth’s inability to go back to the authentic magnetic kingdom. In different phrases, once a ferromagnetic fabric has been located in a magnetic discipline and taken from the sphere, there'll remain within the material a few amount of residual magnetism. This characteristic happens at the order of the individual magnetic domains within a cloth, thus causing a totally unrepeatable transition when the magnetic discipline is changing within a material.

2.7 Magnetic Hysteresis

When the magnetic field applied to ferromagnetic materials is cycled in time, the magnetization does not trace its initial path, resulting in magnetic hysteresis. This hysteretic behavior is related to the influence of the applied magnetic field on magnetic moments which are aligned in particular crystallographic directions in different regions in the material. Such regions are known as magnetic domains and the crystallographic directions in which the moments align are called easy magnetization directions. In neighboring domains, the moments within each domain are aligned along with different directions as seen in Fig. 1.1 (Top). The interfaces between adjacent domains (called the domain wall) can be a few hundred atomic layers thick or even a few atoms (based on the material) and the orientations of the moments change progressively within these layers from that of one domain to that of another. When an external magnetic field is applied to a ferromagnetic material, as in Fig. 1.1 (Bottom), at magnetic field strengths sufficient to move the domains past any

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pinning sites, the magnetic moments within each domain then switch to crystallographic easy directions closest to their orientation. With sufficient field to overcome the anisotropy energy, they switch to the direction of the applied magnetic field to attain a state of minimum energy [Jiles and Atherton (1986); Bertotti (1998)]. During the magnetization process, the domains oriented in the direction of the external field (favorably oriented domains) grow at the expense of neighboring less favorably oriented ones; which shrink. The presence of imperfections or defects within the material serve as a source of lag during magnetization by acting as pinning sites to the domain walls. At sufficiently high magnetic field strengths, all domains will become oriented to the direction of the applied field. A sufficiently strong magnetic field can even reorient the magnetic moments oriented along the favorable crystallographic direction in the direction of the applied magnetic field. Beyond this, no further magnetization is possible and the material is then said to be saturated.

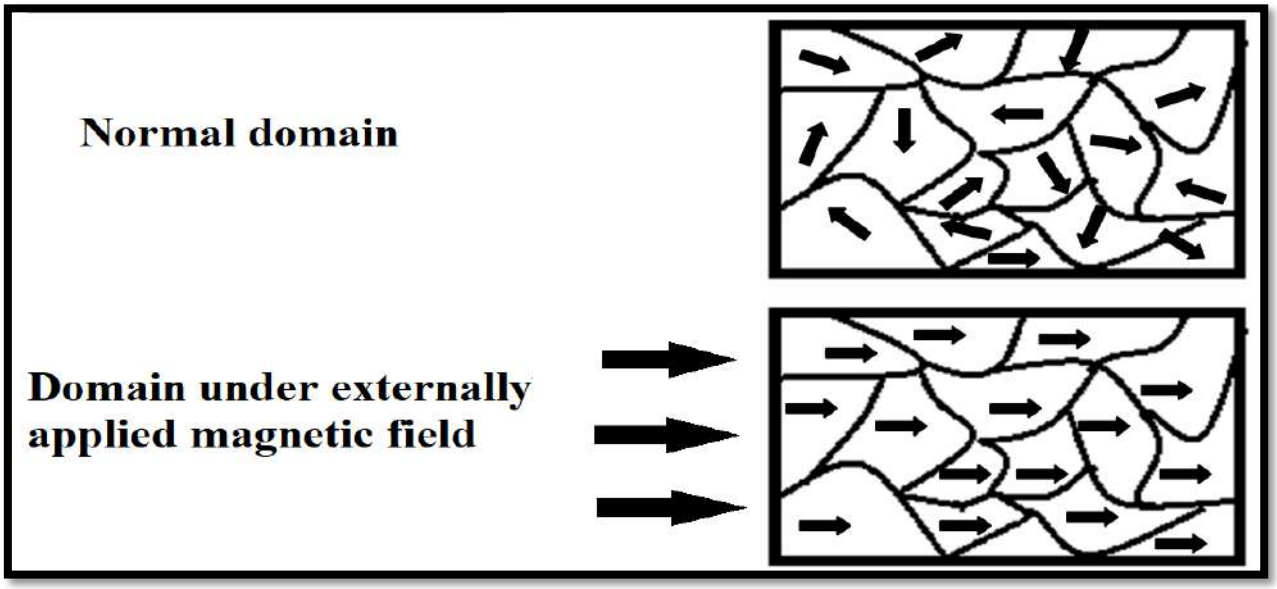

Figure 1.1:Schematic illustration of magnetic domains within grains. The arrows represent the magnetic moments which are randomly oriented before magnetization (top) and are oriented along the direction of the external magnetic field (bottom)

If the direction of the magnetic field is reversed, the magnetic moments realign along the favorable crystallographic direction thereby reducing the magnetization mainly because this reduces the total energy of the system.The hysteresis loop is illustrated in Fig. 1.2. The imperfections and impurities in the material affect the shape of the hysteresis loop. Magnetocrystalline anisotropy also influences the hysteresis loop because it affects the ability of domain walls to align along the field direction. For ferromagnetic materials, the hysteresis process can be described mathematically. If an external magnetic field, H, is applied to a ferromagnetic material with relative permeability of free space, μo, the magnetic induction, B, within the material is:

$$B = \mu o(M + H)$$

Where M is the magnetization of the ferromagnetic material. On the microscopic level, the hysteresis process can be divided into the following processes. In a demagnetized state, the magnetic moments are randomly oriented such that the net magnetization is zero. At saturation, all the magnetic moments align in the direction of the applied magnetic field. The magnetization which remains after removal of the externally applied magnetic field is known as the remanent magnetization as observed in Fig. 1.2

The magnetic field when the net magnetization is zero is known as the coercive field as seen in Fig. 1.2 Describing the hysteresis loop allows for predicting the magnetic properties such as the coercivity or remanence for magnetic materials and in turn, allows for improving their performance in devices. Historically, several models have been proposed to predict this hysteresis behavior. Some earlier work suggested a frictional force responsible for hysteresis and others considered hysteresis as a byproduct of the interactions between the magnetic moments [Jiles and Atherton (1986)]. It is now understood that both of these physical phenomena contribute to hysteresis. The apparently smooth nature of the hysteresis loop is attributed to a frictional force opposing the change in magnetization. This is due to the pinning of domain walls by

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defects in specimens which cause an opposing force resisting changes in magnetization. The mutual interactions between the magnetic domains are also contributing factors.

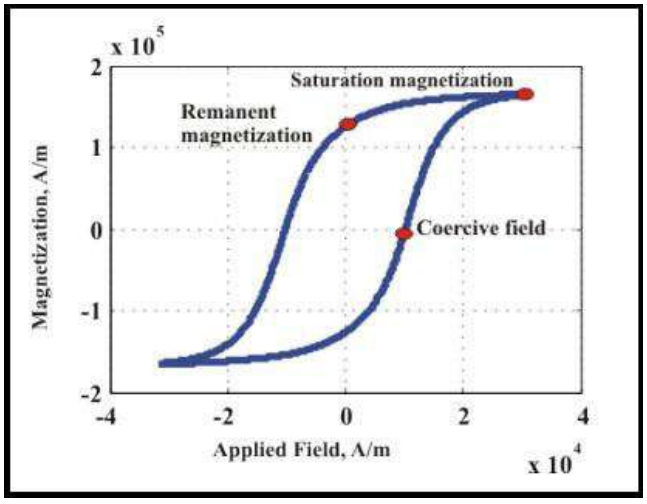

Figure 1.2:Illustration of the magnetization process

3. MECHANISM OF BARKHAUSEN NOISE ANALYSIS (BNA)

Barkhausen Noise Analysis (BNA) method, is based on a concept of inductive measurement of a noise-like signal, generated when a magnetic field is applied to ferromagnetic materials. ferromagnetic materials consist of small magnetic regions resembling individual bar magnets called domains. Each domain is magnetized along a certain crystallographic easy direction of magnetization. Domains are separated from one another by boundaries known as domain walls or bloch walls. Under the externally applied magnetic field domains with the direction close to the applied magnetic field (fig 1.1) get increased in their size which leads to the magnetization of the specimen. If an AC magnetic field is applied it will cause domain walls to move back and forth, this is known as barkhausen jump and can be recorded in the form of BN signals. Barkhausen noise has a power spectrum starting from the magnetizing frequency and extending beyond 2 MHz in most materials. It is exponentially damped as a function of distance it has traveled inside the material. This is primarily due to the eddy current damping.

3.1 Factors affecting the Noise signal

3.1.1 Frequency

The frequency of the AC voltage applied to the magnetizing coil, which determines the penetration depth.The sensor is sensitive to greater depths if a lower frequency is used. High frequencies induce eddy currents that damp the signal, which results in a lower depth of penetration. Lower depth of penetration represents the low coverage area of penetrating the magnetic field. The smaller magnetized volume under the influence of the magnetic field with high frequency indicates the presence of less number of magnetic domain walls for motion as well less number of pinning points to provide resistance for their motion.The range of frequency varies from 10 Hz to 200 Hz for characterization with the Barkhausen Noise signals.

3.1.2 Applied magnetic field intensity

The sensor varies the amount of electrical current passing through the magnetizing coil, and therefore the strength of the external magnetic field. The increase in magnetic field intensity at constant frequency supplies more amount of energy to the magnetic domain. This causes participation of more number of the magnetic domain for movement as well enables them to move over the grain boundaries. The important characteristics of BN signal i.e. RMS value and peak value increased with magnetic field intensity.The field should be strong enough that the hysteresis loop is relatively large, but not so strong that it saturates the sample.

3.1.3 Material properties

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Different materials react differently to an applied magnetic field. As the part material changes, so do its hardness, grain size, magnetic permeability, etc.

3.1.4 Chemical composition

At high machining speeds, the chemical composition has been shown to be the same as the bulk material, most likely because the carbon does not have time to diffuse. In contrast, at lower machining speeds significant cementite presence was found in white layers. These differences are explained by the occurrence of phase transformation at higher machining speeds.

3.1.5 Grain size

Grain boundaries may impede the movement of domain walls, and therefore change the shape of the hysteresis curve. The Barkhausen effect is also responsive to the location, size, and type of carbide precipitates. Typically this is assumed to be aliased with other factors, especially the material type and hardness.

3.1.6 Texture/Surface finish

The surface finish is usually neglected because it is similar enough for each of the parts to be considered approximately the same.

3.1.7 Inclusions

Inclusions affect the sensor response because they have different properties than the bulk material. Inclusions may affect the overall permeability, hysteresis loss, and coercivity of the material.

3.1.8 Thickness of test sample

The limitation of BNA is it can only be used to detect changes in the very near to the surface region of the material. The depth of penetration can be governed by the same skin depth equation of the electromagnetic field.

$$\delta = \frac{1}{\sqrt{\pi f \sigma_m \mu_o \mu_r}}$$

Where, δ - depth of penetration in material

f- Excitation frequency

σ_m - conductivity of material

μ_o- permeability of vacuum

μ_r- relative permeability of the material

3.1.9 Signal analysis

A typical Barkhausen noise signal of 3 cycles(6 brust) is shown in Fig 1.3.

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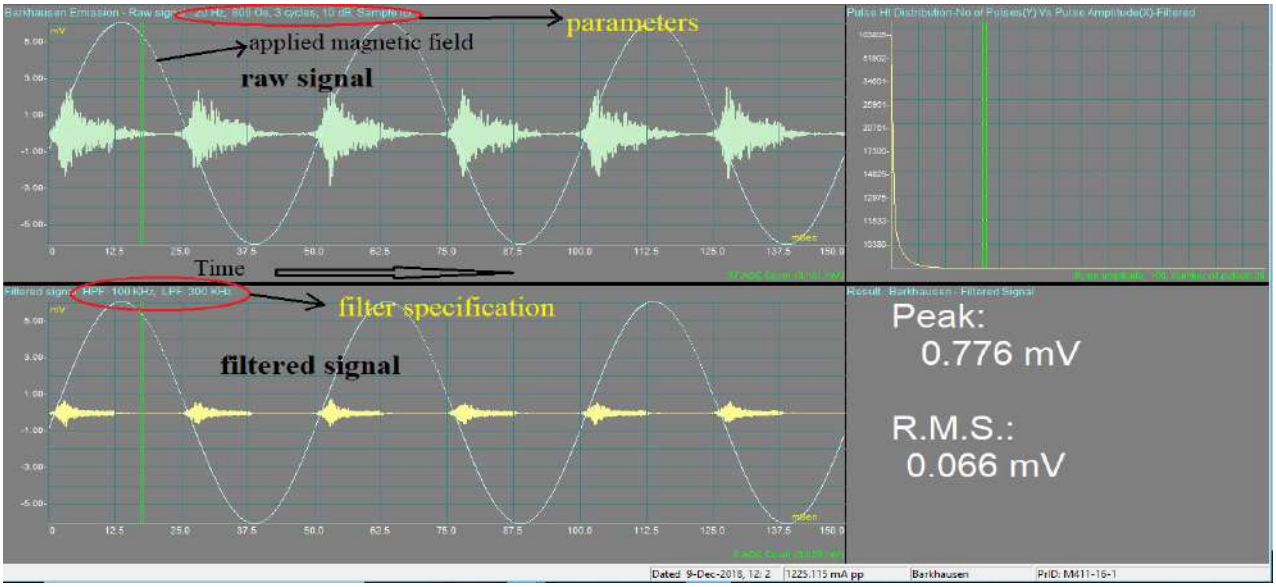

Figure 1.3:Output display of BN test on Megastar technofour

The figure consists, the upper half showing the raw data obtain from measurement and the lower half shows the filtered signal. Usually, some feature is calculated from this signal and then compared with studied material properties.The root-mean-squared (RMS) value of the signal is the most usual one. It has been used, for example, in (Lindgren & Lepisto 2002) and (O'Sullivan,2003).Also,the signal can be plotted and the properties of the curve can be analyzed. The fig1.4 shows the graph between rms in millivolt and time in millisecond. the black hatched line shows the actual variation of rms and the red smooth line show the best fit polynomial. The properties of this polynomial such as skewness, kurtosis, Area under the curve can be calculated and then compared with the material properties.

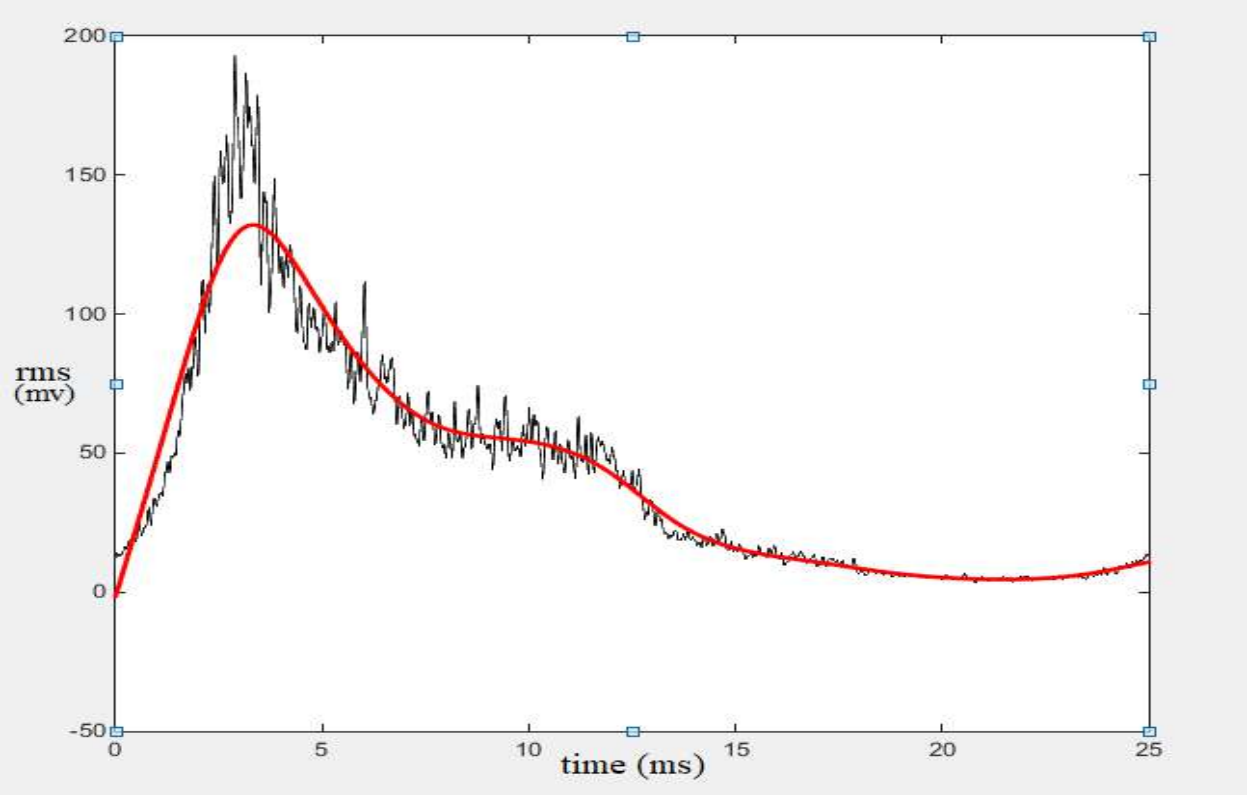

Figure 1.4:Variation of rms VS time for a rectangular sample at 800 Oe magnetic fieldintensity and 20 Hz excitation frequency.

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3.2.0 Barkhausen Noise Analysis - the Applications

Many common surface treatments such as grinding, shot peening, carburizing and induction hardening involves some modification of both stress and microstructure and can be readily detected using the method. Various dynamic processes such as creep and fatigue similarly involve changes in stress and microstructure and can also be monitored with BNA. Practical applications of the BNA can be broadly divided into three categories:

Evaluation of residual stresses; provided microstructural variables can be reasonably controlled.

Evaluation of microstructural changes; provided the level of stress can be reasonably controlled.

Testing of the following surface defects, processes and surface treatments that may involve changes in both stresses and microstructure.

Detection of grinding defects and grinding process control.

Detecting surface defects through Cr-coating.

Evaluation of shot-peening effect in steel.

Measurement of residual surface stresses in steel mill rolls and steel sheet.

3.2.1 SCOPE OF THE WORK

The main focus of the project is to find the effect of the different shaped test sample on BN technique.This work also aims at investigating and selecting a suitable methodology for predicting material properties after annealing based on Barkhausen noise measurement. This subject has not been that well studied in the literature and thus it is of great interest. This study concentrates on the analysis and utilization of Barkhausen noise signals.

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A Model Of Driven All Panels Solar Anomaly Detection for Residential Arrays: Sun-Down

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:

Abstract – *There has been great increase in each application-scale and home-scale solar installations in latest years, driven by means of speedy generation improvements and falling fees. Unlike software-scale sun farms which might be professionally controlled and maintained, smaller residential- scale installations often lack sensing and instrumentation for performance monitoring and fault detection. As a end result, faults may match undetected for long intervals of time, ensuing in generation and sales losses for the home owner. In this thesis, we present Sun-Down, a sensor less technique designed to detect per-panel faults in residential sun arrays. Sun-Down does no longer require any new sensors for its fault detection and rather uses a model-driven approach that leverages correlations between the powers produced with the aid of adjacent panels to stumble on deviations from expected conduct. Sun-Down can manage concurrent faults in multiple panels and perform anomaly class to determine probable reasons. Using two years of sun technology facts from a actual domestic and a manually generated dataset of more than one sun faults, we show that our approach has a MAPE of two.98% when predicting in line with-panel output. Our effects additionally show that v Sun-Down is able to come across and classify faults, along with from snow cowl, leaves and particles, and electric failures with ninety nine.13% accuracy, and may detect a couple of concurrent faults with 97.2% accuracy.*

INTRODUCTION

Recent technological advances and falling hardware price have led to significant growth in the deployment of renewable solar within the electric grid. The costs of solar deployments have dropped to less than $2.75 per watt in recent years [2] and have become competitive with traditional energy sources. As a result, utility-scale and residential-scale solar deployments have experienced sustained growth across the world, with more than 2.6GW of deployments in 2019 Q3 in the US alone [2]. Typically, larger utility-scale solar farms are professionally monitored and maintained for optimal performance—they are instrumented for monitoring real-time generation to identify production issues, and also cleaned frequently to reduce dust or pollen. Researchers have also suggested using drones carrying thermal cameras to identify and locate faults in large solar arrays [6]. However, the majority of solar installations today are small-scale installations, often on residential rooftops, with capacities of less than 10 kW in 2018 [1]. Due to cost reasons, such systems lack sensing and instrumentation that may be present in larger utility-scale solar farms. Further, monitoring of these systems is left to homeowners, who lack the technical expertise for this task. At best, system performance may be monitored at a coarse-grain system-wide basis to determine system-level issues. As a result, it is not un- common for residential solar arrays to encounter power anomalies or other local faults that go undetected for long periods of time, resulting in a loss of generation and revenue for the owner. While it is possible to add sensors and instrumentation for real-time monitoring, doing so for small-scale installations increases their cost, and is challenging to do for millions of installations that are already operational without such capabilities. To address these challenges, in this paper, we present SunDown, a sensor-less approach for detecting generation faults in small-scale solar arrays on a per-panel basis (the terms fault and anomaly are used interchangeably in this paper). Our approach assumes that per- panel generation information is available from the array—an assumption that holds true for any installation that uses micro-inverters or DC power optimizers—and uses a model- driven approach to detect when the panel output deviates in an anomalous manner from the model-predicted output. Our approach is based on machine learning and can detect physical anomalies such as snow obstructions, leaves, and

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electric faults at panels. Our approach seeks to identify and alert solar owners of such issues in a timely manner so that they can be rectified to avoid production losses. In designing, implementing, and evaluating our SunDown system we make the following contributions.

• We present a model-driven approach, based on machine learning, that leverages correlations in the generated output between adjacent panels to predict the expected output of a particular panel and flags anomalies when the model predictions deviate from the expected values. Unlike prior work that has performed system-level fault detection, our approach is designed to perform more fine-grain fault detection at a per-panel level. Further, our approach can handle and detect multiple concurrent faults in the system, a key challenge that has not been addressed by prior work.

• We present a random forest-based classification technique to classify the probable cause of the observed fault. To validate our approach, we construct two labelled datasets of solar anomalies: a two year dataset from a real-home with real snow cover anomalies that we hand label using ground truth information, and a solar anomaly dataset that we construct with a twenty-panel array by injecting synthetic faults such as dust, leaves, and open circuit faults. Since there is a dearth of solar anomaly datasets, we release both datasets and our code as open-source tools to the community.

• We conduct a detailed experimental evaluation of our methods. We show that our approach has a MAPE of 2.98% when predicting per-panel output, which shows the efficacy of using neighboring panels to perform model-driven predictions. Our results also show that SunDown is able to detect and classify faults such as snow cover, leaves, and electrical failures with 99.13% accuracy for single faults and is able to handle concurrent faults in multiple panels with 97.2% accuracy.

PROBLEM STATEMENT

Consider a solar array with N solar panels. We assume that the panels are mounted on a residential roof and may be mounted on one or multiple roof planes. Note that in the latter case, panels will have different tilts and orientations. We assume that the power generated by each panel can be monitored in real-time and that the weather at the site is also known (e.g. from a weather service). Given such a setup, our problem is to design a technique that monitors the power output of each panel and the entire system, and labels the observed out- put in each time interval (e.g. a day) as normal or abnormal. Further, our technique should identify specific solar panels in the system that are experiencing faults and also determine possible cause of the fault (e.g. snow, partial occlusion, or electric fault).

PER-PANEL SOLAR ANOMALY DETECTION

In this section, we describe our model-driven approach for per-panel solar fault detection and how we can build on this approach to perform multiple fault detection. We first describe the basic idea, followed by the details of our models and algorithms. Basic Idea Consider a solar installation with N panels. Suppose that k panels are experiencing an anomaly that result in a reduction, or loss, of output from those panels. Initially, let us assume k = 1 (only one panel out of N is faulty). Later on, we show how our approach can be extended to handle multiple, concurrent faults where k > 1. Since all N panels are mounted on the same roof in close proximity of each other, it follows that they experience highly correlated weather conditions, and produce similar output. Thus, our "sensorless" approach first constructs a model to predict the expected output of a panel from n neighboring panels ($n \geq 1$). For example, a simple predictor is one that uses the mean output of n neighboring panels to estimate a particular panel's output. Under normal conditions, since adjacent panel outputs are highly correlated, the model prediction will match the observed output of that panel with high accuracy. Note that any n out of the available N panels can be chosen to model the output of a particular panel. A useful heuristic is to use the "closest" n panels to the one being predicted or to use the n panels on the same roof plane since they will have higher correlations than those on a different roof surface of the same house. In our evaluation, we experimentally evaluate the accuracy of these heuristics and also evaluate the value of n that yields sufficient accuracy. When a panel experiences an anomaly, however, the model predictions will continue to estimate the "normal case" output of that panel, while the observed output will deviate from this normal case. If the deviation is "large" and persists over an extended period of time, it is indicative of a fault, rather than an error in the model prediction. The cause of the fault can be separately determined by analyzing amount of loss or the power pattern exhibited by the panel. Such a model-driven approach only uses the observed output of panels to detect anomalies—no other instruments or sensors are needed for anomaly detection unlike some other approaches [6].

Prediction Model Accuracy

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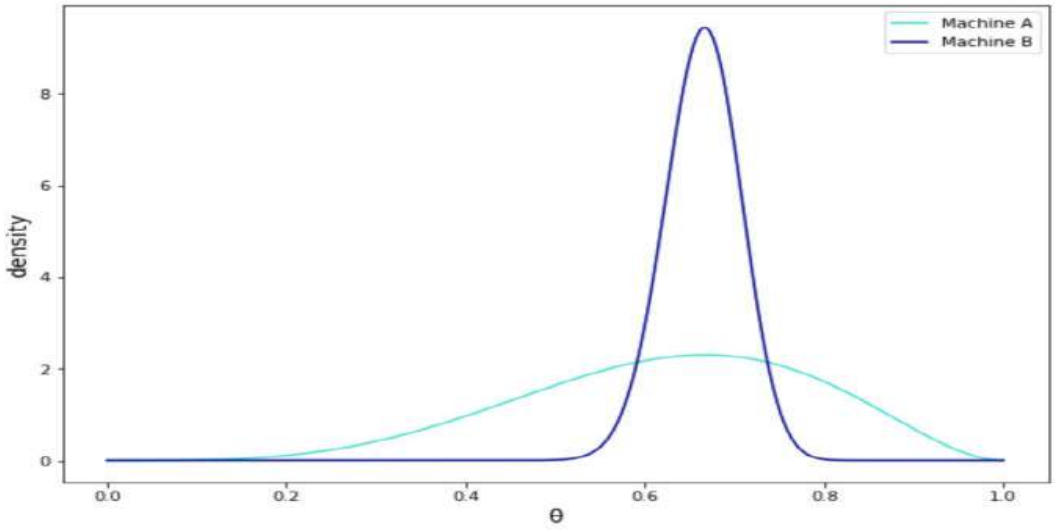
We begin by evaluating the accuracy of predicting the power output of an individual panel using neighboring panels. To evaluate the accuracy of model inference, we choose a test data only from the days where the site experiences no anomaly. We then use the normal days of the home dataset to train our linear regression and graphical model. We also compare their performance with a naive approach that infers the power output of a panel as the mean output of n other panels. We then compare the model predictions using a test dataset and compute the MAPE values for each approach.



As shown in Figure 13, the MAPE values for Bayesian model, linear regression, and naive approach are 3%, 4%, and 8.6%, respectively. The naive approach has the worst accuracy since it all panels produce similar output, which is not true in many cases due to panel level variations. Linear regression works well when the output of different panels is highly correlated and have a linear relation between them, which is not true when some of the panels experience partially shading. Our graphical ensemble learning approach is able to model non-linear relationships and yields highest accuracy and a tight confidence interval. We use the graphical model for the subsequent experiments, unless stated otherwise. Next, we evaluate model accuracy for different amounts of training data. If a model requires a lot of training data for good accuracy, it can hinder its use for solar sites that have been recently deployed or for the sites where long-term panel level data is not available. We vary the training data size (by randomly choosing a certain number of days) and evaluate its ac- curacy for predicting output using a test dataset. Figure 14 demonstrates that our model can achieve a decent accuracy and a 10% MAPE with only one day of per panel data. If the number of days is increased to 4, the MAPE drops to 3.5% and stays almost constant beyond four days. Results: Our graphical model can predict per-panel output with 2.98% MAPE and outperforms linear regression and a naive averaging approach. The random forest-based ensemble graphical model does a better job of capturing non-linear relationships among less correlated data than linear regression. While model accuracy increases with training data size, even only four days of training data yield good accuracy.

CONCLUSION

In this paper, we proposed SunDown, a sensorless approach to detecting per-panel anomalies in residential solar arrays. Our approach uses a model-driven approach that leverages correlations between the power produced by adjacent panels to detect deviations from expected behavior. Sundown can handle faults in multiple panels and determine the probable cause of anomalies. We evaluated SunDown using two year panel-level generation data from the from a real site and a manually gathered dataset of various faults. Our approach requires data from only 5 panels for accurate prediction, is agnostic to weather characteristics, and yields high accuracy even when panels from different roof geometries are used. We show that our approach is accurate in predicting panel level output with a MAPE of 2.98% and can correctly classify anomalies with >97% accuracy. We released the per-panel dataset from the real site and the manually generated dataset of various faults for research use.

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Data Analysis to Provide Solution for Groundwater Management: A Review

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Abstract- *Groundwater resources are essential for providing drinking water to India's population of 1.35 billion, with approximately 80% of the population relying on groundwater. However, the rapid growth in usage of groundwater has put significant stress on the resources, leading to potential adverse consequences such as drought and loss of plumage in agriculture and domestic water supply. Water managers need to be more cautious in managing these resources and take steps to mitigate the risks associated with them.*

This review paper proposes a groundwater monitoring system based on prediction using data- driven models such as Artificial Neural Networks (ANN's) to provide a solution for predicting future groundwater levels in India. The proposed system uses a set of popular data-driven models such as ANN's to provide predictions of groundwater levels in a simplified manner. The feasibility and capability of the model are explained in detail, highlighting its potential for providing accurate predictions of groundwater levels in India.

Keywords- *Groundwater, Data Analysis, ANN, Prediction etc.*

INTRODUCTION

The depletion of groundwater, a critical source of drinking water in many regions, is not solely due to natural factors, but also to human activities. Excessive usage and extraction have led to a rapid decline in water levels in various parts of the country over the last two decades. In addition, India's rapidly growing population and changing lifestyles have also increased the domestic water demand, while industries require more water. The situation is alarming as the country heavily relies on groundwater, with around 80% of its population depending on it.

To address the issue of declining groundwater levels caused by human activities, it is essential to implement an effective monitoring system that can identify regions experiencing water scarcity beforehand. Such a system would play a crucial role in ensuring that proactive measures are taken to mitigate the adverse effects of groundwater depletion, which can have significant impacts on the environment and the livelihoods of people who rely on it for their daily needs.

The proposed monitoring system aims to provide reliable and accurate predictions of groundwater levels, which can help water managers take necessary actions to mitigate potential water scarcity.

In rural areas where water scarcity is a common problem, accurately predicting groundwater levels is crucial in achieving the goal of implementing an effective monitoring system. Reliable predictions can help local communities and authorities plan ahead and take proactive measures to prevent or mitigate the impacts of water scarcity. With the help of advanced technologies and data-driven approaches, it is possible to develop accurate models that can predict groundwater levels with high precision, enabling timely interventions to ensure adequate water supply in these regions.The traditional approach to

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predict groundwater levels involves using physical models that require a comprehensive understanding of the geology and hydrology of the region. However, these models can be expensive and time-consuming.

The proposed system utilizes the concept of machine learning to develop a monitoring system that can predict groundwater levels accurately and efficiently. Machine learning is a subfield of artificial intelligence that enables computers to learn from data and make predictions without being explicitly programmed. The data-driven model will be used to identify the process without ensuring the proper input and output. The next step will involve collecting data about groundwater, such as rainfall conditions, weather conditions, and the depth of the water level.

LITERATURE SURVEY

The prediction of groundwater level (GWL) is a complex task that is influenced by various factors, including over-exploitation, hydrogeological properties, and dynamic variations. In recent years, researchers have proposed different models to predict GWL, including machine learning (ML) and mathematical models. These models are designed to match the accuracy and complexities of estimating GWL under different hydrogeological and structural properties. Soft-computing techniques, such as Artificial Neural Networks (ANN), Support Vector Machines (SVM), and Adaptive Neuro-Fuzzy Interface Systems (ANFIS), have been extensively used for predicting hydrological parameters due to their low computational complexity, high precision, fast training, and performance times, among other factors.

Several studies have proposed hybrid models for predicting GWL using ANN and other techniques. For example, one study proposed a hybrid prediction model based on ANN and wavelet theorem to predict GWL fluctuations in Canada. The model considered monthly recorded temperatures as inputs. In another study, feed-forward ANN was compared with the conventional regression model for estimating GWL in one-hour time intervals. Similarly, ANN and ANFIS models were developed to predict and simulate GWL in Iran, considering three parameters as input: a flow of irrigation returned, predictionrate, and pumping rate. The ANFIS model was found to perform better than ANN.

Furthermore, a study applied ANN and SVM techniques to predict GWL based on borehole data from five stations in the Republic of Korea. The SVM model was found to be more accurate compared to the conventional ANN model. Another study used ANN and SVM to predict water table depth in the United States. The authors compared the performance of both models and found that the SVM model outperformed the ANN model in predicting the water table depth.

In conclusion, the literature survey highlights the strengths and weaknesses of existing GWL prediction models, including the use of ML and mathematical models. Soft-computing techniques, such as ANN, SVM, and ANFIS, have been widely used for predicting hydrological parameters due to their efficiency and accuracy. Hybrid models based on ANN and other techniques have been proposed, and the performance of ANN and SVM models has been compared. These studies provide a valuable reference for the proposed design of the groundwater monitoring system based on prediction in this paper.

METHODOLOGY

The proposed groundwater monitoring system is based on the application of machine learning techniques, particularly Artificial Neural Networks (ANNs). ANNs are a subset of machine learning algorithms inspired by the structure and function of the human brain. They consist of interconnected layers of artificial neurons, which can learn and recognize patterns from data through a process of training.

In this study, ANNs are used to predict the groundwater level in India based on certain input parameters. The input parameters used in this study include rainfall conditions, weather conditions, depth of the water level, and other relevant hydrological factors. The number of neurons in the input layer of the network is equal to the number of independent variables, while the number of neurons in the output layer is equal to the number of dependent variables.

The ANN model used in this study consists of multiple hidden layers, which are responsible for learning the patterns in the

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input data and producing the desired output. The weights and biases of the network are optimized during the training phase, which involves feeding the network with a set of input and output data and adjusting the weights and biases to minimize the prediction error.

CONCLUSION

In conclusion, the prediction of groundwater levels is a crucial task that requires constant monitoring, particularly in areas that are experiencing rapid population growth and changing lifestyles. The development of machine learning models, particularly artificial neural networks, has revolutionized groundwater level prediction and has been proven to be effective in accurately forecasting groundwater levels. However, the existing groundwater level prediction models still have some limitations due to factors such as improper extraction, dynamic variations in hydrogeological properties, and over-exploitation. Therefore, a detailed literature survey is necessary to highlight the strengths and weaknesses of the existing models.

Advancements in wireless networking infrastructure have made it possible to obtain timely data to accurately predict groundwater levels. However, to develop a complete, accurate, and practical solution to real-time groundwater monitoring, all components of the system must be developed and integrated efficiently. The proposed solution in this paper addresses the immediate needs of groundwater research and provides a test bed for future research in environmental monitoring. By implementing this solution, researchers can better understand the complex dynamics of groundwater levels, identify areas that are at risk of drought or loss of plumage, and take appropriate measures to ensure sustainable water usage for the future.

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Black spots at Amravati City and Proposal of Mitigation Measures: A Comprehensive Review

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Abstract *Road accidents are increasing rapidly in India with the increase in traffic density. Due to which there is a huge loss of life and property. The location of road where the maximum number of accidents occurs is known as a Black Spot. In this review paper the location is consider for study is from, "Amravati Welcome point to Badnera Y point". The annual, monthly, hourly variation of accident rate on the road and vehicles involved in fatalities have been presented. The route is divided into 5 stretch. The stretch is around 19 km from "Amravati Welcome point to BadneraY point". Finding out the reasons/causes for those accidents and to suggest mitigation measures in order to reduce accidents and if possible to eliminate the causes which contribute to the accidents. In this study it is mention that why accidents occur on those places reasons of accidents and suggest mitigation measures to reduce accidents in those stretch.*

Keywords: *Black zones, Black spots, Accident frequency, Accident severity*

INTRODUCTION

Road network of a country is one of the most important factors responsible for the economic and social development of that country. India has a high population and requires a large amount of transportation services like air, land and water transportation. Road network is the only means of transportation which has deep penetration in all areas and responsible for door to door service. Road safety is an issue of national concern, considering its magnitude and gravity and the consequent negative impacts on the economy, public health and the general welfare of the people. Today, RoadTraffic Injuries are one of the leading causes of deaths, disabilities and hospitalizations, with severe socioeconomic costs, across the world. Hence it is very important to increase and maintain the road network of our country. Maharashtra is one of the fastest growing states in India. In this study we are going to see the accident rate due to blackspot in Amravati city. In Amravati city we have consider 5 stretch to check the accidents at those stretch. 1st stretch is from "Welcome point Amravati to Irwin Square", 2nd stretch is from "Irwin square to Rajapeth police station", 3rd stretch is from "Rajapeth police station to Sai Nagar", 4th stretch is from "Sai Nagar to Old Town Badnera", and 5th stretch is from "Old Town Badnera to Badnera Y point". The stretch is around 19 km from "Welcome Point Amravatito Badnera Y Point". Finding out the reasons/causes for those accidents and to suggest mitigation measures in order to reduce accidents and if possible to eliminate the causes which contribute to the accidents.

Black Spot

An accident black spot is a term used in road safety management to denote a place where road traffic accidents have historically been concentrated. Black spot methods are designed to identify the prone spots in particular stretch and reduce the crash risk in that area by providing remedial measures. Identification of locations for safety improvementis the starting point of all the processes. The process is sometimes known as black spot identification or hazardous identification location. Generally black spot are termed to define the location where many accidents have occurred and risk (severe, major, and minor) is involved in that accident. There is no universally accepted definition of a Black spotto the best knowledge of the author. The terms "hazardous location" and "high accident locations" often used as synonym.

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LITERATURE REVIEW

Apparao G, et.al (2013) In some countries where the economies are weak, it becomes crucial for those concerned with developmental policies to adopt approacheswhich will ensure that every single cent available is used to develop the country. In those fields to facilitate a conductiveenvironment for economic development. Road traffic accidents have been recognized as one of those adverse elementswhich contribute to the suffocation of economic growth in the developing countries, due to the high cost related to them, hence causing social and economic concern. So Traffic safety is an important key and integral role in sustainabletransportation development areas. Now days, the main negative impact of modern road transportation systems are injuries and deaths in road accidents. The success of traffic safety and highway improvement programs hinges on the analysis of accurate and reliable traffic accident data. This study discuss the present state of traffic accident informationon NH-58 from Meerut to Muzaffarnagar in Uttarakhand State. It shall also discuss the Identification of high rate accident Locations by using GIS Software and safety deficient areas on the highway. So, implement the remedial measures to those accidental locations (Black Spots) and provisions for traffic safety

Liyamol Isen, et.al (2013) An Accident is a rare, multifactor event preceded by a situation or eventwherein one or more road users failed to cope with road environment results vehicle collision. The location in a road where highest number of traffic accidents occurs is called a Black Spot. The recent study conducted by the Kerala Road Safety Authority (KRSA) found that, the maximum numbers of accident-prone stretches or the black spots are in Alappuzha and Ernakulam districts. The present study attempts to identify the most vulnerable accident black spotsin these two districts using Geographic Information System. The study includes collection of secondary accident data and prioritizing the accident prone locations by using Weighted Severity Index (WSI) method. WSI method follows asystem of assigning scores based on the number and severity of accidents in that particular location in the last three years. The evaluation of six identified black spots in Alappuzha district and ten in Ernakulam were done using ARCGIS
10.1 software package by incorporating field survey data.

Nikhil.T.R, et.al (2013) The simultaneous increase of population results in rapid and extensive increase of motor vehicles in the country. It has faced many problems in traffic management; the major issue is Road accidents. The factors of the current scenario are Human, Vehicle and Road. As a matter of fact, to control the issue, road is preferable than Human and vehicle. This paper deals with the identification of Blackspots and improvements to the specific locations in terms of geometrics of road. The procedure described is based on recorded accidents, data about accidents and traffic volume. Finally, the evaluation of the proposed remedieswill be simulated using vissim software. It is observed during the study that the Gorgunte Palya and Jalahalli Junctions were already declared Black Spot / accident zone. From the accident data we also observed that the accidents are increasing Inadequate sight distance, road condition, poor visibility at night, drivers negligence etc.

Snehal Bobade, et.al (2016) National highways and expressways are considered as main veins for the development of states in the country. On theother hand it has been observed that more than 13 peoples are dying in the road accidents per hour all over the world.Government of India formulated Accidental Prevention Committee (APC) in the year 1997 for identifying accidental prone spots on the rural highways of the state and suggested the suitable remedial measures for reducing the accidents. The Yeshwantrao Chavan Expressway (Mumbai - Pune Expressway) has witnessed large number of accidents since itbecame fully operational in April 2002. According to daily DNA, dated April 3, 2012, there were 11,057 accidents in 10 years of its existence. The PWD (Public Works Department) Government of Maharashtra state had undertaken the improvement of such accidental prone spots which generally designated as the black spots on highways. But little research has been done till day on prevention of accidents. The paper deals with study and identification of accidental black spots on Pune-Solapur National Highway (NH9) and Mumbai-Pune Expressway by method of ranking. Readingstaken on Pune-Bangalore Highway from 820 km-830 km are analyzed by Ranking Method, in method of ranking according to importance of parameter (i.e. parameter which is responsible for occurrence of more number of accidents)the rank and weightage are given. The percentages after giving rank and weightage are calculated and on the basis of value of percentage the accidental black spot is identified. By considering all these parameters by using Ranking Method accidental black spots can be identified. It is clear that skidding, grievous injuries and over speeding are responsible for occurrence of more number of accident.

Maen Ghadi, et.al (2017). Indicating road safety-related aspects in the phase of planning and operating is always a challenging task for experts. The success of any method applied in identifying a high-risk location or black spot (BS) on the road should depend fundamentally on how data is organized into specific homogeneous segments. The appropriate combination of black spot identification (BSID) method and segmentation method contributes significantly to the reduction in

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false positive (a site involved in safety investigation while it is not needed) and false negative (not involving a site in safety investigation while it is needed) cases in identifying BS segments. The purpose of this researchis to study and compare the effect of methodological diversity of road network segmentation on the performance of different BSID methods. To do this, four commonly applied BS methods (empirical Bayesian (EB), excess EB, accident frequency, and accident ratio) have been evaluated against four different segmentation methods (spatial clustering, constant length, constant traffic volume, and the standard Highway Safety Manual segmentation method). Two evaluations have been used to compare the performance of the methods. The approach first evaluates the segmentation methods based on the accuracy of the developed safety performance function (SPF). The second evaluation applies consistency tests to compare the joint performances of the BS methods and segmentation methods. In conclusion, BSID methods showed a significant change in their performance depending on the different segmentation method applied. In general, the EB method has surpassed the other BSID methods in case of all segmentation approaches.

Athira Mohan, et.al (2017) The simultaneous increase in population and the number of vehicles led the road authorities to get more focus on the road safety improvements. According to the recent road accident data, the highly populated Maharashtra state has reported the highest accident rate which calls for the need of safety improvements. For this purpose, Identification of accident prone location is considered as the first step in road safety improvements. This paper mainly aims to identifythe accident prone locations along Amravati- Nagpur road stretch from Asian highway 46. The top accident prone spots were selected as black spots based on Weighted Severity Index Method and some suggestions are made to improve the transportation system

Anjali. M. More, et.al (2018) India is a developing country and road safety of is still in a premature stage. An Accident is the result of a combination of factors such as road defects, human error, engineering defects of the vehicle, non-availability of pedestrian facility, cyclist facility, circumstantial factors such as weather condition, visibility etc. Accident causes death, disablement, damage to property and health, social suffering and also general degradation of the environment. The location on a roadway where the traffic accidents often occur is called a black spot. A case study was taken on NH-6 of Amravati district in Maharashtra state. The main problems on this road are bad condition of road and shoulder, trees and poles on the shoulder. The safety deficiencies were detected to minimize accidents on road and save the road users. The deficiencies along with the measures for further improvement had been presented in this paper.

Dinesh K Yadav, et.al (2021) With increase in traffic volume across the globe traffic safety has come into highlight and become a majorconcern. Apparently, with due increase in traffic volume resulting in higher road accidents which considerably causesnegative impact on economic growth, public health and general welfare of wellbeing. In the present scenario challenges are faced to mitigate the traffic volume and by making road users aware with road safety parameters which may resultsin less road fatalities. The root cause of an accidents intends to perception, intellection emotion and violation. The approach towards this research is to get minimal setback/casualties of the road. In order to gain the best possible courseof action, the stretch of 8 KM of National highway (NH-66) situated in a plain terrain in the district of Alapphuza, Kerala India. To begin with, accident data has been collected from NHAI office and Police station of above location with proper analysis by Accident Severity Index (ASI) method has been carried out. Adding to an idea, location of Black Spot has been identified by ASI method. Based on Severity of accident short term and long-term measures has been adopted. Eventually, after analyzing short term measures 10 black spot location along with the estimate has beenworked out.

CONCLUSION

The identification and analysis of accident black spots help in identifying the stretches where accidents are more and these spots reduce the road safety in general. The spot on the road where traffic accidents frequently occur is termed as black spots. The current study was an attempt to find out the most vulnerable accident locations or black spots in stretch.

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A Study of Customer Satisfaction in Public Transportation System

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***Abstract: The** purpose of the study is to examine the factors measuring customers' satisfaction, especially the impact of service quality on customers' satisfaction in public transportation. Regional private transport operators could withstand in the market and variety of new private operators are emerging continuously. The present study throws light on knowing customer satisfaction levels and developing a model for customer choice variables leading to satisfaction. The study tries to establish relation between variables of Empathy, Value added services, Customer Choice with Customer Satisfaction. The study was carried from last decade under different districts of AP, Telangana & Karnataka. The findings of the study are, various independent variables like Value added services, Customer Convenience, Empathy, Reliability, Online, Customer comfort & Choice , Assurance, service value & Enhancers which were identified as reasons for choosing private service operators, even proved to be leading to satisfaction of Customers.*

***Keywords:** Satisfaction, Operators, Empathy, Reliability, Online, Enhancers*

INTRODUCTION

India's transport sector is large and diverse. it caters to the needs of 1.1 billion people. The sector contributed about 5.5 percent to the nation's GDP, with road transportation contributing the lion's share. Good physical connectivity in the urban and rural areas is essential for economic growth. Since the early 1990s, India's growing economy has witnessed a rise in demand for transport infrastructure and services. However, the sector has not been able to keep pace with rising demand and is proving to be a drag on the economy. Major improvements in the sector are therefore required to support the country's continued economic growth and to reduce poverty. Roads are the dominant mode of transportation in India today. They carry almost 85 percent of the country's passenger traffic and more than 60 percent of its freight. The density of India's highway network at 0.66 km of roads per square kilometre of land – is similar to that of the United States (0.65) and much greater than China's (0.16) or Brazil's (0.20). However, most roads in India are narrow and congested with poor surface quality, and 33 percent of India's villages do not have access to all-weather roads.

Objective

The corporation's main objectives are:-

1. To provide efficient, adequate, economical, safe and well-coordinated passenger transport service.
2. Through the development of transport facility, development of this virgin Desert Land for our national economy.

LITERATURE REVIEW

K.Rajesh Sam, Dr. S. Suneetha, Dr. I. Lokananda Reddy (2021): A study on customer satisfaction in private operators across interstate transport. It was found that in the presence of all the dependent variables, the factors like 'empathy', 'reliability' 'Assurance' and 'Customer comfort' are found significant with their p value less than 0.05, leading to satisfaction of customers of Private Service operators.

The factors like 'value added services' 'convenience', 'customer choice' 'service value' 'Online access are found to be insignificant, couldn't influence much the construct of Customer Satisfaction. The value of regression analysis specifies that all independent constructs put together 48.5% customer satisfaction, left with scope for identifying other constructs that result into customer satisfaction in. Among the independent variables, value added services, service value etc.

Rabiul Islam, Mohammed S. Chowdhury,Mohammad Sumann Sarker and 1Salauddin Ahmed(2014): Measuring Customer's Satisfaction on Bus Transportation. To summarize, the present paper tried to reveal the important factors measuring customer satisfaction in Bus transportation services provided by HBR in the city of Sintok located at the province of Kedah, Malaysia. Findings indicate that satisfaction in customers varies in line with the service dimensions which affect total satisfaction. More precisely, the results indicated that customers present a moderate to strong level of satisfaction along the line of service dimensions. The sub criteria route safety, service of personnel, service inside the bus comprises the strong points of the company. The overall result show that service quality attributes influences overall customer satisfaction in using public bus transport. High quality public bus transport not only keep customer to continue using public bus transport to fulfill their travel demand but also attract potential customer. The examination of the literature provide some interested results.

Rida Khurshid ,Dr. Hummayoun Naeem, Sana Ejaz, Faiza Mukhtar, Taha Batool (2012): Service quality and customer satisfaction in public transport sector of Pakistan. An empirical study customer satisfaction is considered to be the most important factor whether it is meant for a product or a service. In case of failure to satisfy customers, company will be replaced by others and when industries offering various services,have to be more vigilant because there is a special attitude that plays an important role attracting and retaining thecustomers. Keeping this in view, the researchers intended to highlight the current issues of transport sector in Pakistan. That how service quality effects customer satisfaction. For this purpose, a convenient sample of 120 respondents was selected (60 male and 60 Female) and data collection tool for all the variables (service quality and customer satisfaction) was used from the body of knowledge to check how do they feel about this service. Regression coefficient was used to analyze two independent sets of data. The empirical analysis proved that there was a positive relationship between service quality and customer satisfaction in the public transport sector of Pakistan.

Dr. V.M. Anitha rajathi, R. Vijaya Kumar (2021): A Study on Customer Satisfaction on Government Buses with Special Reference From Trichy To Chennai. This study discuss about the customer satisfaction on government buses with special reference from Trichy to Chennai. To identify the difficulties faced by the customers in the government buses and measure the satisfaction level, analyse and suggest some measure to improve the service quality in government buses from Trichy to Chennai. This study analysed with 50 respondents were taken in the area Trichy central bus station selected by convenience sampling method. Analysis was made by the use of statistical tools like chi-square, percentage and correlation test. This research undoubtedly shows the level of customer satisfaction towards government buses special reference Trichy to Chennai.

Mohd Faizun Mohamad Yazid, Aeshah Mohd Ali, Sanusi Abdul Manaf (2020): customer satisfaction in public transport service. This research evaluates customer perceptions towards service quality in the public transport services in Kuala Lumpur, Malaysia. Five dimensions from the service quality were measured to identify which dimensions play essential roles in customer satisfaction. The research uses questionnaires to collect data. 300 questionnaires were distributed among the people who commute daily using public transport. Data collection was done at the selected bus station and based on convenience sampling. 221 usable questionnaires were collected for data analysis using Smart PLS. The results indicated that only reliability and tangibles are significant towards customer satisfaction, while the other three dimensions are not supported. The service provider can use the results to study customer perceptions of their services. It can be used to improve their services and gain more trust from the customer.

Vinayak Shivaji Salokhe, Prof. (Dr.) Omprakash Haldar (2022): Passenger's perception and satisfaction towards public transport. study on literature review Transportation is an essential component of human life as well as any country's economic life. Commerce, agriculture, and the service industry all rely on it to survive. It aids in the movement of people and objects from one location to another. A well-functioning transportation network is a must for a rising country like India's future economic progress. Public services can be described as the provision of services or meeting the needs of individuals or groups with an interest in the organization while adhering to the organization's rules and procedures. Passenger's perception and satisfaction are associated with each other. Perception is a user's assessment of a service after utilizing it and comparing it to what he expected and experienced previously. People pick, organize, and interpret information to construct a meaningful image of the

world through perception. The same stimulus can be perceived differently by various people. And satisfaction is determined by how customers perceive public transport services.

Khushbu Arora and A. Lenin Jothi (2016): An Empirical Study on User Satisfaction in Public Transport System. With the increase in population in metro cities and specially being the capital of India, Delhi-NCR is facing many problems in adjusting with the increasing population. Public transportation is a conveyance that provides continuing general or special transportation to the public and show that public transportation plays significant role as it improves the quality of our day to day life by expediting traffic saves money and creates new jobs. The specific objective of this study are to study the satisfaction level of the various users of public transportation system and identify the most influencing determinants of satisfaction and the impact of gender and age on the level of satisfaction on public transportation system. Sample size of 200 was taken for this research and 192 responses were qualified for research. It is found that satisfaction level between male and female customers of public transport system are significantly different in Staff service. Proper network connection, Adequate service frequency, Convenient time schedule, Safety measures from accidents, Cleanliness of the vehicle and Staff service are the factors for which there is significant difference between different age groups in level of customer satisfaction.

Adler Hilary Laisak, Anita Rosli & Nurzalikha Sa'adi (2021): The Effect of Service Quality on Customers' Satisfaction of Inter-District Public Bus Companies in the Central Region of Sarawak, Malaysia. Service quality is a vital factor that influences customer satisfaction. For profit organizations such as public bus companies, high customer satisfaction is a sign for business success and the ability to create long-term relationships with their customers. This research is to assess the effects of service quality attributes on customers' satisfaction towards service quality provided by inter-district public bus companies in the Central Region of Sarawak. A total of 400 respondents were obtained among inter-district public bus users through a convenient sampling method. The mean score for customers' satisfaction was 2.24, which means the level of customer satisfaction towards the service quality of inter-district buses in the Central Region was low. Meanwhile, the result from the multiple regression analysis showed that service quality dimensions of empathy, assurance, and responsibility had significant effects on customers' satisfaction. The inter-district public bus companies in the Central Region of Sarawak should improve their service quality by building and obtaining customer trust to keep existing customers and at the same time to attract potential customers. Good customers' experience towards service and the power of word mouth are marketing tools to enhance business reputation relative to other competitors.

Sobanah Dhevi Tharmalingam, Sai Mei Ling , Vikniswari Vija-Kumaran, Kalai Vani Kalimuthu, Suresh Nodeson (2022): This paper reports the customers' satisfaction about public transportation service in Penang, Malaysia. In this respect, some of the factors namely reliability, accessibility, safety and security are used to measure the customers' satisfaction on bus service Rapid Penang, Malaysia. A survey was conducted where questionnaires were distributed to 500 bus passengers. The results of the study indicates that reliability, accessibility, safety and security of bus service are positively significant to customer satisfaction. The contribution of the study creates better understanding of the service provider the factors that able increase customers' satisfaction and base on the knowledge they able to improve their services and gain the customers' trust.

Lu Gao ,Yao Yu, Wuling Liang (2016): Public Transit Customer Satisfaction Dimensions Discovery from Online Reviews. Online user-generated content provides a valuable source for identifying dimensions of services. This study proposes a framework for extracting the dimensions of consumer satisfaction of public transportation services using unsupervised latent Dirichlet allocation model. A pilot study was performed on 17,747 online user reviews collected from 1452 public transportation agencies in the United States over 8 years. The proposed approach is able to identify a few dimensions that were not discussed in the previous literature. This research also provides an alternative method to collectively gather users' feedback and efficiently preprocess textual data related to transit customer satisfaction

Luong My Linh , Nguyen Quoc Nghi , Dinh Hoang Anh Tuan (2021): Factors Affecting Customer Satisfaction with the Bus Service Quality of Phan Thiet Automobile Transport Cooperative This study aims to determine the factors influencing customer satisfaction with the bus service quality of Phan Thiet Automobile Transport Cooperative. Research data are collected from 290 customers who regularly use bus services of Phan Thiet Automobile Transport Cooperative. Applying the exploratory factor analysis and multivariate linear regression, the research results indicate factors positively affecting customer satisfaction with bus service quality are trust, assurance, empathy, traffic culture, perceived value, quality of the station, and tangible facilities. In which, the perceived value puts the most impact on customer satisfaction with the bus service quality of Phan Thiet

Automobile Transport Cooperative.

Seyed Mohammad Mahmoudi, Fereydun Verdinejad, Gholamreza Jandaghi and Ali Mokhtari Mughari (2020): Analysis and establishment of bus rapid transit (BRT) on customer satisfaction in Tehran**.**This research aims at exploring and analyzing the Bus Rapid Transit (BRT) in passengers' satisfaction in Tehran City, which has been the huge event in public transportation. In doing this research, after exploration of models and approaches in service quality, Vahed Company, as public services organization, serves passengers and uses quality models that emphasize customer satisfaction. However, the conceptual model based on primary and sub hypothesis was designed. For gathering data, two questionnaires were used for BRT passengers and customers satisfaction. The research hypotheses were tested by a correlation test and all the hypotheses were verified. The sequences of priorities in passenger's satisfaction were driver's behavior, ergonomics, and bus velocity and service item. There was a significant relationship between passengers satisfaction and BRT quality. Also, it was concluded that drivers behavior item with mean of 1.99, bus velocity with mean of 2.04, ergonomics item with mean of 2.87 and service quality of BRT with mean of 3.10 were from first to fourth of the passengers' satisfaction priority, respectively.

M L Hamzah, A A Purwati, A Jamal , Sutoyo , M Rizki (2020) : An Analysis of Customer Satisfaction and Loyalty of Online Transportation System in Pekanbaru, Indonesia This study aims to determine themediating role of customer satisfaction in the relationship between customer trust and customer experience on customer loyalty in Grab transportation in Pekanbaru. The variables of this study include customer trust, customer experience, customer satisfaction, and customer loyalty. This research was conducted in Pekanbaru City. Data were collected through a questionnaire method which was filled independently of 400 respondents using the census / questionnaire method then analyzed by Structural Equation Modeling (SEM) with the help of SPSS 26.0 and Smart PLS 3.2.9. The results of the analysis prove Customer Trust has a positive and significant effect on Customer Satisfaction.

CONCLUSION

It was observed that the customer satisfaction is very important role in Public transportation system. It was found that in the presence of all the dependent variables, the factors like empathy, reliability, Assurance, Customer comfort, accessibility, safety and security are used to measure the customers' satisfaction on bus service. The results of the analysis prove Customer Trust has a positive and significant effect on Customer Satisfaction. Customer feedback and efficiently preprocess textual data related to transit customer satisfaction was main purpose of the service.

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Design and Fabrication of Pedal Powered BicycleWashing Machine

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Abstract: *In many developing countries it is not possible to machine wash clothes due to the lack of electric power or the absence of machine itself. Washing clothes by hand leaves one breathless and takes an awful amount of time. A washing machine is a machine designed to wash laundry. Generally, these machines are operated by electricity but pedal operated machine is human operated and totally eco-friendly. It can be used to save electricity and also get physical exercise when implemented in urban areas. In this project, we fabricated such a washing machine with both washing and rinsing mechanism.*

Keywords: *Bicycle Chain, Pedal Power, Rack And Pinion, Sprocket, Washing Machine*

INTRODUCTION

Pedal power is the transfer of energy from a human source through the use of a foot pedal and Gear system. This technology is most commonly used for transportation and has been used to propel bicycles for over a hundred years [1]. An individual can generate four times more power (1/4 HP) by pedaling than by hand cranking. At the rate of 1/4 HP, continuous pedaling can be served for only short periods, approximately 10 to 20 minutes. However, pedaling at half this power (1/8HP) can be sustained for close to 60 minutes but power capability can depend upon age. Conditions vary in developing countries, but women in many regions are washing clothes manually while they could be doing more profitable or rewarding work elsewhere. Women wash clothes by hand, using cold or lukewarm water that they carry from a river or pull up from a well which is a very difficult task. Existing technologies for washing clothes do not work well in underdeveloped rural areas. Indeveloping countries, rural women are among the least privileged

DESIGN SPECIFICATION

The most important aspect in the design of the machine is its ability to perform as a device that eases the task of washing clothes. In order to be a viable solution in rural areas, the machine should be able to deliver the same quality of washing without adding excessive overheads (in terms of water use, clothing wear, effort required to operate, etc.). Thus the design and operation of the machine should be firmly grounded in the physics of clothes washing, with a special emphasis on the mechanical aspects (since water temperature and detergent composition are likely to vary). A number of safety features should also to be included in order to mitigate the inherent safety issues involved in a chain-driven machine. If the machine was to be used in a home, insuring its portability of would allow it to be shared among families, transported close to a water source for operation or used in households where space is limited. Another set of specifications for load sizing, water usage and pricing, depend on the targeted community. Designs allowing for easy re-sizing were preferred.

- Cleaning: Machine-washed clothes must be as clean as those hand-washed for 5 minute
- Gentleness: Must wear clothes at slower rate than hand-washing
- Capacity: Minimum 2KG of clothes/load – should be easy to re-size
- Water usage: Maximum 10L water / 1kg clothes
- Active pedaling time for effective washing: Maximum 30 minutes for wash and 5 minutes for rinse cycle
- Total operation time: Maximum 1 hours, including fetching water, filling, washing, draining, and cleaning

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- Power: Maximum 75W (comfortable level of human-power output).
- Cost: Maximum Rs.5500 (comparable to cost of other machine.
- Dimensions: less than combined size of a bicycle and commercial washing machine.
- Materials: local (wood, wieldable metals, steel drum, bicycle parts, etc.)
- Weight: Maximum 22kg, or 40kg if it has wheels (1 woman can move it indoors so it can't be stolen or damaged)
- Culturally acceptable: Suitable appearance, user position and motion such that most women are willing to use themachine.
- Lifetime of structure: 3 years, assuming daily use

Several local organizations have already expressed an interest in pedal-operated technology. It is an affordable, environmental-friendly alternative to devices operated by electricity or fossil fuels. Since it is based on bicycle components, the machines can be manufactured locally and repair parts are affordable and readily available. Pedal operated washing is amachine, which does not require electricity for several operations like washing, drying, rinsing etc. The design is ideal foruse in the developing countries because it doesn't require electricity and can be built using metal bars for frame, chain, sprocket, bearing, foot pedal and a drum. The main advantage of a pedal operated powering system would be its ease of useby any person who is young or old. After loading the machine, the washing machine is designed to run in two cycles, eachwith its separate driving mechanism. The first is a rack and pinion mechanism that allows the drum to rotate back and forthalternatively to emulate a washing cycle. The operator applies relatively less power and the drum operates a slower rate. This action is carried out for an extended period of time as required, till the clothes are desirably clean enough. Once the clothes have been washed, the second mechanism, which is a chain sprocket arrangement to multiply speed of rotation, is engaged that rotates the drum at a higher speed for a brief duration and the centrifugal force thus generated squeezes the water out from the clothes and it is drained out through the outlet valve.

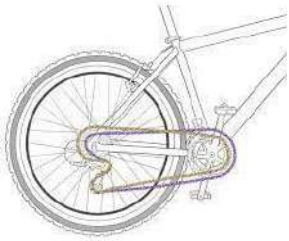
COMPONENTS

1) Seat

Seat is an arrangement in any bicycle on which a person can sit comfortably. Seat may be made of plastic, rubber, metaletc. The seat used here is of satisfactory softness and big enough for most users to use the machine without much fatigue. It has been borrowed from a regular bicycle that was designed for adults. A chair can be used instead of a bicycle seat for sitting and pedaling for making of clothes more comfortable [6].The seat we used in our machine

2) Pedal Arrangement

A bicycle pedal is the part of a bicycle that the rider pushes with their foot to propel the bicycle. It provides the connection between the cyclist's foot and the crank allowing the leg to turn the bottom bracket spindle and propel the bicycle's wheels. Fig.3 shows the pedal arrangement in our washing machine which used to transmit pedaling motion to the intermediate shaft.



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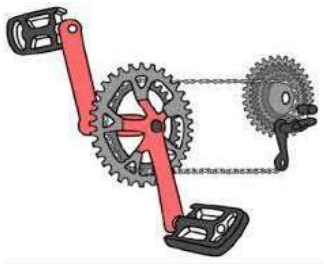
3) Gear

In POWM we are using two sprocket systems or circuits as shown in Fig.4 and Fig.5. The first circuit consists of the sprocket coupled to the pedal and another sprocket that is coupled to the intermediate shaft, where these sprockets are linked to each other with a chain. This circuit is used to provide continuous rotation in a single direction to the intermediate shaft.The second circuit consists of the intermediate shaft and the driving shaft that is coupled to the rotating drum. The drum isconnected to this intermediate shaft through two different mechanisms, one being a regular sprocket and chain arrangementand the other being a rack and pinion arrangement. The first mechanism consists of 2 sprockets, one coupled to the intermediate shaft and the other coupled to the rotating drum. These sprockets are in turn, connected by a chain.



4) Bearing

A bearing is a machine element that constrains relative motion between moving parts to only the desired motion. In POWM we used two bearings on the drum shaft to support the drum. These bearings are International Journal of Latest EngineeringResearch and Applications Page placed on either side of the drum shaft resting on a support on the frame of the machine. Bearings help in smooth rotation of the shafts thereby reducing the pedaling effort.

5) Chain

When creating your own human powered vehicles, a chain drive will likely be your chosen power transfer system, as it isan inexpensive, easy-to-install and highly efficient drive mechanism. Here in POWM we used a regular bicycle chain as shown in Fig.7. As mentioned above this system consists of two circuits, both of which need.

6) Hub

Hub is a part of cycle on which sprocket could be mounted on. In POWM we are using a Hub on to which the intermediate sprockets are mounted as shown in Fig.8. This helps in transferring pedaling motion of front sprocket to the drum shaft. TheHub used here is placed on the intermediate shaft. It carries 2 sprockets, one of which drives the drum and another which isconnected to the pedal. It is also coupled to the cam plate which drives the rack and pinion.

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7) Shaft

In the POWM, we used 3 shafts. The first shaft is coupled to the pedal and acts as a driving shaft. It also carries the pedalsprocket. The second shaft is the intermediate shaft that carries 2 sprockets and the cam plate: It has been designed so that only one mechanism is engaged at a time, thus allowing us to either pedal the machine in washing cycle or rinsing cycle. The third shaft carries the rotating drum and also the pinion and final sprocket.

8) Drum

It is the chamber in which water is filled with detergent further cloth is put inside it for rinse. In this type of machine, thereare two drum are used, inner &outer as shown in Fig

WORKING PRINCIPLE

The clothes to be washed are fed into the drum through the front door and water is allowed through the inlet. Detergent isadded and then the machine door is closed. The cleaning of clothes happens in two cycles namely washing cycle and spinning cycle. In washing cycle the clothes are washed due to tumbling action of the drum by the rack and pinion mechanism as shown in Fig. After the cycle used water can be let out through the outlet and clothes are ready for the spinning cycle. Fig. rack and pinion mechanism While in spinning cycle the water from the clothes are removed due to centrifugalforce of high speed rotating drum obtained by the chain and sprocket mechanism and thus the clothes are dried out. The pedal is directly connected to a chain sprocket mechanism that transmits the power to the intermediate shaft. The intermediate shaft can be switched between two modes namely a low speed to and fro mechanism for the washing cycle anda high speed rotation mode for rinsing cycle. The low speed mode consists of a simple rack and pinion mechanism that consists of a rack coupled to the pedal, and the pinion is the follower which is coupled to the rotating drum. The high speed mode consist of a direct coupling to a sprocket of smaller diameter than the pedal which would act as a speed multiplier andeffectively allows the user to rotate the drum at high speed thus draining the water out of the clothes due to high centrifugalforce, which simulates the rinsing cycle. The soiled clothes are placed inside a rotating inner perforated drum which in turnis placed inside an outer stationary drum. The stationary drum acts as a reservoir thus containing the water within it

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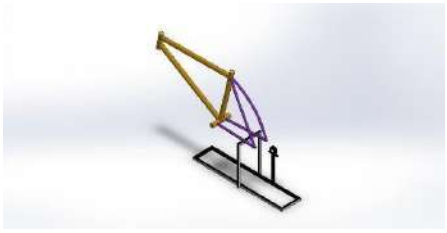
1 Auto CAD Design



CONCLUSION

A pedal-powered washing machine would allow women to wash clothes faster and with less strain. It can be use by man, woman, old people etc. When asked what they would do with their free time, women said that they would try to generate income by making crafts or food to sell. Young daughters who help their mothers with domestic chores may also have the opportunity to concentrate more on their studies. Laundromat microenterprises may even arise if pedal powered washing machines are successful. Conditions vary in developing countries, but women in many regions are washing clothes manually while they could be doing more profitable or rewarding work elsewhere. It is also helpful for maintaining fitness. We hope through our research and analysis we have designed or at least help clarify the design - concept of a pedal-powered washing machine. Hopefully in the near future, such helpful tools become a common addition to Cambodia villages and Third worldcountries.

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Mass Transport Study in Nasik City

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Abstract- *Population is increasing with time geometrically which results the expansions of the city as well as expansion in related infrastructure like traffic and transport. It is noticed that the mobility strength and mode is increased. So we felt need for a transportsystem which is able to transport maximum number of passengers in minimum duration of time. Mass Rapid Transit System (MRTS) is the solution for this problem. MRTS which may base on rail or bus is appreciableamong the world and must be a sustainable transport system. From 1863 to 2013 the MRTS is increasing with increase in tier of city in the hierarchy. Now 168 cities in 55 countries using this system.*

Key Words- *MRTS, Nasik Transportation Management, BRTS, Smart City, Sustainability.*

INTRODUCTION

Mass rapid transit (MRT) is defined as publicly accessible transport in urban areas that can transport a large number of people from one place to another. The selection of appropriate MRT modes is driven by factors such as the potential passenger market for public transport, the trip patterns of prospective users, and other socio-economic criteria. When a municipal planning body has to make decisions regarding which mode should be utilized to serve a community, it must base this decision on the following criteria:

- Ability of the mode to meet demand;
- Implementation cost;
- Environmental impact;
- Social equity impact;
- Cost to user;
- Journey time;
- Travel safety;

Factors of comfort and convenience including:

- Number of interchanges
- System Accessibility
- Flexibility
- Reliability

1. History of MRT modes

The need for MRT was realized when cities became major population centers and concentrations of economic activity during the industrial revolution. The London Underground, the first MRT system, started operations in 1864. In many cities, trams served as the main mode of public transport from the late 19th century to the early 20th century. Trams became prevalent after thewidespread availability of electricity.

Practically every large city in the world, including Nasik, had trams. Nasik's tramway (constructed in 1889) originated from what is now the Old Municipal Corporation building located on Main Road, and terminated at the Nasik Road railway station (a distance of around 8–10 km).14 The tramway originally utilized horse drawn carriages and then switched to petrol-driven railcarsunder the Nasik Tramway Company in the later 1910s.

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2. Aim of the Study

The aim of this mass transport feasibility study is to facilitate Nasik's sustainable development. That is, to provide a development strategy that meets the needs of present Nasik without compromising the ability of the city's future generations to meet their own needs. Nasik stands at a crossroad of history and development. It has the potential to become a commercial and cultural center and afford its citizens the possibility to reap immense benefits in the form of jobs, opportunities and improved quality of life. However, for this possibility to become a reality, Nasik will have to develop adequate infrastructure and services to facilitatethe development and improve the quality of life of all citizens rich and poor alike.

LITERATURE REVIEW

The literature is full of attempts to categorize these modes. They may be categorized in terms of,

- Their technology (bus/rail based), which influences aspects of service, quality, capacity, the ability to segment the market,and cost.
- Right of way exclusively, which determines speed and reliability.
- Grade separation, which allows new alignments, and strong influences cost.
- Guidance which may offer new alignment possibilities and other impacts.

I have reviewed the MRT systems actually operating in developing cities and have categorized them by technology and degreeof segregation which broadly translate into level of service, capacity and cost. Four generic forms of mass transit currently exist. These are defined for use in this study as follows:-

i) **Bus ways:-** These are unless otherwise stated at grade with horizontal protection from other traffic; often with priority over othertraffic at junctions, which are signalized.

ii) **Light Rail Transit (LRT):-** This is unless otherwise stated at-grade, with similar horizontal protection.

iii) **Metros:-**These are fully segregated, usually elevated/underground. It is the segregation that is critical to providing a rapidservice and the technology that allows a high mass ridership to be carried.

iv) **Suburban Rail:-** These services are physically part of a larger rail network, usually at grade and fully segregated by meansof controlled level crossings. I have limited the extent of my study to only one mode viz; Bus ways and have been discussed in the literature part.

METHODOLOGY

The study comprised the following phases:-

Phase I- Selecting Corridors: - Full analysis of metropolitan area including aspects such as population, socio-economic situation, urban layout & journeys in order to determine the corridors suitable for accommodating a public transport system.

Phase II- Selecting Technologies: - Study of four public transport technologies for the purpose of determining the two most suitable once (Mass Rapid Transit, Transit Oriented Development (TOD), Cycle Sharing, BRTS)

Phase III- Assessing the alternatives:- Comparative study of the technologies per corridors as regards investment costs, running costs, environmental impact, social advantages in terms of time savings for users or reduction of vehicle operation costs, one technology and one alignment were recommended for each corridors at the end of this phase.

1. Study area and data collection

Under a Memorandum of Understanding with NMC, the Institute for Transportation and Development Policy (ITDP) is assisting with the planning and implementation of sustainable transport systems and urban development practices in Nasik. This report aims to provide a clear analysis of Nasik's potential for implementing a high-capacity mass rapid transport system. It will provide a detailed description of how high quality transport systems can play a key role in meeting existing and future transport demand in the city. The ultimate goal of the paper is to be a useful reference for decision-makers to serve as the basis for applying for central government funding for advancing Nasik's urban development.

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To assess potential demand for MRT service in Nasik, Institute for transportation and development policy (ITDP) completed a detailed analysis of Nasik traffic at strategic locations in the city (Figure 01). Frequency-occupancy surveys of MSRTC bus and shared auto rickshaw passengers were conducted to estimate passenger volumes on major corridors. In addition, existing bus routes and shared auto routes were mapped.

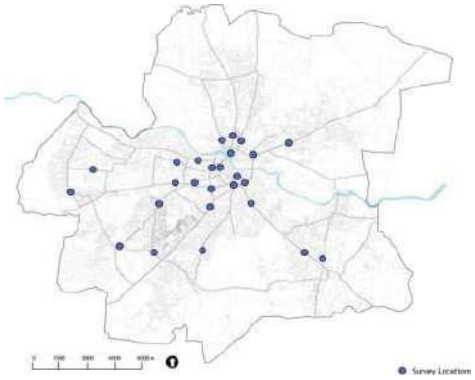

Fig. 1 Traffic count and frequency occupancy surveys

The traffic and frequency occupancy counts yielded a significant amount of data related to the way that Nashikars are currently mobile (See Figure 02). It was observed that per each survey location, the majority of travelers were either using bus (in yellow) or two wheelers (in orange). Across all locations, approximately 10 per cent (in blue) utilized shared and private auto rickshaws.

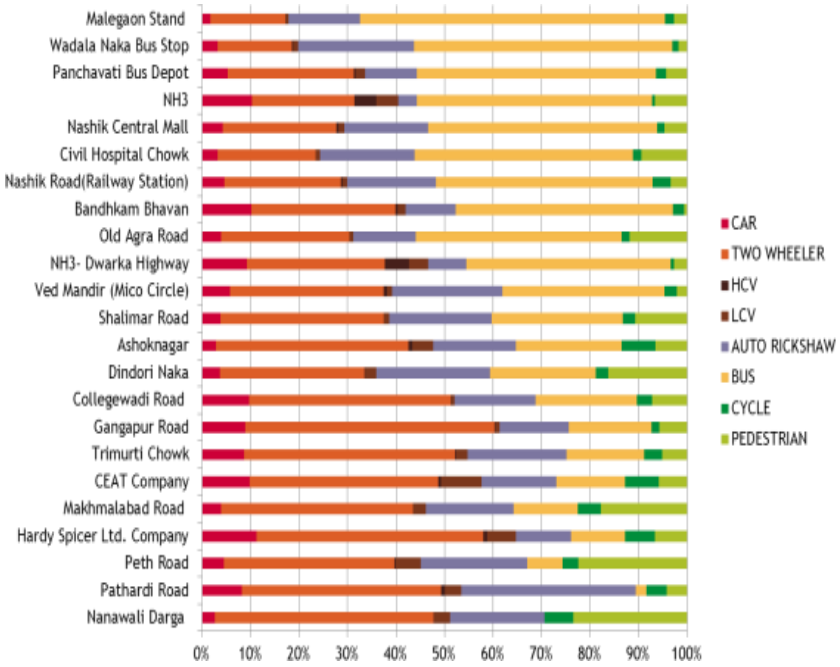

Fig. 2 Observed mode shares at select traffic / frequency occupancy survey locations

Thus, to implement a mass rapid transport system the existing network of services must be identified and analyzed. First,Institute for transportation and development policy (ITDP) completed interviews with MSRTC staff who provided a comprehensivelisting of all MSRTC local routes and stages (319 total) as well as a specific number of the local routes that were the most heavily utilized. The key routes and public transport passenger volumes were mapped to determine existing patterns of use and travel demand (fig. 3).

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Fig. 3 Key MSRTC routes (left) and observed peak period passenger volumes (right).

Next, the following diagram (Figure 04) from the 2008 CMP was reviewed. It is the result of a modeling exercise with travel demand data that were gathered through household surveys.

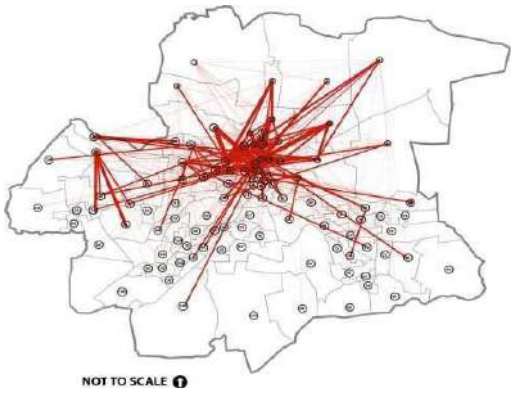

Fig. 4 Origin-destination chart with traffic analysis zones (TAZ) and desire lines (2008 Nasik CMP)

Fig. 4 represents the demand for travel between different locations in Nasik, represented by traffic analysis zones (TAZ). This theoretical set of origins and destinations shows a high concentration of travel demand from the periphery to the city core. As well, there is increased demand for travel between peripheral points on the western edge of the city. After reviewing the MSRTC and shared auto data, as well as the 2008 travel demand data, the following network of potential mass rapid transport corridors was developed.

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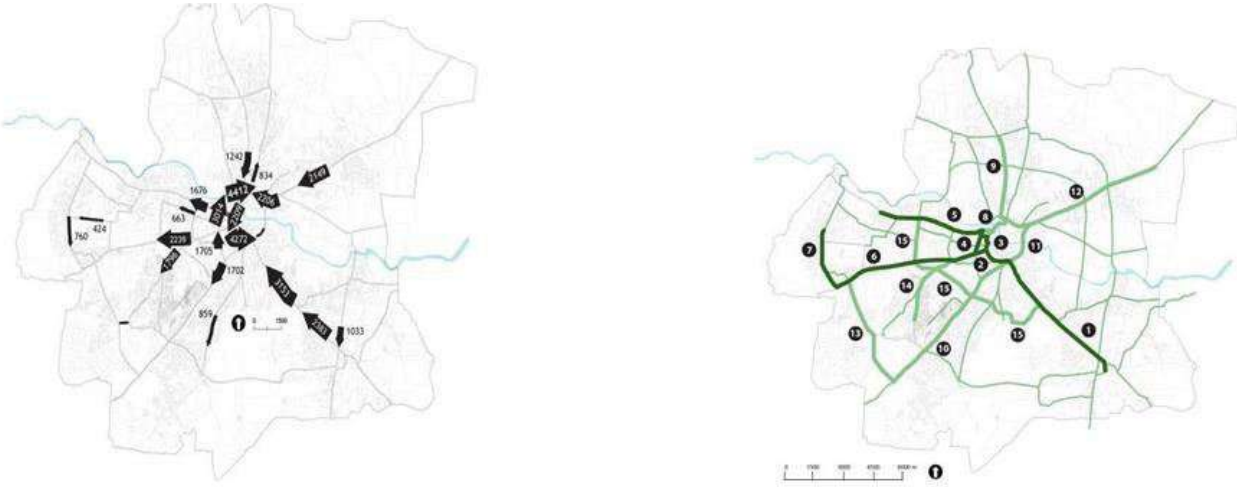

Fig. 5 Total MRT demand (top) and MRT corridors highlighting the highest demand / priority phase sections (bottom).

The location of each corridor is indicated by the ID number in Table 1

Table 1: MRT Corridors and ID Number (Report location key)

	MRT Corridors
1	Nashik Road (from Khadkali Signal to Nashik Road Railways Station)
2	Shalimar (Khadkali Signal) to Trimbak Naka (CBS)
3	MG Road (Meher Chowk) to Shalimar (Khadkali Signal)
4	Old Agra Road (From Ashok Stambh to CBS)
5	Gangapur Road (from Serene Meadows to Ashok Stambh)
6	Trimbak Road (from CBS to Shaneshwar Nagar)
7	Vishwatmak-Jangali Maharaj Road (from Shramiknagar to Shaneshwar Nagar)
8	MG Road to Nimani (via Malegaon Stand)
9	Peth Road (from Nimani to Ozar)
10	NH-3 (from Garware to Dwarka Circle)
11	NH-3 (from Dwarka Circle to Panchwati)
12	NH-3 / State Highway 17 (from Nimani to Adgaon)
13	Ambad-Sathpur Link Road (from Garware to Ambad Police Chowki)
14	Untwadi Road (from Mico Circle to Uttamnagar)
15	Proposed Inner Ring Rd (from Jehan Circle to Ambedkar Nagar via ABB Circle & Indiranagar)

COCLUSION

Traffic congestion has been increasing in Nasik city due to use of more private vehicles on road. Due to lack of public transport facility people switch to private vehicles such as rickshaw, two wheelers and car. Being selected in smart city mission asper norms the city should have Bus Rapid Transit System (BRTS) kind of public transport but looking at the present situation it seems very unlikely in the city where not even a city bus system is planned. As education facility has been increasing in Nasik city,the number of education trips are also increasing on high rate as now a day's mostly student prefer bikes or other two wheeler for education trips because of that traffic congestion also increase in city and moreover students of colleges and government employees, and District Court usually travel by rickshaw, diesel auto or their own private vehicles which also increase traffic problems in peakhours in Nasik city. The pollution level of Nasik city is on curse due to more use of private vehicle so to reduce pollution and sustainable development, city bus system is required. The population of Nasik city is increasing rapidly, as population is growing requirement of city bus service is necessary.

MRT as proposed in this report has the capacity to transform public transport in Nasik into a truly world class

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system. By providing citizens with high quality and environmentally and economically sustainable public transport, NMC can ensure that the city's is able to provide convenient access to all as the city grows The MRT,BRT system can integrate the city core with expandingareas in the periphery, helping to structure growth along corridors with good public transport access. Sustainable transport is key tosecuring a vibrant and prosperous future for Nasik.

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256 PSK Modulation over Various Channels for MIMO –OFDM Wireless System using Receive Beam forming: Performance Evaluation

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Abstract: *The smart antennas are widely used for wireless communication, because it has a ability to increase the coverage and capacity of a communication system. Smart antenna performs two main functions such as direction of arrival estimation (DOA) and beam forming. Using beam forming algorithm smart antenna is able to form main beam towards desired user and null in the direction of interfering signals. In this project Direction of arrival (DOA) is estimated by using MUSIC algorithm. Receive Beam forming is performed by using LMS and LLMS algorithm .In this Paper, in order to perform secure transmission of signal over wireless communication we have used chaotic sequences. This paper evaluates the performance 256PSK over Different channels for MIMO-OFDM wireless system using beam forming with and without LMS and LLMS algorithm. The simulations are carried out using MATLAB.*

Keywords: *OFDM, MIMO, MUSIC, LMS, LLMS, 256PSK, Beamforming*

INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is a multicarrier modulation scheme that combines a large number of low data rate carriers into a composite high data communication system. Unlike in many other modulation techniques, the addition of cyclic prefix to the OFDM symbols combats the inter symbol interference and the orthogonality of the carriers allows it to combat Intercarrier interference in the OFDM modulation technique. Acknowledging these advantages, OFDM is the most preferred modulation technique in most of the next-generation wireless communication networks for transmitting many forms of digital data with higher efficiency. This paper aims at evaluating the performance of 256 phase shift keying (PSK) techniques over various channels. To minimize the interference from different directions, smart antennas can be used at the receivers which form the beam in the direction of the incoming multipath and reject the interference coming from other directions. In a wireless communication scenario, transmitted signals often propagate via just a few distinct paths, for example via a line-of-sight path between transmitter and receiver and/or via paths that are associated with significant reflectors and diffractors in the environment (such as large buildings or mountains). If the directions of these dominant propagation paths are known at the receiver side, beamforming techniques can be applied, in order to adjust the receiver beam pattern such that it has a high directivity towards the dominant angles of reception. By this means, significant SNR gains can be accomplished in comparison to an antenna array with an omni-directional beam pattern. Such SNR gains due to beamforming techniques are often called antenna gains or array gains in the literature. Similarly, if the directions of the dominant propagation paths are known at the transmitter side, the transmit power can be concentrated within the corresponding angular regions and is not wasted for directions that do not contribute to the received signal. Beamforming techniques can also be useful, in order to reduce the delay spread of the physical channel caused by multipath signal propagation. To this end, the transmitter or receiver

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beam pattern is adjusted such that it exhibits nulls in the directions of dominant distant reflectors. Correspondingly, echoes with excessively large delays are eliminated from the received signal. The basic principle of beamforming is illustrated in Fig1.

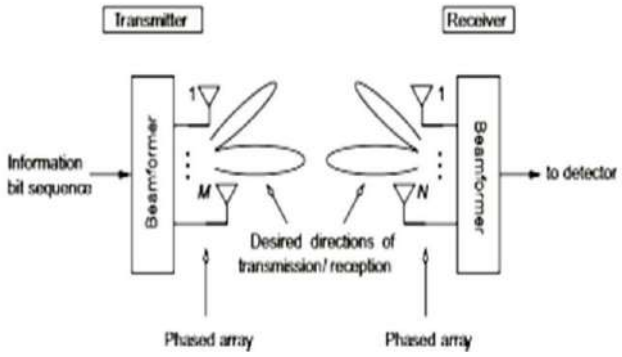

Fig. 1 Principal of beam forming

In the considered example, a beam former is employed both at the transmitter and at the receiver side. In a practical system, the directions of dominant propagation paths must be estimated. This can, for example, be done by means of the well-known MUSIC algorithm. Moreover, when transmitter or receiver is moving, the antenna patterns must be updated on a regular basis. Such adaptive antenna arrays are often called smart antennas or software antennas in the literature. Due to the required equipment and processing power, however, the use of smart antenna technologies is currently limited to fixed stations, such as base stations, or mobile stations that are fixed on vehicles. Yet, for future wireless communication systems it is anticipated that smart antennas will also be feasible for hand-held devices employing small phased arrays fabricated by microstrip technology. In beam forming, both the amplitude and phase of each antenna element are controlled. Combined amplitude and phase control can be used to adjust side lobe levels and steer nulls better than can be achieved by phase control alone. The combined relative amplitude a_k and phase shift q_k for each antenna is called a "complex weight" and is represented by a complex constant w_k (for the k^{th} antenna). A beam former for a radio transmitter applies the complex weight to the transmit signal (shifts the phase and sets the amplitude) for each element of the antenna.

SIMULATION PARAMETERS

Simulation parameters by using different channels and different transmitting angle.

Table 1: Parameters taken for simulation

Parameter	**Value/Type**
Input size	1000 bits
No. of Carriers	64
IFFT/FFT size	64
SNR range	1-30
Carrier modulation used	BPSK,QPSK,16PSK,256PSK
Channel used	AWGN, Rayleigh, Rician
Coding Technique	Convolution based Forward error correction with rate 1/3
No of transmitting Antenna	2
No of Receiving Antenna	2
Interfering Angle	10^o
Transmitting Angle	Case 1:TX_1 -10^o TX_2 - 90^o Case 2: TX_1 -20^o TX_2 -180^o

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SIMULATION RESULTS

A. 256 PSK MODULATION OVER RICIAN CHANNEL (Tx1=10^0, Tx2= 90^0)

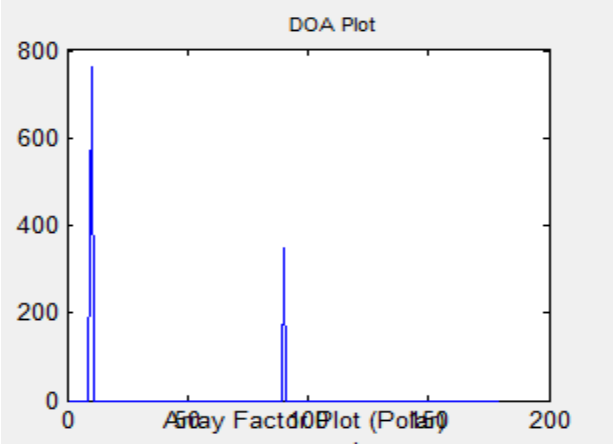

Fig. 1.1 (a) Direction of Arrival Plot

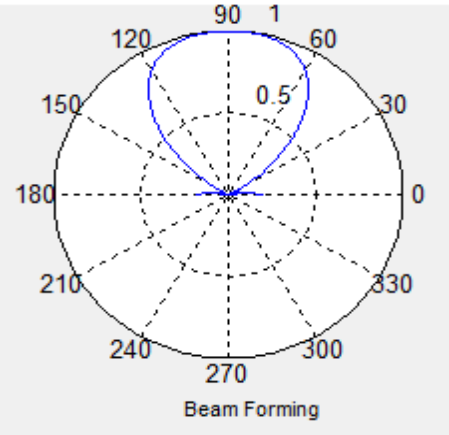

Fig. 1.1 (b) Beamforming

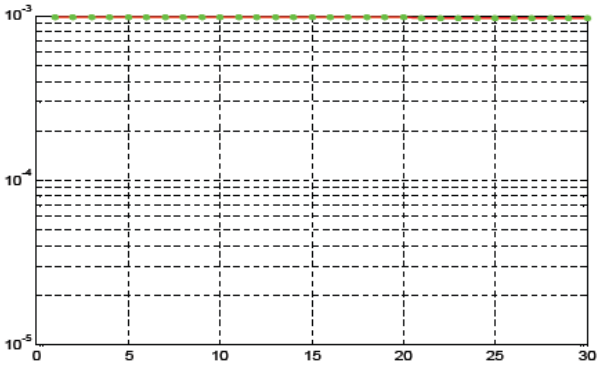

Fig. 1.1(c) Graph between SNR & BER

B. 256 PSK MODULATION OVER RAYLEIGH CHANNEL (Tx1=10^0,Tx2=90^0)

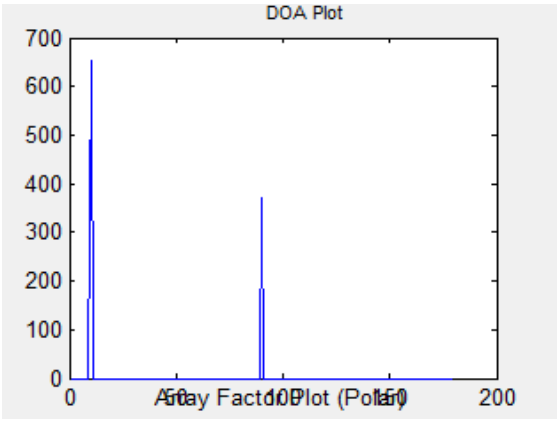

Fig. 2.1(a) Direction of Arrival Plot

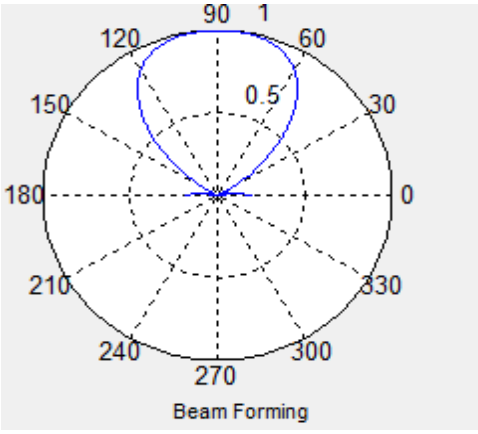

Fig. 2.1(b) Beamforming

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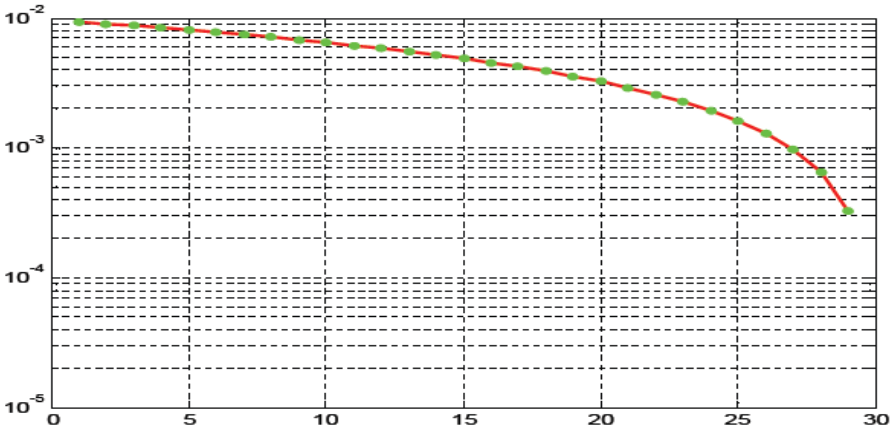

Fig. 2.1(c) Graph between SNR & BER

Table 2: SNR & BER FOR 256PSK (RICIAN channel)

Antenna Angle	RICIAN channel			
	10 ^{0}& 90^0		20^0& 180^0	
SNR	Without Beam forming	With Beam forming	Without Beam forming	With Beam forming
4	0.000982	0.0007291	0.000982	0.0008254
8	0.0009799	0.0006169	0.0009799	0.0007217
12	0.0009778	0.0005048	0.0009728	0.0005905
16	0.0009757	0.0003926	0.0009757	0.0004593
20	0.0009735	0.0002804	0.0009735	0.000328
24	0.0009714	0.0001683	0.0009714	0.0001968
28	0.0009693	0.00005608	0.0009693	0.00006561
29	0.0009688	0.00002804	0.0009688	0.0000328

From the result we have found that BER is less for lower SNR for rician channel using 256 PSK modulation for 10^0 and 90^0 as compared with 20^0 and 180^0 and the width of the beam for the said angle is wider at 90^0 .The slope is gradually decreasing for 20^0 & 180^0 for both algorithm is same as with 10^0 and 90. The slope of BER without beam forming is almost flat.

C. 256 PSK MODULATION OVER RAYLEIGH CHANNEL (Tx1=20^0& Tx2=180^0)

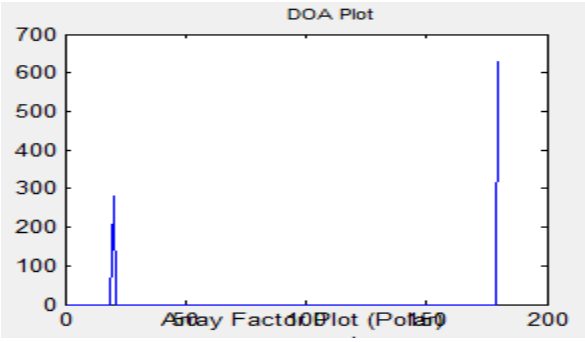

Fig.3.1(a) Direction of Arrival Plot

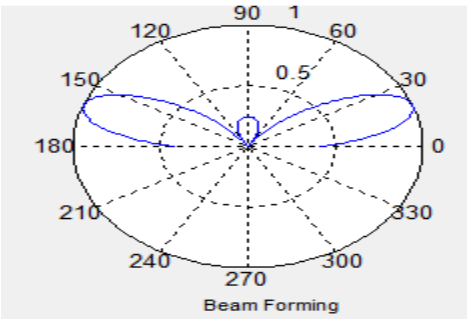

Fig. 3.2 (b) Beamforming

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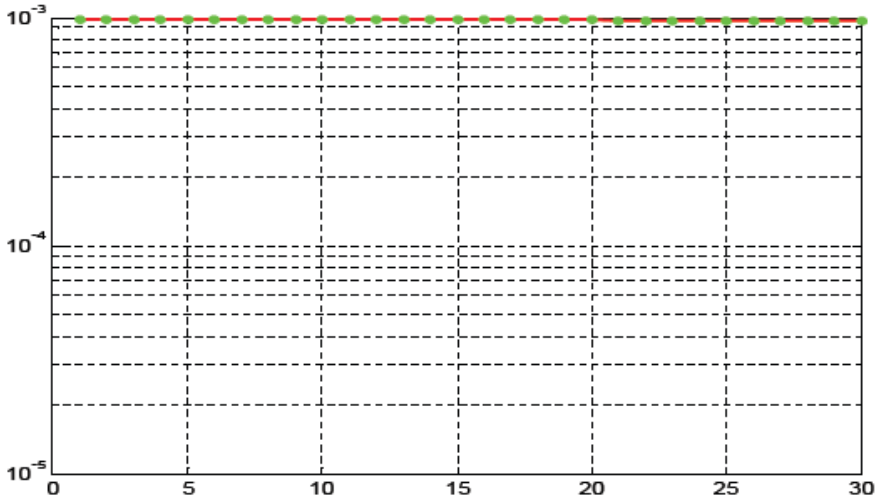

Fig. 3.2(c) Graph between SNR & BER

Table 3: SNR & BER FOR 256 PSK (RAYLEIGH Channel)

	RAYLEIGH Channel			
	10^0 & 90^0		20^0& 180^0	
SNR	Without Beam forming	With Beam forming	Without Beam forming	With Beam forming
4	0.008392	0.0008392	0.000982	0.0008529
8	0.007101	0.0007101	0.0009799	0.0007217
12	0.00581	0.000581	0.0009778	0.0005905
16	0.004519	0.0004519	0.0009757	0.0004593
20	0.003228	0.0003228	0.0009735	0.000328
24	0.001937	0.0001937	0.0009714	0.0001968
28	0.0006455	0.00006455	0.0009693	0.00006561
29	0.0003228	0.00003228	0.0009688	0.0000328

From the result we have found that BER is less for lower SNR for Rayleigh channel using 256 PSK modulation for both 20^0 and 180^0 and 10^0 and 90^0 and the width of the beam for the said angle is wider at 90^0 .The slope is gradually decreasing for 20^0 & 180^0 for both algorithm is same as with 10^0 and 90. The slope of BER without beam forming is almost flat. From the result we have found that BER is less for lower SNR for AWGN channel using 256 PSK modulations for 20^0 and 180^0 as compared with 10^0 and 90^0 and the width of the beam for the said angle is wider at 90^0. The slope for 20^0 & 180^0 for both algorithm is same as with 10^0 and 90. The slope of BER without beam forming is almost flat.

CONCLUSION

From the Simulation Result it is found that RICIAN Channel has improved (lowest) BER with lower SNR for Angle $10^0$and 90°, whereas AWGN Channel has improved (lowest) BER with lower SNR for Angle 20^0 and 180°.

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Condition of High - level Causeway at Naved Darapur Road: A Study

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Abstract -*Bridge construction is closely related to the development of human civilization and is also an important part of human civilization. Building bridges and surmounting obstacles are mankind's unremitting pursuit and dream. With the development of bridge science and technology and the needs of national development and construction, the construction of tens of kilometers of sea-crossing and channel bridges, high-speed railway bridges, and light rail transit viaducts and other grand projects have gradually begun. At the same time, with the continuous deepening of relevant research in the field of bridge engineering, new bridge structures, new processes, new materials, and so on are emerging, and the application level and research level of new technologies have reached a new breadth and depth. The aim of the study is to determine, analyze and investigate the present status of the Naved-Darapur high-level causeway and how it affects the commuters, pedestrians and the residents near the bridge. The researcher used descriptive research and engineering survey to identify solutions to the problems in the rehabilitation of said bridge. Thus, this study provides information that will assist the concerned government and private groups, and the community in the decisionmaking with regard to the development of the facility. Statistical treatments were used to analyze the data and further validated through inspection or investigation of the existing structure. As a result, the respondents were unsatisfied with the physical features, serviceability, safety and maintenance of the existing facility. Thus, it is hereby concluded that there is a need for the improvement of the existing facility. In coordination with the concerned stakeholders, a redesigned plan is produced as basis for the rehabilitation of the existing High-level causeway bridge and for their decision making*

Keywords- *Bridge, Plans, Productivity, Redesign, , Rehabilitation.*

INTRODUCTION

In this fast moving and developing world, people migrate from place to place for their work. In rural areas, not having any structure across a river for the purpose of migration from one place to another place. The bridge construction should not be adopted in every villages because of the low velocity flow and economy.From past studies in rural places cause way is enough . So, The design of cause way is adopted for our project. Here, The taken location is to renovate the damaged cause way due to the heavy flood level and over traffics

Naved-Darapur bridge has defects due to lack of maintenance procedure and not quite budgeted compared to technology that always maintained and developed. Infrastructure must always develop and maintain to have a good condition and quality. Defect structure must be improved or repaired to give more benefit to the people. Lack of maintenance for bridges can lead to sudden closure of a critical transportation that result in loss of lives and a significant decline in regional economic productivity. Safety of the public is one of the considered aspects in constructing structures. Thus, deficient bridges should have a significant maintenance, rehabilitation or replacement.

Naved-Darapur Bridge was built in 2007-2008, which connects the Communities of Darapur, Naved, Kholapur, Vathoda, Dhangarkheda, Sonarkheda and Bhalsi. The overflow- bridge was constructed between Naved and Darapur crossing the Purna River to provide service to people going to other town especially the Students from Naved, Kholapur, Vathoda, Dhangarkheda, Sonarkheda and Bhalsi for higher education facilities available at Darapur.

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Figure 1: High Level Causeway at Naved-Darapur Road

Darapur was as normal as other villages with primary and upto secondary and higher secondary education facility before 2005. But after 2005 honourable laid. Dr. Dadasaheb S Gawai Sir had started to develope the higher education facilities for the welfare of students of all the villages around Darapur. But the problem there was no connection between the villages during monsoon seasondueto flooded Purna River. Therefore, Dr. Dadasaheb Gawai had requested to Government to establish a connecting path across Purna River.

The bridge was designed as High-level Causeway concrete bridge consisting of 6 spans having 15 meters per span or a total length of 40 linear meters with a roadway of 7.5 meters. They used concrete girders and concrete floor slab. The bridge was implemented in two phases, and the both two phases under the PWD Region 2. The existing bridge is very useful only in summer and winter season for the villages neighboring to Darapur which are across the river and could only get to Darapur by other long route of Amaravti-Daryapur highway only or by using the overflow bridge. The completion of the bridge has brought a tremendous impact to the development of Darapur and all the villages around. It also ended the struggles and suffering of people crossing the river through infantry or using the long route during floods. However, the bridge is not passable during heavy rains due to over flow of the water from the river. Moreover, before construction of the bridge, the maximum flood level was high as compare to design flood level as it was designed as high level causeway. But the bridge is not serving properly during rainy season , the bridge is often over flows ant even it is for two to three days . hence, brought damaged to the bridge. Technically wise, the bridge is deteriorating which is dangerous to the passers.

The study focused on the renovation of bridge across Purna River for the communities crossing at Naved-Darapur road in Amaravti district. The descriptive method of research was used in the study. The purposive sampling technique was utilized to select the respondents. Researchers-made questionnaires were used as survey tools for the administration of the study to 150 respondents from the Grampanchayati of Darapur and the villagers crossing the bridge daily from Naved, Kholapur, Vathoda, Dhangarkheda, Sonarkheda, Bhalsi, Department of Public Works and Highways (DPWH), Local Government Official, and Community Leaders as the stakeholders and who are aware of the development and management of the over-flow bridge facility.

REVIEW OF LITERATURES

A bridge is defined as a structure, including supports, erected over a depression or an obstruction, such as water, highway, or railway, having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between under copings of abutments, or spring lines or arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between opening is less than one-half of the smaller connecting opening, (Bridge Inspection Maintenance and Repair, 1994)[4]. According to Lee G.C., et al (2008)[6], bridge failure may be defined as loss of a structural component, loss of a bridge's basic functionality, a catastrophic bridge collapse, or any damage condition in between. A bridge can fail due to a variety of single or combination of reasons including material imperfection or aging, overload, insufficient capacity, construction error or improper maintenance. Lessons can be learned through proper studies of bridge failures. Similar to reconnaissance studies of damaged or collapsed structures after a natural disaster, design guidelines can be improved through better understanding of the cause and mechanism of failure. In the construction of roads and bridges, pedestrians need to be accommodated and suitable sidewalks must be provided. The minimum clear sidewalk width should normally be 5 ft. In no case should a sidewalk not protected by a traffic railing

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be less than 3 ft. 6 in. wide. The need for sidewalks usually occurs in an urban area where a depressed highway

crosses under a city street or on frontage road bridges. A suitable barrier rail or combination railing should be provided, if required. (Roadway Design Manual, 3rd Edition, 2010)[7].According to the Provincial Office of the DPWH at Ilagan, Isabela, Cabagan - Sto.Tomas, the existing bridge was constructed three years ago and was designed as an over-flow bridge due to budget shortage. Since the bridge is the major means of transportation for the residents to access in neighboring towns, the government decided to temporarily build the said structure (Medestomas, R. V., et al, 2011)[3]. in recent years, in particular to improve safety of intersection, numerous of that is to be had in the court cases of the conferences that are very useful to understand the current developments in site visitors engineering. The aim of the protection techniques is to reduce annual highway fatalities. This aim can be done via the good-sized utility of low-value, tested countermeasures that lessen the variety of crashes on the kingdom's highways. Many of the hints and research for implementation of safety Plan gives techniques that can be hired to reduce the variety of unsignalized intersection collisions. The document may be of precise interest to protection practitioners with duty for enforcing applications to reduce injuries and fatalities on the highway system. Though research done on the various macroscopic parameters on the road is not highly documented, the contributions from researchers across the nation and the world have proven to be significantly essential. This paper indicates a very comprehensive review of literature for studies analyzing safety of congested intersection. Condition assessment and evaluation of existing bridges may be prompted by changes in traffic patterns; concern about faulty building materials or construction methods; discovery of a design/construction error after the structure is in service; concern about deterioration discovered during routine inspection; and damage following extreme load events. A condition assessment may be conducted to develop a bridge load rating, confirm an existing load rating, increase a load rating for future traffic, or determine whether the bridge must be posted in the interest of public safety. (Condition Assessment of existing bridge structures, 2009)[5].

METHODOLOGY

The normative survey of descriptive research was used in relation to the stakeholders' perceptions on the assessment of the existing over-flow bridge. Normative survey establishes norms for abilities, performances, beliefs and attitudes on samples of people of different ages, gender and other classifications. The researcher used the purposive sampling which samples were those who are aware of the existing over-flow bridge and are free to answer questionnaires relative to the condition and effect of the said facility. Engineering survey and inspection of the facility were conducted to further investigate and assess its condition.

The 150 respondents of the study composed of the residents of Naved and Darapur and the communities using the bridge for daily work.

However, since it is very important to involve the concerned agencies, the researcher decided to have one hundred fifteen respondents to ensure reliability of information.

Instruments Used

The Bridge inspections were undertaken at the bridges sites and for the entire structure. The tape used to measure the bridge length, span, and widths while the. Visual inspection was undertaken on the bridge superstructure over and under the bridge checking all the critical structural members. Measurements were undertaken for members that were damaged and affected by the flood.

Also, the questionnaires had been made for respondents' perception relative to the condition and effect of the existing over-flow bridge were used in the study. Also, the researcher used other engineering instruments during the inspection in order to investigate the physical features of the structure.

Procedure for Data Gathering

All in all, a closer investigation was undertaken at bridge substructures such as bridge abutments, bridge piers and foundation footings. Riverbanks, bank revetment works such as ripraps, groins, guide banks and other bank protection structures.

The questionnaires were administered to one hundred fifteen respondents. The data were then classified, tallied, tabulated and prepared for statistical treatment and analysis. Other information during the inspection of the over-flow bridge was noted for analysis and interpretation.

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The Statistical Method

Statistics is basically a science that involves data collection, data interpretation and finally, data validation. Statistical data analysis is a procedure of performing various statistical operations. It is a kind of quantitative research, which seeks to quantify the data, and typically, applies some form of statistical analysis. Quantitative data basically involves descriptive data, such as survey data and observational data.

Data Analysis

There is a major task in statistical data analysis, which comprises of statistical inference. The statistical inference is mainly comprised of two parts: estimation and tests of hypothesis.

Estimation in statistical data analysis mainly involves parametric data—the data that consists of parameters. On the other hand, tests of hypothesis in statistical data analysis mainly involve non parametric data— the data that consists of no parameters.

Statistical Treatment of Data

For the survey, total 150 respondents were interviewed in 7 days. For total 150 respondents the surveys in Naved and Darapur village are carried out which are across the Purna River and are mostly affected by the existing bridge condition. Total 95 respondents were interviewed at Naved and Darapur . And remaining 55 interviewed at bridge site were crossing the bridge for their purposes, which include the communities from Kholapur, Vathoda, Dhangarkheda, Sonarkheda and Bhalsi and have been using the route for many years.

After gathering and collecting the data, organized and analyzed information by using tabulation and bar graph.

Table 1: Frequency Distribution of Respondents Based on Gender

Gender	Frequenc y	Percentage (%)
Male	89	59.33
Female	61	40.67
Total	**150**	**100.00**

Weighted Mean. The formula to compute the weighted mean is,

$$\bar{X} = \frac{\sum Fx}{N}$$

Where:

$\bar{X}$ = Weighted Mean

$\sum Fx$ = Summation of the elements and its weight. N = Number of respondents.

Below is the rating scale used in the study,

4.50 – 5.00 = Very Satisfied
3.50 – 4.49 = Satisfied
2.50 – 3.49 = Neutral
1.50 – 2.49 = Unsatisfied
1.00 – 1.49 = Very Unsatisfied

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Outline of the existing Bridge

Table 2: Outline of Bridge Design

Bridge name	Bridge length	Superstructure type	Abutement		Pier	
			No. of Units	Foundation	No. of Units	Foundation
High level Causeway across Purna River At Naved-Darapur , Amravti District	40.00 m	6-Spans RCCDeck slab	2	Raft Foundation	5	Raft Foundation

RESULTS AND DISCUSSIONS

This covers the analysis and interpretation of data relative to the perceptions of the respondents on the.condition and effect of the existing. High-Level Causeway .

Profile of the Respondents

Table 3: Frequency Distribution of Respondents Based on Age

Age	Frequency	Percentage (%)
50 – Above	14	9.33
41 – 50	21	14
31 – 40	33	22
21 – 30	44	29.33
15 – 20	38	25.33
Total	**150**	**100.00**

Frequency Distribution of Respondents Based on Age

Table 3 shows the frequency distribution of respondents based on age. It reveals that age bracket of 21-30 has the highest frequency with a percentage of 29.33 seconded by age bracket 15-20. The age bracket 50 above got the lowest frequency of 10, equivalent to9.33%.

Below is the graphical representation of the frequency distribution of respondents based on age.

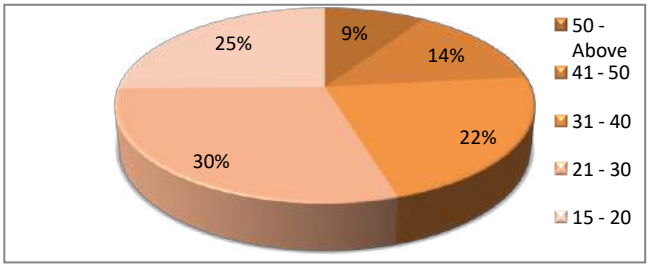

Figure 1: Graph of Frequency Distribution of Respondents Based on Age

Frequency Distribution of Respondents Based on Gender

Table 1 shows the frequency distribution of respondents based on gender. It can be seen that female dominants the respondents with a frequency of 61, equivalent to 40.67%, while the male got the frequency of 89 with a percentage of 59.33.

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Below is the graphical representation of the frequency distribution of respondents based on gender.

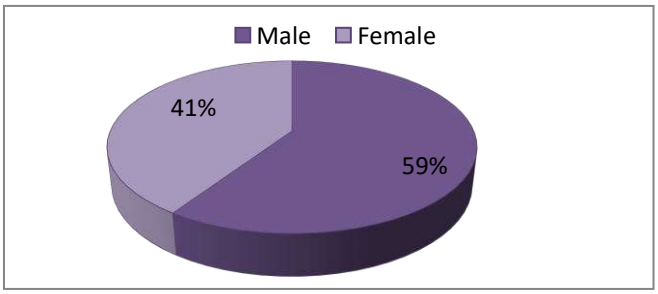

Figure 2: Graph of Frequency Distribution of Respondents Based on Gender

Perceptions of Respondents on the Physical Features of the High-Level Causeway

Table 4 shows the tabulated data on the perceptions of the respondents regarding the physical features of theHigh-Level Causeway.

Table 4: Perceptions of the Respondents on the Physical Features of the High-Level Causeway

Parameters	Mean	Verbal Interpretation
1. Height difference of the bridge from the water level duringflooding	2.18	Unsatisfied
2. Lighting materials and electrical wirings	1.94	Unsatisfied
3. Bridge railings	2.08	Unsatisfied
4. Road pavement of the bridge	1.84	Unsatisfied
Mean-Total	2.01	Unsatisfied

The respondents perceived that they are unsatisfied with all the physical features of the existing over-flow bridge with a mean-total of 2.01.

Below is the graphical representation of the perceptions of the respondents on the physical features of the over-flow bridge.

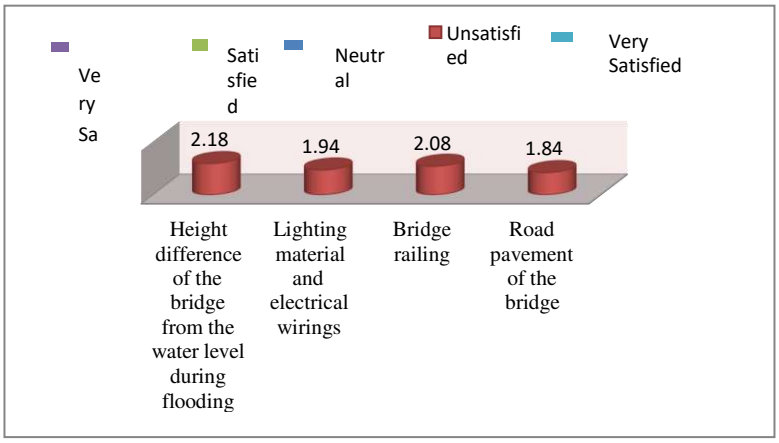

Figure 3: Perceptions of the Respondents on the Physical Features of the Over-Flow Bridge

Perceptions of Respondents on the Safety and Maintenance Measures to Sustain the Effective Use of the High-Level Causeway

Table 5 shows the perceptions of the respondents regarding the safety and maintenance measure to sustain the effective use of the bridge.

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Table 5: Perceptions of Respondents on Safety and Maintenance Measures to Sustain the Effective Use ofthe High-Level Causeway

Parameters	Mean	Verbal Interpretation
1. Provision of safety signage including lane separator	1.85	Unsatisfied
2. Safety of pedestrian lanes	2.32	Unsatisfied
3. Cleanliness of the bridge and the surroundings	2.74	Neutral
4. Traffic flow control	3.04	Neutral
Mean-Total	2.48	Unsatisfied

Table 5 implies that the respondents were neutral on safety and maintenance measures to sustain the effective use of the bridge with a mean-total of 2.48. However, in terms of the provision of safety signage including lane separator, and safety of pedestrian lanes, the respondents were not satisfied. Below is the graphical representation of the perceptions of the respondents on the.

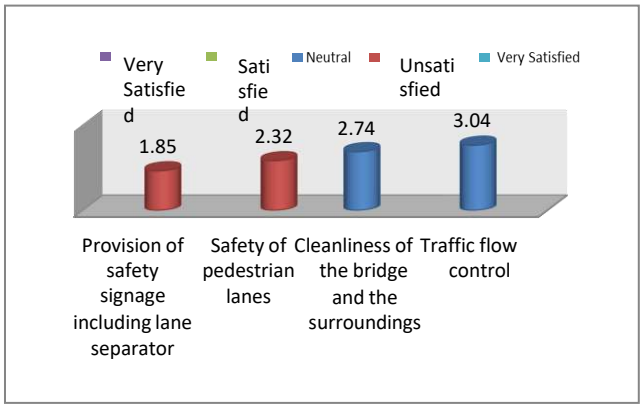

Figure 4: Perceptions of the Respondents on the Safety and Maintenance Measures of the High-LevelCauseway

Result of Project Inspection/Validation

As per validation by the researcher during project inspection, the researcher noted the following statusof the existing high-level causeway.

To prevent drawing of vehicles and motorists into the river damaged wheel guards as controllingpart

Figure 6: Damage Wheel Guard and Reflectors

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High slope of a road going down to the bridge .

Figure 7: High Slope Road Connecting the Bridge

During flooding , the height of the bridge from the water level that caused danger to passers

Figure 9: During flooding , the height of the bridge from the water level that caused danger to passers

Raised Water level during flooding

Figure 8: Raised Water level during flooding

Lack of Lighting and Safety Signage

Figure 9: Lack of Lighting and Safety Signage

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In the Utilization and Maintenance of the High Level Causeway the problems Encountered by the Stakeholders

Based on the information gathered during the actual interview with the respondents, several accidents had happened in the said bridge due to its unfavorable condition such as the following:

1. Passers riding in motorcycles drawn to the river due to absence of railings.
2. Road traffic accidents happened due to lack of safety signage, maintenance and unimplemented traffic control regulations.

CONCLUSIONS

As a result of the findings, it is hereby concluded that the existing high level causeway should be renovated as evidenced by the non-standard height of the bridge from the water level, and its architectural design; absence of lightings, railings, strong guardrails, painting and safety signage including lane separator and pedestrian lane; pavement with potholes; the high slope connecting the bridge and the road causes several accidents; and absence of maintenance measures to sustain the effective use of the bridge.

This Project is expected to be direct benefit for the regions being left behind the social and economic development through the bridge renavation in cooperation with the improvement of road sections by the government, consequently contributing to the poverty reduction in those areas.

- In this project we have successfully made an attempt for ―Renovation of bridge across Purna River for the communities crossing at Naved-Darapur road in Amaravti district‖.
- The existing high level causeway is efficiently converted as high level bridge due to flood level .
- The existing high level causeway can be completely eliminated due to adverse flood condition, rapid development of population and industrialization and unavailability of facilities and basic standard provisions.

RECOMMENDATIONS

Based on the foregoing findings and conclusion, the researchers hereby recommend the rehabilitation of the over-flow bridge with a total cost of Rs.155,55,000/-

The following improvements shall be considered in the rehabilitation of the existing over-flow bridge.

I. Guardrail Improvement
II. Sidewalk Repair
III. Drainage Installation
IV. Pavement Patching
V. Lighting Installation
VI. Safety Signage
VII. Elevation of Existing Over-Flow Bridge
VIII. Signage for Maintenance

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Studies on Traffic Parameters for Heterogeneous Condition

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Abstract: *The traffic circumstances in developing economies are primarily different from that of the developed economies. Traffic density of motorized and non-motorized of two-wheelers and three-wheelers along with numerous other vehicles with no-lane discipline are termed as heterogeneous. This heterogeneous traffic is without a doubt different from the one with the occurrence of trucks which has also been termed as heterogeneous traffic. The concluding is mostly tranquil of passenger cars and can be aptly termed as ''homogeneous'' traffic, whereas the previous is composed of vehicle types with a wide range of static and dynamic characteristics, which reside in the identical right of way, follow-on in an unsynchronized association of the vehicles. Another individual characteristic of this traffic is the lack of lane-discipline, resultant from the wide difference in sizes and maneuvering abilities of any motorized or non motorized vehicles. These distinctions result in some phenomena like vehicle creeping, which are missing in the homogeneous traffic. Therefore, this type of traffic can be referred to as ''heterogeneous disordered'' or ''mixed'' traffic. An evaluation of the literature has shown that most of the studies in such traffic make use of the methods and concepts developed for heterogeneous traffic. A small amount of studies have attempted to capture and understand the distinctive characteristics of the mixed traffic. The main purpose of this paper is to provide a review of the studies on different mixed traffic characteristics in developing economies, identify their limitations and provide guidelines for the future research. In addition, a detailed methodology of the recreation process for the mixed traffic is given, reflecting the ''gap filling'' rather than the conventional ''car-following'' behavior. An assessment of the past modeling approaches is also presented and the accuracy of their implementation is discussed.*

Keywords Heterogeneous · Traffic characteristics, Modeling · PCU · Area occupancy

INTRODUCTION

Road traffic flow in India displays a heterogeneous mix condition where in vehicles possessing distinguished physical and operational attributes constitute the vehicular flow. The behavior of homogeneous flows, commonly observed in the developed Western nations, is characterized by a strict lane discipline and single-file motion of vehicles with restricted movement across the lanes. A heterogeneous flow, on the contrary,is differentiated by the presence of a loose lane discipline and use of the entire road space without any confinements for maneuvering. The lateral movement of vehicles, apart from usual longitudinal motion, resultsin mass queue formations that operate two-dimensionally. Furthermore, wide ranging vehicle types moving in these traffic flows add to the dynamic quality of the flow. With considering behavior of such traffic is ensued by the existence of flow variables that change over space and time. Knowledge about these parameters is, therefore, essential for understanding the nature of a heterogeneous traffic mix moving on the road. Informationconsequential from parametric studies can provide an important base for accomplishing tasks like road design, planning and operation. In India, facilities of traffic flow control carry a high volume of traffic comprising a variety of public, private and commercial vehicles. They serve a wide range of traffic requirements concerned with infrastructural potential and indirectly affect the economy and commerce of the country.

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LITERATURE REVIEW

Significant effort has been devoted, in the last several decades, for accident reduction particularly at intersections. This literature review has examined many of those proposed countermeasures designed to either prevent crashes or reduce injuries in the event of crash at unsignalized intersection. In accumulation, the need ofimprovements to the effectiveness or methods of execution of current counter measures has been assessed. This research paper presents a review of relevant literature to bring out the background of the study undertaken. Theresearch contribution which have a direct relevance are treated in a greater detail and major findings summarized briefly. Some of the historical work which has contributed greatly to the understanding of the safety concerns of the unsignalized intersections. First, a brief review of the past background is presented. The concept of safety of the unsignalized intersections and work on advance methodologies to improve safety of unsignalized intersections carried out in this research, are then discussed. The amount of the literature on the subject has increased rapidly in recent years, particularly to improve safety of intersection, several of this is available in the proceedings of the conferences which are very helpful to understand the recent developments intraffic engineering.

Tamil Nadu India, Kanchumurty Anusha, et. al, has presented traffic flow behavior is a complex phenomenon and need better understanding and concepts for its analysis. The mathematical models developed for quantifying the traffic flow are very well knowingly used for prediction of capacity and level of service. The roadway geometric elements plays important role for efficient and safe traffic system design and speed-flow modeling. The highways in India normally operate under mixed traffic conditions and the driving behavior varies from one place to another. Macroscopic models which are quite suitable for describing the behavior of entire stream and further accepted worldwide for estimation of capacity. The present study analyses the macroscopic traffic flow behavior such as capacity estimation and speed flow modeling on multilane highways.Traffic flow data collected on a section of four lane divided highway are used to develop speed-flow curve. A microscopic traffic simulation model VISSIM has been used in present study for generating traffic flow data which is sometimes very difficult to obtain from field survey. The similar set of field data is used in VISSIM and imitation speed-flow curve is compared with field curve. The VISSIM model parameters those were sensitive to capacity are calibrated based on the traffic composition observed in field by taking measure of effectiveness as traffic volume, speed and capacity. Driver performance parameters CC0 and CC1 are first resolute for homogeneous traffic conditions and then results are aggregated to get the values of these parameters for a mixed traffic stream. Additional analysis of field data with calibrated values of CC0 and CC1 indicated a high-quality match between field and simulated capacity. The procedure is shown to work on another section of four-lane divided highway and validation of model was also performed by the same methodology with the help of VISSIM . The precise determination of relationship between speed and flow is essential under heterogeneous traffic conditions for arriving the capacity of road and to evaluate speed-flow relationships.

2003: Satish Chandra et. al, has presented a new concept to estimate the passenger car unit PCU of dissimilar types of vehicles below mixed traffic conditions is presented. Mixed traffic flow utilizes the area, as opposed to only the length, and speed of a vehicle. Data were collected from ten sections of two-lane roads in disparate parts of India. The width of carriageway this term is normally used in India for the whole width of the paved face of a road excluding its shoulders ranged from 5.5 to 8.8 m. All vehicles categorized in nine part and their PCU's were estimated at each road section. It was establish that the PCU for a vehicle type increases linearly with the width of carriageway. This is recognized to the greater freedom of movement on wider roads and therefore a greater speed differential between a car and a vehicle type. The capacity of traffic flow in a two-lane road also increases with total width of the carriageway and the connection between the two follows a second-degree curve. This connection is used to derive the modification factors for substandard lane widths and the results are compared with literature.

2014: NCHRP 500, Vol.5, Transportation Research Board, has presented Guidelines for Addressing Unsignalized Intersection Collision; The goal of the AASHTO Strategic Highway Safety Plan is to reduce annual highway fatalities by 5,000 to 7,000. This goal can be achieved through the widespread

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application of low-cost, proven countermeasures that reduce the number of crashes on the nation's highways. This fifth volume of NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan provides strategies that can be employed to reduce the number of unsignalized intersection collisions[7]. The description will be of exacting interest to safety practitioners with accountability for implementing programs to reduce injuries and fatalities on the highway system

2003: Yuan Li, Yuan Heweiet. al, presented Stop-controlled intersection represent potential hazards because of the priority of movement on the main road.

1999: Preston, H., et. al, research of preston explores the potential safety effects of dynamic signing at ruralhorizontal accomplish this by asking two key questions. Primary, is there a relationship between a vehicle's speed on the move toward to a curve and the ability to successfully navigate the curve? Secondly, there is a difference between static and dynamic signing in the ability to or reduce the speed of high-speed vehicles? Researchers of traffic flow assembled an off-the shelf hardware and software package and deployed it at a fourdegree curve along CSAH 54 in rural Dakota County.

VEHICLE CHARACTERISTICS

The traffic in developing economies is composed of vehicles with wide variation in physical and performance characteristics. These vehicles include cars, buses, trucks, auto-rickshaws (three-wheelers), and motorized two wheelers and other non-motorized vehicles like bicycles, human and animal-driven carts. The information that these vehicles share the same right of way results in some characteristic features that are missingin the homogeneous traffic conditions. all along with the most important weak lane-discipline behavior, these features include the differences in driver behaviors of different types of vehicles and impacts of these vehicles onthe traffic stream as a whole. Hence, the study a heterogeneous or mixed traffic in developing economies, it is essential to understand the characteristics of each vehicle type and their resulting behavior in the traffic stream.

CLASSIFICATION AND SIZES OF THE DIFFERENT VEHICLE TYPES

The traffic flow characteristics and its composition is depending on the study location, researchers classify the vehicles into different categories. This classification serves two purposes:

To compare a set of vehicles with characteristics which reduces the extra burden of each vehicle type with lesssignificant share in the traffic flow?

1. To allow the usage of standard values for their characteristics available in the literature.

On the other hand, care must be taken to let alone vehicles with significantly different characteristics to be grouped into the same category. Auspiciously, these values agree with each other strengthening their reliability. Vehicle dimensions given by Chandra and Kumar have been widely adopted in the studies of various developing economies.

SPEED AND ACCELERATION CHARACTERISTICS

Speed and acceleration is a fundamental measure in determining various performance and operational characteristics of a highway system like, quality of service, parameter and control of traffic, etc. cooperatively with density and flow, speed forms the essential relation which is the basis for many traffic flow models for homogeneous conditions. However, the idea is not as straight-forward in the mixed traffic. To start with, the average speeds of unlike categories of vehicles vary significantly. A comparatively high variation is found even with in a particular category, because of the different vehicle models present in it. Homogeneous and lane- disciplined traffic are different, where the car-following theory is generally used to determine a vehicle's speed, in mixed traffic, the effect of the interaction of other vehicles on the subject vehicle is hard to quantify, as it is affected by the traffic stream as a whole and the road conditions.

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Table 1: Vehicle categories and their dimensions

Category	Vehicles included	Average dimension (m)		Projected rectangular area onground (m2)
		Length (m)	Width (m)	
Car	Car, jeep	3.72	1.44	5.39
Bus	Bus	10.1	2.43	24.74
Truck	Truck	7.5	2.35	17.62
LCV	Mini bus, vans	6.1	2.10	12.81
Tractor	Tractor trailer	7.4	2.20	16.28
Three-wheeler	Three wheeler	3.2	1.40	4.48
Two-wheeler	Scooter, motorbike	1.87	0.64	1.2
Cycle	Bicycles	1.9	0.45	0.85
Rickshaw	Pedal rickshaw/cart	2.7	0.95	2.56

All the same, several attempts have been made in the pastto include these effects, whose summary is givenbelow.

Hossain and Iqbal conceded out a deterioration analysis to explore the relationship between free-speed andthe shoulder width. It was observed that in the case of buses, this do esnotstoutly compare with the shoulder width. Sarna et al. and Kumarand Madhu observed that the traffic stream speed decreases with an increase in the proportion of auto-rickshaws. The 85th percentile speed is taken as a better estimate of the free speed in some studies. New measures is defined as the ratio of the difference between 85th percentile and the signify stream speed to the difference between mean stream speed and the 15th percentile speed. The speed data is creating to follow the unimodal curve only when the spread ratio is within certain range. As different vehicle categories follow normal distribution with different mean speeds, it is not surprising to see the speed data with multiple peaks. However, researchers have observed that, at higher volumes, the high performance vehicles are obstructed by low performance ones and the stream behave as a single platoon, with relatively constant speed. Other modeling attempts of speed include Dhamaniya and Chandra, who proposed a set of simultaneous equa-tions, relating speeds of each vehicle type to all the indi- vidual densities.

PASSENGER CAR EQUIVALENTS

The concept of passenger car equivalents (PCE) was introduced in the Highway Capacity Manual 1965, toaccount for the effects of trucks and buses.PCE, also known as Passenger Car Unit (PCU), was defined in HCM
1965 as ‘‘the number of passenger cars displaced in the traffic flow by a truck or a bus, under the prevailing roadway and traffic conditions’’. These methods include Walker’s method, headway ratio method, density method, simulation based methods and multiple regression methods. It found that the PCE values suggested by HCM are only applicable for free-flow conditions and attempted to derive PCE values for congested conditions. They are, in fact, shown to behave as random variables that generally follow the normal distribution. Moreover, as pointed out by Van Aerde and Yagar, the assumption that a single set of PCE values being suitable for capacity, speed, platooning and other types of analysis appears to be incorrect and it is perhaps the main source of discrepancies among the vari- ous PCE studies. Hence, those methods cannot be appli- cable to the mixed traffic, without the necessary modifi-cations. As will be seen in later sections, PCUs are almost exclusivelyused in capacity and saturation flow studies. Though, because of the complexity in their estimation, some researchers preferred using the traffic composition inthe PCU values. Tana boriboonand Aryal classified the vehicles observed in Thailand intothree major types, namely: small, medium and large vehicles and used headway based method advocated by Krammes and Crowley to calculate PCUs, with small sized vehicle as the design vehicle. Arasan and Krishnamurthy studied the effects of varying traffic composition, volume to capacity ratio and road width on PCUs using a simulation model. In this study of Passenger Car Equivalents of a vehicle is estimated as the ratio of the number of cars that need to replace the subject vehicles in the traffic such that the average speed of cars remains the same. Significant differences are observed with the varying road and traffic conditions.A few other attempts to give modified PCU

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estimation methods are discussed below.

\MODIFIED DENSITY METHOD

HCM 2000 used concentration method for the estimation of various PCE values. Tiwari et al. modified this method to be suitable for Indian traffic conditions. They also gave an adjustment factor to convert passenger carsin heterogeneous traffic into its homogeneous traffic counterpart. This difference may be a result of the intrinsic differences in the driver behavior and road conditions. The basic idea of this method is to compare densities of various traffic entity types at the same speed. The car density is estimated at different speeds of other vehicles using a car density vs. car speed graph. Thus, PCE value of each traffic type is given by: kcar = W85 car/dx their analyses. PCU still remains among the most exten- sively studied parameters in the developing economies [5]

Several researchers have attempted to derive PCUs based on different traffic characteristics. Some of these studies are aimed at studying the effects of specific vehicle types. Rahmanand Nakamura attempted to derive PCUs of rickshaws using the average speed reduction in the passenger car caused by their presence for the traffic in Dhaka metropolis, Bangladesh. They showed that these PCU values increased with an increase in their proportion in the traffic and the total volume. Rongviriyapanich and Suppattrakul used time headways between different combinations of cars and two wheelers and calculated PCU values using three different approaches. Data for this study was collected at a mid-block section in Bangkok, Thailand. Traffic in developing economies usually consists of various other types of vehicles in significant proportions. Hence, other studies have used more general method to estimate where for the highway type j, qxi is the flow of traffic entity group Xi in heterogeneous traffic (entities/h)

METHOD BASED ON AREAS AND SPEEDS OF VEHICLES

The new method proposed by Chandra and Kumar ‘‘heuristic’’ method to estimate the PCE values in the mixed traffic conditions. This method does not have an equivalence criterion to estimate the effects of the othertraffic entity types in terms of passenger cars. Instead of these compares the area and speeds of each vehicle type

with those of passenger cars. Note that the usage of projected area of a vehicle is a more appropriate indicator in weak lane-

SUMMARY AND CONCLUSIONS

The study discussed in this research paper was performed in order to understand primary traffic parameters and their features pertaining to vehicle behavior on the two-lane road. The objective of this research is threefold: to provide a comprehensive review of the studies on Heterogeneous conditions traffic in developing economies,to identify the limitations and gaps in the current understanding of the traffic characteristics and to supply a background and guidelines for the researchers in planning their future studies. All the reviewed studies have been organized in some sections, namely vehicle characteristics, passenger car equivalents, lateral characteristics, capacity and level of service, except the final section on ‘modeling’, every of the sections present a evaluation of the previous studies on that topic, under a few subsections, as needed. It is generally observed that the concepts of Heterogeneous traffic have formed the basis for many of these studies. The shortcomings of those concepts in Heterogeneous traffic conditions have been emphasized, along with other gaps in the knowledge of those traffic characteristics and thus, identifying the possibilities of the future research. Finally, a general outline of a micro-simulation model for Heterogeneous mixed traffic is described, along witha review of the previous models.

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Planning and Designing Of Intersection by Mixed Traffic Flow Condition

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Abstract - *The developing cities are having a lot of traffic problems with increasing rate of vehicles. In present time Mumbai, Pune and Nagpur, etc. cities in Maharashtra facing traffic problems during peak hours. The present study aims to design a rotary or roundabout for controlled multi leg intersection located in Juhu in Mumbai, Maharashtra. The intersection has four approach roads with two-way traffic in all the approach roads. Although the signals have been provided on Intersection but the traffic congestion has not been reduced effectively. In order to improve the traffic conditions as well as the aesthetic view at the said intersection, we suggest designing the rotary or roundabout at intersection to reduce traffic congestion keeping in view high traffic and conditions favoring the roundabout. For this traffic volume surveys, study and the design is done accordingly.*

Key Words**:** *Traffic, Intersection, Roundabout, Traffic Congestion, Rotary, Conflict.*

INTRODUCTION

India is developing country with population of about 138 crores and with that ranking 2nd in world. Traffic flow in India is heterogeneous. The Increase in the vehicular traffic is becoming serious problem. Traffic problem are due to private vehicles running in this part of city these increased rate of vehicles require space for movement, with safety. So capacity evaluation needs to be done on intersection for easy operation of traffic. During the past decade major cities have under gone hazard growth of Industrialization, urbanization of country. Traffic is increasing day by day, so it is almost impossible for traffic police to control the traffic manually at the intersection. Although the signals have been provided on intersection but the traffic congestion has not been reduced effectively. In order to improve the traffic conditions as well as the aesthetic view at the said intersections, constructing a roundabout or rotary intersection is preferable, which is a special type of at-grade intersection, where all converging vehicles are forced to move round a central island in clock-wise direction. Thus the crossing conflicts eliminate and convert into weaving manoeuvre or a merging operation from right and a diverging operation to the left.

Rotaries are suitable when the traffic entering from three or more approaches are relatively equal. A total volume of about 3000 vehicles per hour can be considered as the upper limiting case and a volume of 500 vehicles per hour is the lower limit.

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Fig .1-Juhu Circle Junction (Source: Google Map)

OBJECTIVES

- To control the merging and diverging operations at crossing.
- To provide equal opportunity for turning right or going straight to all type of vehicular traffic.
- To eliminate the necessity of traffic police or signal to control traffic at intersection.

1. Design Speed

All the vehicles are required to reduce their speed at a rotary. Therefore, the design speed of a rotary will be much lower than the roads leading to it. Although it is possible to design rotary without much speed reduction, the geometry may lead to vary large size incurring huge cost of construction. The normal practice is to keep the design speed as 30 and 40 kmph for urban and rural areas respectively

2. Shape of Central Island

The shape of intersection depends on the number and the layout of intersecting roads. The various shapes considered to suit different conditions are circular, elliptical, turbine, tangent, each having its own advantages and limitations.

3. Entry, Exit and Island Radius

The radius at the entry depends on various factors like design speed, super-elevation, and co efficient of friction. The entry to the rotary is not straight, but a small curvature is introduced. This will force the driver to reduce the speed. The entry radius of about 20 and 25 metres is ideal for urban and rural design respectively. The exit radius should be higher than the entry radius and the radius of the rotary island so that the vehicles will discharge from the rotary at a higher rate. A general practice to keep the exit radius is 1.5 to 2 times the entry radius. However, if pedestrian movement is higher at the exit approach, then the exit radius could be set as same as that of the entry radius. The radius of the central island is governed by the design speed, and radius of the entry curve. The radius of the central island, in practice, is given a slightly higher radius so that the movement of the traffic already in the rotary will have priority. The radius of the central island which is about 1.3 times that of the entry curve is adequate for all practical purposes.

4. Width of Rotary

The entry width and exit width of the rotary is governed by the traffic entering and leaving the intersection and the width of the approaching road. The width of the carriageway at entry and exit will be lower than the width of the carriageway at the approaches to enable reduction of speed. IRC suggests that a two lane road of 7 m width should be kept as 7 m for urban roads and 6.5 m for rural roads. Further, a three lane road of 10.5 m is to be reduced to 7 m and 7.5 m respectively for urban and rural roads. Weaving width is given as

$$w_{weaving} = \frac{(e1 + e2)}{2} + 3.5m$$

e1 is the width of the carriageway at the entry e2 is the carriageway width at exit. Weaving length determines how smoothly the traffic can merge and diverge

5. Weaving Length

The weaving length determines the ease with which the vehicle can maneuver through the weaving section and thus determines the capacity of the rotary. The weaving length is decided on the basis of the factors, such as, the width of weaving section, average width of entry, total traffic and proportion of weaving traffic in it. It is desirable to prevent direct traffic cuts and this can be achieved by making the ratio of weaving length to weaving width large enough. A ratio 4:1 is regarded as minimum. The minimum values of weaving lengths as recommended by IRC are given below:

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Table -1: Design Speed and Weaving Width

Design Speed (Kmph)	Minimum weaving length(m)
40	45
30	30

6. Capacity

The capacity of rotary is determine by the capacity of each weaving section. Transportation road research lab (TRL) proposed the following empirical formula to find the capacity of the weaving section.

$$Qp = \frac{280w(1+e/w)*(1-p/3)}{(1+w/l)}$$

Where, e is the average entry and exit width,
w is the weaving width, l is the length of weaving,
p is the proportion of weaving traffic to the non–weaving traffic where a and d are the non-weaving traffic and b and c are the weaving traffic. Therefore,

$$p = \frac{b+c}{a+b+c+d}$$

TRAFFIC SURVEY AND DATA COLLECTION

The traffic data is collected video graphic method by counting the number of different types of vehicle approaching to the intersection from all the four directions and then converting the values in to the common factor called Passenger Car Unit (PCU).

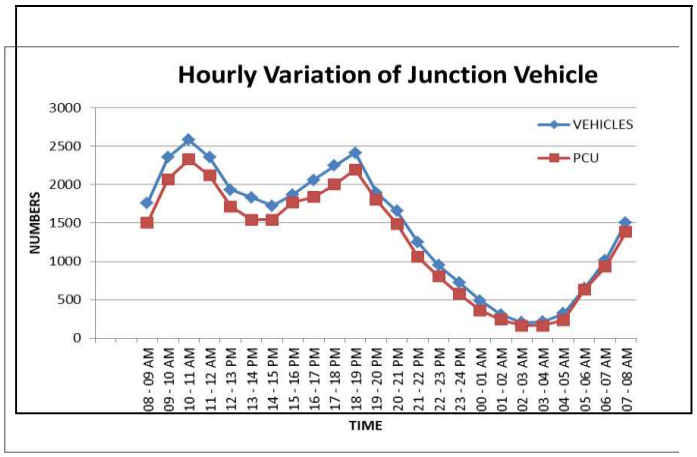

Fig.2-: Hourly Variation Junction Volume Traffic

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Table -2: Traffic Volume in PCU/hour

Direction (Approach)	Left Turning	Straight	Right Turning
North (Andheri-Versova)	245	248	160
South (Guru-Nanak Road)	152	290	199
East (Gulmohar Road	221	163	239
West (Devle Road)	163	200	164

a. Parameters for Calculation

i. For rotary in urban areas, design speed =30kmph

ii. Since intersection legs carry nearly equal traffic, a circular centre island will be adopted.

iii. A radius of 25m of entry, 40m at exit and Diameter of 50m for Central Island is adopted.

iv. Weaving width of 14m and Weaving length as 56m is adopted.

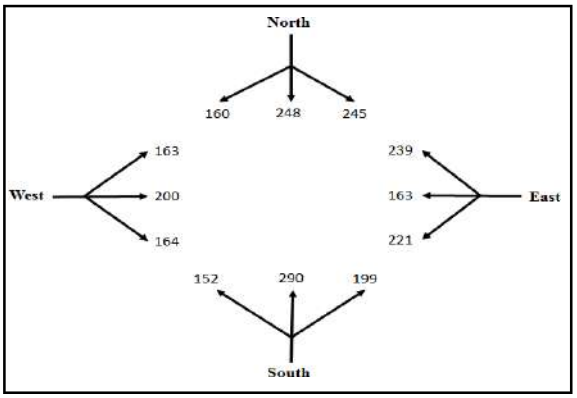

Fig.3-Traffic approach of The Rotary

b. Capacity of Rotary

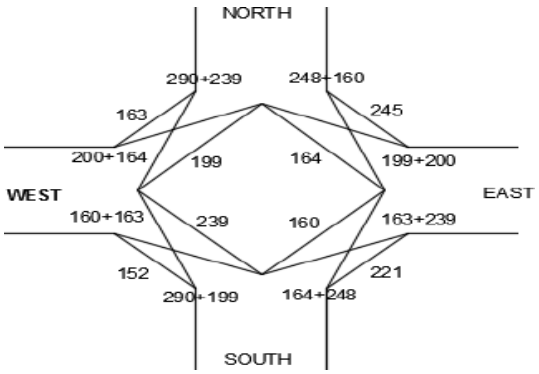

Fig. 4-Traffic Negotiating a Rotary (PCU/hour)

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Weaving traffic from East to South i.e. from Gulmohar Road to Guru-Nanak Road

a= 160 PCU/hr.
b= (164+248) = 412 PCU/hr.
c= (163+239) = 402 PCU/hr.
d= 221 PCU/hr.

$$p = \frac{b+c}{a+b+c+d}$$

$$p(E\text{-}S) = \frac{412+402}{160+412+402+221} = 0.68$$

Hence mathematical formula for capacity of roundabout, from IRC 65-1967

$$Qp(E\text{-}S) = \frac{280w(1+e/w)*(1-p/3)}{(1+w/l)}$$

$$Qp(E\text{-}S) = \frac{280*14*(1+10.5/14)*(1-0.68/3)}{(1+14/56)} = 4244.05 \text{ PCU /hr}$$

.

Similarly, Proportion of weaving traffic to non-weaving traffic for other directions are given below,

$$p(S\text{-}W) = \frac{323+489}{239+323+489+152} = 0.67$$

$$p(W\text{-}N) = \frac{529+364}{199+529+364+163} = 0.71$$

$$p(N\text{-}E) = \frac{399+408}{164+399+408+245} = 0.66$$

The proportion of weaving traffic to non-weaving traffic is highest in the West-North direction.

Thus capacity of roundabout in West-North direction is given as,

$$Qp(W\text{-}N) = \frac{280*14*(1+10.5/14)*(1-0.71/3)}{(1+14/56)} = 4189.17 \text{ PCU /hr.}$$

Similarly proportion of weaving traffic to non-weaving traffic is lowest in the North-East direction.

Thus capacity of roundabout in North-East direction is given as,

$$E) = \frac{280*14*(1+10.5/14)*(1-0.66/3)}{} = 4280.64 \text{ PCU /hr.}$$

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(1+14/56)

The capacity of intersection is the minimum of the capacity of all the weaving section. Hence capacity of designed roundabout is Qp(W-N) i.e. 4189.17 PCU/hr. According to IRC, rotary can handle the traffic upto 3000 PCU/hr efficiently.

CONCLUSIONS

In our study we performed surveys and accumulate traffic data which was required for designing roundabout, and after studying all necessary requirements and calculation we found that minimum capacity of designed roundabout is 4189.17 PCU/hr. whereas maximum required capacity for concerned intersection is 4280.64 PCU/hr. hence we can conclude that designed roundabout can efficiently handle present traffic flow as well as if in near future if there is slightly increase in rate of traffic flow, designed roundabout is capable for managing the traffic.

There are few areas still required to reduce congestion at junction, for betterment of the intersection are:

- Provide the road crossing near the intersection.
- Provide Odd- even parking.
- Expanding the area for better approach

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Stabilization of Black Cotton Soil by Using Fly Ash Powder

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Abstract – *Nearly 51.8 million hectares of land area in India are covered with black cotton soil. The property of these soils, in general, is that they are very hard when in dry state, but they lose all of their strength when in wet state. In light of this property of black cotton soil, these soils pose problems worldwide that serve as challenge to overcome for the Geotechnical engineers. One of the most important aspects for construction purposes is soil stabilization, which is used widely in foundation and road pavement constructions; this is because such a stabilization regime improves engineering properties of the soil, such as volume stability, strength and durability. In this process, removal or replacing of the problematic soil is done; replacement is done by a better quality material, or the soil is treated with an additive. In the present study, using fly ash obtained from Balapur, stabilization of black cotton soil is attempted. With various proportions of this Additive i.e. 5%, 10%, 15%, 20%, expansive soils is stabilized. Owing to the fact that fly ash possess no plastic property, plasticity index (P.I.) of fly ash mixes show a decrease in value with increasing fly ash content. In conclusion, addition of fly ash results in decrease in plasticity of the expansive soil, and increase in workability by changing its grain size and colloidal reaction. Tested under the CBR values of clay with fly ash mixes were observed. Analysis of the formerly found result exposes the potential of fly ash as an additive that could be used for improving the engineering properties of black cotton soils.*

Key Words- *Black Cotton Soil, Fly Ash, Material, Soil Stabilization.*

INTRODUCTION

India has 51.8 million hectares land region that is included with black cotton soil. Various techniques are adopted to enhance the engineering belongings of black cotton soil. Over the past few periods several factors have led to an increase in the number of people migrating to large cities. Consequently these large cities are getting over populated and quite expectedly necessity of business, residential construction has increased the civil engineering projects located in areas with unsuitable soil is one of the most common problems in many parts of the world. Black cotton Soil can be replaced with stronger material by usual method of soil stabilization.

Main objective of our research is to stabilize the locally available black cotton soil near Akola city.

The stabilization is done for the following reasons. Soil stabilization is widely used in connection with road, pavement and foundation construction. It improves the engineering properties of the soil, e.g.:

a) Strength - to increase the strength and bearing capacity,

b) Volume stability - to control the swell-shrink characteristics caused by moisture changes,

c) Durability - to increase the resistance to erosion, weathering or traffic loading.

d) To reduce the pavement thickness as well as cost.

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SOIL STABILIZATION

Soil stabilization is a general term for any physical, chemical, biological or combined method of changing a natural soil to meet an engineering purpose. Improvements include increasing the weight bearing capabilities & performance of in-situ subsoil, sands & other waste materials in order to strength.

Methods of Soil Stabilizations:-

There will be four methods of soil stabilization are as follows:

A. Mechanical stabilization
B. Physical stabilization
C. Chemical stabilization
D. Physio chemical stabilization

Benefits of Soil:-

a) Improve the mechanical qualities of local road construction soil.
b) Increase loading capacity.
c) Improve structural integrity.
d) Reduce harmful moisture penetration.
e) Provide longer economic life of road bed.
f) Reduce maintenance costs.
g) Lower road constructions costs.

Soil Properties:-

Some of the important properties of soils that are used by geotechnical engineers to analyze site conditions & design earthworks, retaining structures, & foundation are-

a) Specific weight or Unit weight.
b) Porosity.
c) Void ratio.
d) Permeability.
e) Compressibility.
f) Shear Strength.
g) Atterbegs Limits.

MATERIAL

Black Cotton Soils:-

As a part of this investigation, the expansive black cotton soil was acquired from the site Vyala, Maharashtra. The black cotton soil thus obtained was carried to the laboratory in sacks. A small amount of soil was taken, sieved through 400 mm sieve, weighed, and air-dried before weighing again to determine the natural moisture content of the same. The various geotechnical properties of the procured soil are as follows

Table 1: Standard Properties of black cotton soil

Sr. No.	Properties	Code referred	Value
1	Specific Gravity	IS 2720 (Part 3/Sec 1) – 1980	2.44
2	Maximum Dry Density (MDD)	IS 2720 (Part 7) – 1980	1.52 gm/cc
3	Optimum Moisture Content (OMC)	IS 2720 (Part 7) – 1980	22.65%
4	Natural Moisture Content	IS 2720 (Part 2) – 1973	7.28%
5	Free Swell Index	IS 2720 (Part 40) – 1977	105%
6	Liquid Limit	IS 2720 (Part 5) – 1985	65%
7	Plastic Limit	IS 2720 (Part 5) – 1985	37.08%
8	Shrinkage Limit	IS 2720 (Part 6) - 1972	17.37%

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Fly Ash

A waste material extracted from the gases emanating from coal fired furnaces, generally of a thermal power plant, is called fly ash. The mineral residue that is left behind after the burning of coal is the fly ash. The Electro Static Precipitator (ESP) of the power plants collects these fly ashes. Essentially consisting of alumina, silica and iron, fly ashes are micro-sized particles. Fly ash particles are generally spherical in size, and this property makes it easy for them to blend and flow, to make a suitable concoction. Both amorphous and crystalline nature of minerals is the content of fly ash generated. Its content varies with the change in nature of the coal used for the burning process, but it basically is a non-plastic silt. For the purpose of investigations in this study, fly ash was obtained from SesaSterlite, Jharsuguda. To separate out the vegetation and foreign material, this fly ash was screen through a 2 mm sieve. The samples were dried in the oven for about 24 hours before further usage.

Table 2: Properties of fly ash.

Properties	Range
Color	Grey
Sp. Gravity	1.95-2.55
Plasticity	Non-plastic
O.M.C (%)	38.0-18.0
M.D.D(gm/cc)	0.9-1.6

Classification of fly ash:

The extracted ash from the flue gases via an Electro Static Precipitator, after the process of pulverization, is called fly ash. It is the finest of particles among bottom ash, pond ash and fly ash. With some unburned carbon, the fly ash chiefly consists of non-combustible particulate matter. These generally consists of silt-sized particles. On the basis of a lime reactivity test, fly ashes have been classified into four different types, as given:

a) Cementations fly ash
b) Cementations and pozzolanic fly ash
c) Pozzolanic fly ash
d) Non-pozzolanic fly ash

With free lime content and negligible reactive silica, this fly ash is called as cementations. As opposed to this, with negligible free lime content, and chiefly reactive silica, this fly ash is called pozzolanic fly ash. Both reactive silica and free lime are predominant in cementations and pozzolanic fly ash. Neither free lime, nor reactive silica are present in non-pozzolanic fly ash. The distinguishable difference between cementations flyash and pozzolanic fly ash is that the cementations fly ash hardens when it comes in connation with water, whereas the pozzolanic fly ash hardens only after the activated lime reacts with water. Cementations &Pozzolanic Fly Ash and Pozzolanic Fly Ash are the types that are found widely. Based on the chemical composition of fly ash, fly ash has been categorized into two categories, as given:

A. Class C fly ash
B. Class F fly ash

Burning of sub-bituminous type of coal and lignite, which contains more than 20% Calcium Oxide, gives the Class C fly ash. By ignition of anthracite and bituminous type of coal, Class F fly ash. This fly ash contains less than 20% Calcium Oxide.

METHODOLOGY

The Indian Standard codes are as follows:

1) Oven drying method – fly ash mixture
2) Atterbegs Limit- fly ash mixture
3) Specific gravity method- fly ash mixture
4) Standard Proctor test- fly ash mixture
5) California bearing ratio- fly ash mixture
6) Unconfined compressive strength- fly ash mixture

Oven drying method – fly ash mixture

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Description: Water content of soil is an important parameter which influences the behavior, particularly of cohesive soils.

Table 3: Results observed for oven drying method

% Of Fly Ash	W.C
0	42.88
5	40.22
10	31.35
15	23.65

Atterbegs Limit- fly ash mixture

Liquid limit: - (Casagrande's Method IS 2720-PART5)

Description:-
This method uses the Casagrande's liquid limit apparatus consisting of a metal dish or cup mounted on a hard rubber pad, fixed with a cam mechanism.

Plastic limit

Description:-
It is the minimum water content at which a soil will just begin to crumble when rolled into 3 mm thread withoutshowing any sign of cracks.

Table 4: Atterbegs Limit of the Soil

Soil Type	Liquid Limit (%)	Plastic Limit (%)	Plasticity index (%)
0	83.27	29.76	53.51
5	66.19	26.24	39.95
10	66.02	23.96	42.06
15	60.65	10.86	49.76
20	59.91	18.55	41.36

Fig 1: Liquid limit distribution curve for fly ash

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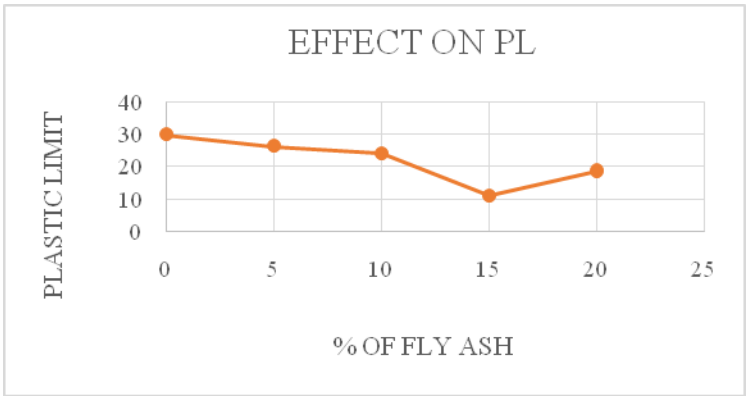

Fig 2: Plastic limit distribution curve for fly ash

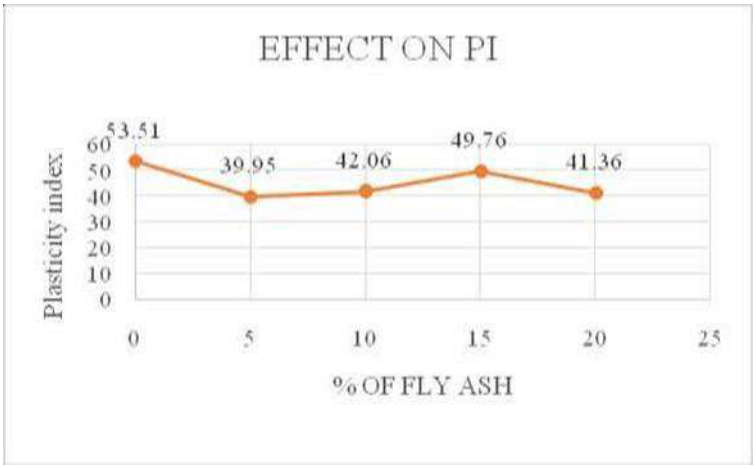

Fig 3: Plasticity index distribution curve for fly ash

Specific gravity method- fly ash mixture Specific Gravity (G) Using Pychometer:-

Description:-Pycnometer is a large size density bottle of about 900 ml capacity.

A conical brass cap 6 mm diameter hole at its top is screwed to open end of pychometer.

Table 5: Specific gravity values for fly ash

% Of Fly Ash	WC
0	2.6
5	2.5
10	2.7
15	2.6
20	2.65

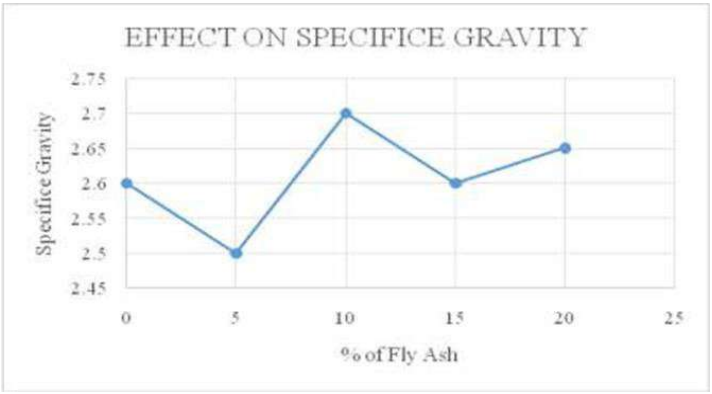

Fig 4. Specific gravity curve for soil with fly ash

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Standard Proctor test- fly ash mixture

Description:- This test was first devised by R. Proctor and has been adopted by ASTM and BSS, as the standard test. The compaction of soil is measured in the term of dry density. The number of laboratory test has been developed for compacting the soil.

The OMC of the soil with varying percentage of Fly Ash is given in table 3 and fig 3

Table 6: OMC values for fly ash

% Of Fly Ash	O.M.C (%)
0	9
5	9.1
10	8.3
15	10.3
20	9.4

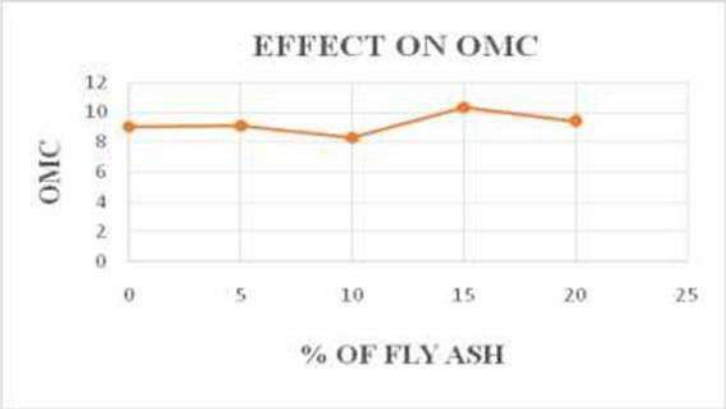

Fig5: OMC curve for fly ash

Maximum dry density

The maximum dry density of the soil with varying percentage of Fly Ash is given in table 4 and fig 4

Table 9: Maximum dry density values for fly ash

% Of Fly Ash	M.D.D
0	2.21
5	2.09
10	2.42
15	2.45
20	2.31

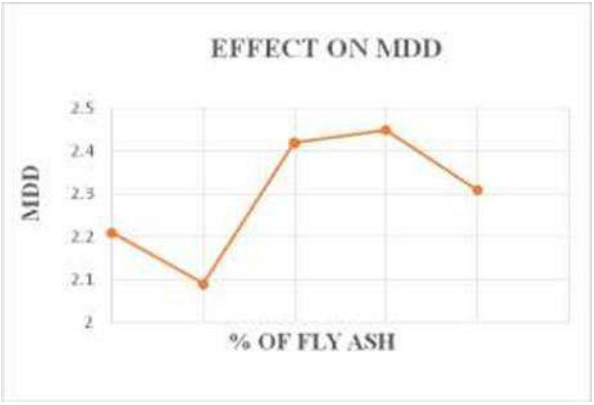

Fig 6: MDD curve for fly ash

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California bearing ratio- fly ash mixture

Description:- The california bearing ratio test is penetration test meant for the evaluation of subgrade strength of roads and pavements. The results obtained by these tests are used with the empirical curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexiblepavement

Table 7 CBR VALUES at 2.5mm deflection

% of Fly Ash	CBR VALUE@ 2.5mm
0	3.02
5	1.67
10	1.61
15	3.85
20	2.23

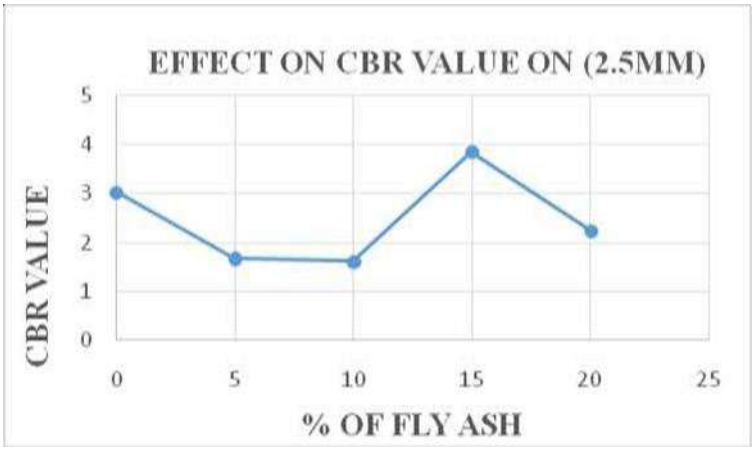

Fig 6 CBR curve for fly ash

Table 8: CBR VALUES at 5mm deflection

% Of Fly Ash	**CBR VALUE@ 5mm**
0	4.2
5	3.9
10	4.12
15	5.1
20	4.02

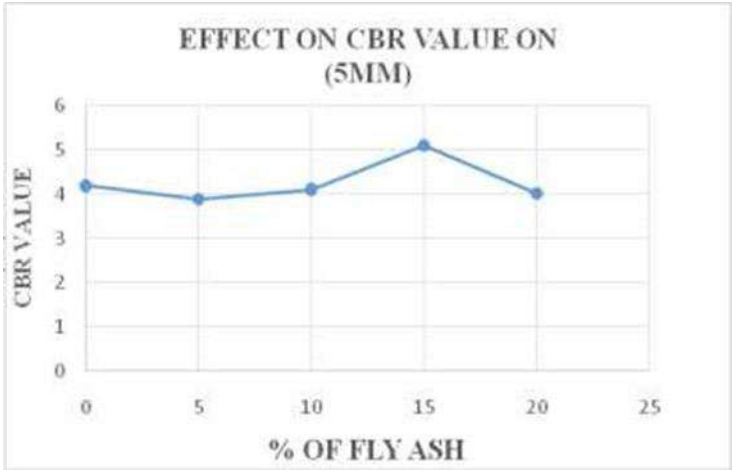

Fig 7 CBR curve for fly ash

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Unconfined compressive strength- fly ash mixture

Table9: UCC values for fly ash

% Of Fly Ash	U.C.C
0	3.88184
5	4.100000
10	4.440923
15	8.881850
20	4.885015

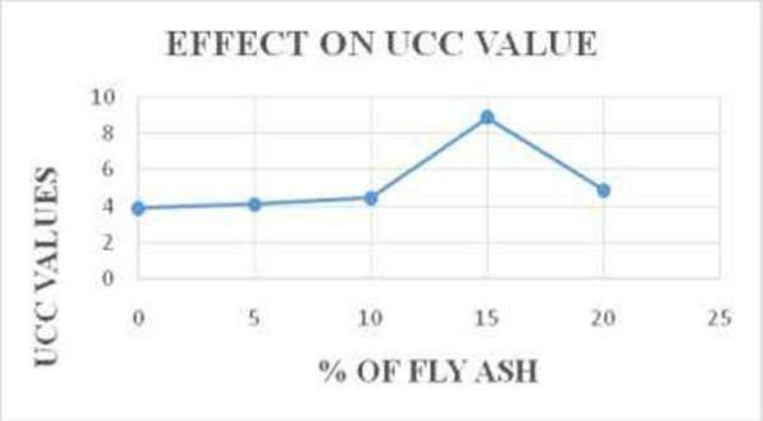

Fig 8. UCC curve for fly ash

UTILIZATION OF FLY ASH

The utilization of fly ash can be largely grouped into following three classes:

a) The Low Value Utilizations, which includes back filling, structural fills, road construction, soil stabilization, and embankment & dam construction, ash dykes, etc.

b) The Medium Value Utilizations, which includes grouting, cellular cement, pozzolana cement, bricks/blocks, soil amendment agents, prefabricated building blocks, fly ash concrete, weight aggregate, etc.

c) The High Value Utilizations, which includes, fly ash paints, ceramic industry, extraction of magnetite, distempers, metal recovery, acid refractory bricks, floor and wall tiles, etc.

CONCLUSION

On the basis of the use of Fly Ash on black cotton soil, it shows an effective use. Fly Ash can be used as an additive for the stabilization of soil. In geotechnical engineering applications, fly ash may be feasible. With the increasing fly ash content in the soil-fly ash mixture, the decrease in value of free swell ratio was remarked. This decrease was also reciprocated by the plasticity index values. Plasticity index values are directly proportional to percent swell in an expansive soil, thus affecting the swelling behavior of the soil- fly ash mixture. Fly ash as an additive decreases the swelling, and increases the strength of the black cotton soil. Now it can be concluded that the improved C.B.R. value is due to addition of Fly Ash as admixture to the black cotton soil. Hydraulic conductivity of black cotton soil is also reduced by this method. If black cotton soil is used in road construction then there will be no need of drainage layer after treatmentof black cotton soil as sub grade with fly ash. Stabilization by black cotton soil is more economical than any other additives.

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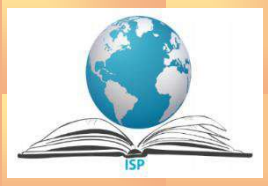

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