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# Intelligent Transportation System–Recent Trends in Transportation System: A Review

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***Abstract–*** *Characteristics and knowledge of fundamentals traffic flow and dynamic behavior of vehicle and essential for operation of transportation system. Intelligent displace can be defined as it gives a traffic between one vehicle to another vehicle ,so that one terror can know about that earlier from which side the vehicles are coming by the information that we have put and from this we can minimize accidents develop that we see in maximum time. The intelligent transportation system (ITS) technology of today is contributing to improved transportation system provides solution on traffic problems with the help of new based technologies. it involves planning , design, construction , maintenance and operation of transportation of facilities. Advance technologies in the area of information system, automation and telecommunication have potential of achieving cost saving and productivity improvement as well as enabling new developments in transportation, now a days developments of roads has created a new havoc which leads to increase the accident cases all across the world, in order to overcome from such a problem intelligent transport system holds a good time ITS is design for a road transportation organization. This system consist of hardware component to provide an integrated solution for the driver consol unit, electronic machine passenger information system and vehicle tracking system .IOT is used in this Intelligent transport system which is a very good and alone technique to solve the problems of displace traffic of city .We know that in our city we are liner several problems while using vehicles .Intelligence system can fetch data from vehicle and enter the data to the correct server by the help of s to manage road traffic. : It is so efficient that it has the capability to send the data to the vehicle radar on its own. So that we can reduce accident.*

***Key Words - Intelligent Transportation System ,Advanced Traveler Information System, Advanced Traffic Management System, Advanced Public Transportation System***
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## I. INTRODUCTION

Intelligent Transport System becomes better transportation safety and plasticity and amplifies global connectivity by means of productivity improvements extract through the group action of advanced publicity technologies into the moving support and in venteligent vehicle. Due to the current energy crisis, globally we have become increasingly aware of the fact that the resources we rely on are not boundless. Interest in the intelligent transportation system comes from problems caused by traffic congestion and a synergy of new information technology for simulation real time and communications networks. Traffic congestion has been increasing worldwide as a result or increased motorization, urbanization, population growth and changes in population density. Congestion reduces efficiency or transportation infrastructure and increases travel time, air pollution and fuel consumption. Now a day's development of roads has created a new havoc which lead to the increase in the accident cases all across the world, in order to over-come from such a problem, Intelligent Transport System holds a good point. Intelligent moving Systems is the application of computer, electronics, and communication technologies and management master plan in an link to provide passenger information to better the patrol and control of the plain moving system. These systems involve vehicles, drivers, passengers, drivers, and managers all communicate with each other and the surrounding, and linking with the complex hold systems to better the protection and meager of road systems. As messenger by Commission for Global Road protection (June 2006), the global road finish were within 750,000 to 880,000 in the year 1999 and predicted about 1.25 million finish per year and the toll is growing more. World health organization news (1999), showed that in the year 199 0 road accidents as a cause of loss or disability were the ninth most powerful cause of loss or unfitness and predicted that by 2020 this will move to sixth place. Without powerful changes to the road transport systems these frozen figures are likely to increase peerless. Intelligent transport systems (ITS) are those in which information, data processing communication, and sensor technologies are applied to vehicles (including trains, aircraft and ships), transport infrastructure and users. The key components of a typical ITS system are shown in figure 1. Broadly speaking, intelligent transport systems:

- **Are designed in an intelligent way to be efficient and effective in meeting the needs of users**. This takes into account the design and organization of supply chains, and the design of transport infrastructure and networks in relation to location and demand. It has much to do with coordination and integrated planning, particularly in the areas of transport and land use, and in freight logistics.
- **Provide users, service providers, infrastructure owners and planners with intelligence.** An ITS has the ability to provide information, both in real- time and over time, that makes transport easier, more efficient, safer and less environmentally damaging. This information needs to be available both to the users of all modes of transport, and to those planning, designing, constructing and operating the transport system.
- **Support and allow intelligent transport choices**. ITS systems provide the tools to enable users to make intelligent transport choices in the way that they use the system.
- H**ave built-in system intelligence.** ITS systems adapt themselves in real-time and over time to improve transport outcomes without the need for user intervention. We are aware that internationally there are a range of definitions of ITS and welcome feedback on the definition used in this paper.

ITS is an integrated system that implements a broad range of communication, control, vehicle sensing and electronics technologies to help in monitoring and managing traffic flow, reducing congestion, providing optimum routes to travelers, enhancing productivity of the system, and saving lives, time and money. A Technical Note of the World Bank named "ITS for Developing Countries" addresses the condition of ITS in developing countries, and discusses the long-term, society-wide benefits that ITS can provide and ways that ITS can provide more immediate benefits to individuals by helping to make surface transportation more affordable, more reliable, and more efficient (Yokota, T., 2004). It states that ITS proves to be useful in the following manner: • Improved mobility for people and freight, including greater access to transportation for the elderly, the disabled, and people living in remote locations

- Greater compatibility of surface transportation with the environment
- Fewer traffic-related deaths and injuries
- A better-managed transportation system.
- Less travel uncertainty, allowing for better planned, quicker, and less expensive travel
- So from the above points we can see that ITS covers and improves almost all the aspects of Transportation engineering.

## II- WHAT ARE INTELLIGENT TRANSPORT SYSTEMS AND CLASSIFICATION

Transportation goals and technology have always been intimately linked. The Intelligent Transportation Systems (ITS) technology of today is contributing to improved transportation just as the steam and internal combustion engine technologies of the industrial revolution contributed to enhanced transportation then. The goals of this paper are to explain what ITS is and how it is or is not contributing to improved transportation. In brief, ITS is the application of computer and information technology to transportation systems in the hope of making them more efficient and productive. Before setting off to examine the contribution ITS is or is not making it is important to describe the context within which ITS and transportation systems are operating in at the beginning of the twenty-first century.

One way to define ITS is as a set of information technologies applied to transportation infrastructure and vehicles to improve their performance. Expanding on this, then, ITS has been viewed by transportation researchers as the application of established communications, control, electronics, and computer hardware and software technologies surface transportation systems to improve their capacity and performance. While there are many other definitions this captures most of the important points cited by others. It is important to note that improved performance means many things including more qualitative factors such as access, environment, equity and competitiveness. This definition is used in the chapter as the cornerstone definition. Within this definitional framework there are many specific technologies and technological systems, and technical applications. These refinements and nuances are examined below in more detail.

## III- ROLE OF TECHNOLOGY IN ITS SYSTEMS

ITS systems are enabled by technology. Examples of technology that support ITS systems include:

- analytical and modeling software that allows better planning of future transport infrastructure and real-time traffic management • information gathering technology (for example air traffic control, roadside air pollution monitoring, joint traffic control centre's) that provides automated and often real- time information to operational managers, users and planners.
- Payment systems such as electronic tolling, public transport ticketing using smartcards and electronic road user charging.
- Vehicle control systems such as advanced driver assistance systems, semi-autonomous and autonomous vehicles and „co-operative ITS systems" (C-ITS2). • systems based on global navigation satellite system (GNSS) technology which, for example, allow efficient organization of freight

supply chains and management of fleets and allow accurate mapping in two and three dimensions.

- Mobile phone/portable computing based information systems that can provide real-time and more general information to users, and which can be used to encourage efficient driving practices. Sophisticated systems tailor the information provided to individual users based on past use. These systems minimize the need for operator input and aim to maximize the benefits to the user. Submerging vegetation, and a large variety of microbial communities that are purposely built for water pollution control.

## IV. APPLICATION

A . Road safety application Road safety applications exploit wireless V2X communications between surrounding ITS abstraction (e.g., rocket, road infrastructures, etc.) to slow down traffic accidents and to secure the drivers from various road risk. To that end, each ITS entity regularly broadcasts safety messages to report its neighborhood about its situation and location information. Furthermore, depending on specific events (e.g., accidents, see road risk), each ITS entity may also generate the transmission of notification messages to close-by vehicles and emergency services

B. Traffic Management Applications Traffic management applications represent a second major class of ITS applications, whose main objective is to enhance the management and coordination of traffic flows and to provide various cooperative navigation services to the drivers. These applications rely on the collection and analysis of the exchanged ITS messages (i.e., between ITS entities) in order to build and maintain global traffic map databases. The traffic data are generally collected by the deployed road side units and/or from road sensors and are transmitted wirelessly to remote trusted data centers for further data analysis and processing. The collected data include contextual and location-based information related to vehicles, drivers and road events

C. Infotainment and Comfort Applications
Infotainment and comfort applications aim at enlarge the driving experience by providing the drivers with various added-value services. These services are generally offered by loyal service providers, where the similar applications and services are downloaded and installed on the vehicles application units. AUs communicate with the remote SPs data centers through their OBUs, using different V2I communication technologies (e.g., 4G/LTE, 5G). A typical example of such an application consists in the remote vehicle indicative and supply application in which the SPs.

D. Autonomous Driving Applications Autonomous driving, also known as automated driving, applications represent the next big leap in human transport technologies, which is habitual to be deployed by 2020 and totally functional by 2030.

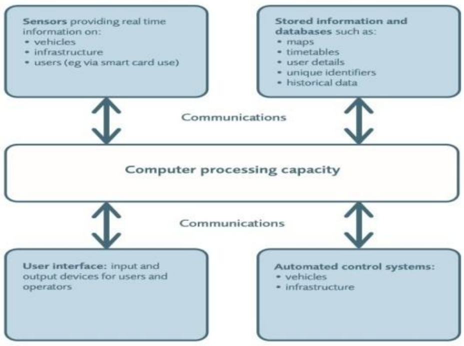


Fig.1- Computer processing capacity

ADVANCEDTECHNOLOGIESINITS

**Transit Signal Priority (TSP**): TSP gives special treatment to transit vehicles at signalized intersections. TSP systems use sensors to detect approaching transit vehicles and alter signal timings to improve transit performance. For example, some systems extend the duration of green signals for public transportation vehicles when necessary. Because transit vehicles can hold many people, giving priority to transit can potentially increase the person throughput of an intersection.

**Electronic Toll Collection (ETC):** ETC supports the collection of payment at toll plazas using automated systems that increase the operational efficiency and convenience of toll collection. Systems typically consist of vehicle-mounted transponders identified by electronic readers located in dedicated or mixed-use lanes at toll plazas. ETC has the potential to significantly increase mobility on the nation's transportation system.

**Ramp Meter (RM):** Traffic signals on freeway ramp meters alternate between red and green signals to control the flow of vehicles entering the freeway. Metering rates can be altered based on freeway traffic conditions.

**Red Light Camera (RLC):** According to the USDOT Federal Highway Administration's Priority, Market-Ready Technologies and Innovations, RLCs detect a motor vehicle that passes over sensors in the pavement after a traffic signal has turned red. The sensors connect to computers in high-speed cameras, which take two photographs of the violation. Typically, the first photo is taken of the front of the vehicle when it enters the intersection, and the second photo is taken of the rear of the vehicle when the vehicle is in the intersection.

Law enforcement officials review the photograph, and a citation is mailed to the registered owner of the vehicle.

**Traffic Signal Coordination (TSC):** According to the USDOT"s Traffic Signal Timing Manual, TSC provides the ability to synchronize multiple intersections to enhance the operation of one or more directional movements in a system.

Some examples include arterial streets, downtown networks, and closely spaced intersections such as diamond interchanges.

**Traveler Information Systems (TIS):** According to the USDOT ITS JPO"s Developing Traveler Information Systems Using the National ITS Architecture, effective TIS are multimodal and support many categories of drivers and travelers.

Traveler information applications use a variety of technologies, including Internet websites, telephone hotlines, and television and radio, to allow users to make informed decisions regarding trip departures, routes, and mode of travel.

## 1) OVERVIEW OF SOME ADVANCED TECHNOLOGIES AND TRANSPORTATION APPLICATIONS

Intelligent Transportation System technology can be defined as the application of information technology to surface transportation in order to achieve enhanced safety and mobility while reducing the environmental impact of transportation. Knowledge-Based Expert Systems Knowledge-based expert systems (KBES) evolved from research in artificial intelligence with the overall objective of producing intelligent behavior with computers (Harmon 1985). Numerous artificial intelligence research areas exist, including theorem proving, automatic programming, vision, learning, natural language processing, and others. KBES differ from these other areas by the restriction to a limited problem solving domain such as diagnosis of malfunctions in particular equipment types. These systems are finding a wide range of suitable application areas. Several reviews of transportation (Ritchie 1986; Yeh 1986) and civil engineering (Kim 1987; Kostem 1986; Sriram 1986) applications exist. Applications have included a variety of areas such as design (Harris 1987), diagnosis (Ritchie et al. 1986), vehicle control (Weisbin 1986) and operations control (Hendrickson 1987). As computer hardware and software develops and as more experience is accumulated, KBES will become a common alternative to conventional programming. The integration of expert systems and conventional programming approaches is likely to be particularly rewarding in this regard (Glover 1986; Hajek 1986).

ITS aims to facilitate a national multi-modal surface transportation system that features a connected transportation environment around vehicles of all types, the infrastructure, and carry-in passenger devices to serve the public good by leveraging technology to maximize safety, mobility, and environmental performance.[1]

Its covers all modes of transport and considers all elements of the transportation system- the vehicle, the infrastructure, and the driver or user, interacting together dynamically. The overall function of ITS is to improve decision making, often in real-time, by transport network controllers and other users, thereby improving the operation of the entire transport system. The definition encompasses a broad array of techniques and approaches that may be achieved through stand-alone technological applications or enhancements to ether transportation strategies. [2]

Vehicular Navigation, Control, and Location Recent advances in technology provide some significant new opportunities in the vehicular control area and, by extension, to the entire area of vehicle operations. New sensors and control procedures make continuous monitoring of locations possible and even introduce the possibility of widespread automated vehicle control (Skomai 1981). For example, several railroads have installed NAVSTAR satellite receivers so that precise locations of all locomotives are available at all times. Transit agencies have experimented with passive signpost systems to provide similar information on bus locations. The use of autonomous ground vehicles have become economical in applications such as warehousing and factory materials movement. With these hardware developments, a variety of control and other operations information becomes of interest. Immediate dispatching and routing of vehicles in response to current locations and demands requires new management strategies. Integration of sensing and control procedures provides many new challenges (Moravec 1981; Weisbin 1986). Although operation of automated vehicles in uncontrolled roadways may still be a distant prospect, applications in automated guideways, or maintenance activities are realistic possibilities. Better sensing and control of roadways may prevent the familiar backward-bending congestion phenomenon prevalent on roadways. For the transportation engineer, these new technologies present challenges to devise effective vehicle control strategies, to design more efficient and capable transportation systems, and to improve system operations over a travel network. Under the Automated Highway System (AHS), a system of vehicles was developed that uses both conventional roads under manual control and special guideways under automatic control (Elias 1977; Fenton 1980; Saxton 1980). The design goals of AHS are to increase lane capacity and improve travel time performance. However, the problems of decision making network, computer-to-vehicle communication, and roadway devices still remain to be solved. Computer-based route finding (Elliott 1982) and electronic trail finding (O'Rourke 1957) can both be used as part of AHS. The first simulates human thinking and can be employed on a smart vehicle. The second uses an electronic control system installed on the vehicle to trail the two-wire guided route by detecting the signal phase difference. Additional applications of automation in transportation include methods for reducing the demand, such as electronic road pricing (Fong 1984) and automatic vehicle monitoring (AVM) (Symes1980) that can be used to dispatch, monitor, and control vehicles to optimize a fleet performance. Traffic control strategies can be classified as pretimed and on-line (real time). Pretimed (open-loop) control strategies are applicable to steady state flow conditions. Real-time control is applicable in traffic systems that experience frequent state transitions and rapid flow variations, i.e., in most urban systems. The need for developing real-time control methods for traffic systems is evidenced by the excessive amounts of delays, energy consumption, pollution levels, and other user or indirect costs resulting from highway congestion in urban areas. Much recent work has been done in this area

(Isaksen 1973; Looze 1978; Payne 1971; Payne et al. 1973; Phillips 1978). However, one of the major difficulties in real-time control is associated with the lack of realistic, yet sufficiently simple and effective, models describing the traffic dynamics in critical roadway components of the freeway corridor. Major modeling problems that have not been resolved include treatment of interrupted flow, especially in merging, diverging, and weaving areas, and consideration of lane-changing effects and geometric variations. Additional problems include the problem of ramp diversion, the lack of an on-line demand predictor, and an on-line determination of the freeway origin-destination matrix.

Computer-Aided Planning and Design Traditionally, transportation has been a test bed for new theories and methods of design. Transportation applications provided a context for new developments such as mathematical programming or econometric models of discrete choice analysis (Ben-Akiva and Lerman 1985). As a new wave of computer-aided planning and design theory develops, transportation can provide another important application area. With limited budgets, effective planning and design have become more important. Computer-aided planning and design system are evolving to incorporate a constellation of analysis, evaluation, and synthesis application programs with shared data and inter process communication (Rehak 1985). Graphic displays, knowledge-based expert systems, and databases, as well as conventional analysis programs, are all important components. Theories of design synthesis and creativity are finding an important role in the design of such systems (Gero 1985; McDermott 1982). Both technological developments to aid computer performance as well as new concepts of design are appearing and available for application and further development. After considerable effort devoted to planning and design system development in the past 30 years, transportation has not experienced widespread application of the new integrated design systems. This is now changing, particularly for private-sector operations planning. A similar effort in traffic systems, transit providers, port facilities, and other systems of interest to transportation engineers can be expected.

Robotics and Automation While construction and maintenance have seen considerable mechanization over time, the use of robotics and automation for these purposes is in its infancy. These technologies offer the potential for productivity improvements, cost savings, quality improvements, and increased workforce safety. Given the enormous investment and maintenance needs evident for transportation infrastructure, vigorous pursuit of these technologies is extremely important for civil engineering. Introducing robots and automation into transportation will be a challenging task. Construction robots must be hardened for extreme conditions of vibration and environment distress. Maintenance robots should be designed and operated to avoid conflict with the users of facilities. In addition to the technical problems, institutional and organizational impediments to the introduction of automation might be expected from existing workers and managers. It is likely that widespread introduction of robots in the transportation domain will require the use of smart or cognitive robots that can sense, model the world, plan, and act to achieve working goals (Whittaker 1985).

In transportation, numerous useful application areas for robots and automation may exist. A partial list was provided by Zuk (1985) for roadways to include: culvert inspection; bridge inspection (both underwater and superstructure); shop welding; shop fabrication of signs; fabrication of structural steel and reinforcing bars; placing of reinforcing bars; striping roadways; culvert repair; underwater repair; grass cutting; grading and excavating; painting and cleaning bridges; pothole patching; fastening structural members; changing lamps on lampoles; washing signs and luminaires; servicing vehicles; and security patrolling.

Machine Vision and Image Processing for Vehicle Detection The advantages of vehicle detection through image processing over detection by existing loop detectors are several. In particular, an imaging detection system has multitask capabilities, i.e., it can simultaneously detect traffic, derive traffic measurements, perform surveillance, detect incidents, recognize special vehicles, and alert a human operator, among others. The system does not disturb the pavement thus improving reliability, and can perform the function of multiple detectors. In addition, it can vary detection location and this flexible detection configuration accommodates future development of advanced truly dynamic control strategies for both arterial networks and freeway corridors. Application of advance image processing technology to traffic surveillance has been pursued by the Federal Highway Administration (Schurmeier 1980). In Europe, eleven countries participated in a joint project for research and development of electronic traffic aids. In Japan, University of Tokyo conducted research on measuring traffic flow using real time video processing. The major problem with all existing systems, all experimental, is that they employ "fixed geometry" sensors; this implies that the points of the roadway being measured cannot be changed unless the camera is physically moved. Therefore, existing systems cannot extract all the necessary traffic information and, therefore, are not better than loop detectors. Moreover, existing experimental systems do not extract all the traffic parameters needed for surveillance and control in real time. In short, no practical cost-effective imaging detection system is available today.

## IV-CONCLUSION

The basic purpose of the paper was to review the areas where advanced technologies can significantly affect the way transportation engineering is practiced. The strategies for implementation of the necessary changes in the practice were also discussed along with the expected impact on civil engineering curriculum.

Implementing the use of Intelligent Transport System will definitely be going to affect our ride in a good way. Information Services remain fundamental to passenger satisfaction, which will Encourage use of public transport and reduce the use of personal vehicles. This significantly contributes to saving the environment from heavy vehicle pollution and reducing congestion on city wads. At the end we conclude that I.T.S. holds a good point in providing us a good, safe journey.

Traffic congestion is an important problem in Indian cities. There is scope for evaluating existing ideas in different and challenging traffic scenarios, innovate new solutions and empirically evaluate ideas in collaboration with public and private sectors. In this paper, we make a small effort to put together the different ideas and people relevant in Indian ITS, so that it gives an overview of the problem. This significantly contributes to saving the environment from heavy vehicle pollution and reducing congestion on city wads. At the end we conclude that I.T.S. holds a good point in providing us a good, safe journey

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