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Smart Breath Bag Unit and Evaluation of Vital Signs Module

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Abstract— *Due to Contraction motion in the diaphragm, reverse pressure is produced. By using this reverse pressure, human lungs suck the air from the environment for breathing. Contradictory motion is used to inflate the lungs by pumping type motion. Normally, Ventilators can generate 10-12 breaths per minute. With the help of Ventilator, we can also be able to monitor patient monitoring parameters like Temperature, SPO2, Heartbeat, Electrocardiogram and Electroencephalogram. The setting to adjust the time duration for inhalation to exhalation ratio is very important. We used a silicon ventilator bag which is coupled driven by DC motors with one side push mechanism to push the ventilator bag. For switching, here we use a relay switch and a variable pot to adjust the breath length and the BPM value for the patient. The vital sign module sensor is mainly used to monitor the necessity of the patient monitoring and display the results on LCD screen. There are different types of existing systems which can be used for operating an artificial manual breath unit bag. Such as Ruler chain mechanism, CAM mechanism, Rack and Pinion mechanism, Lead screw mechanism but here using front and back mechanism with the help of wiper motor function. The ventilator we designed and improved by using Microcontroller and Wi-fi module helps us to develop a low-cost, portable, and reliable Emergency Ventilator.*

Keywords – Ventilator, ECG, EEG, BPM Value, LCD Screen, CAM Mechanism, Wi-fi Module*.*

1- INTRODUCTION

Ventilators are machines that act as bellows to move air in and out of your lungs. Ventilators are computerized microprocessor-controlled machines, but patient scan also be ventilated with a simple, hand-operated bag valve mask. Ventilators are chiefly used in intensive-care medicine, home care, and emergency medicine (as standalone units) and in anesthesiology (as a component of an anesthesia machine). Units simplest form, a modern positive pressure ventilator consists of a compressible air reservoir or turbine, air and oxygen supplies, a set of valves and tubes, and a disposable or reusable patient circuit. The air reservoir is pneumatically compressed several times a minute to deliver room-air, or in most cases, an air/oxygen mixture to the patient. If a turbine is used, the turbine pushes air through the ventilator, with a flow valve adjusting pressure to meet patient-specific parameters. When over pressure is released, the patient will exhale passively due to the lungs' elasticity, the exhaled air

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being released usually through a one-way valve within the patient circuit called the patient manifold.

Ventilators may also be equipped with monitoring and alarm systems for patient- related parameters (e.g., pressure, volume, and flow) and ventilator function, backup batteries, oxygen tanks, and remote control. The pneumatic system is now days replaced by a computer-controlled turbo pump. Assist-control (AC) mode is one of the most common methods of mechanical ventilation in the intensive care unit. AC ventilation is a volume-cycled mode of ventilation. It works by setting a fixed tidal volume (VT) that the ventilator will deliver at set intervals of time or when the patient initiates a breath.

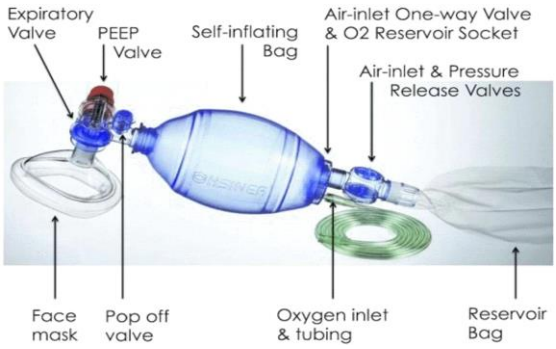

Fig 1.1:Artificial Manual Breath Bag unit

The Ambu (Air-Shields Manual Breathing Unit) Bag is a special type of Bag Valve Mask (or BVM) that is used to help a child or an adult who is either not breathing or having a hard time breathing on his own.

The utilization of manual resuscitators to provide ventilation to a patient is frequently termed as "bagging" the patient and is routinely essential for medical emergencies whenever the breathing of the patient is considered insufficient or has halted completely. They are used within the premises of the hospital for temporary ventilation of patient's that are dependent on mechanical ventilators whenever the mechanical ventilator is required to be evaluated for possible malfunction or whenever ventilator-dependent patients are mobilized within the hospital. It supplements air or oxygen directly into the lungs to expand them under controlled pressure, thus resultingina method to deliver positive pressure.

II- LITERATURE SURVEY

1. Ravinder Dahiya et al. (2020) has developed a method for the COVID-19 patient's who find it difficult to breathe as the virus infects the upper or lower parts of their respiratory act. These DIY emergency ventilators address this issue by automating the squeezing of the bag.

2.Mr. Edwincalilung et al. (2020) has developed a mechanical ventilator to help the short age so for ventilator or sinter and midranges. Many of these designs are based on automating the manual operation of the Bag Valve Mask (BVM), a ubiquitous resuscitator device used for emergency ventilation or resuscitation of patients with breathing problems.

3.Mr. Navid bin Ahmed et al. (2021) has developed a system for the Pneumonia patientswithhighpulseandbreathingrates,andlowbloodoxygen.Pulserateandbloodoxygenare two parameters that doctors use to diagnose and measure Pneumonia and Bronchitis.

4.Mr. AbhishekPandeyetal.(2021),hasintroducedaLow-CostPortableVentilatorDesignin 2021.They developed and tested the performance of an Atmel ATmega328P MCU andMAX30100 sensor kit-based pulse rate and blood oxygen monitor.

5.Mr. Muhammad Jawad Ghafoor et al. (2017), has introduced a Prototyping of a cost effective and portable ventilator. This piece of prototype is cost effective as well as energy efficient as far as the present technology in ventilators is concerned.

III.METHODOLOGY

ATMEGA328PU is the main controlling unit of the proposed system. Temperature sensor, Pulse oximeter, ECG sensor and EEG sensor are connected in ATmega328PU 's ADC port. oxygen flow can be controlled through the solenoid valve by relay which is connected to the controller's digital I/O pin. Oxygen pump is controlled by DC motor using relay which is connected to the controller's digital I/O pin. Temperature value, SPO2 data, Heartbeat data, ECG value and EEG value are sent to IoT module through ATmega238PU serial port. The IoT module receives the data and sends it to the cloud. The cloud data publishes

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the values and status of the patient on our own designed App by MIT inverter app domain.

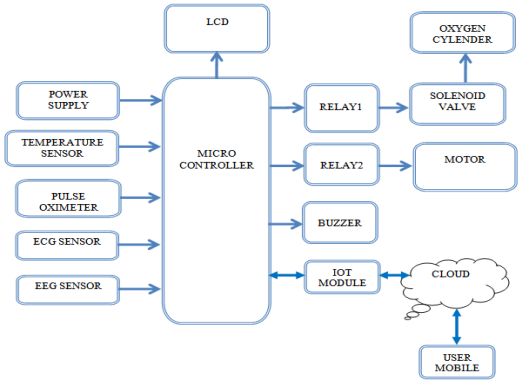

Figure 1.2: Block Diagram

IV.RESULT

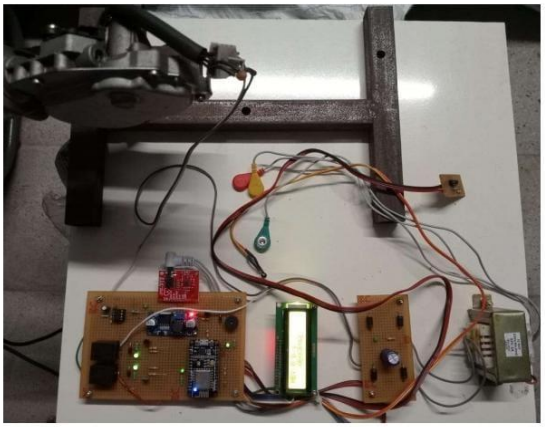

Figure1.3: Model

By using the IOT Module in our project, the results we get are all in digital values. With the help ofTemperature sensor, we will get an accurate body temperature in Celsius scale. The Heartbeat sensor helps us to sense the heartbeat and is measured in beats per minute (BPM).The pulse oximeter measures the percentage saturation of oxygen which ranges between 95% and 100% in the healthy body. ECG is a test mainly used to check the electrical activity of the heart. If the test done by ECG is normal, then the normal heart rate will be from 60 to 100 per minute. But if the test shows a slow or fast heart rate, then it maybe considered as abnormal heartbeat and it may lead to different heart conditions like a heart defect, coronary artery disease, heart valve disease, or an enlarged heart.EEG is a test used to measure the electrical activity of the brain. With the help of EEG, we can diagnose epilepsy, sleep disorders and brain tumours. With the help of this, doctors can easily identify the illness and can treat the patients for a better life.

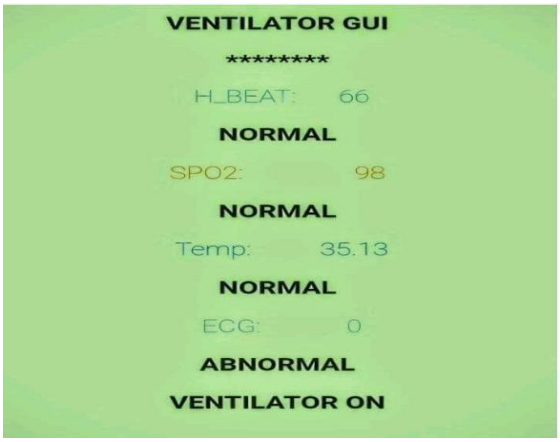

Figure 1.4: Result

V.CONCLUSION

Theproject is mainly discussed about thedevelopmentofArtificialManualunitbag-basedemergency ventilator and focused on two main mechanical design prototypes. Byusingamodifiedmechanismdrivenbyawiper motor helps us to design a low-cost ventilator.Thisprototypewas alsouncomplicatedandstabilized,didnotallowfullcontrolofventilation parameters. The ventilator provides oxygen to the patient's body mechanically. The tube which is connected to the ventilator allows the air to flow through the patient's mouth and to the windpipe.And, we also had added the extra medical parameters for bettertreatment.

VI.FUTURE WORK

The Artificial manual breath unit bag is the most efficient treatment for treating Covid andillness Patient at present. This device can be integrated with vital parameters for additionalmonitoring of pulse rate, temperature, ECG, EEG, SpO2. The therapy can be improvised andintegrated with otherwise breathing devices (Like we add mix of Oxygen Gas) using

newhighly technological breathing systems for combined medication and treatment of not onlyemergency and covid pandemic but also various kind of Breathing disorders and lunginfections. The ventilator we designed and improved by using Microcontroller and Wi-fi module helps us to develop a low-cost, portable, and reliable Emergency Ventilator

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