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SMART BREATH BAG UNIT AND VITAL SIGN MODULE

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ABSTRACT

Basically, human lungs are used to reverse pressure normally generated by contraction motion of the diaphragm to suck the air for breathing from the environment. To inflate the lungs by pumping type motion, contradictory motion is used. Normally 10 breathes per minute must be generated by the ventilator. Ventilator must have the ability to adjust the air volume pushed into lungs while assisted breathing. Apart from this the ventilator must be able to monitoring the patient monitor parameters like Temperature, Peripheral oxygen saturation (SpO2), Pulse rate and Electrocardiogram. The ventilator we design and develop using Microcontroller and Wi-Fi module encompasses all these requirements to develop a reliable yet affordable Emergency ventilator to help in times of Emergency.

Keywords: Ambu Bag, ECG, Pulse Rate, Temperature, Spo2, Firebase.

I. INTRODUCTION

The introduction should be typed in Times New with the pandemic caused by the corona virus disease 2019 outbreak as spurred researches around the world turn to an open source emergency type ventilator in response lighten the demand for these life saving devices. The patient can difficult to breathe as the virus infects the upper or lower part of the respiratory tract. An artificially manual breath unit of ventilator mechanically helps to pump oxygen into body. The air flows through the tube that goes mouth and down wind pipe. A ventilator may breathe out or it may do it or own. We use silicon ventilator bag coupled driven by wiper motor with one side worm gear mechanism to push the ventilator. we use relay switch because a variable potentiometer control to adjust the breath length and the beats per minute value. Here, we use a wiper motor or air compressor to squeeze the bag valve mask. The motor's speed and the air compression speed controls the breathing rate and the plunger controls the level of Bag valve mask compression. Our system also includes Peripheral oxygen saturation, Pulse rate, Temperature sensor along with sensitive Electrocardiogram sensor to monitor the necessary vitals of the patient and display on a mini-LCD display. Also, an emergency buzzer is included in the system to allot as soon as any anomaly is detected. The attributes of these initiative for their fast deployment, scalability and compact size low cost. The device is meant to be used only for short period of time to a few hours. It came be operated manually by some with no medical experience.

The main goal of this project and development work is together design ventilator and vital sign module, Fabricate and integrate an artificially manual breath unit bag-based emergency ventilator device for clinical testing and other emergency situation.

1) Mechanical design, assembly, integration and testing of the AMBU actuation mechanism.

2) Specification, integration of wiper motor and drive system for the compression mechanism.

3) Source code of controls and Instrumentation user interface safety system.

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II. BLOCK DIAGRAM

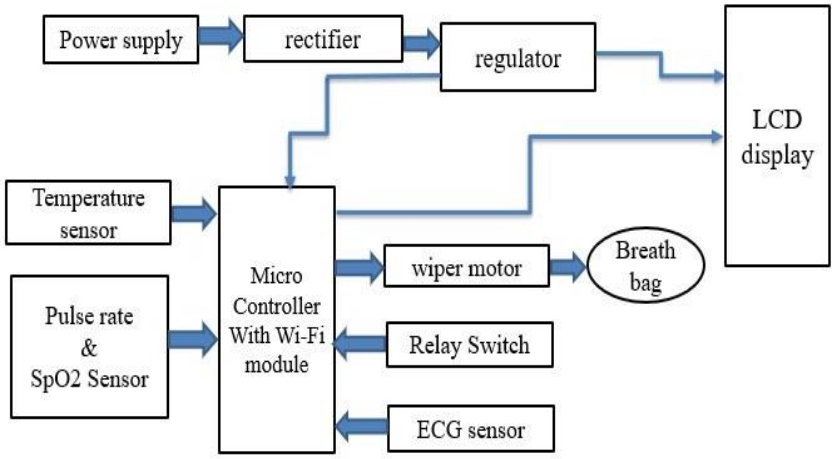

Figure 1: Block diagram of Experimental method

III. MATERIALS USED

A) Bag valve mask

A bag valve mask (BVM), sometimes referred to as an Artificial manual breath unit bag, is a handheld device. It is used to deliver positive pressure ventilation to patients who are not breathing or not breathing adequately. That involves the delivery of air (or) a mixture of oxygen combined with other gases by positive pressure into the lung. The device is normally used in hospitals as consideration of standard equipment situated in every emergency room or any other critical care facility.

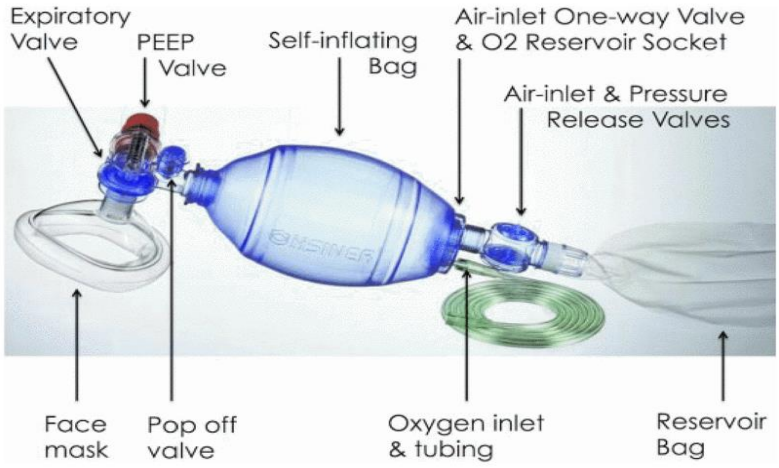

Figure 2: Artificial Manual Breath Bag Unit

B) Max30100 sensor

The max30100 is an integrated pulse oximetry and heartrate sensor. It combines two LED's a photodetector, optimized and low noise analog signal processing to detect SpO2 and beat per minute signal. Our analysis this sensor given as 97.11 % and 98.84% measurement.

C) 103 Thermistor

103 thermistor is an electrical resistor making use of a semiconductor whose resistance sharply in a known manner with the temperature. Quick and small reaction, long and good service, Good interconvertibility.

D) ECG sensor

This sensor to calculate the electrical movement of the human heart. It helps to getting a clear signal from the intervals simply. By implementing electrocardiogram, we can also monitor the change in heart rate, while the patient is connected with the ventilator to prevent sudden Arrhythmia.

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E) NODEMUC – ESP8266EX

NODEMCU is an open-source platform on ESP8266 which can connect object and let data transfer using the Wi-Fi protocol. ESP826EX delivers highly integrated Wi-Fi solution to meet the continuous demands for efficient power usage, compact design and reliable performance in the industry. Self-contained Wi-Fi networking capabilities, it can perform as either an application sperate or the slave to a host MCU. Small sized module to fit smartly inside our IoT project.

F) Wiper motor

Wiper Motor, the power origin of the wiper blade, is the core of the whole wiper system. The motor activities linkage that moves the wiper arms back and forth motion. The wiper motor blade is a permanent-magnet direct current (DC) one. The worm gear mechanism to slow down and increase torque.

G) Software Requirement

The internet of things (IoT) IoT refer to a system interrelated, internet connect objects that one able to collect and transfer data over a wireless network without human interaction.

1) Based on ESP-12F ESP8266EX Wi-Fi Board.

2) Platform: IoT (Internet of Things)

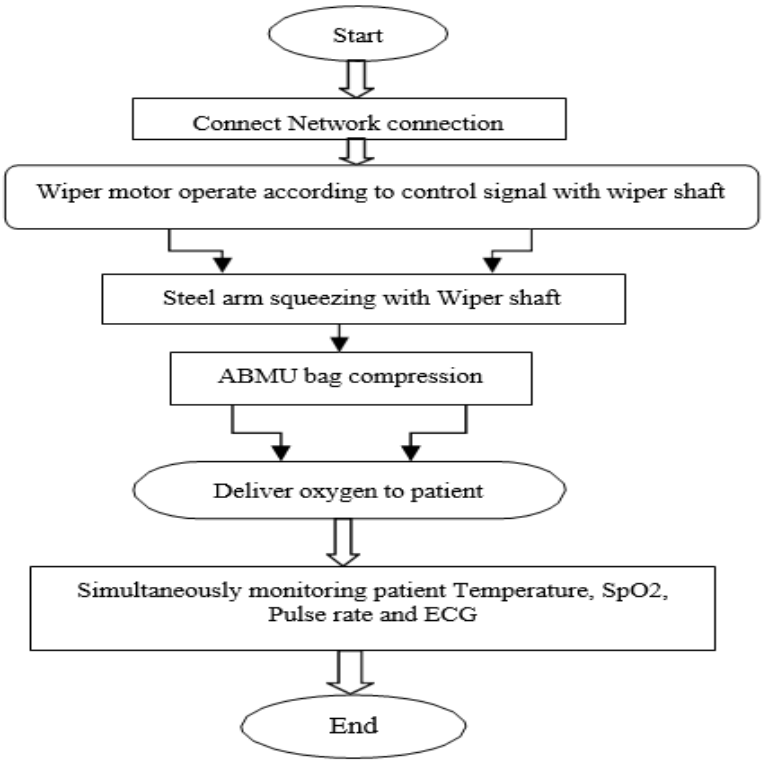
3) Developing language: C program

4) Near field communication medium: Wi-Fi

IV. PROBLEM IDENTIFICATION

Due to pandemic the lack of ventilator patients suffers in inhaling and exhaling at emergency situation. Mostly in hospitals both medical monitoring parameters and DIY ventilator are kept separately.

V. FLOW PROCESS



VI. PROPOSED METHOD

Our proposed system is based on Artificial Manual breath unit bag - based emergency ventilator and we have focused on two main Mechanical things. It was simple compact and low-cost ventilator designed by using a modified yoke mechanism driven by a wiper motor. When using stepper motor sometime its mechanism works in the speed. Of low angle. So, we use DC Wiper motor to control the speed of work function and also

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compression of the Ambu bag. The shafts of the motor are attached with a mechanical pulley they rotate according to motor direction. Combining both the ventilator and medical monitoring parameters there is more advantages in identifying their illness accede ring to their body condition. Providing them a good inhalation and exhalation together it helps to identifying four parameters. By implementing electrocardiogram, we can also monitor the change in heart rate, while the patient is connected with the ventilator to prevent sudden Arrhythmia. Using Firebase console the data can be stored and shared among doctors and therapists for mobile monitoring and treatment suggestions.

VII. OVERALL PROJECT MODEL

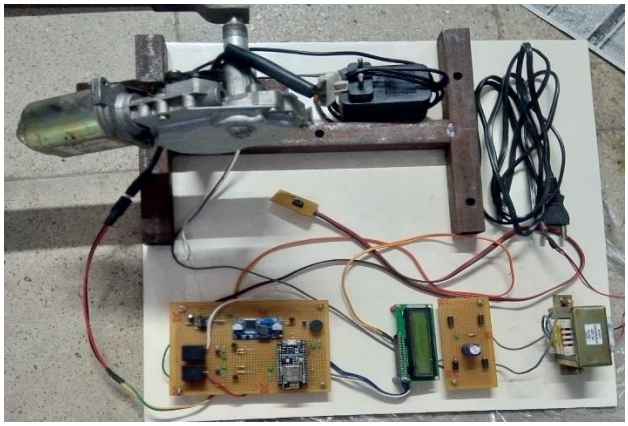

Figure 3: Overall Project Model

VIII. OUTPUT REPRESENTATION

Table 1: Output Representation.

Medical parameters	Standard Output	Actual Output
Pulse rate	72	72
SpO2	97.11% to 98.84%	96%
Temperature	37 °C	31 °C

Note: ECG Output represented three “Waves” of signals. The “P” wave indicates the electrical impulse in the upper chambers. The “QRS” wave records electrical activity in the lower chambers. The “T” wave reflects the heart’s return to rest.

IX. RESULTS AND DISCUSSION

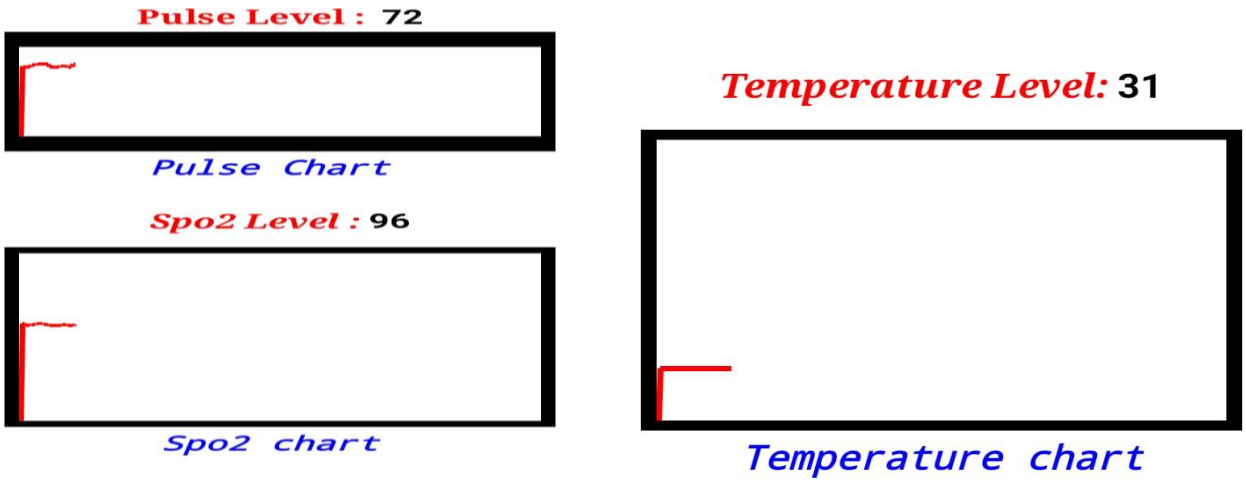

Figure 4: Results Representation

We are using IOT Module in our project. We obtained the final results in both the analog and digital values as well. It will be more useful for the doctors to identify the illness and to treat them for their betterment of the patient. The obtained datas of the patients can be maintained for the later use.

X. CONCLUSION

The paper discussed about the development of Artificial Manual unit bag-based emergency ventilator and we have focused on two main mechanical design prototypes. It was possibly low-cost ventilator designed by using a modified mechanism driven by a wiper motor. This prototype also uncomplicated and stabilize, did not allow full control of ventilation parameters. The ventilator mechanically helps in pumping the oxygen into body. Air flows through a tube that goes in our mouth and down to windpipe. The ventilator also helps in breathing out. And also, we had added the extra medical parameters for better treatment.

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