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EMERGENCY DIY MINI VENTILATOR SYSTEM

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ABSTRACT

The patient is suffering from an injury or illness that makes it hard to breathe. A ventilator may help to breathe during these conditions. It is useful in surgery where you are asleep, but this is usually for no more than a few hours. So simply ventilator is a machine that helps a patient to breath when they are having a surgery or cannot breathe their own due to a critical illness. Here, the patient is connected to the ventilator with a hollow tube that goes in their mouth and down into their main airway or trachea. In this paper develops a portable ventilator using AMBU (Artificial Manual Breathing Unit) Bag. The main advantages of this ventilator is that it is less expensive, portable and also automatically works. At emergency conditions the doctor can adjust the amount of air using a control mechanism that is built in Android application. Also, if the Doctor is not there a will be a notification sent to telegram of the Doctor or the hospital health assistant, and people around are alerted by the buzzer if pressure increases.

1. INTRODUCTION

The global COVID-19 pandemic has highlighted the need for a low-cost, rapidly-deployable ventilator solution for the current and future pandemics. While safe and robust ventilation technology exists in the commercial sector, there exist a small number of suppliers who have been unable to meet the extreme demands for ventilators during a pandemic. Moreover, the specialized and proprietary equipment developed by medical device manufacturers can be prohibitively expensive and inaccessible in low-resource areas. Moreover, ventilation as a technology is needed globally beyond pandemics for applications spanning neonatal intensive care, surgical anaesthesia, life support, and general respiratory treatments. Hence there is a clear need for a broader range of solutions, both for research and clinical applications. Ventilators are one of the most important devices to keep COVID-19 patients in the most critical condition alive. As the global demand for ventilators is increasing and there is shortage of

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ventilators in our country as well, also managing patients during this time is a big task, so we have designed portable operated Ambu bag compressing machine, which enables the doctors or nurses to monitor, and have made the prototype and we are improving it's performance by adding extra new features. It can be used for emergency purposes, in hospitals, Corona virus quarantine coaches, isolation wards and rural areas as well. The shortage of ventilators can be met effectively by developing this project. This project is a low cost yet effective ventilating system for the people affected with COVID-19.

2. LITERATURE SURVEY

The respiratory system is also affected by the viral disease caused by the pandemic coronavirus. Dyspnea is the medical term for the coronavirus symptom of shortness of breath. Ventilator is the name of the medical device that is used to treat respiratory failures. Ventilators are used for patients who are unable to breathe, so the term "life support" is also used. If you're unable to breathe on your own, this device will assist you. Another name for it is a "mechanical ventilator." It's also frequently referred to as a "breathing apparatus" or "respirator."

Re za S. Dilmaghani (2016) in their study found the design of Wi-Fi sensor network that is capable of monitoring patient's chronic diseases at their home itself via a remote monitoring system. So immerging of wireless sensor techno+-logy individual test like only blood pressure, heart rate, temperature etc. can be measured but this research project enables all this parameter together to be measured under single system, and also thus all can be worn by patient and processed data send toward internet through internet of things (IOT).

In the year 2017, Muhammad Jawad Ghafoor et.al. are introduced Prototyping of a Cost-Effective and Portable Ventilator. An electronic pressure sensor attached to the patient's airway sends a signal that is monitored by a pair of nonlinear recursive envelope trackers in a low complexity signal processing system.

Later in the year 2017, Abhishek Pandey et.al. gives An Introduction to Low-Cost Portable Ventilator Design. An electronic pressure sensor attached to the patient's airway sends a signal that is monitored by a pair of nonlinear recursive envelope trackers in a low complexity signal processing system.

S. J. Jung and W. Y. Chung studied the Flexible and scalable patient's health monitoring system in 6 LoWPAN. The main advantage of this enabling factor is the combination of some technologies and communications solution. The results of Internet of Things are synergetic activities gathered in various fields of knowledge like telecommunications, informatics and electronics.

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Md. Rakibul Islam, Designing an Electro-Mechanical Ventilator Based on Double CAM Integration Mechanism. (ICASERT 2019), This paper proposes a simplified structure of microcontroller based mechanical ventilator integrated with a Bag-Valve-Musk (BVM) ventilation mechanism. Here, an Ambu bag is operated with computer-aided manufacturing (CAM) arm that is commanded via a microcontroller and manual switches by sending a control signal to the mechanical system.

During the year 2020, Ryan M. Corey Evan et.al. are introduced Low-Complexity System and algorithm for an Emergency Ventilator Sensor and Alarm. Numerous organizations have created affordable emergency ventilators in response to the COVID-19 pandemic's predicted lack of ventilators. These products frequently consist of pressure-cycled pneumatic ventilators, which are simple to manufacture but frequently lack the sensing or alarm capabilities present on commercial ventilators.

Edwin Calilung et.al in the year 2021, Designed and Developed of an Automated Compression Mechanism for a Bag Valve Mask-Based Emergency Ventilator. On a computer screen, the prototype can provide settings and status. Since these ventilators frequently break down and become vulnerable over time, the manufacturer must be paid for expensive service agreements.

3. EXISTING SYSTEM

There has been an exponential growth in healthcare technology in the last century. Devices like health care monitoring systems and modern ventilators are being produced. A ventilator is an electromechanical device that can be used as an alternative breathing mechanism for a patient whose lungs have lost the capacity to inhale and exhale.

The most pressing shortage facing hospitals during the COVID-19 emergency is a lack of ventilators. The global COVID-19 pandemic has highlighted the need for a low-cost, rapidly-deployable ventilator solution for the current and future pandemics. While safe and robust ventilation technology exists in the commercial sector, there exist a small number of suppliers who have been unable to meet the extreme demands for ventilators during a pandemic. Positive pressure ventilation has been an important components of respiratory disease management for the last 50 years. External instruments called ventilators are intended to provide artificial breath to a patient.

There are several existing systems of operating an Ambu bag. Such as Ruler chain mechanism, CAM mechanism, Rack and pinion mechanism, Lead screw Mechanism. They have some advantages and disadvantages.

Moreover, the specialized and proprietary equipment developed by medical device manufacturers can be prohibitively

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expensive and inaccessible in low-resource areas. Hence there is a clear need for a broader range of solutions, both for research and clinical applications

4. PROPOSED SYSTEM

The proposed system aims to solve the problem of expensive and sophisticated ventilator systems and health monitoring systems by introducing an easy-to-use low-cost IoT based ventilator and patient monitoring system.

The obligatory control mode is automatically employed in this project. Figure depicts the breath delivery system's flow. The patient is given breath based on an equal time delay. by using the controller's internal timer. the scheduled delay based on the doctor's recommended breath rate. Due to the pressure limiting valve at the AMBU bag, the supplied breath is set at 60cmH2O (centimetre of water). This quantity was likewise discovered to be the highest breath pressure required for an older patient. The flowchart for a cheap portable ventilator is shown in the picture. The flowchart in this example has a start block that must first initialize all global variables and Communication. Global variable initialization is employed. For the initialization of communication and machine codes for the clearance of the server path.

5. BLOCK DIAGRAM

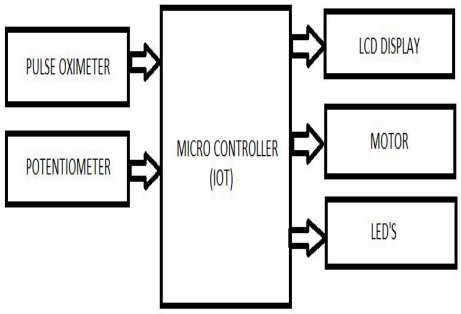

Fig. 1 Block diagram

6. HARDWARE USED:

6.1 ESP32:

ESP32 is a low-cost, low-power Microcontroller with an integrated Wi-Fi and Bluetooth. It is the successor to the ESP8266 which is also a low-cost Wi-Fi microchip albeit with limited vastly limited functionality.

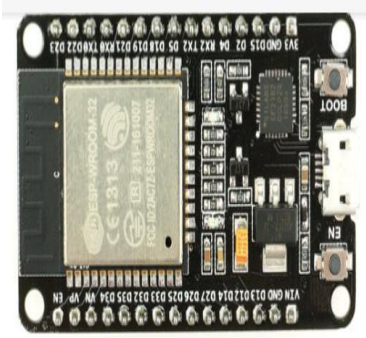

Fig. 2 ESP32

6.2 NodeMCU:

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The Internet of Things (IoT) has been a trending field in the world of technology. It has changed the way we work. Keeping this in mind, Espressif Systems (A Shanghai-based Semiconductor Company) has released an adorable, bite-sized WIFI enabled microcontroller – **ESP8266**, at an unbelievable price! For less than $3, it can monitor and control things from anywhere in the world – **perfect for just about any IoT project**.

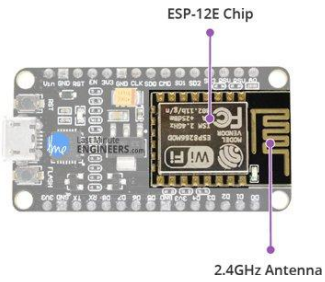

Fig. 3 NodeMCU

6.3 LCD Display:

LCD stands for Liquid Crystal Display
LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs)

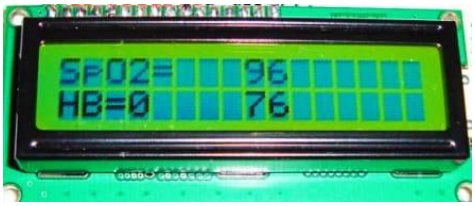

Fig. 4 LCD Display

6.4 Motor:

Electric motor, any of a class of devices that convert electrical energy to mechanical energy, usually by employing electromagnetic phenomena.

Fig. 5 Motor

The basis of operation of the induction motor may be developed by first assuming that the stator windings are connected to a three-phase electric supply and that a set of three sinusoidal currents of the form shown in the figure flow in the stator windings.

6.5 Motor Driver:

L298N module is a high voltage, high current dual full-bridge motor driver module for controlling DC motor and stepper motor. It can control both the speed and rotation direction of two DC motors.

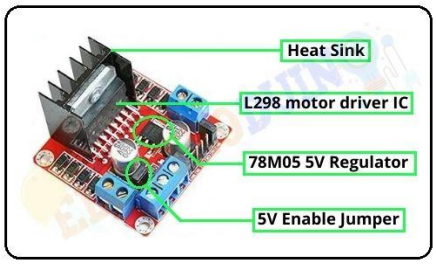

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Fig. 6 Motor Driver

This motor driver module consists of two main key components, these are L298 motor driver IC and a 78M05 5V regulator.

6.6 Potentiometer:

The potentiometer is an important topic of Physics, and students need to understand the basic concepts related to this topic.

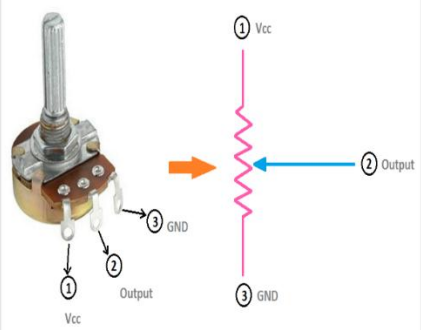

Fig. 7 Potentiometer

The potentiometer is an instrument designed for measuring the unknown voltage by comparing it with the known voltage. In other words, it is the three-terminal device used for measuring the potential differences by manually varying the resistances. of three sinusoidal currents of the form shown in the figure flow in the stator windings.

6.7 MAX30100 Pulse Oximeter:

MAX30100 is an integrated pulse oximeter and heart-rate monitor sensor solution. It's an optical sensor that derives its readings from emitting two wavelengths of light from two LEDs – a red and an infrared one – then measuring the absorbance of pulsing blood through a photodetector.

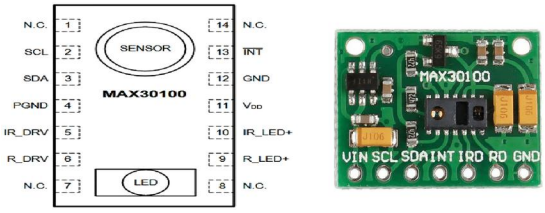

Fig. 8 Pulse Oximeter

The pulse oximetry subsystem in MAX30100 consists of ambient light cancellation (ALC), 16-bit sigma delta ADC, and proprietary discrete time filter. It has an ultra-low-power operation which makes it ideal for battery operated systems

7. CONCLUSION

There is clear technical potential for alleviating ventilator shortages during this

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and future pandemics using open-source ventilator designs that can be rapidly fabricated using distributed manufacturing. With the considerably larger motivation of an ongoing pandemic, it is assumed these projects will garner greater attention and resources to make significant progress to reach a functional and easily replicated open-source ventilator system. There is a large amount of technical future work needed to move open-source ventilators up to the level considered adequate for scientific grade equipment and further work still to reach medical-grade hardware.

8. FUTURE SCOPE

Future work is needed to achieve the potential of this approach not only on the technical side, but also by developing policies, updating regulations and securing funding mechanisms for the development and testing of opensource ventilators for both the current COVID19 pandemic, as well as for future pandemics and for everyday use in low-resource settings. As the reliability of the sensors are very less the estimation of oxygen requirement is not so accurate, but this project is very much needed and useful in the present Pandemic.

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