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Emergency Sensing DIY Ventilator for Covid Pandemic Using Arduino Uno

Ms.A.P.Nithyapriya¹, S.Premji², R.Pusphakaran³, V.Raghavganesh⁴, T.Tamilselvan⁵

Assistant Professor, Department of ECE, Adhiyamaan Engineering College, M.G.R.Nagar, Hosur,
Tamilnadu, India¹

U.G. Students, Department of ECE, Adhiyamaan Engineering college, M.G.R. Nagar, Hosur,
Tamilnadu, India^{2,3,4,5}.

ABSTRACT: During pandemic time such as covid 19 which affect our respiratory system there will be too many people who need ventilators for breathing but a modern mechanical ventilator cost very high and so there are no enough ventilators in government hospitals. To solve this problem a low cost ventilator with sensing devices to detect and alert if anomaly exist in patients as full time monitoring by concerned person is impossible. To satisfy all this needs a reliable yet affordable ventilator can be developed and designed using Arduino Uno. The entire system is driven by Arduino controller to achieve desired results and to assist patients in pandemic and other emergency situations.

KEYWORDS: Pandemic, Low cost, Pumping, Monitoring, and Anomaly.

I. INTRODUCTION

One significant gadget which has very high requirement is ventilators as it is for patients who need help with their breathing because of the respiratory impacts of COVID-19. Essentially a ventilator is a machine that gives breathable air in and out of the lungs, to convey breaths to a patient who is actually incapable to inhale or breathing inadequately. A DIY ventilator may not be effective as that of a medical grade ventilator yet it can go about as a decent substitute in the event that it has authority over the accompanying key boundaries. In this ventilator sensing devices such as Heart beat sensor, Pressure sensor and Temperature sensor can be integrated to detect and warn if any anomaly exists in patients. Arduino Uno is the ATMEGA 328 controller used here to process and control the entire operation. If there is a considerable value in heart beat rate sensor the ventilator will start pumping as there is no need of ventilator to a heartbeat less person. The rate of pumping is based on the output values of sensors especially pressure sensor as the controller takes the output of sensors as inputs and gives output as per the input. This design is new and modified but it is open which means any one can replicate this design. DIY ventilators are Bag valve mask (Ambubag) but this system is automated and so there is no need of squeezing the bag as the microcontroller and servo motor take care of it.

II. RELATED WORKS

Abdul Mohsen Al Hussein et al., 2019, introduced the idea of Low cost portable mechanical ventilator. This group designed and made a prototype of low cost portable mechanical ventilator for use in mass casualty cases and resource poor environments. The ventilator compresses Bag Valve Mask (BVM) with automatic cam arm to deliver breaths, this system eliminates human operator for compressing BVM. They developed working prototype with assist control and over pressure alarm, they system needs low power requirements and runs for 3.5 hours on single battery charge. SubhaHency Jose P et al., 2019 introduced the idea of a Prototype which is built by minimum components to assist patients who can only partially breathe. This group developed a

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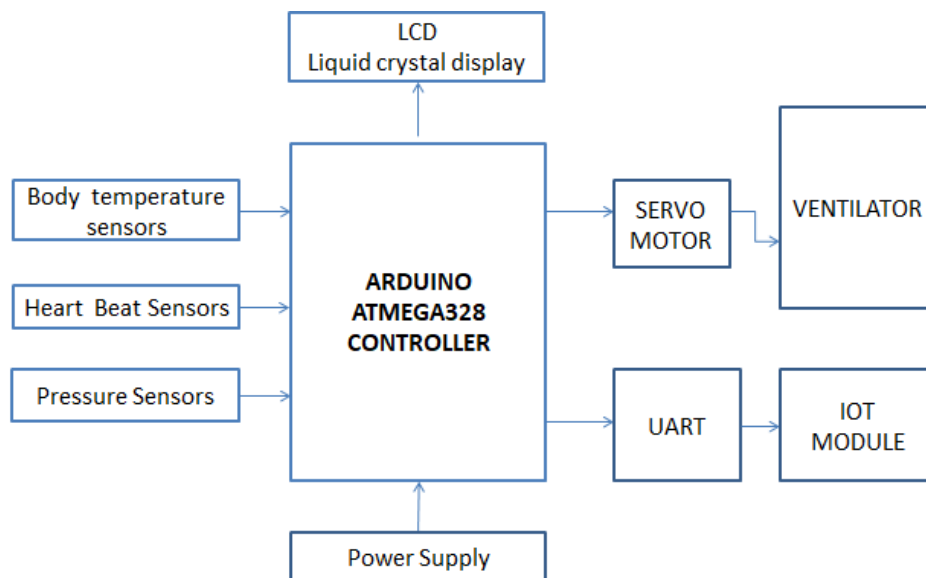
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prototype of device to assist patients who can partially breathe by their own. They used needle valve with potentiometer to replace the flow analyse and to make it cost effective.

III. METHODOLOGY

Human lungs use the reverse pressure generated by the contraction motion of the diaphragm to suck in air for respiratory. A contradictory motion is employed by the ventilator to inflate the lungs by pumping kind motion. Here a silicon ventilator bag is employed couple driven by DC motors with push mechanism to push the ventilator bag. Toggle switch is employed for switching and variable pot is employed for adjusting the breath length and also the BPM value of the patient. This method makes use of Heart beat sensing element, temperature sensing element alongside sensitive pressure sensing element to observe the related vitals of the patient and show on a mini screen. Additionally an emergency buzzer alert is fitted within the system to sound an alert if any anomaly is detected. The complete system is driven by arduino controller to attain desired results and to help patients in COVID pandemic and other emergency situations. The dominant processing device used here is Arduino Uno to which three sensors are connected then the controller provides needed digital outputs as per the inputs. In alternative words the speed of pumping relies on the necessity of patients. The output of arduino activates the servo motor and it decides however the motor should work then it controls the speed of pumping of ventilator. The output of arduino i.e the decipherable values of sensing element is shipped to the web site iotclouddata.com, this become doable because the output is shipped to the iot module via UART(Universal Asynchronous Receiver and Transmitter).The iot module ESP8266 incorporates a TCP/IP stack which might be accustomed connect with the LAN network. The output is also send to the LCD(Liquid Crystal Display) for nearby monitoring. The power supply of 5V is needed for the operation of arduinouno.

BLOCK DIAGRAM



IV. EXPERIMENTAL RESULTS

In this project as the Heart beat sensor, Temperature sensor and Pressure or force sensor are integrated with the ventilator these sensors detect the magnitude of the related values which are processed by arduinouno. Based on these values pumping of ventilator occurs. The expected output here is the pumping of ventilator as per the detected values of sensor. The speed of pumping depends on the output of arduinounowhich depends on its

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input that is sensor detected values. The output of sensors values are displayed on LCD display and updated in the website iotclouddata.com through IOT. Above mentioned are expected outputs.

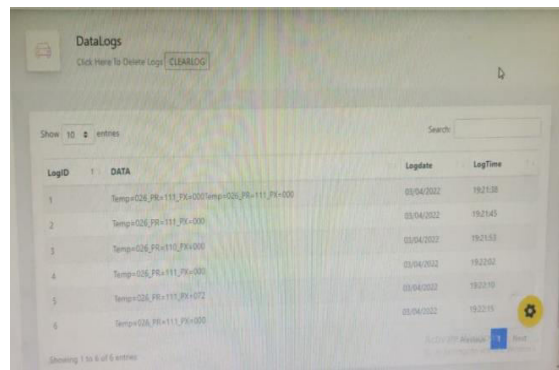
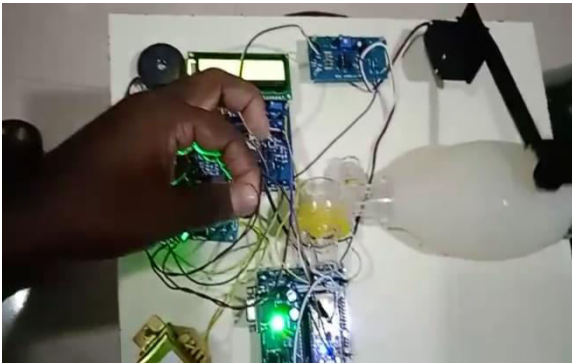


FIG:1 Prototype Design

FIG: 2 Outputs Displayed Via Wi-Fi Module



FIG: 3 Real Time Usage

V. CONCLUSION

This work proposes the design of a low-cost artificial ventilator in which mechatronic design strategies and manufacturing techniques based on rapid prototyping were implemented. To guarantee the robustness and effectiveness of the proposed design, a robust control scheme based on a sliding mode super twisting controller is used which allows the proper trajectory tracking control and enables to follow the required respiratory profiles. Experimental results validate the effectiveness of the proposed controller and mechatronic design. As future development, it is proposed to work toward the grant of the certification of this prototype in order to be used in the medical sector

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BIOGRAPHY



Ms. A. P. Nithyapriya,
Assistant Professor,
Electronics And Communication
Engineering Department,
Adhiyamaan College of Engineering,
Anna University.



S.PREMJI
Electronics And Communication
Engineering Department,
Adhiyamaan College of Engineering,
Anna University.



R.PUSPHAKARAN
Electronics And Communication
Engineering Department,
Adhiyamaan College of Engineering,
Anna University.

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Department of ECE, Adhiyamaan College of Engineering, Hosur, Tamilnadu, India



V.RAGHAV GANESH
Electronics And Communication
Engineering Department,
Adhiyamaan College of Engineering,
Anna University.



T.TAMIL SELVAN
Electronics And Communication
Engineering Department,
Adhiyamaan College of Engineering,
Anna University.



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