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Rapid Manufacturing Ventilator

[1]Shweta Kanakdande, [2]Anushka Isane, [3]Pawan Sagade, [4]Prof. Dr. S.B.Dhonde

[1,2,3]Student, B.E., Electronics and Telecommunication, AISSMS Institute of Information Technology, Pune, Maharashtra, India

[4]Professor, B.E., Electronics and Telecommunication, AISSMS Institute of Information Technology, Pune, Maharashtra, India

***Abstract* - The reports of the ventilator shortage in Italy inspired many teams worldwide to attempt designing easily manufacturable ventilators utilizing several different approaches. However, it was challenging to comply with the international standards for critical care ventilators and to provide ventilator parameter setting compliant with the current protective ventilation recommendations according to the latest evidence-based medicine. The properties of the ventilator evaluated during its first use on a patient on October 31, 2020, proved its applicability in the clinical practice, the accuracy of ventilator parameters and the ability to easily switch between Coro Vent and a standard mechanical lung ventilator. The Coro Vent project demonstrated that even a rapidly manufactured ventilator can help to manage pandemic situations if it is developed in accordance with the international technical standards for critical care ventilators.**

Keywords: frequency, generator, ATmega328P, microcontroller, voltage / frequency.

I. INTRODUCTION

COVID-19 pandemic has the potential for a rapid outburst where emergency medical care has to be re-organised so as to meet the spiked respiratory support needed for the critically ill. In such a scenario, the ventilator must be rapidly manufacturable and deployable. Even otherwise, the need for ventilators is accelerated due to air pollution-related lung diseases that are on the rise in the developing countries (Aït-Khaled et al. 2001). Mechanical ventilators are the machines that assist the patients with severe acute respiratory distress; they enable an artificial exchange of oxygen and carbon dioxide in the lungs (WebMD 2008). While there are sophisticated ventilators with advanced features that cost up to INR 20 lakhs, the aim of this paper is to describe a quick construction of a low-cost ventilator to ventilate patients on oxygenated air mixture through an endotracheal tube, for the most severe hypoxemic phase of the COVID-19 disease, also known as severe acute respiratory syndrome (SARS) or acute respiratory distress syndrome (ARDS). In COVID-19 disease, approximately 5% of the infected people are expected to get ARDS (Cao 2020). There are many designs of the emergency and portable ventilators in the market, which are one order cheaper than the hospital ventilators (Husseini et al. 2010). They are broadly classified into two types: pneumatic and electric. The pneumatic ventilators require externally pressurized air, which may not be readily available in emergencies. On the other hand, the modern electrically operated ventilators can operate anywhere. However, due to its intricate design and function, they are generally costlier than the pneumatic ones.

II. METHODOLOGY

In our project, we are basically concentrating on following applications such as: There are many mechanical ventilators on the market with different levels of complexity and sophistication The most sophisticated hospital ventilators have integrated sensors, electronics, and software intelligence that control the volume of air flow, air pressure, and breathing rate. Because of the exponential growth of COVID-19 infected patients, it is currently unknown whether enough hospital-grade ventilators will be available to meet demand in the coming weeks and months. When a hospital-grade ventilator is not available, alternative ventilation methods are desired.

This low-cost portable ventilator is an inexpensive alternative to the exorbitant purchasing cost hospital ventilators. The proposed ventilator can provide 500-600ml tidal volume with a continuous working ability with 12 RR/min that is sufficiently high for a pneumonia patient and also for heart attack patient. Effective and safe deployment of the devices to patients in need. There is clear technical potential for alleviating ventilator shortages during future pandemics using open source ventilator designs that can be rapidly fabricated using distributed manufacturing. An IoT based motor drive of clockwise and counter clockwise will provide the required motion for the arm movement to maintain an automatic air flow with a controlled pressure rate. Figure 1 shows the working process of this proposed automatic ventilation machine.

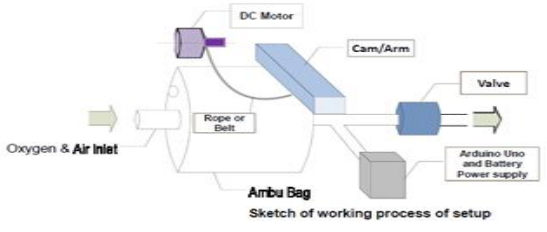

Figure 1: Process of this proposed automatic ventilation machine

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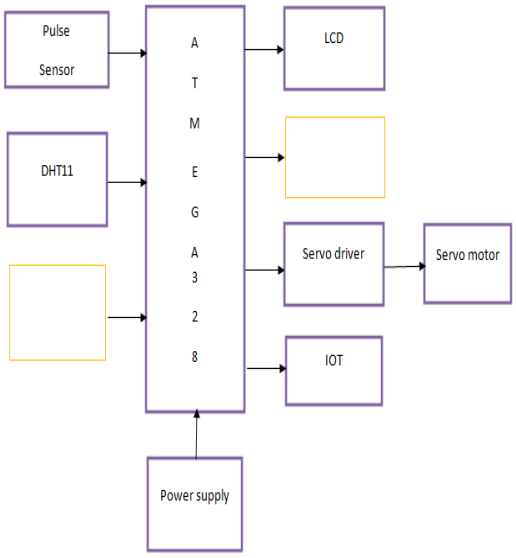

Figure 2: Block Diagram

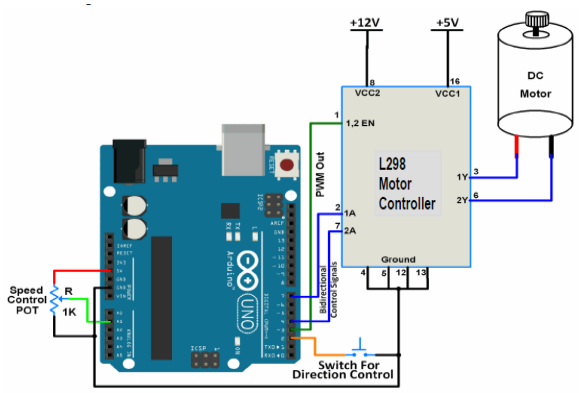

Figure 3: Circuit diagram of proposed system

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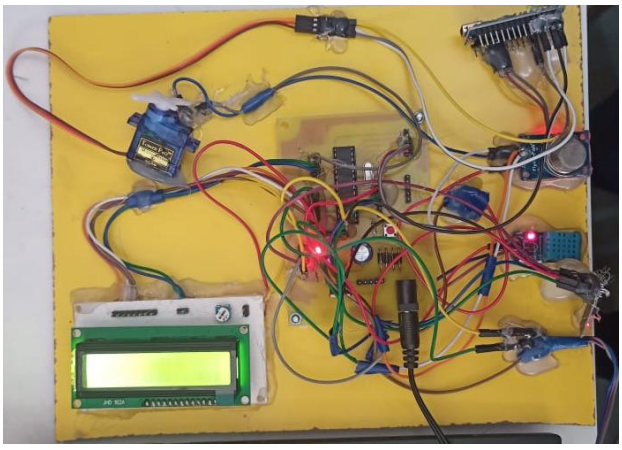

Figure 4: Hardware Implementation

Figure 5: Result

Figure 6: Output

III. RESULTS AND CONCLUSION

In this study we presented a new, versatile, rapid-response based design ventilator for the current COVID-19 pandemic. Our design has been authorized under the FDA's Emergency Use requirements. The relatively straightforward, physiologically well-grounded design will permit ready deployment into the clinical arena. The cost and simplicity of the design promises to motivate production at scale. These properties may enable the ventilator to fill a large gap in our current healthcare armamentarium, specifically a scalable, inexpensive, and highly functional mechanical ventilator. The ventilator is especially well positioned to address the marked divergence of supply and demand that has happened, and will continue to occur, in large scale pandemics worldwide.

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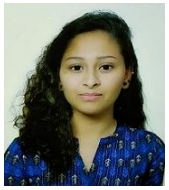
Shweta Kanakdande, Student, B.E., Electronics and Telecommunication, AISSMS Institute of Information Technology, Pune, Maharashtra, India.



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Pawan Sagade, Student, B.E., Electronics and Telecommunication, AISSMS Institute of Information Technology, Pune, Maharashtra, India.

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