An Inexpensive and Effective Ventilator for use in Emergencies

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Abstract - *A low-cost ventilator is made in compliance with the US Food and Drug Administration's (FDA) emergency usage guidelines. In addition to drastically reducing the time from strategy to clinical deployment and improving reliability, this straightforward method eliminates the requirement for several components that are necessary for standard ventilators while still producing life-saving ventilation*.

***Key Words*:** Arduino, ventilator, bag valve mask , pneumatic, COVID-19

1.INTRODUCTION

Human lungs utilize the opposite pressure produced by the compression movement of the stomach to suck in air for relaxing. An incongruous movement is utilized by a ventilator to swell the lungs by siphoning type movement. A ventilator component should have the option to convey inside the scope of 10-30 breaths each moment, with the adaptability to manage rising augmentations in sets of two. along with this, the ventilator should have the ability to manage the air volume drove into the lungs with every breath. Last however presently least is that the setting to control the time length for inward breath to exhalation proportion.

In addition, the ventilator ought to be able to simultaneously monitor the patient's blood oxygen saturation and exhaled lung strain in order to prevent over- or undergas tension. Here, we design and develop a ventilator that uses Arduino to fulfill these requirements, making it a reliable yet affordable do-it-yourself ventilator that can help during pandemic seasons. Here, we push the ventilator sack using a two-side push mechanism in conjunction with a silicon ventilator pack powered by DC engines. We use a variable pot to control the patient's breath length and, consequently, their heart rate (BPM), and an electric switch for exchanging. Our system uses a blood oxygen sensor and a sensitive tension sensor to monitor the necessary vital signs of thetolerant and display them on a small screen. Similarly, when an anomaly is detected, a crisis ringer alert installed within the framework will sound. An Arduino regulator powers the entire system, acknowledging desired outcomes and assisting patients throughout the COVID-19 epidemic and other emergency situations. Amidst the global crisis caused by the Covid epidemic, hospital facilities and medical services departments are identifying serious equipment shortages. It is our responsibility as creators to combat the shortage by creating makeshift, open-source replacement devices. Even if our country may be under extreme lockdown, our inventiveness is unaffected! Ventilators are a major device whose demand has increased, particularly for patients who require assistance breathing due to the respiratory effects of COVID-19. In essence, a ventilator can be thought of as a device that supplies air that can be breathed into and out of the lungs in order to support a patient who is actually unable to breathe on their own or who is breathing inadequately. Although a do-it-yourself ventilator is unlikely to be as effective as a ventilator of the highest caliber, it can serve as a respectable stand-in in the unlikely event that it has control over the ensuing critical boundaries. Tidal volume is the amount of air that the ventilator delivers to the lungs with each breath; it is usually 500 ml at a time Breaths per minute, or BPM, is often the standard breathing rate. Ten to thirty is the range.

2. LITERATURE SURVEY

The development of inexpensive, open-source automated ventilators is demonstrated in this work. The numerical technique for tracking patients' lung status is also demonstrated in this literature. We shall categorize the patients' lungs as healthy or unhealthy with the help of a pressure sensor. The pressure sensor's data is gathered by an Arduino board and sent to a Raspberry Pi. The raspberry pi issues the appropriate breathing bag compress and acuter commands. The pressure sensor can detect differential pressure of up to 70 cm H2O, according to the manufacturer. The servo meter rod has the gear fastened to it. Plexi glass bars were used to make the rod. This gear has a radius of 2.5 cm. Joshua M. Pearce, Shane Oberloier, Adam Pringle, Samantha Dertinger, Nagendra G. Tanikella, and Aliaksei Petsiuk

(Automated, open-source, somewhat RepRap able bag valve mask ventilator)[1] This book describes the event of a simple, portable, automated mask value bag that is easy to construct. This is a real-time package put on a mostly RepRap 3D printing parameter component-based structure that is handled by an Arduino controller. The controller's possible results expand greatly for Arduino. Basic software functions, such as scheduling, dispatching, intertask communication, and synchronization, are made possible by a real-time software system. Couchman, B. A. et al. (2006) "Nurses' role in preventing and managing complications related to mechanical ventilation"[2] In their piece headed "Medical management of patients on mechanical ventilation," in summary, providing medical attention and managing patients on mechanical ventilation can be difficult and necessitate nursing knowledge to understand the technological challenges that undermine the patient-centered approach. For severely ill patients, mechanical ventilation causes a number of current and possible difficulties. When ventilator care is used in patients on mechanical ventilation, it can lead to favorable results and involves four interventions: raising the top of the bed, taking a sedative break, preventing peptic ulcers, and preventing deep vein thrombosis. There is insufficient substantial data to support the medical assistance practice's claim that one care strategy is healthier than the other. The most basic medical aid practice for patients on mechanical ventilation is the application of evidence-based treatment in conjunction with thorough and organized patient

Table -1:

Table 1. Components of the proposed design.

Component	Range	Quantity
Compressed Air and O2 Source	2000–6000 cmH2O	–
Pressure Regulator	0.001–0.1 MPa	1
Proportional Valve	–	2
Pressure Sensor	1 and 5 PSI	3
Solenoid Valve	20 Hz	3
Flow Sensor	0–10 L/min	2
Tubes	~22 mm	according to the requirements
Wires	–	according to the requirements
Computer System	Arduino uno	1
Pulse Oximeter	–	1
Display unit	–	1
Alarm System	–	1

3. CONCLUSION

This paper represents a viable crisis management and pandemic preparedness method. This ventilator setup is open source and was made with distributed fabrication. This study provides a detailed explanation of how to provide patients with low-cost, open-source mechanical ventilators. This is where the plan's initial phases call for additional turns. Without a doubt, this work will receive more significant attention. A significant amount of work still needs to be done in the future to upgrade the equipment to clinical quality. In any case, it is a major hotspot for routine use in low-asset contexts as well as for the continuing pandemic situation and crisis purposes.

REFERENCES

[1] Alamurugan, C. R., Kasthuri, A., Malathi, E., Dharanidharan, S., Hariharan, D., Kishore, B. V., & Venkadesh, T. (2021). Design of Ventilator Using Arduino for Covid Pandemic. Annals of the Romanian Society for Cell Biology, 14530-14533.

[2] Acho, L., Vargas, A. N., & Pujol-Vázquez, G. (2020, September). Low-Cost, Open-Source Mechanical Ventilator with Pulmonary Monitoring for COVID-19 Patients. In Actuators (Vol. 9, No. 3, p. 84). Multidisciplinary Digital Publishing Institute.

[3] Petsiuk, A., Tanikella, N. G., Dertinger, S., Pringle, A., Oberloier, S., & Pearce, J. M. (2020). Partially RepRapable automated open source bag valve maskbased ventilator. HardwareX, 8, e00131.

[4] World Health Organization: Critical preparedness, readiness and response actions for COVID-19: interim guidance, 7 March 2020.(No. WHO/COVID19/Community_Actions/2020.1).

[5] World Health Organization.2020. 2. The Lancet: COVID19: too little, too late? Lancet. 2020;395(10226):755. 10.1016/S0140-6736(20)30522-5

[6] Fisher D, Heymann D: Q&A: The novel coronavirus outbreak causing COVID-19. BMC Med. 2020;18(1):57. 10.1186/s12916-020-01533-

[7]Couchman, B. A., et al. (2006). Nurses role in prevention and management of mechanical ventilation related complications.