

# Mechatronic Design And Robust Control of An Artificial Ventilator In Response To The COVID-19 Pandemic

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**Abstract:** The emergency coming about because of the COVID19 pandemic has created an unfriendly circumstance in which great many individuals kicked the bucket because of counterfeit ventilation devices. The primer plan of a straightforward, simple to-utilize, and simple to-construct ventilator with a novel plan that can be utilized for COVID-19 patients in crises and to forestall monstrous death toll in asset poor environments. Human lungs utilize the converse tension produced by the constriction movement of the stomach to suck in air for breathing. A problematic movement is utilized by a ventilator to swell the lungs by siphoning type movement. We here plan and foster utilizing Node-MCU enveloping this multitude of prerequisites to foster a dependable yet reasonable ventilator to help in the midst of pandemics. The whole framework is driven by an ARDUINO regulator to accomplish wanted results and to help patients in COVID pandemics and other crisis circumstances.

**Keywords:** SPO2 Sensor, Heartbeat Sensor, Temperature Sensor (LM35), Arduino UNO, Nebulizer Pump.

## I. INTRODUCTION

Respiratory illnesses and disappointments are a significant general medical problem in both created and creating countries. This worldwide issue has been enormously complemented by the COVID-19 pandemic, which has brought about a dire requirement for additional ventilators. Indeed, even created nations like Spain, Italy, and the United States are experiencing a lack of these costly respiratory gadgets which likewise demand a generally lengthy investment to produce them. There are two kinds of ventilator gadgets. One sort just drives a specific volume of air into the lungs precisely without representing whether the patient needs to bring air into their body or to push air out. Practically these gadgets depend on the utilization of the ordinary pack valve veil (BVM). A BVM is a plastic pack that a clinical consideration professional can flatten physically with their hands, and hence gives a cheap and simple method for constraining air into the lungs. Indeed, BVMs are applied by specialists on call for patients who are not breathing, as opposed to doing CPR resuscitation. All ventilator gadgets in view of a BVM are basically mechanical arms that crush the sack over and over at a set recurrence. These gadgets can be produced rapidly and on a huge scale, yet since these ventilators are basically siphons that power air into the patient's lungs, they must be utilized for patients under broad sedation or the individuals who are close to death and have nonfunctional lungs. Applying such a gadget to a cognizant patient would prompt a gamble of death through barotrauma, which happens when the human body is presented to an unseemly gaseous tension.

## II. PROPOSED SYSTEM

In this proposed framework, we are estimating the multiparameter, for example, heart beat sensor, SPO2 sensor, internal heat level sensor, arduino and Node-MCU regulator board. All the boundary information is gathered and given to the Node-MCU and afterward refreshed to the IOT page/application. The specialist/client can screen the wellbeing boundaries. ARDUINO is modified in such a way to get the upsides of all sensors like SPO2, Heart thump and internal heat level. On the off chance that any of the qualities are strange, the Nebulizer pack will be turned ON naturally. Once our system predicts the abnormality of human respiration rate, the minimized nebulizer life saving kit is switched ON and produces ventilation automatically without human intervention. To monitor the Heart rate and SPO2 content in their body, we use the MAX30100 sensor which operates on I2C protocol to produce both Heart beat and SPO2 to display in the IOT app/ web page.

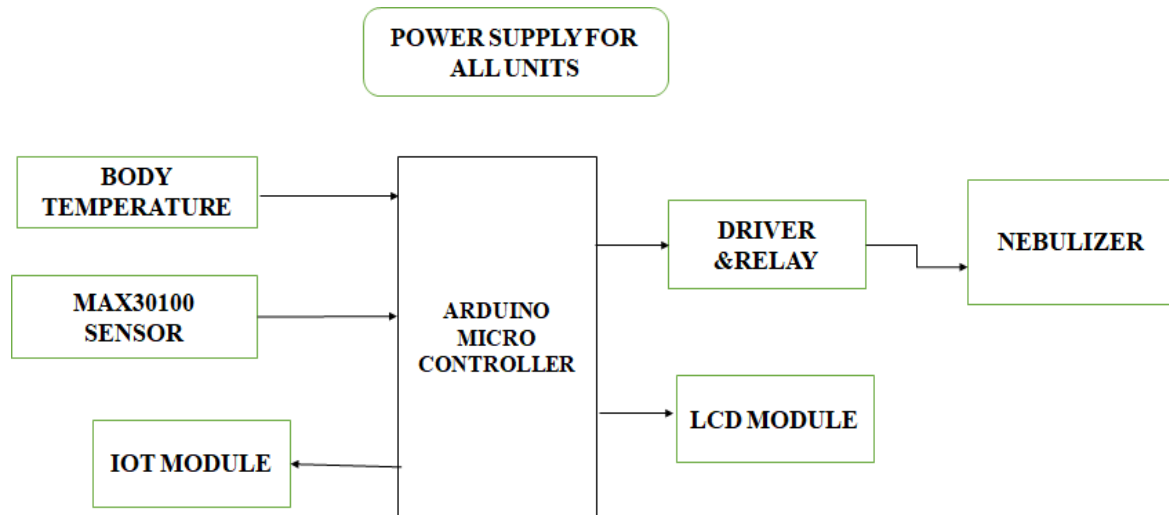


Fig. 1 A sample figure

### III. RESULT AND DISCUSSION

In this project, the ventilator is design to access easily at home without hospitality. It is enabled as when temperature increases, then the nebulizer will be switched on automatically. Actually before if the patient is not able to breath and having low pulse rate, the oxygen will be given to the patient . But it is not possible in all times. The main drawback is that , the availability of bed is low and deaths are happened in this situation. To overcome this, this smart home ventilator will work if heart beat is increased or temperature is increased , by taking heart beat, the spo2 is also checked and then if temperature increased or spo2 is low then the nebulizer will be turned on automatically.

The data of the patient and their heart beat, spo2, temperature is viewed in CAYENNE website Basically in this website the data of the patients are stored up to date. The user who is controlled the website will be provided with user name and password. It will be monitored 24/7 and if the patient is going abnormal, then the nebulizer will turn and when the patient is at normal, then it will be turned off. These are done automatically, so that this model is designed automation and helps the patient from abnormal to normal.

### IV. 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 the user to follow the required respiratory profiles using servo motors.

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