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# Patient Ventilator Using Arduino with Blood Oxygen Sensing

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**ABSTRACT:** Human lungs use the reverse pressure generated by contraction motion of the diaphragm to suck in air for breathing. A contradictory motion is used by a ventilator to inflate the lungs by pumping type motion. A ventilator mechanism must be able to deliver in the range of 10 – 30 breaths per minute, with the ability to adjust rising increments in sets of 2. Along with this the ventilator must have the ability to adjust the air volume pushed into lungs in each breath. The last but not the least is the setting to adjust the time duration for inhalation to exhalation ratio. Apart from this the ventilator must be able to monitor the patient's blood oxygen level and exhaled lung pressure to avoid over/under air pressure simultaneously. Our machine uses blood oxygen sensor alongside touchy heart Beat sensor to display the important vitals of the patient and show on a webpage the usage of IoT. To alter the time duration for inhalation the choice command given in the IoT application to set. The complete machine is driven by way of arduino controller to gain desired results and to assist patients in COVID pandemic and other emergency situations.

## I. INTRODUCTION

Respiratory diseases and screw ups are a prime public fitness issue in each evolved and developing countries. This global trouble has been greatly accentuated by way of the COVID-19 pandemic, which has led to an urgent need for additional ventilators. Even advanced nations consisting of Spain, Italy, and the United States are laid low with a shortage of these steeply-priced respiratory gadgets which also require an exceedingly long time to manufacture them. There are varieties of ventilator gadgets. One kind honestly pushes a certain extent of air into the lungs automatically without accounting for whether the patient desires to draw air into their body or to push air out. Almost all of these devices are primarily based on the use of the conventional bag valve masks (BVM). A BVM is a plastic bag that a medical care practitioner can deflate manually with their hands, and consequently presents a less expensive and clean manner to pressure air into the lungs. Indeed, BVMs are implemented through first responders to patients who are not breathing, rather than performing mouth-to-mouth resuscitation. All ventilator gadgets based on a BVM are essentially robotic arms that squeeze the bag time and again at a hard and fast frequency. These gadgets can be manufactured fast and in big numbers, however considering those ventilators are surely pumps that pressure air into the affected person's lungs, they are able to simplest be used for sufferers beneath preferred anesthesia or individuals who are near demise and have nonfunctional lungs. Applying this type of tool to an aware patient would result in a threat of demise thru barotrauma, which takes place while the human frame is exposed to an inappropriate air strain. The coronavirus pandemic is a major health emergency, as of 15 July, the World Health Organization (WHO) has reported over 1.3 Million of confirmed coronavirus cases all over the world. According to data provided by WHO, 80% of confirmed coronavirus cases will be able to recover without the need for hospitalization. However, 1 in 6 patients could have significant aggravated symptoms, causing damage to the lungs and therefore decreasing the levels of oxygen in the body.

## II. LITERATURE SURVEY

### 1. LowCost Contact Thermometry for Screening and Monitoring During the COVID-19 Pandemic

Author - Narasimha Sai Yamanoor

Year- 2020

They have evolved the key element of the UN Sustainable Development Goals (SDG) is purpose 3, Good Health, and Well-Being. Fundamental to the accomplishment of this aim is ladies's health. Pregnant girls and women raising babies might benefit from early screening. In socially disadvantaged areas, patients might not have ready and common get right of entry to to formal healthcare or screening answers. In such times, simple solutions that allow for selfmonitoring can assist. Additionally, whilst supplied with gadgets that promote wonderful conduct change such as sensor-enabled wearable devices, different benefits might also accrue. Data collection from multiple topics for screening and



contact tracing may also have ability use in the ongoing COVID-19 pandemic and beyond. A low-price, contact thermometer answer based totally on a silicon bandgap temperature sensor that permits for non-public screening is defined the usage of a Proof-of-Concept answer.

## 2. Designing of Ventilator Using Pic Microcontroller with Blood Oxygen Sensor

Author - BLESSY. NS, SIVAGAMI. K

Year – 2020

The Corona-virus pandemic is a major health emergency, as of 15 July, the World Health Organization (WHO) has reported over 1.3 Million of confirmed Corona-virus cases all over the world (shaik M, et al 2020). According to data provided by WHO, 80% of confirmed Corona-virus cases will be able to recover without the need for hospitalization (Catho G, et al 2020). However, 1 in 6 patients could have significant aggravated symptoms, causing damage to the lungs and therefore decreasing the levels of oxygen in the body. In this sense for patients with severe effects of the infection, an artificial ventilator may offer the best chance of survival. 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.

## 3. Bpm Ventilation With Oximeter

Author - Yarramsetty Ganesh, Vasireddy Karthik

Year – 2022

In this paper, economical and wearable pulse oximeter device using sparkfun oximeter sensor and raspberry pi v2 model B is presented. Nowadays whole world is facing COVID-19 pandemic from December 2019 and in corona patient blood oxygen level is goes down due to attack of virus on lungs. In this scenario economical and easy to use pulse oximeter is life saving device. To control pandemic; early detection of patients are important. We have presented easy to develop oximeter in this paper. We have connected sensor to Arduino uno using I2C protocol and using serial communication data is sent do raspberry pi using USB serial communication. We have achieved over 90% accuracy when result are compare with commercial health band. We also did comparative study with other sensor and we found that sparkfun sensor gives more accurate and quick results. Data visualization is implemented using python library.

## 4. Design And Prototyping Of A Low-Cost Portable Mechanical Ventilator

Author - Patil Amol Devidas , Patil Prashant Rajesh

Year – 2019

This paper describes the design and prototyping of a low-cost portable mechanical ventilator for use in mass casualty cases and resource-poor environments. The ventilator delivers breaths by compressing a conventional bag-valve mask (BVM) with a pivoting cam arm, eliminating the need for a human operator for the BVM. An initial prototype was built out of Wooden, measuring 11.25 x 6.7 x 8 inches (285 x 170 x 200 mm) and weighing 9 lbs (4.1 kg). It is driven by an electric motor powered by a 14.8 VDC battery and features an adjustable tidal volume up to a maximum of 750 ml. Tidal volume and number of breaths per minute are set via user-friendly input knobs. The prototype also features an assist-control mode and an alarm to indicate overpressurization of the system. Future iterations of the device will include a controllable inspiration to expiration time ratio, a pressure relief valve, PEEP capabilities and an LCD screen. With a prototyping cost of only 6 K, the bulk-manufacturing price for the ventilator is estimated to be less than 5 K.

### III. PROJECT DESCRIPTION

#### EXISTING SYSTEM

They have designed the robust mechatronic layout and manage of a low-cost non-invasive ventilator, for which rapid prototyping manufacture techniques such as 3-D printing and product design are used. In order to assure the reliability of the device operation, in this current paintings, a strong control scheme based on top notch-twisting sliding modes is proposed, which ensures the trajectory tracking manipulate corresponding to the respiratory profiles required by way of the patients. Experimental and simulation effects tested the effectiveness of the prototype design. Nevertheless, the prototype is waiting to be tested and permitted to be used in health help. In this feel, this work offers Experimental and simulation consequences validate the effectiveness of the proposed prototype design Nevertheless, the prototype is waiting to be tested and accredited for use in fitness help.

#### DISADVANTAGE

- Requires External Oxygen Supply



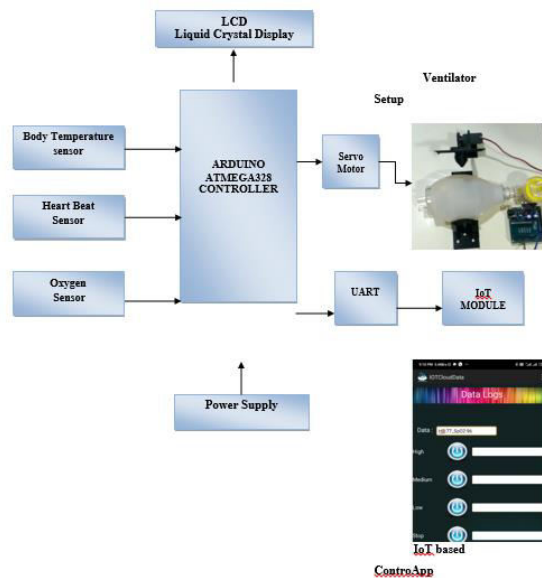
**PROPOSED SYSTEM**

In this proposed machine, we're measuring the multipara meter which include coronary heart beat sensor, SPO2 sensor, body temperature sensor with Arduino Uno board. All the parameter facts are collected and given to the ATMEGA 328 after which up to date to the cloud server through IoT module. The doctor/user can video display units the fitness parameters. Max30100 sensor is used to get both Heart beat and SPO2 degree of the character since it works at the I2C protocol. Temperature sensor is used to display the human frame temperature and it's far displayed in the LCD and also up to date inside the iot. Comparing these kinds of values inside the Micro controller, whilst the SPO2 stage decreases from the regular degree or temperature sensor price increases to the unusual level then the ventilator is growing to become on to offer them oxygen supply. Once our device predicts the abnormality of human breathing charge, the minimized ventilator which is designed with the aid of dc motor produces air flow routinely without human intervention.

**ADVANTAGE**

- Easy to Use
- Automatic Operation

**BLOCK DIAGRAM**

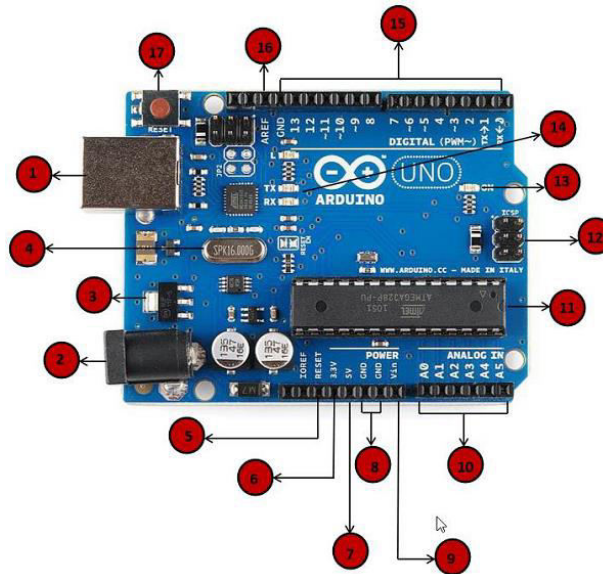


**HARDWARE COMPONENTS**

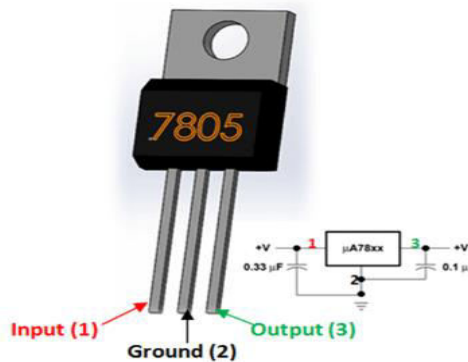
**1. ARDUINO UNO**

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package. Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller).





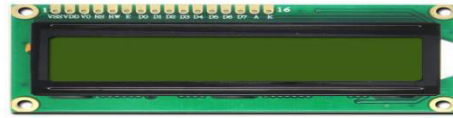
## 2. 7805 Regulator



The 7805 Voltage Regulator IC is a commonly used voltage regulator that finds its application in most of the electronics projects. It provides a constant +5V output voltage for a variable input voltage supply. Input capacitor 0.33µF is a ceramic capacitor that deals with input inductance problem and the output capacitor 0.1µF is also a ceramic capacitor that adds to the stability of the circuit. These capacitors should be placed close to the terminals for them to work effectively. Also, they should be of ceramic type, since ceramic capacitors are faster than electrolytic.

## 3. LCD display

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome.



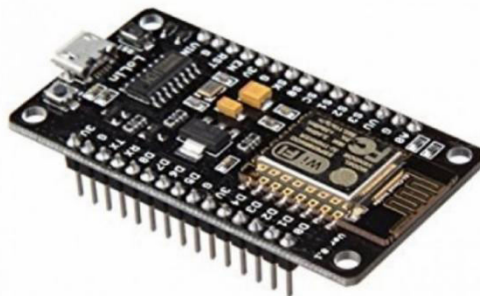
LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

#### 4. Capacitor

In this introduction to capacitors tutorial, we will see that capacitors are passive electronic components consisting of two or more pieces of conducting material separated by an insulating material. The capacitor is a component which has the ability or “capacity” to store energy in the form of an electrical charge producing a potential difference (*Static Voltage*) across its plates, much like a small rechargeable battery. There are many different kinds of capacitors available from very small capacitor beads used in resonance circuits to large power factor correction capacitors, but they all do the same thing, they store charge.



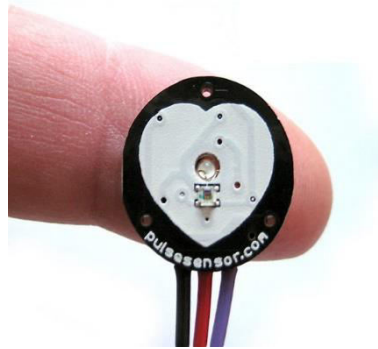
#### 5. Node MCU



The NodeMCU (*Node MicroController Unit*) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and

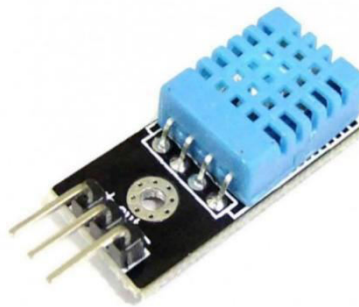
even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

## 6. PULSE SENSOR



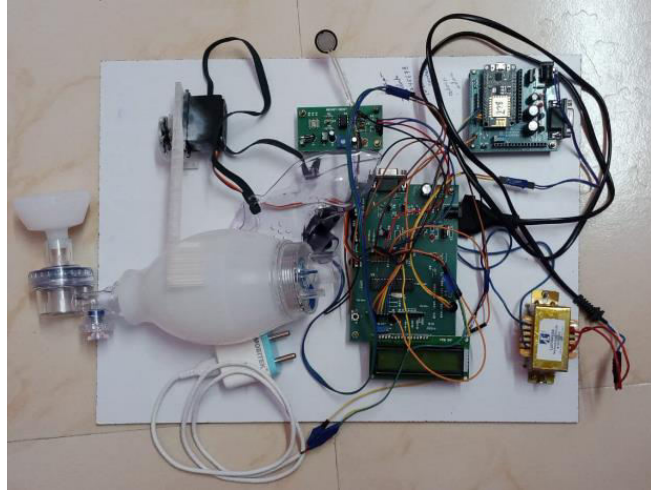
The Heartbeat rate information knowing is very useful while doing exercise, studying, etc. But, the heartbeat rate can be complicated to calculate. To overcome this problem, the pulse sensor or heartbeat sensor is used. This is a plug & play sensor mainly designed for Arduino board which can be used by makers, students, developers, artists who can utilize the heartbeat information into their projects. This sensor uses an easy optical pulse sensor along with amplification & cancellation of noise to make a circuit. By using this circuit, we can get fast and reliable heartbeat readings.

## 7. TEMPERATURE SENSOR



A temperature sensor is a device that detects and measures hotness and coolness and converts it into an electrical signal. At TE Connectivity (TE), we design and manufacture a broad portfolio of temperature sensors – including our NTC thermistors, RTDs, thermocouples, and thermopiles – designed for efficiency and easy installation, with capacity to reliably integrate technology that responds to human behavior.

#### IV. RESULT



#### 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. Simulation and 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.

#### REFERENCES

- [1] D. J. Baker, *Artificial Ventilation, a Basic Clinical Guide*. Springer, 2016.
- [2] S. Nava and F. Fanfulla, *Non Invasive Artificial Ventilation; How, When and Why*. Springer-Verlag Italy, 2010.
- [3] M. Warner and B. Patel, *Mechanical Ventilation*, 12 2013, pp. 981–997.e3.
- [4] I. Jenayeh, F. Simon, S. Bernhard, H. Rake, and B. Schaible, “Digital control of a positioning device for a ventilation machine,” in 1997 European Control Conference (ECC), July 1997, pp. 2341–2346.
- [5] A. Das, P. P. Menon, J. G. Hardman, and D. G. Bates, “Optimization of mechanical ventilator settings for pulmonary disease states,” *IEEE Transactions on Biomedical Engineering*, vol. 60, no. 6, pp. 1599–1607, 2013.
- [6] Hoi-Fei Kwok, D. A. Linkens, M. Mahfouf, and G. H. Mills, “Siva: a hybrid knowledge-and-model-based advisory system for intensive care ventilators,” *IEEE Transactions on Information Technology in Biomedicine*, vol. 8, no. 2, pp. 161–172, 2004.
- [7] M. R. Islam, M. Ahmad, M. S. Hossain, M. Muinul Islam, and S. F. Uddin Ahmed, “Designing an electro-mechanical ventilator based on double cam integration mechanism,” in 2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT), 2019, pp. 1–6.





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