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# Emergency Respiratory System

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***Abstract:*** ***Coronavirus Disease 2019 (COVID-19) threatens to overwhelm our medical infrastructure at the regional level causing spikes in mortality rates because of shortages of critical equipment, like ventilators. Human lungs use lungs for respiration. They use push mechanism in each Breath. Inhalation and exhalation process takes place. The ventilator here we design is to help people during Covid situation. It is very cheap and affordable. When people suffer from lungs or breathing problem this can be used for emergency situation. Motor mechanism is used to push the air bag. When oxygen level counts are low this mechanism can be performed. Small screen is used to display the oxygen levels. The entire system is driven by an Arduino microcontroller and a buzzer is fitted to detect any low levels of oxygen count. In this study, after providing a background on ventilators, the academic literature is reviewed to find the existing and designs for ventilators systems. With the considerably larger motivation of an ongoing pandemic, it is assumed these projects will garner greater attention and resources to make significant progress to reach a functional and easily-replicated system. There is a large amount of future work needed to move Emergency Respiratory System up to the level considered scientific-grade equipment, and even further work needed to reach medical-grade hardware. Future work is needed to achieve the potential of this approach by developing policies, updating regulations, and securing funding mechanisms for the development and testing of Emergency Respiratory System for both the current COVID19 pandemic as well as for future pandemics.***

## I. 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 to 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. Aside from this the ventilator should have the option to screen the patient's blood oxygen level and breathed out lung strain to keep away from over/under gas tension at the same time.

The ventilator we here plan and foster utilizing Arduino envelops of these prerequisites to create a solid yet reasonable Emergency Respiratory System to aid seasons of pandemic. We here utilize a silicon ventilator pack coupled driven by DC engines with 2 side push system to push the ventilator sack. We utilize an electric switch for exchanging and a variable pot to direct the breath length and thusly the BPM an incentive for the patient.

Our framework utilizes a blood oxygen sensor along with a delicate tension sensor to watch the compulsory vitals of the patient and show them on a little screen. Likewise, a crisis ringer alert is fitted inside the framework to sound a ready when an abnormality is identified. The whole framework is driven by an Arduino regulator to acknowledge wanted results and to help patients inside the COVID pandemic and other crisis circumstances. In the midst of the world emergency brought about by the Covid pandemic, medical clinics and medical services offices are revealing deficiencies of significant gear. As creators, it's our obligation to battle the deficiency by building improvised open-source substitute gadgets. Our nation likely could be in an extremely lockdown yet our creativity is not! One significant gadget that request has inclined up is ventilators for patients who need help with their breathing thanks to the respiratory impacts of COVID19. Fundamentally, a ventilator could be a machine that gives breathable air into and out of the lungs, to convey breaths to a truly incapable patient to inhale, or breathing deficiently. An Emergency Respiratory System probably won't be proficient as that of a clinical grade ventilator yet it can go about as a fair substitute on the off chance that it's command over the ensuing key boundaries.

## II. METHODS & MATERIALS

### *A. Existing System*

TRADITIONAL VENTILATOR SYSTEM:

 

The main drawback with the regular ambu bag is their manual operation requiring continuous operator engagement to hold the mask on the patient and squeeze the bag. This operating procedure induces fatigue during long operations, and effectively limits the usefulness of these bags to temporary relief. Moreover, an untrained operator can easily damage a patient's lungs by over compression of the bag.

*B. Proposed System*

To overcome the challenges faced by the existing systems, two main strategies were identified for the ventilator's air delivery system. One strategy uses a constant pressure source to intermittently deliver air while the other delivers breaths by compressing an air reservoir. The latter approach was adopted as it eliminates the need for the continuous operation of a positive pressure source. This reduces power requirements and the need for expensive and difficult to repair pneumatic components. Where most emergency and portable ventilators are designed with all custom mechanical components, we chose to take an orthogonal approach by building on the inexpensive BVM, an existing technology which is the simplest embodiment of a volume-displacement ventilator. Due to the simplicity of their design and their production in large volumes, Ambu bags are very inexpensive (approximately $10) and are frequently used in hospitals and ambulances. They are also readily available in developing countries. Equipped with an air reservoir and a complete valve system, they inherently provide the basic needs required for a ventilator

*1) Hardware*

Components used are as follows:

*a) Arduino Uno*

The Arduino Uno is a ATmega328 based microcontroller. It features 14 digital I/O pins, among which 6 can be used as PWM outputs, the rest of the pins include 6 analog inputs, a 16MHZ crystal oscillator pin, power jack point, USB connection port, an ISCP header pin, and a reset button. It can be powered either by using a USB cable or with an AC- to -DC adapter or a battery. Though this board can accept voltages between 7 to 20 V, its operating voltage is 5V. This board can be programmed using an open-source software tool Arduino IDE. It has 32 KB of memory which is used for the bootloader, 2 KB of SRAM, and 1 KB of EEPROM.

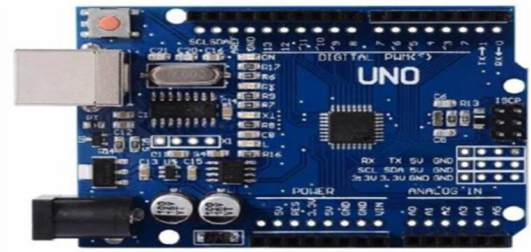


Figure 1: Arduino Uno

*b) Pressure Sensor*

A pressure sensor is a device for pressure measurement of gases or liquids. Pressure is an expression the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. Pressure sensors are used for control and monitoring in thousands of everyday applications. Pressure sensors can be classified in terms of pressure ranges they measure, temperature ranges of operation, and most importantly the type of pressure they measure. Pressure sensors are variously named according to their purpose, but the same technology may be used under different names.

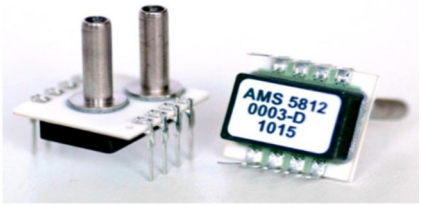


Figure 2: Pressure Sensor

*c) 20*4 LCD Module*

LCD stands for Liquid Crystal Display. The LCD screen is an alphanumeric electronic display and it has various applications in different fields. This display is a very basic module and is most commonly used in devices and circuits. A 20*4 LCD means it can be used to display a maximum of 20 characters per line, and there are two such lines. Each character in this LCD is displayed in a 5x7 pixel matrix format. The alphanumeric display is capable to display 224 various characters and symbols in two modes like 4-bit and 8-bit. It consists s of 16 pins. This can be operated between 4.7 V to 5.3 V.

Figure 3: 20*4 LCD Module

*d) Stepper Motor*

NEMA 17 Stepper motor has a 1.8° step angle. There are 200 steps or revolutions per angle. Each phase of the motor type can draw a voltage of 12V when it is in operation. As a result, the current can maintain a holding torque of 3.2 kg-cm. Keep in mind that the motor type has six wires that are color-coded as well. Additionally, a bare lead is present on each cable. To provide control by unipolar and bipolar stepper motor drivers, cables are therefore essential.

A stepper motor, also known as a step motor or stepping motor, is a brushless DC electric motor that separates a whole rotation into many equal steps. Without a position sensor to provide input, the motor's position can be told to move and hold at one of these phases as long as it is scaled correctly for the application in terms of torque and speed (an open-loop controller). Switched reluctance motors are large stepping motors with fewer poles.

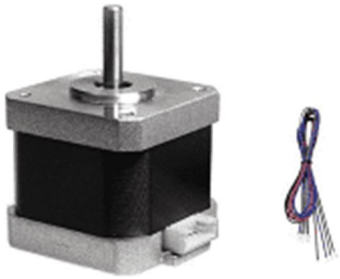

Figure 4: Pressure Sensor

*e) Ambu Bag*

A bag valve mask (BVM), sometimes known by the proprietary name “Ambu bag” or generically as a manual resuscitator or "self-inflating bag", is a hand-held device commonly used to provide positive pressure ventilation to patients who are not breathing or not breathing adequately. The device is a required part of resuscitation kits for trained professionals in out-of-hospital settings (such as ambulance crews) and is also frequently used in hospitals as part of standard equipment found on a crash cart, in emergency rooms or other critical care settings.

Figure 5: Ambu Bag

*f) Blood Oxygen Sensor*

Small beams of light pass through the blood in the finger, measuring the amount of oxygen. It does this by measuring changes of light absorption in oxygenated or deoxygenated blood. This is a painless process. In medical situations, blood oxygen monitoring can be critical. SpO2 is an important metric for monitoring patients afflicted with respiratory illnesses like sleep apnea, emphysema, COPD, or Covid-19


Figure 6: Blood Oxygen Sensor

*2) Software*

The software used is Arduino IDE. The Arduino IDE (Integrated Development Environment) is open source software and a cross-platform application that is written in the programming language Java. It is useful in writing and uploading programs to Arduino Compatible Boards. The Arduino IDE software supports C and C++ languages by following the special rules for code structuring. It can be implemented within the Windows, Mac, and Linux operating systems. The components are mainly written in JavaScript for easy editing and compiling. The main advantage of using this software is writing codes for Arduino. But several other features are worth noting. The software is schematics can be easily modified by the user when required. Some guides are helpful during the process of installation.


Figure 7: Arduino IDE

## III. BLOCK DIAGRAM & WORKING

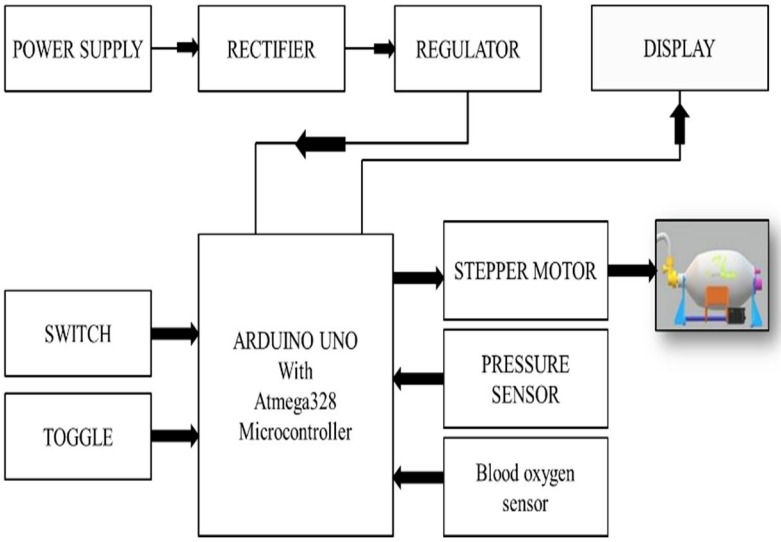


Figure 8: Arduino IDE

The extension rectifier is used to change ac over completely to throbbing dc. Then, at that point, capacitors go about as channel so we use capacitor for shifting. Transformer is used to supply fixed yield voltage 5V DC. Arduino required voltage is 5V DC supply. A LCD show is utilized for show the message and it likewise required 5V DC supply. Arduino are required three essential need power supply, reset circuit and oscillator unit. The ventilator we here plan and foster utilizing Arduino envelops of those prerequisites to create solid yet reasonable DIY ventilator to help in the midst of pandemic. We here utilize a silicon ventilator sack coupled driven by DC engines with 2 side push system to push the ventilator sack. We use control for exchanging and a variable pot to control the breath length thus the BPM an incentive for the patent. Our framework utilizes blood oxygen sensor alongside delicate strain sensor to notice the predetermined vitals of the patent and show on a small screen. Additionally, a crisis ringer alert is fitted inside the framework to sound a ready when any abnormality is identified. The whole framework is driven by Arduino regulator to appreciate wanted results and to help patients in COVID pandemic and other crisis circumstances.

## IV. RESULT

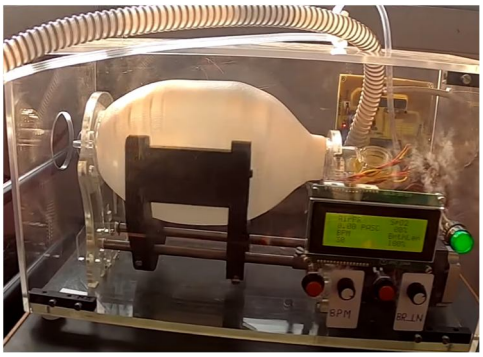

Figure 9A: Proto type of the Project


Figure 9B: Proto type of the Project

## V. ADVANTAGES

1) Easy to use
2) Automatic operation
3) During Emergency situations it helps to the patient
4) Low cost

## VI. DISADVANTAGES

1) Requires External supply

## VII. APPLICATIONS

1) Clinics
2) First Aid centers
3) Emergency care
4) Home care

## VIII. CONCLUSION

This paper proposes, "EMERGENCY RESPIRATORY SYSTEM", which automizes the manual operation of the ambu bag. There is a great advancement in technology due to its features like low cost and ease of use. In addition, this system reduces the manpower in the hospitals. The mistakes done by nurses and doctors while performing the manual operation can be reduced using this system. A Menu can be updated every time based on the availability of food present in the kitchen. This is an effective system to improve the performance of medical system. Finally, we can conclude that this system will work perfectly and efficiently by solving all issues faced by doctors and patients.

## IX. FUTURE SCOPE

We can involve this venture in season of crisis as a first help device. For instance: If an individual gets a respiratory issue. He really wants to take to clinic quickly while going in rescue vehicle or in the mishap area he wanted of ventilator to breath so around then our venture is little, helpful and to work which can save a daily existence. Since the cost of our project is reasonable it is simple purchase by a destitute group to rich individuals. In later we can foster the venture by adding GSM module to remain associated

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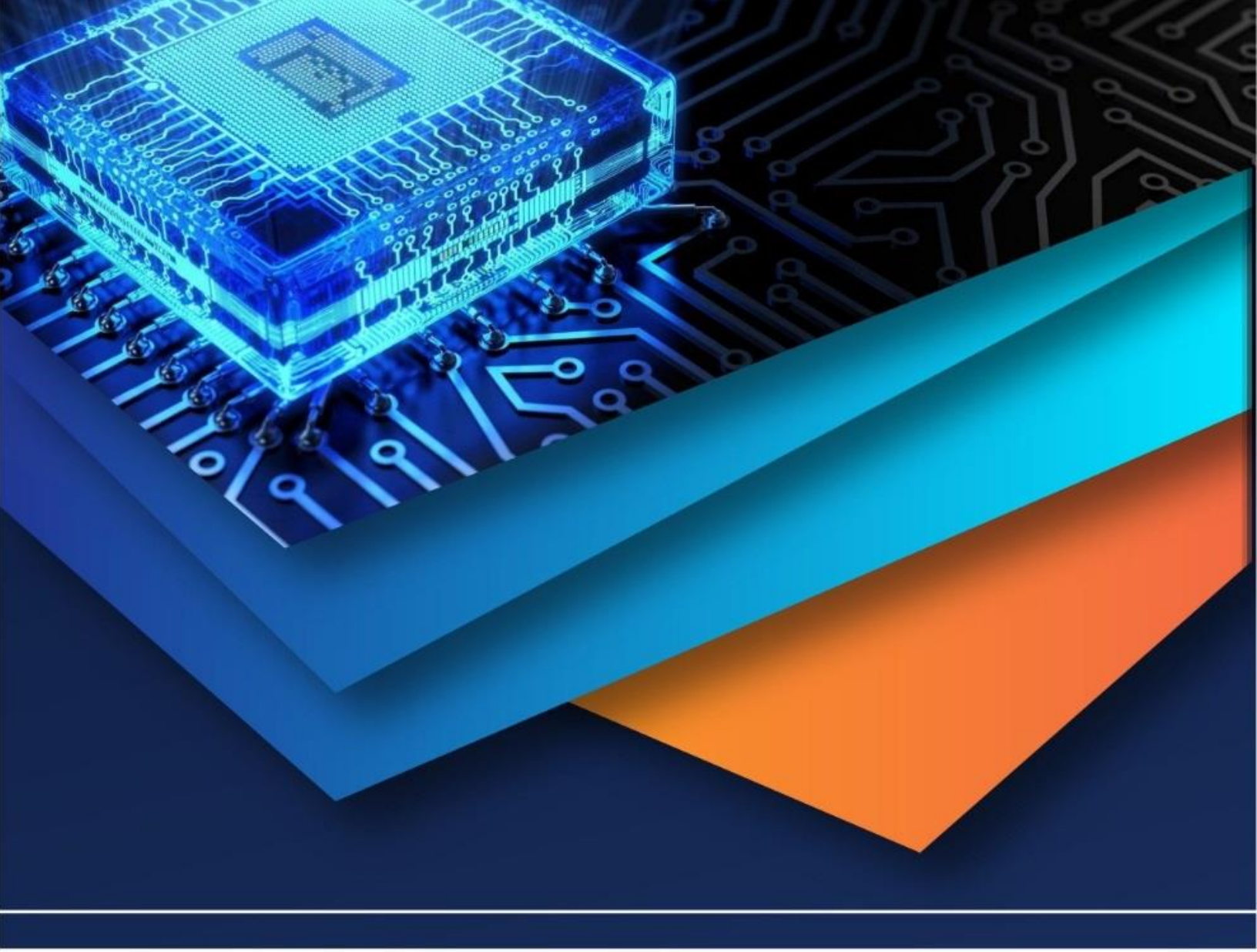

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