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DIY Ventilator using Arduino

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***Abstract:** This document shows the summaries of the several tests we have taken. Breathing occurs in the human lungs. Every time they inhale, they push a system that triggers motivation and the exhalation process. It is really reasonably priced. This can be used when a patient's vital condition is in jeopardy and they are suffering from the harmful consequences of lung or breathing problems. It usesa stepper motor component to propel the ambulance bag. Heartbeat levels are low during breathing, although this component can be. The levels of respiration and heartbeat are displayed on the LED screen. A ringer is included in the system to sound alert in the event that any anomalies related to a patient's critical condition or breathing problem are discovered. In addition, to prevent over- or under-air pressure, the ventilator should be able to track the patient's blood oxygen saturation level and exhale lung strain. The Arduino-powered ventilator that we are developing here satisfies all of these requirements, making it an affordable and dependable do-it-yourself ventilator that can be useful during a pandemic.*
***Keywords:** Arduino, ventilator, bag valve mask , pneumatic, COVID-19*

I. INTRODUCTION

Human lungs draw in fresh air to relax by using the opposing pressure created by the stomping motion of the abdomen. A ventilator uses an incongruent movement, similar to a siphoning movement, to expand the lungs. A ventilator component must to have the capacity to deliver 10–30 breaths per minute, and it ought to be adaptable enough to handle increasing increments in pairs. In addition,the air volume that is forced into the lungs with each breath should be carried by the ventilator. The last but certainly not least parameter controls how long the inhalation to exhalation ratio takes.

In addition, the ventilator ought to have the option to simultaneously check the patient's blood oxygen saturation and exhale lung strain in order to avoid going over or below the gas pressure. These specifications are met by the ventilator that we design and create here using Arduino, creating a reliable but reasonably priced do-it-yourself ventilator that can help during pandemics. Here, we use a silicon ventilator pack that is connected to two DC engines and has a two-sided push mechanism to force the ventilator sack into place. We use an electric switch to turn on and off, and a variable pot to control the patient's breath duration and, consequently, heart rate. Our device monitors the patient's mandatory vitals and shows them on a small screen using a blood oxygen sensor and a soft pressure sensor. Additionally, the system is equipped with an emergency bell alert that will sound when an anomaly is detected. An Arduino controller powers the whole device, enabling it to accept desired results and assist patients in COVID-19 and other emergency scenarios. Amidst the global catastrophe brought on by the Covid epidemic, medical facilities and hospitals are reporting a scarcity of critical equipment. It is our responsibility as artists to address the scarcity by building makeshift, open-source alternatives. Even though our country is under lockdown, our creativity is not! Ventilators are a vital device whose demand has increased because of COVID-19's respiratory effects on individuals who require aid breathing.In essence, a ventilator is a device that forces air into and out of the lungs to help patients who are physically unable to breathe or who are not breathing enough. Even if a homemade ventilator lacks the clinical grade ventilator's efficiency, it can serve as a respectable stand-in if it has control over the important parameters.

1) *Tidal Volume:* It is the amount of air that the ventilator delivers to the lungs with each breath; at rest, this is usually 500 ml.
2) *BPM (Breaths Per Minute):* This is frequently the standard breathing rate. Ten to thirty is the range. Respiratory
3) *Expiratory Ratio (IE Ratio):* Speaks about the proportion between expiratory and inspiratory times.
4) *Flow Rate:* Is the maximum flow rate at which the ventilatorcan deliver a certain tidal volume of breath.
5) *Peep (Positive end-expiratory Pressure):* At the peak of expiration, it is the pressure inside the lungs above the gas pressure.

II. 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 sick with the use of a pressure sensor. The pressure sensor's data is gathered by an Arduinoboard and sent to a Raspberry Pi. The raspberry pi issues theappropriate breathing bag compress and acuter instructions.

The pressure sensor can detect differential pressure of upto 70 cm H2O, according to the manufacturer. The servo meter rod has the gear fastened to it. A Plexiglass bar served as the rod's material. 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 RepRapable 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] What does the evidence indicate about the medical treatment of the patient on mechanical ventilation? is the title of their paper. In summary, nursing experience is necessary to navigate the complex challenges of managing mechanically ventilated patients and providing medical help. The patient-centered approach is undermined by technological concerns. For severely sick patients, mechanical breathing causes a number of current and future 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 treatment strategy is healthier than the other. The most basic medical aid practice for patients on mechanical ventilation is the application of evidence-based practice in collaboration with patients who are comprehensive and organized.

This study details the design and early development of a low-cost, portable mechanical ventilator that might be employed in settings with limited resources and in mass casualty situations. Breathing is accomplished by compressing a standard Ambu bag using a rotating cam arm, which removes the need for an operator to hold the Ambu bag. The first version has an electrical motor that runs on a 12 VDC battery and can be adjusted to have a maximum tidal capacity of 750 cc. The number of breaths per minute and tidal volume are set to the default values. The gadget will have an LCD panel, a pressure escape clock, a customizable inspiration to expiration time ratio, and an alert to indicate when the system has been over-pressurized in the future.

Through this prototype, the strategy of automated Ambubag compression is proven to be a viable choice to achieve low-cost, low-power portable

III. BLOCK DIAGRAM

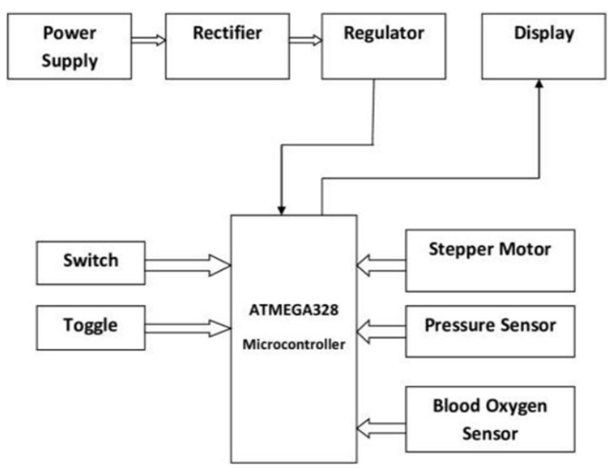


Fig.1: Block diagram

IV. WORKING

The extension rectifier is used to convert finished ac to pulsating dc. Capacitors are then channeled so they may be used for shifting at that moment.

A transformer that supplies a set yield voltage of 5V DC is used. Arduino required a 5 V DC power source. The message was shown using an LCD display, which required a 5V DC source. Three fundamental components are required by Arduino for each supply, reset circuit, and oscillator unit. In order to produce a robust yet reasonably priced DIY ventilator to help during a pandemic, we designed and developed a ventilator here using an Arduino.

Here, we use a silicon ventilator bag that is pushed by a two-side push mechanism that is driven by DC motors. To regulate the breath length and, consequently, the BPM valuefor the invention, we employ a variable pot and control for switching. Our device notices the selected patent vitals and displays them on a mini screen using a blood oxygen sensor and a tender pressure sensor. Furthermore, the system is equipped with an emergency bell warning that will sound analarm upon detection of any anomaly. An Arduino controller powers the whole system, enabling it to achieve desired results and support patients during COVID-19 pandemics and other emergencies.

V. HARDWARE USED

Components used are as follows:

1) ARDUINO UNO

An ATmega328 grounded microcontroller powers the Arduino Uno. Its 14 digital I/O legs comprise 6 PWM-capable legs, 6 analog inputs, a 16 MHz demitasse oscillator leg, a power jack point, a USB connection harborage, an ISCP title leg, and a reset button. These legs are divided into 6 groups. It has three different power sources: a battery, an AC-to-DC adapter, and a USB cord. This board operates at 5V, however it can handle voltages of up to 20V. The Arduino IDE is an open-source software package that may be used to program this board.

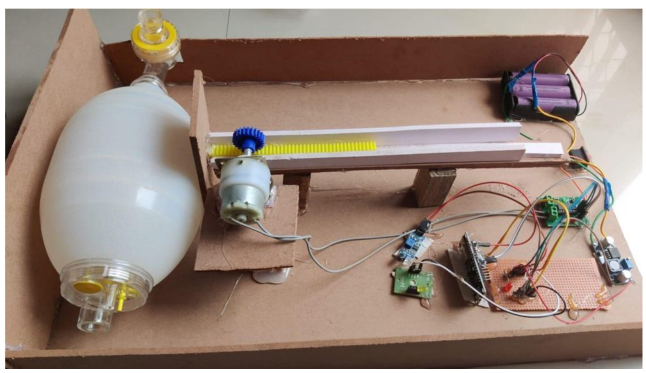
2) Pressure Sensor

One instrument for counting liquid or gas pressure is a pressure sensor. Pressure is defined as the force necessary tostop a liquid from spreading, expressed as force for a certain unit zone. A pressure sensor frequently acts as a kind of converter, producing a signal in response to applied pressure. Pressure gauges are essential for controlling and verifying a wide range of everyday situations. A common way to organize pressure gauges is by the temperature ranges they operate in, the ranges they count, and most importantly, the kind of pressure they measure. These gadgets may have different names depending on what they do, however the same technology may be used under severallabels.

3) 16x4 LCD Module

LCD is an acronym for liquid display in the LCD module. An LCD screen is an alphanumeric display with a wide range of uses. This display is typically used in circuits and devices, and it may be a very important module. With a 16 x4 LCD, there are two lines and a maximum of 16 characters per line that may be shown. Via this LCD, each character is shown in a matrix of 5 by 7 pixels. In two modes—4-bit and8-bit—the digital display may show 224 distinct letters and symbols. It has sixteen pins total. You can run this between 4.7 and 5.3 volts.

VI. RESULT



VII. CONCLUSION

This work has the potential to be a strategically useful emergency and chaos! This is a ventilator arrangement with exposed origin made using scattered production! This essay provides a detailed description of how to provide patients with accessible, low-cost mechanical ventilators! You are inthe beginning stages of planning necessary additional twists! This work will undoubtedly get more eminently concentrated! There is still a great deal of work to be done in order to build equipment of the clinical grade! It is a religious hub for emergency preparations as well as the current state of chaos, or at the very least for everyday use in low-resource settings.

VIII. FUTURE SCOPE

We may use this endeavor as a first aid tool throughout the crisis. For example: If someone has a respiratory condition. He truly wants to be brought as soon as possible to theclinic, either at the accident scene or in a rescue vehicle. He needs a ventilator to breathe, thus our project is little, beneficial, and functional enough to save a person'severyday life. Our project is affordable, so wealthy people may just buy it from a bunch of impoverished people. Subsequently, we can advance the project by integrating a GSM module to stay connected to experts while traveling inan emergency vehicle, a blood pressure sensor in place of a pressure sensor for greater accuracy, and a camera to enable real-time communication with experts for improved first aid care while traveling.

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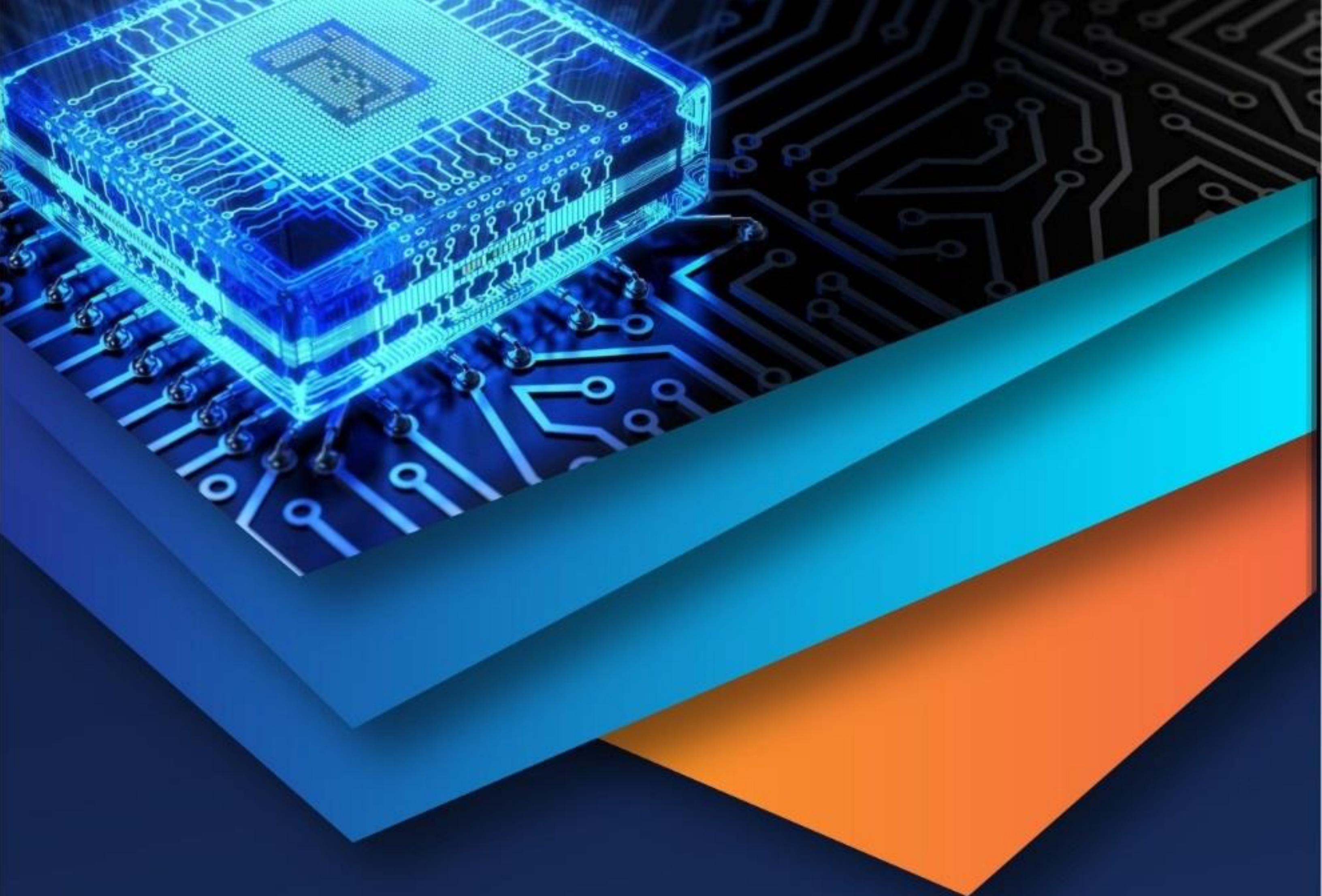

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