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ARTIFICIAL BREATHING MACHINE WITH VARIABLE VOLUME, PRESSURE AND BREATH RATE

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Abstract: Low-cost mechanical ventilators have been developed in order to deal with the shortage of traditional ventilators whose quantity is not sufficient in an emergency context.

An artificial breathing machine with variable volume pressure and breath rate is a medical device used to assist patients who are unable to breathe on their own. The machine is designed to make the natural breathing pattern of a healthy individual by providing air to the lungs through a tube inserted into the patient's airway. The machine has several adjustable settings that can be customized to meet the patient's specific needs.

One of the key features of the machine is its ability to vary the volume and pressure of the air delivered to the patient's lungs. This allows the machine to provide more or less air as needed, depending on the patient's condition. The machine can also adjust the breath rate, which is the number of breaths delivered per minute, to ensure that the patient receives the appropriate amount of air.

The machine typically consists of a ventilator, tubing, a mask or mouthpiece, and a control panel. The control panel allows the healthcare provider to adjust the settings of the machine based on the patient's condition and response to treatment.

Overall, an artificial breathing machine with variable volume pressure and breath rate is a crucial tool in the management of patients with respiratory failure, and its advanced features help to ensure that patients receive the appropriate support for their breathing needs.

Keywords: ventilator, tubing, mask, mouthpiece, artificial breathing machine.

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 10-30 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 DIY ventilator 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 COVID-19. 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.

Artificial breathing machines with variable volume pressure and breath rate are used in a variety of settings, including intensive care units, emergency rooms, and during surgical procedures. They are particularly important in critical care situations where patients may have compromised lung function or require more advanced support.

Overall, artificial breathing machines with variable volume pressure and breath rate are a critical component of modern medicine and have played an important role in saving countless lives.

II. LITERATURE SURVEY

1. **Balamurugan C. R., Kasthuri A., Malathi E., Dharanidharan S., Hariharan D., Kishore B. V., Venkadesh T, "Design of Ventilator Using Arduino for Covid Pandemic" Annals of R.S.C.B., ISSN: 1583-6258, Vol. 25, Issue 4, 2021, Pages. 14530-14533Received 05 March 2021; Accepted 01 April 2021.**
   This ventilator is made with push mechanism in each breath. This ventilator is very cheap and affordable. Motor mechanism is used push the air bag. When oxygen level count is low this mechanism is performed. Small screen is used to display the oxygen level at real time.

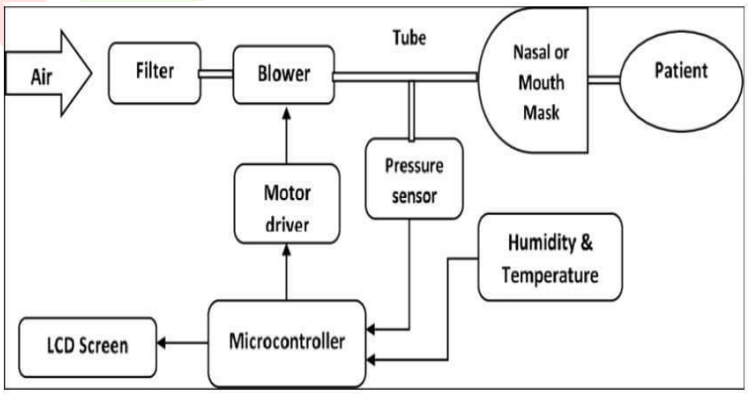
2. **Leonardo Acho, Alessandro N. Vargas, Gisela Pujol–Vázquez, "Low-Cost, Open- Source Mechanical Ventilator with Pulmonary Monitoring for COVID19 Patients" Actuators2020,9(3),84; https://doi.org/10.3390/act9030084**.
   This article shows that construction of low-cost, open-source mechanical ventilator. This article also shows that numerical method for monitoring patients pulmontory condition. With the help of pressure sensor, we can classify the patients are healthy or unhealthy lungs. An Arduino board collects the information from pressure sensor and sends them to raspberry pi. The raspberry pi commands the acutor and breathing bag compress accordingly. According to manufacture the pressure sensor can measure differentially pressure of up to 70 cm H2O the gear was attached to the servo meter rod. The rod was made by plexi glass bar. The radius of this gear is 2.5cm.

3. **Aliaksei Petsiuk, Nagendra G. Tanikella, Samantha Dertinger, Adam Pringle, Shane Oberloier, Joshua M. Pearce, "Partially RepRapable automated open source bag valvemask-based ventilator", Volume 8, 2020, e00131,ISSN2468-0672, https://doi.org/10.1016/j.ohx.2020.e00131.**
   This article shows that development of simple and easy to build portable automated mask value bag. This handle with Arduino controller with real time operating system installed on largely rep- rap 3d printable parameter component-based structure. For Arduino extensively grows the conceivable outcomes of the controller. A real-time operating system gives fundamental capacities to software tasks, like planning, dispatching, inter-task communication, and synchronization time. From the result, it is observed that the overshoot (%) value of output current will be 1700%, which settle to 0.14 at a settling time of 1.5S.

III. OBJECTIVES

- The main aim of the proposed work is to present a new Artificial breathing machine with a low cost involving a pressure volume and breath rate Controller to control the volume of oxygen depending on their blood pressure and their body temperature.
- To provide the required oxygen supply to the patient having difficulty in breathing.

IV. METHODOLOGY



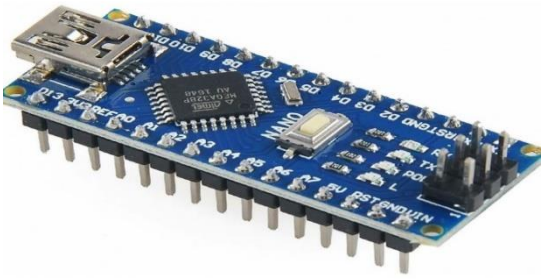
An artificial breathing machine with variable volume pressure and breath rate works by delivering a controlled amount of air to a patient's lungs. The machine is connected to the patient through a tube, which is inserted into the patient's airway.
The machine is capable of delivering different amounts of air with each breath, known as the tidal volume, which can be adjusted based on the patient's needs. The machine can also adjust the pressure of the air being delivered to the patient's lungs, which can help ensure that the air is reaching the appropriate areas of the lungs.

Additionally, the machine can adjust the breath rate, or the number of breaths delivered per minute, which can be important in managing a patient's oxygenation and carbon dioxide elimination needs.
The ambu bag which is been pushed by the servo motor and which can vary or can be adjusted at a particular power according to the values set by the potentiometer. But firstly, the whole system checks the vitals of patient through the oximeter and pressure

sensor and then according to standard values we can give inputs to vary the bpl and bpm after which the servo motor accordingly it presses the ambu bag. The output or the air push through the ambu bag is passed to patient by a ventilation pipe.

Overall, an artificial breathing machine with variable volume pressure and breath rate is a sophisticated medical device that requires trained professionals to operate and monitor, but it can be an important tool in managing respiratory failure and other serious medical conditions.

a) Arduino Nano

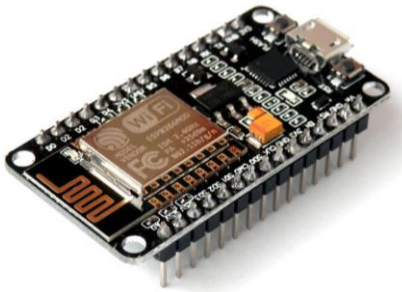


- The Nano board compatible with Arduino has an operating voltage of 5V.
- It comes with soldered connectors and 8 analog inputs ports: A0- A7.
- The Nano board has 14 digital input / output ports:TX,RX,D2-D13.
- This Nano microcontroller is compatible with Arduino uses Atmel Atmega328P-AU MCU.

b) MAX 30 100 Pulse oximeter Heart rate sensor module

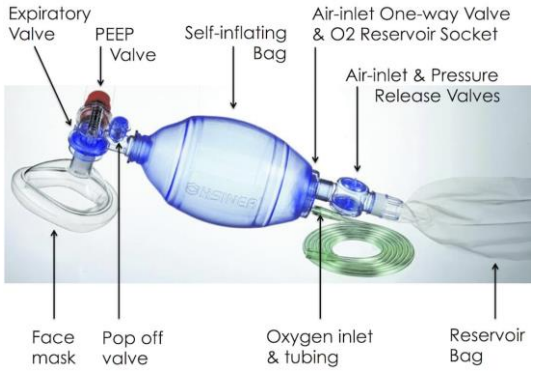
- The max 30100 is an integrated pulse oximetry and heart rate monitor sensor solution.
- It combines two LEDs ,a photo detector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart rate signals.
- The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current permitting the power supply to remain connected at all times.

c) Node MCU-ESP 8266



- Node MCU is an open source Lua based firmware for the ESP8266 Wi-Fi SOC from Espressif and uses an on-module flash-based SPIFFS file system.
- Node MCU is implemented in C and is layered on the Espressif NON-OS SDK.
- The Node MCU(Node Microcontroller Unit) its operating voltage is from 2.5-3.3V and operating current is 800mA.

d) Ambu Bag



- A bag valve mask, 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 face difficulty in breathing.
- It consists of a self-inflating bag, one-way valve, mask, and an oxygen reservoir.

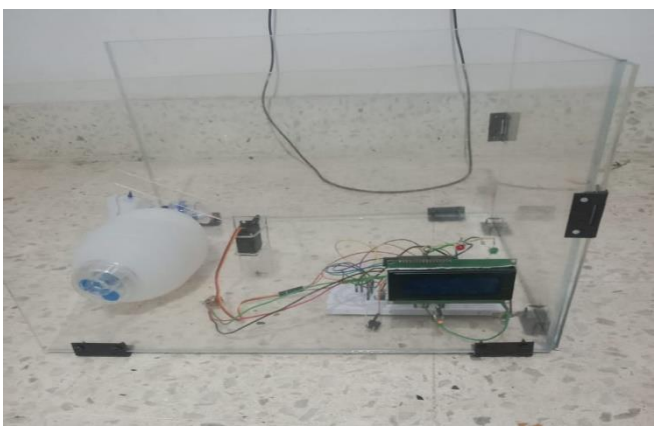
e) Servo Motor

- The servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision.
- If we want to rotate an object at some specific angles or distance, then we use a servo motor.

Advantages

- The patient does not have to work as hard to breathe when their respiratory muscles rest.
- Helps the patient get adequate oxygen and clears carbon dioxide.
- Low maintains.
- Product cost is less.
- Helpful for old-age persons, carried women, physically challenged persons.
- Provides the required oxygen depending on the patients blood pressure.

V. RESULTS AND DISCUSSION



Artificial breathing machines with variable volume pressure and breath rate are commonly used in medical settings to assist patients with breathing difficulties. These machines provide mechanical ventilation to the patient, allowing them to breathe more easily and comfortably.

One key advantage of a machine with variable volume pressure and breath rate is its ability to adjust to the patient's changing needs. For example, if the patient's lung capacity increases or decreases, the machine can adjust the volume of air delivered to

the patient accordingly. Similarly, if the patient's breathing rate changes, the machine can adjust the frequency of breaths delivered to the patient.

In terms of clinical outcomes, studies have shown that mechanical ventilation can improve patient outcomes in certain cases, such as in patients with acute respiratory distress syndrome (ARDS) or those undergoing surgery. However, mechanical ventilation can also lead to complications, such as ventilator-associated pneumonia, barotrauma, and volutrauma. Therefore, it is important to carefully monitor patients receiving mechanical ventilation and adjust the machine settings as needed to minimize these risks.

Overall, artificial breathing machines with variable volume pressure and breath rate can be a valuable tool in the treatment of respiratory failure and other breathing difficulties. However, proper use and monitoring are crucial to ensure the best possible outcomes for patients.

VI. CONCLUSION

An artificial breathing machine with variable volume pressure and breath rate can be a highly effective tool in providing respiratory support to patients who are unable to breathe on their own. By varying the volume of air delivered with each breath, the machine can be tailored to the specific needs of the patient. Similarly, by adjusting the pressure and breath rate, the machine can help maintain a healthy level of oxygenation and carbon dioxide elimination.

The development and use of mechanical ventilators have significantly improved the outcomes for patients who require this type of life support. However, the use of these machines is not without risks, and they should be used only under the supervision of trained medical professionals.

This type of machine is often used in critical care settings, such as intensive care units, where patients may be suffering from acute respiratory failure or other serious medical conditions. The machine can be programmed to deliver different breathing patterns, including synchronized intermittent mandatory ventilation (SIMV), which provides a combination of machine-delivered and patient-initiated breaths.

Overall, an artificial breathing machine with variable volume pressure and breath rate is an important tool in the management of respiratory failure and other critical medical conditions. Its ability to adapt to the specific needs of the patient can help improve outcomes and enhance overall patient comfort and safety.

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