PROJECT SYNOPSIS

KARNATAKA STATE COUNCIL FOR SCIENCE AND TECHNOLOGY Indian Institute of Science campus, Bengaluru Telephone: 080 -23600978, 23341652 || Email: spp@kscst.org.in Website: www.kscst.iisc.ernet.in/spp.html or www.kscst.org.in/spp.html FORMAT FOR STUDENT PROJECT PROPOSAL FOR THE 46th SERIES OF STUDENT PROJECT PROGRAMME

"DESIGN OF AUTOMATIC CONTROLLER FOR AMBU BAG"

K. L. E. SOCIETY'S

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(NBA Accredited)

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• INTRODUCTION

Ventilators are a prominent item for which demand has increased due to the respiratory effects of COVID-19 in patients who require assistance with their breathing. Essentially an AMBU (Artificial Manual Breathing Unit) Bag Controller is a device that gives breathable air in and out of the lungs, to provide breaths to a patient who has not been able to inhale or is breath inadequately.

An AMBU Bag Controller (Ventilator) may not be as functional as a medical grade ventilator, but it can serve as a great substitute if it has control over the following significant parameters. It is also combined with robust blood oxygen measuring sensor. The use of pulse oximetry is possible in inpatient and outpatient settings.Your doctor might advise you to purchase a pulse oximeter for use at home in certain circumstances. A little lamp-like device is placed on a finger, earlobe, or toe during a pulseoximetry test. Little light emissions pass through the finger's blood to calculate the amount of oxygen. This is accomplished by estimating variations in light absorption in either oxygenated or deoxygenated blood. It doesn't hurt to do this [1].

But in times of a COVID epidemic, this dependable and reasonably priced ventilator (AMBU) Bag Controller. After creating this model, the models were made available online for anyone to adopt and create their own ventilators, even on a compact size. To treat patients in intensive care units, coronavirus, and influenza Ventilators were previously only used in intensive care units (ICUs), but following a severe corona outbreak, demand for them skyrocketed. Breathing is facilitated by a ventilator. People who have the coronavirus require a ventilator because they have trouble breathing maybenot enough oxygen in their blood. However, Ventilators are in limited supply as a result of the widespread corona. Many medical units are short on ventilators.

- **LITERATURE REVIEW:**

1. Balamurugan C.R., Kasturi A., Malathi E. Dharanidharan S., Hariharan D., Kishore B.V., Venkatesh T., “Design of Ventilator Using Arduino for Covid Pandemic”, (2021). This ventilator has a push mechanism in each breath. This ventilator is really inexpensive. Theair bag is pushed by a motor system. This mechanism is activated when the oxygen level count is low. The oxygen level is displayed in real time on a little screen. Arduino is usedto control the entire system. The buzzer will sound if the oxygen level is low. Toggle switches and a variable pot are used to check patients’ breth length and BPM level [3].

2. H. Güler and F. Ata, “ title” (2010), implemented closed-loop control of tidal volume, a parameter controlled in mechanical ventilators being used intensive care units (ICU) and veterinary facilities for exploratory examinations, which decreased the remaining burdenon clinicians [1].

3. R. Robert, P. Micheau, O. Avoine, B. Beaudry, A. Beaulieu, and H. Walti, “Weight-controlled ventilation significantly streamlines the use of the fluid ventilator” (2010), Thispaper undoubtedly encourage its presentation in highly elevated care units for clinical applications, according to. Authors used numerical simulations to design a powerful controller to perform weight-managed expiratory stream using the most recent fluid ventilator model (Inolivent-4) [2].

- **OBJECTIVES**

1. To design an automatic hardware controller for AMBU BAG to control pumping of oxygen according to the Breath Per Minute (BPM) of the patient.

2. To monitor/indicate the pattern of inhale and exhale status of the patient to the doctor to decide on further treatment.

- **METHODOLOGY**

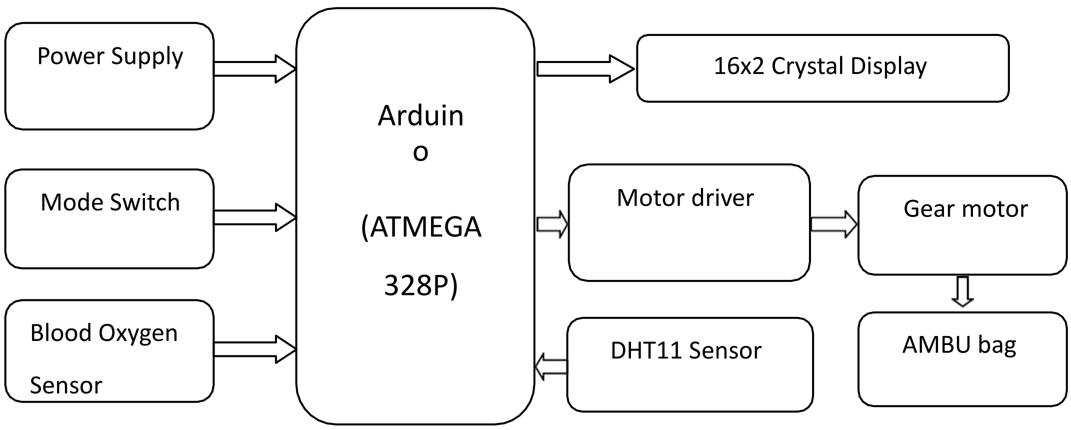

Fig 1: Block diagram of Arduino connections

One factor in determining the mobility of the automated AMBU Bag is the Product design. The above fig 1., demonstrates how the system operates and how the device is controlled.

The system's block diagram, shown in Fig1, shows how the microcontroller ATMEGA328P will receive input from the device's switch and a blood oxygen sensor that is connected to it. The ATMEGA328P will trigger the PWM and will simultaneously display the output on the LCD. The PWM pin will regulate the Johnson Motor (DC motor) with preconfigured setting and control push rod for the pumping of the AMBU bag. The

Pressure sensor attached to output valve of AMBU bag, when the AMBU bag is pushed the pressure sensor read the data and produces value accordingly and display the value in LCD.

The pressure mechanism is controlled in two ways one is manual mode where the motor starts and pushes AMBU bag continuously and in assist mode the ATMEGA328P or Arduino UNO receive BPM data of patient using blood oxygen sensor and if it falls below threshold then only turn on push mechanism else turn off the system and continuously monitor BPM and SPo2 level of patient.

a). Arduino Uno: A microcontroller board called Arduino/Genuine Uno is based on the ATmega328P. It contains a 16 MHz quartz crystal, 6 analog inputs, 14 digital input/output pins (of which 6 can be utilized as PWM outputs), and a USB connection.

b). Power supply: 5V and 12V supply is needed for the model the same designed and used as supply.

c). Mode switch: **i). Manual Mode:** The compression mechanism is controlled manually by the person and it can be turned ON/OFF whenever it is required.

ii). Auto Mode: We use a blood oxygen sensor that will monitor the patient's BPM regularly if the value falls below the threshold AMBU bag starts automatically when the BPM reaches normal compression of the AMBU bag stops automatically.

d). Blood Oxygen sensor: Used to detect pulse oximetry (SpO2) and heart rate (HR) signals, it combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing.

e). DHT11 Humdity & Temperature Sensor: This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor complex. Its technology ensures the high reliability and excellent long-term stability. A high-performance 8-bit microcontroller is connected.

f). Gear motor: Gear motor is a simple DC motor with a metal gearbox that drives the motor's shaft, making it a mechanically commutated electric motor that is powered by a DC supply.

g). LCD Display: A liquid crystal display, or LCD or 16*2, is a video display that utilizes the light modulating properties of liquid crystals to display pictures or text on a set.

- ## RESULT:

Project work titled **“DESIGN OF AUTOMATIC CONTROLLER FOR AMBU BAG”** is successfully implemented and demonstrated in the department. Different test scenarios are used to validate the results, which are explained in this section.

This describes the evaluations carried out on the product design, after the DHT11 sensor andoxygen sensor is added to the Arduino Micro controller. The air flow values were collectedwhen the DHT11 sensor is attached to the patient port of the AMBU bag. The DHT11 sensor read real-time air flow values. These air flow values are important to determines theair flow at the patient port of the AMBU bag. The DHT11 sensor was connected to the Arduino UNO, which monitored the ventilator performance parameters such as pressure, and airflow. DHT11 sensor data is collected every millisecond.
A breathing circuit with a pressure meter was connected between the control mechanism and the AMBU bag.

The amount of O2 in the blood, or blood O2 saturation level, is defined as the fraction of O2-saturated hemoglobin in red blood cells compared to the total amount of hemoglobin. Invasive medical tests can be used to measure arterial blood gases (ABG) very accurately; however, standard practice is to estimate peripheral oxygen saturation (SpO2) non-invasively with pulse oximetry using a colorimetric light sensor attached to a finger. SpO2 between 95 and 100% is considered normal; readings between 90 and 95% are considered mildly hypoxic, and a level of 90% or below indicates a serious medical condition called hypoxemia that needs to be treated quickly. The human body can adapt slightly to lower levels of SpO2, but generally this engenders feelings of fatigue and shortness of breath.
At complete rest, the typical adult male exchanges approximately 0.5 L (500 mL; 400 mL for female) of air per breath (tidal volume) at a rate of 12 times per minute, resulting in a minute ventilation rate of about 6 L of air per minute. and related thoracic muscles can exert maximum exhalation pressures of 44 to 88 mmHg and maximum inhalation pressures of negative 29 to 74 mmHg. We given the delay of the motor speed as 1700ms,1800ms, 2100ms, 2200ms for high and low parameters.

- # CONCLUSION:

The conclusion based on the results obtained for the project work **"DESIGN OF AUTOMATIC CONTROLLER FOR AMBU BAG"** are given in this chapter. The work presented here is geared at the creation of an intelligent controller mechanism for the AMBU bag. A survey of the literature was conducted in order to know and understand the ventilator's operation and to list the various open-source, inexpensive ventilator types that are currently available.

- **The conclusions are:**

(i) A functioning product of the controller module was created, and several sensors considered for the design were debated and implemented. Even when alternative ventilator and lung characteristics are used, the ventilator works successfully.

(ii) This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor complex. Its technology ensures the high reliability and excellent long-term stability.

- # FUTURE SCOPE:

The work completed for this project can still be improved. Below is a list of some modifications that could be made to the prototype in future iterations.

1. The Push rod Mechanism can be added at both side of AMBU bag to improve the pressure pattern of AMBU bag and produce more accurate volume.
2. Multiple modes can be implemented depending on the patient breath and oxygen levelin patient body
3. Multiple modes can be implemented in manual mode to control different set of value such as PEEP,I/E,BPM and BPM length to increase the system's intelligence.
4. Data on system usage in real time can be obtained by connecting a real-time monitoring system. In order for the doctor to understand the patterns from monitor, inspiratory pressure, and expiratory pressure, these data can be

transformed into waveforms.

5. To verify the system's durability, the device must be put through more severe testing procedures (such as using it in various weather conditions, operating it at full capacityfor a longer amount of time, collecting data for more cycles, and comparing the results,etc.). The reproducibility of the ventilator should also be thoroughly tested.
6. The system can be connected to IoT control over the internet and monitor via internet.