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Virtual doctor assist robot for online consultation using IOT

[1] Prof Jeevika Mary A ,[2]Thejeshwi Ongole Y ,
Department of Electronics and Communication , Dr T Thimmaiah Institute of Technology

Abstract: The patient is suffering from an injury or illness that makes it hard to breathe. A ventilator may help to breathe during these conditions. It is useful in surgery where you are asleep, but this is usually for no more than a few hours. So simply ventilator is a machine that helps a patient to breath when they are having a surgery or cannot breath their own due to a critical illness, that is why the device is more important in hospitals. Here the patient is connected to the ventilator with a hollow tube that goes in their mouth and down into their main airway or trachea. In this paper develops a portable ventilator using AMBU (Artificial Manual Breathing Unit) Bag. The pressure and volume of air passed to the patient from the ventilator can be measured using sensors and the readings can be displayed using Android app. The count, pressure and volume of air passed to the patient from the ventilator can be measured using relevant sensors and the readings can be displayed in both LCD display and Android app. The controlling of pressure is also possible with the help of Android app. The main advantages of this ventilator are that it is less expensive, portable and also automatically works. At emergency conditions the doctor can adjust the amount of air using a control mechanism that is built in Android application. Also, if the Doctor is not there a will be a notification sent to telegram of the Doctor or the hospital health assistant, and people around are alerted by the buzzer if pressure increases.

Keywords: *AMBU Bag; Ventilator; Prototype*

I. INTRODUCTION

The use of ventilators to support critically ill patients with respiratory failure is a critical aspect of modern medicine. However, close monitoring of a patient's blood oxygen levels is also crucial, as low levels of oxygen can lead to serious complications and even death. This need for continuous monitoring led to the development of a blood oxygen sensor that can be attached to a patient's fingertip or earlobe to measure oxygen saturation levels. In recent years, the use of Arduino microcontrollers has become increasingly popular in the field of medical device development. The low cost and ease of use of these devices have made them attractive tools for designing and prototyping new medical devices. The use of Arduino in the field of medical devices is known as "Arduino Med" or "Medduino".

Our project of monitoring the blood oxygen levels with a ventilator using Arduino was developed to provide a real-time monitoring system for critically ill patients, where the Arduino is used to read data from a blood oxygen sensor and display the results on an OLED screen. Monitoring the blood oxygen levels with healthcare. Furthermore, the recent progress in a ventilator using Arduino involves using an Arduino board to measure the blood oxygen saturation levels of a patient connected to a ventilator. The Arduino board is connected to a pulse oximeter sensor that is attached to the patient's finger or earlobe to measure their oxygen saturation levels. The data collected by the sensor is processed by the Arduino board and displayed on an LCD screen, providing real-time monitoring of the patient's oxygen saturation levels.

The ventilator is used to assist patients who are having difficulty breathing or are unable to breathe on their own. Monitoring the patient's oxygen saturation levels is crucial in ensuring that they receive the appropriate amount of oxygen to avoid hypoxia, a condition in which the body does not receive enough oxygen to function properly. This project is an example of the application of Arduino in the medical field, where it

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has been used to develop innovative and practical solutions for monitoring patient vital signs. This project has the potential to improve patient outcomes and provide better care for critically ill patients. The use of Arduino in monitoring blood oxygen levels with a ventilator provides accessible solution for healthcare facilities, especially in low-resource settings. It allows healthcare professionals to monitor patients' oxygen levels more easily and accurately, thereby improving patient outcomes.

II. LITERATURE SURVEY

V. Srinivasa Rao et.al [1] proposed, "Design and development of an automated low-cost Arduino-based ventilator", the paper describes the design and development of a low-cost ventilator using an Arduino microcontroller. The authors discuss the various components used in the ventilator, including the Arduino UNO board, LCD display, motor driver module, pressure sensor, and solenoid valve. They also provide details on the software used to control the ventilator and the algorithm used to regulate the airflow. The ventilator was tested and validated using a lung simulator, and the results showed that it was capable of delivering the required tidal volume and respiratory rate. The authors conclude that their low-cost ventilator could be used in emergency situations where commercial ventilators are not available or affordable.

Asim Waris et.al [2] proposed, "Development of a Low-Cost Open-Source Ventilator with Computerized Control System", The paper presents the development of a low-cost, opensource ventilator that can be used in emergency situations. The system is based on an Arduino microcontroller and includes a computerized control system that allows the user to adjust the ventilator settings using a graphical user interface (GUI). The authors discuss the hardware and software components used in the ventilator, including the Arduino board, LCD display, pressure sensor, and solenoid valve. They also describe the design of the GUI and the algorithm used to control the ventilator. The system was tested and validated using a lung simulator, and the results showed that it was capable of delivering the required tidal volume and respiratory rate. The authors conclude that their open-source ventilator provides a low-cost solution for emergency situations where commercial ventilators are not available or affordable.

R. Shu Et.al [3] proposed, "Real-time monitoring of arterial oxygen saturation in patients with COVID-19 using pulse oximetry", the paper discusses the use of pulse oximetry for real-time monitoring of blood oxygen levels in patients with COVID-19. The authors conducted a retrospective analysis of patients admitted to a hospital in Hong Kong with confirmed COVID19 between January and April 2020. They found that pulse oximetry was a reliable and noninvasive method for monitoring blood oxygen levels in COVID-19 patients and could help identify patients who require supplemental oxygen or other interventions. The study highlights the importance of continuous monitoring of blood oxygen levels in COVID-19 patients to ensure timely interventions and improve patient outcomes

Matsuo et.al [4] proposed, "Noninvasive Continuous Monitoring of Blood Oxygen Saturation Using Red and Infrared Reflectance Photoplethysmography with the Wrist Sensor of a Smart Device", the paper presents a novel method for continuous monitoring of blood oxygen saturation using a wrist sensor of a smart device. The authors developed a photoplethysmography (PPG) system that measures the reflection of red and infrared light from the skin to estimate oxygen saturation levels. The system was tested on healthy volunteers during various activities, including rest, exercise, and sleep, and showed high accuracy and reliability compared to conventional pulse oximeters. The study suggests that non-invasive continuous monitoring of blood oxygen saturation using a wrist sensor of a smart device can be a useful tool for monitoring health and disease states, including respiratory diseases.

Sahoo et.al [5] proposed, "An Arduino-based portable spirometer for pulmonary function testing", the paper describes the development of a low-cost portable

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spirometer based on the Arduino platform. The device is designed to measure various parameters related to lung function, such as forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and peak expiratory flow (PEF). The authors used off-the-shelf components to build the spirometer, including a pressure sensor, a flow sensor, and an Arduino microcontroller. They also developed a custom software interface to display and analyze the data collected by the spirometer. The results of the study showed that the device was able to accurately measure pulmonary function parameters and could be a useful tool for clinical and research applications.

III. METHODOLOGY

The monitoring of blood oxygen levels is a crucial aspect of using a ventilator for patients with respiratory distress. The Arduino microcontroller can be used in conjunction with other sensors to monitor and display the oxygen saturation levels of the patient. The system consists of an Arduino microcontroller, a pulse oximeter sensor, and an oled display. The pulse oximeter sensor is attached to the patient's finger and measures the oxygen saturation level in the blood by emitting a beam of light that passes through the finger and detects the amount of oxygen in the blood. This data is then sent'to the Arduino microcontroller, which processes the information and displays the oxygen saturation level on the led screen. In addition to measuring the oxygen saturation level, the system is programmed to alert medical personnel if the oxygen levels fall below a certain threshold. This threshold can be set according to the patient's needs. The Arduino microcontroller is programmed to record the oxygen saturation level over time and store the data for future analysis. This information can be useful for monitoring the patient's progress and adjusting the ventilator settings accordingly.

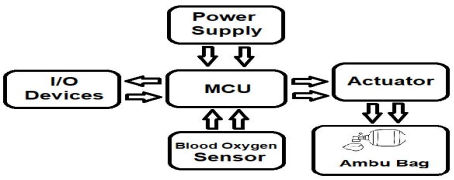

Fig 1: Block diagram

IV. HARDWARE AND SOFTWARE REQUIREMENTS

Hardware Requirements

1. Arduino mega
2. Arduino uno
3. Bread board
4. Servo motor mg995
5. Oled display
6. Pulse oximeter max30100
7. Ambu bag with valve mask
8. Adapters
9. Connecting wire

Software Requirements

1. Arduino Sketch IDE 1.8.1

V. DESCRIPTION OF HARDWARE COMPONENTS

A. Arduino ATmega 2560

Arduino Mega 2560 which is a microcontroller board based on the ATmega2560 microcontroller, which is a powerful 8-bit AVR (Advanced Virtual RISC) microcontroller developed by Atmel (now owned by Microchip Technology Inc.). The Arduino Mega 2560 is one of the popular members of the Arduino family, known for its extensive input/output (I/O) capabilities, making it suitable for a wide range of projects that require a larger numberof I/O pins.

B.ARDUINO UNO R3 The Arduino Uno R3 board is a popular microcontroller board based on the Atmega328P microcontroller chip. It was released in 2011 as an upgrade to the original Arduino Uno board, which was released in 2005. The Arduino platform was created by a group of students at the Interaction Design Institute Ivrea (IDII) in Italy, led by Massimo Banzi and David Cuartielles. The original Arduino board was designed to make it easy for artists, designers, and hobbyists to prototype and create interactive electronic projects. The board was based on the Atmel AVR microcontroller and featured a simple circuit board design that could be easily replicated by anyone with basic electronics skills. The Atmega328P microcontroller chip used in the Arduino Uno R3 board is an 8-bit microcontroller with 32 KB of flash memory, 2 KB of SRAM, and 1 KBofEEPROM.

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C.OLED OLED stands for Organic Light-Emitting Diode. It is a type of display technology that uses organic materials to emit light when an electric current is passed through them. OLED displays are known for their high contrast ratios, wide viewing angles, fast response times, and low power consumption. They are commonly used in smartphones, televisions, and other electronic devices. OLED displays are made up of individual pixels that emit their own light, which allows for deeper blacks and brighter colours compared to traditional LCD displays that use a backlight. This also makes OLED displays more power-efficient since only the pixels that need to be lit are turned on, while the rest remain off

D.MAX30100 is a highly integrated pulse oximeter and heart-rate sensor module that is commonly used for noninvasive monitoring of blood oxygen saturation (SpO2) and heart rate in various applications. It is a compact module that combines an infrared (IR) LED, a red LED, and a photodetector to measure the amount of light absorbed or reflected by blood vessels, allowing for accurate determination of SpO2 and heart rate. The MAX30100 module uses a technique called photoplethysmography (PPG) to measure changes in light absorption and reflection by blood vessels. It emits infrared and red light into the skin, and measures the amount of light that is absorbed or reflected by blood vessels. This data is then processed to determine SpO2 and heart rate. In addition to heart rate and SpO2 measurement, the MAX30100 module also includes builtin motion artifact rejection and ambient light cancellation to improve the accuracy of the readings. It also features a low power consumption mode, which makes it suitable for use in battery-powered devices.

E.SERVO MOTOR A servo motor is an electrical device that rotates to a precise angle and position based on the input it receives from a control system. Servo motors are commonly used in a wide range of applications, including robotics, industrial automation, and consumer electronics. They are particularly useful in applications that require precise control over motion and positioning. The MG995 servo motor is a specific type of servo motor that is known for its high torque and durability. It is commonly used in hobbyist and educational projects, as well as in some industrial and commercial applications. With its metal gears and dual ball bearings, the MG995 can deliver high power output while maintaining smooth and reliable operation. It is typically 20 controlled using a standard 3-wire interface and can be powered using a range of voltages depending on the specific variant.

A Bag Valve Mask (BVM), also known as a manual resuscitator or Ambu bag, is a medical device used to provide positive pressure ventilation to patients who are not breathing or who are breathing inadequately. It is typically used in emergency situations when a patient's breathing has stopped or is compromised, and immediate intervention is required. The BVM consists of a flexible bag that is connected to a face mask and a source of oxygen or air.

WORKING OF PROPOSED MODEL

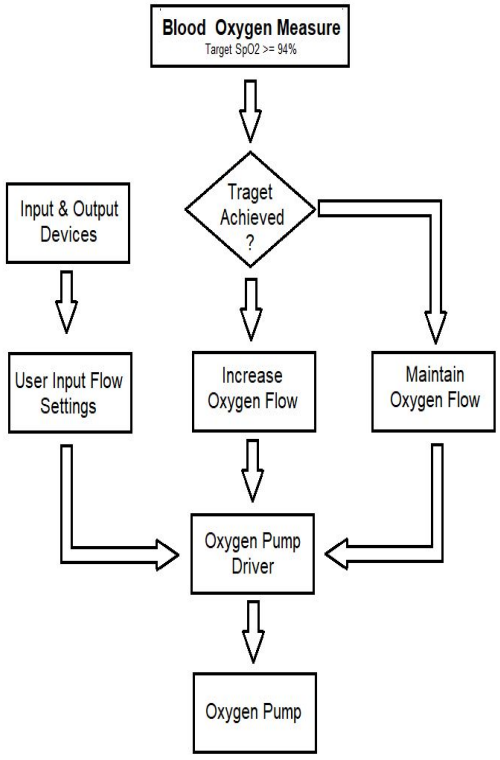

Fig 2: Flow Chart

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VI. RESULTS

The hardware connection of the system is shown in the fig 4.1. The system consists of two Arduino boards which acts as brain, it also consists a blood oxygen level sensor for measuring the blood oxygen level in time interval. The system is connected to a bag valve mask for supplying the oxygen to the need. The entire system is built on a breadboard and an oled display is used to show the parameters.

The above Fig 4.2 shows the parameters measured with the help of blood oxygen level sensor and is displayed in the OLED display. The Arduino board takes this parameters as input and gives the output as oxygen to the patients who requires it.

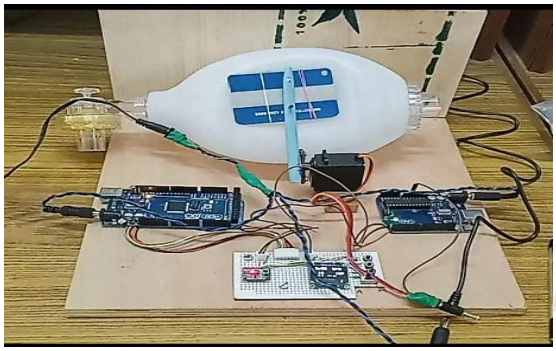

Fig 3: Hardware model of virtual doctor robot

VII. CONCLUSION

Monitoring blood oxygen levels with a ventilator using an Arduino is a feasible and effective solution for ensuring the well-being of patients with respiratory illnesses. The use of an Arduino allows for real-time monitoring of oxygen levels, as well as the ability to adjust ventilation settings and alert medical staff in case of emergency. By utilizing this technology, healthcare professionals can more efficiently monitor and manage patients' respiratory health, leading to better outcomes and improved quality of life. However, it is important to note that the implementation of such a system should be done under the guidance of medical professionals with experience in respiratory care and the use of ventilators.

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