International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

Dual Mode Ventilator Integrated with Patient Monitoring System

Monisha D[1], Akshara R[2], Akhil P[3], Athira Raju[4], Sugina Sudhakaran[5]

[1]*Monisha D Department of BME Hindusthan College of Engineering and Technology Coimbatore, India*
[2]*Akshara R Department of BME Hindusthan College of Engineering and Technology Coimbatore, India*
[3]*Akhil P Department of BME Hindusthan College of Engineering and Technology Coimbatore, India*
[4]*Athira Raju Department of BME Hindusthan College of Engineering and Technology Coimbatore, India*
[5]*Sugina Sudhakaran Department of BME Hindusthan College of Engineering and Technology Coimbatore, India*

Abstract - *The major objective of this project is to design an efficient low-cost ventilator for covid-19 patients and to measure the vital parameters using integrated patient monitoring system which can works on adult and pediatric mode and can be available for multiple patients. A mechanical ventilator is a device that supports enough oxygen for patients with respiratory distress in an intensive care unit (ICU). In this work, a portable mechanical ventilator is designed in such a way that it can be used in emergency vehicles and can also be used as a portable ventilation device for patients who are suffering from breathing. Through the integration of advanced electronics and mechanical instruments such as microcontroller and sensors like heart beat sensor, spo2 sensor, temperature sensors, pulse sensors, we implement a portable high-frequency ventilator which can measure ECG, SPO2, Temperature and Pulse. It is capable of working at two different modes by adding motor drivers which can be controlled via switches. All the sensed data is updated to the microcontroller and it will process the ventilator data and updated to the concerned person through IOT. All the updates will be displayed on the mobile phone/PC through Blynk Application.*

Key Words: Ventilator, Arduino, ESP 32, IoT, Blynk Application

1. INTRODUCTION

A mechanical ventilator is a gadget that helps ample oxygen for sufferers with respiratory misery in an intensive care unit (ICU). The everyday ventilator reserve of the health center is a ways from assembly the desires of patients. So unhappy to hear information reviews that some international locations have no desire however to quit the use of a ventilator for sufferers over sixty five years of age. Such a choice is irritating however can recognize the helplessness. Some international locations even initiated animal ventilators for human scientific use. Ventilators, additionally recognized as life-support machines, won't treatment an illness, however they can preserve sufferers alive whilst they battle a contamination or their physique heals from an injury. This mechanical air flow is an automated method that routinely affords air flow to sufferers through the given inputs to the system. Mechanical air flow helps the respiratory of respiratory failure sufferers to preserve enough blood oxygenation and reduces the work of respiratory to permit them to get better from the underlying ailment or insult. However, deciding on best patient-specific MV settings is tough due to restricted measurements and giant inter and intra- affected person variability. The ensuing sub-optimal air flow settings can introduce problems hindering terrible affected person healing and lowering outcomes. Protective MV strategies, and staircase recruitment man oeuvres observed with wonderful end-expiratory stress are frequent protecting computer air flow strategy for acute respiratory misery syndrome and respiratory failure sufferers to preserve their lung open and enhance oxygenation. However, these tactics are generalized and do no longer think about patient-specific disorder nation and their response to treatment. As a result, sufferers ventilated with immoderate airway stress or tidal extent can increase ventilator brought on lung injury, growing morbidity and mortality. Thus, accurate, predictive, and patient-specific MV techniques should drastically improve desktop air flow care, and limit both VILI and mortality. Currently, no effective standardized method exists for clinicians to determine the optimal patient-specific machine ventilation settings, leading to uncertainty, variability, and increased risk. Model-based methods are a growing means of personalizing care. While many fashions can efficaciously seize lung dynamics, very few can precisely predict the pulmonary response over time. In addition, these model-based works are carried out well, and there is a want of a platform to allow computing device air flow monitoring, processing and to furnish selection assist data to the clinicians. Some ventilators can grant some real-time assessments, such as useful residual ability estimator and inflection points, and some additionally supply estimates of elastance from Pressure-Volume curves. However, these ventilators do now not supply a couple of affected person monitoring, nor do they grant accurate, clinically validated estimates of quintessential respiratory mechanics parameters or patient-ventilator interplay monitoring. Most research have been relying on clinicians at the bedside to diagnose and manipulate computer air flow treatment. A range of monitoring structures in the literature supply statistics acquisition, however do now not grant real-time evaluation and feedback. In order to tackle the aforementioned drawbacks, there is a want to enhance statistics acquisition of ventilator waveform information

(VWD) which beautify the find out about of affected person respiratory mechanics and PVI. With growing tendencies in the numbers and severity of laptop air flow sufferers with growing old demographics, there is a developing want for effective, without difficulty implemented, and affordable structures to remotely gather data, reveal affected person condition, and assist customize care to enhance productiveness and consequences Automated evaluation of amassed data, collectively with complete information storage solution, affords a basis for next-generation model-based and personalized care solutions. Collection of large amounts of patient-generated data can be realized in clinical environments for research and quality improvements in

machine ventilation therapy, as well as its use at the bedside to enable personalized care In this work, the proposed mechanical ventilator device can provide the patient with the right amount of air and constant flow rate delivery, replacing the human effort.

2. DESIGN

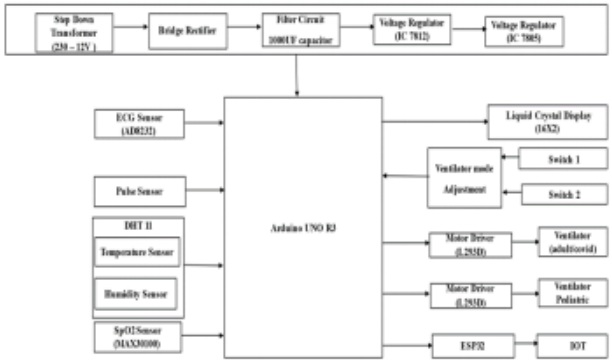

Chart -1: Block Diagram Transmitter Unit

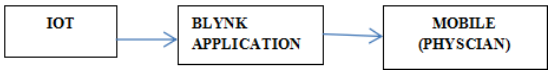

Chart-2: Block Diagram Receiver Unit

3. PROPOSED METHODOLOGY

In this venture we have developed a clever ventilator with a easy mechanism and cost-effectiveness, additionally we are going to overview quite a number strategies that can be used to produce excessive attention oxygenated air from ambient air. This proposed machine incorporates two distinct modes in a single device i.e. grownup mode and paediatric mode. Both the modes can be managed a single time. The microcontroller we used right here is an Arduino UNO R3. The controller works at the voltage of 12V DC. That will be linked to the energy provide unit. In this proposed gadget we have developed a clever transportable ventilator machine with size of SpO2 stage (max30100), Heart electric powered pulse (AD8232), Body temperature and humidity (DHT11), and Heart pulse price the use of revered sensors. All the sensed values will be up to date to the microcontroller. The microcontroller will method it and it indicates the person's pulse rate, coronary heart electric powered pulse, physique temperature, and oxygen stage on the Liquid Crystal Display. The microcontroller will switch that data to the worried man or woman thru the web the use of Blynk Application. The prototype consists of two switches to function two exclusive modes. One is for adult mode and the other swap is for paediatric mode.

4. COMPONENTS

4.1 Arduino UNO

The Arduino Uno is a microcontroller board primarily based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a sixteen MHz crystal oscillator, a USB connection, an electricity jack, an ICSP header, and a reset button. It carries the whole thing wished to assist the microcontroller; truly join it to a pc with a USB cable or electricity it with an AC-to-DC adapter or battery to get started. The Uno differs from all previous boards in that it does now not use the FTDI USB-to-serial driver chip. Instead, it facets the Atmega8U2 programmed as a USB-to-serial converter. "Uno" capacity one in Italian and is named to mark the upcoming launch of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions.

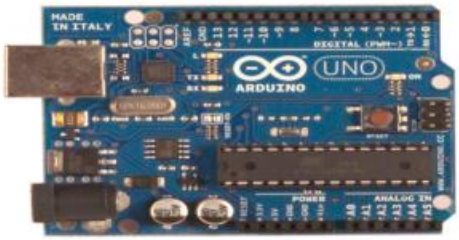

Fig-1: Arduino UNO

4.2 Temperature and Humidity Sensor

It measures the temperature and humidity price sensor module is comprised of a capacitive kind humidity sensor, a CMOS capacitor to frequency converter and an EEPROM used to preserve the calibration factors. Due to the traits of capacitor kind humidity sensor, the device can reply to humidity exchange very quickly. Each sensor is calibrated twice at two exclusive correct humidity chambers and two special sensor associated coefficients are saved on the EEPROM Module.

Fig-2: Temperature and Humidity Sensor

4.3 Heart Beat Sensor

Medical coronary heart sensors are successful of monitoring vascular tissue via the tip of the finger or the ear lobe. It is regularly used for fitness purposes, specifically when monitoring the physique after bodily training. Heart beat is sensed with the aid of the use of an excessive depth kind LED and LDR. The finger is positioned between the LED and DR. As Sensor an image diode or a photograph transistor is used.

Fig-3: Heart Beat Sensor

4.4 ECG Sensor

An electrocardiogram documents the electrical alerts in the heart. It's a frequent and painless take a look at used to rapidly become aware of coronary heart troubles and screen the heart's health. An electrocardiogram additionally known as ECG or EKG is regularly achieved in a fitness care provider's office, a medical institution or a medical institution room. ECG machines are well-known gear in working rooms and ambulances. Some non-public devices, such as clever watches, provide ECG monitoring. An electrocardiogram is a painless, non-invasive way to assist diagnose many frequent coronary heart problems. A fitness care issuer may use an electrocardiogram to decide or detect.

Fig-4: ECG Sensor

4.5 MAX 30100 Sensor

The MAX30100 is an integrated pulse oximetry and coronary heart rate monitor sensor solution. It combines two LEDs, an image detector, optimized optics, and low-noise analog signal processing to notice pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V electricity supplies and can be powered down via software program with negligible standby current, enabling the electricity supply to stay connected at all times. The MAX30100 is a whole pulse oximetry and coronary heart rate sensor device solution designed for the demanding necessities of wearable devices.

Fig-5: MAX 30100 Sensor

4.6 ESP 32

ESP32 is a sequence of cheap, low-power devices on chip microcontrollers with built-in Wi-Fi and dual-mode Bluetooth. ESP32 can function as an entire standalone device or as a slave system to a host MCU, lowering conversation stack overhead on the principal software processor. ESP32 can interface with different systems to supply Wi-Fi and Bluetooth performance via its SPI / SDIO or I2C / UART interfaces.

Fig-6: ESP 32

5. RESULTS

In this project, the crucial parameters such as ECG, SpO2, Temperature and Pulse are acquired from the patient. Two modes had been activated by motor drivers. All the sensed parameters had been processed via Arduino UNO R3 and transmitted to factor talk and additionally acquired message in cellular phone.

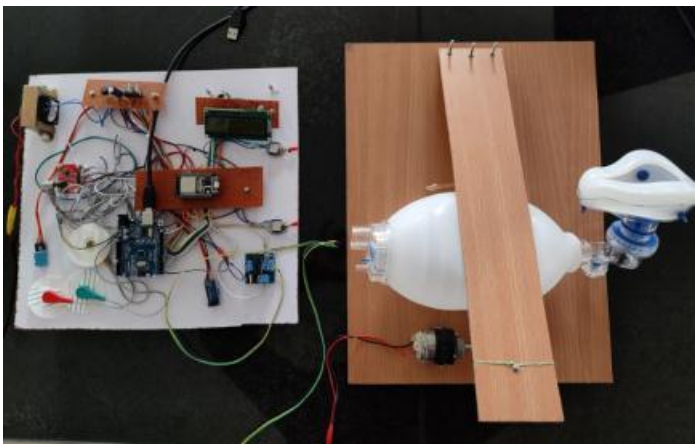

Fig-7: Experimental setup

6. CONCLUSIONS AND FUTURE SCOPE

In response of the COVID-19 pandemic, we designed, prototype, and examined an emergency ventilator having multi-mode that can examine grownup and pediatric in single system. Through microcontroller, all the sensors are convenient connecting to web and with the aid of IOT technological know-how get the affected person fitness situation important points easily. Due the integration of essential parameter monitoring device in ventilator, there is no want of separate affected person monitoring system. In future many different parameters can be monitored. BP dimension module can be included.

REFERENCES

[1] A REVIEW ON PORTABLE VENTILATOR WITH BUILT IN OXYGEN GENERATOR Alok Narkhede, Siddharth Gupta, Vivek Gorle, Aman Ninave and Tapesh Dule. International Research Journal of Engineering and Technology (IRJET) Volume: 08 Issue: 01 | Jan 2021

[2] DESIGN AND SIMULATION OF MECHANICAL VENTILATOR WITH SELF-INFLATING BAG Dr. G.Yedukondalu, P. Ganesh Sai Tarun. Turkish Journal of Physiotherapy and Rehabilitation; 32(3) ISSN 2651-4451 | e-ISSN 2651-446X – 2021

[3] From Mouth-to-Mouth to Bag-Valve-Mask Ventilation: Evolution and Characteristics of Actual Devices—A Review of the Literature Abdo Khoury, Sylvère Hugonnot, Johan Cossus, Alban De Luca, Thibaut Desmettre, Fatimata Seydou Sall, and Gilles Capellier - 2014

[4] P. Arpaia et al., "Conceptual design of a machine learning-based wearable soft sensor for non-invasive cardiovascular risk assessment," Measurement, vol. 169, Feb. 2021, Art. no. 108551.

[5] A. S. Alharthi, S. U. Yunas, and K. B. Ozanyan, "Deep learning for monitoring of human gait: A review," IEEE Sensors J., vol. 19, no. 21, pp. 9575–9591, Nov. 2019.

[6] B. Zhang, X. Hong, and Y. Liu, "Multi-task deep transfer learning method for guided wave-based integrated health monitoring using piezoelectric transducers," IEEE Sensors J., vol. 20, no. 23, pp. 14391–14400, Dec. 2020.