International Journal of Advance Research in Science and Engineering
Volume No. 14, Issue No. 03, March 2025
www.ijarse.com
IJARSE
ISSN 2319 - 8354

IoT Based Artificial Ventilator

Vivek Kajagar[1], Sejal Patil[2], Narahari Bhutanal[3], Pratibha Gavade[4], Niranjan Nalkar[5]

[1] Assistant Professor, *Electronics & Communication Engineering,*
Jain College of Engineering & Research, Belagavi
[2,3,4,5]*Electronics & Communication Engineering*
Jain College of Engineering & Research, Belagavi
vivekvkajagar5@gmail.com, Sejalpatil441@gmail.com, bhutanalnarahari@gmail.com, Gavadepratibha018@gmail.com, Nalkarniranjan300@gmail.com

ABSTRACT

Ventilators are often complex to operate, costly, and challenging to maintain, making them less accessible in low-resource settings. They can lack customization, reliable monitoring, and remote compatibility, which can compromise patient care, particularly where power and technical support are limited. Improving these aspects is crucial for safer, more adaptable ventilator use in diverse healthcare environments.

Keywords: *IOT, ESP8266, AMBU-BAG*

I. INTRODUCTION

The IoT-Based Artificial Ventilator addresses ventilator shortages during healthcare crises by providing a low-cost, portable solution. Traditional ventilators are expensive and complex, limiting accessibility in under-resourced areas. This project features an automated manual resuscitation system that can be operated with minimal training. Integrated sensors monitor vital health metrics, such as heart rate and temperature, transmitting data via IoT to a cloud platform. The Blynk app interface enables real-time remote monitoring and alerts healthcare providers to critical changes. An ESP camera module streams live visuals to ensure proper functionality.

The ventilator includes a power backup system for uninterrupted operation during outages. Designed for portability and scalability, it is suitable for emergencies, rural clinics, and field hospitals. This innovation enhances healthcare accessibility by automating ventilatory support and enabling remote supervision. The integration of IoT and real-time data monitoring improves patient care and response times. The project provides an affordable alternative to conventional ventilators in resource-limited settings. It offers a life-saving solution to reduce mortality rates during ventilator shortages.

II. LITERATURE REVIEW

[1] The first study was, **"An Affordable Respiratory Support in Resource-Limited Settings",** by Jeffrey Dellosa, Joven, Alexander, et. al. (Sep 2024). This survey describes how we designed a viable low-cost prototype of ventilator. The prototype built on an Ambu-bag and powered by a stepper motor with the Arduino taking command of oxygen delivery as per user set parameters. The ventilator's operation was

controlled by a touchscreen LCD that could provide an intuitive graphical user interface.

[2] The second study was **"Design and technical evaluation of an AMBU-BAG based low-cost ventilator-armed"**, by Mohit Kumar, et.al, (2024). This survey reviews that the device can be produced using affordable, widely available parts and simple manufacturing techniques, allowing assembly even in remote areas. It includes a battery backup with 2.5 hours of run time per charge, making it suitable for transport and reliable during power interruptions. These features make it a viable, low-cost alternative to standard commercial ventilator systems.

[3] The third study was, **"A Portable IoT-Based Smart Artificial Ventilator",** by Deepan, Rahul K, et. al. (2022). This survey reviews that the controller can monitor health parameters like heart rate. This data is sent via an IoT module for real-time monitoring by doctors or patients. If the system detects an irregular respiratory rate, it triggers a low-cost, non-invasive ventilator to provide support. The ventilator uses robust mechatronic design and rapid prototyping technologies, powered by a battery that can be recharged. This ensures portability and continuous operation.

[4] The fourth study was, **"DIY Ventilator using Arduino with Blood Oxygen Sensing for Covid Pandemic"**, by Rameshwar, et. al (2022). This survey reviews advancements in affordable, open-source ventilator systems using Arduino. One system monitors lung pressure and automates a breathing bag, while other features a portable, automated mask valve bag with control and real-time software. This highlights the potential of open-source tech in accessible medical ventilation solutions.

III. PROPOSED SYSTEM

The block diagram represents the working mechanism of an artificial ventilator system, designed to provide automated respiratory support for patients in emergency healthcare situations. This ventilator integrates automation, sensor technology, and IoT capabilities, ensuring efficient respiratory assistance and real-time monitoring.

At its core, the system is controlled by the ESP8266 microcontroller, which processes data from multiple sensors and regulates the operation of various components. The regulated power supply (5V) ensures stable operation, distributing power to critical elements such as sensors, the MG995 servo motor, and the 20×4 LCD display.

A key feature of the ventilator is the MG995 servo motor, which automates the mechanical compression and release of an Ambu Bag, mimicking natural breathing by delivering air at controlled intervals. An oxygen cylinder is connected to the Ambu Bag to ensure proper oxygenation for the patient.

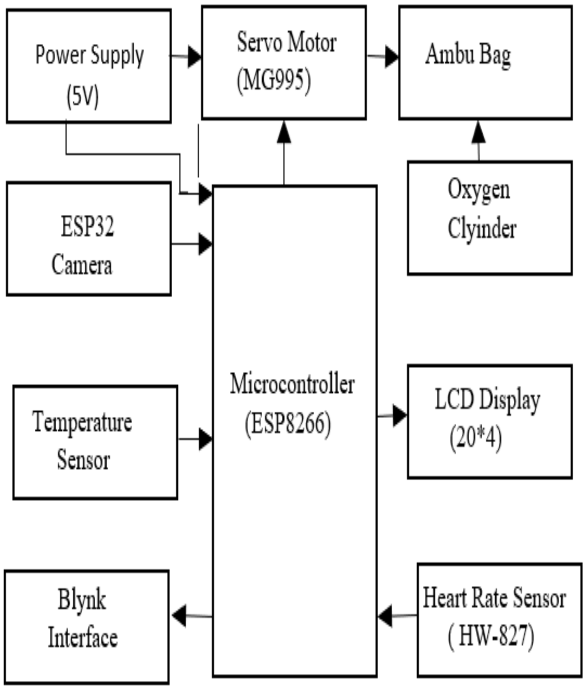
To monitor the patient's vital signs, the system includes a DS-18B20 temperature sensor for body temperature measurement and an HW-827 heart rate sensor for heart rate monitoring. These real-time data inputs allow the microcontroller to dynamically adjust ventilator settings based on patient conditions.

The 20×4 LCD display serves as a user interface for healthcare providers, showing vital information such as heart rate, temperature, and ventilator status. Additionally, an ESP32 camera module provides live video feedback, enabling remote visual assessment of the patient's condition, particularly useful in remote or pandemic scenarios.

The ventilator is equipped with a Blynk IoT interface, allowing healthcare providers to monitor and control the device remotely via smartphones or computers. This feature ensures continuous oversight, even from a distance, enhancing accessibility to medical care.

Compact, cost-effective, and user-friendly, this ventilator system is designed for use in hospitals, field settings, and home care environments. Its IoT-based features and automation capabilities make it a crucial tool in medical crises, offering life-saving respiratory support where advanced equipment is scarce.

BLOCK DIAGRAM:



IV. HARDWARE IMPLEMENTATION

ESP8266 (Node MCU)

The ESP8266 microcontroller is the central processing unit of the ventilator. It collects data from sensors, processes it, and controls various components such as the servo motor and LCD. It enables communication between the ventilator and the IoT cloud platform. This allows remote monitoring of patient vitals and device operation. It ensures efficient automation and smooth operation of the ventilator system.

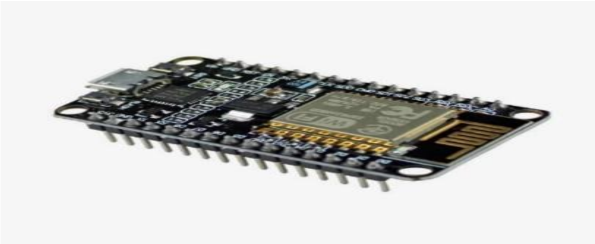


Fig.4.1Esp8266 (NodeMCU)

ESP32 Camera Module

The ESP32 Camera Module provides real-time visual monitoring of the ventilator's operation. It streams video data to a remote device, allowing healthcare providers to observe the system's functionality. This feature is useful for remote patient monitoring, especially in critical conditions. It ensures that the ventilator is functioning correctly and safely. The camera adds an extra layer of supervision for enhanced patient care.

IJARSE
ISSN 2319 - 8354

ESP32 Cam Base Board

The ESP32 Cam Base Board acts as a support module for the ESP32 Camera. It provides the necessary power and interface connections to integrate the camera module with the system. It ensures stable communication between the camera and the microcontroller. This module allows seamless video streaming and image capturing. It is crucial for real-time patient supervision.

Fig.4.2 ESP32-CAM Module With its Base Module

LCD with I2C Pins (20×4)

The LCD screen displays real-time data, including heart rate, temperature, and ventilator status. It provides an easy-to-read interface for healthcare professionals to monitor patient vitals. The I2C interface reduces the number of connection wires required, simplifying the circuit. It ensures quick access to critical information without external monitoring tools. This enhances the usability and efficiency of the ventilator system.

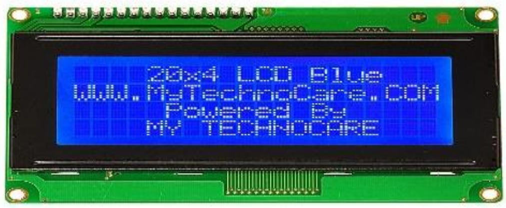


Fig.4.3.LCD Display 20x4

Servo Motor (MG995)

The MG995 servo motor is responsible for compressing and releasing the Ambu-Bag. It mimics the natural breathing process by delivering air to the patient at controlled intervals. The motor operates with high precision, ensuring that the correct volume of air is delivered. It is programmed to adjust its motion based on patient requirements. This makes the ventilator effective in providing consistent respiratory support.

Fig.4.4. MG995 Servo Motor

Heart-Rate Sensor (HW-827)

The HW-827 heart-rate sensor continuously monitors the patient's pulse. It transmits real-time heart rate data to the ESP8266 microcontroller for processing. This allows the ventilator system to adjust settings based on the

International Journal of Advance Research in Science and Engineering
Volume No. 14, Issue No. 03, March 2025
www.ijarse.com
IJARSE
ISSN 2319 - 8354

patient's condition. The data is displayed on the LCD screen and transmitted to the IoT platform. It ensures proper monitoring and alerts healthcare providers if irregularities occur.

Fig.4.5.Heart Sensor

Temperature Sensor (DS-18B20)

The DS-18B20 sensor measures the patient's body temperature in real time. It provides accurate readings, which are displayed on the LCD and sent to the IoT platform. The microcontroller uses this data to help regulate ventilator settings if needed. It ensures continuous patient monitoring to prevent critical health issues. This enhances the overall effectiveness of the ventilator system.

Fig.4.6 is the DS-18b20 Temperature Sensor

Ambu-Bag (1 Litre)

The Ambu-Bag serves as the main air delivery mechanism of the ventilator. The servo motor compresses and releases the bag to provide controlled ventilation. It ensures that the patient receives a consistent oxygen supply. The oxygen cylinder can be connected to enrich the air with necessary oxygen levels. This setup allows for an affordable and effective emergency ventilator solution.

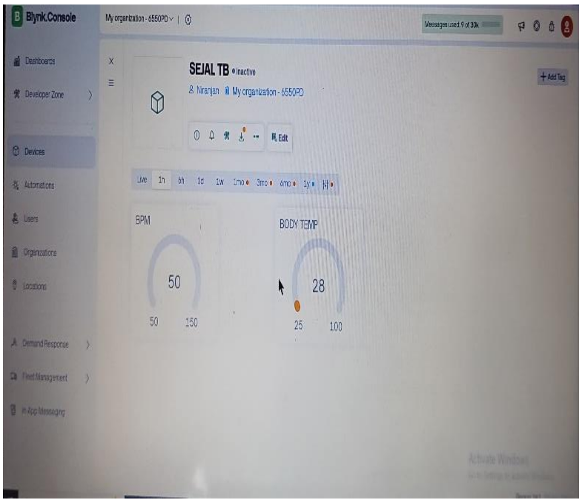
Fig.4.7 Ambu Bag

V. SOFTWARE IMPLEMENTATION

In our artificial ventilator project, we have implemented an interface using the Blynk application to enable real-time remote monitoring. The ESP8266 microcontroller collects data from the DS-18B20 temperature sensor and

HW-827 heart rate sensor and transmits it to the Blynk platform via Wi-Fi. The Blynk app displays critical patient parameters such as body temperature and heart rate on a user-friendly dashboard. This allows healthcare providers to remotely monitor patient vitals without needing to be physically present.

The app also sends alerts and notifications if the vitals exceed safe limits, ensuring timely medical intervention. Additionally, the interface provides graphical representations of data trends, helping doctors track patient conditions over time. The ventilator settings can also be adjusted remotely through the app if necessary. The ESP32 camera module further enhances monitoring by providing live visual feedback of the ventilator's operation. This IoT-enabled system improves accessibility and efficiency in patient care. The integration of Blynk ensures seamless real-time supervision and enhanced healthcare response in emergency situations.



VI. RESULTS & DISCUSSION

The implementation of the IoT-based artificial ventilator was successfully completed, integrating automation, sensor technology, and remote monitoring capabilities. The Blynk application interface effectively displayed real-time patient parameters, including body temperature and heart rate, allowing remote supervision. The ESP8266 microcontroller efficiently processed sensor data and controlled the MG995 servo motor, ensuring precise Ambu-Bag compression for consistent ventilation. The ESP32 camera module provided live video feedback, enhancing monitoring and operational safety.

The system successfully sent alerts for abnormal vitals, ensuring timely intervention. The ventilator operated smoothly on a stable 5V power supply, with a backup system ensuring uninterrupted function during power failures. The compact and portable design makes it suitable for use in emergency settings, rural clinics, and field hospitals. Compared to traditional ventilators, this system is cost-effective, easy to use, and scalable. The project demonstrates how IoT integration can revolutionize healthcare accessibility, making life-saving ventilatory support more affordable and widely available. Further improvements can include enhanced AI-based automation for adaptive ventilation control.

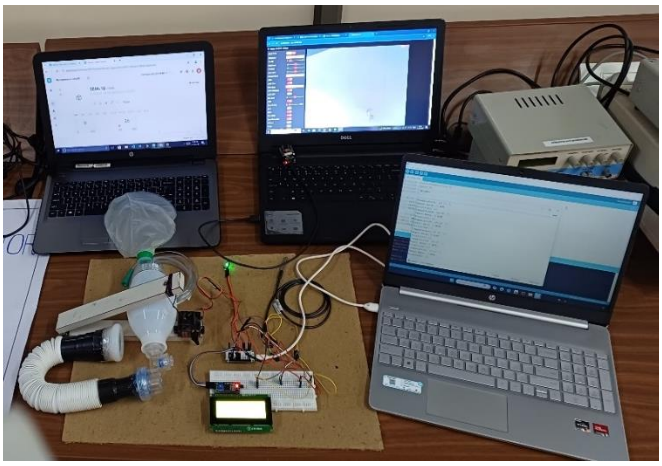


Fig.14 Results

VII. CONCLUSION

In conclusion, this work is a reasonable strategy potential for crisis and pandemic. It is an open-source ventilator configuration created utilizing disseminated fabricating. This prototype is an itemized clarification of delivering minimal expense, open-source mechanical ventilators for patients.

This is at the beginning phases of plan required further turns. Sure, this work will acquire more worthy consideration. There is a great deal of future work to be moved up to make it clinical grade equipment. It is a major hotspot for both the pandemic circumstance and crisis purposes and in any event, for regular use in low asset settings.

REFERENCES

[1] Jeffrey Dellosa, Joven, Alexander et. al. "An Affordable Respiratory Support in Resource-Limited Settings", Department of Electronics Engineering, Turkey, Sept 2024.

[2] Mohit Kumar, et. al. "Design and technical evaluation of an AMBU-BAG based low-cost ventilator-armed", Department of Biomedical Engineering, Indian Institute of Technology, Ropar.2024.

[3] Deepan, Praveen Kumar, Sarannath Vt, Dr.G.Saravana Venkatesh Rahul K. "A Portable IoT-Based Smart Artificial Ventilator" Department of Electrical and Electronics Engineering, Tamil Nadu.2022.

[4] Rameshwar Bhaginath Kale,Shashank Kumar Singh. "DIY Ventilator using Arduino with Blood Oxygen Sensing for Covid Pandemic", National Institute of Electronics & Information Technology, Aurangabad, Maharashtra.2022.