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IOT Venticare

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A B S T R A C T

The COVID-19 pandemic and similar health crises have demonstrated the urgent need for affordable and accessible ventilator systems. Traditional ventilators, while highly effective, are often costly and out of reach for many healthcare facilities, especially in resource-limited settings. IOT Venticare aims to bridge this gap by leveraging automation and IOT technology. This system uses an Ambu bag. This system uses an Ardino Uno microcontroller to control a servo motor, automating the compression of an Ambu bag. The device integrates a 20x4 LCD to display real-time parameters, potentiometers to adjust breath rate and pressure, and a NodeMCU for a cloud-based monitoring of hearth ECG data using ThingSpeak. This project showcases how low components and IOT can provide life-saving solutions, offering accessibility and real-time monitoring in emergency healthcare scenarious

Keywords: IoT (Internet of Things), Ventilator, Remote Monitoring, Real-time Data, Smart Healthcare, Data Logging, Sensors, Automated Adjustment, Oxygen Concentration, Air Pressure.

1. Introduction

Ventilators play a critical role in life-support systems, aiding patients who cannot breathe independently. However, their high cost and technical complexity often limit their availability in rural and underprivileged areas. The goal of this project, *IOT Venti Care*, is to create a simplified, low-cost ventilator system that can operate autonomously while providing remote monitoring capabilities via IoT. The system automates manual ventilation, traditionally performed using an Ambu bag, by employing a servo motor for precise and consistent compression.

With the integration of IoT features, the system goes beyond basic functionality, allowing caregivers to monitor the patient's heart activity remotely through a cloud-based dashboard. This combination of automation and connectivity makes *IOT Venti Care* an ideal solution for healthcare providers in emergencies and regions with limited resources

The integration of **Internet of Things (IoT)** technology into healthcare systems has revolutionized the way patient monitoring and critical care are managed. By using IoT, medical devices can collect real-time data, share it over networks, and enable remote monitoring, which improves patient care and reduces costs. Among these applications, IoT-enabled ventilators and ECG monitoring devices have become crucial in healthcare, especially in emergency settings or resource-limited environments.

This literature review focuses on IoT-based ventilators, the use of real-time ECG monitoring, and the cloud-based data sharing models that enhance patient management. The following sections cover research papers related to the IoT ventilator systems and their relevance to the **IOT Venti Care** project.

2.Review of Literature

IoT-Based Ventilator Systems

2.1. IoT-Enabled Ventilator for Critical Care:

A research paper by **S. Gupta et al. (2020)** discusses the development of an IoT-enabled ventilator prototype designed for use in critical care. The ventilator collects real-time patient data such as **breathing rate, tidal volume, and pressure** and transmits this data to a cloud-based platform. The system also includes remote control capabilities, allowing healthcare providers to adjust the ventilator settings remotely.

- **Relevance to IOT Venti Care:**

This research demonstrates the potential of IoT for automating and remotely controlling ventilator functions. The **IOT Venti Care** system, similar to the study by Gupta et al., uses **servo motors** to control the **Ambu bag** and provides real-time data (breath rate and pressure) on an **LCD display**, enhancing the caregiving experience with continuous monitoring.

2.2. Smart Ventilator System for Emergency Healthcare:

A study by **A. R. Chouhan and D. Sharma (2021)** explores a smart ventilator system built on **IoT** technology that uses multiple sensors to monitor **respiratory parameters**. The system integrates **sensors** (temperature, pressure, and flow rate) with an Arduino-based controller and a cloud interface. The authors emphasize the need for such systems in emergency care environments where skilled personnel may not always be available.

- **Relevance to IOT Venti Care:**

The integration of multiple sensors to measure **pressure** and **flow** in the ventilator system aligns with the concept of **IOT Venti Care**, where the primary focus is on providing automated ventilation and real-time data monitoring. The cloud interface used in Chouhan and Sharma's work aligns with the **ThingSpeak platform** used in **IOT Venti Care** for storing and analyzing data remotely.

2.3.ECG Monitoring in IoT-based Systems

IoT-Based ECG Monitoring for Remote Healthcare: The paper by **M. R. Manogaran and R. K. Manohar (2020)** presents an IoT-based system for remote **ECG monitoring**. The system collects heart rate data using a **ECG sensor** integrated with a microcontroller (Arduino/ESP32) and transmits this data over **Wi-Fi** to a cloud platform. The cloud platform (ThingSpeak) stores the data, where it can be accessed remotely by healthcare providers.

- **Relevance to IOT Venti Care:**

The **IOT Venti Care** system incorporates a similar approach by integrating an **ECG sensor** with the **NodeMCU** to send heart rate data to **ThingSpeak**. This allows real-time tracking of the patient's heart status remotely, offering doctors and caregivers a comprehensive view of both respiratory and heart parameters.

2.4 Wearable ECG Monitoring System with IoT Integration:

T. K. S. Kumar et al. (2021) designed a **wearable ECG monitoring system** that utilizes an IoT-based platform to monitor patients' ECG data in real time. The wearable system transmits data via **Bluetooth** to a mobile device or cloud platform, allowing for continuous heart health monitoring without requiring the patient to visit the hospital frequently.

- **Relevance to IOT Venti Care:**

Although the **IOT Venti Care** system uses **Wi-Fi** for communication instead of **Bluetooth**, the concept of **wearable ECG monitoring** aligns with the goal of remote health monitoring in critical care. By sending real-time heart rate data to a cloud platform, the **IOT Venti Care** system can allow healthcare professionals to continuously monitor patients without needing direct physical checks.

Cloud-Based Data Monitoring and Visualization

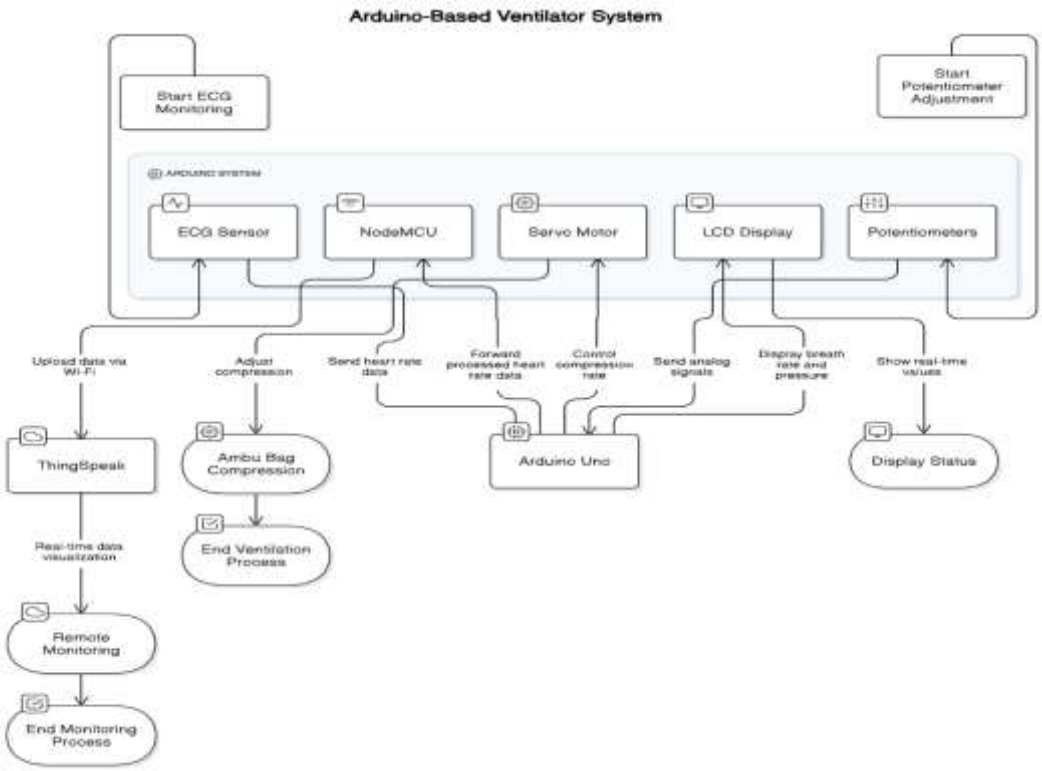
2.5. Cloud-Based IoT for Health Monitoring Systems:

J. Singh et al. (2021) focus on **cloud-based health monitoring systems** powered by IoT. The research highlights how data from various sensors (ECG, respiration rate, etc.) are uploaded to a **cloud platform** like **ThingSpeak** for real-time monitoring. The study discusses the importance of cloud-based platforms in facilitating healthcare professionals to make timely decisions, especially in remote areas.

- **Relevance to IOT Venti Care:**

The **ThingSpeak** platform used in **IOT Venti Care** aligns with the findings in Singh et al.'s research. By integrating **cloud data storage** and **visualization**, the system can display real-time ECG and ventilation data to caregivers, facilitating quick decision-making and patient management.

3.Methodology



System Workflow:

1.The **potentiometers** allow manual adjustment of the **breath rate** and **pressure**, which are fed to the Arduino.

2.The **Arduino** processes these inputs and controls the **servo motor** to adjust the Ambu bag's compression and drives the **LCD** to display the updated values.

3.The **ECG sensor** monitors the patient's heart rate, sending the data to the Arduino.

4.The **NodeMCU** connects to the Wi-Fi network and sends the ECG data to **ThingSpeak** for real-time cloud monitoring.

This system allows caregivers to monitor and control the mechanical ventilation process while also tracking heart rate through cloud-based IoT connectivity.

- **Functional Description**

The system operates in three key stages:

1.Input Stage: Caregivers use the potentiometers to set the desired breath rate and pressure. The ECG sensor continuously monitors the patient's heart activity.

2.Processing Stage: The Arduino processes the potentiometer inputs and generates PWM signals to control the servo motor. It also updates the LCD with real-time parameter values.

3.Output Stage: The servo motor compresses the Ambu bag at the set rate and depth, while the NodeMCU transmits ECG data to the ThingSpeak cloud.

4.Summary

An IoT-based ventilator is a smart medical device that uses Internet of Things technology to support and monitor patients' breathing in real time. Equipped with sensors, the ventilator tracks critical parameters such as air pressure, oxygen concentration, airflow, and respiratory rate, allowing healthcare providers to remotely access and monitor these data. The device can automatically adjust ventilation settings based on the collected data, ensuring optimal respiratory support for the patient. Additionally, IoT integration enables real-time alerts and alarms if any parameters deviate from safe levels, helping healthcare professionals respond quickly to emergencies. The ventilator also logs patient data, which can be used for analysis, and can be integrated with hospital systems for streamlined patient care. This combination of continuous monitoring, remote access, and automated adjustments improves the quality of care, making treatment more personalized and efficient while enhancing overall patient safety.

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Academic Databases

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4. ResearchGate: https://www.researchgate.net/

5. Google Scholar: https://scholar.google.com/

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2. Library of Congress: https://www.loc.gov/

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