



# Iot Based Patient Health Monitoring System

**Basavanagowda B S<sup>1</sup>, Basavaraju Bailaannavar<sup>2</sup>, Gagangowda<sup>3</sup>, Vijaykumar Hovale<sup>4</sup>,  
Prof. Padmavathi N<sup>\*5</sup>**

U.G. Student, Department of Electronics & communication Engineering,  
Akshaya Institute of Technology Tumkur, Karnataka, India<sup>1-4</sup>

Associate Professor, Department of Electronics & communication Engineering,  
Akshaya Institute of Technology Tumkur, Karnataka, India<sup>\*5</sup>

**Abstract:** The proposed system is an advanced Internet of Things (IoT)-based health monitoring solution designed to provide continuous and real-time tracking of a patient's vital parameters. The system is built around the ESP32 microcontroller, which acts as the central processing unit and communication hub. It integrates multiple biomedical sensors, including a temperature sensor, heart rate sensor, ECG sensor, and blood pressure sensor, to collect accurate physiological data from the patient. The acquired data is processed by the ESP32 and displayed on an LCD screen for immediate local monitoring. In addition to local display, the system utilizes Wi-Fi connectivity to transmit the data to an IoT platform, enabling remote access through a caregiver's smartphone. This allows doctors or caretakers to monitor the patient's health condition from any location in real time. The system also incorporates a buzzer for emergency alerts and a manual button that can be used by the patient to signal distress. These features enhance the safety and responsiveness of the system during critical situations. By combining sensor technology, wireless communication, and IoT capabilities, the proposed system offers a reliable, cost-effective, and efficient solution for remote health monitoring. It is particularly useful for elderly patients, individuals with chronic diseases, and situations where continuous medical supervision is required.

## I. INTRODUCTION

This chapter presents an IoT-based health monitoring system. The rapid advancement of technology has significantly transformed the healthcare sector, enabling smarter and more efficient ways to monitor patient health. One such innovation is the development of real-time health monitoring systems that allow continuous tracking of vital parameters without the need for frequent hospital visits. These systems are especially important for patients with chronic diseases, elderly individuals, and those requiring constant medical supervision. By combining sensors, microcontrollers, and wireless communication, modern healthcare solutions can provide accurate and timely information, improving early diagnosis and treatment.

## II. LITERATURE SURVEY

This paper presents the design and implementation of a health monitoring system using the Internet of Things (IoT). In present days, with the expansion of innovations, specialists are always looking for innovative electronic devices for easier identification of irregularities within the body. IoT-enabled technologies enable the possibility of developing novel and noninvasive clinical support systems. This paper presents a health care monitoring system. In particular, COVID-19 patients, high blood pressure patients, diabetic patients. Due to the successful emergence of internet of things, sensor-based real-time health monitoring is getting popularized. A usable health-monitoring system is required for prolonged monitoring of the patient with reduced cost. This paper describes a working prototype system for real-time health-monitoring system using DS18B20 temperature sensor, Arduino Nano with micro-controller ATmega328 where Zigbee module is used for wireless communication. The Indian healthcare scenario has been gradually changing in terms of the use of advanced healthcare and health ware systems. In accordance with the recent surrounding conditions and increasing health issues rate, accelerate the use of health ware and healthcare system. The growth of healthcare systems in India is obstructed due to lack of medical professionals, hospitals, poor accessibility to medicines, and unavailability of quality healthcare in distant and rural areas. The recent technology developments and innovations improve the life style of people through smart applications, sensors, wireless communication networks, etc., for all those technologies internet is the backbone and the information processing like accessing, distributing the necessary information is achieved through Internet of Things (IoT). IoT supports multi-disciplinary applications as an active entity in engineering, science and business discipline. Based on the user preference these applications and its services could. Smartphones can be used as multifunctional devices for instant monitoring of the users' health. In this



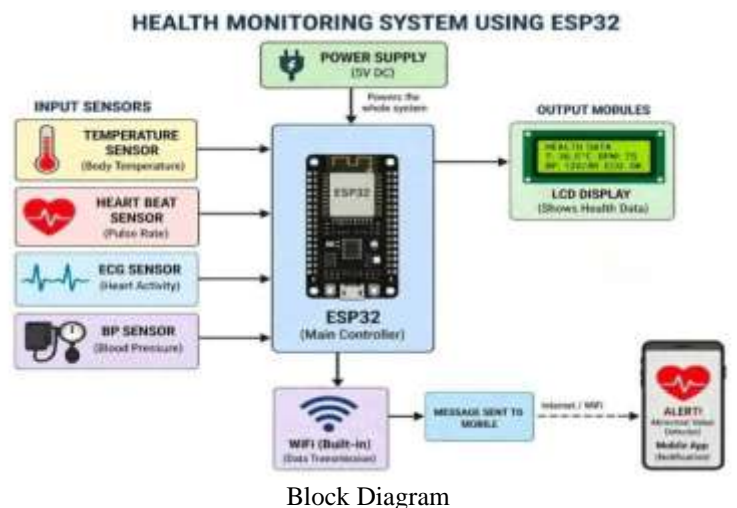
study, we proposed methods for the estimation of heart rate (HR), blood oxygen saturation (SpO<sub>2</sub>), and blood pressure (BP). Two smartphone sensors were used for data recording: the rear camera and the microphone. Our approach for HR and SpO<sub>2</sub> estimation was based on creating a photoplethysmogram (PPG) from the camera data. Internet of Things (IoT), which provides smart services and remote monitoring across healthcare systems according to a set of interconnected networks and devices, is a revolutionary technology in this domain. Due to its nature to sensitive and confidential information of patients, ensuring security is a critical issue in the development of IoT-based healthcare system. Aim: Our purpose was to identify the features and concepts associated with security requirements of IoT in healthcare system. Methods: A survey study on security.

### III. METHODOLOGY

The methodology of the IoT Health Monitoring System is structured to ensure seamless acquisition, processing, transmission, and monitoring of patient health data. The process begins with biomedical sensors—temperature, heartbeat, ECG, and blood pressure that continuously capture physiological signals from the patient. These signals are fed into the ESP32 microcontroller, which acts as the central processing unit. The ESP32 not only conditions and organizes the sensor data but also provides immediate feedback through an LCD display for local visualization. In cases of abnormal readings, the buzzer is activated to alert nearby caretakers, while a button allows manual acknowledgment or control of alarms. Beyond local monitoring, the ESP32 leverages its built-in Wi-Fi capability to transmit the processed data to an IoT platform, ensuring secure and real-time communication. This platform relays the information to the caretaker's smartphone, enabling remote monitoring and timely intervention. A stable power supply underpins the entire system, guaranteeing uninterrupted operation. By integrating local alerts with remote accessibility, the methodology ensures continuous patient supervision, rapid response to emergencies, and enhanced healthcare management through IoT connectivity. This system works as a complete real-time health monitoring solution centered on the ESP32, which integrates sensing, processing, display, and communication. Each sensor continuously captures specific physiological signals: the temperature sensor measures body heat, the heart beat sensor detects pulse rate using light-based or electrical signals, the ECG sensor records the electrical activity of the heart to identify rhythms, and the blood pressure sensor estimates systolic and diastolic pressure. These analog or digital signals are sent to the ESP32, where they are filtered, converted, and analyzed using programmed algorithms to ensure accurate readings.

The system is powered by a stable supply to guarantee uninterrupted operation. Overall, this methodology ensures that patient health parameters are continuously tracked, locally displayed, and remotely accessible, thereby enhancing both immediate response term care management. In the next stage, the processed data is displayed on an LCD screen for real-time local monitoring. Simultaneously, the ESP32 uses its built-in Wi-Fi module to transmit the data to a mobile application or cloud platform, enabling remote access. The system is programmed with predefined threshold values, allowing it to detect abnormal conditions. When such conditions occur, alert notifications are automatically sent to the user or care giver.

Finally, the system is tested and calibrated to ensure accuracy and reliability under different conditions. Power management techniques are applied to optimize energy consumption, especially for portable use. Overall, the methodology integrates hardware setup, software programming, data processing, wireless communication, and system validation to create an efficient and reliable health monitoring solution.





The circuit uses the ESP32 DevKit V1 as the main controller. All sensors like temperature, heartbeat, ECG, and blood pressure are connected to the input pins of the ESP32 to send health data. A 5V power supply is given to the system, and all components share a common ground. The LCD display is connected using two pins (SDA and SCL) to show the readings. A buzzer is connected to give an alert when values are abnormal. The ESP32 reads the sensor data, displays it on the LCD, and sends a message to the mobile using WiFi.

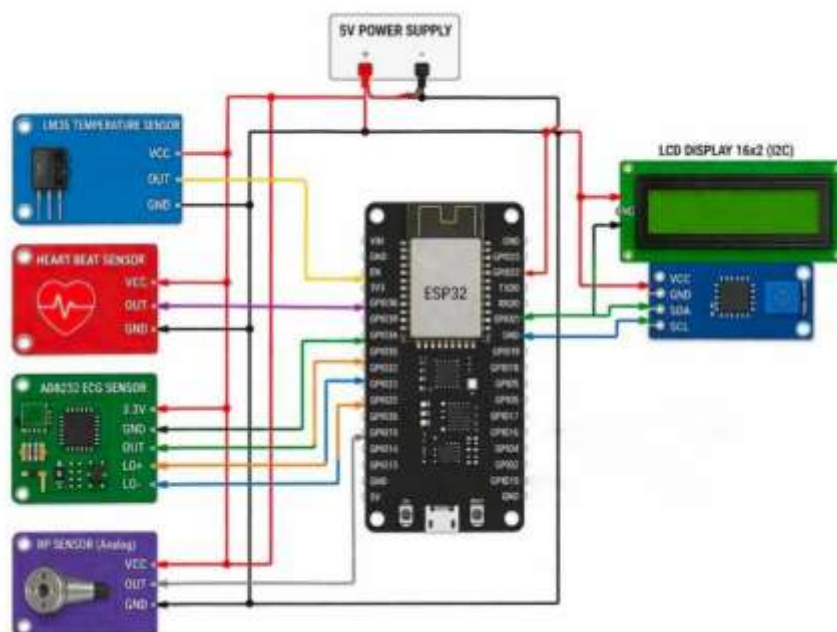
A stable 5V regulated power supply is used to power all components, and a common ground connection ensures proper circuit operation and signal reference. The processed data is displayed on a 16x2 LCD module using I2C communication, which minimizes wiring complexity by utilizing only two communication lines, SDA (Serial Data) and SCL (Serial Clock). Additionally, a buzzer is connected as an alert mechanism that is triggered when-ever any health parameter deviates from predefined safe limits, providing immediate audible warnings.

One of the key features of this system is the built-in WiFi capability of the ESP32, which enables wireless transmission of health data to a mobile application or cloud-based platform for remote monitoring. This allows doctors or caregivers to track patient health in real time, even from distant locations. Overall, this system offers a compact, efficient, and cost-effective solution for continuous health monitoring, early detection of abnormalities, and improved patient care through IoT technology.

In addition to these sensors, a blood pressure monitoring module may also be integrated into the system. This module measures systolic and diastolic blood pressure levels, which are critical indicators of cardiovascular health. The data obtained from this module is processed by the ESP32 and can be displayed or transmitted for further analysis.

Together, these sensors provide a comprehensive overview of the patient's health condition. The circuit is powered by a regulated 5V power supply, which ensures stable and reliable operation of all components. Proper power management is essential in such systems to prevent fluctuations that could affect sensor readings or damage components. All devices in the circuit share a common ground (GND), which is necessary to complete the electrical circuit and provide a reference point for voltage levels. Without a common ground, the system would not function correctly.

The working of the system can be explained step by step. Initially, all sensors continuously monitor the patient's physiological parameters. These sensors generate electrical signals corresponding to the measured values. The ESP32 reads these signals through its input pins and processes them using programmed algorithms. The processed data is then displayed on the LCD screen for immediate reference. At the same time, the ESP32 checks whether the readings fall within normal ranges. If any parameter exceeds the safe threshold, the buzzer is activated to provide an alert. Simultaneously, the data is transmitted via WiFi to a connected mobile device or cloud platform, enabling remote monitoring.



Circuit Diagram



## COMPONENTS

**Hardware Components**

- 1 ESP32
- 2 Temperature sensor
- 3 ECG Sensor
- 4 Blood pressure sensor
- 5 LCD

**Software Components**

- 1 Blynk app

**IV. EXPERIMENTAL RESULTS**

## OVERALL RESULT

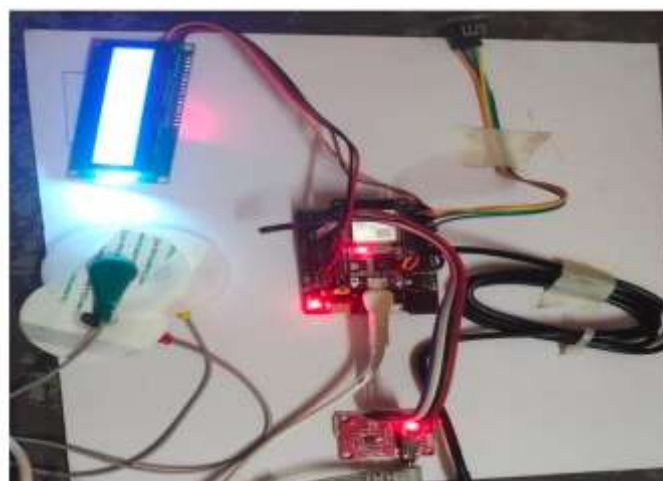
The overall result shows that the system is able to display health parameters on the LCD screen and can generate alerts when needed. It also demonstrates proper communication between hardware components, including sensors, display, and controller. Overall, the project result proves that the designed circuit works effectively as a basic health monitoring system, capable of collecting, processing, and displaying physiological data in real time.

## 6.1.1 Real-Time Sensor Readings

The developed IoT patient health monitoring system provides continuous real-time sensor readings, meaning that the system continuously collects and updates data from the sensors without delay. In this health monitoring system, all sensors such as the temperature sensor, heartbeat sensor, and ECG sensor constantly measure the user's body parameters and send signals to the ESP32.

1. Continuous Monitoring Sensors constantly measure body parameters like temperature, heart rate, and ECG without stopping.
2. Instant Processing Display The ESP32 immediately processes the data and shows updated values on the LCD screen.
3. Immediate Response Alerts If any value is abnormal, the system quickly activates the buzzer and can send data via WiFi.

Overall, this project demonstrates how modern IoT technology can be used to create a smart and cost-effective healthcare system. It provides continuous monitoring, quick response, and improved accessibility to health data, making it useful for both personal and medical applications. This system can help in early detection of health issues and supports better decision-making for timely medical care.





## HARDWARE CONNECTION

## Output window

The output window shows the real-time results of the health monitoring system on both the LCD display and the mobile interface. On the LCD screen, the measured values such as temperature, heart rate BPM, oxygen level SpO<sub>2</sub>, and ECG status are displayed clearly. For example, the temperature is around 31.7°C, oxygen level is 100, heart rate is shown, and ECG status indicates whether it is active or not.

(a) Accurate Data Measurement The system correctly measures temperature, heart rate, SpO<sub>2</sub>, and ECG.

(b) Real-Time Display Transmission Data is continuously shown on the LCD and sent to a mobile device via WiFi.

(c) Instant Display on LCD All readings are clearly



## CONCLUSION

"The IoT-Based Health Monitoring System" successfully demonstrates how biomedical sensors, microcontrollers, and wireless communication can be integrated to provide real-time patient data to caretakers. By employing the ESP32 microcontroller as the central unit, the system efficiently collects physiological parameters such as temperature, heart rate, ECG signals, and blood pressure. These values are processed and displayed locally on an LCD screen while simultaneously being transmitted via Wi-Fi to an IoT cloud platform, enabling remote monitoring through a caretaker's smartphone. This system addresses the growing need for continuous health monitoring, especially for elderly patients and individuals with chronic conditions. It reduces dependency on hospital visits for routine checkups, enhances patient safety through early detection of anomalies, and empowers caretakers with instant access to health data.

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