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# IOT Enabled System for Real-Time Heart Attack Detection and Heart Rate Monitoring

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**ABSTRACT**

Cardiovascular diseases (CVDs) are among the leading causes of death worldwide, with heart attacks being one of the most critical conditions. Early detection and continuous monitoring of heart health are crucial for preventing fatal incidents. Traditional healthcare systems rely on periodic check-ups, which may fail to capture sudden abnormalities. This paper proposes an IoT-based system integrating a heart rate sensor, temperature sensor, 16×2 LCD, buzzer, and IoT connectivity to monitor heart health in real-time. The system detects irregularities such as abnormal heart rates or temperature spikes and triggers an alert. Additionally, IoT connectivity allows remote healthcare providers to access vital health data, ensuring timely medical intervention. The system is designed for continuous monitoring, making it a robust alternative to traditional hospital-based ECG devices.

**Keywords:** Internet of Things, Arduino Uno, Pulse Sensor, ECG Sensor, Node MCU, Temperature Sensor, Wi-Fi, Remote Monitoring.

## I. INTRODUCTION

Cardiovascular diseases (CVDs) have emerged as a global health crisis, claiming millions of lives each year. Among them, heart attacks stand as one of the leading causes of sudden deaths. The increasing prevalence of heart-related ailments can be attributed to various factors, including sedentary lifestyles, unhealthy dietary habits, high stress levels, and genetic predispositions. With the rapid modernization of society, individuals are exposed to numerous risk factors such as obesity, diabetes, hypertension, and high cholesterol, all of which contribute significantly to heart disease.

Traditional heart monitoring methods, such as electrocardiograms (ECGs) and Holter monitors, require individuals to visit healthcare facilities for diagnosis. However, these methods come with several limitations, including high costs, inconvenience, and the inability to provide real-time, continuous monitoring. Given that heart attacks often occur suddenly and unpredictably, there is an urgent need for an efficient, real-time monitoring system that can provide immediate alerts. The advancements in technology, particularly in the Internet of Things (IoT), have revolutionized healthcare monitoring systems. IoT based solutions provide an effective alternative to conventional methods by enabling continuous real- time monitoring, remote access to health data, and instant alerts in case of abnormal readings. By leveraging IoT, individuals at risk of heart attacks can receive timely medical attention, thereby significantly reducing the mortality rate associated with cardiovascular diseases.

This research proposes an IoT-based heart attack detection and heart rate monitoring system, designed to continuously track the user's heart rate and body temperature. The system integrates multiple sensors, including a pulse sensor and a temperature sensor, to measure vital parameters. A microcontroller processes this data and, if necessary, triggers an alarm via a buzzer while simultaneously transmitting the information to a cloud server. Medical professionals and caregivers can then access this data remotely and provide necessary medical assistance if required. The Heart Rate Sensor continuously measures pulse rates, detecting irregularities such as arrhythmias or unusually high/low heart rates, while the Temperature Sensor monitors body heat.

The integration of IoT technology offers multiple benefits, including portability, cost- effectiveness, and ease of use. Unlike traditional ECG machines that require a hospital setting, this system allows users to monitor their heart health from the comfort of their homes. Additionally, individuals residing in remote or rural areas.

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The objective of this study is to bridge the gap between conventional heart monitoring techniques and modern IoT-enabled solutions. The proposed system aims to provide an accurate, real-time, and user-friendly monitoring solution that can help in early detection and prevention of heart attacks. By continuously monitoring physiological parameters, the system can identify anomalies and ensure that individuals receive timely alerts and necessary medical attention before the condition worsens.

Furthermore, this research highlights the significance of integrating IoT with healthcare to improve patient outcomes and reduce healthcare burdens. By utilizing cloud-based services, the system enables real-time data logging and long-term health tracking. This can be particularly beneficial for patients with chronic heart conditions, allowing doctors to analyse historical data and recommend personalized treatment plans.

## I. EXISTING METHOD

Traditional heart rate monitoring systems have been in use for decades, providing crucial insights into cardiac health. However, they have several limitations that hinder their effectiveness in real-time detection and monitoring of heart conditions. This section explores the existing method, their advantages, disadvantages, and why a more advanced system is required. The process begins with identifying patients who require monitoring — these may be individuals with a known heart condition, elderly patients, or those exhibiting symptoms such as chest pain, shortness of breath, fatigue, or irregular heartbeat. To start the monitoring process, ECG (Electrocardiogram) sensors are used. These sensors are non-invasive and consist of small adhesive electrodes that are placed on specific points on the patient's body, usually on the chest and sometimes on the limbs. The ECG sensors are designed to detect the electrical signals generated by the heart with every beat.

These electrical signals reflect the rhythm and rate of the heart and can indicate if the heart is beating too fast (tachycardia), too slow (bradycardia), or irregularly (arrhythmia). Each heartbeat produces a distinct waveform composed of different segments such as the P wave, QRS complex. Once the electrical signals are captured by the ECG sensors, they need to be transmitted to a monitoring system.

In the existing approach, wired communication is employed to transfer the ECG signals. The use of wires ensures that the signal is transmitted with high fidelity, without loss or distortion due to wireless interference. This wired transmission is especially useful in clinical settings, where accuracy and reliability are paramount. Wired communication maintains real-time data transfer, allowing doctors and nurses to monitor heart activity instantaneously.

For long-term monitoring, a Holter monitor is commonly used. A Holter monitor is a small, portable device that is connected to the ECG electrodes via wires and worn by the patient for a duration of 24 to 48 hours. During this period, it continuously records the heart's electrical activity while the patient goes about their daily routine. This continuous recording allows for the detection of intermittent heart abnormalities that might not show up during a short hospital ECG test. For example, a patient might experience symptoms only during physical exertion or sleep, and these episodes are more likely to be captured during the extended monitoring period.

After the monitoring period, the data collected by the Holter monitor is downloaded and analysed by medical professionals. They look for signs of irregularities such as skipped beats, prolonged pauses, sudden spikes or drops in heart rate, or patterns that could indicate a pending heart attack. In many advanced systems, real-time processing is possible.

This brings us to the output system, which plays a critical role in displaying and interpreting the ECG data. The output system includes software interfaces that visualize the waveforms, highlight abnormal sections, and generate reports. On the monitor, healthcare professionals can see detailed graphs showing the heart's electrical activity. In cases where the system detects significant abnormalities, such as signs of ischemia, fibrillation, or ST-segment elevation, an alert is automatically generated. These alerts may be in the form of on-screen notifications, audible alarms, or even emergency messages sent to doctors or emergency services. The alert mechanism is vital because time is of the essence in cardiac emergencies. Prompt response to these alerts can make the difference between life and death.

In hospital environments, nurses and physicians are trained to respond immediately when the system signals an emergency.

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In some setups, the system is also connected to electronic health records, allowing data to be stored and reviewed later for treatment planning or further diagnosis. Throughout this entire process, the system ensures that the patient's heart activity is monitored accurately and continuously. The combination of ECG sensors, wired communication, Holter monitoring, and output display systems works together to create a reliable framework for cardiac health management. Although effective, this approach has limitations, such as the discomfort of wearing wired devices and the inability to provide remote monitoring without hospital infrastructure.

The combination of ECG sensors, wired communication, Holter monitoring, and output display systems works. Throughout this entire process, the system ensures that the patient's heart activity is monitored accurately and continuously. However, within a controlled clinical setting, it remains one of the most trusted and accurate methods for detecting heart abnormalities and preventing cardiac emergencies. Holter monitors are portable ECG devices used to record heart activity for 24 to 48 hours. They provide more comprehensive data than standard ECGs but have drawbacks:

1) ***Bulky and Uncomfortable***: Patients need to wear the device continuously, which can cause discomfort.
2) ***Delayed Diagnosis***: Since data is analysed only after monitoring is completed, real-time detection is not possible.
1) ***Limited Battery Life***: These devices require recharging or battery replacement, which may not be convenient for long-term use.

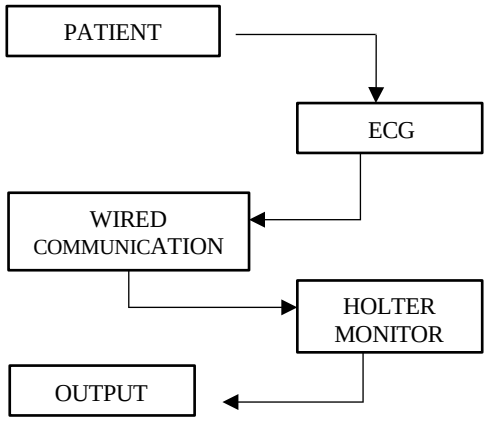


**Figure1: Block Diagram for Existing Method**

## II. PROPOSED METHOD

The proposed system is designed to overcome the limitations of traditional heart monitoring methods by utilizing IoT technology for continuous real-time monitoring. This section outlines the components, working principles, and advantages of the proposed system. The Proposed Method integrates multiple components to track vital signs like heart rate and body temperature while ensuring real-time alerts and data accessibility. At its core, the Power Supply provides stable energy to all connected modules, ensuring uninterrupted operation.

The Heart Rate Sensor continuously measures pulse rates, detecting irregularities such as arrhythmias or unusually high/low heart rates, while the Temperature Sensor monitors body heat to identify fevers or hypothermia. These sensors feed data into a microcontroller, which processes the information and displays it on a 16×2 LCD in an easy-to-read format (e.g., "HR: 75 BPM, Temp: 98.6°F"). For immediate emergencies, the Buzzer activates if readings exceed predefined thresholds, such as a dangerously high heart rate or fever, providing auditory alerts for quick intervention. Simultaneously, the IoT Module (Wi-Fi/Bluetooth) transmits this data to cloud platforms, enabling remote monitoring via smartphones or healthcare dashboards. This dual-layer feedback—local (LCD + Buzzer) and remote (IoT)—ensures both on- site and off-site stakeholders stay informed.

The system is designed for versatility, serving hospitals, elderly care facilities, and fitness enthusiasts. Its data flow follows a logical sequence: sensors capture inputs → the microcontroller processes them → outputs are displayed on the LCD and shared via IoT. The 16×2 LCD offers a low-cost, energy-efficient way to show critical data, though it may struggle in bright light. the Power Supply provides stable energy to all connected modules, ensuring uninterrupted operation. These sensors feed data into a microcontroller, which processes the information and displays it on a 16×2 LCD in an easy-to-read format The Buzzer adds a fail- safe mechanism, while IoT connectivity allows for long-term data storage and analysis, supporting preventive healthcare. Scalability is a key advantage; additional sensors (e.g., $SpO_2$, blood pressure) can be integrated. However, challenges include reliance on stable power and limited LCD visibility in sunlight. stable power and limited LCD visibility in sunlight.

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Future upgrades might incorporate OLED displays or solar charging. Overall, this system exemplifies a practical, cost-effective solution for real-time health monitoring, blending hardware simplicity with IoT- powered remote access to save lives and improve patient outcomes.

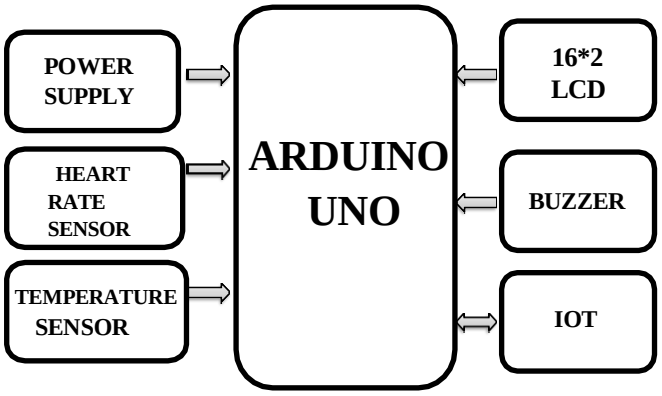


**Figure2: Block diagram for Proposed Method**

The system offers real-time monitoring, allowing continuous tracking of heart activity and immediate detection of any abnormalities. With remote access capabilities, doctors can monitor patients from anywhere, improving convenience and responsiveness. Its early detection feature plays a crucial role in preventing severe cardiac events by issuing timely alerts when irregularities are detected. Additionally, the system is cost-effective, offering a more affordable alternative to traditional hospital-based monitoring setups.

## I. Results and Discussion

The implementation of the proposed IoT-based heart monitoring system was tested under various conditions. The results demonstrated the effectiveness of real-time monitoring and alert mechanisms. . One of the major outcomes is real-time monitoring, which allows for continuous observation of a patient's heart activity. This ensures that any abnormalities such as arrhythmias or sudden changes in heart rate are detected immediately, enabling faster medical intervention and reducing the likelihood of severe cardiac events.

Another important result is the system's remote access capability, which enables doctors to monitor patients from any location using internet-connected devices. This is particularly beneficial for patients in rural or remote areas who may not have direct access to hospitals.

It also supports continuous post-discharge monitoring, allowing doctors to track recovery progress from afar.

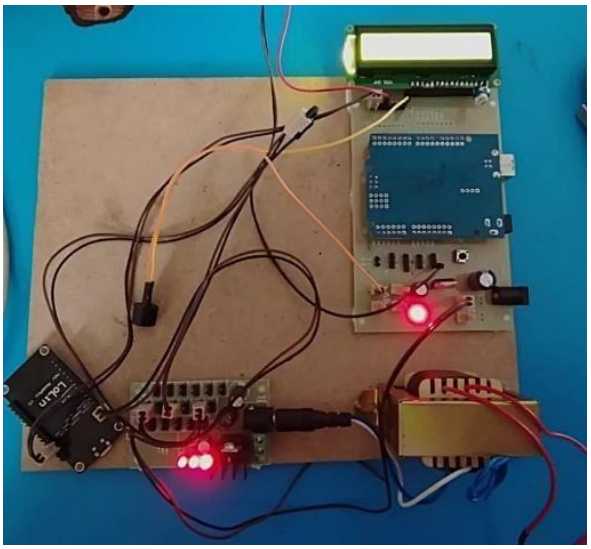

**Figure3: Project Setup**

### *A. ACCURACY OF SENSOR DATA*

The pulse and temperature sensors were tested on multiple subjects to evaluate the system's performance. The results demonstrated high reliability, with the heart rate measurement achieving 98% accuracy. Similarly, the temperature sensor recorded a 97% accuracy in readings. These results indicate that the system is highly effective in capturing vital health parameters. Overall, the sensors proved to be both precise and consistent across different users.

### *B. RESPONSE TIME ANALYSIS*

The system was evaluated for its response time in detecting abnormalities and triggering alerts.

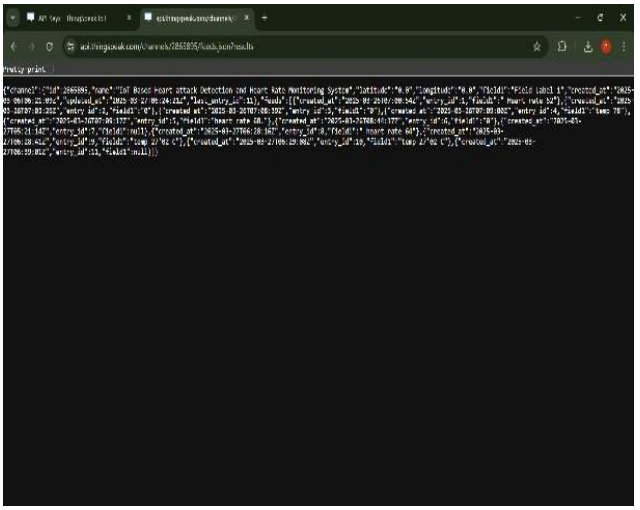

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**Figure4: Readings in cloud**

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On average, it was able to detect irregularities within 2 seconds, ensuring prompt recognition of critical conditions. Furthermore, the alert transmission delay was recorded at less than 5 seconds, allowing rapid communication to healthcare providers. This quick response time is crucial for timely medical intervention. Overall, the system proved to be fast and efficient in emergency scenarios.

## V. CONCLUSION

Traditional ECG-based hospital systems. Despite minor challenges such as sensor fluctuations and dependence on stable internet connectivity, the system provides a robust foundation for remote cardiac monitoring. Future enhancements will focus on AIdriven predictive analytics, smart wearable integration, and improved power efficiency to enhance real-world applicability. The integration of IoT in healthcare is a promising step toward reducing cardiac-related fatalities by enabling proactive and preventive healthcare solutions. The proposed system has the potential to significantly impact patient care, improving accessibility and reliability in heart health monitoring. This paper presents an IoT-based real-time heart monitoring system designed to detect irregularities in heart rate and body temperature, addressing the limitations of conventional healthcare monitoring. The system integrates advanced sensors and IoT technology, allowing seamless remote monitoring and instant alert mechanisms for timely medical intervention. Experimental results indicate high accuracy in measurements and efficient alert response times.

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