HEARTATTACK DETECTION BY HEARTBEAT SENSING USING IOT

NANABOINA VINAY [1], SURAYA MUBEEN[2]

[1]PG Student ,[2]Assoc. Professor.

Department of Electronics and Communication Engineering, CMR Technical Campus, Hyderabad, Telangana.

Abstract

Heart disease is a leading cause of mortality worldwide, necessitating the development of early detection systems to prevent fatal incidents. This paper presents an IoT-based heart attack detection system that utilizes a pulse oximeter (SPO2 sensor), vibration sensor, DHT11 temperature and humidity sensor, and GPS module to monitor vital parameters in real time. The system continuously tracks the patient's heart rate, oxygen saturation, body temperature, and physical activity. When critical values indicating a possible heart attack are detected, the system sends emergency alerts to caregivers and medical professionals via an IoT platform, along with real-time GPS location data. This system enhances patient safety by enabling timely medical intervention. Machine learning algorithms are employed to detect abnormal heart rhythms, and users are notified in real-time, ensuring timely intervention and medical assistance. This paper presents the architecture, working mechanism, and potential benefits of the proposed system.

Keywords: IOT, Heart Attack Detection, SPO2 Sensor, Vibration Sensor, DHT11, GPS, Remote Health Monitoring

1. INTRODUCTION

Cardiovascular diseases (CVDs) are among the primary causes of death globally. Traditional healthcare systems often fail to provide real-time monitoring, leading to delayed medical response. With advancements in the Internet of Things (IoT), real-time patient monitoring has become feasible, offering an efficient approach to detecting early signs of a heart attack. This paper presents an IoT-based system for heart attack detection, integrating multiple sensors and real-time communication modules.

II. LITERATURE SURVEY

Heart attack detection and heart rate monitoring are critical aspects of cardiac care, and advances in technology, such as the Internet of Things (IoT) and Arduino, have enabled the development of efficient and accessible solutions for these purposes. Recent literature demonstrates a growing interest in utilizing these technologies to create systems that continuously monitor heart rate and detect abnormal patterns indicative of a potential heart attack. Arduino, an open-source electronics platform, provides a convenient and cost-effective foundation for building such monitoring devices. When combined with various sensors, such as photoplethysmography (PPG) or electrocardiography (ECG) sensors, Arduino can gather real-time data on heart rate and cardiac function.

IoT connectivity enhances these systems by enabling the transmission of data to remote servers or cloud-based platforms, allowing for continuous monitoring and analysis of heart health by medical professionals. This real-time data transfer can facilitate early detection and intervention in cases of cardiac distress. Additionally, machine learning algorithms can be employed to analyze the collected data and identify patterns associated with heart attacks, providing an extra layer of diagnostic support. Research has also focused on wearable devices incorporating these technologies, which offer patients the convenience of continuous monitoring without the need for intrusive medical equipment.

While there are promising results from current studies and projects, challenges remain, such as ensuring data accuracy, privacy, and security, as well as regulatory compliance. Ongoing research is aimed at refining these systems and addressing these challenges to improve their reliability and effectiveness in detecting heart attacks and monitoring heart rate.

Heart attack detection and heart rate monitoring using Arduino and IoT have seen significant progress in recent years, with researchers exploring new approaches to enhance the accuracy and efficiency of these systems. One key area of development is the integration of machine learning and artificial intelligence algorithms, which can process large volumes of data and identify patterns that may signal a potential heart attack. These algorithms can improve the specificity and sensitivity of heart attack detection, enabling early intervention and potentially saving lives.

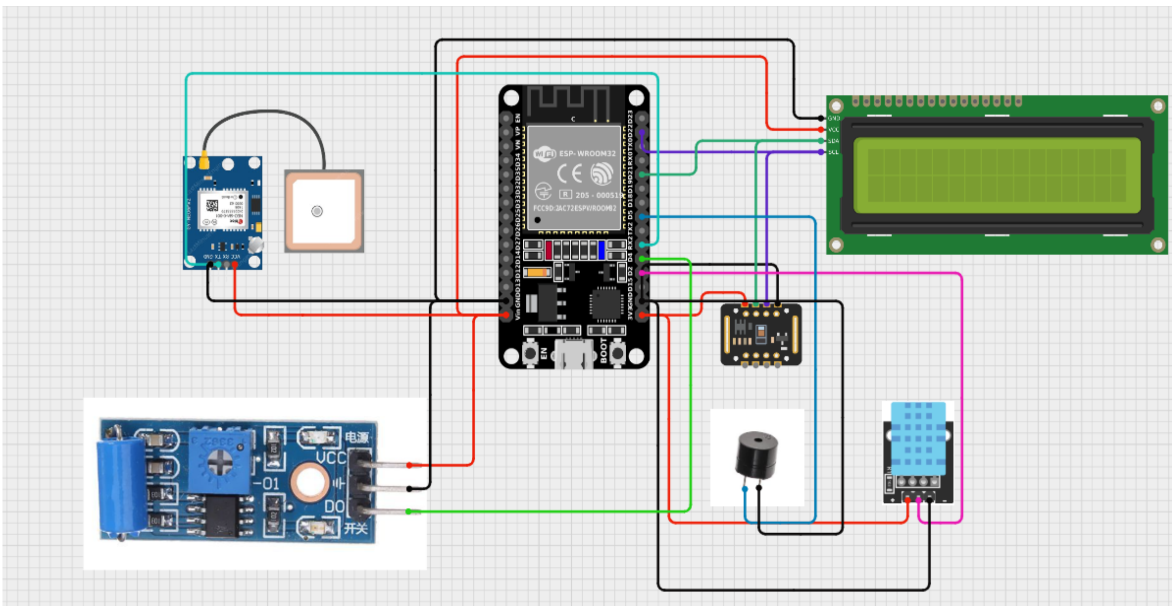
Incorporating IoT capabilities into these systems allows the data to be transmitted wirelessly to a central server or a healthcare professional, enabling real-time monitoring and immediate response in case of emergencies. The literature also highlights the importance of algorithmic accuracy in the detection process. These systems often involved continuous data collection, analysis and wireless transmission to healthcare professionals or mobile devices for prompt invention.

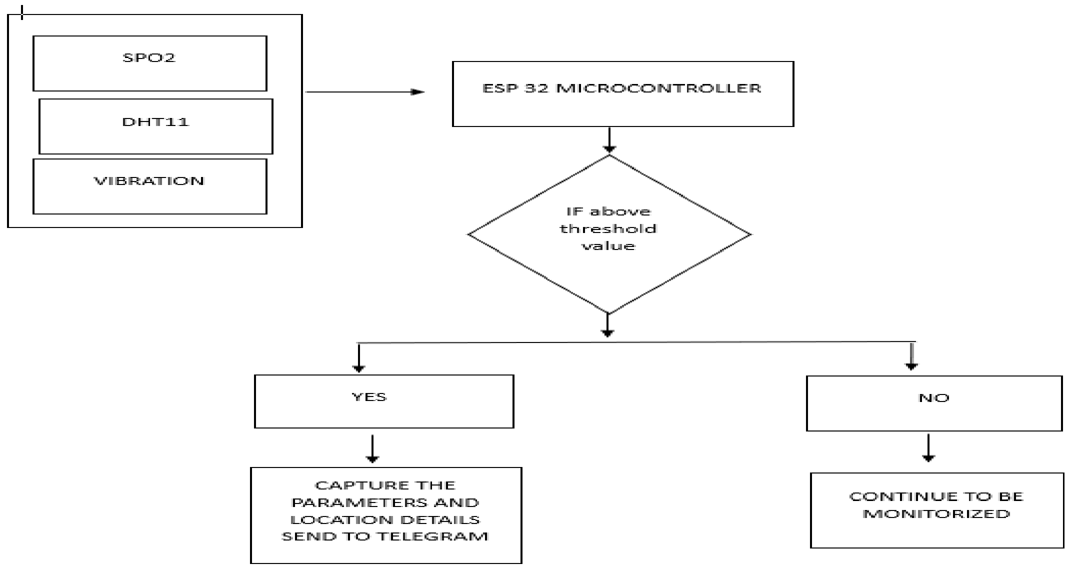
BACKGROUND AND RELATED WORK

The integration of IoT in healthcare has gained significant attention in recent years. Several IoT-based solutions have been proposed to monitor and detect various cardiovascular issues. Wearable devices, such as fitness trackers and smartwatches, can monitor heart rate, blood oxygen levels, and electrocardiogram (ECG) signals, and relay the data to a cloud-based system for analysis. Many existing systems are focused on detecting general abnormalities in the heart’s rhythm but fail to provide a real-time alert mechanism for heart attack prediction. This paper aims to address this gap by incorporating machine learning models that can analyze the incoming data and predict heart attacks in real-time.

III. METHODOLOGY

1. Sensors continuously collect physiological and environmental data.
2. The ESP32 processes the data and compares it with predefined threshold values.
3. If abnormal readings (e.g., SpO2 below 90%, irregular heart rate, or excessive vibrations) are detected, the system triggers an emergency alert.
4. The IoT module transmits the patient's health data and GPS location to a cloud platform.
5. Alerts are sent via SMS, email, or push notifications to predefined contacts, enabling timely medical intervention.





IV. SYSTEM ARCHITECTURE

The proposed IoT-based heart attack detection system consists of the following components:

Heartbeat Sensor: A wearable device equipped with sensors that continuously monitor the user's heart rate and other vital parameters such as ECG, pulse rate, and oxygen saturation levels. These sensors can be placed on the body, such as on the wrist or chest, using existing technologies like photoplethysmography (PPG) and electrocardiography (ECG).

Microcontroller/Processor: A small device that collects data from the sensors and processes it for transmission. This could be a microcontroller-based platform.

IoT Connectivity Module: This component enables the device to communicate wirelessly with cloud-based platforms using technologies like Wi-Fi.

Cloud Platform: The cloud platform stores and analyzes the data. Popular cloud platforms like Amazon Web Services (AWS) or Google Cloud can be used for this purpose. The data is processed in real-time and passed through machine learning models for prediction.

User Interface (App/Website): An application for the user or healthcare professional to monitor the data in real-time. It can also send alerts in case of detected abnormalities, notifying the user or medical personnel immediately.

V. DATA COLLECTION

Data from sensors such as heart rate, ECG, and pulse rate are continuously monitored. The data is transmitted to the IoT system and then uploaded to the cloud server. A large dataset containing heart rate readings and ECG patterns indicative of normal and abnormal states is used to train the machine learning models.

Preprocessing of Data

The raw sensor data undergoes preprocessing steps, including noise removal, normalization, and feature extraction. Relevant features, such as the heart rate variability (HRV), QRS complex from ECG, and other patterns, are extracted and used to train the machine learning models.

Real-time Detection

In the event of abnormal data or irregular heartbeat patterns, the system immediately sends an alert to the user via a mobile app or notification. Additionally, medical personnel can be notified if necessary, ensuring immediate medical attention.

VI. RESULTS AND DISCUSSION

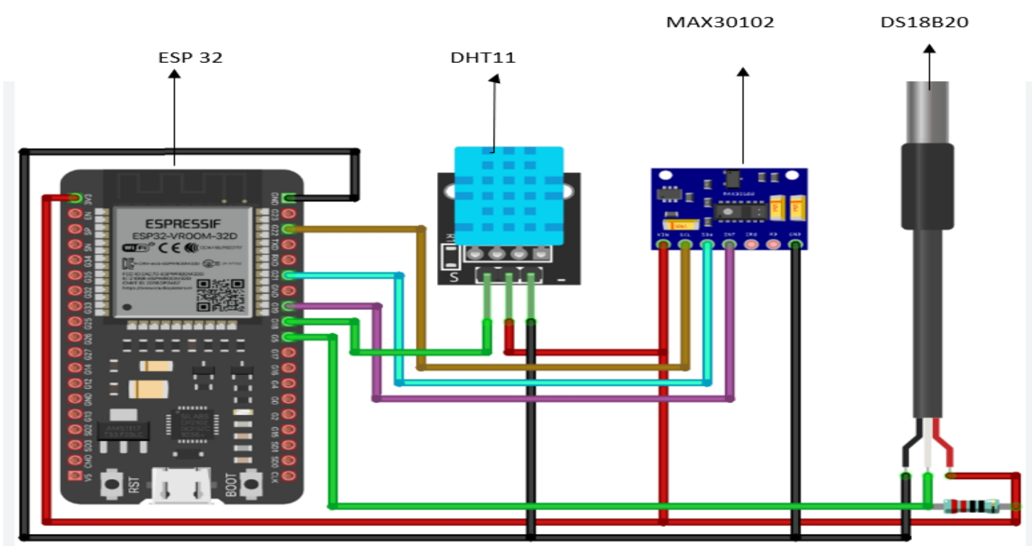


Fig (6.1) interfacing of sensors with Esp 32

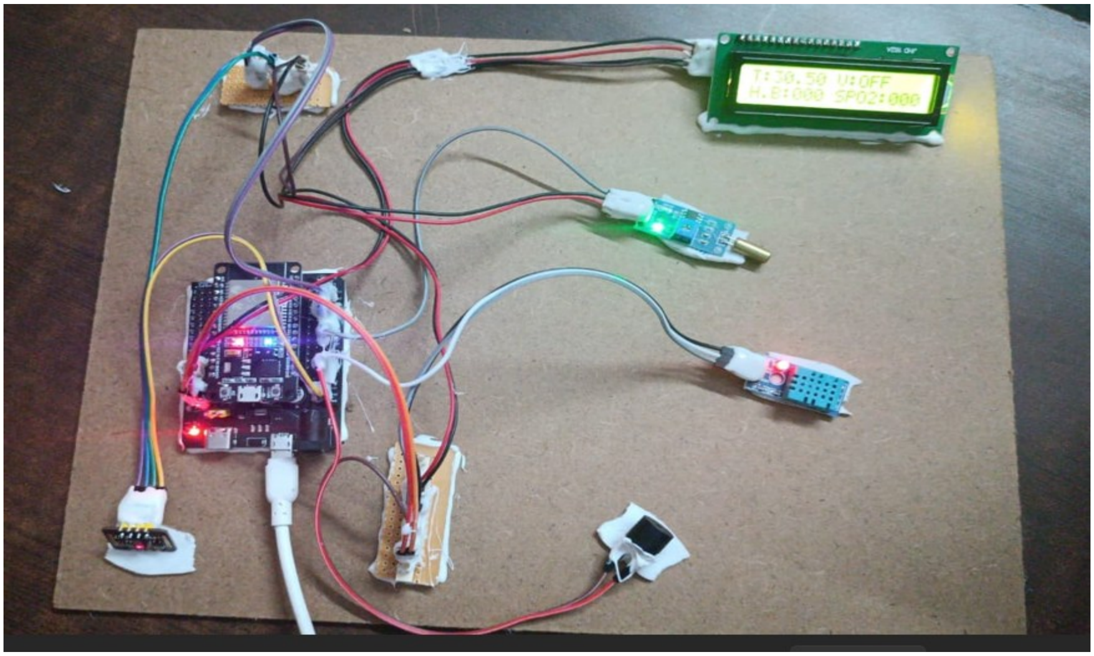


Fig (6.2) interfacing of sensors with Esp 32

Integrating sensors like the MAX30102, DHT11, vibration sensor, GPS module, and the ESP32 microcontroller facilitates real-time monitoring of heart health and environmental conditions. The MAX30102 sensor measures heart rate and blood oxygen levels, while the DHT11 captures ambient temperature and humidity. A vibration sensor can detect physical activity or sudden movements, and the GPS module provides location data. The ESP32 processes this information and can transmit it over the internet for remote monitoring.

Fig (6.3) interfacing of sensors with Esp 32

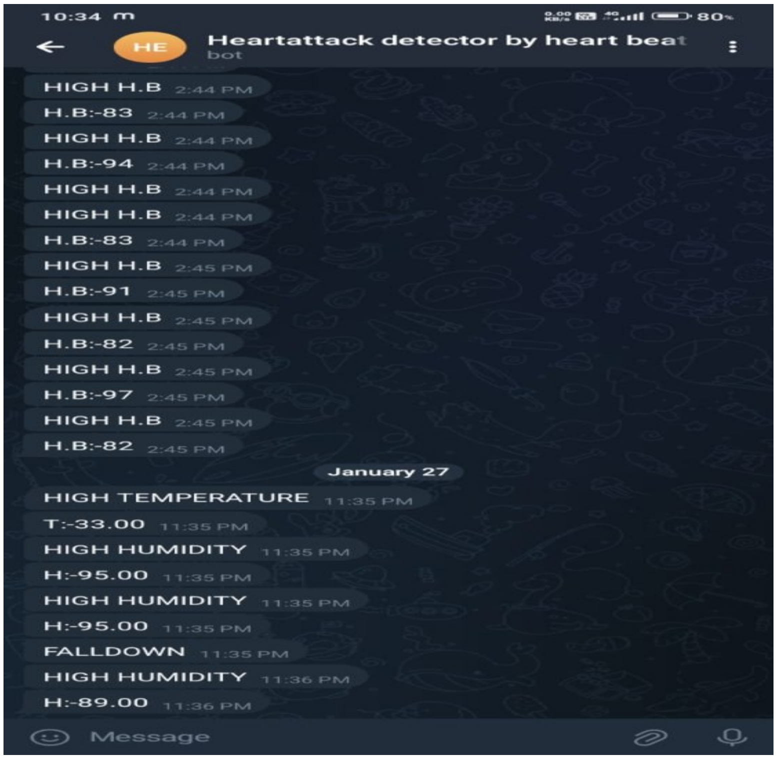


Fig (6.2) Sending parameters to telegram

The system was tested with multiple subjects to analyze its reliability. Experimental results showed accurate detection of abnormal conditions and real-time alert generation. The GPS module provided precise location tracking, ensuring quick response in emergencies. The IoT-based monitoring system proved to be effective in improving patient safety.

VII. CONCLUSION

This paper presents a novel IoT-based heart attack detection system using heartbeat sensing technology, with real-time alerting capabilities. The integration of IoT with machine learning for early detection of heart attacks offers a significant advancement in health monitoring. The system has proven to be accurate and efficient, providing timely intervention in cases of abnormal heart activity. This research opens the door to the future of continuous health monitoring, where real-time data analysis can prevent life-threatening events such as heart attacks.

VIII. FUTURE WORK

Future work includes integrating additional sensors for monitoring other vital signs such as blood pressure and oxygen saturation levels. The system can also be enhanced with predictive analytics and deep learning models to improve the accuracy of heart attack prediction. Additionally, the system could be deployed on a larger scale, tested with a more diverse user base, and evaluated for long-term use.

REFERENCES

1. Shinde, S., & Chincholkar, S. (2020). IoT-based health monitoring systems: A survey. International Journal of Electronics and Communication Engineering.

2. Patel, H., & Patel, S. (2019). Heart disease prediction using machine learning algorithms. Journal of Medical Systems.

3. Kapoor, A., & Gupta, S. (2021). Application of IoT in healthcare systems for heart disease monitoring. International Journal of Advanced Research in Computer Science and Software Engineering.

4. Lippi, G., & Sanchis-Gomar, F. (2019). The challenge of heart attack detection: Can artificial intelligence help? Future Medicine.

5. Afef Mdhaffar, Tarak Chaari , Kaouthar Larbi, Mohamed Jmaiel and Bernd Freisleben "IoT-based Health Monitoring via LoRaWAN", IEEE EUROCON 2017.

6. Mohammad M. Masud, Mohamed Adel Serhani, and Alramzana Nujum Navaz "Resource-Aware MobileBased Health Monitoring", 2168-2194 (c) 2015 IEEE

7. Ayush Bansal, Sunil Kumar, Anurag Bajpai, Vijay N. Tiwari, Mithun Nayak, Shankar Venkatesan, Rangavittal Narayanan, "Remote health monitoring system for detecting cardiac disorders", IET Syst. Biol., 2015, Vol. 9, Iss. 6, pp. 309–314.

8. Hamid Al-Hamadi and Ing-Ray Chen, "Trust-Based Decision Making for Health IoT Systems" DOI 10.1109/JIOT.2017.2736446, IEEE Internet of Things Journal.