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HEART RATE MONITORING SYSTEM

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Abstract - The Heart Rate Monitoring System is designed to provide an efficient solution for monitoring and analyzing heart rate data. This system offers a reliable and accessible means of tracking an individual's heart rate in real-time. One of the significant parameters under consideration is the heart rate data. The Heart Rate Monitoring System combines IoT technology and Artificial Intelligence to empower individuals with the tools to monitor and analyze irregularities in heart health. The system integrates Arduino as a microcontroller, enabling seamless data collection and analysis while ensuring compatibility with a wide range of devices and applications. By incorporating age and gender considerations, the system can classify heart rate data to individual characteristics, enhancing the accuracy of its assessments. The system utilizes diverse datasets derived from real-time activities such as running, walking, and other activities that may lead to irregularities in heart rate. The system employs decision tree algorithms to classify heart rate samples, facilitating the identification of abnormal heart rate patterns. This system not only provides continuous monitoring but also enables users to access and interpret their heart rate data conveniently.

***Key Words*:** NodeMCU, Pulse Sensor, Arduino.

1.INTRODUCTION

A heart rate monitoring system provides accurate measurements of heart rate samples along with the time stamp information. This technology enables individuals to monitor their heart rate in various contexts, such as during exercise, stress, or leisure activities, allowing for timely interventions when necessary.

The combination of IoT technology and Artificial Intelligence allows the detection of abnormalities. This system also emphasis on user friendly data visualization approaches which not only enhances accessibility but also makes it well-suited for users.

The Internet of Things (IoT) provides a valuable approach for heart rate monitoring, delivering real-time data to the users. The Heart Rate Monitoring System uses Arduino, NodeMCU, and a pulse rate sensor to track heart rate efficiently and accurately. The core of our system is the Arduino, a user-friendly microcontroller that processes signals from the heart. NodeMCU allows the heart rate data collected by the Arduino to be sent directly to the internet, making it accessible anywhere by both patients and healthcare providers. The pulse rate sensor detects the heart beats. It uses a simple method called photoplethysmography, which measures blood flow through light absorption changes.

Heart rate ranges vary throughout individuals in different age groups. Here we are creating a dataset that classifies heart rate data based on age, gender, and heartbeat characteristics. By collecting data during various activities, the paper aims to provide comprehensive insights into irregularities of heart rate across different demographic groups. By considering the unique heart rate ranges of various age groups and genders, we can understand individual heart rate patterns.

The incorporation of AI-driven decision tree algorithms further enhances the functionality and utility of the heart rate monitoring system. By employing these advanced algorithms, the system can intelligently classify the sensed data into categories such as normal and abnormal, taking into consideration various factors such as age, gender, and athletic status.

Overall, heart rate monitoring systems play a crucial role in detecting irregularities by leveraging IoT and AI technologies. The integration of these technologies has revolutionized the field, making it not only more effective but also user-friendly. This advancement enhances accessibility, enabling individuals to actively monitor and manage irregularities in their heart health with greater ease and precision.

2.LITERATURE SURVEY

In the literature review, relevant references from previous papers that are related to the current project are taken into account.

[1] Arita Ray describes about the critical need for secure and efficient pulse rate monitoring in healthcare. The study explores the integration of IoT devices and cloud technology to provide real-time monitoring while ensuring data security and privacy.

[2] TV Sethuraman, Amritha G, Kartik Singh Rathore, and Kanimozhi G discuss an Internet of Things-based method for tracking heart rate and identifying myocardial infarctions. Here IoT technology is used to continuously monitor heart rates and employ algorithms for timely detection of potential cardiac events.

[3] S. Gopi, Dr.E. Panneerselvam, introduces an IoT-based system designed for both heart rate monitoring and heart attack detection. This research emphasizes the significance of real-time heart rate monitoring and incorporates advanced algorithms to identify potential heart attacks promptly.

[4] Sahana S Khamitkar and Prof. Mohammed Rafi published in the International Journal of Engineering Research & Technology (IJERT) in 2020 Remote monitoring systems allow healthcare providers to track patients' health status in real-time, regardless of their location.

2. PROPOSED METHODOLOGY

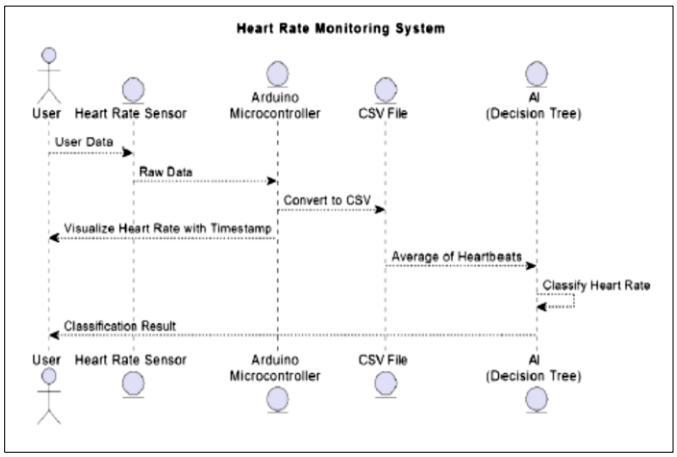

Figure 2.1
Sequence Diagram of Heart Rate Monitoring System

For a heart rate monitoring system, the initial state or representation could be derived from various sources of data, each contributing to a comprehensive understanding of the user's heart rate dynamics.

1.Actor Initialization: The diagram starts with the actor User initiating the process by sensing the pulse rate. This implies that the user is using pulse sensor to measure their pulse rate.

2.Data Collection: The pulse rate sensor receives the sensed pulse rate data from the user and forwards it to the microcontroller.

3.Data Processing: The Arduino Microcontroller processes the received data. This step involves any necessary calculations required to prepare the data for display.

4.Data Visualization: After processing, the microcontroller sends the processed data to the display. This step represents the communication between the microcontroller and the display component in the system.

5.Data Analysis: The Arduino sends an average of 6 heartbeats (a subset of the CSV data) to an AI module, specifically a Decision Tree AI model.

6.Decision Tree Analysis: The AI module processes the averaged data to classify the heart rate. The classification process could involve determining if the heart rate is normal, elevated, or indicative of a health issue based on predefined thresholds.

7.Classification Results: Finally, the AI module sends the classification result back to the User. This outcome informs the user about their heart rate status, potentially prompting further action such as consulting a healthcare provider if irregularities are detected.

3. RESULT

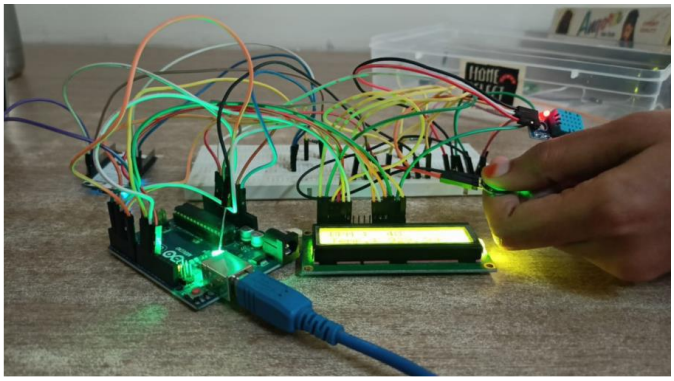

Fig 3.1
Circuit Connections

Fig 3.2
LCD Display

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Enter age: 6
Enter gender (M/F): M
Enter HeartRate1: 70
Enter HeartRate2: 75
Enter HeartRate3: 100
Enter HeartRate4: 90
Enter HeartRate5: 87
Enter HeartRate6: 110
Predicted heart rate: 86.17
Heart rate classification: Normal
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Fig 3.3
Classification result

4. CONCLUSION

The heart rate monitoring system introduced aims to revolutionize healthcare monitoring by providing continuous, real-time heart rate tracking with prompt detection of irregularities. By capturing heart rate samples with time-stamp data, it ensures accurate monitoring over time. Utilizing advanced AI techniques, the system efficiently classifies irregularities, enabling timely medical intervention.

5. FUTURE SCOPE

Our model employs minimal number of sensors, integrating additional sensors to capture comprehensive health data, including blood pressure and activity level, enhances its capabilities. Advancements in AI can predict cardiac events, enabling proactive interventions. Adapting it for remote monitoring offers personalized care beyond clinics. Cloud-based storage and analytics can enable population-level health monitoring, advancing cardiovascular management on a broader scale.

6. REFERENCE

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