

Smart Heart Health Monitoring and Predictive Alert System

Ranjitha U¹, Sahil Pasha², Shriya Shridhar³, Vishwasnayaka S⁴

¹²³⁴Department of ECE, PES College Of Engineering Mandya, Karnataka, India

⁵Assistant Professor, Department of ECE, PES College Of Engineering Mandya, Karnataka, India

Abstract - Heart disease is one of the major causes of death across the world. Early detection of cardiovascular problems can help prevent serious medical conditions and improve patient health. With the development of machine learning and smart healthcare technologies, it has become possible to analyze medical data and predict diseases more efficiently. This paper presents a smart heart disease prediction and monitoring system that combines hardware monitoring with machine learning techniques. The proposed system measures heart rate using sensors and displays the heart condition on an LCD screen. The system categorizes the heart rate into three conditions: tachycardia, bradycardia, and normal. In addition, a machine learning model analyzes medical attributes from a dataset to predict whether a patient has heart disease. The results demonstrate that the system can effectively monitor heart conditions and provide predictive analysis using machine learning algorithms. This system can assist healthcare professionals in early diagnosis and improve preventive healthcare.

Key Words: Heart Disease Prediction, Machine Learning, Heart Rate Sensor, Healthcare Monitoring, Artificial Intelligence

1. INTRODUCTION

Heart disease is one of the most common health problems affecting people worldwide. Many individuals suffer from cardiovascular disorders due to unhealthy lifestyle habits, stress, lack of physical activity, and poor diet. If heart disease is not detected at an early stage, it may lead to severe complications or even death. Traditional diagnostic methods rely on medical tests and doctor evaluation. Although these methods provide accurate results, they require regular hospital visits and laboratory examinations. With the increasing availability of healthcare data, machine learning techniques can be applied to analyze patient information and identify potential health risks. Machine learning algorithms are capable of learning patterns from medical datasets and predicting whether a patient is likely to develop heart disease. By integrating machine learning with sensor-based monitoring systems, it becomes possible to develop smart healthcare solutions that provide real-time monitoring and predictive analysis. The objective of this research is to develop a heart disease monitoring and prediction system that uses a heart rate sensor and machine learning algorithms to detect abnormal heart conditions and predict the likelihood of heart disease.

2. LITERATURE REVIEW

Several research studies have focused on using machine learning algorithms for predicting heart disease. These approaches analyze patient medical data and use classification techniques to determine the probability of disease. Decision tree algorithms have been widely used for disease classification due to their simplicity and interpretability. Support vector machines have also been applied for heart disease prediction because they can effectively classify complex datasets. Random forest algorithms combine multiple decision trees and provide improved accuracy compared to individual models. Recent studies have also explored neural networks and deep learning methods for analyzing healthcare datasets. These techniques can detect complex relationships between different medical attributes and improve prediction accuracy. Although many prediction models have been proposed, combining hardware monitoring with machine learning analysis can provide more practical healthcare solutions. This research focuses on integrating heart rate monitoring with machine learning based disease prediction.

3. PROPOSED SYSTEM

The proposed system monitors heart rate using a sensor and analyzes patient health data using machine learning algorithms. The system measures heart rate values and categorizes the heart condition into different states. The measured values are displayed on an LCD screen. The heart rate conditions are classified as follows:

Tachycardia – high heart rate
Bradycardia – low heart rate
Normal – healthy heart rate

In addition to heart rate monitoring, the machine learning model analyzes medical attributes such as age, cholesterol level, blood pressure, and heart rate to determine whether a patient is likely to have heart disease.

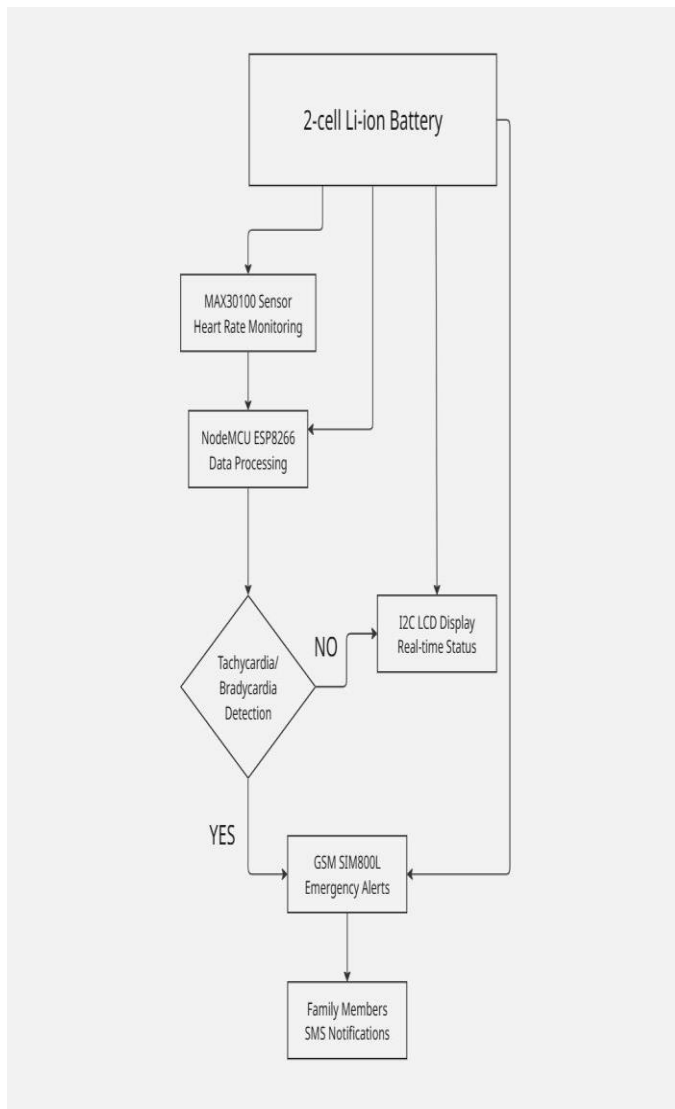


Fig -1 : Flow Chart Of Heart Health Monitoring

4. METHODOLOGY

The methodology of the proposed system includes data collection, preprocessing, model training, and prediction.

4.1 DATA COLLECTION

The dataset used in this study contains various medical parameters related to heart disease. These parameters are used as input features for training the machine learning model.

Table -1: Sample Dataset Attributes

Attribute	Description
Age	Age of the patient
Sex	Gender of the patient
Chest Pain Type	Type of chest pain

	experienced
Blood Pressure	Resting blood pressure
Cholesterol	Serum cholesterol level
Maximum Heart Rate	Maximum heart rate achieved
Target	Presence or absence of heart disease

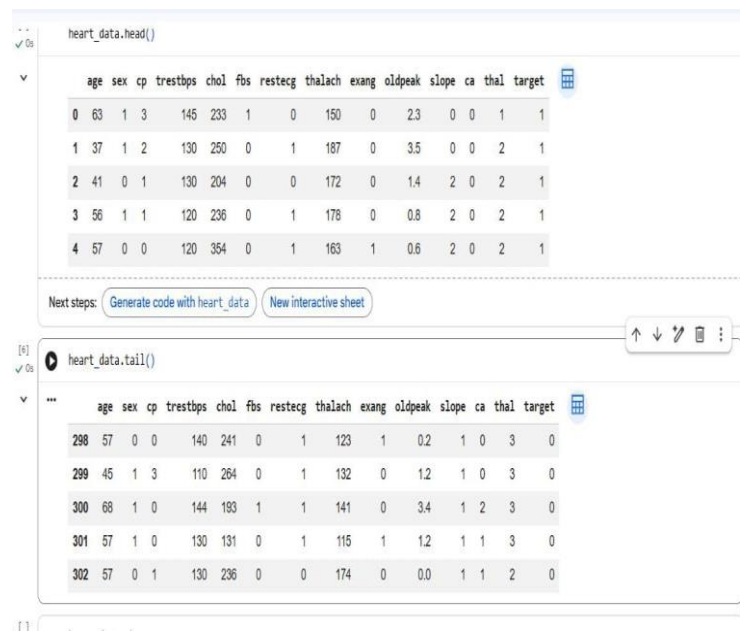


Fig -2: Heart Disease Prediction Dataset

4.2 MODEL TRAINING

The machine learning model is trained using the dataset to identify patterns associated with heart disease. The trained model is then used to predict the presence of heart disease based on input medical parameters.

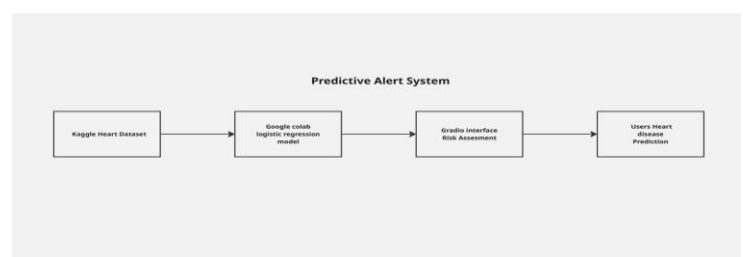


Fig -3: Block Diagram Of Predictive Alert System

5. RESULTS AND DISCUSSION

The developed system was tested using both hardware monitoring and machine learning prediction models. The heart rate sensor measures the heart rate of the user and displays the result on an LCD screen. The system categorizes the heart rate based on beats per minute. The prediction

model is implemented using a Logistic Regression algorithm, which provides reliable classification performance. The model achieved an accuracy of approximately 85% during testing.

Table -2: Heart Rate Classification

Heart Rate (BPM)	Condition
< 60 BPM	Bradycardia
60 - 100 BPM	Normal
>100 BPM	Tachycardia

5.1 Hardware Results



Fig -4: LCD Display Showing Tachycardia



Fig -5: LCD Display Showing Bradycardia



Fig -6: LCD Display Showing Normal Heart Rate

5.2 Software Results

A machine learning model studies patient health information such as age, blood pressure, cholesterol levels, and heart activity to understand patterns related to heart disease. It is trained using past medical records where the condition of the patient is already known, which helps the system learn how different factors are connected to the disease. When new data is given, the model compares it with what it has learned and predicts whether the person may have heart disease, often providing a likelihood score. Different techniques can be used to improve how accurately the model makes these predictions. Such a system can support doctors by giving quick insights and helping in early detection, but it is not meant to replace medical expertise.

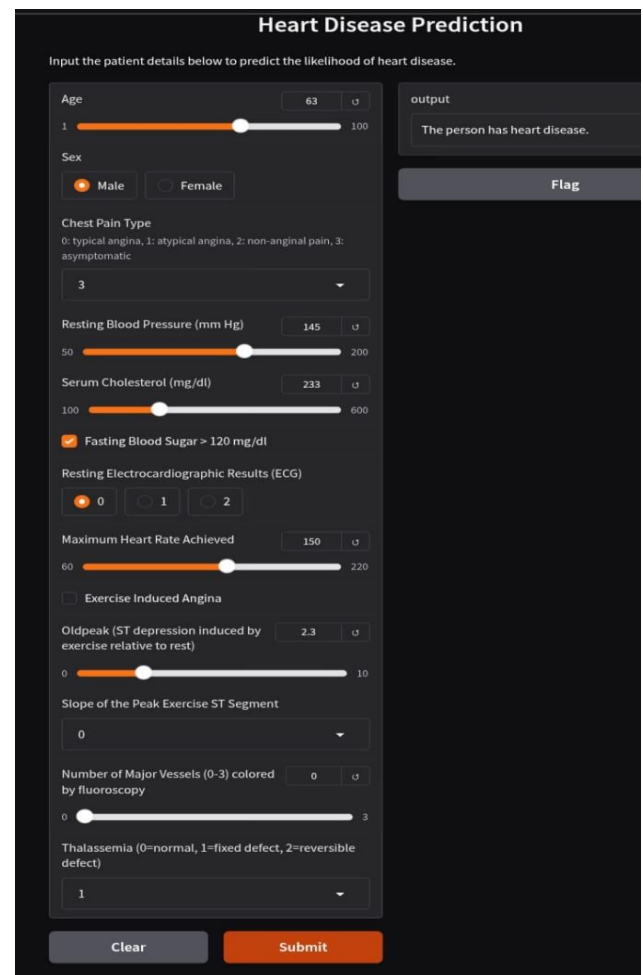


Fig -7: Software Output Showing Heart Disease Detected

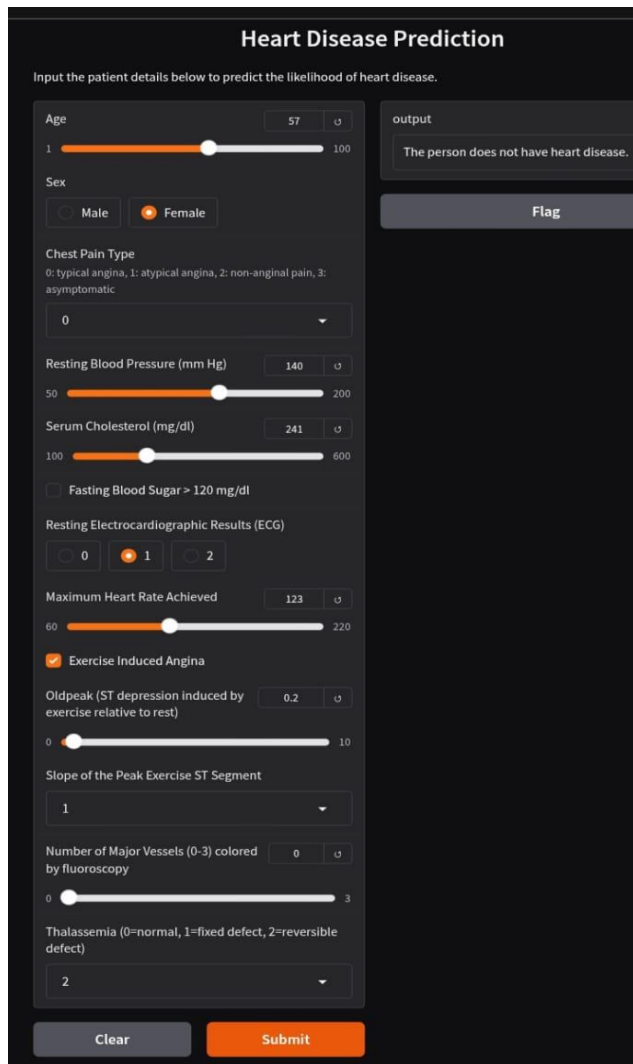


Fig -8: Software Output Showing No Heart Disease

The experimental results demonstrate that the proposed system can effectively monitor heart rate conditions and provide predictive analysis for heart disease detection.

6. CONCLUSION

This paper presented a smart heart disease monitoring and prediction system using machine learning techniques. The system monitors heart rate using sensors and displays the condition on an LCD screen. The machine learning model analyzes medical attributes and predicts whether a patient is likely to have heart disease. The results demonstrate that the proposed system can assist healthcare professionals in early detection of cardiovascular diseases and improve patient monitoring. Integrating machine learning with health monitoring devices can significantly enhance preventive healthcare.

6.1 FUTURE SCOPE

The proposed heart disease prediction and monitoring system can be further improved in several ways. In future work, the system can be integrated with Internet of Things (IoT) technology to enable real-time remote monitoring of patient health data. This would allow doctors and healthcare professionals to track patient conditions from any location. Additional physiological parameters such as blood oxygen level, body temperature, and ECG signals can also be incorporated to improve the accuracy of heart disease prediction. Advanced machine learning and deep learning algorithms can be implemented to enhance prediction performance and provide more reliable diagnostic results. Furthermore, the system can be developed as a mobile or web-based application to make it easily accessible for patients and healthcare providers. This will enable continuous monitoring and early detection of cardiovascular diseases, ultimately contributing to improved healthcare services and patient safety.

REFERENCES

- [1] A. Kumar and S. Reddy, "IoT-Based Wearable Heart Monitoring Systems," International Journal of Smart Healthcare Systems (IJSHS),
- [2] L. Zhang, Y. Chen, and F. Liu, "Cloud-Assisted ECG Monitoring for Early Cardiac Risk Detection," Journal of Cloud Computing Applications (JCCA),
- [3] R. Patel and T. H. Wong, "Low-Power Edge Devices for Cardiovascular Health Tracking," Edge Computing in Healthcare Journal (ECHJ),
- [4] J. Fernandes and K. Rao, "Mobile Applications for Real-Time ECG Visualization," Mobile Health Innovations Magazine (MHIM),
- [5] T. Alvarez and M. Choi, "Predictive Health Monitoring Using Physiological Time-Series Data," Smart Health Analytics Journal (SHAJ),