HYPOTHESIS OF CARDIO DISEASES AND SURVEILLING PATIENT'S HEALTH AND RESCUE

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Abstract*— heart disease describes a scope of conditions that affect your heart. Diseases under the heart disease umbrella include blood vessel diseases, such as coronary artery disease, heart pattern problems (arrhythmias) and heart defects you're born with (congenital heart defects), among others. According to World Health Organization (WHO), cardiovascular disease (CVD) is one of the lethal diseases leads to the large number of deaths worldwide. Cardiovascular disease prediction aids practitioners in making high accurate health decisions for their patients. Early detection can aid people in making lifestyle changes and, if needs, ensuring effective medical care. Machine learning (ML) is a possible option for reducing and understanding heart symptoms of disease using the device vital parameters like body temperature, heart rate and blood pressure. This project proposes a Light Gradient Boosting Machine (LightGBM) technique as the backbone of computer-aided diagnostic tools for more accurately predicting heart disease and send alert message to doctor and the guardian with the location details of the patient. LightGBM modelling is a promising classification approach for predicting medication adherence in CVD patients. This predictive model helps stratify the patients so that evidence-based decisions can be made and patients managed appropriately. The chi-square statistical test is performed to select specific attributes from the Cleveland heart disease (HD) dataset. The data visualization has been generated to illustrate the relationship between the features. According to the findings of the experiments, the LightGBM achieves 88.5% accuracy during validation for 303 data instances with 13 selected features of the Cleveland HD dataset. *Keywords— cardiovascular disease (CVD), Light Gradient Boosting Machine (LightGBM).

I.INTRODUCTION

Heart disease describes a scope of conditions that affect your heart. Diseases under the heart disease umbrella include blood vessel diseases, such as coronary artery disease, heart pattern problems (arrhythmias) and heart defects you're born with (congenital heart defects), among others. According to World Health Organization (WHO), cardiovascular disease (CVD) is one of the lethal diseases leads to the large number of deaths worldwide. Cardiovascular disease prediction aids practitioners in making high accurate health decisions for their patients. Early detection can aid people in making lifestyle changes and, if needs, ensuring effective medical care.

1.1 PROJECT INTRODUCTION

Cardiovascular disease (CVD) refers to a group of conditions that causes the heart and blood vessels. It is a leading cause of death globally, accounting for over 17 million deaths per year, according to the World Health Organization (WHO). The most common types of CVD include coronary artery disease, which can lead to heart attacks; stroke, which occurs when blood flow

to the brain is blocked or reduced; and heart failure, which is a condition where the heart is unable to pump blood efficiently. Other types of CVD include arrhythmia (abnormal heart rhythms), heart valve disease, and peripheral artery disease. Several risk factors can increase the likelihood of developing CVD, including high blood pressure, high cholesterol, smoking, obesity, physical inactivity, diabetes, and family history of heart disease. Prevention and management of CVD often involve lifestyle changes such as eating a healthy diet, engaging in regular physical activity, avoiding tobacco use, and managing underlying health conditions. Treatment may also involve medications, surgery, or other medical interventions depending on the specific type and severity of the condition cardiovascular disease (CVD) is a leading cause of mortality worldwide. According to the World Health Organization, an estimated 17.9 million people died from CVD in 2016, accounting for 31% of all global deaths. In the United States, CVD remains the leading cause of death, accounting for approximately 1 in every 4 deaths. Identifying risk factors for CVD is essential for prevention and early intervention. While many risk factors for CVD have been identified, such as smoking, high blood pressure, and high cholesterol, there may be additional factors that contribute to CVD risk that have not yet been fully explored. The purpose of this project is to investigate the relationship between a specific risk factor and CVD risk. Specifically, we will examine the hypothesis that [insert hypothesis here]. By exploring this hypothesis, we hope to contribute to a better understanding of CVD. Risk factors and ultimately improve prevention and treatment strategies for this significant health issue. Cardiovascular disease is a complex condition that involves many different factors, including genetics, lifestyle, and environmental factors. While some risk factors are well- established, others may be less understood or less widely recognized. For example, recent studies have suggested that insert recent studies related to the hypothesis. In order to test our hypothesis, we will be conducting a retrospective study using insert study design and population]. We will collect data on insert variables to be measured and compare the incidence of CVD between those with insert exposure variable] and those without. We will also control for other known risk factors for CVD in our analysis. If our hypothesis is supported, this could have significant implications for the prevention and treatment of CVD. For example, it could lead to the development of new screening tools or interventions to target this specific risk factor. Additionally, it could help identify individuals who are at increased risk for CVD, allowing for earlier interventions to prevent or manage the condition. The system involves wearable devices, such as smartwatches or fitness trackers, that monitor various physiological parameters such as heart rate, blood pressure, and activity levels. The data collected from these devices is then sent to a central database, where it is analyzed using machine learning algorithms to identify any patterns or anomalies that may indicate a potential cardiovascular problem. Overall, this project has the potential to contribute to a better understanding of CVD risk factors and ultimately improve health outcomes for individuals at risk for this significant health issue. The System aims to improve the management of cardiovascular disease by providing early detection and intervention, promoting healthy lifestyle choices, and empowering patients to take control of their health.

1.2 OBJECTIVE

[1] The objective of developing a machine learning intelligence framework for heart disease diagnosis is to possibilities the system in predicting the heart disease in order to increase the survival rate of patients by the proper, precise and detection of disease

[2] Make alert to the guardian of the patient with location

[3] In addition to provide suggestion to the patient.

II.EXISTING SYSTEM

The previous system utilized wearable sensors to collect medical attributes such as blood pressure, temperature, and glucose levels to predict heart disease. Various machine learning algorithms including Naïve Bayes, Decision Tree, and Support Vector Machine were employed in the data mining process. Naïve Bayes was used to extract relevant information from the dataset, Decision Tree was utilized for predicting cardio arrest, and Support Vector Machine was employed to generate alerts when certain patterns were detected in the medical attribute graph. The entire project was developed based on the principles of data mining. Support vector machine is a powerful algorithm that can be used for both binary and multi- class classification tasks. SVM seeks to find the optimal hyperplane that separates the two classes of data points. SVM can be effective for CVD prediction when the data is non-linearly separable. Decision trees are a simple and interpretable algorithm that can be used for both binary and multi-class classification tasks. Decision trees partition the data space into a set of rectangular regions, with each region corresponding to a unique class label. Decision trees can be effective for CVD prediction when the data has a clear hierarchy of important features.

2.1.1 DISADVATAGES

[1] Limited Risk Factors. [2] Lack of Personalization.[3] Inability to Update.[4] Limited Accuracy.[5] Lack of Explain ability.

2.2 PROPOSED SYSTEM

The proposed methodology for the web-based cardiovascular disease (CVD) prediction and alert system with sensor data using LightGBM could involve the following steps:
Data Collection the first step is to collect relevant data from patients, including sensor data such as temperature, pressure, heart rate, and other parameters. This data can be collected using wearable sensors or other medical devices and transmitted to a secure cloud- based database. Data Pre-processing once the data is collected, it needs to be pre-processed to remove any noise or errors and to transform it into a format suitable for analysis. CVD Prediction Model Development the next step is to develop a CVD prediction model using the LightGBM algorithm. The model can be trained using the pre-processed data, with the target variable being the presence or absence of CVD. Alert System Development once the CVD prediction model is developed and evaluated, the alert system can be developed to notify the patient's guardians, doctors, and ambulance services in case of any emergency. The alert system can be location-based to provide alerts to the nearest hospital and ambulance services. Integration finally, the CVD prediction model and alert system can be integrated into a web-based platform that patients can access from their smartphones or other devices. The platform can also provide personalized recommendations based on the patient's health status and CVD risk factors. Personalized recommendations are generating personalized recommendations for patients based on their predicted CVD risk, such as lifestyle changes, medication, or follow- up appointments. Evaluate the performance of the CVD

prediction model and the alert system using various metrics such as accuracy, precision, recall, and F1 score. Validate the model and system performance on independent datasets and different populations. Deployment system on a web-based platform that can be accessed by patients, guardians, doctors, and ambulance services, and ensure compliance with data privacy and security regulations. Thus, the proposed methodology involves collecting and pre-processing health and sensor data, training a LightGBM model for CVD prediction, developing an alert system, generating personalized recommendations, evaluating the system's performance, and deploying it on a web-based platform. Careful attention to data quality, model validation, and privacy and security concerns is essential for the success of the proposed system.

2.2.1 ADVANTAGES

[1] Improved Accuracy.[2] Real-Time Monitoring.[3] Rapid Response.[4] Location-based Alerts.[5] Personalized Recommendations.[6] Reduced Healthcare Costs.

III.PROBLEM DEFINITION

The problem that the cardiovascular disease (CVD) prediction and alert system with sensor data using LightGBM aims to solve is the early detection and timely management of CVDs. CVDs are a major cause of morbidity and mortality worldwide, and early detection and management can significantly improve patient outcomes. Currently, CVD diagnosis and management rely on manual processes and subjective clinical assessments, which can lead to delayed diagnosis, misdiagnosis, and ineffective treatment. The proposed system aims to address these challenges by leveraging sensor data and machine learning algorithms to predict the likelihood of CVD and provide alerts to patients, guardians, doctors, and ambulance services in case of any emergency. The system aims to provide personalized recommendations based on the patient's health status and CVD risk factors, improving the accuracy and timeliness of CVD diagnosis and treatment. By leveraging sensor data and machine learning algorithms, the system aims to reduce the burden on healthcare providers, increase patient engagement and satisfaction, and improve patient outcomes.

IV.OVERVIEW OF THE PROJECT

The system will collect data from patients using various sensors such as temperature, pressure, heart rate, and other parameters. The data collected will be stored in a database for further processing. The collected data will undergo pre-processing, which involves cleaning, normalization, and transformation. The purpose of this stage is to ensure the quality and consistency of the data before feeding it into the machine learning algorithm. The system will use LightGBM, a gradient boosting machine learning algorithm, to predict the likelihood of CVDs based on the pre-processed

V.SYSTEM DESIGN

5.1 ARCHITECTURE DIAGRAM

A system architecture or systems architecture is the abstract model that defines the structure, behaviour , and farther views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports sense about the structures and behaviours of the system. System architecture can comprise system factors, the externally visible parcels of those factors, the connections(e.g. the behaviour between them. It can give a plan from which products can be carried, and systems developed, that will work together to apply the overall system. There have been sweats to formalize languages to describe system architecture, collectively these are called architecture description languages(ADLs).

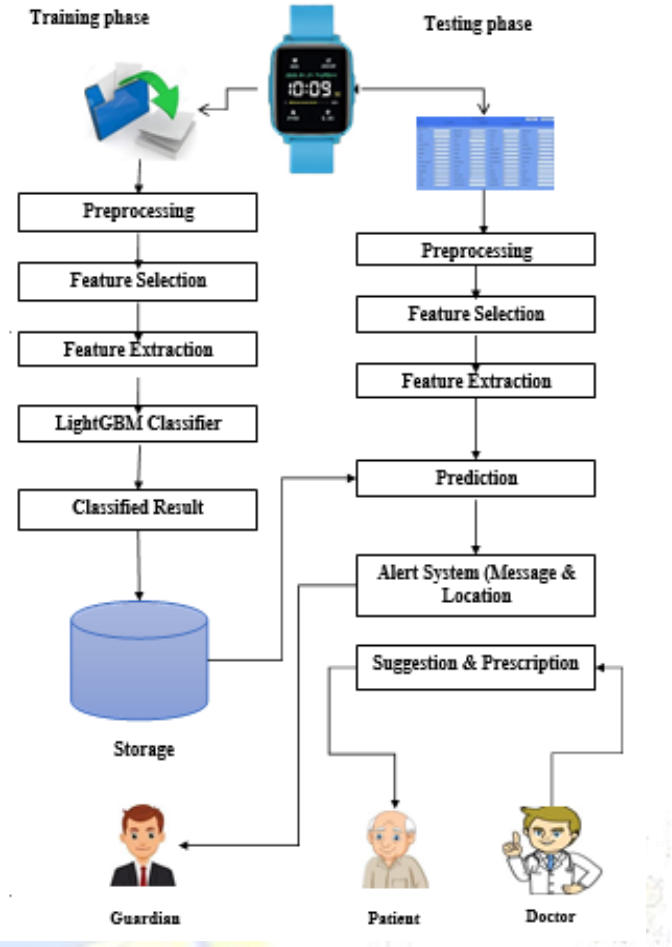

Figure no.5.1 Architecture diagram

Architecture comprises the most important, pervasive, top-position, strategic inventions, opinions, and their associated accounts about the overall structure(i.e., essential rudiments and their connections) and associated characteristics and behaviour. However, it may include information similar as a detailed force of current tackle, software and networking capabilities; a description of long- range plans and precedence for unborn purchases, If proved.

5.2 E-R DIAGRAM

Figure no.5.2 E-R Diagram

5.3 USE CASE DIAGRAM

A use case illustration at its simplest is a representation of a stoner's commerce with the system that shows the relationship between the stoner and the different use cases in which the stoner is involved. In this environment, a" system" is commodity being developed or operated, similar as a web point. The" actors" are people or realities operating under defined places within the system.

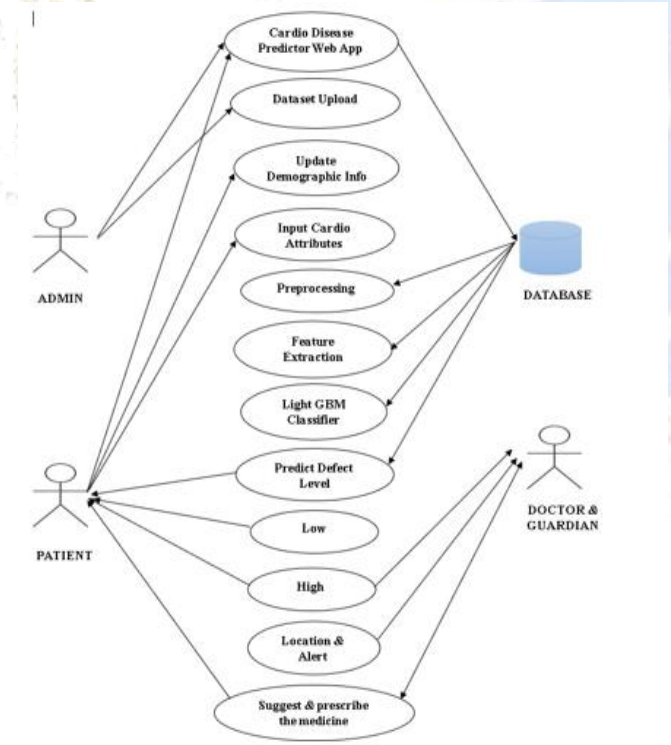

Figure no.5.3 Use Case Diagram

5.4 CLASS DIAGRAM

A class illustration in the Unified Modelling Language(UML) is a type of stationary structure illustration that describes the structure of a system by showing the system's classes, their attributes, operations and the connections among objects. The class illustration is the main structure block of object- acquainted modelling. It's used for general abstract modelling of the methodical of the operation, and for detailed modelling rephrasing the models into programming law.

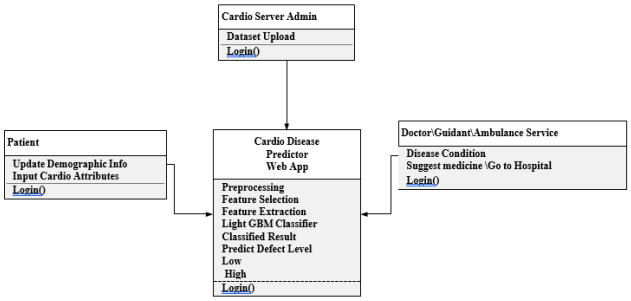

Figure no 5.4 Class Diagram

5.5 ACTIVITY DIAGRAM

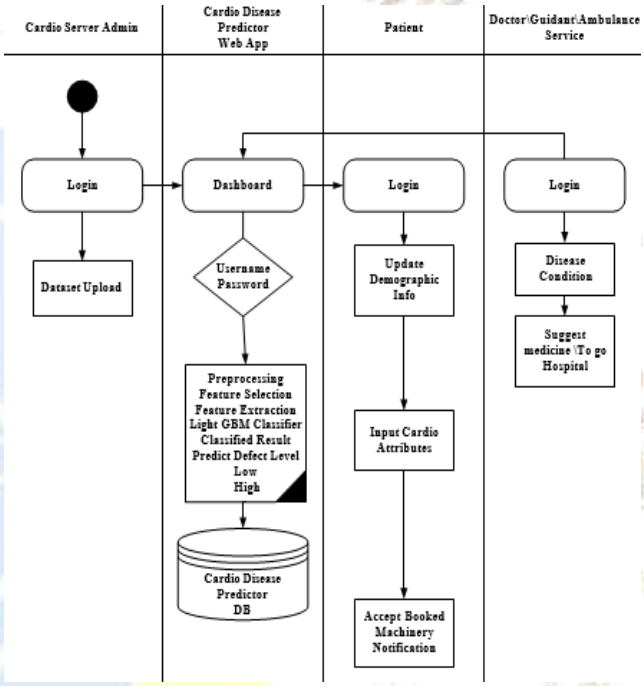

Figure no.5.5 Activity Diagram

Exertion illustration displays a special state illustration, where utmost of the state are action countries and utmost of the transitions are touched off by completion o0f the action in the source countries. The exertion can be described as an operation of the system. So, the control inflow is drawn from one operation to another. This inflow can be successional, fanned or concurrent. exertion plates deals with all type of inflow control by using different rudiments.

5.6 STATE DIAGRAM

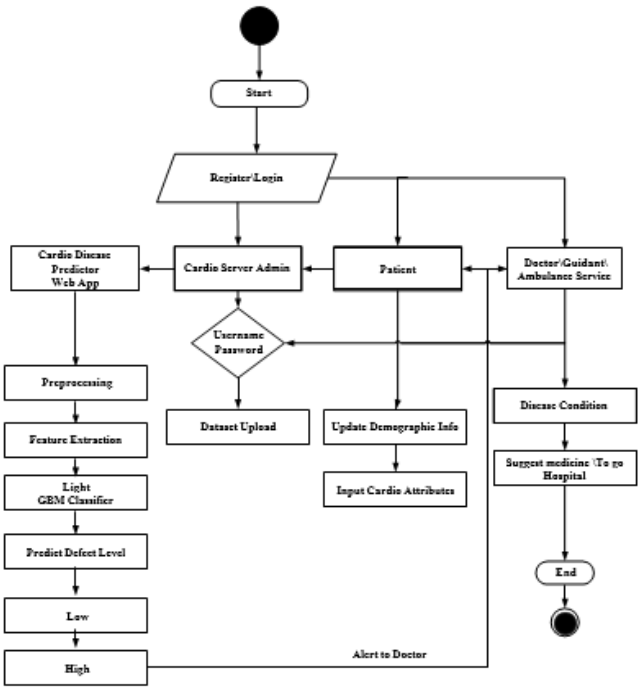

Figure no.6.5 State Diagram

It represents an interactive system and the realities inside the system. It records the dynamic behavior of the system. The state machine illustration implements the real- world models as well as the object- acquainted systems. It records the dynamic behavior of the system, which is used to separate between the dynamic and stationary behavior of a system.

VI. MODULE DESCRIPTION

6.1. Patient Information

Registration: The Registration detail is a combined patient management system, which captures complete and relevant patient information. It is used to create new users, who can login to the web UI. Login: This module deals with the reliability matters, user logons and authentications. Here, the system contain patient information and patient can update the guardian details. The system can capture the disease attributes and produce the prediction result. They can get suggestion from the doctor and also get medicine prescription. It is help to avoid travel because of patient's illness.

6.2 Doctor Suggestion System

In this module it contains patient information. Doctor's system includes the main database for all patients. It will help to monitor all the patient. Doctor can give suggestion to the patient as per their current medical situation. Doctor can give prescribe the medicine to the patient as per their current medical situation. Live monitoring and guidance help to the doctor for reduce the death. Suggestion and prescription through web UI are immediate action to the disease.

6.3 Guardian Monitoring

This module belongs to the patients care taker, who can view their patients' health condition by login into the web UI. This module can also receive the emergency active message. The web UI provide current medical situation of the patient. And also View the patient current location with help of google map. If the patient unconscious easily recovers the patient with the help of map location and alert message give immediate attention to the guardian for their patient.

6.4 Admin Process

The person who maintains all these functions in between actors and will take care of overall system. Here admin Contain the all the available doctor in Web UI. The admin module has dataset for prediction. Here data preprocessing, feature selection, feature extraction available. Classification process also in admin module.

6.5 Alert System

Alert service is introduced for reminding the patient about his or her health emergency in taking times to guardian. Normally people forget these because of their work or declining. It would be very helpful to the patients to maintain their health status healthy. Whenever patient needs medical advice from doctor this system able to send Short Message Service (SMS) to the doctor including blood pressure and blood glucose data. Temperature and heartbeat. Here patient need to attach the reading manually.

VII.CONCLUSION

In this project, the machine learning based LightGBM classification and prediction models were developed and evaluated based on diagnostic performance of coronary heart disease in patients. The developed LightGBM based classification and prediction models were trained and tested using the holdout method and 28 input attributes based on the clinical dataset from patients at the Cleveland Clinic. Based on the testing results, the developed machine learning models achieved diagnostic accuracy for heart disease of 83.67%, probability of misclassification error of 16.33. Therefore, the developed machine learning classification and prediction models can provide highly reliable and accurate diagnoses for coronary heart disease and reduce the number of erroneous diagnoses that potentially harm patients. Thus, the models can be used to aid healthcare professionals and patients throughout the world to proceed both public health and global health, especially in developing countries and resource-limited areas where there are fewer cardiac specialists available. The alert and recommendation system is much more help for patient.

7.1 FUTURE ENHANCEMENTS

In future research, we would investigate other enhanced methods that would further raise the diagnostic accuracy of the deep learning model by utilizing deep learning based on morphologic class pattern predictions in order to further enhance the performances of the LightGBM models for heart disease diagnoses in patients worldwide. In future, we are using smart watches as a wearable sensor and monitor entire health condition of the patient regarding cardio disease and also track the location. The nearest ambulance driver can get details of the patient location. And also, nearest hospital can get details of the patient location, disease report and history of treatment. The algorithm will be improved as per the demand of monitor and predict the health condition of the patient.

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