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Heart Attack Prediction System Using IoT and Machine Learning

Priti Kalse[1], Sneha Kumbhar[2], Mansi Desai[3],Prof.P.R.Patil[4]
[1, 2, 3, 4]*Department of Computer Engineering, TSSM's Bhivarabai Sawant College of Engineering and Research affiliated with SPPU*

Abstract: ***Nowadays, health diseases are increasing day by day due to lifestyle, hereditary. Especially heart attack has become more common lately, i.e., the life of people is at risk. Each individual has different values for vital sign, cholesterol, and pulse. But consistent with medically proven results the traditional values of vital sign are 120/90, Cholesterol is 100- 129 mg/dL, pulse is 72, Fasting blood glucose level is 100 mg/dL, Heart rate is 60-100bpm, ECG is normal, Width of major vessels is 25 mm (1 inch) in the aorta to only 8 m in the capillaries.***
This paper analyses various classification systems for determining a person's risk level based on age, gender, blood pressure, cholesterol, and pulse rate. A predictive modelling-based "Ailment Prediction" system predicts the user's disease based on the symptoms provided as input to the system. The system takes the input from user and analyses the symptoms and gives the output as a probability of the disease. Five approaches are used to predict disease: Naive Bayes, KNN, Decision Tree, Linear Regression, and Random Forest Algorithms. These methods are used to evaluate the disease's probability. Therefore, the average prediction accuracy probability of 83 % is obtained.
Keywords: Heart rate sensor Pulse, Android smartphone, Pulse Sensors, ECG sensor, Internet of Things.

I. INTRODUCTION

The World Health Organization's estimate provided the impetus for this project. According to the World Health Organization, roughly 23.6 million people will die from heart disease between now and 2030. To reduce the risk, the expectation of coronary sickness should be eliminated. Analysis of coronary illness is typically given signs, manifestations , and physical examination of a patient. The Most troublesome and complex assignment in the medicinal services area is finding the right ailment. This colossal entirety of rough data is the rule resource that can be capably pre-taken and inspected for key information extraction that directly or by suggestion influences the remedial society for cost sufficiency and reinforces deciding Simple human understanding cannot be used to provide an accurate diagnosis of coronary artery disease.
A variety of factors can influence the accuracy of a conclusion, including less precise results, lack of experience, time-subordinate execution, data to a degree, and so on. In this sector, numerous advancements and examinations were made using multi-parametric characteristics with nonlinear and direct components of Heart Rate Variability (HRV). Various experts have utilised various classifiers to achieve this, e.g. CMAR (Classification Multiple Association Rules), SVM (Support Vector Machine), Bayesian Classifiers, and C4.5).The latest rate techniques in this field depicted in Some plausible strategies and techniques we recommended incorporates the clinical information institutionalization, examination, and the information sharing over the related industries to improve the precision viability of information mining applications in social insurance. It is likewise prudent to investigate the utilization of content digging and picture digging for extension the nature and extent of information mining applications in the medicinal services part. The viability of an information mining application can also be assessed using computerised suggestive images. In these areas, some progress has been made.

II. LITERATURE SURVEY

There are multiple studies that have focused on diagnosis of heart disease .They have applied different machine learning techniques for diagnosis achieved different probabilities for various methods. proposed Prediction of Heart Disease using multiple correlation Model and it proves that Multiple Linear Regression is acceptable for predicting heart condition chance. It recommended different algorithms like Naive Bayes, Classification Tree, KNN, Logistic Regression, SVM and ANN. The Logistic Regression gives better accuracy compared to other algorithms. This paper's main objective is to predict the occurrence of heart attack for early automatic diagnosis of the disease within a brief time.

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The given methodology is additionally critical in healthcare organizations with experts that haven't any more knowledge and skill. They focuses on techniques which will predict chronic disease by processing the info containing in historical health records using Naive Bayes, Decision tree, Support Vector Machine and Artificial Neural Network. A comparative study is performed on classifiers to live the higher performance at an accurate rate. From this experiment, SVM gives the very best accuracy rate, whereas for diabetes Naive Bayes gives the very best accuracy. It uses different medical attributes like blood glucose and pulse, age, sex is a number of the attributes are included to spot if the person has heart disease or not. By testing and training phase a particular parameter, this paper shows86.3% accuracy in testing phase and 87.3% in training phase.

This paper mainly the values manually on the appliance interface. If any fatal situation is detected by the appliance, the patient can communicate with any doctor via video call and any registered doctor associated with heart condition can be found by putting his telephone number within the search bar. Concentrates on predicting the guts disease. Cloud and that i OT Software focused on m-healthcare are developed and revised to spot truth seriousness degree and to diagnose it consistent with gravity. The IOT equipment is understood as embedded and wearable IOT tools. These instruments are wont to obtain information from remote areas surrounding the procedure. it's possible to collect the immediate measurement as restorative information gathered by IOT apps, connected to the physical body. Similar medicinal information is made by the utilization of the UCI Repository data-set and therefore the therapeutic sensors to anticipate the overall population that was extremely impaired by diabetes. The resultant knowledge are often securely processed by implementing five different steps of a previously introduced management

process, like information collection, information retrieval, information science, separation of data, and knowledge blending. Cloud storage may be a process that grants structured access to the design of administrators for the asking. It processes operates beyond the capacity of everyone to see and is employed to get data from the smart devices, to seem at and analyses these details, and to form the buyer online insights. it's also a captivating aspect for solutions because that might build a sector of many incentives to supply a lift to IOT software customers. Huge data analysis and machine learning predictions can conventionally conduct the testing of this data within the cloud. Machine learning may be a quite man-made reasoning and empowers these computations to raised themselves by collecting data from them.

A Wireless Sensor Network (WSN) may be a self-decision sensor device that transmits its data through the frame to a central zone. An IOT system that needs a WSN to collect data for a spread of applications, thus far few out of any specific IOT application will use it so separate, distinctive results are likely. Data aggregation is simply the essential step of an IOT process, and this data has to be collected and converted into noteworthy information or provided to specific objects. The devices that the WSN uses are likely to form any protest impossible, and therefore the tremendous progress of those devices is undoubtedly the most development that began the IOT movement. Another IOT-related thinking is learning; a condition where boundaries are established and treated and may function for people. this idea is not necessarily the inverse of IOT because it just supports certain predefined functionality during a specific environment (e.g., space, a building), is concentrated on human interaction, and therefore the items used might not usually be interrelated .This is not necessarily the inverse of IOT despite how a foundation component of IOT limits human knowledge. Machine-to-machine (M2M) Mapping is an enhanced version of IOT. M2M'semphasis is on associating gadgets and offers the prospect to urge details from certain gadgets remotely. this data is ready to realize productivity benefits, decrease expenditures, and improve well-being or stability in an administration application The knowledge isn't organized into various processes, it's all occurring at the system level that you simply don't even get to connect with a cloud point. it's slowly and instantaneous, a one-way quite correspondence.

Data in IOT implementations originates in various forms from heterogeneous demonstrations, and is then implemented without human intercession; this is widespread in M2M implementations. IOT may help distinct M2M administrations yet has substantially more capabilities because knowledge in IOT applications could also be used for varied purposes thanks to technological developments. The analysis showed that the usage of Electronic Health Records (EHRs)may be improved with the help of data Technology. As the study shows, the usage of EHRs is a smaller amount likely to be unsuccessful due to the multifaceted complexity correlated with it. Kopper suggested an easy and technically employable solution to EHR (EEHR) [10] and called it Weber. This approach facilitates the electronic delivery of varied human resources, thereby enhancing data storage and sharing among the various health centres. The elderly patients monitoring from indoor or outdoor locations had been presented by a real-time mobile healthcare system. a sign sensor and a smartphone were the first components of the system.

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The bio- signal sensor data was transmitted to an intelligent server via GPRS/UMTS network for data collection. The system could perform in monitoring the mobility, vital signs, location, and condition of the elderly patient from a foreign location. A fully functional wireless body area network (WBAN) system had been proposed. The designed system used medical bands to get physiological data from sensors. The author had chosen some medical bands to abate the interruption between the sensors and other existing devices. to extend the operating extent, the multi-hopping technique had been implemented and a medical gateway wireless board had been utilized in this regard.

III. PROBLEM DEFINITION

To build a such sort of IOT based device which provides the analysis of heart to beat from the issues of heart diseases. This all data must be analysed using IOT device and sensors then sent to the external devices like mobile android application .This all details are going to be visible to user. This work aims in developing a choice network in heart condition detection that uses the…data mining technique having best accuracy and performance among Naïve Bayes, Support Vector Machine, Simple Logistic Regression, Random Forest Artificial Neural Network (ANN), etc. By using several circulatory system parameters like age, vital sign, ECG results, sex, and blood glucose, it's possible to live the likelihood of getting suffering from heart condition. For deriving the algorithm with the simplest accuracy within the detection and prediction of heart condition, a comparative analysis of chosen machine learning algorithms has been shown. This algorithm takes the medical parameters like age, vital sign, heartbeat, sex, ECG results, blood glucose etc. as input and shows the probability of getting suffering from heart condition as output. This proposed system comprises the scheme and style of a web-based android application which uses an efficient machine learning technique to detect heart condition. It can function a really useful gizmo for doctors, patients, and medical students to diagnose heart condition. For diagnosis of fatal physiological conditions and symptoms like attack requires 24 hours monitoring of the patient's health after transferring from hospital to home The patient can use this programme to input current heart condition parameters from anywhere on the appliance interface and assess the risk of developing heart disease.

All of the parameters that aren't real-time like blood glucose, Serum cholesterol, and ECG results are going to be available within the doctor's prescribed report and there are some parameters like pain type and exercise-induced angina, which need to be self- measured periodically by the patient and input the values manually on the appliance interface. If any fatal situation is detected by the appliance, the patient can communicate with any doctor via video call and any registered doctor associated with heart condition are often found by putting his telephone number within the search bar.

A. How The Heart Works?

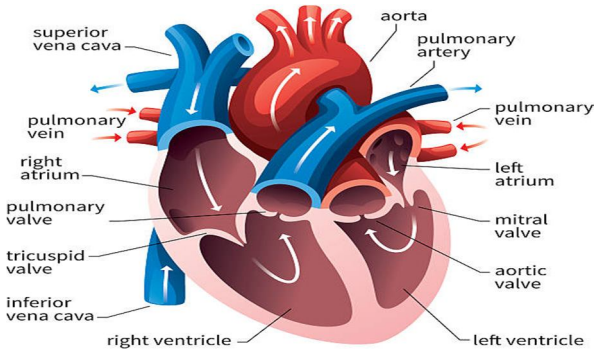


Figure 1: Cross section of Heart

Your heart may be a pump. it is a muscular organ about the dimensions of your first, situated slightly left of centre in your chest. Your heart is split into the proper and therefore the left side. The division keeps oxygen-rich blood separate from oxygen-depleted blood. After passing through your body, oxygen-depleted blood returns to your heart. The appropriate atrium and ventricle on the right side of the intestines gather and pump blood to the lungs via the pulmonary arteries. The lungs provide a replacement supply of oxygen to the blood. CO2, a waste product, is also exhaled by the lungs. The oxygen-rich blood then enters the left side of the heart, comprising the left atrium of the heart and ventricle. The left side of the heart pumps blood through the aorta to give oxygen and nutrients to tissues throughout the body.

B. Causes Of Cardiovascular Disease

1) Heart defects you're born with (congenital heart defects)
2) Arteria coronaria disease
3) High vital sign
4) Diabetes
5) Smoking
6) Excessive use of alcohol or caffeine
7) Substance abuse
8) Stress
9) Some over-the-counter medications, prescription medications, dietary supplements, and herbal remedies
10) Valvular heart condition

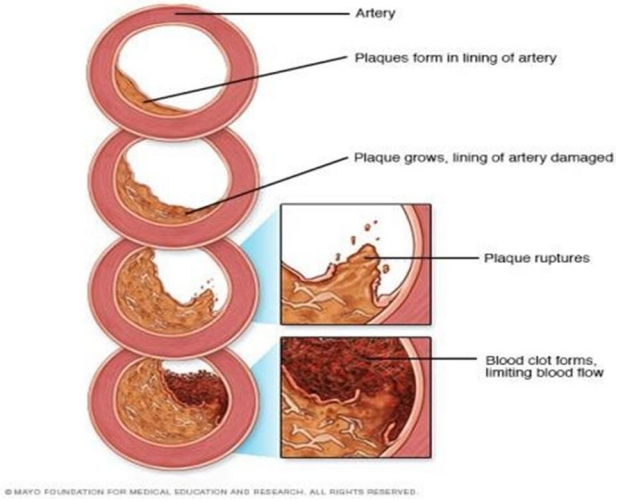


Figure 2: Artery Vane

In a healthy person with a traditional, healthy heart, it's unlikely for a fatal arrhythmia to develop without some outside trigger, like an electrical shock or the utilization of illegal drugs.
This is due to the fact that a healthy person's heart is free of any aberrant diseases that can induce an arrhythmia, such as scarred tissue. In this paper, they describe that the choice taken by experts and practitioners from many various branches of action must be rapid, accurate, and with the possible lowest level problems caused by these decisions.

IV. PROJECT PLAN

A. Project Scope

This device is extremely helpful to anyone because it provides the whole important analysis of heart at one step with the help of this user can save the expenses of lab reports regarding heart problems. It is portable as users can take it anywhere we also managed to make a coffee power consumption channel between the smart IOT device and therefore the smartphone application. This research provides users a non-invasive device that permits them to better understand how they'll feel about their ECG.

B. User Classes and Characters

Provide Nominal details like Name, age and DOB User has to attached the sensors to the body The user should verify whether the devices are connected or not with mobile.

C. Assumptions and Dependencies

1) Every user must have smartphone.
2) Also, they need an online connection to upload the data to the respective

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D. Functional Requirements

Software requirement specification document was prepared for capturing the wants during future driven development. ER Diagram and requirement specification document was designed. For the completion of the activity a website object model was prepared along with overall application architecture.

1) The system provides login for admin.
2) The system should allow administrators to monitor and take away inappropriate data-sets and code.
3) The system allows users to make an account and login.
4) The system allows the users to predict heart disease.
5) The system allows the user to update their profile and password

E. External Interface Requirement:

1) User Interface

a) Interface is going to be given the required information.
b) Interface will provide an honest look and feel effect in order that it'll be user friendly.
c) Interface will provide an honest look and feel effect in order that it'll be user friendly.
d) Various Tools are going to be available on the user interface which the user can Operate.

2) Hardware Interface

The minimum configuration required on the developer platform. Operating System: Android 4.2, Android 4.4.2, or Android 4.4.4· Processor:3 1 gigahertz (GHz) or faster processor or SoC. ·RAM: 1 gigabyte (GB) for 32-bit or 2 GB for 64-bit. · Storage: Between 850 MB and 1.2 GB, depending on the language version Pulse sensor.

3) Software Requirements

a) IDE: Jupyter notebooks
b) Platform: Windows 10 (for development), Android 7.0 or above (for deployment), Arduinsuite
c) Language: Python
d) Database: MySQL/SQLite

F. Non-Functional Requirements:

1) Performance Requirement

a) Fast Data Operation
b) Accuracy
c) Efficiency

2) Security Requirements

a) Data encryption
b) Data Privacy

3) Software Quality Attributes

a) Correctness
b) Reliability
c) Adequacy

G. Analysis Models

1) *SDLC Model to be Applied Iterative SDLC Model:* The development process may start with the wants for the functional part, which may be expanded later. The process is repetitive, allowing to form new versions of the product for each cycle Every iteration entails the construction of a separate system component, which is then added to the functional that was produced previously. the main steps of the SDLC model are given below:

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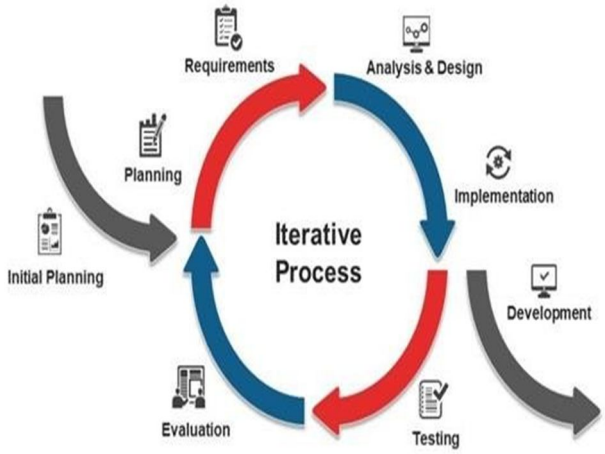


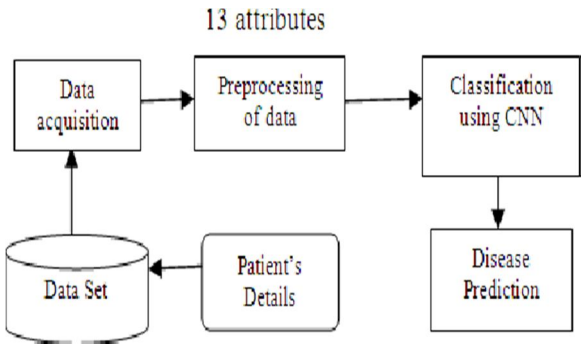
Figure 3: Iterative Model

All the functional and non-functional requirements of the project were identified. Interaction with the users and every one other stakeholders of the project was conducted to identify all the wants ranging from important features like maintaining an audit trail, security parameters etc. to the very basic features just like the look and the feel of the interface. the various requirements mainly fall under categories:

a) *Design:* The primary step was the database design. A complete database was required for the implementation of this project design. The second step was the project design. The project was designed supported a framework. The framework uses three layers: a. Business entities layer: It identifies all the entities utilized in the project.
b) *Business Logic layer:* This layer operates on the business entity to achieve the goals.
c) *Data Access Layer:* This layer is an interface between back-ended the services.
d) *Construction:* All modules and interface were inbuilt this step. Development was done using Python and Flutter. The database is going to be constructed in MySQL.
e) *Integration and System Testing:* All the modules were integrated together. The interface was integrated with the modules which made the use of web services. Data flow originated from the database built-in MySQL. The testing phase project was tested and debugged. Various test cases were developed and therefore the project was tested at the developer send also as users end. Debugging was done to get errors and exceptions which were corrected.

V. SYSTEM DESIGN

A. *System Architecture*



The proposed architecture of the system primarily comprises of three main components:

1) User -for Interacting with the device
2) IOT-for data collections and mobile for showing analysis
3) Sensors for collecting data

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We used the output of the embedded sensors to conduct an extensive set of experiments for evaluating and distinguishing between normal and aberrant pulse patterns in order to integrate the sensors The subjects wear the integrated sensors and keep their smartphones in their pockets or hands. While the topic leads a normal life, the integrated ECG and temperature sensors continuously collect heart information The smartphone will evaluate the data after receiving it over a low-power Bluetooth connection channel to determine whether the user's state is normal or abnormal. The Android platform performs a quantitative pulse analysis, giving the user the option of viewing real-time charts of the ECG signal and body temperature.

VI. OTHER SPECIFICATION

A. *Advantages*

1) Increased accuracy for effective heart condition diagnosis.
2) Handles roughest(enormous) amount of knowledge using the random forest algorithm and have selection.
3) Reduce the time complexity of doctors.
4) Cost-effective for patients

B. *Limitations*

We always need to stay connected with these sensors and micro-controllers. This only predicts and depends on heart-related problems but in health care, various parameters should be taken into consideration.

C. *Applications*

This product we will use anywhere if an individual if unable to understand there-heart attack symptoms then this device will help to research that thing and their life will get saved.

VII. CONCLUSION

Developed a system that measures and detects the patient's human heartbeat and body temperature, then communicates the data to the user or server end via a microcontroller at a low cost. Use two different sensors and these are mainly under the control of micro-controllers. For Human Heartbeat measurement use fingertip, it's in bpm (beats per minute). These calculated rates are going to be stored within the server by transferring through the Wi-Fi module via the web. a liquid display (LCD) has been used to display the calculated human heartbeat rate.

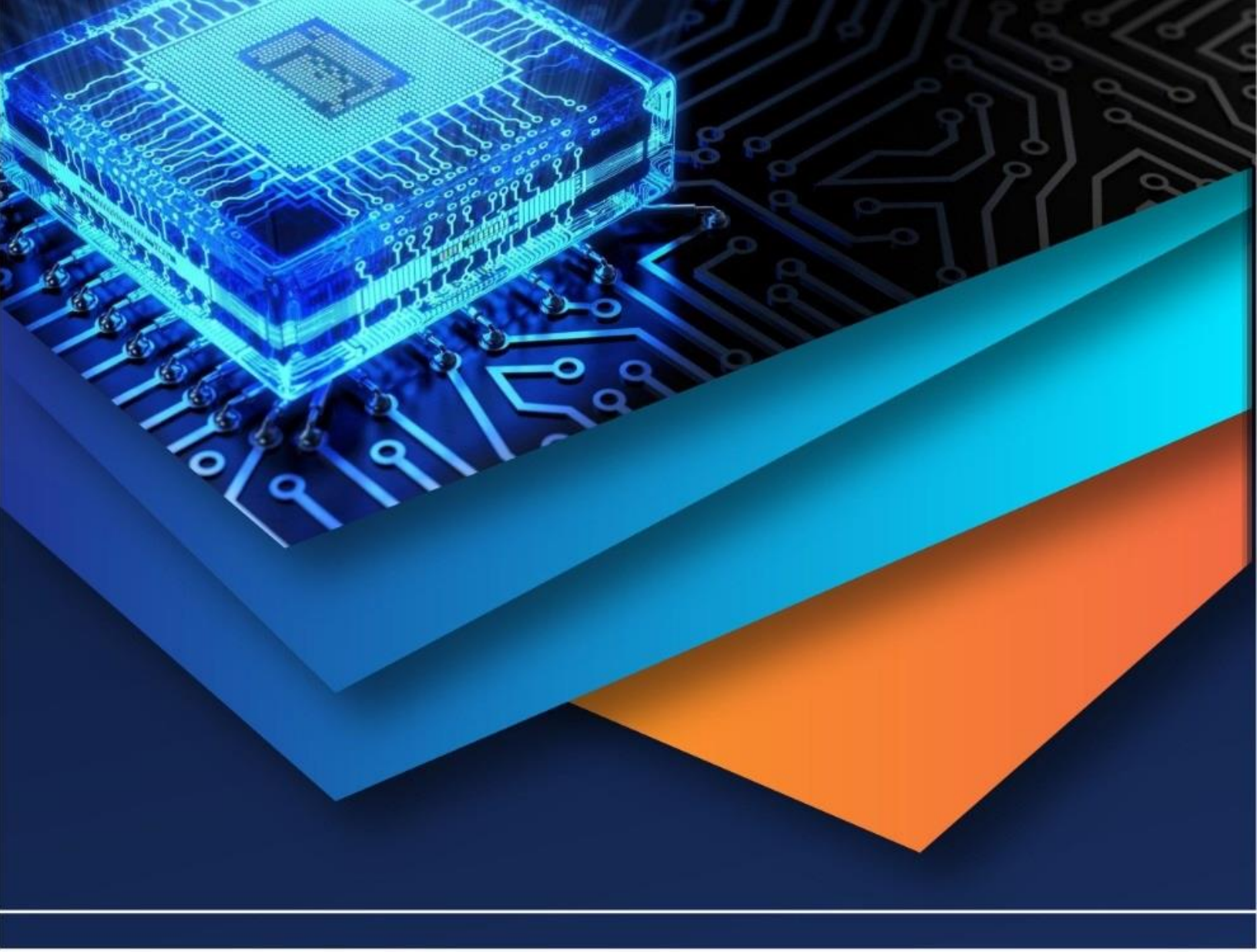
VIII. FUTURE ENHANCEMENT

In the future, improvements are frequently made by developing an internet application based on the random Forest algorithm, as well as using a larger dataset than the one used in this analysis, which can help to provide better results and assist health professionals in effectively and efficiently predicting heart disease.

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