Visualizing and Predicting Heart Diseases with Interactive Dashboard

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Project Report

CHAPTER 1

INTRODUCTION

PROJECT OVERVIEW:

The terms **"heart disease"** and **"cardiovascular disease"** are frequently used interchangeably. Heart disease is a general term that covers a wide range of heart related medical conditions. The irregular health state that directly affects the heart and all of its components is characterized by these medical conditions.

In order to forecast cardiac disease, this study discusses various data mining, big data, and machine learning-techniques. Building an important model for the medical system to forecast heart disease or cardiovascular illness requires the use of data mining and machine learning. Our application helps the user in finding out if they have heart disease or not.

They can find out by entering details such as their heart rate, cholesterol, blood pressure etc. A dashboard is also attached along with the results for better understanding where they can compare their blood pressure and similar metrics with other users. This project focuses on Random Forest Classifier. The accuracy of our project is 87% for which is better than most other systems in terms of achieving accuracy quickly.

PURPOSE:

This project's goal is to determine, depending on the patient's medical characteristics such as gender, age, chest pain, fasting blood sugar level, etc…whether they are likely to be diagnosed with any cardiovascular heart illnesses. The leading cause of death in the developed world is heart disease. Heart disease cases are rising quickly every day, thus it's crucial and worrisome to predict any potential illnesses in advance. This diagnosis is a challenging task thatrequires accuracy and efficiency.

Therefore, there needs to be work done to help prevent the risks of having a heart attack or stroke. It is the main factor in adult deaths. By using a person's medical history, our initiative can identify those who are most likely to be diagnosed with a cardiac condition. It can assist in identifying disease with less medical tests and effective therapies, so that patients can be treated appropriately. It can identify anyone who is experiencing any heart disease symptoms, such as chest pain or high blood pressure.

Around the world, machine learning is applied in many different fields. There is no exception in the healthcare sector.Machine learning may be crucial in determining whether loco motor disorders, heart illnesses, and other conditions are present or absent. If foreseen well in advance, such information can offer valuable insights to doctors, who can then customize their diagnosis and course of care for each patient.

CHAPTER 2

LITERATURE SURVEY

EXISTING PROBLEM

The diagnosis of heart disease in most cases depends on a complex combination of clinical and pathological data. Because of this complexity, there exists a significant amount of interest among clinical professionals and researchers regarding the efficient and accurate prediction of heart

disease. In this paper, develop a heart disease predict system that can assist medical professionals in predicting heart disease status based on the clinical data of patients. These approaches include three steps.Firstly, select 13 important clinical features, i.e., age, sex, chest pain type, trestbps, cholesterol, fasting blood sugar, resting ecg, max heart

rate, exercise induced angina, old peak, slope, number of vessels colored, and thal. Secondly, develop an artificial neural network

algorithm for classifying heart disease based on these clinical features.

The accuracy of prediction is near 80%. Finally, develop a user-friendly heart disease predict system (HDPS). The HDPS system will be consisted of multiple features, including input clinical data section, ROC curve display section, and prediction performance display section

(execute time, accuracy, sensitivity, specificity, and predict result).

Our approaches are effective in predicting the heart disease of a patient.The HDPS system developed in this study is a novel approach that can be used in the classification of heart disease.

References:

1. C. Sowmiya and P. Sumitra, "Analytical study of heart disease diagnosis using

classification techniques," 2017

2. IEEE International Conference on Intelligent Techniques in Control, Optimization and Signal Processing (INCOS), 2017, pp. 1-5, doi: 10.1109/ITCOSP.2017.8303115.
3. J. Thomas and R. T. Princy, "Human heart disease prediction system using data mining techniques," 2016 International Conference on Circuit, Power and Computing Technologies (ICCPCT), 2016, pp. 1-5,doi: 10.1109/ICCPCT.2016.7530265.
4. M. S. Raja, M. Anurag, C. P. Reddy and N. R. Sirisala, "Machine Learning Based Heart Disease Prediction System," 2021 International Conference on Computer Communication and Informatics (ICCCI), 2021, pp. 1-5,doi: 10.1109/ICCCI50826.2021.9402653.
5. N. M. Lutimath, N. Sharma and B. K. Byregowda, "Prediction of Heart Disease using Random Forest," 2021Emerging Trends in Industry 4.0 (ETI 4.0), 2021, pp. 1-4, doi: 10.1109/ETI4.051663.2021.9619208.
6. G. N. Ahmad, H. Fatima, S. Ullah, A. Salah Saidi and Imdadullah, "Efficient Medical Diagnosis of Human Heart Diseases Using Machine Learning Techniques With and Without GridSearchCV," in IEEE Access, vol. 10, pp. 80151-80173, 2022, doi: 10.1109/ACCESS.2022.3165792.

7. J. P. Li, A. U. Haq, S. U. Din, J. Khan, A. Khan and A. Saboor, "Heart Disease Identification Method Using Machine Learning Classification in E-Healthcare," in IEEE Access, vol. 8, pp. 107562-107582, 2020,doi: 10.1109/ACCESS.2020.3001149. A. H. Chen, S. Y. Huang, P. S. Hong, C. H. Cheng and E. J. Lin, "HDPS: Heart disease prediction system," 2011 Computing in Cardiology, 2011, pp. 557560.

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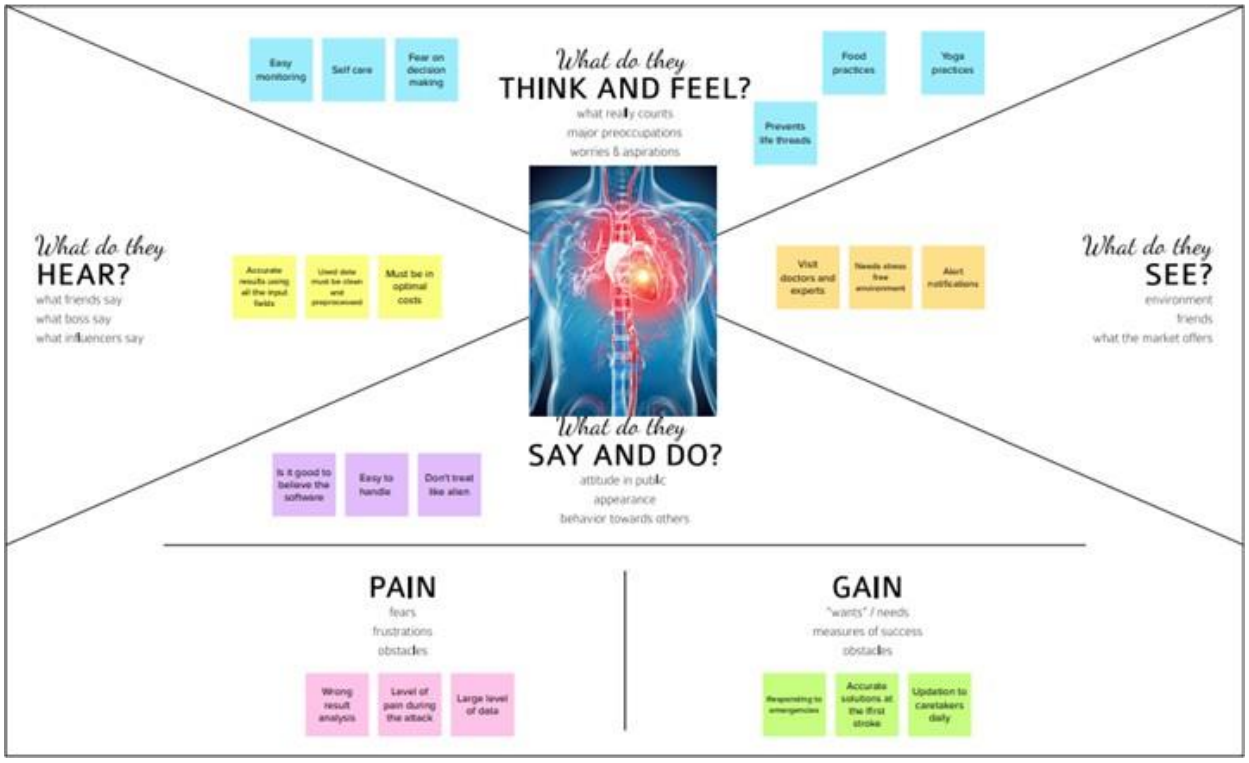
9. T. Feng, H. Tang, M. Wang, C. Zhang, H. Wang and F. Cong, "Continuous Estimation of Left Ventricular Hemodynamic Parameters Based on Heart Sound and PPG Signals Using Deep Neural Network," 2020 InternationalConference on Sensing, Measurement & Data Analytics in the era of Artificial Intelligence (ICSMD), 2020,pp. 313-318, doi: 10.1109/ICSMD50554.2020.9261681.

10. M. Chourasia, A. Thakur, S. Gupta and A. Singh, "ECG Heartbeat Classification Using CNN," 2020 IEEE 7th UttarPradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON),2020, pp. 1-6, doi: 10.1109/UPCON50219.2020.93764

CHAPTER 3

IDEATION & PROPOSED SOLUTION

EMPATHY MAP CANVAS



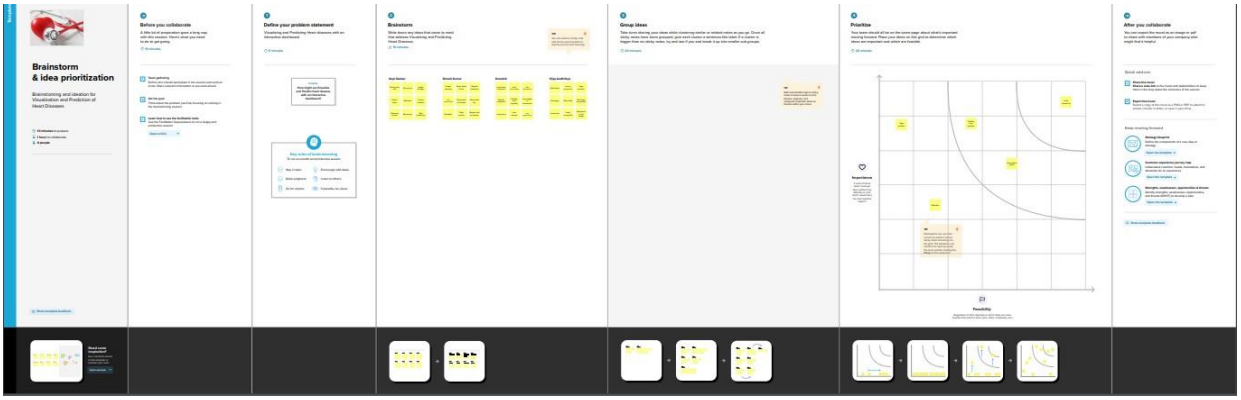
Ideation Phase:

Brainstorm & Idea PrioritizationTemplate

Brainstorm & Idea Prioritization Template:

Brainstorming providesa free and open environment that encourages everyonewithina team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouragedto collaborate, helpingeach other developa rich amountof creative solutions.

Use this templatein your own brainstorming sessionsso your team can unleashtheirimagination and start shaping concepts even if you'renot sitting in the same room.



PROPOSED SOLUTION:

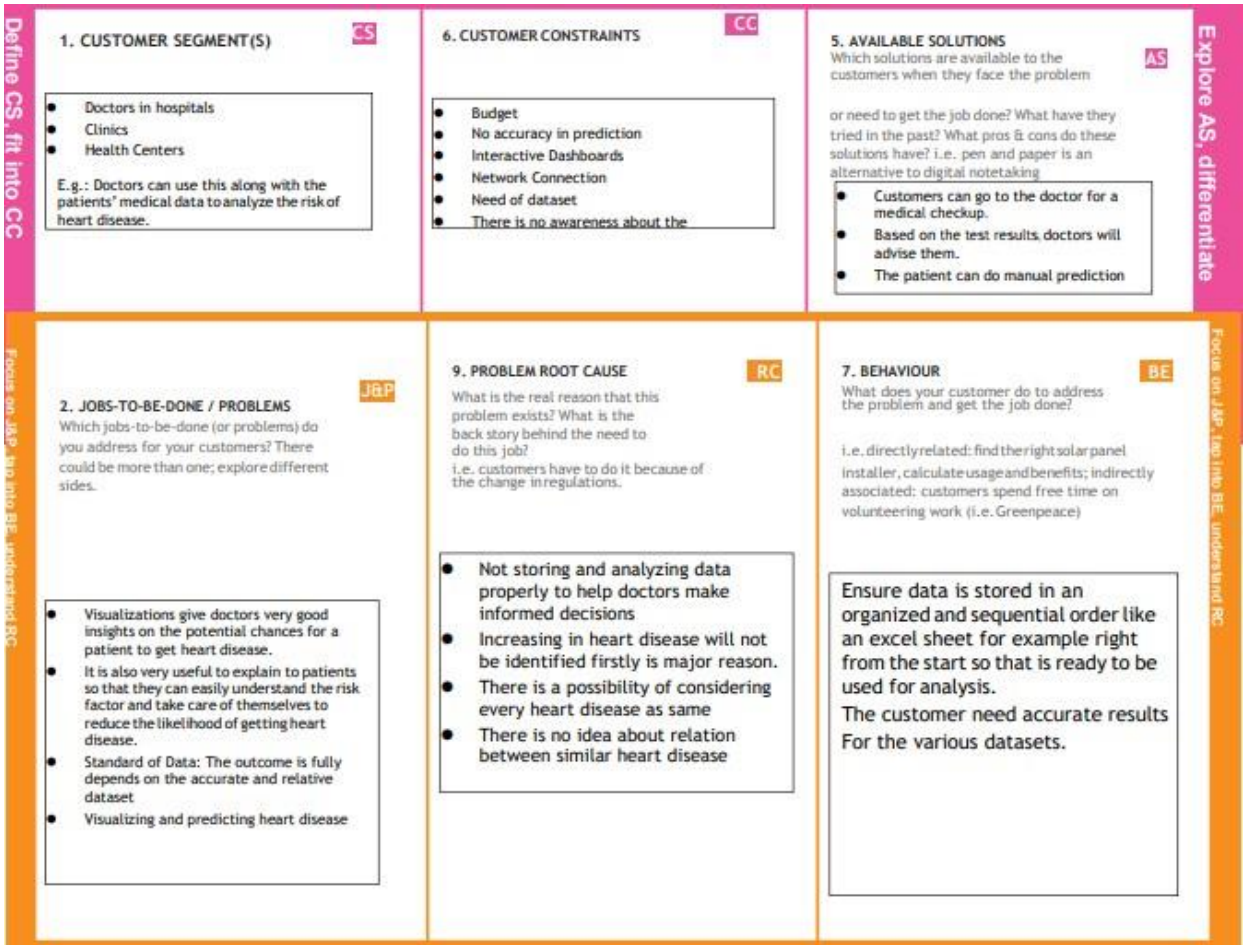
S.No	Parameter	Description
1.	Problem Statement (Problem tobe solved)	To analyze which patients are most likely to suffer from heart disease based on given parameters.It can provide visualization dashboards and uses this information to easily visualize and predict the patient details
2.	Idea / Solution description	Parameters in data set helps hospitals to identify the patient heart condition and their health condition.A dashboard using cognitive analysis can be created to present the data and utilize it for future use

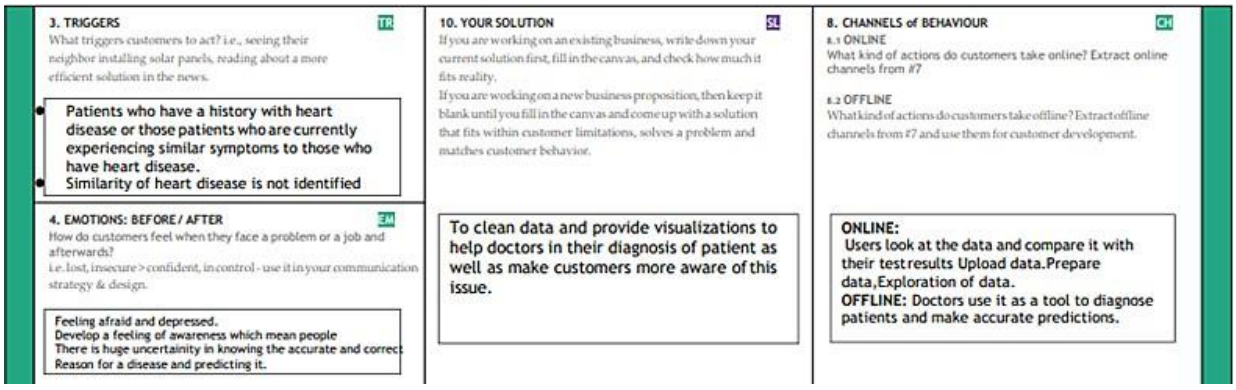
3.	Novelty / Uniqueness	Many tests are taken by doctors to detect presence of heart disease. The parameters used are often understood only by medical professional.Time can be saved.To provide a significant contribution in computing strength scores with significant predictors inHeart disease prediction
4.	Social Impact / Customer Satisfaction	Reduces the patient's risk level Reduces the medical cost Save human lives.Handy Interactive dashboard It will make the hospital to work efficiently It help the hospitals to know the health records of the heart patient
5.	Business Model (Revenue Model)	Awareness can be created amongthepatients through ads Updates will be updated according to the necessity for the patients No complexity Data security This project can be converted to an software kit, webpage or even an

		application which users can interact with.
6.	Scalability of the Solution	Maintains best user experiences Disease Easy prediction of the patient details with heart Adding new characteristics Scalable dataset Machine learning l

PROBLEM SOLUTIONFIT

The Problem-Solution Fit simply means that we have found a problem with our customer and that the solution we have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why. The purpose is to solve complex problems in a way that fits the state of your customers and succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior


Define CS, fit into CC
1. CUSTOMER SEGMENT(S)
CS
Doctors in hospitals
Clinics
Health Centers
E.g.: Doctors can use this along with the patients' medical data to analyze the risk of heart disease.
6. CUSTOMER CONSTRAINTS
CC
Budget
No accuracy in prediction
Interactive Dashboards
Network Connection
Need of dataset
There is no awareness about the
5. AVAILABLE SOLUTIONS
Which solutions are available to the customers when they face the problem
AS
or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking
Customers can go to the doctor for a medical checkup.
Based on the test results doctors will advise them.
The patient can do manual prediction
Explore AS, differentiate
Focus on J&P, tap into BE, understand RC
2. JOBS-TO-BE-DONE / PROBLEMS
J&P
Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.
Visualizations give doctors very good insights on the potential chances for a patient to get heart disease.
It is also very useful to explain to patients so that they can easily understand the risk factor and take care of themselves to reduce the likelihood of getting heart disease.
Standard of Data: The outcome is fully depends on the accurate and relative dataset
Visualizing and predicting heart disease
9. PROBLEM ROOT CAUSE
RC
What is the real reason that this problem exists? What is the back story behind the need to do this job?
i.e. customers have to do it because of the change in regulations.
Not storing and analyzing data properly to help doctors make informed decisions
Increasing in heart disease will not be identified firstly is major reason.
There is a possibility of considering every heart disease as same
There is no idea about relation between similar heart disease
7. BEHAVIOUR
BE
What does your customer do to address the problem and get the job done?
i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)
Ensure data is stored in an organized and sequential order like an excel sheet for example right from the start so that is ready to be used for analysis.
The customer need accurate results For the various datasets.
Focus on J&P, tap into BE, understand RC


3. TRIGGERS
TR
What triggers customers to act? i.e., seeing their neighbor installing solar panels, reading about a more efficient solution in the news.
Patients who have a history with heart disease or those patients who are currently experiencing similar symptoms to those who have heart disease.
Similarity of heart disease is not identified
4. EMOTIONS: BEFORE / AFTER
EM
How do customers feel when they face a problem or a job and afterwards?
i.e. lost, insecure > confident, in control - use it in your communication strategy & design.
Feeling afraid and depressed.
Develop a feeling of awareness which mean people
There is huge uncertainity in knowing the accurate and correct
Reason for a disease and predicting it.
10. YOUR SOLUTION
SL
If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behavior.
To clean data and provide visualizations to help doctors in their diagnosis of patient as well as make customers more aware of this issue.
8. CHANNELS of BEHAVIOUR
CH
8.1 ONLINE
What kind of actions do customers take online? Extract online channels from #7
8.2 OFFLINE
What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.
ONLINE:
Users look at the data and compare it with their test results Upload data.Prepare data,Exploration of data.
OFFLINE: Doctors use it as a tool to diagnose patients and make accurate predictions.

CHAPTER 4

REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENTS:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Facebook Registration through Gmail Registration through google
FR-2	Account creation	User fill Gmail and password for account creation
FR-3	User Confirmation	Confirmation via Email Confirmation via OTP
FR-4	Personal details for account	Apart from the basic details, user need to enter details such as name, age, sex, height, weight, previous medical records, etc
FR-5	Regular medical condition updation in app	Entry present medical records, symptoms, etc
FR-6	Doctor consultation	Expert doctor consultation through app

NON-FUNCTIONAL REQUIREMENTS:

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

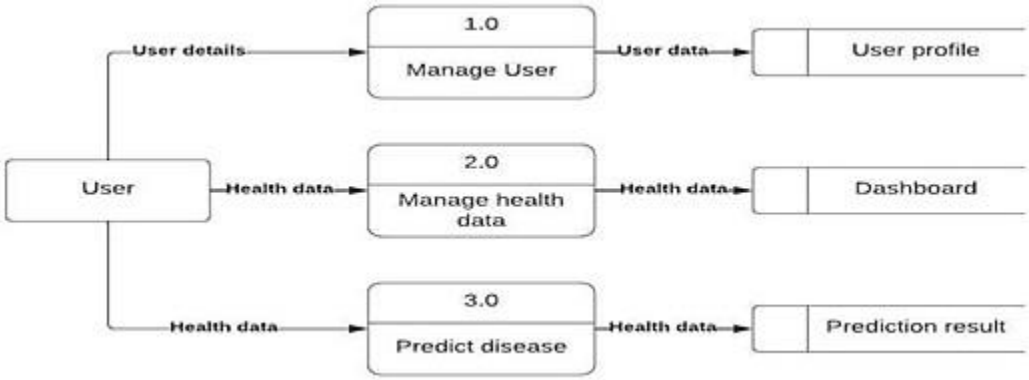
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	As usability is a prerequisite for success of health and wellness mobile apps, our proposed solution aims to provide insights and suggestions for improving usability experience of the mobile health app by exploring the degree of alignment between app insiders and users.
NFR-2	Security	Our proposed solution can empower patients, streamline communication, and provide real-time monitoring and self-management of medical conditions by building a secure app that puts security, privacy and compliance by considering authentication, privilege management, secure data storage and communication, compliance and testing and installation.
NFR-3	Reliability	Measuring reliability can improve the quality and value of health care apps. Our proposed solution will provide accurate prediction of disease with a lower risk of errors that cause harm to user and reduces the death rate. Our solution provides Safety to user's data with lot of benefits simply in home which is Efficient without wasting equipment, supplies, ideas, and energy.
NFR-4	Performance	The performance of this project is to reduce heart disease death rate by earlier accurate disease prediction. Our solution offers services such as disease prevention, diagnosis and treatment, and rehabilitation.
NFR-5	Availability	Availability is important because, while there are often shortages in human resources, deployed providers are frequently inappropriately absent or, when present, are not actively delivering health care because they are engaged in other duties. Our proposed solution provides immediate access to care anytime anywhere

Chapter 5: Project Design

Data Flow Diagrams ,Solution & Technical Architecture

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a graphical representation of the flow of data in a business information system. It describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation. It shows how data enters and leaves the system, what changes the information, and where data is stored.



Solution and Architecture diagram:

Solution Architecture:

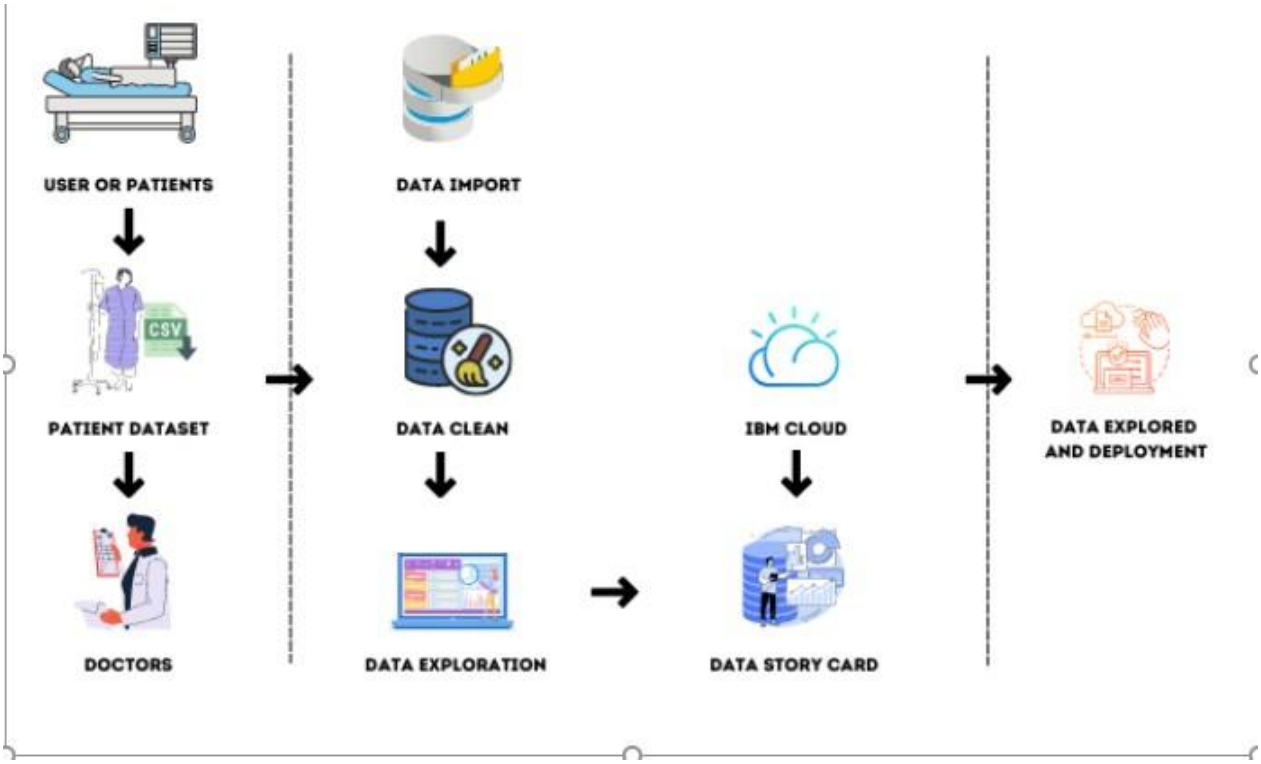
Solution architecture is a complex process with many sub-processes that bridges the gap between business problems and technology solutions. Its goals are to:

a. Find the best tech solution to solve existing business problems.

b. Describe the structure, characteristics, behavior, and other aspects of thesoftware to project stakeholders.

c. Define features, development phases, and solution requirements.

d. Provide specifications according to which the solution is defined, managed,anddelivered.



USER STORIES

User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application.	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook.	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail.		Medium	Sprint-1
Customer (Web user)	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard	USN-6	User can able to view only his medical records.	I can view it in Dashboard	High	Sprint-2
		USN-7	User can able to view the possibilities of occurrence of heart disease.	I can view it in the analysis reports.	High	Sprint-2
Customer Care Executive	Helpdesk	USN-8	Able to view the queries	I can able to post queries on dashboard	Medium	Sprint-3
		USN-9	Able to answer queries	I can able to view the answers for those queries	High	Sprint-3
Administrator	User Profile	USN-10	Able to update the users medical records	I can view my updated health details.	High	Sprint-4
		USN-11	Able to add or delete users	I can access my accounts when logged in.	High	Sprint-4
		USN-12	Able to manage the user details	I can view the organized data of myself.	High	Sprint-4

PROJECT PLANNING

ProductBacklog,SprintSchedule,andEstimation(4Marks)

Use the below template to create productbacklog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	ARUN PRAKASH N
Sprint-1		USN-2	As a user, I will receive confirmation email onceI have registered for the application	1	High	MOHANA PRIYAN P
Sprint-2		USN-3	As a user, I can register for the applicationthrough Facebook	2	Low	BHARATHA

Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	SWARUN
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	BHARATHA
Sprint-2	Dashboard	USN-6	Able to view only his medical records	2	High	ARUN PRAKASHN
Sprint-2		USN-7	View the possibilities of occurrence of heart disease	1	High	BHARATHA
Sprint-3	Helpdesk	USN-8	Admin be able to view queries	2	High	MOHANA PRIYAN P

Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-3	Registration	USN-9	Admin can able to answer queries	2	High	ARUN PRAKASHN
Sprint-4	User Profile	USN-10	Able to update userprofile records	1	Medium	MOHANA PRIYAN P
Sprint-4		USN-11	Add to users or delete to users	2	High	BHARATHA
Sprint-4		USN-12	Able to view/organize the user details	1	High	SWARUN

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time.
It is often used in agile software development methodologies such as Scrum. However,
burn down charts can be applied to any project containing measurable progress over time.

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	18	06 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	19	19 Nov 2022

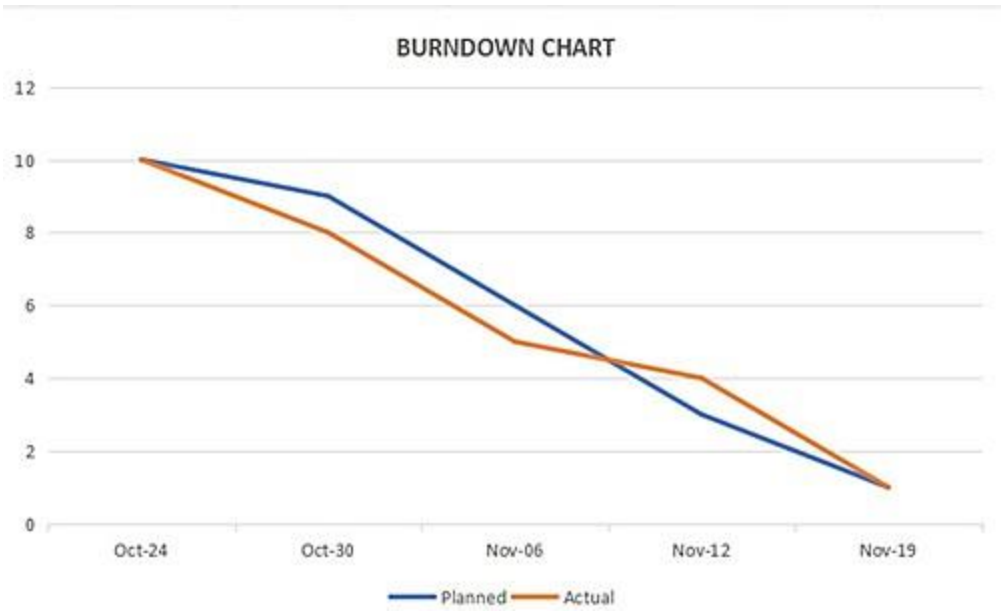
Velocity:

Imagine we have a 5-day sprint duration,and the velocity of the team is 10 (points per sprint).
Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

AV=Sprint Duration/Velocity=10/5=2

BurnDown Charts:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



Chapter 7: Coding and Solutioning

Feature 1: Log In index.html:

```
{%extends home.html}
{% block title %}
   {{title}}
{% end block title %}
{% block content %}
   {% if succ %}

      <div class="hero">
        <p class="alert alert-success" role="alert" style="z-index:1;">{{ succ }}
        </p>
        <br>

        <h1>Heart Disease Prediction</h1>
        </div>


  {% else %}
    <div class="hero">
      <div class="container-n">
```

```
        <p class = "para" >Cardiovascular diseases (CVDs) are the leading cause of
death globally, taking an estimated
 17.9 million lives each year. CVDs are a group of disorders of the heart and blood
vessels and include coronary heart disease, cerebrovascular disease, rheumatic heart
disease and other conditions. More than four out of five CVD deaths
 are due to heart attacks and strokes, and one third of these deaths occur prematurely in
people under 70 years of age.

          The most important behavioral risk factors of heart disease and stroke are
unhealthy diet, physical inactivity,
 tobacco use and harmful use of alcohol. The effects of behavioral risk factors may
show up in individuals as raised
blood pressure, raised blood glucose, raised blood lipids, and overweight and obesity.
These “intermediate risks
 factors” can be measured in primary care facilities and indicate an increased risk of
heart attack, stroke,
 heart failure and other complications. </p>
          <br>
       </div>
     </div>

   {% endif %}
{% endblock content %}
```

Feature 2: Sign Up

```
{% extends 'home.html' %}

{% endblock title %}
{% block content %}

<body>

   <div class="main">


      <section class="signup">
         <div class="container">
            <div class="signup-content">
               <div class="signup-form">
                  <h2 class="form-title">Sign up</h2>
```

```
                <form method="POST" class="register-form" id="register-form">
                  <div class="form-group">
                    <label for="name"><i class="zmdi zmdi-account material-icons-
name"></i></label>
                    <input type="text" name="name" id="name" placeholder="Your
Name"/>
                  </div>
                  <div class="form-group">
                    <label for="email"><i class="zmdi zmdi-email"></i></label>
                    <input type="email" name="email" id="email" placeholder="Your
Email"/>
                  </div>
                  <div class="form-group">
                    <label for="pass"><i class="zmdi zmdi-lock"></i></label>
                    <input type="password" name="password" id="pass"
placeholder="Password"/>
                  </div>
                  <div class="form-group">
                    <label for="re-pass"><i class="zmdi zmdi-lock-
outline"></i></label>
                    <input type="password" name="re_pass" id="re_pass"
placeholder="Repeat your password"/>
                  </div>
                  <div class="form-group">
                    <input type="checkbox" name="agree-term" id="agree-term"
class="agree-term" />
                    <label for="agree-term" class="label-agree-
term"><span><span></span></span>I agree all
statements in  <a href="#" class="term-service">Terms of service</a></label>
                  </div>
                  <div class="form-group form-button">
                    <input type="submit" name="signup" id="signup" class="form-
submit" value="Register"/>
                  </div>
                </form>
              </div>
              <div class="signup-image">
                <figure><img src="../static/heart1.jpg" alt="sing up image"></figure>
                <a href="/signin" class="signup-image-link">I am already member</a>
              </div>
            </div>
          </div>
        </section>
```

```
    </div>

  </body>

  {% endblock content %}
```

Feature 3: Home PageHome.html

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta http-equiv="X-UA-Compatible" content="IE=edge">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>{% block title %}{% endblock title %}</title>
   <link rel="stylesheet" href="/static/style.css">
      <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/css/bootstrap.min.css" rel="stylesheet"
integrity="sha384-iYQeCzEYFbKjA/T2uDLTpkwGzCiq6soy8tYaI1GyVh/UjpbCx/TYkiZhlZB6+fzT"
       crossorigin="anonymous">



</head>
<body>
   <div id="content">
      <nav class="navbar navbar-dark navbar-expand-lg bg-dark">
        <div class="container-fluid">
          <button class="navbar-toggler" type="button" data-bs-toggle="collapse" data-bs-
target="#navbarNavAltMarkup" aria-controls="navbarNavAltMarkup" aria-expanded="false" aria-
label="Toggle navigation">
            <span class="navbar-toggler-icon"></span>
          </button>
          <div class="collapse navbar-collapse" id="navbarNavAltMarkup">
            <div class="navbar-nav">
              <a class="nav-link active" aria-current="page" href="/">Home</a>
              <a class="nav-link" href="signin">Sign In</a>
              <a class="nav-link" href="signup">Sign Up</a>
              <a class="nav-link" href="Heart_Disease_Classifier">Heart_Disease_Classifier</a>
            </div>
          </div>
        </div>
      </nav>
```

```
    {% block content %}
    {% endblock content %}
  </div>
  <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/js/bootstrap.bundle.min.js" integrity="sha384-u1OknCvxWvY5kfmNBILK2hRnQC3Pr17a+RTT6rIHI7NnikvbZlHgTPOOmMi466C8" crossorigin="anonymous"></script>


</body>
</html>
```

Feature 4:

Visualizations:

visual.html

```
<html>
<head>
    <!-- Bootstrap CSS -->
        <link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css" integrity="sha384-JcKb8q3iqJ61gNV9KGb8thSsNjpSL0n8PARn9HuZOnIxN0hoP+VmmDGMN5t9UJ0Z" crossorigin="anonymous">

        <script src="https://code.jquery.com/jquery-3.5.1.slim.min.js" integrity="sha384-DfXdz2htPH0lsSSs5nCTpuj/zy4C+OGpamoFVy38MVBnE+IbbVYUew+OrCXaRkfj" crossorigin="anonymous"></script>

        <script src="https://cdn.jsdelivr.net/npm/popper.js@1.16.1/dist/umd/popper.min.js" integrity="sha384-9/reFTGAW83EW2RDu2S0VKaIzap3H66lZH81PoYlFhbGU+6BZp6G7niu735Sk7lN" crossorigin="anonymous"></script>


        <script src="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js" integrity="sha384-B4gt1jrGC7Jh4AgTPSdUtOBvfO8shuf57BaghqFfPlYxofvL8/KUEfYiJOMMV+rV" crossorigin="anonymous"></script>


        <title>Heart Disease Test</title>
    </head>
    <body>
    <!-- Java Script -->
```

```
<script src="https://code.jquery.com/jquery-3.5.1.slim.min.js" integrity="sha384-DfXdz2htPH0lsSSs5nCTpuj/zy4C+OGpamoFVy38MVBnE+IbbVYUew+OrCXaRkfj" crossorigin="anonymous"></script>

<script src="https://cdn.jsdelivr.net/npm/popper.js@1.16.1/dist/umd/popper.min.js" integrity="sha384-9/reFTGAW83EW2RDu2S0VKaIzap3H66lZH81PoYlFhbGU+6BZp6G7niu735Sk7lN" crossorigin="anonymous"></script>

<script src="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js" integrity="sha384-B4gt1jrGC7Jh4AgTPSdUtOBvfO8shuf57BaghqFfPlYxofvL8/KUEfYiJOMMV+rV" crossorigin="anonymous"></script>

<!-- Navbar-->
<nav class="navbar navbar-dark" style="background-color: rgb(13, 102, 87);">
    <span class="navbar-brand mb-0 h1">Heart Disease Test</span>
</nav>
<div class="container">
    <br>
    <!--Form-->
    <form action = "{{url_for('predict')}}" method ="POST" >
        <fieldset>
        <legend style="color: rgb(41, 15, 134);"><b>Heart Disease Test Form</b></legend><br>

         <div class="card card-body" style="background-color: rgb(194 245 236 / 56%);">
                <div class="form-group row">
                    <div class="col-sm-3">
                        <label for="age">Age</label>
                        <input type="number" class="form-control" id="age" name="age" required>
                    </div>
                    <div class="col-sm-3">
                        <label for="sex">Sex</label>
                        <select class="form-control" id="sex" name="sex" required>
                          <option disabled selected value> -- Select an Option -- </option>
                          <option value = "0">Female</option>
                          <option value = "1">Male</option>
                        </select>
                </div>
```

```
                    </div>
                    <br>
                    <div class="form-group row">
                        <div class="col-sm">
                            <label for="cp">Chest Pain Type</label>
                            <select class="form-control" id="cp"
 name = "cp" required>
                              <option disabled selected value> -- Select an Option -- </option>
                              <option value = "1">Typical Angina</option>
                              <option value = "2">Atypical Angina</option>
                              <option value = "3">Non-anginal Pain</option>
                              <option value = "4">Asymptomatic</option>
                            </select>
                        </div>
                        <div class="col-sm">
                            <label for="trestbps">Resting Blood Pressure in mm Hg</label>
                            <input type="number" class="form-control" id="trestbps" name="trestbps"
 required>
                        </div>
                        <div class="col-sm">
                            <label for="chol">Serum Cholestoral in mg/dl</label>
                            <input type="number" class="form-control" id="chol" name="chol"
 required>
                        </div>
                        <div class="col-sm">
                            <label for="fbs">Fasting Blood Sugar > 120 mg/dl</label>
                            <select class="form-control" id="fbs"
 name="fbs" required>
                              <option disabled selected value> -- Select an Option -- </option>
                              <option value = "0">False</option>
                              <option value = "1">True</option>
                            </select>
                       </div>
                    </div>

                    <br>
                    <div class="form-group row">
                            <div class="col-sm">
                                <label for="restecg">Resting ECG Results
 </label>
                                <select class="form-control" id="restecg" name="restecg" required>
                                  <option disabled selected value> -- Select an Option -- </option>
                                  <option value = "0">Normal </option>
```

```
                                    <option value = "1">
Having ST-T wave abnormality  </option>
                                    <option value = "2">Probable or definite left ventricular
hypertrophy</option>
                                </select>
                            </div>
                            <div class="col-sm">
                                <label for="thalach">Maximum Heart Rate</label>
                                <input type="number" class="form-control" id="thalach"
name="thalach" required>
                            </div>
                            <div class="col-sm">
                                <label for="exang">Exercise Induced Angina
 </label>
                                <select class="form-control" id="exang" name="exang" required>
                                  <option disabled selected value> -- Select an Option -- </option>
                                  <option value = "0">No</option>
                                  <option value = "1">Yes</option>
                                </select>
                            </div>
                            <div class="col-sm">
                                <label for="oldpeak">ST Depression Induced
</label>
                                <input type="number" step="any" class="form-control" id="oldpeak"
name="oldpeak" required>
                            </div>
                        </div>
                        <br>
                        <div class="form-group row">
                        <div class="col-sm">
                            <label for="slope">Slope of the Peak Exercise
 ST Segment </label>
                            <select class="form-control" id="slope" name="slope" required>
                              <option disabled selected value> -- Select an Option -- </option>
                              <option value = "1">Upsloping</option>
                              <option value = "2">Flat</option>
                              <option value = "3">Downsloping</option>
                            </select>
                        </div>
                         <div class="col-sm">
                            <label for="ca">Number of Vessels Colored by Flourosopy</label>
                            <select class="form-control" id="ca" name = "ca"
required>
```

```
                                <option disabled selected value> -- Select an Option -- </option>
                                <option value = "0">0</option>
                                <option value = "1">1</option>
                                <option value = "2">2</option>
                                <option value = "3">3</option>
                            </select>
                        </div>
                        <div class="col-sm">
                            <label for="thal">Thalassemia</label>
                            <select class="form-control" id="thal" name = "thal" required>
                                <option disabled selected value> -- Select an Option -- </option>
                                <option value = "3">Normal</option>
                                <option value = "6">Fixed defect</option>
                                <option value = "7">Reversable defect</option>
                            </select>
                        </div>
                    </div>
                    <br>
                    <div class="form-group">
                        <input class="btn btn-primary" type="submit" value="Result">
                    </div>

                    <!--Prediction Result-->
                    <div id ="result">
                            <strong style="color:red">{{result}}</strong>
                    </div>
                </div>
            </fieldset>
            </form>

        </div>

    </body>
</html>
```

Integration:

app.py

```
Import numpy as np
import pickle
import sklearn
from flask import Flask, render_template, request, redirect, url_for, flash
import sqlite3
model = pickle.load(open('models.pkl', 'rb'))
app = Flask(_name_)
app.secret_key = "7847541"

def get_db():
    conn = sqlite3.connect('user_details.db')
    conn.row_factory = sqlite3.Row
    return conn
@app.route('/')
def index():
    return render_template('index.html', title='Home')


@app.route('/about')
def about():
    return render_template('about.html', title='About')


@app.route('/signin', methods=('GET', 'POST'))
def signin():
    error = None
    if request.method == 'POST':
        name = request.form['name']
        password = request.form['password']
        db = get_db()
        user = db.execute(
            'SELECT name FROM user_details WHERE password = ?', (password, )
        ).fetchone()

        if user is None:
            error = 'Incorrect Username/Password.'


        if error is None:
            return render_template('index.html', title="Home", succ="login successfull!")
        flash(error)
        db.close()
```

```
    return render_template('signin.html', title='Sign In', error=error)


@app.route('/signup', methods=('POST', 'GET'))
def signup():
    if request.method == 'POST':
        name = request.form['name']
        email = request.form['email']
        password = request.form['password']
        db = get_db()
        curr = db.cursor()
        curr.execute(
            'INSERT INTO user_details (name, email, password) VALUES (?, ?, ? );',
 (name, email, password )
        )
        db.commit()
        curr.close()
        db.close()
        return render_template('index.html', title="Home", succ="Registration Successfull!")

    return render_template('signup.html', title='Sign Up')


@app.route('/Heart_Disease_Classifier')
def Heart_Disease_Classifier():
      return render_template('Heart_Disease_Classifier.html')

@app.route('/predict', methods =['POST'])
def predict():

  features = [float(i) for i in request.form.values()]
  #Convert features to array
  array_features = [np.array(features)]
  #Predict features
  prediction = model.predict(array_features)
  output = prediction
  if output == 1:
        return render_template('Heart_Disease_Classifier.html', result = 'The patient is not likely
         to have heart disease!')

  else:
    return render_template('Heart_Disease_Classifier.html', result = 'The patient is likely to have heart
disease!')
```

```
if __name__== '_main_':
  debug(True)
```

CHAPTER 8

TESTING

Date	18 November 2022
Team ID	PNT2022TMID01927
Project Name	Visualizing and Predicting Heart Diseases with an Interactive Dash Board
Maximum Marks	10 Marks

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Screenshot / Values
1.	Dashboard design	No of Visualizations / Graphs - 10
2.	Data Responsiveness	Good
3.	Amount Data to Rendered (DB2 Metrics)	-
4.	Utilization of DataFilters	Yes for filtering out visualizations concerning people with existing heart disease

5.	Effective User Story	No of Scene Added - 8
6.	Descriptive Reports	No of Visualizations / Graphs - 7

Acceptance Testing:
UAT Execution & Report Submission

Date	18 November 2022
Team ID	PNT2022TMID01927
Project Name	Visualizing and Predicting Heart Diseaseswith an Interactive DashBoard
Maximum Marks	4 Marks

1. Purpose of Document

The purpose of this document is to brieflyexplain the test coverage and op issues of the [ProductName] projectat the time of the releaseto Us Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severitylevel, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

3.Test Case Analysis

This reportshows the number of test cases that have passed, failed,and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final ReportOutput	4	0	0	4
Version Control	2	0	0	2

5.RESULTS

PERFORMANCE METRICS

i. Hours worked: 50 hours

ii. Stick to Timelines: 100%

iii. Stay within budget: 100%

iv. Consistency of the product: 85%

v. Efficiency of the product: 85%

vi. Quality of the product: 85%

ADVANTAGES & DISADVANTAGES:

ADVANTAGES:

- Smooth User Interface
- Accuracy is achieved quickly

DISADVANTAGES:

Random forest can be used for both classification and regression tasks, butt is not more suitable for Regression tasks

CONCLUSION:

This overview of the project conveys the idea that numerous methods have been investigated for diagnosing cardiovascular disease. Big data,machine learning, and data mining can be used to great success to analyse the prediction model with the highest degree of accuracy. The primary goal of this project is to diagnose cardiovascular disease or heart disease utilizing a variety of techniques and procedures to obtain a prognosis.

FUTURE SCOPE

A future update shall comprise of section for viewing renowned cardiologists and scan centers in their city. The obtained output can be further processed and sent to smart devices to provide necessary assistance. Constant monitoring can provide necessary data to recommend to consult a doctor in case of an emergency.

9 RESULTS

Through this approach, the early findings of the data analysis to find the essential underlying patterns for forecasting cardiac illnesses are presented. Age, the type of chest discomfort, blood pressure, and blood sugar level are factors used in tests to predict heart disease based on information gathered from patients. The K-means technique is then used to put the pre-processed heart disease data set together. With the help of machine learning algorithms and data mining techniques, this initiative aims to forecast cardiac disease. In the study, the random forest algorithm was utilised to forecast the development of heart disease in patients. To verify the accuracy of these rules, a group of significant feature scopes and rules were found in the diagnosis of heart disease.

10 ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

As we are using the patient's or person's pre-existing data, it forecasts the likelihood of illnesses and categorises the patient depending on risk level. Because of this prognosis, patients can met with the appropriate doctor as a preventative action and be mentally free of worries about condition.

DISADVANTAGES:

Swelling, lightheadedness, and other symptoms that can impair daily activities can appear in people with heart failure. A person with heart disease who has been diagnosed must also deal with the anxiety of having a chronic illness that could cause a cardiac event, such as a heart attack or stroke. Patients with a history of CVD may have a range of physical and psychological symptoms, including fatigue, edoema, and sleeping issues. These symptoms might limit their participation in physical and social activities,

which lowers their quality of life.

11 CONCLUSIONS:

It is essential to create a system that can forecast heart diseases precisely and effectively given the rise in fatalities caused by heart diseases. Finding the best effective ML algorithm for heart disease detection was the study's driving force. The UCI machine learning repository dataset is used in this work to examine the accuracy scores of the Decision Tree, Logistic Regression, Random Forest, and Naive Bayes algorithms for predicting heart disease.The outcome of this study shows that the Random Forest algorithm is the most effective algorithm for predicting heart disease, with an accuracy score of 90.16%. The work can be

improved in the future by creating a web application based on a machine learning algorithm.

12 FUTURE SCOPE:

In this study, we are using data analysis to estimate the risk of developing heart disease based only on the history or data set we have acquired from the subject. However, there may be dangers of developing one prior to the prediction if we wish to use this to anticipate heart disease. In order to show the person's cardiac state, we would like to design or find some algorithm to analyse data that has been streamingly collected from wearable devices such smart watc fitness bands, and healthcare metres.

13 APPENDIX:

SOURCE CODE:

app.py:

```
import numpy as np
import pickle
import sklearn
from flask import Flask, render_template, request, redirect, url_for, flash
import sqlite3
model = pickle.load(open('models.pkl', 'rb'))
app = Flask(_name_)
app.secret_key = "7847541"

def get_db():
    conn = sqlite3.connect('user_details.db')
    conn.row_factory = sqlite3.Row
    return conn
@app.route('/')
def index():
    return render_template('index.html', title='Home')
```

```
@app.route('/about')
def about():
    return render_template('about.html', title='About')


@app.route('/signin', methods=('GET', 'POST'))
def signin():
    error = None
    if request.method == 'POST':
        name = request.form['name']
        password = request.form['password']
        db = get_db()
        user = db.execute(
            'SELECT name FROM user_details WHERE password = ?', (password, )
        ).fetchone()

        if user is None:
            error = 'Incorrect Username/Password.'



        if error is None:
            return render_template('index.html', title="Home", succ="login
successfull!")
        flash(error)
        db.close()

    return render_template('signin.html', title='Sign In', error=error)


@app.route('/signup', methods=('POST', 'GET'))
```

```
def signup():
    if request.method == 'POST':
        name = request.form['name']
        email = request.form['email']
        password = request.form['password']
        db = get_db()
        curr = db.cursor()
        curr.execute(
            'INSERT INTO user_details (name, email, password) VALUES (?, ?, ?
);',
 (name, email, password )
        )
        db.commit()
        curr.close()
        db.close()
        return render_template('index.html', title="Home", succ="Registration
Successfull!")
    return render_template('signup.html', title='Sign Up')



@app.route('/Heart_Disease_Classifier')
def Heart_Disease_Classifier():
       return render_template('Heart_Disease_Classifier.html')

@app.route('/predict', methods =['POST'])
def predict():

  features = [float(i) for i in request.form.values()]
  #Convert features to array
  array_features = [np.array(features)]
  #Predict features
  prediction = model.predict(array_features)
```

```
 output = prediction
 if output == 1:
     return render_template('Heart_Disease_Classifier.html', result = 'The patient
is not likely
      to have heart disease!')
 else:
   return render_template('Heart_Disease_Classifier.html', result = 'The patient
is likely to have
 heart disease!')

if __name__== '__main__':
  debug(True)
```

PREDICTION:

```
<html>
<head>
    <!-- Bootstrap CSS -->
        <link rel="stylesheet"
href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/css/bootstrap.min.css" integrity="sha384-
JcKb8q3iqJ61gNV9KGb8thSsNjpSL0n8PARn9HuZOnIxN0hoP+VmmDGMN5t9UJ0Z"
crossorigin="anonymous">

        <script src="https://code.jquery.com/jquery-3.5.1.slim.min.js" integrity="sha384-
DfXdz2htPH0lsSSs5nCTpuj/zy4C+OGpamoFVy38MVBnE+IbbVYUew+OrCXaRkfj"
crossorigin="anonymous"></script>

        <script src="https://cdn.jsdelivr.net/npm/popper.js@1.16.1/dist/umd/popper.min.js"
integrity="sha384-9/reFTGAW83EW2RDu2S0VKaIzap3H66lZH81PoYlFhbGU+6BZp6G7niu735Sk7lN"
crossorigin="anonymous"></script>
```

```
        <script src="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js"
integrity="sha384-B4gt1jrGC7Jh4AgTPSdUtOBvfO8shuf57BaghqFfPlYxofvL8/KUEfYiJOMMV+rV"
crossorigin="anonymous"></script>


        <title>Heart Disease Test</title>
    </head>
    <body>
    <!-- Java Script -->
        <script src="https://code.jquery.com/jquery-3.5.1.slim.min.js" integrity="sha384-
DfXdz2htPH0lsSSs5nCTpuj/zy4C+OGpamoFVy38MVBnE+IbbVYUew+OrCXaRkfj"
crossorigin="anonymous"></script>

        <script src="https://cdn.jsdelivr.net/npm/popper.js@1.16.1/dist/umd/popper.min.js"
integrity="sha384-9/reFTGAW83EW2RDu2S0VKaIzap3H66lZH81PoYlFhbGU+6BZp6G7niu735Sk7lN"
crossorigin="anonymous"></script>


        <script src="https://stackpath.bootstrapcdn.com/bootstrap/4.5.2/js/bootstrap.min.js"
integrity="sha384-B4gt1jrGC7Jh4AgTPSdUtOBvfO8shuf57BaghqFfPlYxofvL8/KUEfYiJOMMV+rV"
crossorigin="anonymous"></script>



        <!-- Navbar-->
        <nav class="navbar navbar-dark" style="background-color: rgb(13, 102, 87);">
            <span class="navbar-brand mb-0 h1">Heart Disease Test</span>
        </nav>
        <div class="container">
            <br>
            <!--Form-->

             <form action = "{{url_for('predict')}}" method ="POST" >
                <fieldset>
                <legend style="color: rgb(41, 15, 134);"><b>Heart Disease Test Form</b></legend><br>

                  <div class="card card-body" style="background-color:
rgb(194 245 236 / 56%);">
                      <div class="form-group row">
                          <div class="col-sm-3">
                              <label for="age">Age</label>
                              <input type="number" class="form-control" id="age" name="age" required>
```

```
                    </div>
                    <div class="col-sm-3">
                        <label for="sex">Sex</label>
                        <select class="form-control" id="sex" name="sex" required>
                          <option disabled selected value> -- Select an Option -- </option>
                          <option value = "0">Female</option>
                          <option value = "1">Male</option>
                        </select>
                 </div>
                </div>
                <br>
                <div class="form-group row">
                    <div class="col-sm">
                        <label for="cp">Chest Pain Type</label>
                        <select class="form-control" id="cp"
 name = "cp" required>
                          <option disabled selected value> -- Select an Option -- </option>
                          <option value = "1">Typical Angina</option>
                          <option value = "2">Atypical Angina</option>
                          <option value = "3">Non-anginal Pain</option>
                          <option value = "4">Asymptomatic</option>
                        </select>
                    </div>
                    <div class="col-sm">
                        <label for="trestbps">Resting Blood Pressure in mm Hg</label>
                        <input type="number" class="form-control" id="trestbps" name="trestbps"
 required>
                    </div>
                    <div class="col-sm">
                        <label for="chol">Serum Cholesterol in mg/dl</label>
                        <input type="number" class="form-control" id="chol" name="chol"
 required>
                    </div>
                    <div class="col-sm">
                        <label for="fbs">Fasting Blood Sugar > 120 mg/dl</label>
                        <select class="form-control" id="fbs"
 name="fbs" required>
                          <option disabled selected value> -- Select an Option -- </option>
                          <option value = "0">False</option>
                          <option value = "1">True</option>
                        </select>
                    </div>
                </div>
```

```
                        <br>
                        <div class="form-group row">
                                <div class="col-sm">
                                    <label for="restecg">Resting ECG Results
 </label>
                                    <select class="form-control" id="restecg" name="restecg" required>
                                      <option disabled selected value> -- Select an Option -- </option>
                                      <option value = "0">Normal </option>
                                      <option value = "1">
Having ST-T wave abnormality  </option>
                                      <option value = "2">Probable or definite left ventricular
hypertrophy</option>
                                    </select>
                                </div>
                                <div class="col-sm">
                                    <label for="thalach">Maximum Heart Rate</label>
                                    <input type="number" class="form-control" id="thalach"
name="thalach" required>
                                </div>
                                <div class="col-sm">
                                    <label for="exang">Exercise Induced Angina
 </label>
                                    <select class="form-control" id="exang" name="exang" required>
                                      <option disabled selected value> -- Select an Option -- </option>
                                      <option value = "0">No</option>
                                      <option value = "1">Yes</option>
                                    </select>
                                </div>
                                <div class="col-sm">
                                    <label for="oldpeak">ST Depression Induced
</label>
                                    <input type="number" step="any" class="form-control" id="oldpeak"
name="oldpeak" required>
                                </div>
                            </div>
                            <br>
                            <div class="form-group row">
                            <div class="col-sm">
                                <label for="slope">Slope of the Peak Exercise
 ST Segment </label>
                                <select class="form-control" id="slope" name="slope" required>
                                  <option disabled selected value> -- Select an Option -- </option>
```

```
                                <option value = "1">Upsloping</option>
                                <option value = "2">Flat</option>
                                <option value = "3">Downsloping</option>
                            </select>
                        </div>
                        <div class="col-sm">
                            <label for="ca">Number of Vessels Colored by Flourosopy</label>
                            <select class="form-control" id="ca" name = "ca"
required>
                                <option disabled selected value> -- Select an Option -- </option>
                                <option value = "0">0</option>
                                <option value = "1">1</option>
                                <option value = "2">2</option>
                                <option value = "3">3</option>
                            </select>
                        </div>
                        <div class="col-sm">
                            <label for="thal">Thalassemia</label>
                            <select class="form-control" id="thal" name = "thal" required>
                                <option disabled selected value> -- Select an Option -- </option>
                                <option value = "3">Normal</option>
                                <option value = "6">Fixed defect</option>
                                <option value = "7">Reversable defect</option>
                            </select>
                        </div>
                    </div>
                    <br>
                    <div class="form-group">
                        <input class="btn btn-primary" type="submit" value="Result">
                    </div>

                    <!--Prediction Result-->
                    <div id ="result">
                            <strong style="color:red">{{result}}</strong>
                    </div>
                </div>
            </fieldset>
        </form>

    </div>

</body>
</html>
```

}

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-7605-1658894196

DEMO LINK:

https://drive.google.com/file/d/15QrMvqTM4Z2lzQ57ok-g-LfOOj2nTWuJ/view