VISUALIZING AND PREDICTING HEART DISEASES WITH AN INTERACTIVE DASHBOARD

Project Report Format

1. INTRODUCTION

1.1 Project Overview

Healthcare industries generate enormous amount of data, so called big data that accommodates hidden knowledge or pattern for decision making. The huge volume of data is used to make decision which is more accurate than intuition. Exploratory Data Analysis (EDA) detects mistakes, finds appropriate data, checks assumptions and determines the correlation among the explanatory variables. In the context, EDA is considered as analysing data that excludes inferences and statistical modelling. Analytics is an essential technique for any profession as it forecast the future and hidden pattern. Data analytics is considered as a cost effective technology in the recent past and it plays an essential role in healthcare which includes new research findings, emergency situations and outbreaks of disease. The use of analytics in healthcare improves care by facilitating preventive care and EDA is a vital step while analysing data. In this paper, the risk factors that causes heart disease is considered and predicted using K-means algorithm and the analysis is carried out using a publicly available data for heart disease. The dataset holds 209 records with 8 attributes such as age, chest pain type, blood pressure, blood glucose level, ECG in rest, heart rate and four types of chest pain. To predict the heart disease, K-means clustering algorithm is used along with data analytics and visualization tool. The paper discusses the pre-processing methods, classifier performances and evaluation metrics. In the result section, the visualized data shows that the prediction is accurate.

1.2 Purpose

The objective of this project is to check whether the patient is likely to be diagnosed with any cardiovascular heart diseases based on their medical attributes such as gender, age, chest pain, fasting sugar level, etc. A dataset is selected from the UCI repository with patient's medical history and attributes.The proposed work predicts the chances of Heart Disease and classifies patient's risk level by implementing different data mining techniques such as Naive Bayes, Decision Tree, Logistic Regression and Random Forest.

2. LITERATURE SURVEY

2.1 Existing problem

Heart disease can be managed effectively with a combination of lifestyle changes, medicine and, in some cases, surgery. With the right treatment, the symptoms of heart disease can be reduced and the functioning of the heart improved. The predicted results can be used to prevent and thus reduce cost for surgical treatment and other expensive. The overall objective of my work will be to predict accurately with few tests and attributes the presence of heart disease. Attributes considered form the primary basis for tests and give accurate results more or less. can be taken but our goal is to predict with few attributes and faster efficiency the risk of having heart disease.

2.2 References

1.A study of predicting heart disease, https://www.irjet.net/archives/V7/i5/IRJET-V7I5579.

2.K. Prasanna Lakshmi, Dr. C.R.K. Reddy, “Fast Rule-Based Heart Disease Prediction using Associative Classification Mining”, IEEE International Conference on Computer, Communication and Control (IC4-2015)

3. M. Satish, D Sridhar, “Prediction of Heart Disease in Data Mining Technique”, International Journal of Computer Trends & Technology (IJCTT), 2015.

4. Lokanath Sarangi, Mihir Narayan Mohanty, Srikanta Pattnaik, “An Intelligent Decision Support System for Cardiac Disease Detection”, IJCTA, International Press 2015.

5. Boshra Bahrami, Mirsaeid Hosseini Shirvani, “Prediction and Diagnosis of Heart Disease by Data Mining Techniques”, Journal of Multidisciplinary Engineering Science and Technology (JMEST) ISSN: 3159-0040 Vol. 2 Issue 2, February–2015.

2.3 Problem Statement Definition

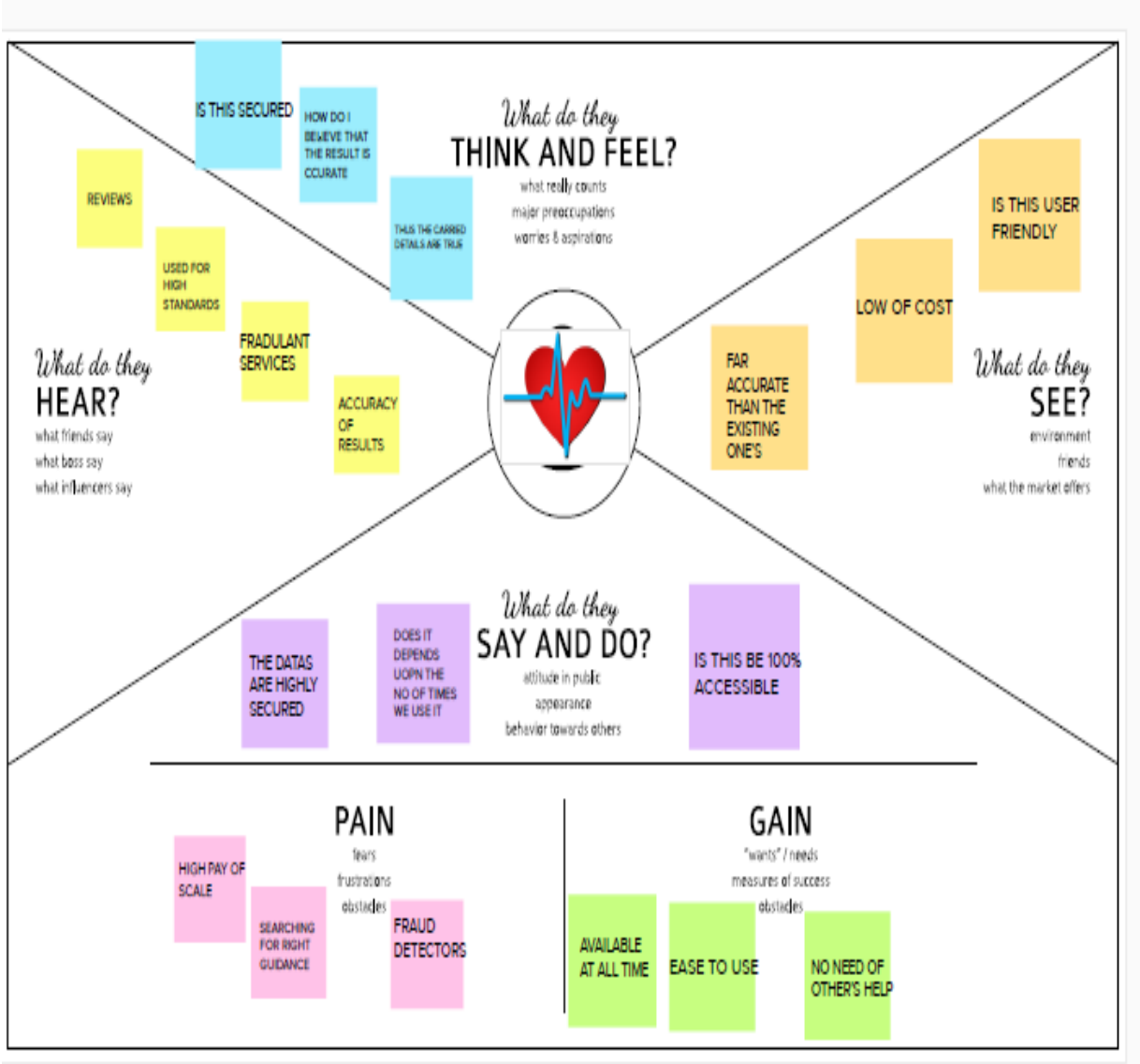
Heart disease can be managed effectively with a combination of lifestyle changes, medicine and, in some cases, surgery. With the right treatment, the symptoms of heart disease can be reduced and the functioning of the heart improved. The predicted results can be used to prevent and thus reduce cost for surgical treatment and other expensive. Objective of this project is to develop an interactive dashboard to predict the heart disease accurately with few tests and attributes the presence of heart disease.

• The healthcare environment is still “information rich” but “knowledge poor”. There is a wealth of data available within the healthcare systems. However, there is a lack of effective analysis tools to discover hidden relationships and trends.

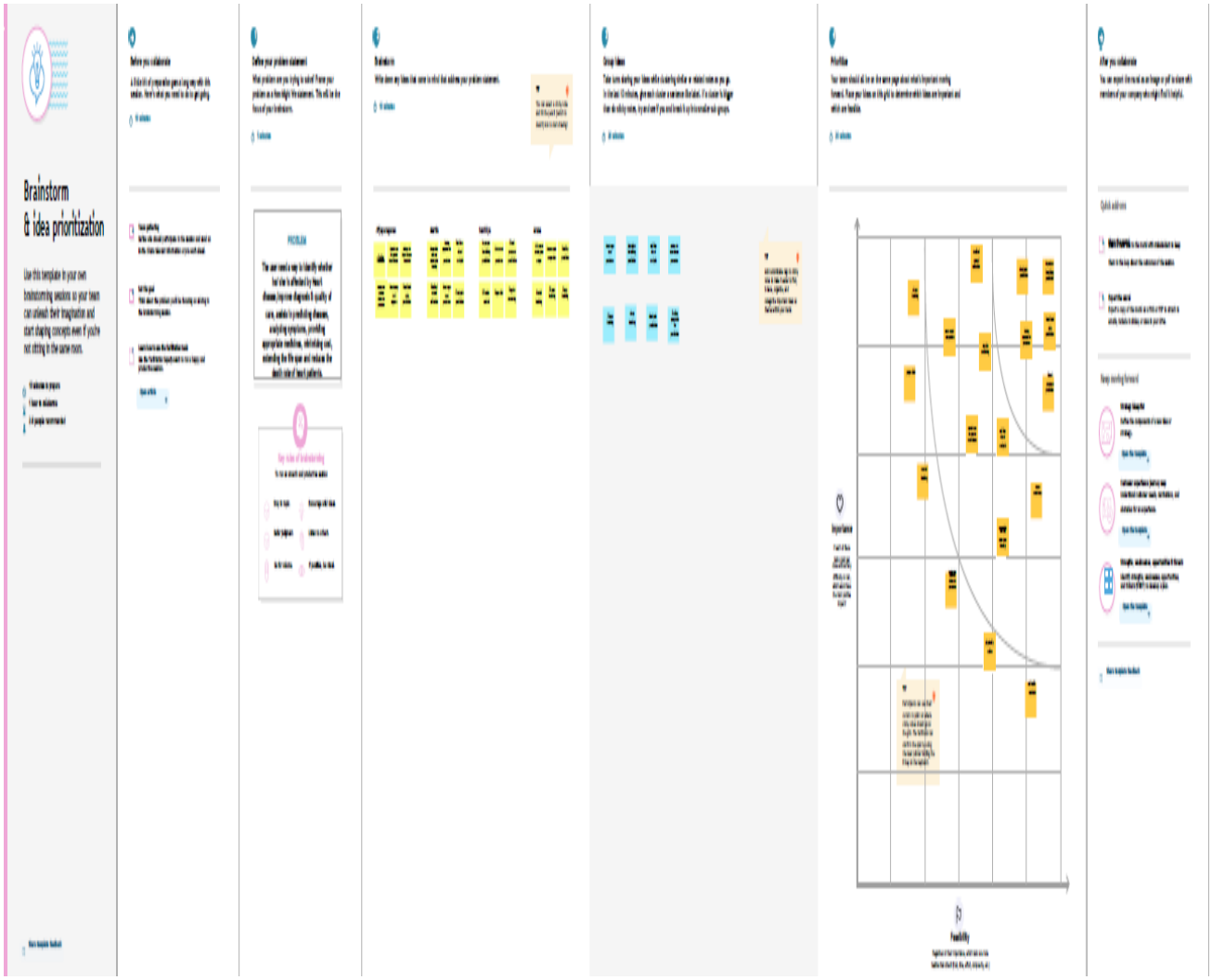
• Attributes considered form the primary basis for tests and give accurate results more or less. Many more input attributes can be taken but our goal is to predict with few attributes and faster efficiency the risk of having heart disease.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Easy to use heart disease predicting application with interactive easy to use dashboard. Nutritional recommendation system and various other diseases other than heart to be explored.
2.	Idea / Solution description	To develop an application which predicts heart diseases using heart scan and displays the issues in a dashboard solving manual intervention saving both time as well as helping when there is shortage of doctors such as the time of pandemic.
3.	Novelty / Uniqueness	Various other non-heart diseases would be explored and nutritional recommendation system would also be explored. To this, security features would also be explored and if possible would be added.
4.	Social Impact / Customer Satisfaction	The social impact is that it would be useful in many hospitals for immediate output and on a social cause, would be useful in UPHCs/govt hospitals.
5.	Business Model (Revenue Model)	The business model is tentatively planned as a purchase for license model wherein the hospital or the government can purchase license for 1 user or in bulk and can pay price in bulk. No subscription fees has been planned as of now.
6.	Scalability of the Solution	The solution is as of now scalable wherein a network can be introduced, and the solution can be deployed in cloud wherein process happening in a back-centre. The business model can then be changed into a subscription model from a pay for license model. It can also be expanded to various other diseases for various inputs.

3.3 Problem Solution fit

4.REQUIREMENT ANALYSIS

4.1Functional requirement

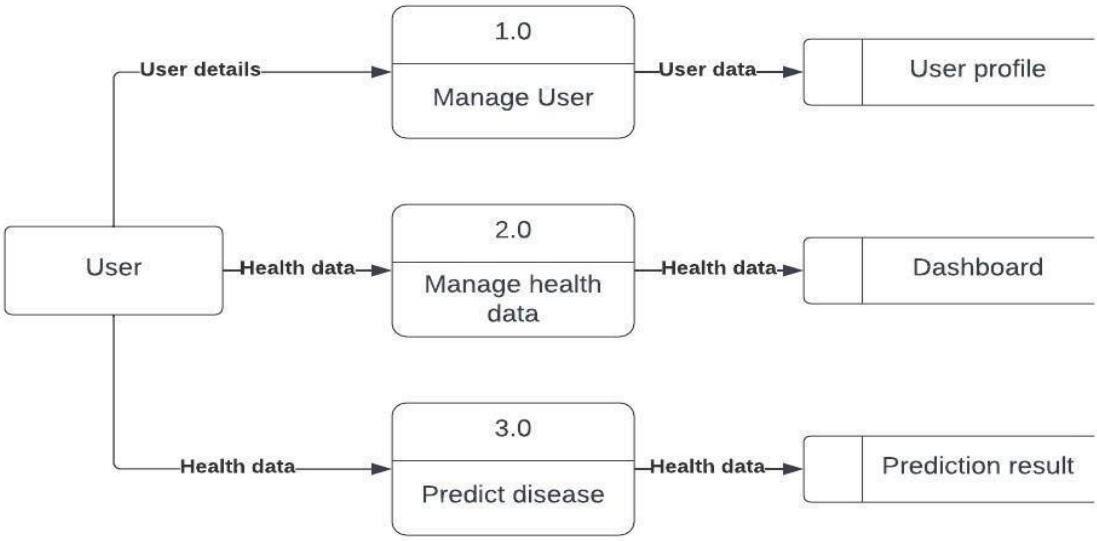
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through dashboard Registration through app registration through link
FR-2	User Fill the Particular	User fill through the online User fill through the application
FR-3	User Confirmation	User confirmation through Gmail User confirmation through notification

4.2 Non-Functional requirements

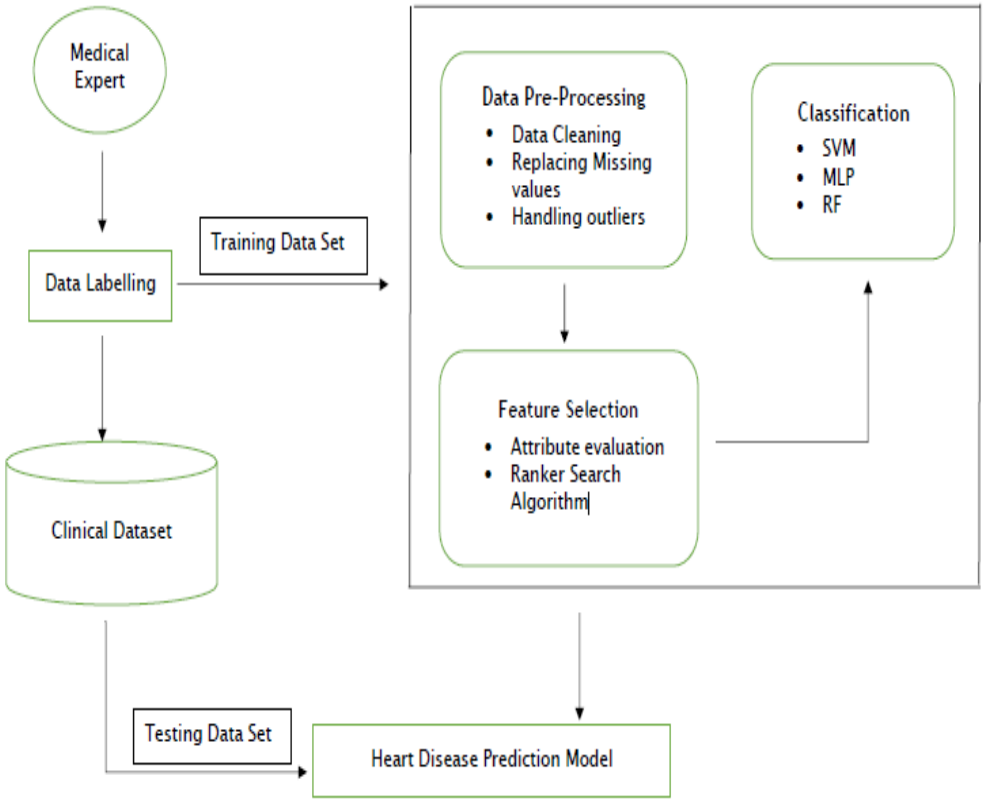
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Used to improve the accuracy of the Heart Diseases Prediction
NFR-2	**Security**	In this project we secure more lives early
NFR-3	**Reliability**	Reliability for accessing the attributes of cardiovascular patients about the Illness
NFR-4	**Performance**	The performance of this project is to Improve the accuracy of the diseases prediction
NFR-5	**Availability**	The availability solution is more benefit for all type persons to predict the Heart Diseases
NFR-6	**Scalability**	The scalability is 90%-95%

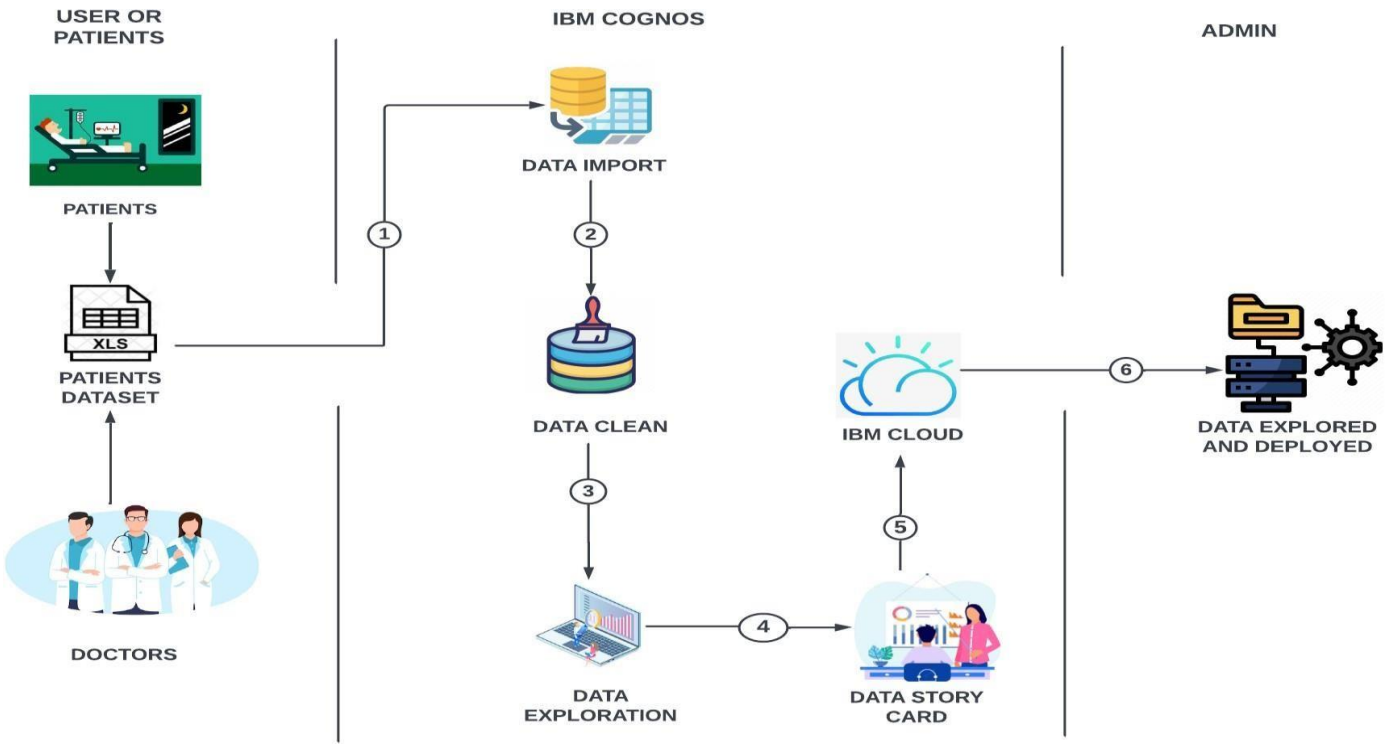
5.PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture


Medical Expert
Data Labelling
Training Data Set
Clinical Dataset
Data Pre-Processing
Data Cleaning
Replacing Missing values
Handling outliers
Feature Selection
Attribute evaluation
Ranker Search Algorithm
Classification
SVM
MLP
RF
Testing Data Set
Heart Disease Prediction Model



5.3 User Stories

Flow:

1) User creates an account in the application.
2) User enters the medical records in the dashboard.
3) User can view the visualizations of trends in the form of graphs and charts for his/her medical records with the trained dataset.
4) User can view the accuracy of probability of occurrence of heart disease in the dashboard.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user)	Registration	USN-1	As a user, I can register for the applicationby 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 confirmationemail once I have registered for the application	I can receive confirmation email &click confirm	High	Sprint-1
	Login	USN-3	As a user, I can log into the application byentering email & password	I can access my account / Dashboard when logged in	High	Sprint-1
Customer (Web user)	Dashboard	USN-4	User can view his/her complete medical analysis and accuracy of disease prediction	I can view my medical analysis in the dashboard	High	Sprint-2
		USN-5	User can view the accuracy of occurrenceof heart disease	I can view the accuracyof heart disease in the dashboard	High	Sprint-2
Customer Care Executive	Helpdesk	USN-6	As a customer care executive, he/she can view the customer queries.	I can post my queries in the dashboard	Medium	Sprint-3
		USN-7	As a customer care executive, he/she cananswer the customer queries.	I can get support fromhelpdesk	High	Sprint-3
Administrator	User Profile	USN-8	As an admin, he/she can update the health details of users.	I can view my updated health details.	High	Sprint-4

6 PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

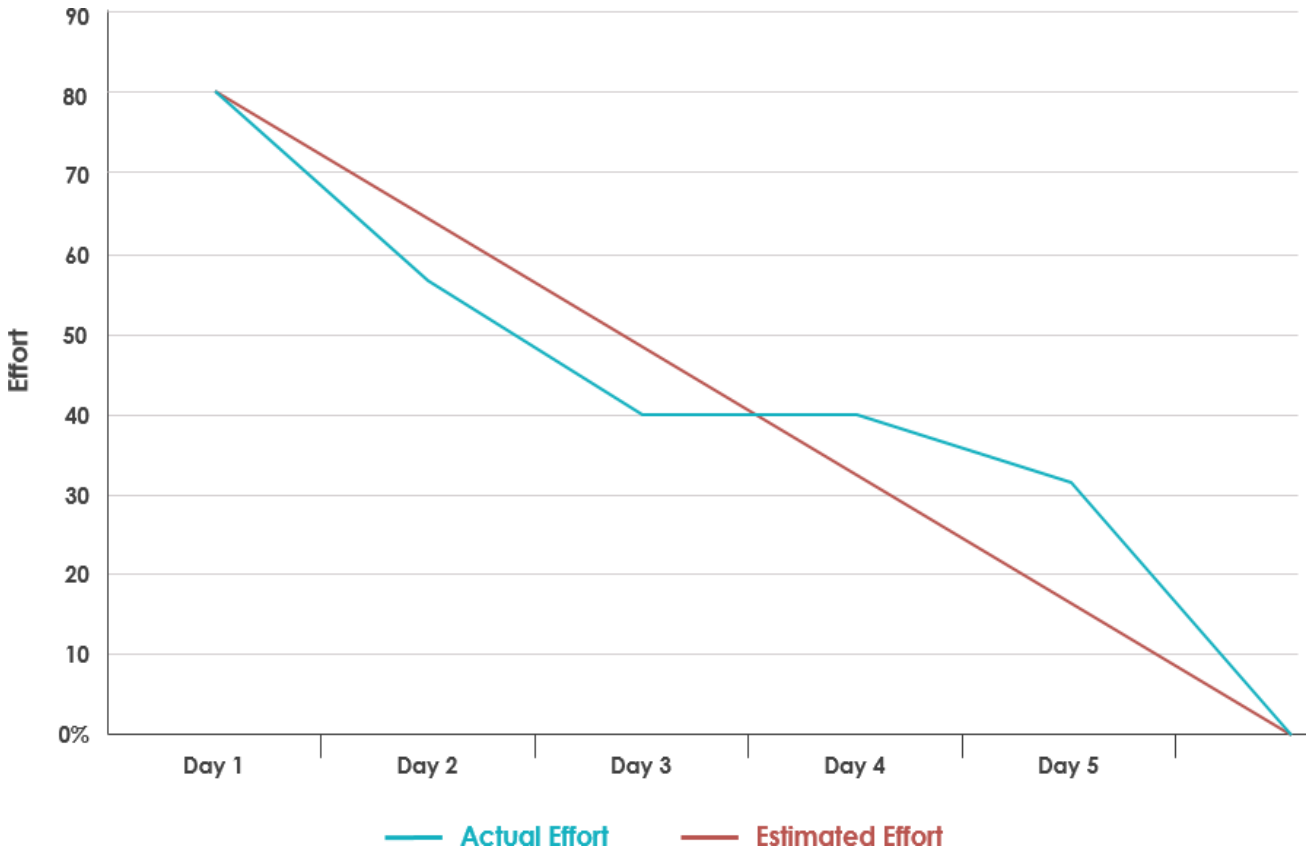
7

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.	5	High	S.Vijaya ragavan, G.Santhiya
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	5	High	W.Martin, M.Aruna
Sprint-1		USN-3	As a user, I can register for the application through Email, Google account and mobilenumber	2	High	S.Vijaya ragavan, G.Santhiya
Sprint-1	Login	USN-4	As a user, I can log into the application by entering email&password	8	High	W.Martin, M.Aruna
Sprint-2	Dashboard	USN-5	As a user, I can update my profile and medical records for analysis	10	High	S.Vijaya ragavan, G.Santhiya
Sprint-2		USN-6	As a user, I can view the accuracy of occurrence of heart disease through thereport generation	10	Medium	W.Martin, M.Aruna
Sprint-3	Guidelines	USN-7	As a user, they can view the guidelines and perform the requiredactions	10	High	S.Vijaya ragavan, G.Santhiya
Sprint-4	User profile	USN-8	As an admin, he/she can update the health details of theusers	10	High	W.Martin, M.Aruna
Sprint-4		USN-9	As an admin, he/she can addor delete users	5	High	S.Vijaya ragavan, G.Santhiya
Sprint-4		USN-10	As an admin, he/she canmanage the user details	5	High	W.Martin, M.Aruna

6.2 Sprint Delivery Schedule

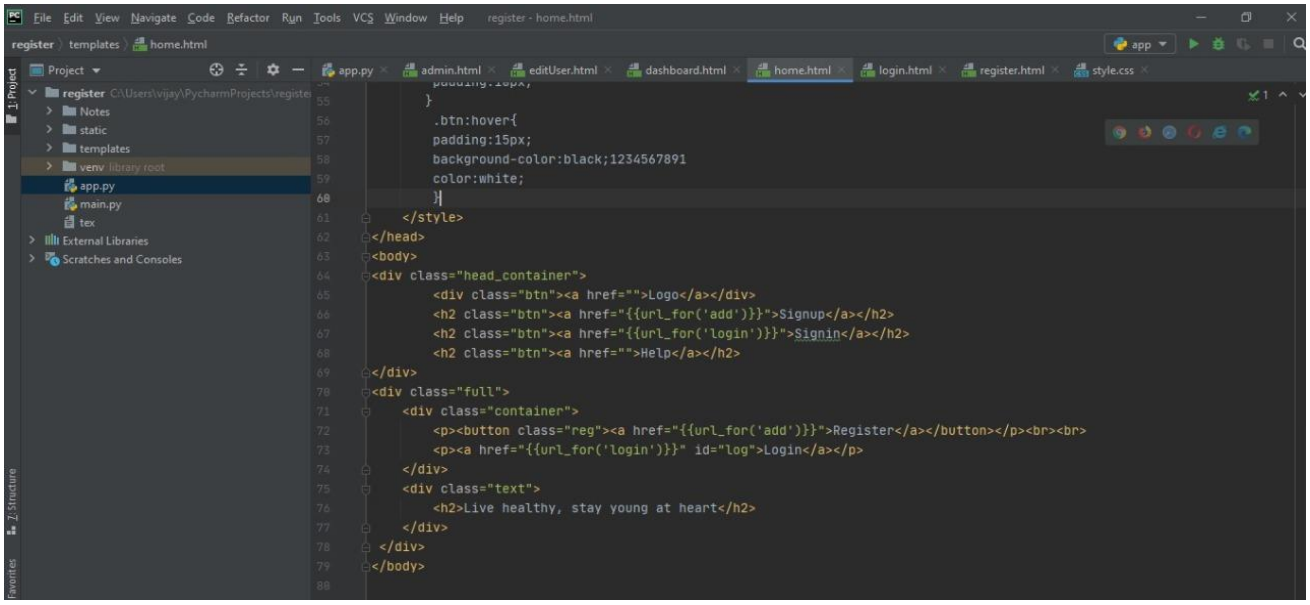
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint EndDate (Planned)	Story Points Completed (as on Planned EndDate)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

6.3 Reports from JIRA



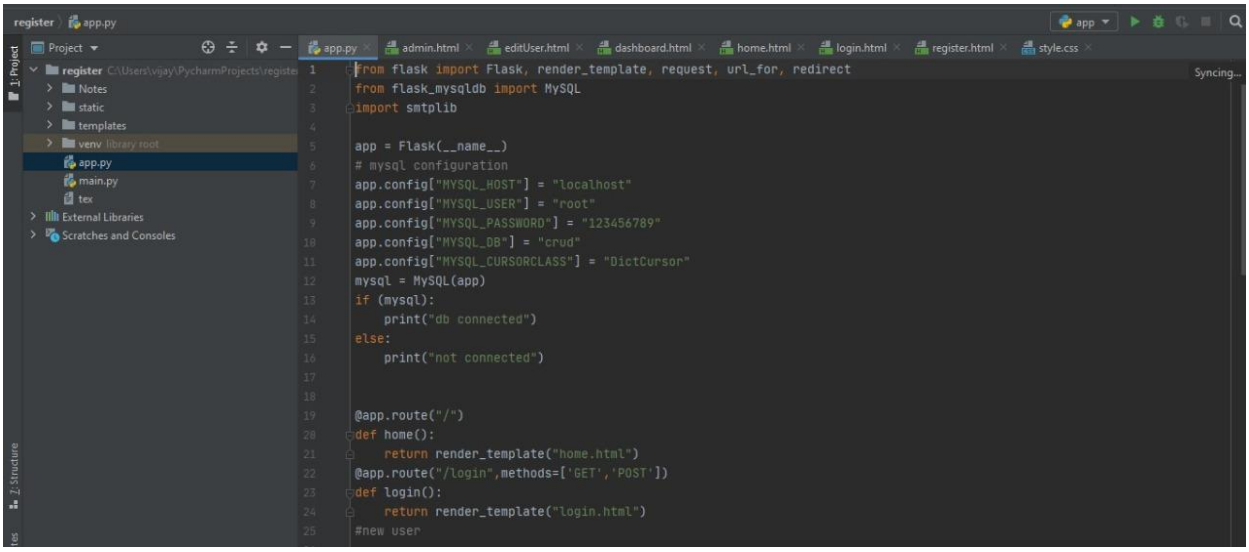
7 CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1



```
        .btn:hover{
        padding:15px;
        background-color:black;1234567891
        color:white;
        }
    </style>
</head>
<body>
<div class="head_container">
        <div class="btn"><a href="">Logo</a></div>
        <h2 class="btn"><a href="{{url_for('add')}}">Signup</a></h2>
        <h2 class="btn"><a href="{{url_for('login')}}">Signin</a></h2>
        <h2 class="btn"><a href="">Help</a></h2>
</div>
<div class="full">
    <div class="container">
        <p><button class="reg"><a href="{{url_for('add')}}">Register</a></button></p><br><br>
        <p><a href="{{url_for('login')}}" id="log">Login</a></p>
    </div>
    <div class="text">
        <h2>Live healthy, stay young at heart</h2>
    </div>
 </div>
</body>
```

7.2 Feature 2



```
from flask import Flask, render_template, request, url_for, redirect
from flask_mysqldb import MySQL
import smtplib

app = Flask(__name__)
# mysql configuration
app.config["MYSQL_HOST"] = "localhost"
app.config["MYSQL_USER"] = "root"
app.config["MYSQL_PASSWORD"] = "123456789"
app.config["MYSQL_DB"] = "crud"
app.config["MYSQL_CURSORCLASS"] = "DictCursor"
mysql = MySQL(app)
if (mysql):
    print("db connected")
else:
    print("not connected")


@app.route("/")
def home():
    return render_template("home.html")
@app.route("/login",methods=['GET','POST'])
def login():
    return render_template("login.html")
#new user
```

7.3 Database Schema (if Applicable)

8 TESTING

8.1 Test Cases

This report shows 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 Report Output	4	0	0	4
Version Control	2	0	0	2

8.2 User Acceptance Testing

1. **Purpose of Document**

The purpose of this document is to briefly explain the test coverage and open issues of the Visualizing and Predicting Heart Disease with an Interactive Dash Board project at the time of the release to User Acceptance Testing (UAT).

2. **Defect Analysis**

This report shows the number of resolved or closed bugs at each severity level, and howthey were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	0	2	2	9

Duplicate	0	0	1	0	1
External	2	1	0	0	3
Fixed	5	0	0	13	18
Not Reproduced	0	0	1	0	1
Skipped	0	1	1	1	3
Won't Fix	0	0	0	0	0
Totals	12	2	5	16	35

9. RESULTS

9.1 Performance Metrics

S. No	Parameter	Screenshot / Values
.	Dashboard design	Visualization-7
.	Data Responsiveness	Yes, the website is responsive completely, by resizing thebrowser window size as per the test scenario.
.	Amount Data to Rendered (DB2Metrics)	Totally there are **270** records in the dataset.
.	Utilization of DataFilters	Data Filter used in Visualizing and Predicting HeartDisease with an Interactive Dash Board
.	Effective User Story	• To create the Registration page of the Website • To create the Log in page of the Website • To work on the given dataset • To Understand the Dataset • Load the dataset to Cloud platform then Build therequired Visualizations • With the help of Heart Disease dataset, create various graphs & Charts to highlight the insights inthe dataset • Build a Visualizations to showcase the HeartDisease Prediction

10.ADVANTAGES & DISADVANTAGES

Advantages

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

Disadvantages

1. Prediction of cardiovascular disease results is not accurate.
2. Data mining techniques does not help to provide effective decision making.
3. Cannot handle enormous datasets for patient records.

11.CONCLUSION

1. Out of the 13 features we examined, the top 4 significant features that helped us classify between a positive & negative Diagnosis were chest pain type (cp), maximum heart rate achieved (thalach), number of major vessels (ca), and ST depression induced by exercise relative to rest (oldpeak).

2. Our machine learning algorithm can now classify patients with Heart Disease. Now we can properly diagnose patients, & get them the help they needs to recover. By diagnosing detecting these features early, we may prevent worse symptoms from arising later.

3. Our Random Forest algorithm yields the highest accuracy, 80%. Any accuracy above 70% is considered good, but be careful because if your accuracy is extremely high, it may be too good to be true (an example of Over fitting). Thus, 80% is the ideal accuracy!

12.FUTURE SCOPE

In our project, we analysis given dataset and visualizing the dashboard further we will get the input from the user and predict the heart diseases instantly by using machine learning.

13.APPENDIX

Source Code

Home.html

```
<!DOCT
YPE
html>
        <html lang="en">
        <head>
        <meta charset="UTF-8">
        <title>Title</title>
        <link rel="stylesheet" type="text/css"
        href="{{url_for('static',filename='css/style.css')}}">
        <style>
        *{
        margin:0px;
        }
        body{
        background:url({{url_for('static',filename='images/home.jpg')}});
        background-repeat: no-repeat;
        background-size: cover;
        background-position: center;
        width: 100vw;
        height: 100vh;
        box-shadow: inset 0 0 0 2000px rgba(0, 0, 0, 0.5);
        }
        a{
        color:white;
        text-decoration:none;
        }
        .reg:hover{
```

```
background-color: pink;
}
.reg{
background-color: transparent;
}
button{
width:100px;
height:50px;
}
.container{
position:absolute;
left:62%;
top:40%;
}
#log:hover{
color:blue;
}
.full{
display:flex;
}
.text{
position:absolute;
left:10%;
top:40%;
}
.head_container{
display:flex;
justify-content:space-evenly;
background-color:grey;
padding:10px;
}
.btn:hover{
padding:15px;
background-color:black;1234567891
color:white;
}
</style>
</head>
<body>
<div class="head_container">
<div class="btn"><a href="">Logo</a></div>
<h2 class="btn"><a href="{{url_for('add')}}">Signup</a></h2>
<h2 class="btn"><a href="{{url_for('login')}}">Signin</a></h2>
```

```
<h2 class="btn"><a href="">Help</a></h2>
</div>
<div class="full">
<div class="container">
<p><button class="reg"><a href="{{url_for('add')}}">Register</a></button></p><br><br>
<p><a href="{{url_for('login')}}" id="log">Login</a></p>
</div>
<div class="text">
<h2>Live healthy, stay young at heart</h2>
</div>
</div>
</body>
</html>
```

Login.html

```
<!DOCT
YPE
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>Login page</title>
        <link
        href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTwFspd3yD65VohhpuuCOmLASjC" crossorigin="anonymous">
        <link rel="stylesheet" href="./style.css"/>
        <style>
        *{
        border: 0px;
        box-sizing: border-box;
        }
        body{
        background-color: rgb(179, 168, 212);
        }
```

```
.logo{
border-radius: 50%;
}
.container{
width: 70%;
height: 60%;
position: relative;
display: flex;
flex-direction: column;
align-items: center;
background: linear-gradient(rgb(151, 151, 234),violet);
margin-top: 100px;
border: 2px solid white;
padding-top: 50px;
padding-bottom: 50px;
border-radius: 50px;
box-shadow: 5px 3px 10px#000;
}
input{
width: 200px;
height: 50px;
border-radius: 50px;
text-align: center;
}

.header{
padding: 15px;
}
#login{
margin-left: 25%;
width: 100px;
height: 50px;
border-radius: 50px;
}
.link{
padding-top: 20px;
}
</style>
</head>
<body>
<div class="container">
<img          src="{{url_for('static',filename='images/bgimg.jpg')}}"
width="300px" height="200px" class="logo"/>
```

```
<h1 class="header">Login</h1>
<form>
<input type="text" placeholder="Enter your name"/><br/><br/>
<input type="password" placeholder="Enter your password"/><br/><br/>
<button id="login">Login</button>
</form>
<h5 class="link">New User ?<span><a href="{{url_for('add')}}">Register</a></span></h5>
</div>
</body>
</html>
```

Register.html

```
<!DOCT
YPE
html>
<html lang="en">
<head>
<style>
body{
background-image:url({{url_for('static',filename='images/v870-tang-36.jpg')}});

background-size: cover;
background-position: center;
}
section{
width: 70%;
height: 60%;
position: relative;
display: flex;
flex-direction: column;
align-items:center;
background: transparent;
border:transparent;
margin-top: 10px;
margin-left: 15%;
border: 2px solid white;
padding-top: 50px;
padding-bottom: 50px;
border-radius: 50px;
box-shadow: 5px 3px 10px#000;
```

```
padding-bottom: 20px;
}
.header{
text-align: center;
padding: 15px;
}
input{
width: 200px;
height: 50px;
text-align: center;
border-radius: 50px;
border-style: none;
background-color:rgb(235, 165, 165);
color: white;
}
#register{
margin-left: 30%;
width: 100px;
height: 50px;

}

</style>
<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>Register</title>
<link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTwFspd3yD65VohhpuuCOmLASjC" crossorigin="anonymous">
<link rel="stylesheet" href="./style.css"/>
</head>
<body>
<header>
<h1 class="header">Register</h1>
</header>
<section>
<form method="post" action=" ">
<tr>
<td><input type="text" name="name" placeholder="Enter Name"
```

```
class="in"/></td>
</tr><br><br>
<tr>

<td><input type="Number" name="age" placeholder="Enter Age" class="in"/></td>
</tr><br><br>
<tr>

<td><input type="text" name="gender" placeholder="Enter gender"></td>
</tr><br><br>
<tr>

<td><input type="email" name="email" placeholder="Enter Email" class="in"/></td>
</tr><br><br>
<tr>

<td><input type="Password" name="password" placeholder="Enter Password" class="in"/></td>
</tr><br><br>
<tr>

<td><input type="Number" name="phone" placeholder="Enter Phone Number" class="in"/></td>
</tr><br><br>
<tr>
<button id="register">
Register
</button></tr>
</form>
</section>
</body>
</html>
```

GitHub & Project Demo Link

IBM-Project-47455-1660799512

https://drive.google.com/drive/u/0/folders/1CzuQO8rUDJ4I0Mx6e6i_aGrcRiFudUPR