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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

IBM NALAIYA THIRAN PROJECT NOTE BOOK

IBM NALAIYA THIRAN PROJECT

NOVEMBER - 2022

VISUALIZING AND PREDICTING HEART DISEASE WITH AN INTERACTIVE DASHBOARD

A PROJECT REPORT

Submitted by

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

According to the World Health Organization, every year 12 million deaths occur worldwide due to Heart Disease. Heart disease is one of the biggest causes of morbidity and mortality among the population of the world. Prediction of cardiovascular disease is regarded as one of the most important subjects in the section of data analysis. The load of cardiovascular disease is rapidly increasing all over the world from the past few years.

Heart Disease is even highlighted as a silent killer which leads to the death of the person without obvious symptoms. The early diagnosis of heart disease plays a vital role in making decisions on lifestyle changes in high-risk patients and in turn reduces the complications.

1.2 PURPOSE

Heart disease is perceived as the deadliest disease in the human life across the world. In particular, in this type of disease the heart is not capable in pushing the required quantity of blood to the remaining organs of the human body in order to accomplish the regular functionalities. Some of the symptoms of heart disease include physical body weakness, improper breathing, swollen feet, etc.

The techniques are essential to identify the complicated heart diseases which results in high risk in turn affect the human life. The purpose 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. To predict this, we use 14 medical attributes of a patient and classify him if the patient is likely to have a heart disease.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING PROBLEM

Human life is highly dependent on proper functioning of blood vessels in the heart. The improper blood circulation causes heart inactiveness, kidney failure, imbalanced condition of brain, and even immediate death also. Some of the risk factors that can cause heart diseases are obesity, smoking, diabetes, blood pressure, cholesterol, lack of physical activities and unhealthy diet.

The primary reason for this disease is the blockage means that the blood flow to the heart muscle become obstructed or reduced. If the blood flow is reduced or obstructed, the functioning of red blood cells that carries enough oxygen helps in sustaining consciousness and human life have a severe impact. Without oxygen supply for 6 to 8 minutes, heart muscle may get arrest that in turn resulted in patient's death.

2.3 PROBLEM STATEMENT DEFINITION

The significant cause of the cardiovascular disease is 'plaque' means a hard substance formed in the coronary arteries which is made up of cholesterol (fat), causes the blood flow to be reduced or obstructed. Sometimes, it can be formed in the arteries known as atherosclerosis and investigating the cause of it are determined as a chronic inflammation.

Working with the heart disease prediction and for that, we will be looking into the heart disease dataset from that dataset we will derive various insights that help us know the weightage of each feature and how they are interrelated to each other but this time our sole aim is to detect the probability of person that will be affected by a savior heart problem or not.

CHAPTER 3
IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS
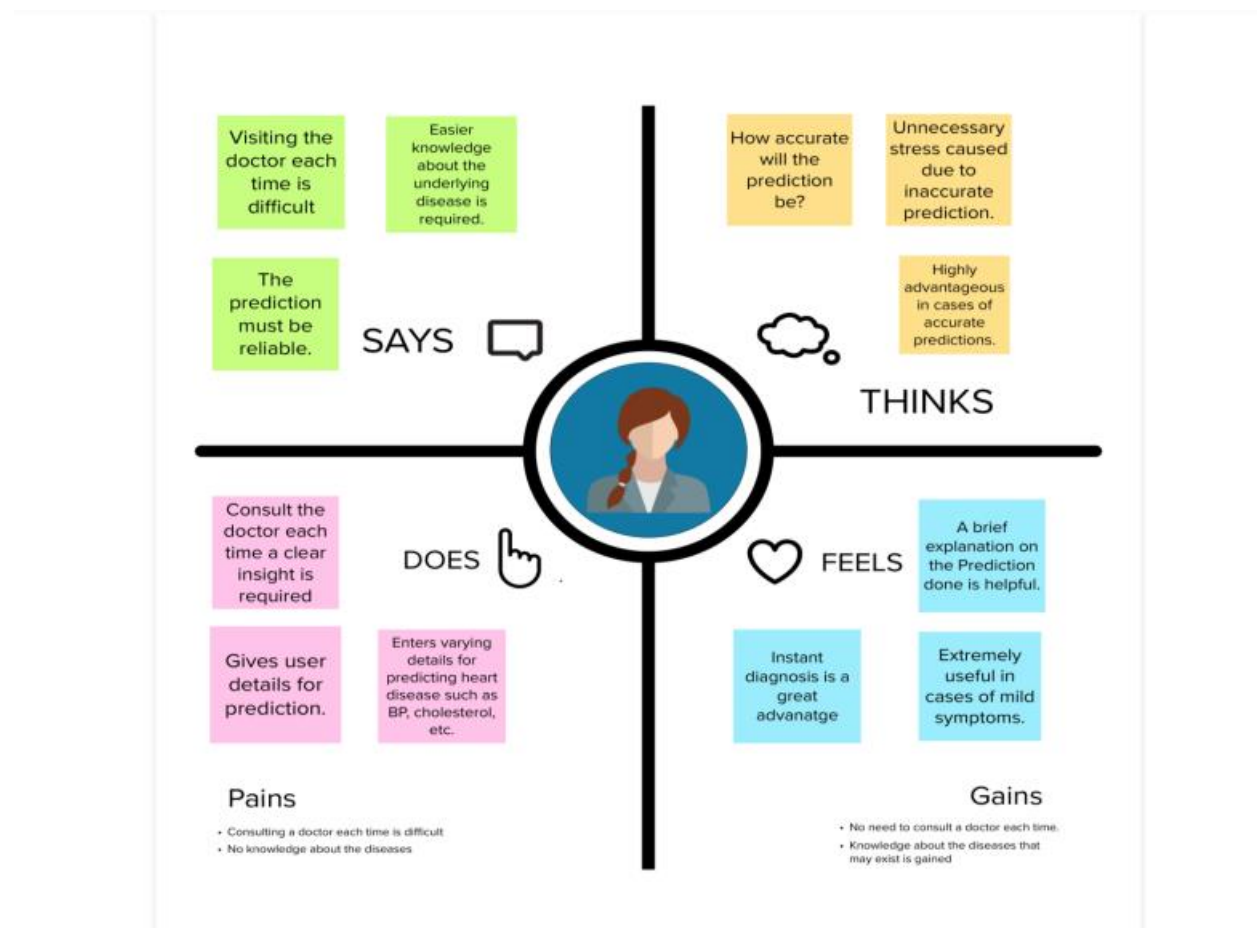
3.2 IDEATION & BRAINSTORMING

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Step-2: Brainstorm, Idea Listing and Grouping

Step-3: Idea Prioritization

④

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⏱ 20 minutes

The data from the tests done by the user can be inaccurate.

Not all the details necessary for the prediction will be available on the user's side.

Inaccuracies in the data set can cause issues in prediction.

The test equipments used for testing can be faulty.

The data given by the user can contain inaccuracies.

Early symptoms must be listed in brief.

There can be variations in the parameters considered for prediction according to each body.

The predictions can sometimes be inaccurate.

♡

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

The model can predict more than one disease with the same probability.

Environmental conditions can also affect the tests on the user.

The predictions can even be affected by the person's personal circumstances.

Not all people's body types are the same.

⚑

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Predicting the occurrence of heart diseases before the patient gets affected entirely can be highly beneficial as it can even save lives.
2.	Idea / Solution description	We aim to visualise and predict heart diseases with an interactive dashboard.
3.	Novelty / Uniqueness	The visualization can be done considering any two or more parameters that contribute to the prediction.
4.	Social Impact / Customer Satisfaction	The customer will be able to view the prediction and visualisation of the heart diseases that could occur to the patient.
5.	Business Model (Revenue Model)	Revenue could be generated when the model is sold to customers (Hospitals and individuals).
6.	Scalability of the Solution	The proposed system could predict and visualize for a large dataset to observe general trend as well as for individuals.

3.4 PROBLEM SOLUTION FIT

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) `CS`
Who is your customer?
i.e. working parents of 0-5 y.o. kids

1. Every individual
2. Hospitals
   -Government
   -Private

6. CUSTOMER CONSTRAINTS `CC`
What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

Lack of data needed for predictions

Unanailability of newer test results

Explore AS, differentiate

5. AVAILABLE SOLUTIONS `AS`
Which solutions are available to the customers when they face the problem, 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.

Prediction of heart diseases were done by consulting the docctors in person in the past. But today it is easy to predict the heart diseases through these predicting dashboard by uploading proper datasets.

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.

Every individual can check their health

Hospitals can easily predict the medical conditions of their patients that could occur in the future.

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.

Manually predicting the heart diseases can consume more time, so there are chances for the patients' health to decline.

But with prediction dashboards, heart diseases can be predicted and also visualised easily and quickly.

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).

Customers can enter their health related datset into the dashboard and can wait patiently till they get their details about their health

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS `TR`
What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

Customer using the dashboard can understand their health conditions and will act accordingly to have a healthy life style.

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.

Before:Tensed about their health,fear

After:Clear insight about their health, Peace

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 behaviour.

We aim to predict and visualise heart diseases with an interactive dashboard.

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.

Offline: The user should have test results in hand

Online:The users data should be entered to get the prediction and visualisation.

Identify strong TR & EM

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	Registration through Form Registration through Gmail
FR-2	**User Confirmation**	Confirmation via Email Confirmation via OTP
FR-3	**Network Allowance**	Access internet through Wi-Fi Access internet through mobile data
FR-4	**Inevitable questions**	Must attend all the unavoidable questions
FR-5	**Terms and Conditions**	Accept the policies

4.2 NON-FUNCTIONAL REQUIREMENTS

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The quality of a user's experience when interacting with products or systems will be high.
NFR-2	**Security**	The data collected from the user is stored securely.
NFR-3	**Reliability**	The project software consistently does what is supposed to do and the user can navigate safely.
NFR-4	**Performance**	The software could be so effective with respect to time constraints and allocation of resources.
NFR-5	**Availability**	The network bandwidth will be at good range so that the software can be available for large number of users.
NFR-6	**Scalability**	The software could be moved from a smaller to a larger operating system and take full advantage of the larger operating system, in turn the large number of users can be handled

CHAPTER 5
PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS
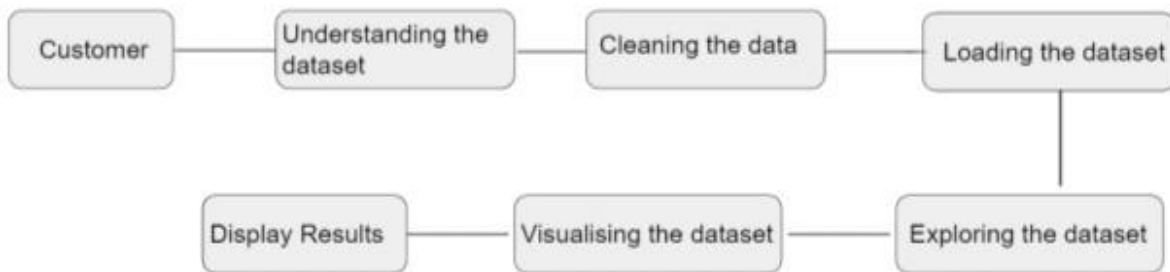
5.2 SOLUTION & TECHNICAL ARCHITECTURE

5.3 USER STORIES

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

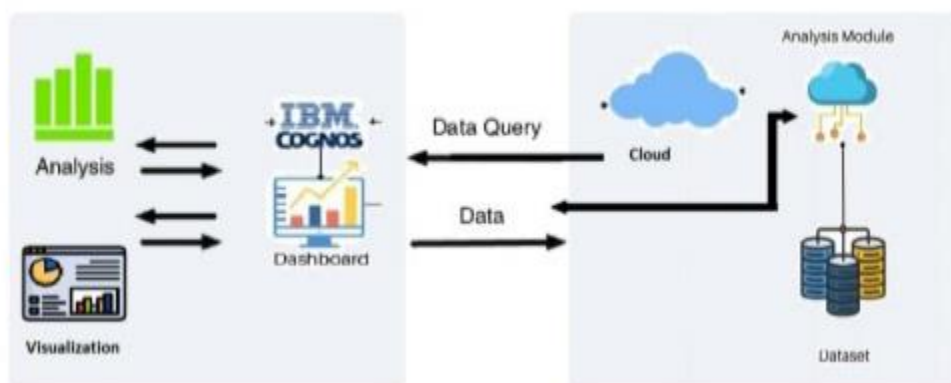| User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	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
	Login	USN-1	As a user, I can log into the application by entering email & password	I can login to the dashboard and can access it easily.	Medium	Sprint-2
	Data Insertion	USN-1	As a user, I can insert the dataset easily into the dashboard.	I can insert the dataset regarding my health care.	High	Sprint-3
Customer (Web 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
			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
	Login		As a user, I can log into the application by entering email & password	I can login to the dashboard and can access it easily.	Medium	Sprint-2
	Data Insertion	USN-1	As a user, I can insert the dataset easily into the dashboard.	I can insert the dataset regarding my health care.	High	Sprint-3
Customer Care Executive	Registration	USN-1	As a customer care executive, 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 customer care executive, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-2
	Login	USN-1	As a customer care executive, I can log into the application by entering email & password	I can login to the dashboard and can access it easily.	Medium	Sprint-2
	Customer care	USN-1	As a customer care executive,I can provide 24/7/365 day service to the customers	I can provide endless service to the customers	High	Sprint-3

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Administrator	Registration	USN-1	As an administrator, 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 an administrator, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
	Login	USN-1	As an administrator, I can log into the application by entering email & password	I can login to the dashboard and can access it easily.	Medium	Sprint-2
	Monitor & Control	USN-1	As an administrator, I have to monitor and control the entire process of the application	I have to check all the process and will be dealing with customer data	High	Sprint-3

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 1	Dataset collection	USN-1	Dataset Collection The data required for analysis and prediction must be collected from various sources	10	High	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R
Sprint 1	Dataset cleaning	USN-1	Dataset Cleaning Dataset cleaning will eliminate duplicate data and reduce data redundancy.	10	Medium	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R
Sprint-1	Exploring dataset	USN-2	Exploring the data set. The data set would be explored to find the general trends of the data set.	10	High	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R
Sprint-2	Creating dashboard	USN-3	Creation of the dashboard. The dashboard will be created using IBM cloud and IBM Cognos Analytics.	20	High	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R
Sprint-3	Uploading dataset	USN-4	Uploading the data set to the dashboard. This uploaded data set will be used for the exploration and visualization.	20	High	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Visualizing dataset	USN-5	Visualizing and Predicting data. The explored dataset with their trends being spotted would be visualized and predicted.	10	High	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R
Sprint-5	Stories	USN-6	Stories A detailed story on the analysis and the prediction of the data should be projected.	10	Medium	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R
Sprint-5	Reporting	USN-7	Presenting the final report. The final report with the exploration and visualization would be presented.	10	High	R.Kawshika, Brundashree.R, Manashi V J, Madhumitha.R

6.2 SPRINT DELIVERY SCHEDULE

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	30	6 Days	24 Oct 2022	29 Oct 2022	30	31 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	07 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	14 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	19 Nov 2022	10	21 Nov 2022
Sprint-5	20	6 Days	19 Nov 2022	25 Nov 2022	0	27 Nov 2022

6.3 REPORTS FROM JIRA
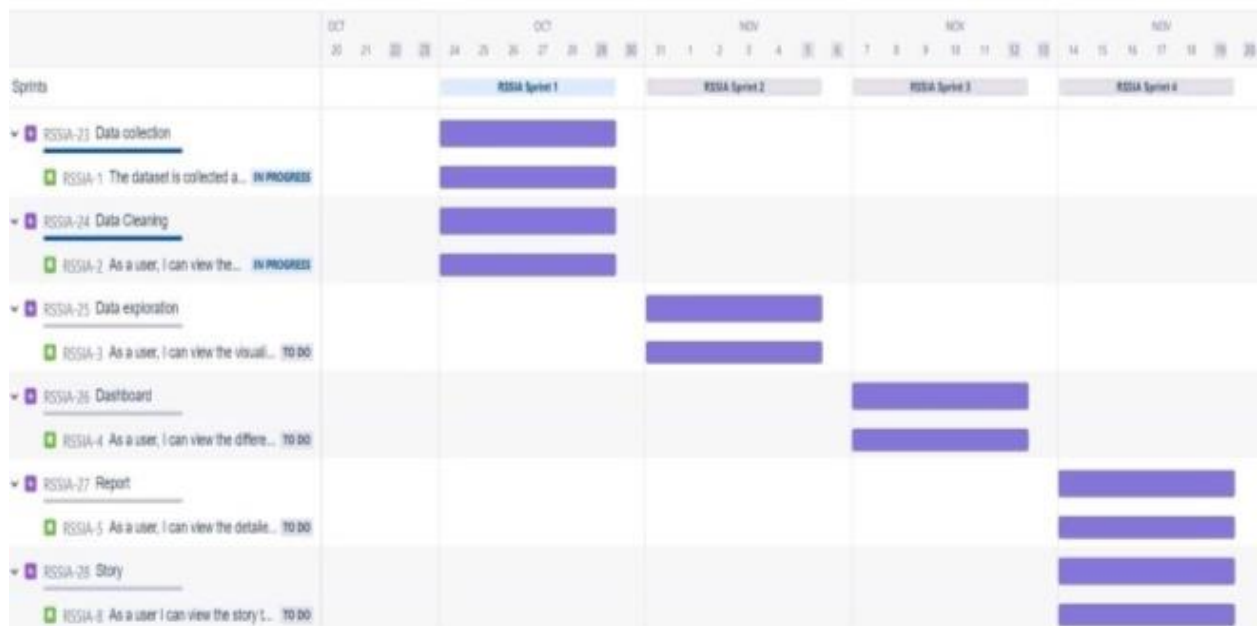
BURNDOWN CHART
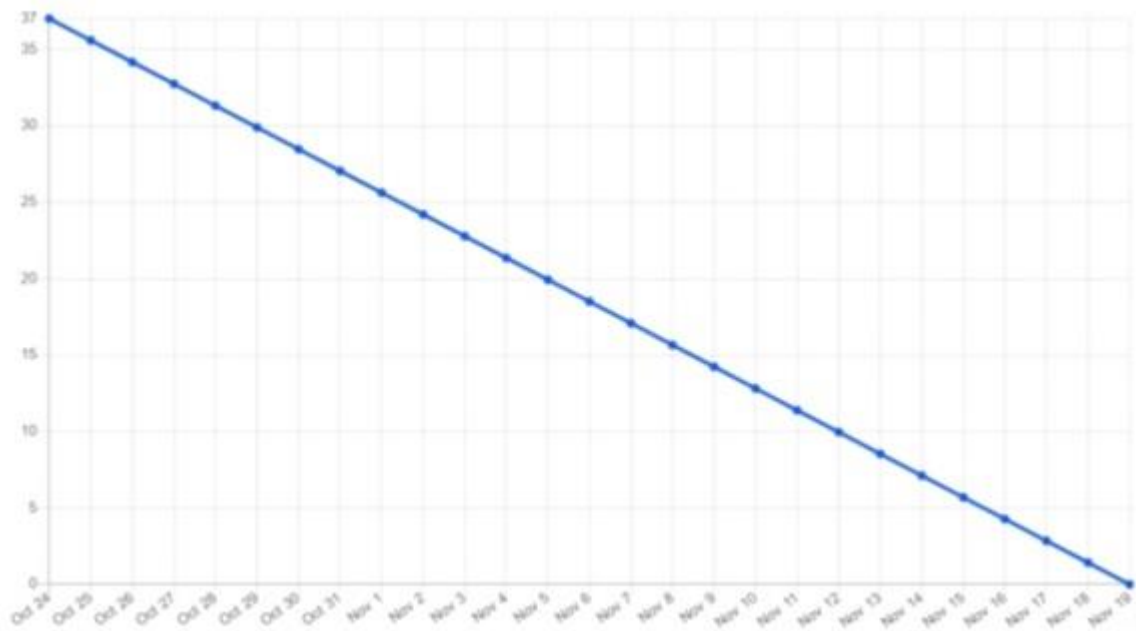
CHAPTER 7

CODING & SOLUTIONING

7.1 FEATURE

DASHBOARD
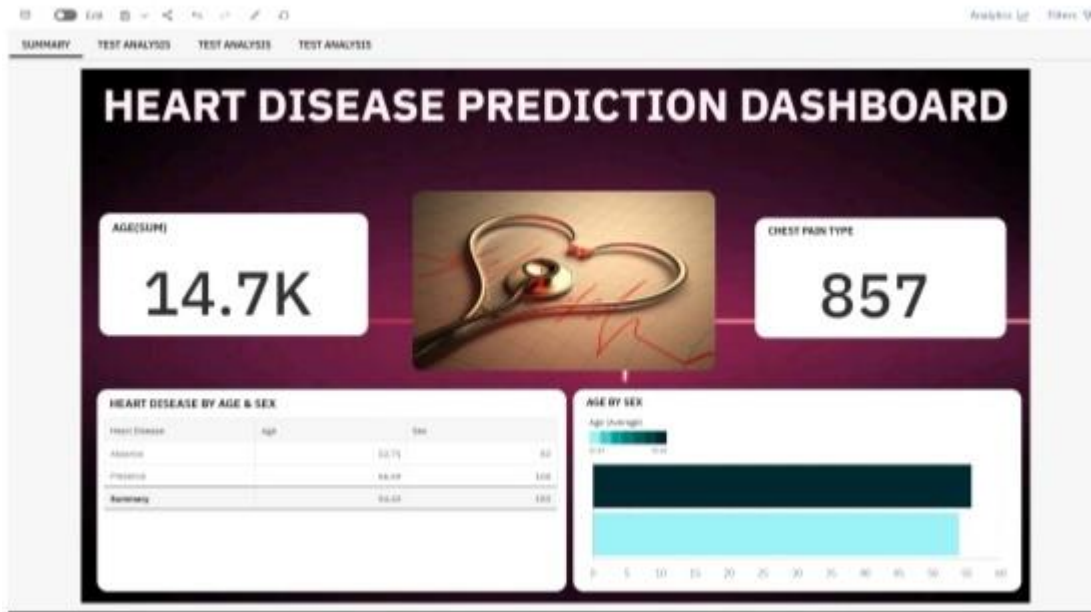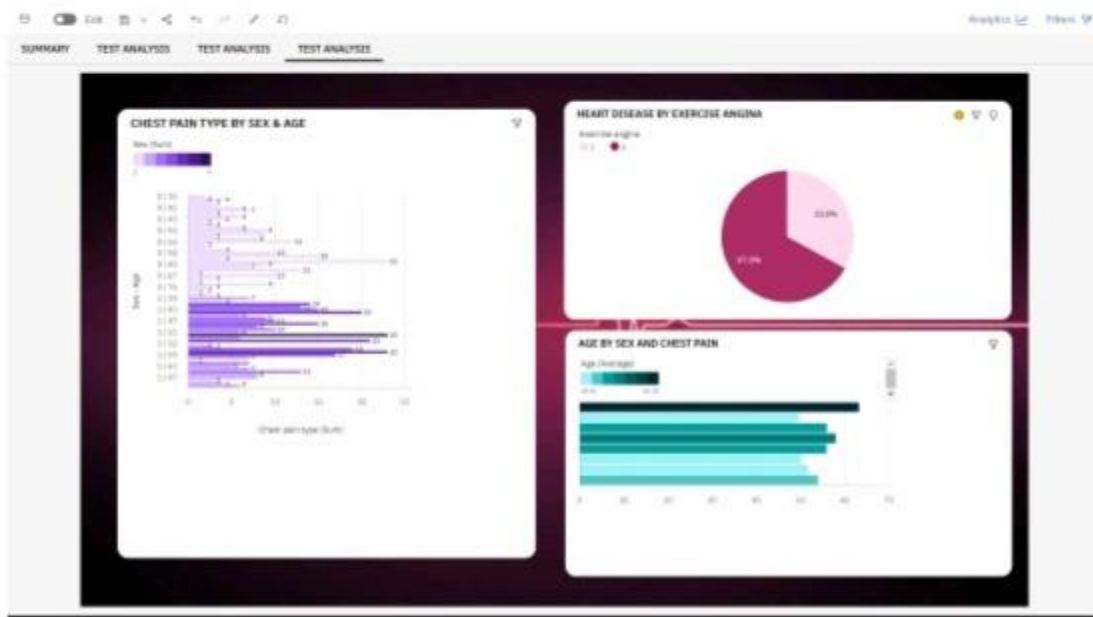
STORY
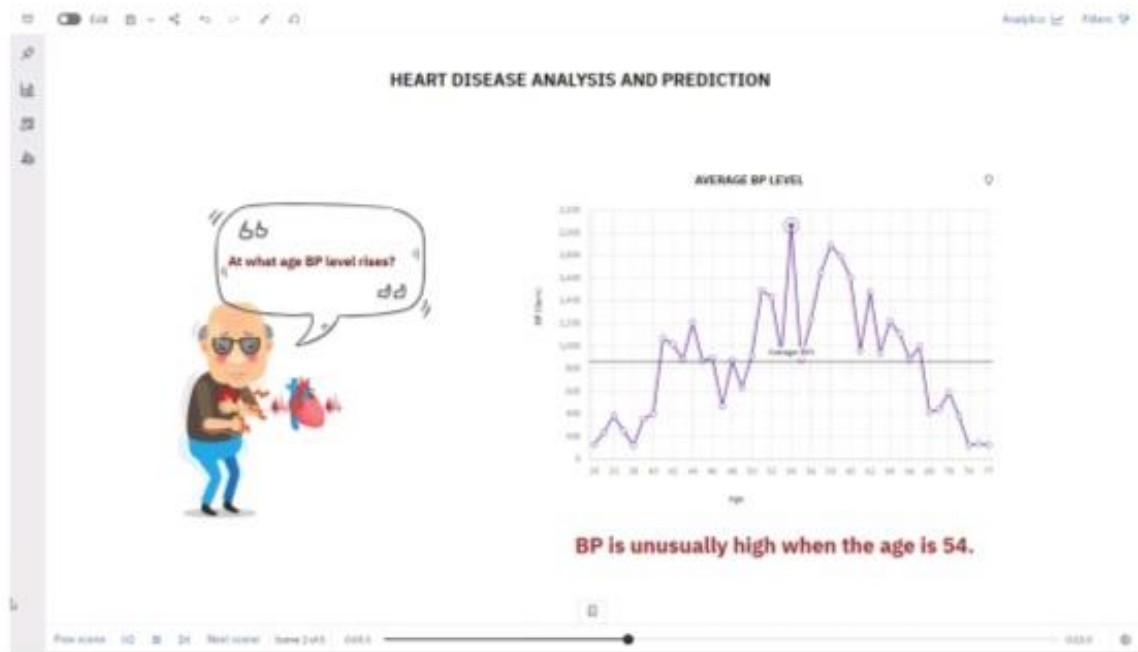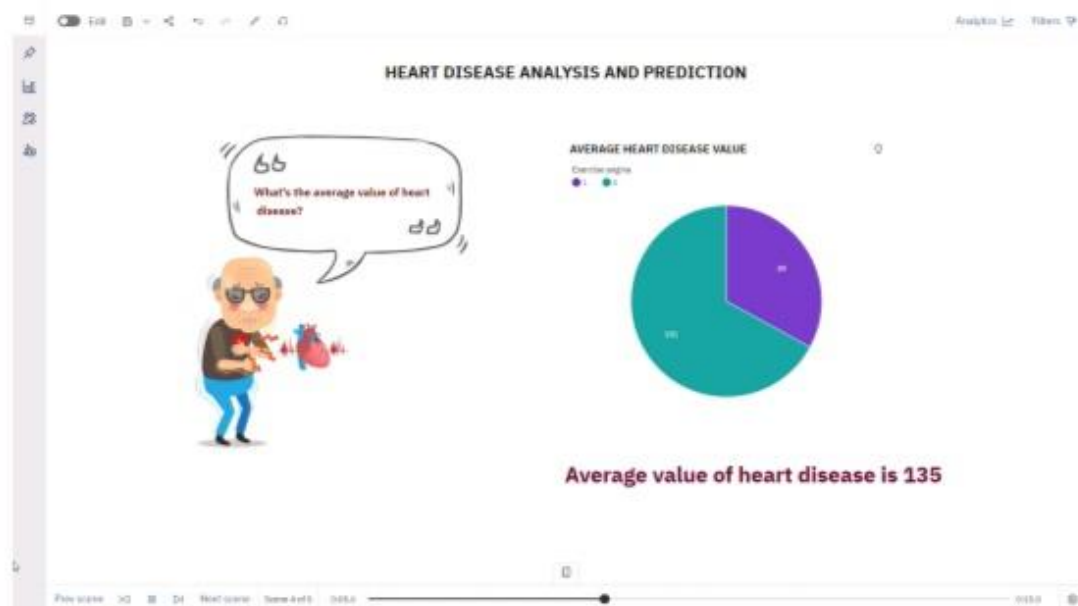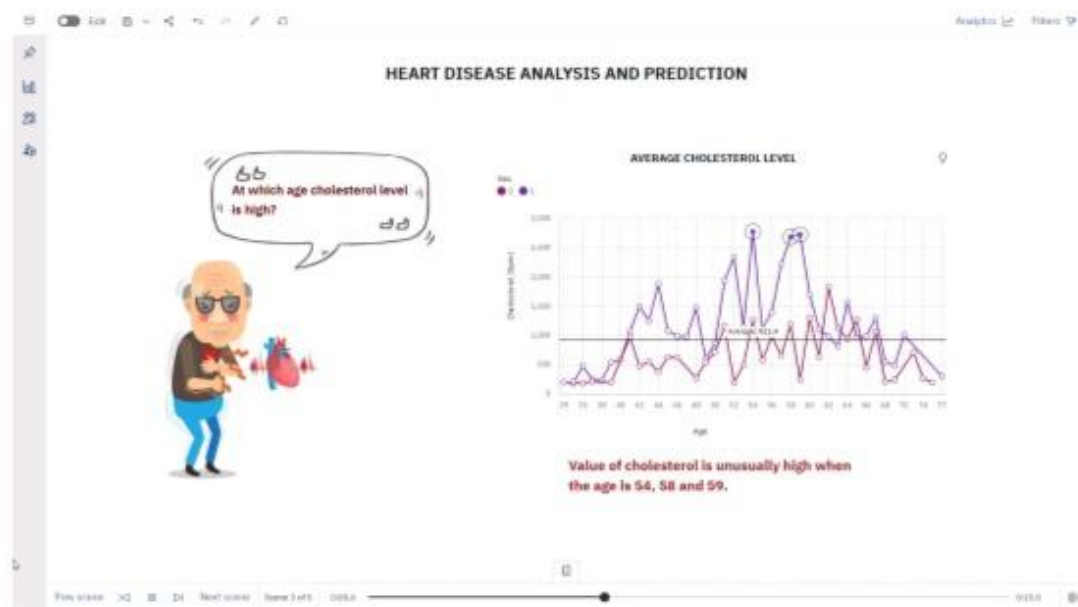
REPORT

CHAPTER 8

TESTING

8.1 TEST CASES

S.No	Input	Expected output	Actual output
1.	Verify User's IBM Cognos Credentials and if they are correct.	Logged in.	Logged in.
2.	Verify User's IBM Cognos Credentials and if they are not correct	Not logged in.	Not logged in.
3.	Display Visualizations for uploaded dataset.	Visualizations provided.	Visualizations provided.

8.2 USER ACCEPTANCE TESTING

1. Defect Analysis

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	8	4	2	1	15
Duplicate	0	0	0	0	0
External	3	2	0	1	6
Fixed	4	0	1	1	6
Not Reproduced	0	0	1	0	1
Skipped	0	0	0	1	1
Won't Fix	0	0	1	0	1
Totals	15	6	5	4	30

2. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	25	0	0	25
Security	4	0	0	4
Outsource Shipping	5	0	0	4
Exception Reporting	6	0	0	6
Final Report Output	8	0	0	8
Version Control	4	0	0	4

CHAPTER 9

RESULTS

9.1 PERFORMANCE METRICS

S.No	Parameter	Screenshot / Values
1	Dashboard design	Dashboard consist of 8 graphs in 4 different tabs.
2	Data Responsiveness	Data was responsive for creating dashboard, story and report.
3	Amount Data to Rendered (DB2 Metrics)	Inventory management dataset which consists of 937 data in it.
4	Utilization of Data Filters	Data filters was used to find the top most of the data in form of visualization.
5	Effective User Story	Story consists of 5 scenes and 3 graphs
6	Descriptive Reports	Created 1 reports with 3 graphs.

CHAPTER 10

ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES

- Increased accuracy for effective heart disease diagnosis.
- Handles roughest (enormous) amount of data using feature selection.
- Reduce the time complexity of doctors.
- Cost effective for patients

.10.2 DISADVANTAGES

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

CHAPTER 11
CONCLUSION

Heart Disease is one of the major concerns for society today. It is difficult to manually determine the odds of getting heart disease based on risk factors. This project predicts people with cardiovascular disease by extracting the patient medical history that leads to a fatal heart disease from a dataset that includes patients' medical history such as chest pain, sugar level, blood pressure, etc. This system performs realistically well even without retraining. Furthermore, the experimental results show that the system predicts heart disease.

CHAPTER 12
FUTURE SCOPE

Improve cardiovascular health and quality of life through prevention, detection, and treatment of risk factors for heart attack and stroke; early identification and treatment of heart attacks and strokes; prevention of repeat cardiovascular events; and reduction in deaths from cardiovascular disease.

Be sure to eat plenty of fresh fruits and vegetables and fewer processed foods. Eating lots of foods high in saturated fat and trans fat may contribute to heart disease. Eating foods high in fiber and low in saturated fats, trans fat, and cholesterol can help prevent high cholesterol.

CHAPTER 13

APPENDIX

SOURCE CODE

Index.html

```html
<!DOCTYPE html>
<html lang="en" dir="ltr">
<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>Heart Disease Prediction</title>
    <link rel="stylesheet" href="../static/style.css">
    <link rel="icon" href="./image/icon.png">
</head>
<body >
        <div class="bc">
            <div class="nav container">
                <div><a href="/signup" style="color:white ;text-decoration:none;
font-size :22px; font-weight: 500;" class="s">Sign up</a>
                <a href="/login" style="color: white; text-decoration:none; font-
size:22px; font-weight: 500;" class="l">Login </a></div>
            </div>
```

```html
        <!-- <img src="../imaggee/bluebc.jpg" alt="imagee"style ="padding-
right: 75px; padding-top: 50px; align-content: right; width:500px; height:250px;
display: inline-block; float: right;"> -->

        <h1 style="color: white; padding: 40px;">"Be smart, protect your
heart"</h1>

        <div class="card">

            <h4>Wanna Know some crazy facts about heart?</h4><a href="/facts"
class="click">Click here</a>

        </div>

        <div class="card">

            <h4>To know about best exercises for heart</h4><a href="/exercise"
class="click">Click here</a>

        </div>

        <div class="card">

            <h4>Looking for healthy foods for heart?</h4><a href="/foods"
class="click">Click here</a>

        </div>

        </div>


</body>

</html>
```

Login.html

```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>Heart Disease Prediction</title>
  <link rel="stylesheet" href="../static/style.css">
  <link rel="icon" href="./image/icon.png">
</head>
<body class="bc">
  <h1 style="text-align:center;color: rgb(248, 239, 248);">LOGIN HERE!!!</h1>
  <section class="login">
  <form>
    <input type="text" placeholder="Username" class="f">
    <br>
    <input type="password" placeholder="password" class="f f1">
    <br><br><br>
    <a href="/main" class="btn">Submit</a>
```

```
    </form>

</section></body></html>
```

Signup.html

```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>Heart Disease Prediction</title>
  <link rel="stylesheet" href="../static/style.css">
  <link rel="icon" href="../image/icon.png">
</head>
<body class="bc">
  <h1 style="color:white ;text-align: center;">REGISTER HERE!!!</h1>
  <form class="reg">
    <input type="text" placeholder="Enter your name" class="f"><br><br>
    <input type="email" placeholder="Enter email address" class="f"><br><br>
    <input type="password" placeholder="Enter Password" class="f"><br><br>
    <input type="password" placeholder="Confirm Password"
class="f"><br><br><br>
    <a href="/login" class="btn">Submit</a>
  </form>
</body>
```

```html
</html>
```

Main.html

```html
<!DOCTYPE html>
<html lang="en" dir="ltr">
<head>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Heart Disease Predictor</title>
  <link rel="stylesheet" type="text/css" href="{{ url_for('static',
filename='style.css') }}">
  <!-- <script src="https://kit.fontawesome.com/5f3f547070.js"
crossorigin="anonymous"></script>
  <link href="https://fonts.googleapis.com/css2?family=Pacifico&display=swap"
rel="stylesheet"> -->
  <link rel="stylesheet" href="../static/style.css">
</head>
<body class="bc">
  <div class="">
    <form action="{{ url_for('predict')}}" method="POST" class="det">
      <label for="age">Age</label>
      <input type="text" id="age" name="age" placeholder="Your age.." required =
"required"><br><br>
```

```html
<label for="sex">Sex</label>
<select id="sex" name="sex" required = "required" >
 <option selected>----select option----</option>
 <option value="1">Male</option>
 <option value="0">Female</option>
</select><br><br>
<label for="cp">Chest Pain Type</label>
<select id="cp" name="cp" required = "required">
 <option selected>----select option----</option>
 <option value="0">Typical Angina</option>
 <option value="1">Atypical Angina</option>
 <option value="2">Non-anginal Pain</option>
 <option value="3">Asymtomatic</option>
</select><br><br>
<label for="trestbps">Resting Blood Pressure</label>
<input type="text" id="trestbps" name="trestbps" placeholder="A number in
range [94-200] mmHg" required = "required"><br><br>
<label for="chol">Serum Cholesterol</label>
<input type="text" id="chol" name="chol" placeholder="A number in range
[126-564] mg/dl" required = "required"><br><br>
<label for="fbs">Fasting Blood Sugar</label>
<select id="fbs" name="fbs" required = "required">
 <option selected>----select option----</option>
 <option value="1">Greater than 120 mg/dl</option>
 <option value="0">Less than 120 mg/dl</option>
</select><br><br>
```

```html
<label for="restecg">Resting ECG Results</label>

<select id="restecg" name="restecg" required = "required">

 <option selected>----select 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><br><br>

<label for="thalach">Max Heart Rate </label>

<input type="text" id="thalach" name="thalach" placeholder="A number in
range [71-202] bpm" required = "required"><br><br>

<label for="exang">Exercise-induced Angina</label>

<select id="exang" name="exang" required = "required">

 <option selected>----select option----</option>

 <option value="1">Yes</option>

 <option value="0">No</option>

</select><br><br>

<label for="oldpeak">ST depression</label>

<input type="text" id="oldpeak" name="oldpeak" placeholder="ST
depression, typically in [0-6.2]" required = "required"><br><br>

<label for="slope">slope of the peak exercise ST segment</label>

<select id="slope" name="slope" required = "required">

 <option selected>----select option----</option>

 <option value="0">Upsloping</option>

 <option value="1">Flat</option>

 <option value="2">Downsloping</option>
```

```html
    </select><br><br>


    <label for="ca">Number of Major vessels</label>

    <input type="text" id="ca" name="ca" placeholder="Typically in [0-4]"
required = "required"><br><br>

    <label for="thal">Thalassemia</label>

    <select id="thal" name="thal" required = "required">

     <option selected>----select option----</option>

     <option value="0">Normal</option>

     <option value="1">Fixed Defect</option>

     <option value="2">Reversible Defect</option>

    </select><br><br>

   <input type="submit" class="my-cta-button" value="Predict" required =
"required">

  </form>

 </div>

</body>

</html>
```

Result.html

```html
<!DOCTYPE html>
<html lang="en" dir="ltr">
  <head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Heart Disease Predictor</title>
    <link rel="shortcut icon" href="{{ url_for('static', filename='diabetes-favicon.ico') }}">
    <!-- <script src="https://kit.fontawesome.com/5f3f547070.js" crossorigin="anonymous"></script> -->
    <link rel="stylesheet" href="../static/style.css">
    <!-- <link href="https://fonts.googleapis.com/css2?family=Pacifico&display=swap" rel="stylesheet">
    <link rel="stylesheet" type="text/css" href="{{ url_for('static', filename='style.css') }}"> -->
</head>
<body class="bc">
 <!-- Result -->
    <div class="results">
        {% if prediction==1 %}
```

```html
        <h1 class="h1"><span class="spn">Prediction</span><br><span
class='danger'>Oops! You have Chances of Heart Disease.</span></h1>


        {% elif prediction==0 %}

            <h1 class="h1"><span class="spn">Prediction</span><br><span
class='safe'>Great! You DON'T have chances of  Heart Disease.</span></h1>


        {% endif %}

    </div>

    <a href="/dash" class="btnd">Check Dashboard </a>

  </body>

</html>
```

Dash.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>Heart Disease Prediction</title>
  <link rel="stylesheet" href="../static/style.css">
  <link rel="icon" href="./image/icon.png">
</head>
<body>
  <div class="navv">
    <a href="/home" class="hh">Home</a>
  </div>
  <iframe
src="https://us3.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRef=.
my_folders%2Fheart_prediction_dashboard&amp;

closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;

action=view&amp;mode=dashboard&amp;subView=model000001845798b59a_0
```

0000002" width="1500" height="750" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

</body>

</html>

Exercise.html

```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>Heart Disease Prediction</title>

   <link rel="stylesheet" href="../static/style.css">

   <link rel="icon" href="/Heart-Disease-Prediction-
Deployment/image/icon.png">

</head>

<body class="bc">

   <div class="navv">

      <a href="/home" class="hh">Home</a>

   </div>

   <h1 style="color:white; padding-top: 0px; padding-left: 8px;">BEST
EXERCISES FOR A HEALTHY HEART</h1>

    <div style="border:1px solid blue; background-color:rgb(188, 218, 244);
height: 490px; width: 400px; margin: 30px; padding: 20px; font-weight: 500;">

      <p>1.Tadasana (Mountain pose)</p>

      <p>2.Vrikshasana (Tree pose)</p>
```

```
        <p>3.Swimming</p>

        <p>4.Walking</p>

        <p>5.Weight training</p>

        <p>6.Cycling</p>

        <p>7.Breathing exercises</p>

        <p>8.Running</p>

        <p>9.Strength training</p>

        <p>10.Jumping</p>

    </div>

</body>

</html>
```

Facts.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>Heart Disease Prediction</title>

    <link rel="stylesheet" href="../static/style.css">

    <link rel="icon" href="/Heart-Disease-Prediction-
Deployment/image/icon.png">

</head>

<body class="bc">

    <div class="navv">
```

```html
    <a href="/home" class="hh">Home</a>

  </div>

  <h1 style="color:white; padding-top:0px; padding-left: 8px;">INTERESTING
FACTS ABOUT HUMAN HEART!!</h1>

   <div style="border:1px solid blue; background-color:rgb(188, 218, 244);
height: 560px; width: 490px; margin: 30px; padding: 20px; font-weight: 500;">

   <p>1) The average heart is the size of a fist in an adult</p>

   <p>2) The earliest known case of heart disease was identified in the remains of
a 3,500-year-old Egyptian mummy</p>

   <p>3) The fairy fly, which is a kind of wasp, has the smallest heart of any
living creature</p>

   <p>4) Most heart attacks happen on a Monday</p>

   <p>5) If you were to stretch out your blood vessel system, it would extend over
60,000 miles</p>

   <p>6) Heart cells stop dividing, which means heart cancer is extremely
rare</p>

   <p>7) A woman's heart beats slightly faster than a man's heart</p>

   <p>8) Other than the cornea, every cell in the human body gets blood from the
heart</p>

   <p>9) Your heart pumps about 1.5 gallons of blood every minute. Over the
course of a day, that adds up to over 2,000 gallons</p>

   <p>10)Your heart beats over 100,000 times per day </p>

   </div>

</body>

</html>
```

Foods.html

```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>Heart Disease Prediction</title>
    <link rel="stylesheet" href="../static/style.css">
    <link rel="icon" href="/Heart-Disease-Prediction-
Deployment/image/icon.png">
</head>
<body class="bc">
    <div class="navv">
        <a href="/home" class="hh">Home</a>
    </div>
    <h1 style="color:white; padding-top:0%; padding-left: 8px;">BEST FOODS
FOR A HEALTHY HEART</h1>
    <div style="border:1px solid blue; background-color:rgb(188, 218, 244);
height: 490px; width: 400px; margin: 30px; padding: 20px; font-weight: 500;">
        <p>1.Leafy green vegetables</p>
        <p>2.Whole grains</p>
```

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```html
        <p>3.Berries</p>

        <p>4.Fatty fish and fish oil</p>

        <p>5.Walnuts</p>

        <p>6.Beans</p>

        <p>7.Tomatoes</p>

        <p>8.Almonds</p>

        <p>9.Garlic</p>

        <p>10.Green tea</p>

        <p>11.Olive oil</p>

    </div>

</body>

</html>
```

Style.css

```css
@import
url('https://fonts.googleapis.com/css2?family=Poppins:wght@300;400;500;600&display=swap');

*{

    font-family: 'Poppins', sans-serif;

}



.login{

    text-align: center;

    background-color: rgb(136, 212, 254);

    color: rgb(63, 60, 241);
```

```css
    border: 1px solid grey;

    border-radius: 20px;

    height: 300px;

    width: 450px;

    margin-left: 35%;

    padding-top: 102px;

    margin-top: 30px;

    border-radius: 6px;

}

.reg{

    text-align: center;

    background-color: rgb(136, 212, 254);

    color: rgb(63, 60, 241);

    border: 1px solid grey;

    border-radius: 18px;

    height: 500px;

    width: 490px;

    margin-left: 35%;

    padding-top: 102px;

    margin-top: 30px;

}

.det1{

    text-align: center;

    background-color: rgb(136, 212, 254);

    color: rgb(63, 60, 241);
```

```css
    border: 1px solid grey;

    border-radius: 18px;

    height: 560px;

    width: 520px;

    margin-left: 35%;

    padding-top: 80px;

    margin-top: 30px;

}

.det{

    text-align: center;

    background-color: rgb(136, 212, 254);

    color: rgb(232, 232, 248);

    border: 1px solid grey;

    border-radius: 18px;

    height: 680px;

    width: 520px;

    margin-left: 35%;

    padding-top: 80px;

    margin-top: 30px;

    font-weight: 700;

}

.f{

    font-size: 20px;

    padding:16px;
```

```css
    border: 1px solid  rgb(63, 60, 241);

    margin-left: 4%;

    margin-right:10%;

}

.f1{

    margin-top: 28px;

    margin-left: 5%;

    margin-right: 10%;



}

.d{

    padding: 13px;

    font-size: 16px;

}

.d1{

    padding: 12px;

    font-size: 16px;

}

.btn{

  border: 1px solid rgb(63, 60, 241);

  background-color: aliceblue;

  padding: 12px 36px;

  border-radius: 30px;

  text-decoration: none;
```

```css
}
.btnd{
    border: 1px solid rgb(63, 60, 241);
    background-color: aliceblue;
    padding: 12px 36px;
    border-radius: 30px;
    text-decoration: none;
    position:relative;
    left:42%;
    right:20%;
    bottom:0%;
    top:75%;
}
.bc {
    background-image: url("bluebc.jpg");
    background-color:darkblue;
    width: 100%;
    background-position: center;
    background-repeat: no-repeat;
    background-size: cover;
    position: relative;
    margin-top: 0px;
}
```

```css
.nav{
  background-color: rgb(136, 212, 254);
  color: white;
  text-decoration: none;
  height:60px;
  position: relative;
  margin-top: 0%;
}
.container{
  display: flex;
  flex-wrap: wrap;
}
.s{
  margin-left: 1200px;
  margin-right: 70px;
}
.card{
  border:2px solid grey;
  border-radius: 30px;
  background-color: rgb(141, 178, 248);
  color: white;
  height: 100px;
  width: 400px;
  margin:27px;
  padding: 13px;
```

```css
    font-size: 17px;

    justify-content: center;

    align-items: center;

}

.click{

    color: blue;

}

.hh{

    margin-left: 89%;

    color: rgb(205, 216, 225);

    font-size: 20px;

}

.results{

    padding: 15% 0 0;

    flex: 1 0 auto;

    align-items: center;

    align-content: center;

    justify-content: center;


}

.h1{

    font-weight: 600;

    margin-left: 28%;

    color: white;
```

```css
    border: 1px solid grey;

    background-color: rgb(141, 178, 248);

    height: 160px;

    width: 700px;

    border-radius: 40px;

    padding: 12px;

}

.spn{

    font-size: 70px;

    font-weight: 800;

    padding-left: 20%;

}
```

App.py

```python
# Importing essential libraries

from flask import Flask, render_template, request

import pickle

import numpy as np




# Load the Random Forest CLassifier model

filename = 'heart-disease-prediction-knn-model.pkl'

model = pickle.load(open(filename, 'rb'))
```

```python
app = Flask(__name__)


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


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


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


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


@app.route('/foods')
```

```python
def foods():
    return render_template('foods.html')


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




@app.route('/dash')
def dash():
    return render_template('dash.html')
@app.route('/facts')
def facts():
    return render_template('facts.html')
@app.route('/bluebc')
def bluebc():
    return render_template('../imaggee/bluebc.jpg')



@app.route('/predict', methods=['GET','POST'])
def predict():
    if request.method == 'POST':
```

```python
age = int(request.form['age'])

sex = request.form.get('sex')

cp = request.form.get('cp')

trestbps = int(request.form['trestbps'])

chol = int(request.form['chol'])

fbs = request.form.get('fbs')

restecg = int(request.form['restecg'])

thalach = int(request.form['thalach'])

exang = request.form.get('exang')

oldpeak = float(request.form['oldpeak'])

slope = request.form.get('slope')

ca = int(request.form['ca'])

thal = request.form.get('thal')


data =
np.array([[age,sex,cp,trestbps,chol,fbs,restecg,thalach,exang,oldpeak,slope,ca,thal]
])

my_prediction = model.predict(data)


return render_template('result.html', prediction=my_prediction)
```

```python
if __name__ == '__main__':

    app.run(debug=True)
```

Prediction.py

```python
# importing required libraries

import numpy as np

import pandas as pd

import pickle

from sklearn.preprocessing import StandardScaler

from sklearn.model_selection import train_test_split

from sklearn.linear_model import LogisticRegression

from sklearn.metrics import accuracy_score, classification_report,
confusion_matrix

from sklearn.ensemble import RandomForestClassifier

from sklearn.svm import SVC

from sklearn.linear_model import LogisticRegression

from sklearn.neighbors import KNeighborsClassifier

from sklearn.tree import DecisionTreeClassifier




# loading and reading the dataset
```

```python
heart = pd.read_csv("heart_cleveland_upload.csv")
```

```python
# creating a copy of dataset so that will not affect our original dataset.
heart_df = heart.copy()
```

```python
# Renaming some of the columns
heart_df = heart_df.rename(columns={'condition':'target'})
print(heart_df.head())
```

```python
# model building
```

```python
#fixing our data in x and y. Here y contains target data and X contains rest all the features.
x= heart_df.drop(columns= 'target')
y= heart_df.target
```

```python
# splitting our dataset into training and testing for this we will use train_test_split library.
x_train, x_test, y_train, y_test= train_test_split(x, y, test_size= 0.25, random_state=42)
```

```python
#feature scaling
scaler= StandardScaler()
x_train_scaler= scaler.fit_transform(x_train)
x_test_scaler= scaler.fit_transform(x_test)


# creating K-Nearest-Neighbor classifier
model=RandomForestClassifier(n_estimators=20)
model.fit(x_train_scaler, y_train)
y_pred= model.predict(x_test_scaler)
p = model.score(x_test_scaler,y_test)
print(p)


print('Classification Report\n', classification_report(y_test, y_pred))
print('Accuracy: {}%\n'.format(round((accuracy_score(y_test, y_pred)*100),2)))


cm = confusion_matrix(y_test, y_pred)
print(cm)


# Creating a pickle file for the classifier
filename = 'heart-disease-prediction-knn-model.pkl'
```

```
pickle.dump(model, open(filename, 'wb'))
```

Requirements.txt

Flask==1.1.2

gunicorn==20.1.0

itsdangerous==1.1.0

Jinja2==2.11.3

kiwisolver==1.3.1

MarkupSafe==1.1.1

matplotlib==3.4.1

numpy==1.20.2

pandas==1.2.4

scikit-learn==0.24.1

sklearn==0.0

threadpoolctl==2.1.0

Werkzeug==1.0.1

DASHBOARD LINK

https://us3.ca.analytics.ibm.com/bi/?perspective=dashboard&pathRef=.my_folders%2Fheart_prediction_dashboard&action=view&mode=dashboard&subView=model000001845798b59a_00000002

REPORT LINK

https://us3.ca.analytics.ibm.com/bi/?perspective=story&pathRef=.my_folders%2Fstory_heart_prediction&action=view&sceneId=model0000018479fa85ea_00000000&sceneTime=0

STORY LINK

https://us3.ca.analytics.ibm.com/bi/?perspective=story&pathRef=.my_folders%2Fstory_heart_prediction&action=view&sceneId=model0000018479fa85ea_00000000&sceneTime=0

GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-20238-1659715254

DEMO LINK

https://youtu.be/XJTP1ngEvko