

# Visualizing and Predicting Heart Diseases with an Interactive Dash Board

## 1 INTRODUCTION

### 1.1 Project Overview

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. Presently, diagnosis and treatment process are highly challenging due to inadequacy of physicians and diagnostic apparatus that affect the treatment of heart patients. Early diagnosis of heart disease is significant to minimize the heart related issues and to protect it from serious risks. The invasive techniques are implemented to diagnose heart diseases based on medical history, symptom analysis report by experts, and physical laboratory report. Moreover, it causes delay and imprecise diagnosis due to human intervention. It is time consuming, computationally intensive and expensive at the time of assessment. Heart disease can be predicted based on various symptoms such as age, gender, pulse rate etc. Data analysis in healthcare assists in predicting diseases, improving diagnosis, analysing symptoms, providing appropriate medicines, improving the quality of care, minimizing cost, extending the life span and reduces the death rate of heart patients. ECG (Electro Cardio Gram) helps in screening irregular heart beat and stroke with the embedded sensors by resting it on a chest in order to track the patient's heart beat. Heart disease prediction is being done with the detailed clinical data that could assist experts to make decision. Human life is highly dependent on proper functioning of blood vessels in the heart. The improper blood circulation causes heart inactivity, 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. Acute Myocardial Infarction (AMI) is the cardiovascular disease that happens due to interruption in the blood flow or circulation in the heart muscle, causes heart muscle to become necrotic (damage or die). 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. 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 132 R. Indrakumari et al. / Proceed Computer Science 173 (2020) 130–139 R. IndraKumari et al./ Proceed Computer Science 00 (2020) 000–000 3 investigating the cause of it are determined as a chronic inflammation. The increase in the amount of white blood cells causes inflammation and other subsequent disorders such as stroke or re infarction. Generally, there are two stages of wound healing in terms of monocytes and macrophages, namely, inflammatory and reparative stages. However, the two stages are compulsory for proper wound healing and if the inflammation is continued too long, then it leads to heart failure. An unusual type of heart disease is the acute spasm or contraction in the coronary arteries. The spasms become visible in arteries suddenly with no symptom of atherosclerosis. It blocks the blood flow that causes oxygen deprivation in the heart. Male genders are more likely to experience heart attack than females. Moreover, women can experience pain more than an hour and the duration to experience the pain of men is normally less than an hour. The cardiovascular disease has an impact in the complete physiological system, not only in the heart; changes occur everywhere that too in the remote organs such as bone marrow and spleen.

## **1.2 Purpose**

One of the leading causes of morbidity and mortality among the global population is heart disease. One of the most crucial topics in the clinical data analysis subsection is the prediction of cardiovascular disease. The volume of information in the healthcare sector is enormous. The vast amount of unprocessed healthcare data is transformed via data mining into knowledge that may be used to make forecasts and educated judgments. The main cause of death for both men and women is heart disease. This makes heart disease a serious issue that has to be addressed. However, because of numerous contributing risk factors, including diabetes, high blood pressure, high cholesterol, an irregular pulse rate, and many other factors, it can be challenging to diagnose heart disease. Due to such constraints, scientists have turned towards modern approaches like Data Mining and Machine Learning for predicting the disease.

## **2 LITERATURE SURVEY**

### **2.1 Existing problem**

1. Predicting the Risk of Heart Failure With EHR Sequential Data Modelling Bo Jin, Chao Che et al. (2018) proposed a "Predicting the Risk of Heart Failure With EHR Sequential Data Modelling" model designed by applying neural network. This paper used the electronic health record (EHR) data from real-world datasets related to congestive heart disease to perform the experiment and predict the heart disease before itself. We tend to used one-hot encryption and word vectors to model the diagnosing events and foretold coronary failure events victimization the essential principles of an extended memory network model. By analysing the results, we tend to reveal the importance of respecting the sequential nature of clinical records.

2.Heart Disease Prediction using Evolutionary Rule Learning Aakash Chauhan et al. (2018) presented "Heart Disease Prediction using Evolutionary Rule Learning". This study eliminates the manual task that additionally helps in extracting the information (data) directly from the electronic records. To generate strong association rules, we have applied frequent pattern growth association mining on patient's dataset. This will facilitate (help) in decreasing the amount of services and shown that overwhelming majority of the rules helps within the best prediction of coronary sickness.

### **2.2 References**

1. Jin, Bo, et al. "Predicting the risk of heart failure with EHR sequential data modeling." Ieee Access 6 (2018): 9256-9261.

2. Chauhan, Aakash, et al. "Heart disease prediction using evolutionary rule learning." 2018 4th International conference on computational intelligence & communication technology (CICT). IEEE, 2018.

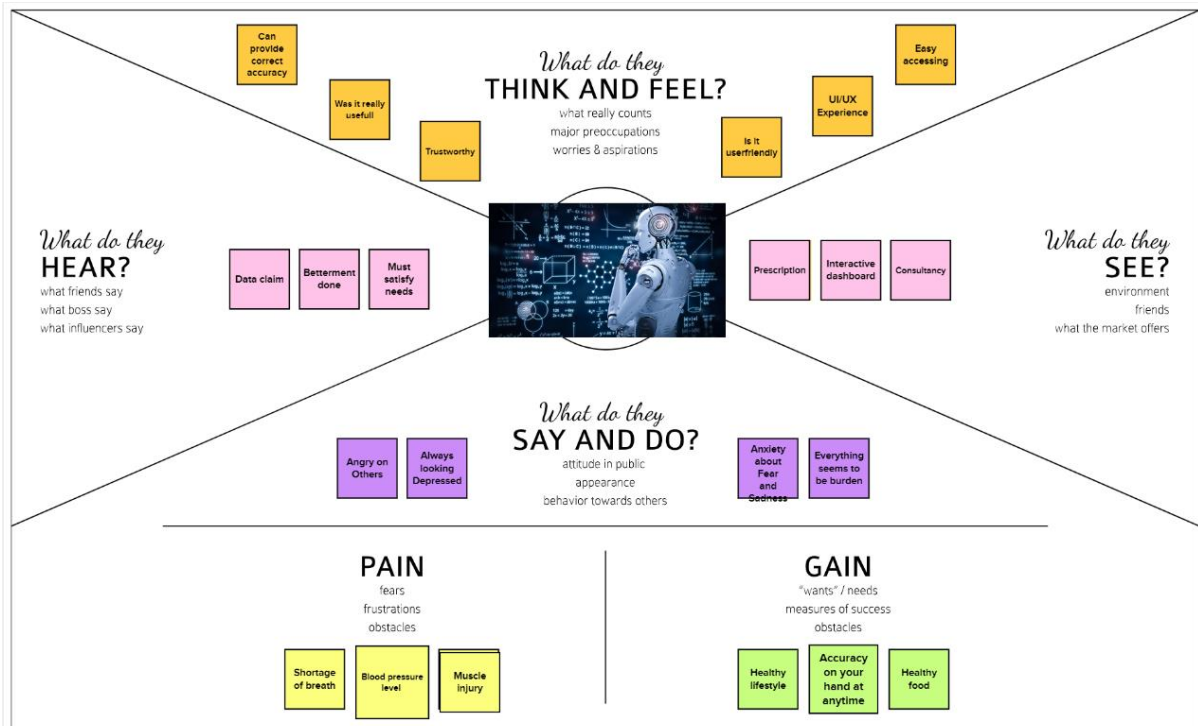
3. Javeed, Ashir, et al. "An intelligent learning system based on random search algorithm and optimized random forest model for improved heart disease detection." IEEE Access 7 (2019): 180235-180243

### **2.3 Problem Statement Definition**

<b>Who does the problem affect?</b>	Most persons with coronary heart disease who pass away are 60 years of age or older. Although both sexes can get heart attacks in old age, women have a higher mortality rate.
<b>What are the boundaries of the problem?</b>	Risk for heart disease can be increased by a number of medical issues, lifestyle, age, and family history.
<b>What's the issue?</b>	When a person is affected by heart disease, it causes side effects. Chest pain, chest tightness, chest pressure and chest discomfort Breathing difficulties, Neck, jaw, throat, upper abdomen, or back pain.
<b>When the issue occur?</b>	Heart disease - and the conditions that lead to it - can happen at any age. High rates of obesity and high blood pressure among younger people (ages 35–64) are putting them at risk for heart disease earlier in life.

### 3 IDEATION & PROPOSED SOLUTION

#### 3.1 Empathy Map Canvas

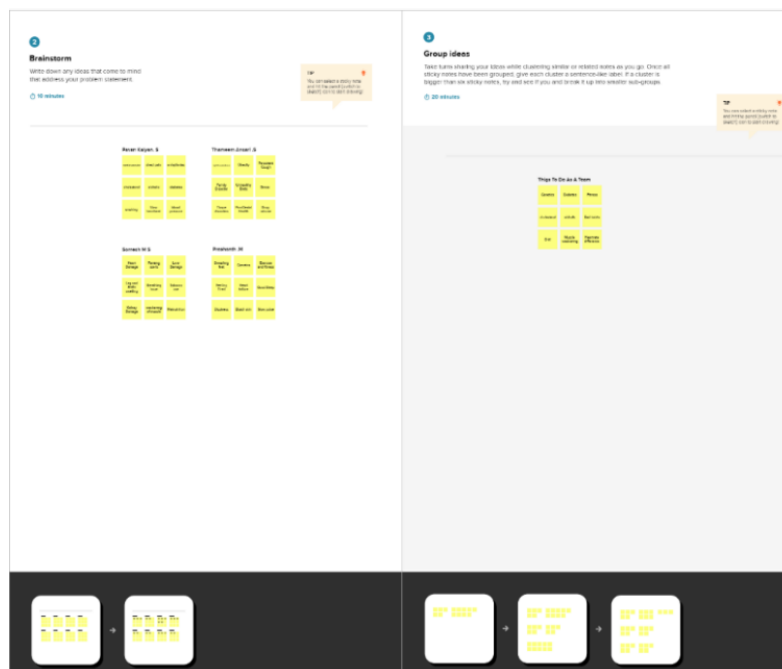


## 3.2 Ideation & Brainstorming

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



## Step-2: Brainstorm, Idea Listing and Grouping



## 3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To Develop an interactive dashboard to predict the heart disease accurately with few data's given by patient.
2.	Idea / Solution description	Analyzing the patient symptoms and identifying the heart related symptom using Cognos analytics.
3.	Novelty / Uniqueness	It Achieve maximum accuracy to provide prior treatment to the patients and reduce the fatality rate.
4.	Social Impact / Customer Satisfaction	User friendly (anyone can identify the problem using the interactive dashboard). Reduce the cost of the patient.
5.	Business Model (Revenue Model)	Data security. It has a huge revenue when it comes to the market.
6.	Scalability of the Solution	It can be used in any Platform (windows, max, etc...) Adding new feature doesn't affect the performance of the system.

### 3.4 Problem Solution fit

**Problem-Solution fit canvas 2.0** Purpose / Vision

Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> <b>CS</b> Who is your customer? i.e. working parents of 0-5 y.o. kids I. Heart Disease affected Patients	<b>6. CUSTOMER CONSTRAINTS</b> <b>CC</b> 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. Avoidable medical errors. Low treatable mortality rates. Lack of transparency. Difficulty finding a good doctor. High maintenance costs. The lack of insurance coverage. The shortage of nurses and doctors. A different perspective on solving the shortage crisis.	<b>5. AVAILABLE SOLUTIONS</b> <b>AS</b> 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. I. Eliminate the short-term practice of data cleansing. II. Learn how to perform analysis, visualizations and algorithms effectively. III. Heart disease prediction system aims to exploit data mining techniques on medical data set to assist in the prediction of the heart diseases.	Explore AS, differentiate
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> <b>J&amp;P</b> Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. <b>Quality of Data:</b> The quality of data we have should be accurate and reliable. Obviously, the outcome will solely depend on the data we put into the prediction. If the data is skewed, then the prediction which is dependent on it, will be skewed as well.	<b>9. PROBLEM ROOT CAUSE</b> <b>RC</b> 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. Leading risk factors for heart disease and stroke are high blood pressure, high low-density lipoprotein (LDL) cholesterol, diabetes, smoking and secondhand smoke exposure, obesity, unhealthy diet, and physical inactivity. Solutions: Don't smoke or use tobacco, eat a heart-healthy diet, maintain a healthy weight, manage stress, Get regular health screenings.	<b>7. BEHAVIOUR</b> <b>BE</b> 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) I. Develop or improve upon the strategic vision. II. Segment Patients with personalization. III. Disruptive conduct as they've an altered intellectual degree of worry of being sick, stressful approximately out of the pocket cost, alteration of way of life if suffered from a continual illness	
<b>3. TRIGGERS</b> <b>TR</b> What triggers customers to act? i.e. seeing their neighbour installing solar panels; reading about a more efficient solution in the news. Accuracy of Datasets, Information of ECG and Heart disease related tests for patients.	<b>10. YOUR SOLUTION</b> <b>SL</b> 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. The use of analytics in healthcare improves care by facilitating preventive care and EDA is a vital step while analysing data. The use of data analytics and virtualization tool to find 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.	<b>8. CHANNELS of BEHAVIOUR</b> <b>CH</b> <b>8.1 ONLINE</b> What kind of actions do customers take online? Extract online channels from #7 Patients will be a part of virtualization. For example, accessing and seeing all medical records in online. <b>8.2 OFFLINE</b> What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. I. Emergency stroke II. Surgery III. Regular checkup	Extract online & offline CH of BE	
<b>4. EMOTIONS: BEFORE / AFTER</b> <b>EM</b> How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure & confused, in control, use it in your communication strategy & design. Indicate that strong emotions, especially negative emotions, such as hostility, anger, depression and anxiety, precipitate coronary heart disease.	Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 license Created by Daria Nęgrakowska / Amaltama.com			

## 4 REQUIREMENT ANALYSIS

### 4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	The website has a home page Which lists the options	Two options- predict , dashboard
FR-2	A “predict” page	Predicts whether the person has heart disease or not
FR-3	A “dashboard” option	Shows the data entered in the form of charts

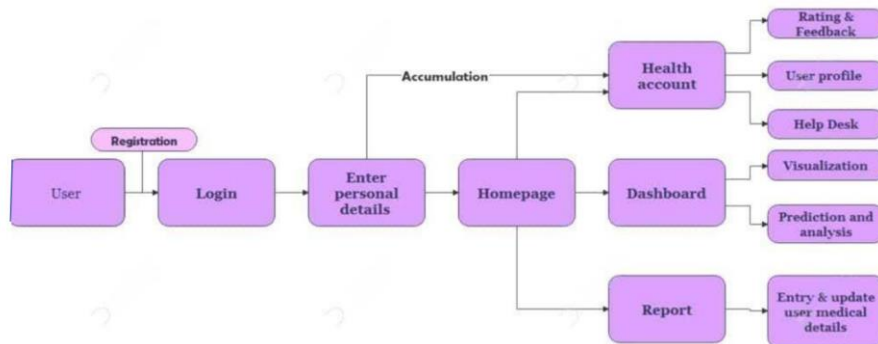
### 4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The website will utilise the user interface for navigation purposes
NFR-2	Security	The website will be protected against SQL injection, DDoS attacks.
NFR-3	Reliability	The model will give exact results most of the time
NFR-4	Performance	An optimized website which includes smooth experience for the user.
NFR-5	Availability	The tool will be available to use for the users.
NFR-6	Scalability	The system will be able to support n no of users at the same time with good speed.

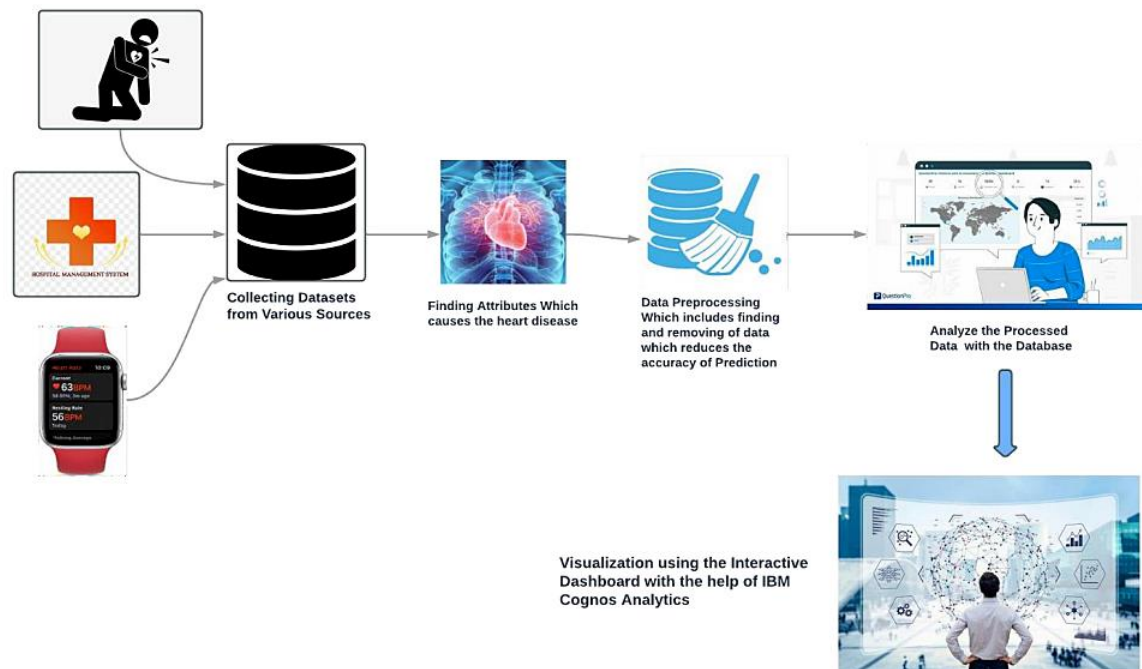


## 5 PROJECT DESIGN

### 5.1 Data Flow Diagrams



### 5.2 Solution & Technical Architecture



### 5.3 User Stories

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 Google	I can register & access my dashboard with Gmail login	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can access my account / Dashboard when logged in	High	Sprint-1
	Dashboard	USN-6	As a User, I can view my complete medical analysis & accuracy and prediction of heart disease in a dashboard	I can view my medical analysis in the dashboard	High	Sprint-2
	User entry	USN-7	As a User, I can enter my personal details for analysis	I can view the details in my health account	High	Sprint-2
		USN-8	As a User, I can entry my medical records & symptoms	I can view the analysis in a dashboard	High	Sprint-2

## 6 PROJECT PLANNING & SCHEDULING

### 6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Cholesterol Level	USN-1	Cholesterol is essential for your body to work, although too much 'bad cholesterol' can lead to fatty deposits building up in your arteries. These fatty deposits can increase your risk of developing heart conditions.	2	High	Pavan Kalyan. S Thameem Ansari. S Somesh M S Prashanth .M
Sprint-2	Thallium	USN-2	As in humans, animal studies indicate that exposure to large amounts of thallium for brief periods of time can damage the nervous system and heart and can cause death.	1	Low	Pavan Kalyan. S Thameem Ansari. S Somesh M S Prashanth .M
Sprint-3	EKG(Electro Cardiogram)	USN-3	An electrocardiogram (ECG or EKG) records the electrical signal from the heart to check for different heart conditions. Electrodes are placed on the chest to record the heart's electrical signals, which cause the heart to beat.	2	High	Pavan Kalyan. S Thameem Ansari. S Somesh M S Prashanth .M
Sprint-3	Exercise Angina	USN-4	Angina is a symptom of coronary artery disease.A type of chest pain caused by reduced blood flow to the heart.	2	High	Pavan Kalyan. S Thameem Ansari. S Somesh M S Prashanth .M

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	ST depression	USN-5	An ST-elevation myocardial infarction (STEMI) is a type of heart attack that is more serious and has a greater risk of serious complications and death.	1	Medium	Pavan Kalyan. S Thameem Ansari. S Somesh M S Prashanth .M
	Dashboard	USN-6				

### 6.2 Sprint Delivery Schedule

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	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

## 7 CODING & SOLUTIONING

### 7.1 Feature Dashboard

Using Cognos Analytics, dashboard is created which shows the relation between attributes and how they are responsible for chances of heart disease. The dashboard is incorporated in website using iframe. It is mandatory to have an IBM account to view the dashboard. As soon as the page is loaded, it asks to sign in to the IBM account. Once signed in, user can view the dashboard. Dashboard has multiple tabs, each containing a chart of relation between attributes. The above code shows how dashboard is included in the website

```

19     color: white;
20     text-shadow: 2px 2px #ff0000;
21     text-align: center;
22 }
23 .dashboard {
24     display: flex;
25     align-items: center;
26 }
27 iframe {
28     margin: 0 auto;
29     max-width: 80%;
30 }
31 </style>
32 </head>
33 <body>
34     <div class="main-container">
35         <marquee>
36             Please enable any pop-up blocked and sign in to your IBM account
37         </marquee>
38         <h3>
39             This dashboard needs you to have a IBM account. So please create one if
40             you don't have any.
41         </h3>
42         <div class="dashboard">
43             <iframe
44                 src="https://sa1.ca.analytics.ibm.com/bi/?perspective=dashboard&pathRef=.my_folders%2FInteractive%2BDashboard&am
45                 width="800"
46                 height="600"
47                 frameborder="0"
48                 gesture="media"
49                 allow="encrypted-media"
50                 allowfullscreen=""></iframe>
51         </div>
52     </div>
53 </body>
54 </html>
55

```

## Feature 2 - Predictor

The above code shows how user input is got as form and how it is processed and given as input to machine learning model. Which in turn gives if heart disease is present or absent.

```

16 <div class="main-container">
17 <div>Please fill in the details:</div>
18 <form name="form", method="POST", style="text-align: center">
19 <label for="text" name="name">Name: </label>
20 <input type="text" name="name" />
21
22 <label for="text" name="age">Age: </label>
23 <input type="text" name="age" />
24
25 <label for="text" name="sex">Sex: </label>
26 <select name="sex">
27 <option value="1">Male</option>
28 <option value="0">Female</option>
29 </select>
30
31 <label for="cp">Chest pain type: </label>
32 <select name="cp">
33 <option value="1">Typical angina</option>
34 <option value="2">Atypical angina</option>
35 <option value="3">Non-anginal pain</option>
36 <option value="4">Asymptomatic</option>
37 </select>
38
39 <label for="trestbps">Resting Blood Sugar: </label>
40 <input type="text" name="trestbps" />
41
42 <label for="chol">Serum Cholesterol in mg/dl: </label>
43 <input type="text" name="chol" />
44
45 <label for="fbs">Fasting Blood Sugar higher than 120 mg/dl: </label>
46 <select name="fbs">
47 <option value="1">True</option>
48 <option value="0">False</option>
49 </select>
50
51 <label for="restecg">Resting Electrocardiographic Results: </label>
52 <select name="restecg">

```

```

21 @app.route('/predict', methods=['GET', 'POST'])
22 def predict():
23     if request.method == "POST":
24         import pickle
25         import numpy as np
26         model = pickle.load(open("./heart_disease.sav", "rb"))
27         scaled = pickle.load(open("./scaled.sav", "rb"))
28         name = request.form.get("name")
29         age = request.form.get("age")
30         sex = request.form.get("sex")
31         cp = request.form.get("cp")
32         trestbps = request.form.get("trestbps")
33         chol = request.form.get("chol")
34         fbs = request.form.get("fbs")
35         restecg = request.form.get("restecg")
36         thalach = request.form.get("thalach")
37         exang = request.form.get("exang")
38         oldpeak = request.form.get("oldpeak")
39         slope = request.form.get("slope")
40         ca = request.form.get("ca")
41         thal = request.form.get("thal")
42         user_input = [age, sex, cp, trestbps, chol, fbs, restecg, thalach, exang, oldpeak, slope, ca, thal]
43         user_input = np.array(user_input)
44         user_input = user_input.reshape(1, -1)
45         user_input = scaled.fit_transform(user_input)
46         prediction = model.predict(user_input)
47         print(prediction)
48         if prediction == "Presence":
49             output = "Sorry " + name + ", you are at high risk of having a heart disease. Please consult a doctor as soon as possible"
50             image = "../static/high-risk.jpg"
51         elif prediction == "Absence":
52             output = "Hi " + name + ", you are at low risk of having a heart disease. If you are still not convinced please consult a doctor"
53             image = "../static/low-risk.jpg"
54         else:
55             output = "Hey " + name + ", there was some error processing your details. Please try again later."
56             image = "../static/error.png"
57         return render_template("result.html", output = output, result_image = image)
58     return render_template("predictor.html")

```

## 8 TESTING

## 8.1 Test Cases

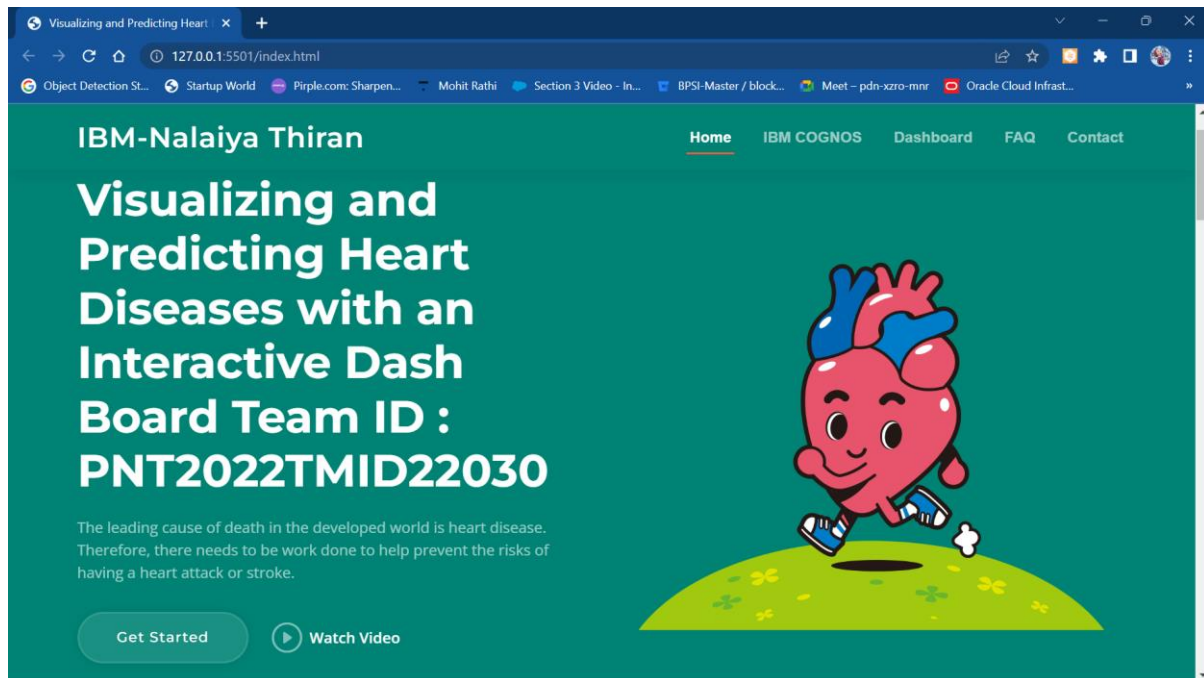
Test case ID	Test case description	Expected results	Actual results	Pass/Fail
TC01	Check for valid IBM account	User should see the IBM cognos dashboard	As Expected	Pass
TC02	Check for invalid IBM account	User should not see the IBM Cognos dashboard	As Expected	Pass
TC03	Check for values in all the Input boxes	User should see whether he/she has high risk or low risk of getting affected by heart disease	As Expected	Pass
TC04	Check for empty values in any one of the input boxes	User should not see whether he/she has high risk or low risk of getting affected by heart disease	As Expected	Pass

## 8.2 User Acceptance Testing

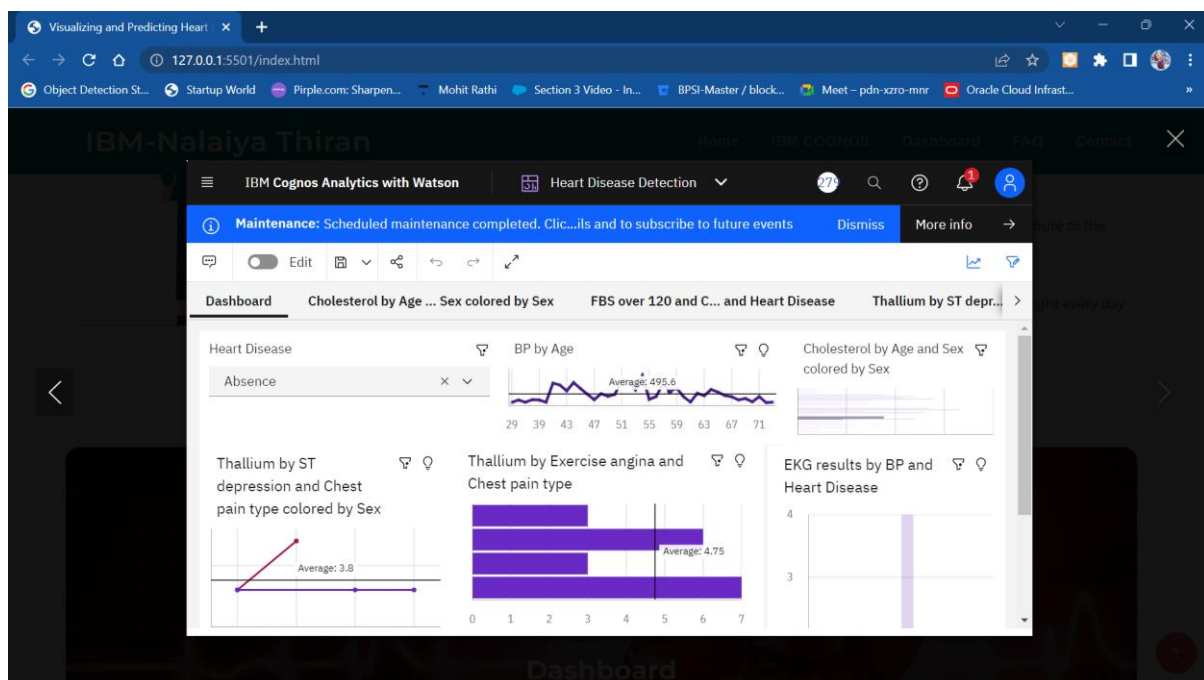
Test case ID	Test case description	Acceptance criteria	Actual results	Pass/Fail
TC01	As a user, I can go to homepage	I can access predictor or dashboard	As Expected	Pass
TC02	As a user, I can click on dashboard	I will see dashboard	As Expected	Pass
TC03	As a user, I can click on predict	I will see form for prediction	As Expected	Pass
TC04	As a user, I can interact with dashboard	I can change parameters of the charts	As Expected	Pass
TC05	As a user, I can access prediction form	I can fill form	As Expected	Pass
TC06	As a user I can submit the form	I can see if I have heart disease or not	As Expected	Pass

## 9 RESULTS

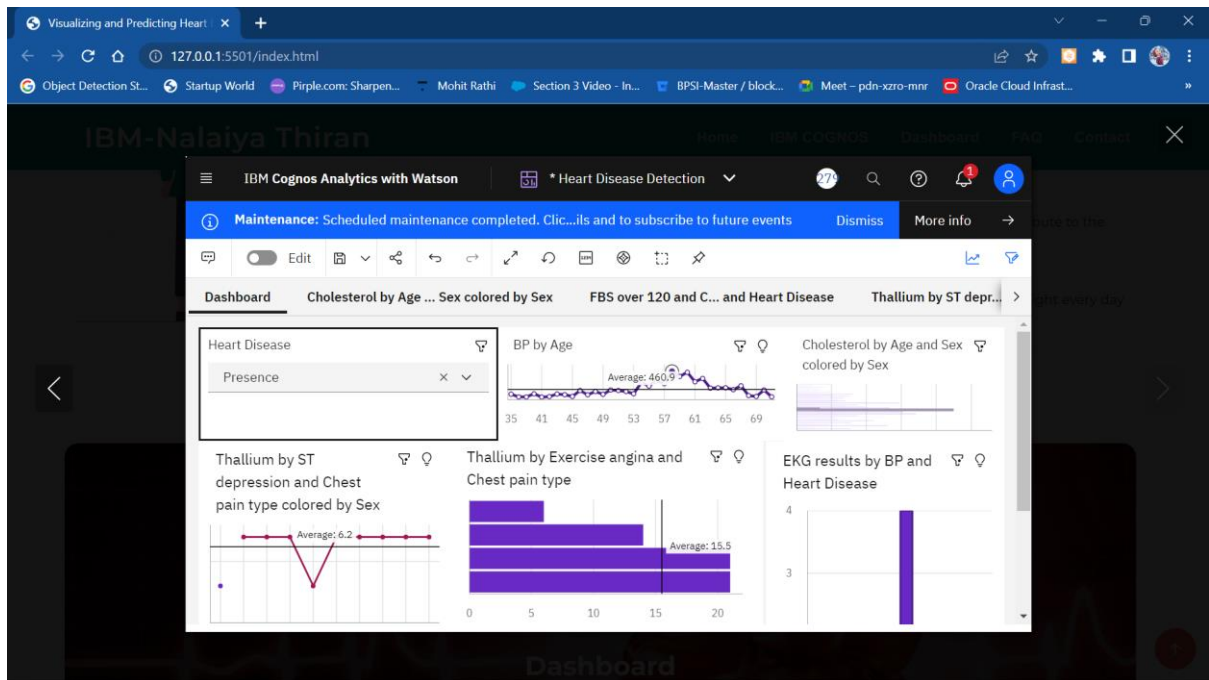
## 9.1 Homepage



## 9.2 Dashboard





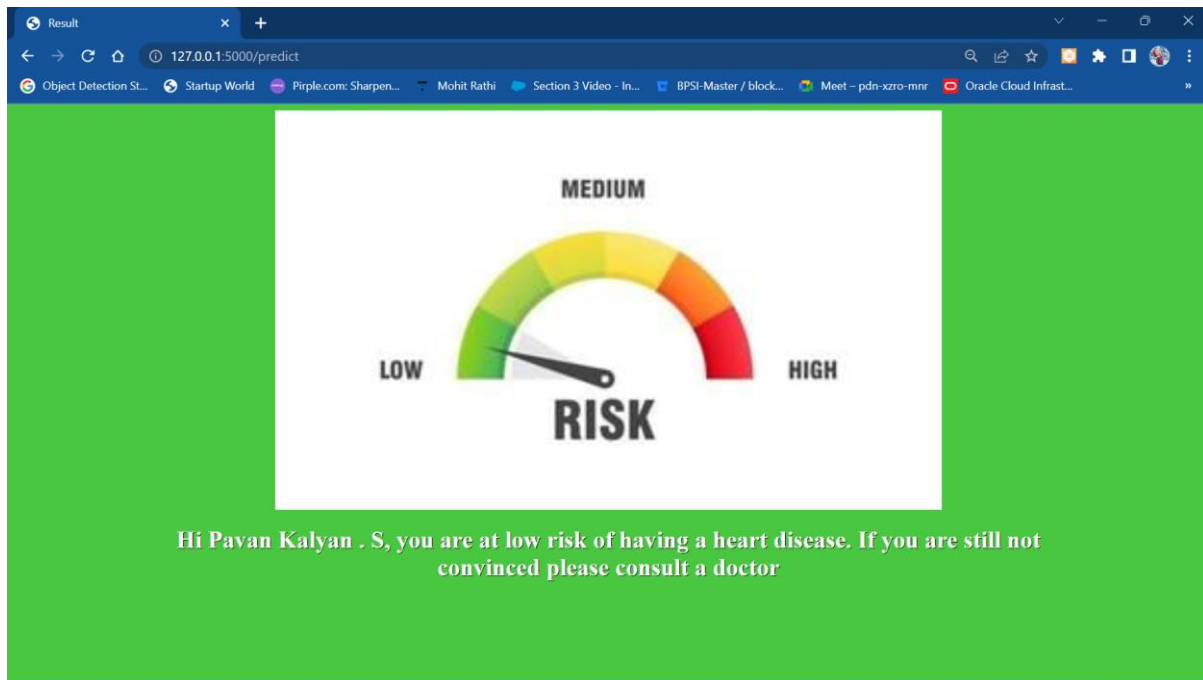


## Prediction Form

The Prediction Form is a web-based interface for inputting patient data to generate heart disease predictions. It includes the following fields:

- Name:
- Age:
- Sex:
- Chest pain type:
- Resting Blood Sugar:
- Serum Cholesterol in mg/dl:
- Fasting Blood Sugar higher than 120 mg/dl:
- Resting Electrocardiographic Results:
- Maximum Heart Rate Achieved:
- Exercise Induced Angina:
- Oldpeak:
- Heart Rate Slope:
- Number of Major Vessels Colored by Fluoroscopy:
- Thallium Stress Result:

A 'Get Predictions' button is located at the bottom of the form.



## 10 ADVANTAGES & DISADVANTAGES

### 10.1 Advantages

1. Reduce the work of doctors
2. Users can know the result instantly
3. Can change parameters of charts in dashboard

### 10.2 Disadvantages

4. Can have unwanted biases and errors
5. Diagnosis from doctor is more trusted than an online predictor

## 11 CONCLUSION

This project predicts if people have cardiovascular disease using their medical history. Using a dataset that includes parameters such as chest pain, sugar level, blood pressure, etc, a dashboard is constructed which showcases the relation between attributes. A machine learning model is also created with the same dataset to predict the chances of a user having heart disease.

## 12 FUTURE SCOPE

Using more robust dataset with more necessary parameters, the accuracy of prediction can be increased. In collaboration with hospitals, doctors can be suggested with contact information. People can also book appointments through the website. The dashboard can be expanded to have more charts and relations.

## 13 APPENDIX

### 13.1 Source Code

```
app.py > predict
1  from flask import Flask, request, render_template, redirect
2  import joblib
3  import requests
4
5  # Declare a Flask app
6  app = Flask(__name__)
7
8  @app.route('/', methods=['GET', 'POST'])
9  def main():
10     if request.method == "POST":
11         if request.form.get("predict")=="predict":
12             return redirect("/predict")
13         if request.form.get("dashboard")=="dashboard":
14             return redirect("/dashboard")
15     return render_template("website.html")
16
17 @app.route('/dashboard', methods=['GET', 'POST'])
18 def dashboard():
19     return render_template("dashboard.html")
20
21 @app.route('/predict', methods=['GET', 'POST'])
22 def predict():
23     if request.method == "POST":
24         import pickle
25         import numpy as np
26         model = pickle.load(open(r"./heart_disease.sav", "rb"))
27         scaled = pickle.load(open(r"./scaler.sav", "rb"))
28         name = request.form.get("name")
29         age = request.form.get('age')
30         sex = request.form.get('sex')
31         cp = request.form.get('cp')
32         trestbps = request.form.get('trestbps')
```

```
app.py > predict
32     trestbps = request.form.get('trestbps')
33     chol = request.form.get('chol')
34     fbs = request.form.get('fbs')
35     restecg = request.form.get('restecg')
36     thalach = request.form.get('thalach')
37     exang = request.form.get('exang')
38     oldpeak = request.form.get('oldpeak')
39     slope = request.form.get('slope')
40     ca = request.form.get('ca')
41     thal = request.form.get('thal')
42     user_input = [age,sex,cp,trestbps,chol,fbs,restecg,thalach,exang,oldpeak,slope,ca,thal]
43     user_input = np.array(user_input)
44     user_input = user_input.reshape(1,-1)
45     user_input = scaled.fit_transform(user_input)
46     prediction = model.predict(user_input)
47     print(prediction)
48     if prediction=='Presence':
49         output = "Sorry "+name+", you are at high risk of having a heart disease. Please consult a doctor as soon
50         image = "../static/high-risk.jpg"
51     elif prediction=='Absence':
52         output = "Hi "+name+", you are at low risk of having a heart disease. If you are still not convinced plea
53         image = "../static/low-risk.jpg"
54     else:
55         output = "Hey "+name+", there was some error processing your details. Please try again later."
56         image = "../static/error.png"
57     return render_template("result.html", output = output, result=image)
58     return render_template("predictor.html")
59
60 # Running the app
61 if __name__ == '__main__':
62     app.run(debug = True)
63
```

```
PROBLEMS OUTPUT TERMINAL JUPYTER DEBUG CONSOLE
Python + - - - - -
PS C:\Users\mysel_jynj310\OneDrive\Documents\IBM-Project-25300-1659957984-main\Final Deliverables\Code> conda activate base
PS C:\Users\mysel_jynj310\OneDrive\Documents\IBM-Project-25300-1659957984-main\Final Deliverables\Code> & C:/Users/mysel_jynj310/anaconda3/python.exe "c:/Users/mysel_jynj310/OneDrive\Documents\IBM-Project-25300-1659957984-main\Final Deliverables\Code/app.py"
* Serving Flask app "app" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: on
* Restarting with watchdog (windowsapi)
* Debugger is active!
* Debugger PIN: 126-280-528
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
* Detected change in 'C:\Users\mysel_jynj310\anaconda3\Scripts\pip-script.py', reloading
* Restarting with watchdog (windowsapi)
* Debugger is active!
* Debugger PIN: 126-280-528
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [18/Nov/2022 15:17:22] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [18/Nov/2022 15:17:26] "POST / HTTP/1.1" 302 -
```

index.html

```

index.html > html > body > section#hero.hero
1  <!DOCTYPE html>
2  <html lang="en">
3
4  <head>
5    <meta charset="utf-8">
6    <meta content="width=device-width, initial-scale=1.0" name="viewport">
7
8    <title>Visualizing and Predicting Heart Diseases
9      with an Interactive Dash Board - Index</title>
10   <meta content="" name="description">
11   <meta content="" name="keywords">
12
13   <!-- Favicons -->
14   <link href="assets/img/favicon.png" rel="icon">
15   <link href="assets/img/apple-touch-icon.png" rel="apple-touch-icon">
16
17   <!-- Google Fonts -->
18   <link rel="preconnect" href="https://fonts.googleapis.com">
19   <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
20   <link href="https://fonts.googleapis.com/css2?family=Open+Sans:ital,wght@0,300;0,400;0,500;0,600;0,700;1,300;1,400;"
21     rel="stylesheet">
22
23   <!-- Vendor CSS Files -->
24   <link href="assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
25   <link href="assets/vendor/bootstrap-icons/bootstrap-icons.css" rel="stylesheet">
26   <link href="assets/vendor/aos/aos.css" rel="stylesheet">
27   <link href="assets/vendor/lightbox/css/lightbox.min.css" rel="stylesheet">
28   <link href="assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">
29
30   <!-- Template Main CSS File -->
31   <link href="assets/css/main.css" rel="stylesheet">
32 </head>

```

```

index.html > html > body > section#hero.hero
34 <body>
35
36 <!-- ===== Header ===== -->
37 <header id="header" class="header d-flex align-items-center">
38
39   <div class="container-fluid container-xl d-flex align-items-center justify-content-between">
40     <a href="index.html" class="logo d-flex align-items-center">
41       <!-- Uncomment the line below if you also wish to use an image logo -->
42       <!-- 
43       <h1>IBM-Nalaiya Thiran</h1><span></span></h1>
44     </a>
45     <nav id="navbar" class="navbar">
46       <ul>
47         <li><a href="#hero">Home</a></li>
48         <li><a href="#about">IBM COGNOS</a></li>
49         <li><a href="#Dashboard">Dashboard</a></li>
50         <li><a href="#faq">FAQ</a></li>
51
52         <li><a href="#footer">Contact</a></li>
53       </ul>
54     </nav><!-- .navbar -->
55
56     <i class="mobile-nav-toggle mobile-nav-show bi bi-list"></i>
57     <i class="mobile-nav-toggle mobile-nav-hide d-none bi bi-x"></i>
58
59   </div>
60 </header><!-- End Header -->
61 <!-- End Header -->
62
63 <!-- ===== Hero Section ===== -->
64 <section id="hero" class="hero">
65

```

1 New Notification

```
index.html > html > body > section#hero.hero
65 <section id="hero" class="hero">
66   <div class="container position-relative">
67     <div class="row gy-5" data-aos="fade-in">
68       <div class="col-lg-6 order-2 order-lg-1 d-flex flex-column justify-content-center text-center text-lg-start">
69         <h2>Visualizing and Predicting Heart Diseases
70         <span>with an Interactive Dash Board </span>Team ID : PNT2022TMD22030</h2>
71         <p>The leading cause of death in the developed world is heart disease. Therefore, there needs to be work do
72         <div class="d-flex justify-content-center justify-content-lg-start">
73           <a href="#about" class="btn-get-started">Get Started</a>
74           <a href="https://youtu.be/BlsPKg612x0" class="lightbox btn-watch-video d-flex align-items-center"><i cla
75         </div>
76       </div>
77     </div>
78     <div class="col-lg-6 order-1 order-lg-2">
79       
80     </div>
81   </div>
82 </section>
83
84 <div class="icon-boxes position-relative">
85   <div class="container position-relative">
86     <div class="row gy-4 mt-5">
87
88
89
90   </div>
91 </div>
92 </div>
93
94 </div>
95 </section>
96 </div>
1 New Notification
```

```
index.html > html > body > section#hero.hero
101 <section id="about" class="about">
102   <div class="container" data-aos="fade-up">
103
104     <div class="section-header">
105       <h2>IBM Cognos Analytics</h2>
106       <p>Heart failure is very hard to detect early, but with the help of a National Institutes of Health (NIH) g
107     </div>
108
109     <div class="row gy-4">
110       <div class="col-lg-6">
111         <h3>Using AI and science to predict heart failure</h3>
112         
113         <p>Machine learning proves to be effective in assisting in making decisions and
114         predictions from the large quantity of data produced by the health care industry. This
115         project aims to predict future Heart Disease by analyzing data of patients which
116         classifies whether they have heart disease or not using machine-learning algorithm.
117       </p>
118
119       <p>Machine Learning techniques can be a boon in this regard. Even though heart disease
120       can occur in different forms, there is a common set of core risk factors that influence
121       whether someone will ultimately be at risk for heart disease or not. By collecting the
122       data from various sources, classifying them under suitable headings & finally
123       analysing to extract the desired data we can say that this technique can be very well
124       adapted to do the prediction of heart disease.</p>
125     </div>
126     <div class="col-lg-6">
127       <div class="content ps-0 ps-lg-5">
128         <p class="fst-italic">
129           Today, doctors will typically document signs and symptoms of heart failure in the patient record and
130         </p>
131
132       </div>
133     </div>
134   </div>
135 </section>
1 New Notification
```

```
index.html > html > body > section#hero.hero
147 <section id="stats-counter" class="stats-counter">
148   <div class="container" data-aos="fade-up">
149     <div class="row gy-4 align-items-center">
150       <div class="col-lg-6">
151         
152       </div>
153       <div class="col-lg-6">
154         <div class="stats-item d-flex align-items-center">
155           <span data-purecounter-start="0" data-purecounter-end="1" data-purecounter-duration="1" class="purecounter"></span>
156           <p><strong>Cholesterol Level</strong> It is a scientific fact that your body will not absorb cholesterol</p>
157         </div><!-- End Stats Item -->
158         <div class="stats-item d-flex align-items-center">
159           <span data-purecounter-start="0" data-purecounter-end="2" data-purecounter-duration="1" class="purecounter"></span>
160           <p><strong>Thallium</strong> your diet is a bank account .Good food choices are good investments</p>
161         </div><!-- End Stats Item -->
162         <div class="stats-item d-flex align-items-center">
163           <span data-purecounter-start="0" data-purecounter-end="3" data-purecounter-duration="1" class="purecounter"></span>
164           <p><strong>Exercise Angina</strong> Exercise should be regarded as tribute to the heart</p>
165         </div><!-- End Stats Item -->
166         <div class="stats-item d-flex align-items-center">
167           <span data-purecounter-start="0" data-purecounter-end="4" data-purecounter-duration="1" class="purecounter"></span>
168           <p><strong>ST Depression</strong> isn't a war you win. It's a battle you fight every day with yours head</p>
169         </div><!-- End Stats Item -->
170       </div>
171     </div>
172   </div>
173 </section><!-- End Stats Counter Section -->
174
175
176
177
178
```

1 New Notification

```
index.html > html > body > section#hero.hero
182 </section><!-- End Stats Counter Section -->
183
184 <!-- ===== Call To Action Section ===== -->
185 <section id="Dashboard" class="call-to-action">
186   <div class="container text-center" data-aos="zoom-out">
187     <a href="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&pathRef=.my_folders%2FHeart%2BDisease%2BDashboard">Dashboard</a>
188     <p>Use this dataset to predict which patients are most likely to suffer from a heart disease in the near future</p>
189   </div>
190 </section><!-- End Call To Action Section -->
191
192
193
194
195
196
197 <!-- ===== Frequently Asked Questions Section ===== -->
198 <section id="faq" class="faq">
199   <div class="container" data-aos="fade-up">
200     <div class="row gy-4">
201       <div class="col-lg-4">
202         <div class="content px-xl-5">
203           <h3>Frequently Asked Questions</h3>
204           <p>Some of the Frequently Asked Questions are answered here, feel free to contact us.</p>
205         </div>
206       </div>
207     </div>
208   </div>
209 </section>
210
211
212
213 <div class="col-lg-8">
```

```

index.html > html > body > section#hero.hero
217     <div class="accordion-item">
218       <h3 class="accordion-header">
219         <button class="accordion-button collapsed" type="button" data-bs-toggle="collapse" data-bs-target="
220           <span class="num">1.</span>
221           What Causes Heart Failure?
222         </button>
223       </h3>
224       <div id="faq-content-1" class="accordion-collapse collapse" data-bs-parent="#faqlist">
225         <div class="accordion-body">
226           The most common causes are myocardial infarction (heart attack), hypertension (high blood pressur
227         </div>
228       </div>
229     </div><!-- # Faq item-->
230
231     <div class="accordion-item">
232       <h3 class="accordion-header">
233         <button class="accordion-button collapsed" type="button" data-bs-toggle="collapse" data-bs-target="
234           <span class="num">2.</span>
235           If I Have Heart Failure, Do I Have to Stop Eating Salty Foods?
236         </button>
237       </h3>
238       <div id="faq-content-2" class="accordion-collapse collapse" data-bs-parent="#faqlist">
239         <div class="accordion-body">
240           Not entirely, but you do have to pay attention to how much salt you're eating. Sodium, a mineral
241         </div>
242       </div><!-- # Faq item-->
243
244     <div class="accordion-item">
245       <h3 class="accordion-header">
246         <button class="accordion-button collapsed" type="button" data-bs-toggle="collapse" data-bs-target="
247           <span class="num">3.</span>
248           How Much Water Can I Drink?

```

```

index.html > html > body > section#hero.hero
250     </h3>
251     <div id="faq-content-3" class="accordion-collapse collapse" data-bs-parent="#faqlist">
252       <div class="accordion-body">
253         Check with your health care provider about how much water you should drink every day. You may be
254       </div>
255     </div><!-- # Faq item-->
256
257     <div class="accordion-item">
258       <h3 class="accordion-header">
259         <button class="accordion-button collapsed" type="button" data-bs-toggle="collapse" data-bs-target="
260           <span class="num">4.</span>
261           What Type of Exercise Is Best for Someone With Heart Failure?
262         </button>
263       </h3>
264       <div id="faq-content-4" class="accordion-collapse collapse" data-bs-parent="#faqlist">
265         <div class="accordion-body">
266           Physical activity is a great way to strengthen your heart, improve blood circulation, and raise y
267         </div>
268       </div><!-- # Faq item-->
269
270     <div class="accordion-item">
271       <h3 class="accordion-header">
272         <button class="accordion-button collapsed" type="button" data-bs-toggle="collapse" data-bs-target="
273           <span class="num">5.</span>
274           How Do I Know if My Heart Failure Is Getting Worse?
275         </button>
276       </h3>
277       <div id="faq-content-5" class="accordion-collapse collapse" data-bs-parent="#faqlist">
278         <div class="accordion-body">
279           Talk with your doctor if you notice mental changes like confusion or memory loss. Also pay attent
280         </div>
281     </div><!-- # Faq item-->

```



```
<> index.html > html > body > section#hero.hero
294 <footer id="footer" class="footer">
295
296   <div class="container">
297     <div class="row gy-4">
298       <div class="col-lg-5 col-md-12 footer-info">
299         <a href="index.html" class="logo d-flex align-items-center">
300           <span>IBM-Nalaiya Thiran.</span>
301         </a>
302         <p>Visualizing and Predicting Heart Diseases with an Interactive Dash Board</p>
303         <div class="social-links d-flex mt-4">
304           <a href = "mailto: myselfkalyanpal@gmail.com" class="mail"><i class="bi bi-envelope-open-heart"></i></a>
305           <a href="https://github.com/IBM-EPBL/IBM-Project-17772-1659676075" class="github"><i class="bi bi-github">
306           <a href="https://www.linkedin.com/in/kalyanpavan18/" class="linkedin"><i class="bi bi-linkedin"></i></a>
307         </div>
308       </div>
309     </div>
310   </div>
311 </div>
312
313   <div class="container mt-4">
314     <div class="copyright">
315       &copy; Copyright <strong><span>IBM-Nalaiya Thiran.</span></strong>. All Rights Reserved
316     </div>
317   </div>
318
319 </footer><!-- End Footer -->
320 <!-- End Footer -->
321
322 <a href="#" class="scroll-top d-flex align-items-center justify-content-center"><i class="bi bi-arrow-up-short"></i>
323
324 <div id="preloader"></div>
325
```

## 13.2 Github Link <https://github.com/IBM-EPBL/IBM-Project-17772-1659676075>

### 13.3 Project Demo Link

<https://youtu.be/mWowimXTh1Q>