UNIVERSITY COLLEGE OF ENGINEERING VILLUPRAM

(A CONSTITUENT COLLAGE OF ANNA UNIVERSITY,CHENNAI)

KAKUPPAM,VILLUPURAM-605 103

BONAFIDE CERTIFICATE

Certified that this project titled **"VISUALIZING AND PREDICTING HEART DISEASES WITH AN INTERACTIVE DASHBOARD"** is the bonafide work of **"AMIRTHAVARSHAN.K (422519106004), RAGUL.P (422519106034), SUBASH.S (422519106046), VINOTH.S (422519106302), VISHWANATH.R (422519106701)"** who carried out the project work under my supervision.

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VISUALIZING AND PREDICTING HEART DISEASE WITH AN INTERACTIVE DASHBOARD

1. INTRODUCTION

Overview

Now a day's heart disease is emerging as one of the most death-dealing diseases. As per a report published by the World Health Organization [WHO], heart disease is one of the most hazardous diseases to human which causes death all over the world from the last 20 years. Approx. 12 million people are dying every year, which makes it the biggest challenge for medical professionals to develop an early diagnosis of heart disease with better accuracy. Various medical datasets are uploaded to IBM Cognos analytics to automate the analysis of large and complex data.

Purpose

Cardiovascular diseases (CVDs) are the number one cause of death globally, taking an estimated 17.9 million lives each year, which accounts for 31% of all deaths worldwide. Heart failure is a common event caused by CVDs and the dataset uses in this project contains 9 features that can be used to predict mortality by heart failure. In this project, a prediction model using IBM Auto AI service is built and a web server application also built to showcase the prediction of heart failure. The goal of this effective heart disease prediction project is to determine whether a patient should be diagnosed with heart disease or not, which is a binary outcome, so the positive result = 1, the patient will be diagnosed with heart disease and the negative result = 0, the patient will not be diagnosed with heart disease.

2. LITERATURE SURVEY

Existing problem

It is very important to take into account the prediction of risk level of heart disease for healthcare industry in order to ease the medical treatment for the patients. Data science

classification techniques are used in a number of applications like healthcare analytics, customer analytics, marketing analytics, water quality analytics, textile production analytics, manufacturing analytics and textile waste analytics etc.,

There are various heart disease prediction models are available based on data mining techniques such as regression, clustering, association rule and classification techniques such as decision tree, artificial neural network.

Even though there are lot of prediction models and ensemble techniques available, there is no single infrastructure or framework existing to execute all the above techniques altogether. Therefore, for developing the effective and best heart disease prediction model, lot of efforts are needed to incorporate everything.

References

Dhai Eddine Salhi et al.,[1] published the paper on Heart Diseases prediction using Machine Learning Algorithm. They discussed about algorithms, techniques and performance of various models such as Support Vector Machines (SVM), K-Nearest Neighbour (KNN), neural network.

Hlaudi Daniel Masethe et al .,[2] published the paper on Prediction of Heart Diseases using various classification algorithm. They discussed about Data mining algorithms such as J48, Naive Bayes REPTREE, CART, and Bayes Net are applied in this research for predicting heart attacks.

Abdul Saboor et al.,[3] provide the survey and published the paper on Method for Improving Prediction of Human Heart Disease Using Machine Learning Algorithms. They used the machine learning classifiers, such as AB, LR, ET, MNB, CART, SVM, LDA, RF, and XGB.

Dr Md Ali Hossain et al.,[4] published the paper on Comparative Analysis of Classification Approaches for Heart Disease Prediction. They used the info gain feature selection technique and removing unnecessary features, different classification

techniques such that KNN, Decision Tree (ID3), Gaussian Naive Bayes, Logistic Regression and Random Forest are used on heart disease dataset for better prediction.

Various research workers like Armin Yazdani et al[6], Kasturi Dewi Varathan et al.,[7],Yin Kia Chiam et al.,[8], Asad Waqar Malik Wan Azman Wan Ahmad et al.,[9] and Ashapu Bhavani et al., have provided different solutions using different machine learning techniques for developing effective heart disease prediction model.

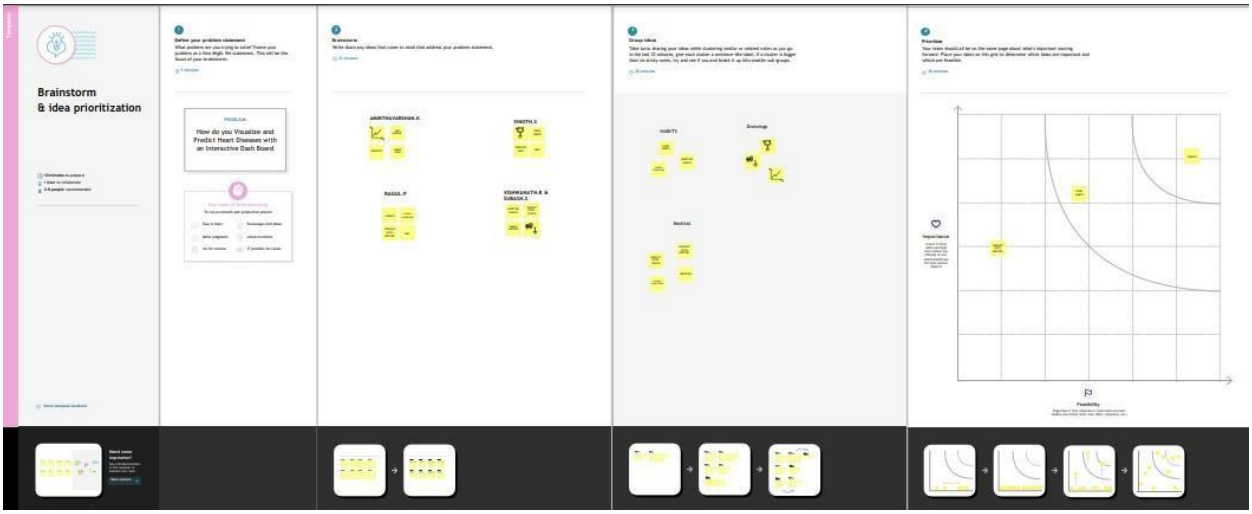
Problem Statement Definition

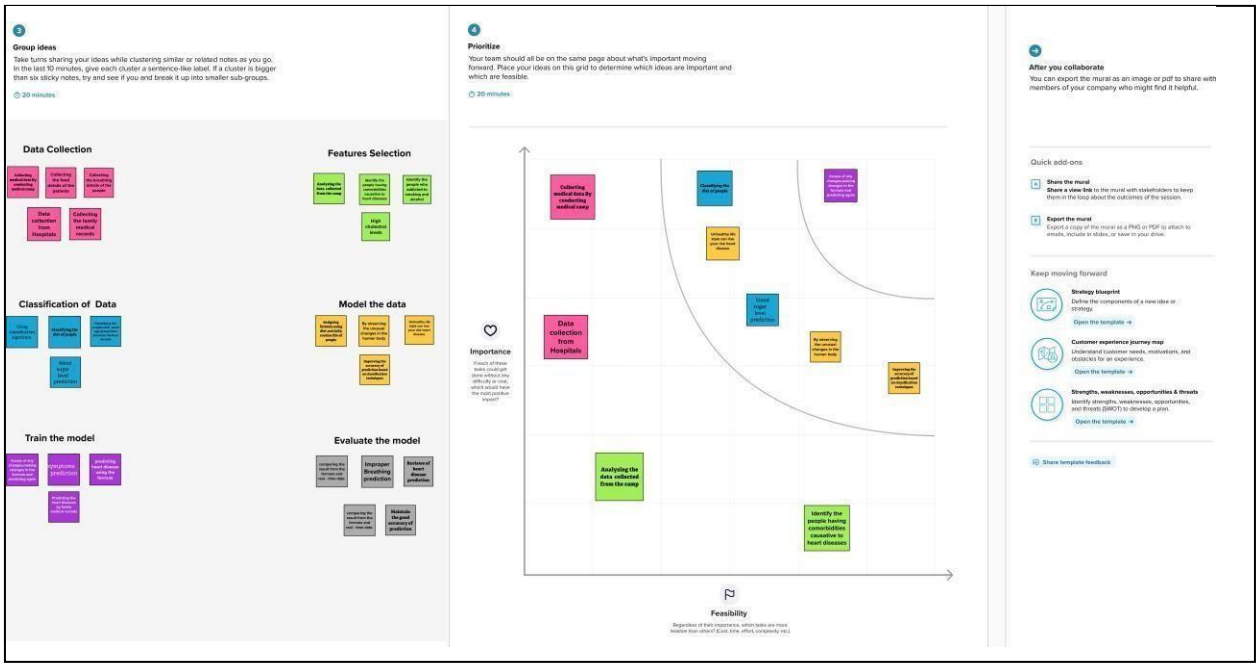
The leading cause of death in the developed world is heart disease. Cardiovascular diseases (CVDs) have now become the leading cause of mortality in India. Therefore, there needs to be work done to help prevent the risks of having a heart attack or stroke.

3. IDEATION & PROPOSED SOLUTION

3.1EmpathyMap Canvas

Ideation & Brainstorming





Proposed Solution

1) Problem Statement

Predicting the Heart Disease of a patient by analysing past or Historical records. Where patient can get cure or take necessary treatment before the disease is affected.

2) Idea / Solution description

Our idea is to predict the Heart Disease at the beginning stage and provide treatment for speedy recovery.

3) Novelty / Uniqueness

Comparing other models the prediction will vary. But our model will predict accurately and give effective results.

4) Social Impact / Customer Satisfaction

By this project people can able to diagnose the heart disease at initial stage by themselves.

5) Business Model (Revenue Model)

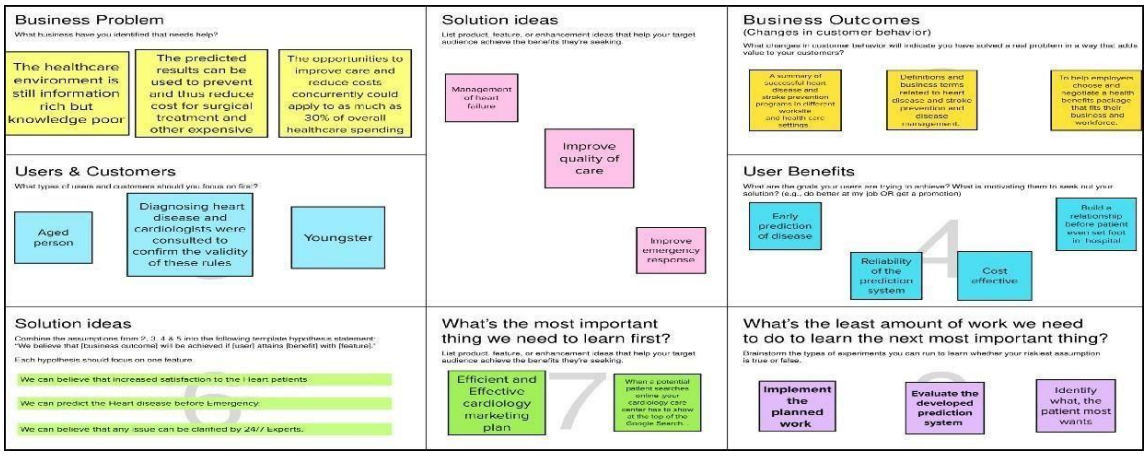
By subscription technique, one user will be allowed to predict the disease.

6) Scalability of the Solution

In future, some more health associated prediction will be added with the same interactive dashboard.

Problem Solution fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem.



4. REQUIREMENT ANALYSIS

Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	Enables the user to make registration for using the application.
FR-2	**User Confirmation**	During registration, the user will get confirmation mail for authentication purpose.
FR-3	**Visualizing Data**	User can visualize the records on heart disease through the Dashboard created using IBM Cognos Analytics.
FR-4	**Generating Report**	User can view the health report and can come to an conclusion.

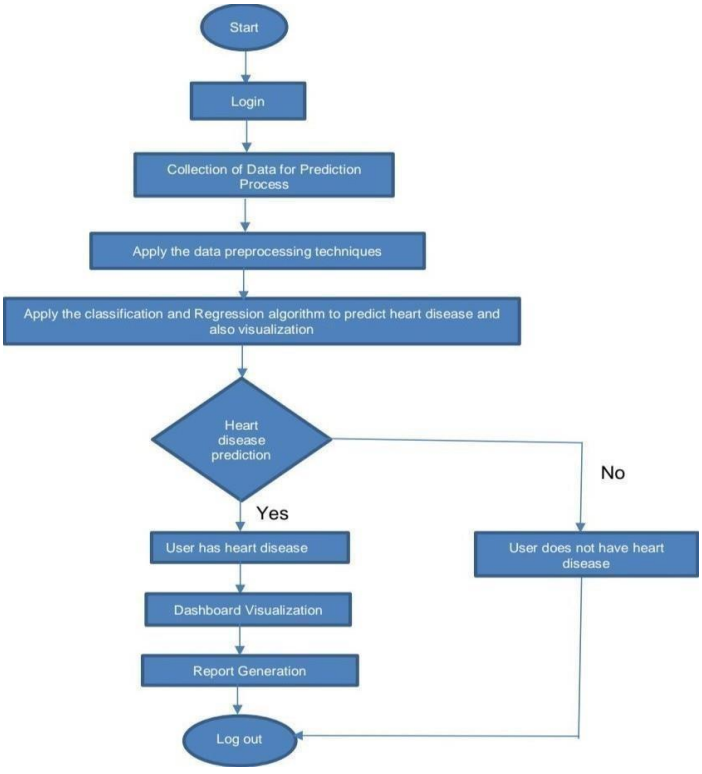
Non-Functional requirement

NFR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The application will have a simple and user-friendly graphical interface. Users will be able to understand and use all the features of the application easily. Any action has to be performed with just a few clicks
NFR-2	**Security**	Security of the application should be higher as it handles user data. For this database replication technique should be used as the important data can be kept safe. So that in case of crash, the system can be able to backup and recover the data.
NFR-3	**Reliability**	The application has to be reliable and consistent at every situation and has to run without failure.

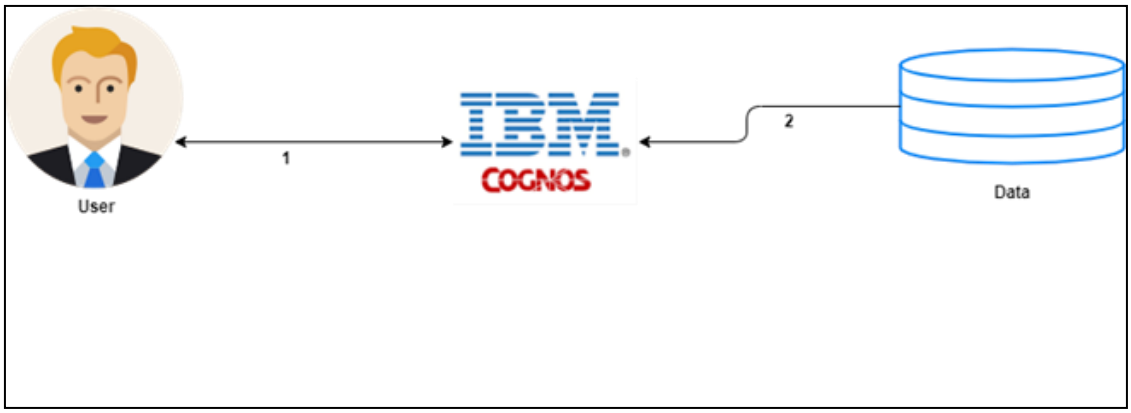
NFR-4	**Performance**	Performance of the application depends on the response time and the speed of the calculation on data. The calculation time of the application depends on the efficiency of algorithm used.
NFR-5	**Availability**	The application should to be available 24 x 7 for users without any kind of interruption.
NFR-6	**Scalability**	The application can withstand in increase of number of users and has to be able to upgrade to higher versions.

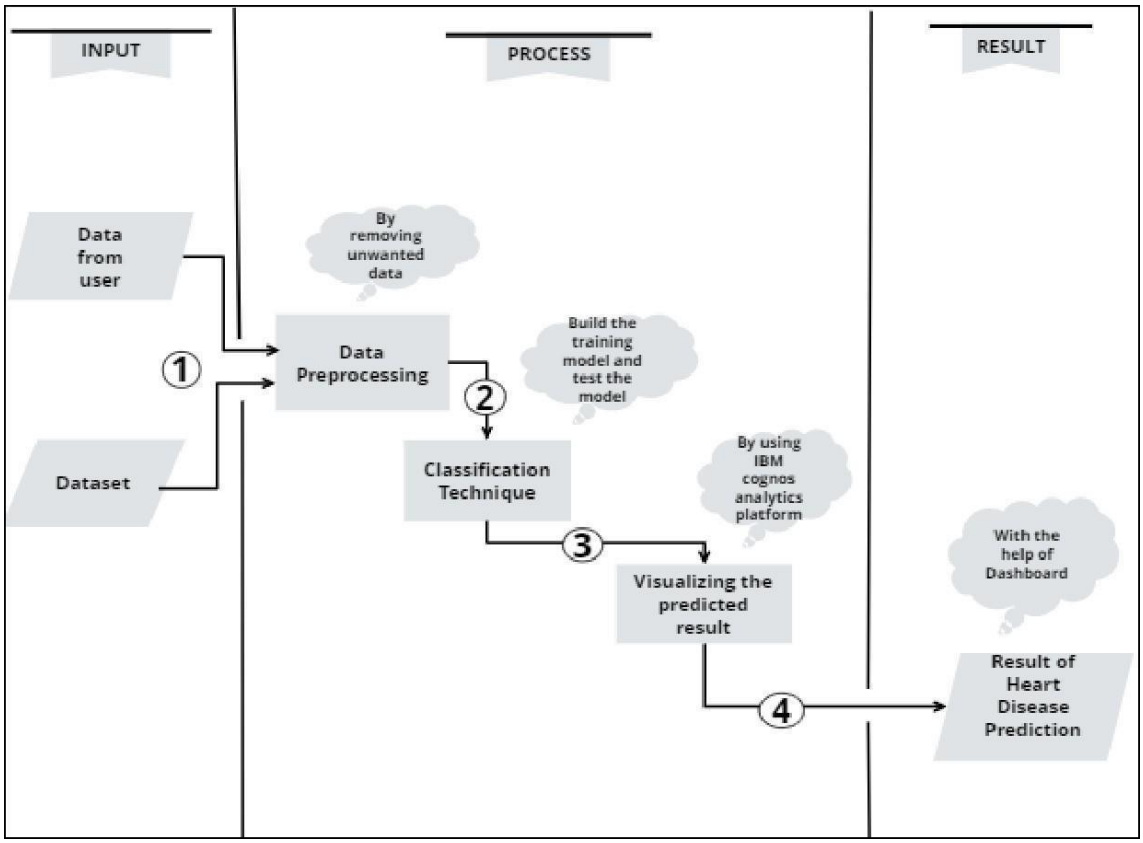
5. PROJECT DESIGN

Data Flow Diagrams



Solution & Technical Architecture





User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story I Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-I	As a user, I can register for the application by entering my email, password, and confirming mail 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 a lication	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through mobile number	I can receive Conformation through email	Medium	Sprint-1
		USN-4	As a user, I will receive confirmation through email	I can receive confirmaton through email.	Medium	Sprint-1

Customer (Web user)	Login	USN-5	As a user, I can log into the application by entering email & password	I can access my account	High	Sprint-I
	Dashboard	USN-6	User can view medical analysis and accuracy of heart disease prediction	I can view my complete medical analysis by prediction	High	Sprint-2
	Dashboard	USN-7	User can generate their report with the help of this Dashboard	I can view the report generation of heart disease in this dashboard	High	Sprint-2
Customer Care Executive	Support team	USN-8	As a customer care executive, they can post their queries.	I can post my queries in the dashboard	Medium	Sprint-3
		USN-9	As a customer care-executive, they want to resolve the customer posted queries	I can get help from the support team	High	Sprint-3

Administrator	User profile	USN-10	Admin want to maintain and update the health details of the users.	I can view my updated health details	High	Sprint-4
		USN-11	Admin can add or delete wrong information of the users.	I can access the Dashboard when logged in	High	Sprint-4
		USN-12	Admin, can manage the user details	I can view the organized data of myself.	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

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.	8	High	Amirthavarshan K

		USN-2	As a user, I will receive confirmation email once I have registered for the application	8	High	Amirthavarshan k
	Login	USN-3	As a user, I can log into the application by entering email & password	4	Medi um	Ragul P
Sprint-2	Working with the dataset	USN-4	To work on the dataset, understand and load the dataset	10	High	Subash S,Ragul P, Vishwanath R
		USN-5	Exploration of BP vs chest pain type and gender, maximum heart rate during the chest pain	5	High	, Subash S,Ragul P, Vishwanath R
		USN-6	BP by age, Cholesterol by agent gender	5	High	Amirthavarshan k, Ragul P
Sprint-3	Data Visualization	USN-7	Visualization of average age for chest pain types, average exercise angina curing chest pain	2	Medi um	Vinoth S
		USN-8	BP variation with respect to age, Effect of existing heart disease on	6	High	Subash S,Ragul P

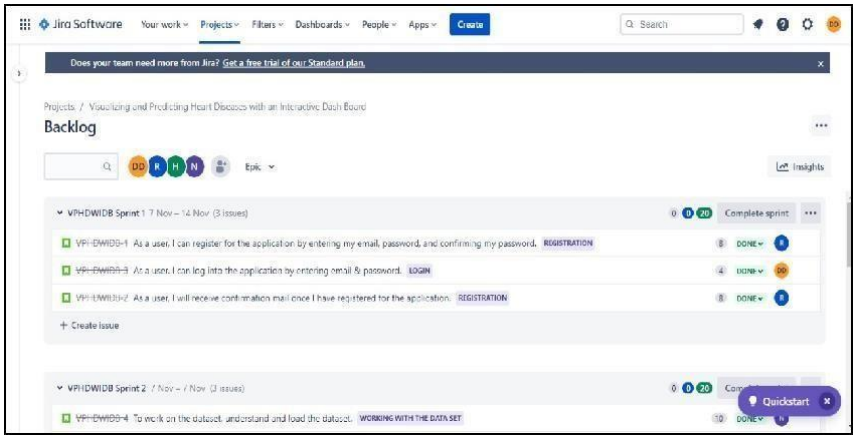
		USN-9	Average age for different types of chest pain in existing heart disease, serum cholesterol levels vs age	6	High	Vinoth S
		USN-10	Maximum heart rate in Existing heart disease by Exercise Angina	6	High	Vinoth S
Sprint-4	Dashboard Creation	USN-11	Dashboard showing different types of visualization	20	High	Vinoth S

Sprint Delivery Schedule

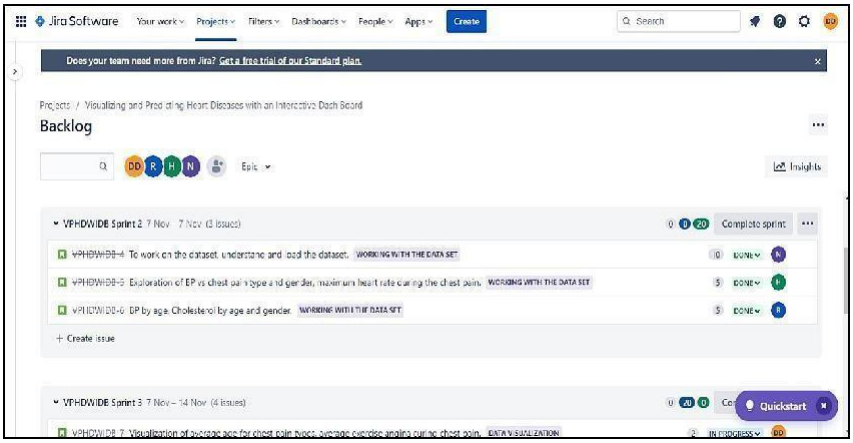
Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

Reports From JIRA

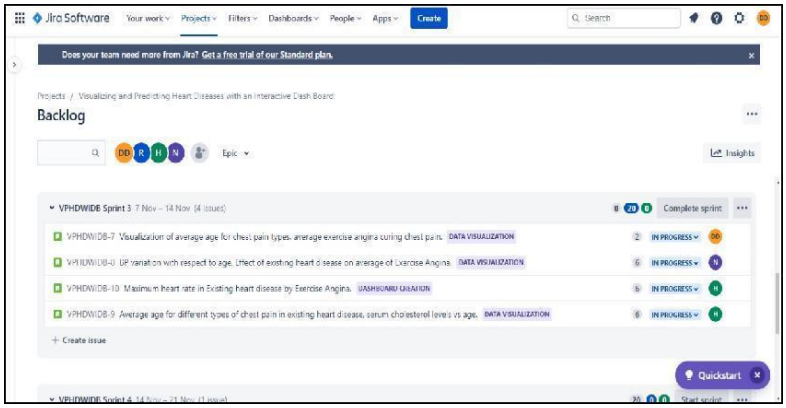
Sprint-1



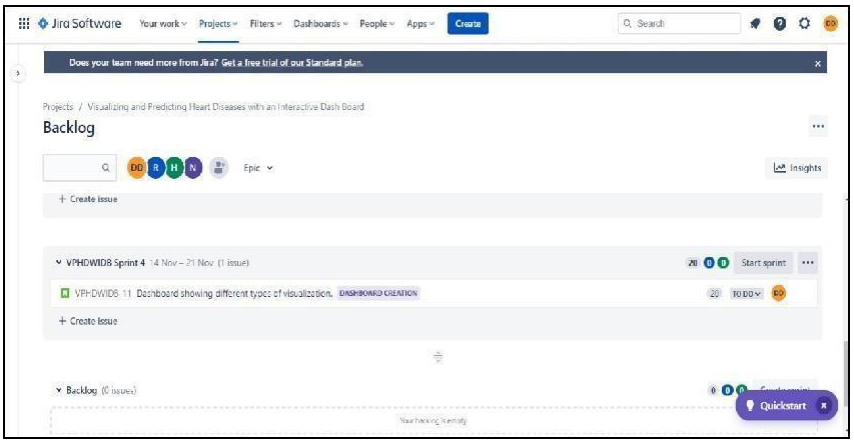
Sprint-2



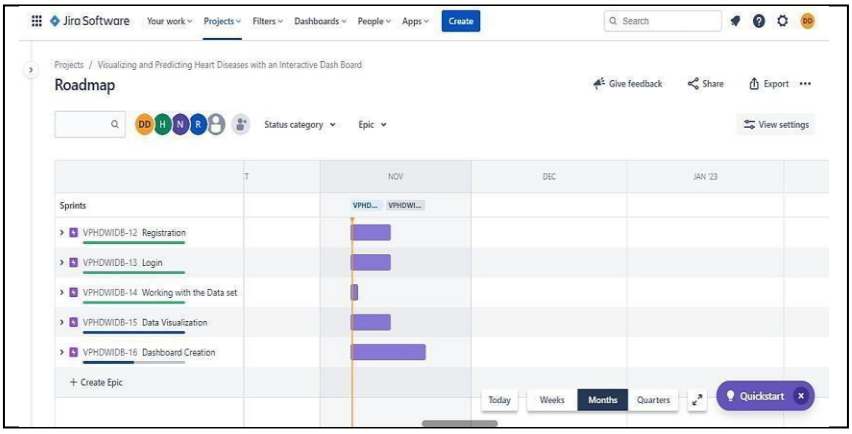
Sprint-3



Sprint-4



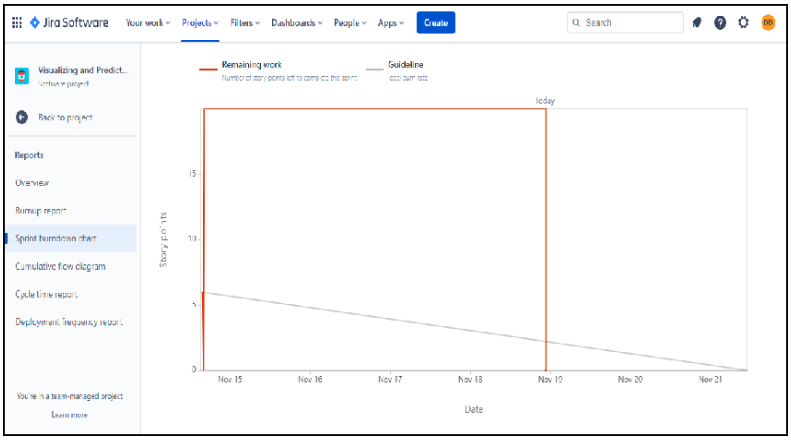
Sprint-3 RoadMap



Sprint-3 Burndown Chart

Sprint-4 RoadMap

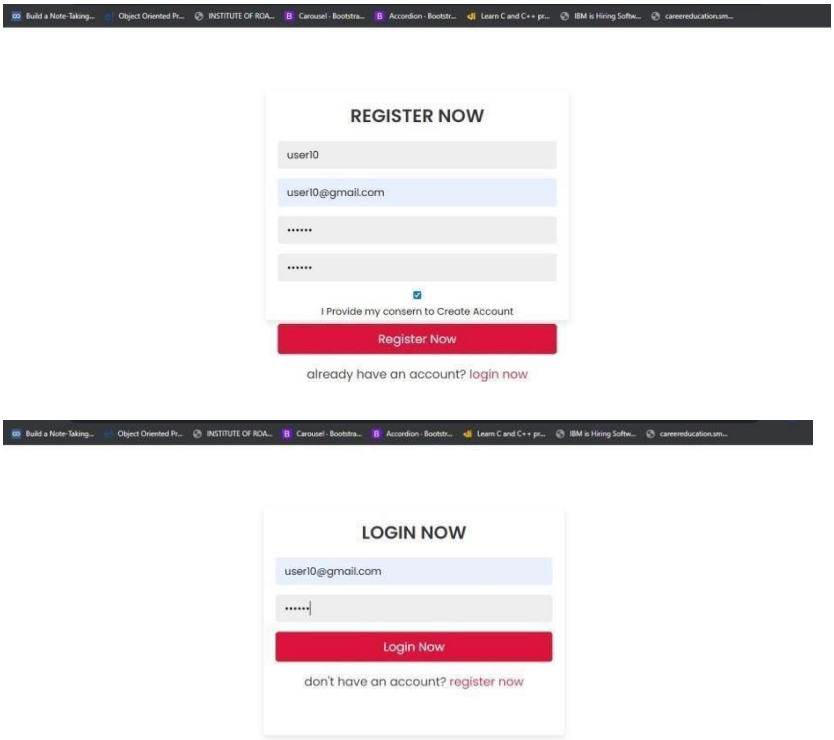
Sprint-4 Burn down Chart



7. CODING & SOLUTIONING

Feature 1

- New user can able to register in our website.
- verified user can able to login in our website.
- Verified user can not able to login with invalid credentials.



Feature 2

- User can View the Live Dashboard of Visualizing And predicting Heart disease With An InterActive Dashboard
- User can also view the Static Dashboard of Visualizing And predicting Heart disease With An InterActive Dashboard

8. TESTING

Test Cases

Test Scenario	Expected Result
Verify user is able to see the Login/Signup popup when user clicked on My account button	Login/Signup popup should display
Verify the UI elements in Login/Signup popup	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link
Verify user is able to log into application with Valid credentials	User should navigate to user account homepage
Verify user is able to log into application with InValid credentials	Application should show 'Incorrect email or password ' validation message.
Verify user is able to log into application with InValid credentials	Application should show 'Incorrect email or password ' validation message.
Verify user is able to log into application with InValid credentials	Application should show 'Incorrect email or password ' validation message.
New user can able to register in the webpage	Application should show the New User to register
Existing User Name Cannot be used as New User Name	Application Should Show Existing Username

User Acceptance Testing

1) Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issuesof 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 showsthe 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	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

3) Test Case Analysis

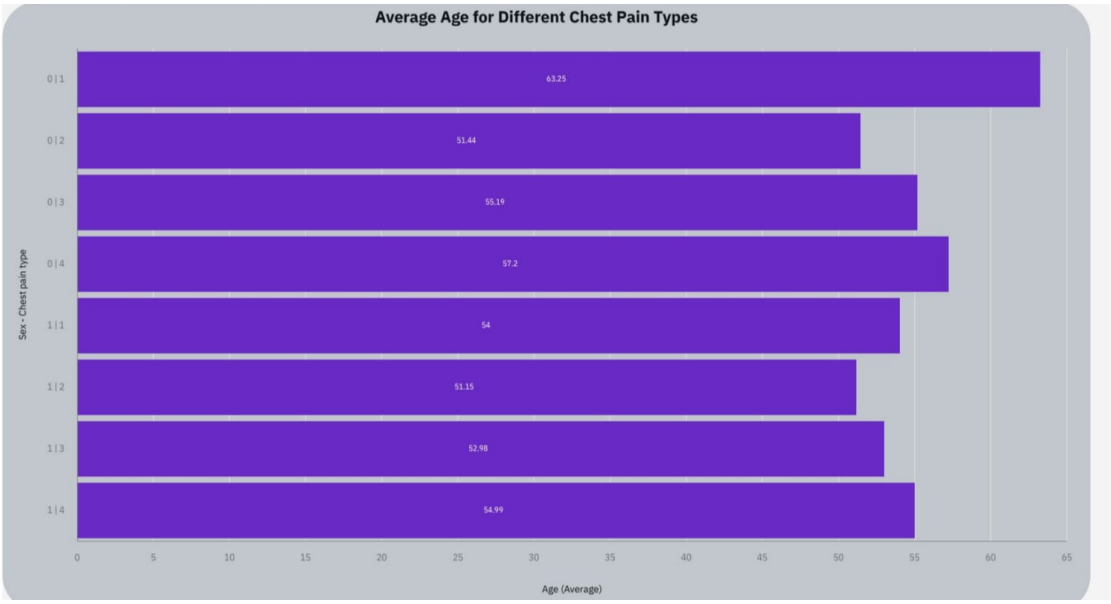
This report shows the number of test cases that have passed, failed,and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	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

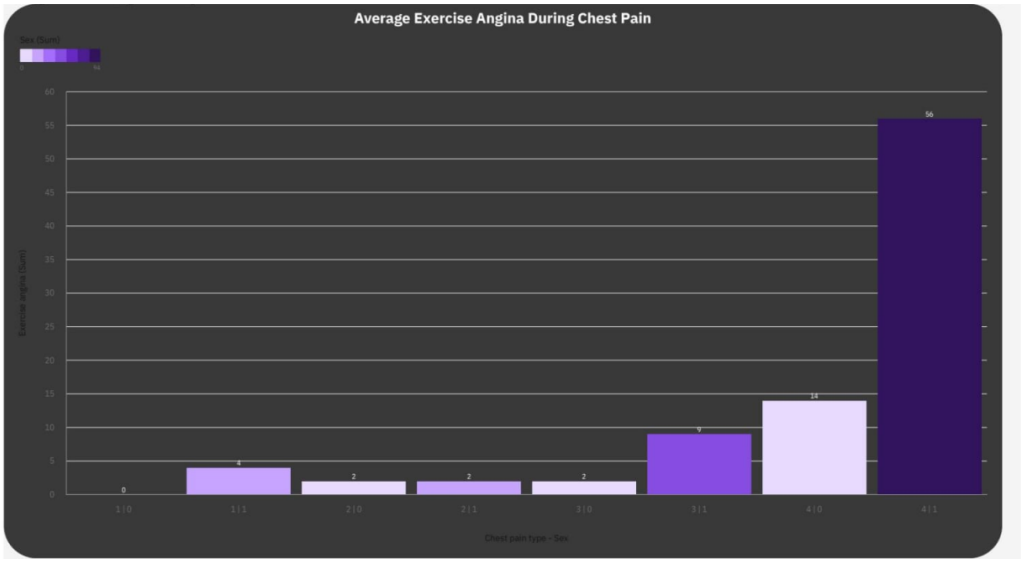
9. Results

Performance Metrics

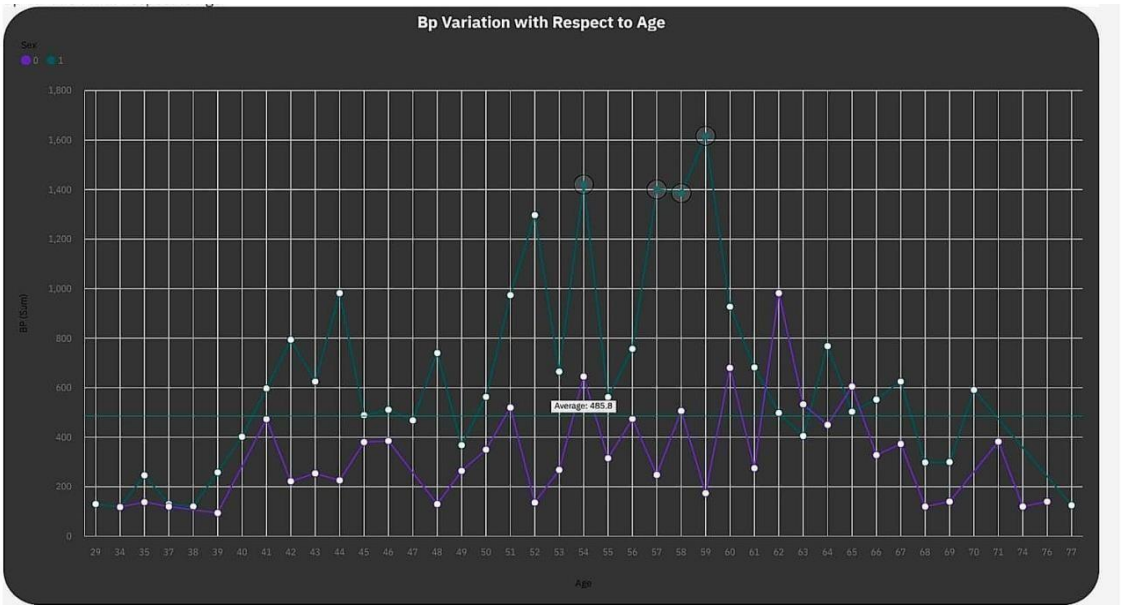
Average Age for Different Chest Pain



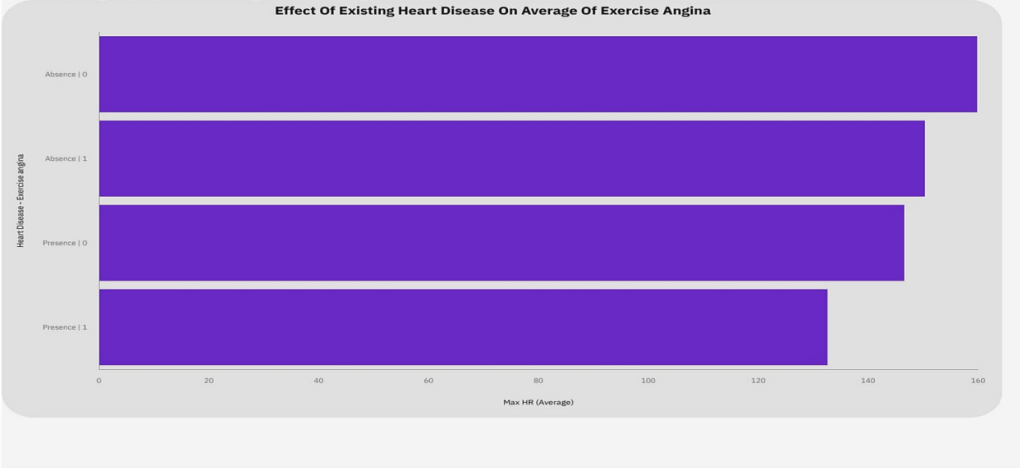
Average Exercise Angina During Chest Pain



BP Variation With Respect to Age



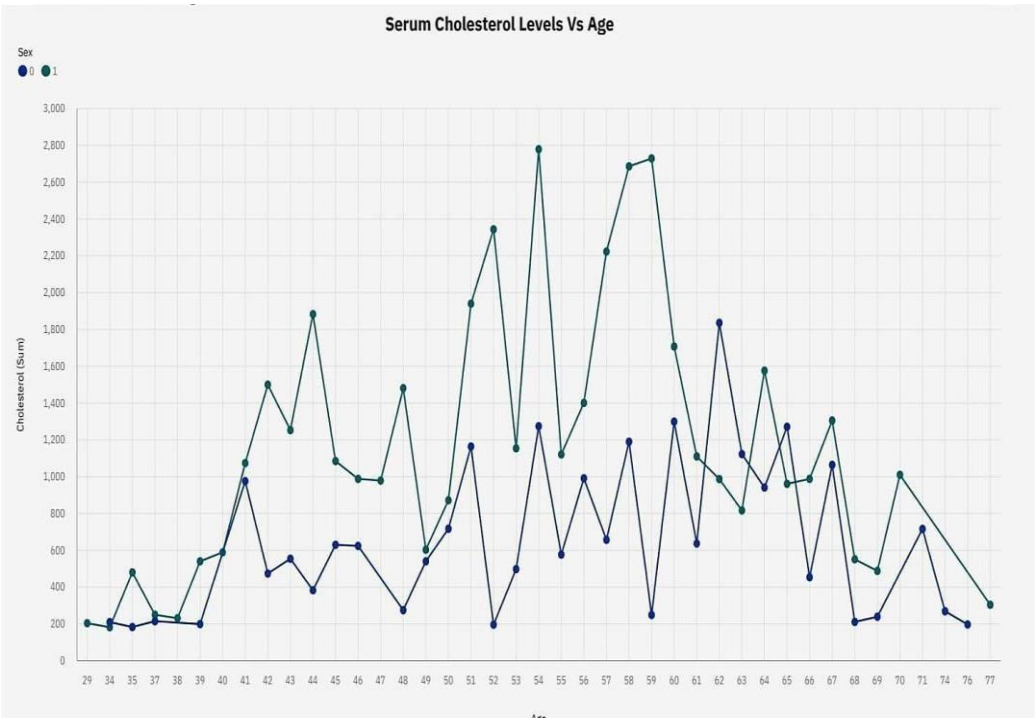
Effect of Existing Heart Disease On Average Of Exercise Angina



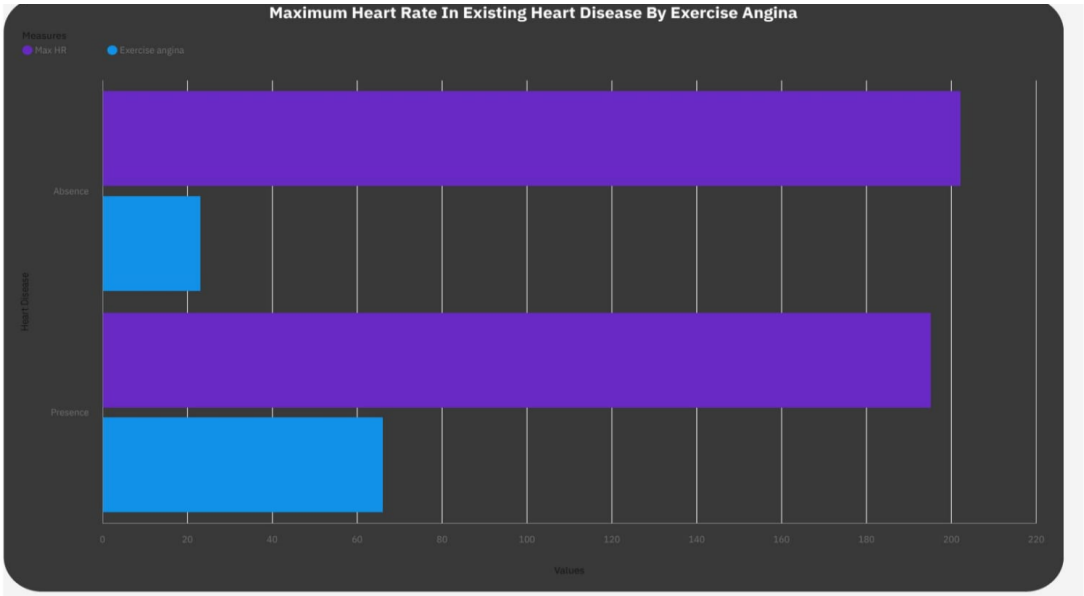
Average Age For Different Types Of Chest Pain In Existing Heart Disease

Heart Disease	1	2	3	4	Summary
0	4	16	32	35	87
1	16	26	47	94	183
Summary	20	42	79	129	270

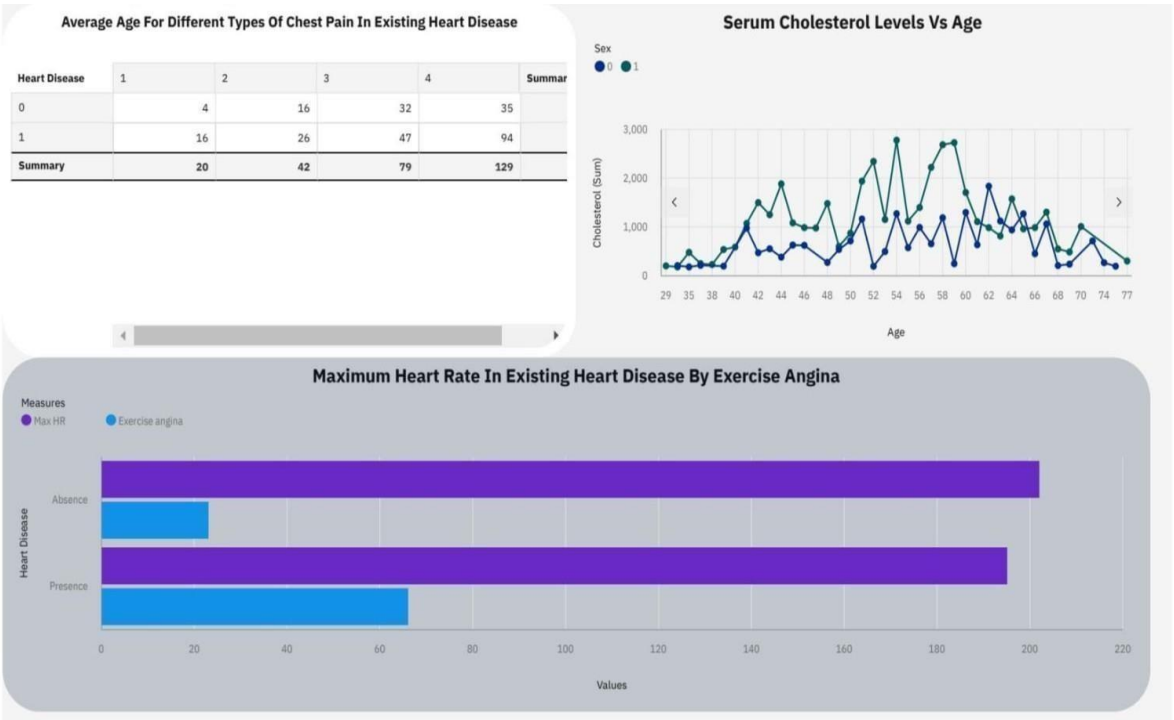
Serum Cholesterol Levels Vs Age



Maximum Heart Rate In Existing Heart Disease By Exercise Angina



Dashboard Showing Different Types Of Visuals



10. Advantages And Disadvantages

Advantages

- ◊ Increase the Accuracy for effective Heart disease Diagnosis
- ◊ Reduce the time Complexity of Doctors
- ◊ Cost Effective for patients
- ◊ predicts the likelihood of patients getting heart disease
- ◊ predicts people with cardiovascular disease by extracting the patient medical history that leads to fatal health.
- ◊ Improves health care services
- ◊ Initial setup and maintenance cost is reduced

DisAdvantages

- ◊ Cannot Handle Enornomous Datasets
- ◊ Internet Connectivity is Mandatory
- ◊ More steps to remember during creation of different services
- ◊ User Interface creation is little bit tougher

11. Conclusion

The early prognosis of cardiovascular diseases can aid in making decisions on lifestyle changes inhigh risk patients and in turn reduce the complications,which can be a great milestone in the field of medicine. This project resolved the feature selection backward elimination behind the models and successfully predict the heart disease with accuracy.Hence we predict the Accuracy of heart disease with an IBM cognos with help of Datasets.

12. Future Scope

The model creation,validation and deployment have taken lots of procedures and steps.The aim of the future work is to predict the target attribute by reducing the number of procedures and steps. The accuracy of the model is also somewhat less compared to already existingprediction models discussed under literature review. In order to improve the accuracy, pipelinestructure and algorithm selection procedure will need to be optimized.

13. APPENDIX

Source Code

register_form.php

```
<?php
@include 'config.php';
if(isset($_POST['submit'])){
   $name = mysqli_real_escape_string($conn, $_POST['name']);
   $email = mysqli_real_escape_string($conn, $_POST['email']);
   $pass = md5($_POST['password']);
   $cpass = md5($_POST['cpassword']);
   $user_type = $_POST['user_type'];
  $select = " SELECT * FROM user_form WHERE email = '$email' && password = '$pass' ";
 $result = mysqli_query($conn, $select);
   if(mysqli_num_rows($result) > 0){
   $error[] = 'user already exist!';
 }else{
        if($pass != $cpass){
        $error[] = 'password not matched!';
      }else{
        $insert = "INSERT INTO user_form(name, email, password, user_type)
VALUES('$name','$email','$pass','$user_type')";
        mysqli_query($conn, $insert);
        header('location:login_form.php');
      }
   }
};
?>
```

```
<!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>register form</title>
  <!-- custom css file link -->
  <link rel="stylesheet" href="css/style.css">
 </head>
<body>
<div class="form-container">
<form action="" method="post">
    <h3>register now</h3>
    <?php
    if(isset($error)){
       foreach($error as $error){
          echo '<span class="error-msg">'.$error.'</span>';
       };
    };
    ?>
    <input type="text" name="name" required placeholder="enter your name">
    <input type="email" name="email" required placeholder="enter your email">
    <input type="password" name="password" required placeholder="enter your password">
    <input type="password" name="cpassword" required placeholder="confirm your password">
    <input type="checkbox" name="user_type" value="user" required> I provide my concern to create Account
    <input type="submit" name="submit" value="register now" class="form-btn">
<p>already have an account? <a href="login_form.php">login now</a></p>
```

```
</form>
</div>
</body>
</html>
```

login_form.php

```
<?php
@include 'config.php';
session_start();
if(isset($_POST['submit'])){
   $email =  mysqli_real_escape_string($conn, $_POST['email']);
   $pass = md5($_POST['password']);
   $user_type = $_POST['user_type'];
   $select = " SELECT * FROM user_form WHERE email = '$email' && password = '$pass' ";
   $result = mysqli_query($conn, $select);
   if(mysqli_num_rows($result) > 0){
         $row = mysqli_fetch_array($result);
if($row['user_type'] == 'user'){
         $_SESSION['user_name'] = $row['name'];
         header('location:user_page.php');
 }
}else{
     $error[] = 'incorrect email or password!';
   }
};
?>
<!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>login form</title>
   <!-- custom css file link -->
   <link rel="stylesheet" href="css/style.css">
   <style>
      }
</style>
</head>
<body >
<div class="form-container">
<form action="" method="post">
      <h3>login now</h3>
      <?php
      if(isset($error)){
      foreach($error as $error){
      echo '<span class="error-msg">'.$error.'</span>';
  };
};
      ?>
      <input type="email" name="email" required placeholder="enter your email">
       <input type="password" name="password" required placeholder="enter your password">
       <input type="submit" name="submit" value="login now" class="form-btn">
```

```
    <p>don't have an account? <a href="register_form.php">register now</a></p>
</form>
</div>
</body>
</html>
```

user_page.php

```
 <?php
@include 'config.php';
session_start();
if(!isset($_SESSION['user_name'])){
   header('location:login_form.php');
}
?>
<!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>user page</title><!-- custom css file link -->
    <link rel="stylesheet" href="css/style.css">
<style>
     body {
    background-image: url(https://img.freepik.com/free-vector/clean-medical-
background_53876-97927.jpg?w=2000);}
</style>
</head>
```

```
<body>

<div class="container">

<div class="content">

    <h1>Hai <span><?php echo $_SESSION['user_name'] ?></span>!</h1>

    <p>Welcome to Visualizing and Predicting Heart Diseases with an Interactive Dash Board</p>

    <a href="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&id=iB00A89B4254849DF883FDEFE16C2F7B0&objRef=iB00A89B4254849DF883FDEFE16C2F7B0&options%5BdisableGlassPrefetch%5D=true&options%5Bcollections%5D%5BcanvasExtension%5D%5Bid%5D=com.ibm.bi.dashboard.canvasExtension&options%5Bcollections%5D%5BfeatureExtension%5D%5Bid%5D=com.ibm.bi.dashboard.core-features&options%5Bcollections%5D%5Bbuttons%5D%5Bid%5D=com.ibm.bi.dashboard.buttons&options%5Bcollections%5D%5Bwidget%5D%5Bid%5D=com.ibm.bi.dashboard.widgets&options%5Bcollections%5D%5BcontentFeatureExtension%5D%5Bid%5D=com.ibm.bi.dashboard.content-features&options%5Bcollections%5D%5BsaveServices%5D%5Bid%5D=com.ibm.bi.dashboard.saveServices&options%5Bcollections%5D%5Btemplates%5D%5Bid%5D=com.ibm.bi.dashboard.template" class="btn">live Dashboard</a>

    <a href="register_form.php" class="btn">Predicted one</a>

    <a href="logout.php" class="btn">logout</a>

</div>

</body>

</html>
```

logout.php

```
<?php

@include 'config.php';

session_start();

session_unset();
```

```
session_destroy();
header('location:login_form.php');
?>
```

Config.php:

```
<?php
$conn = mysqli_connect('localhost', 'root', 'user_db');
?>
```

IBM Cognos Analytics Link:
https://us3.ca.analytics.ibm.com/bi/?perspective=dashboard&pathRef=.my_folders%2FHeart_Disease_Prediction-Dashboard_01&action=view&mode=dashboard

Github link: https://github.com/IBM-EPBL/IBM-Project-34661-1660242565

Project Demo Link: https://youtu.be/ZGE4_emRkkk