# VISUALIZING AND PREDICTING HEART DISEASES WITH AN INTERACTIVE DASH BOARD

IBM – DOCUMENTATION

**UNDER THE GUIDANCE OF**

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# 1. INTRODUCTION

## 1.1 PROJECT OVERVIEW

The heart is one of the main parts of the human body after the brain. The primary function of the heart is to pumping blood to the whole body parts. Any disorder that can lead to disturbing the functionality of the heart is called heart disease. Several types of heart disease are there in the world; Coronary artery disease (CAD), and heart failure (HF) are the most common heart diseases that are present. The main reason behind the coronary heart disease (CAD) is blockage or narrowing down of the coronary arteries .Coronary arteries are also responsible for supplying blood to the heart. CAD is the leading cause of death over 26 million people are suffering from coronary heart disease(CAD) around the world, and it is increasing 2% annually due to CAD 17.5 million deaths happened globally in 2005. In the growing world, 2% of the population around the world is suffering from CAD, and 10% of the people are older than 65 years. Approximately 2% of the annual healthcare budget spent only to treat CAD disease. USA government spent 35 billion dollars for CAD in 2018. Different factors can raise the risk of heart failure. Medical scientists have classified those factors into two different categories; one of them is risk factors that cannot be changed, and another one is risk factors that can be changed. Family history, sex, age comes under risk factors that cannot be changed. High cholesterol, smoking, physical inactivity, high blood pleasure all these come under risk factors.

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## 1.2 PURPOSE

a) The dashboard will provide the hidden insights which will help the doctors to prevent or cure the disease.
b) The dashboard can give recommendations to the patients based on the past data.
c) The dashboard will predict the future heart disease .

## 2. LITERATURE SURVEY

### 1.1 EXISTING PROBLEM

1. The purpose of the author is to develop a solution and help doctors .The project describes that the system uses a 5-fold cross-validation technique for verification. A comparative study is given for these four methodologies. It is found in the analysis that the Extreme Gradient Boosting Classifier with GridSearchCV gives the highest and nearly comparable testing and training accuracies as 100% and 99.03% for both the datasets Moreover, it is found in the analysis that XGBoost Classifier without GridSearchCV gives the highest and nearly comparable testing and training accuracies as 98.05% and 100%. The primary aim of this paper is to develop a unique model creation technique for solving real-world problems.

2. Heart disease prediction using data mining is one of the most interesting and challenging tasks. The shortage of specialists and high wrongly diagnosed cases has become the need to develop a fast and efficient detection system. According to past system the integration of clinical decision support with computer based patient record can reduce medical errors and it can be made more precise to enhance the patient's safety.

3. In this paper the author is closely working with the heart disease prediction by looking into the heart disease dataset. From that dataset they have derived various insights that help us to know the weightage of each feature and how they are interrelated to each other but our aim is to detect the probability of person who will be affected by a severe heart problem or not .The Heart Disease prediction will have the following key takeaways are Data insight, EDA (Exploratory data analysis) Feature engineering , Model building. They carried out data visualization and data analysis of the target variable, age and other features. They also carried out a complete feature engineering part in this article which summons all the valid steps needed for further steps i.e. model building. KNN model gives us the accuracy value of about 89%.

4. In this paper, the risk factors that causes heart disease is considered and predicted using K-means algorithm and the analysis is carried out using a publicly available data for heart disease. The dataset holds 209 records with 8 attributes such as age, chest pain type, blood pressure, blood glucose level, ECG in rest, heart rate and four types of chest pain. To predict the heart disease, K-means clustering algorithm is used along with data analytics and visualization tool. The paper discusses the pre-processing methods, classifier performances and evaluation metrics. In the result section, the visualized data shows that the prediction is accurate.

## 1.2 REFERENCES


1. J. Schmidhuber, “Deep Learning in neural networks: An overview,” Neural Networks, vol. 61, pp. 85–117, 2015, doi: 10.1016/j.neunet.2014.09.003.’
2. N. H. Farhat, “Photonit neural networks and learning mathines the role of electron-trapping materials,” IEEE Expert. Syst. their Appl., vol. 7, no. 5, pp. 63– 72, 1992, doi: 10.1109/64.163674. 3.
3. A. K. M Sazzadur Rahman, M. Mehedi Hasan, S. Asaduzzaman, M. Asaduzzaman, and S. Akhter Hossain, “An analysis of computational intelligence techniques for diabetes prediction Machine Learning View project An analysis of computational intelligence techniques for diabetes prediction,” Int. J. Eng. &Technology, vol. 7, no. 4, pp. 6229–6232, 2018, doi: 10.14419/ijet.v7i4.28245. 4.
4. G. H. Tang, A. B. M. Rabie, and U. Hägg, “Indian hedgehog: A mechanotransduction mediator in condylar cartilage,” J. Dent. Res., vol. 83, no. 5, pp. 434–438, 2004, doi: 10.1177/154405910408300516.


## 1.3 PROBLEM STATEMENT DEFINITION

Problem Statement 1:

The doctor Needs a way to penetrate technology into healthcare.

Problem Statement 2:

The doctor Needs a way to use data analytics for heart disease prediction.

Problem Statement 3:

The doctor Needs a way to predict accurate heart disease.

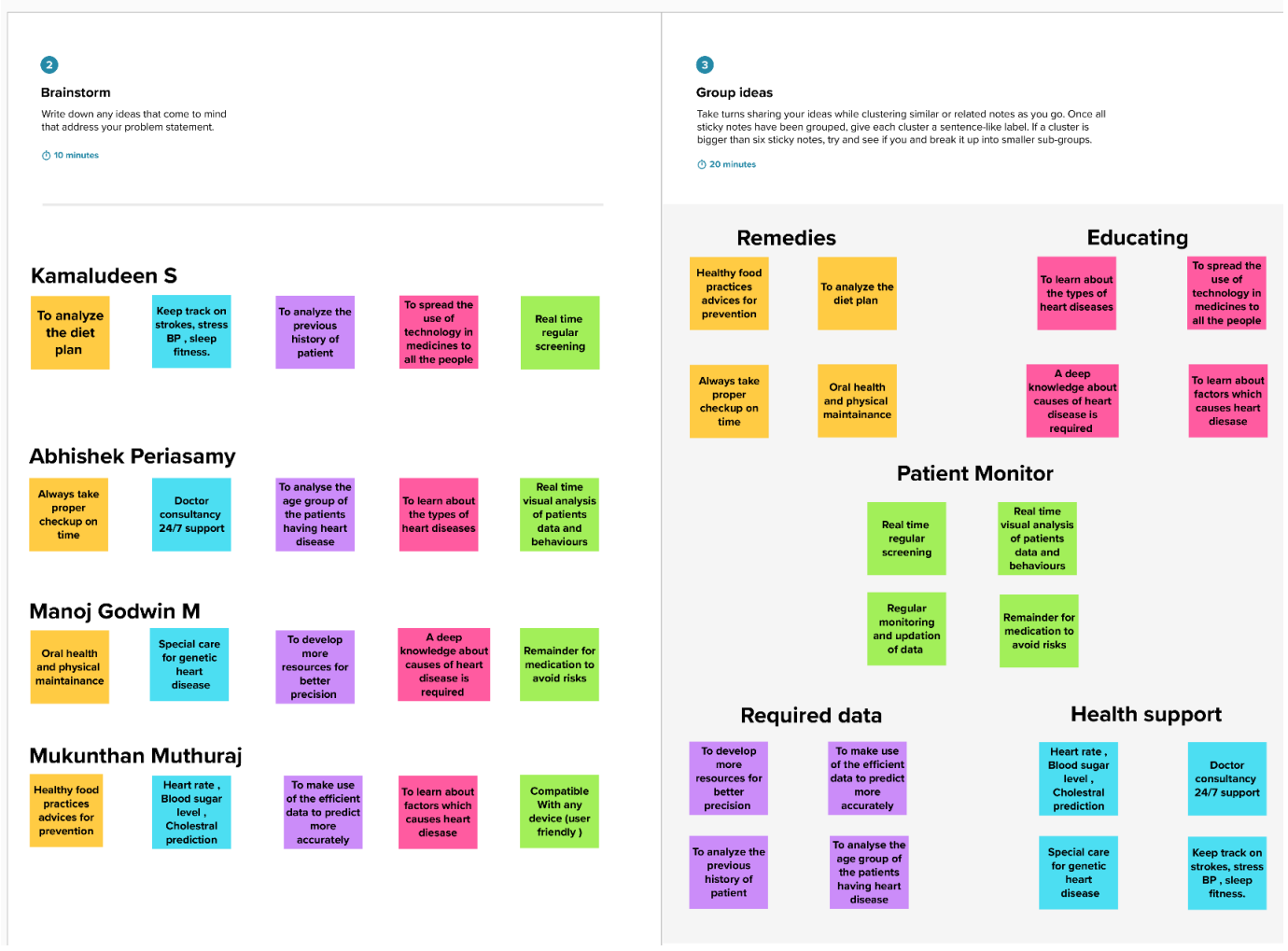
Problem Statement 4:

The doctor Needs a way to see visible progress in prediction.

# 3. IDEATION & PROPOSED SOLUTION

## 3.1 EMPATHY MAP CANVAS

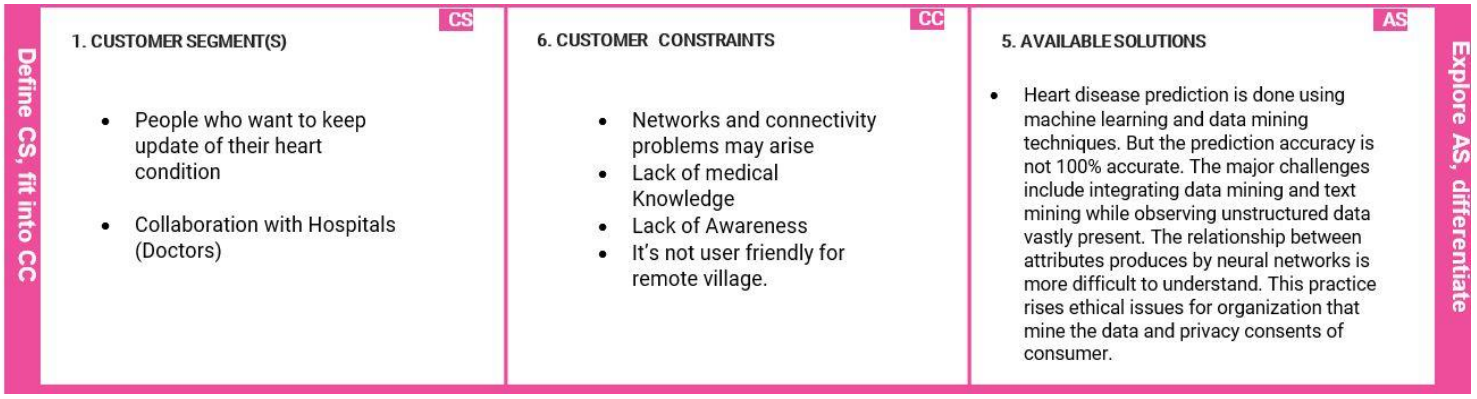
# 3.2 IDEATION & BRAINSTORMING

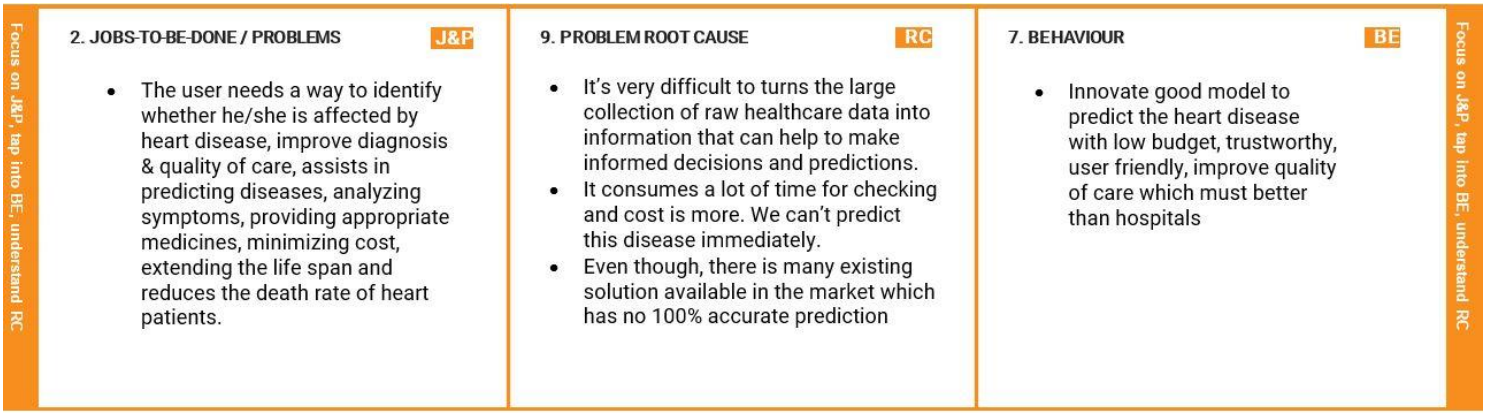


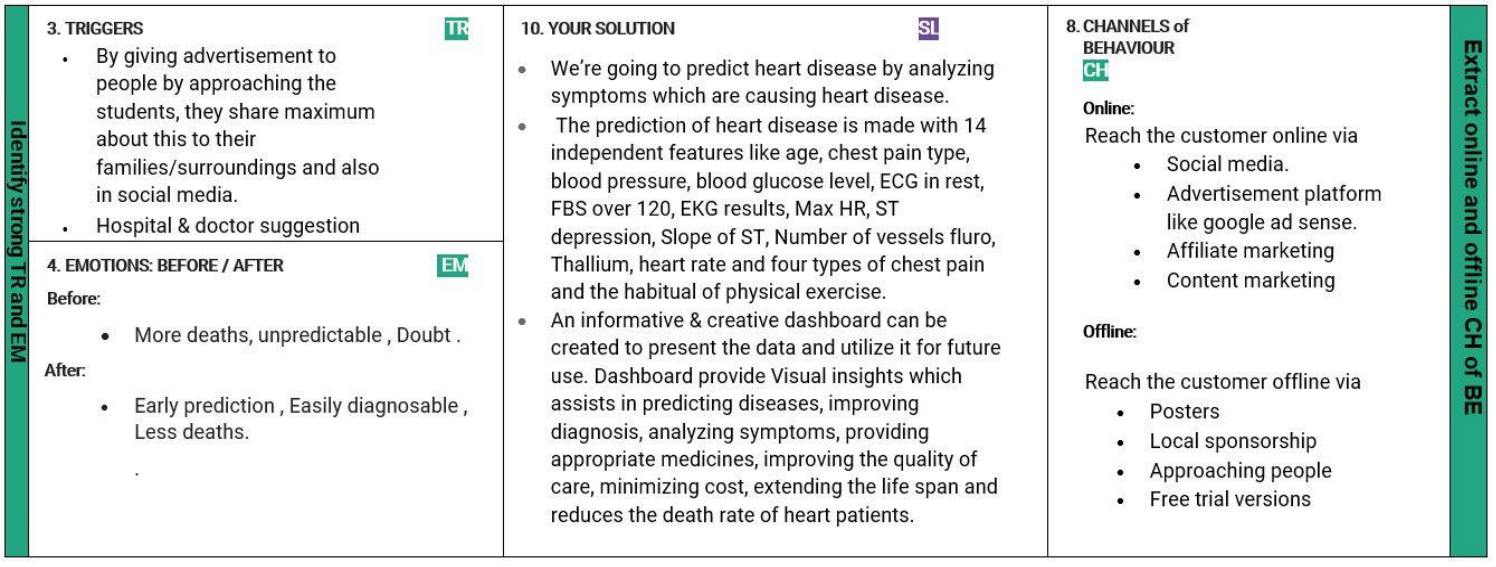

### 3.3 PROPOSED SOLUTION

| S. No | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | • The user need a way to identify whether he/she is affected by Heart disease, improve diagnosis & quality of care, assists in predicting diseases, analyzing symptoms, providing appropriate medicines, minimizing cost, extending the life span and reduces the death rate of heart patients.. |
| 2. | Idea / Solution description | • The prediction of heart disease is made with 14 independent features like age, chest pain type, blood pressure, blood glucose level, ECG in rest heart rate and four types of chest pain and the habitual of physical exercise.<br>• Dashboard provide Visual insights which assists in predicting diseases, improving diagnosis, analyzing symptoms, providing appropriate medicines, improving the quality of care, minimizing cost, extending the life span and reduces the death rate of heart patients |
| 3. | Novelty / Uniqueness | • The use of analytics in healthcare improves care by facilitating preventive care and visually represented data provide various insights easily. It is cost efficient. Earlier prediction is very helpful in reducing mortality rate. Moreover on the basis of patient heart condition, patient's treatment is very easy for the doctors it can be integrated with any real time systems such as app. |
| 4. | Social Impact / Customer Satisfaction | • It will reduce the mortality rate due to heart disease. Heart prediction can be done easier and earlier by visual analytics.<br>Most importantly, it is very helpful for doctors to give treatments according to the patient's conditions and it's preferred by the doctors as it saves time. |
| 5. | Business Model (Revenue Model) | • There are 2 ways to generate a revenue from this project by creating product model. First one by introducing app for predicting heart disease or it can be integrated with smart watch for producing more efficient model. |
| 6. | Scalability of the Solution | • It can be integrated with smart watch and apps for further advancements which is very helpful for earlier prediction. And further, we can provide live doctor consultancy, keep up the old data records for increasing accurate prediction and advices to prevent heart disease. Notifies alerts to nearby hospital when person is at risk. |

## 3.4 PROBLEM SOLUTION FIT



## 4. REQUIREMENT ANALYSIS

### 4.1 FUNCTIONAL REQUIREMENTS

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| **FR-1** | **User Registration** | • Registration through Website<br>• Registration through Gmail<br>• Registration through LinkedIN |
| **FR-2** | **User Confirmation** | • Confirmation via Email<br>• Confirmation via OTP |
| **FR-3** | **User Login** | Login using the user registered id and password |
| **FR-4** | **User Profile** | It consists of all the user information such as Name, Email, Phone number and Region. |
| **FR-5** | **Input Data** | The required input Heart disease data is uploaded into the account. |
| **FR-6** | **Prepare the Data** | The Heart disease data needs to be prepared before starting the analysis. In here the cleaning of the data takes place. |
| **FR-7** | **Data Exploration** | The Heart disease data needs to be explored to discover and analyse the data. We can also find out the hidden relationships and identify the patterns. |
| **FR-8** | **Data Visualization** | Different types of charts, graphs can be formed with the help of the insights taken. |
| **FR-9** | **Dashboard Creation** | • With the help of the Heart disease visualization charts an interactive dashboard can be created which is very easy to understand by everyone.<br>• It helps doctors to take better decisions like which steps must be taken , at which conditions etc. |
| **FR-10** | **Present the data** | The heart disease data can be presented in different ways such as dashboard, reports and stories. |

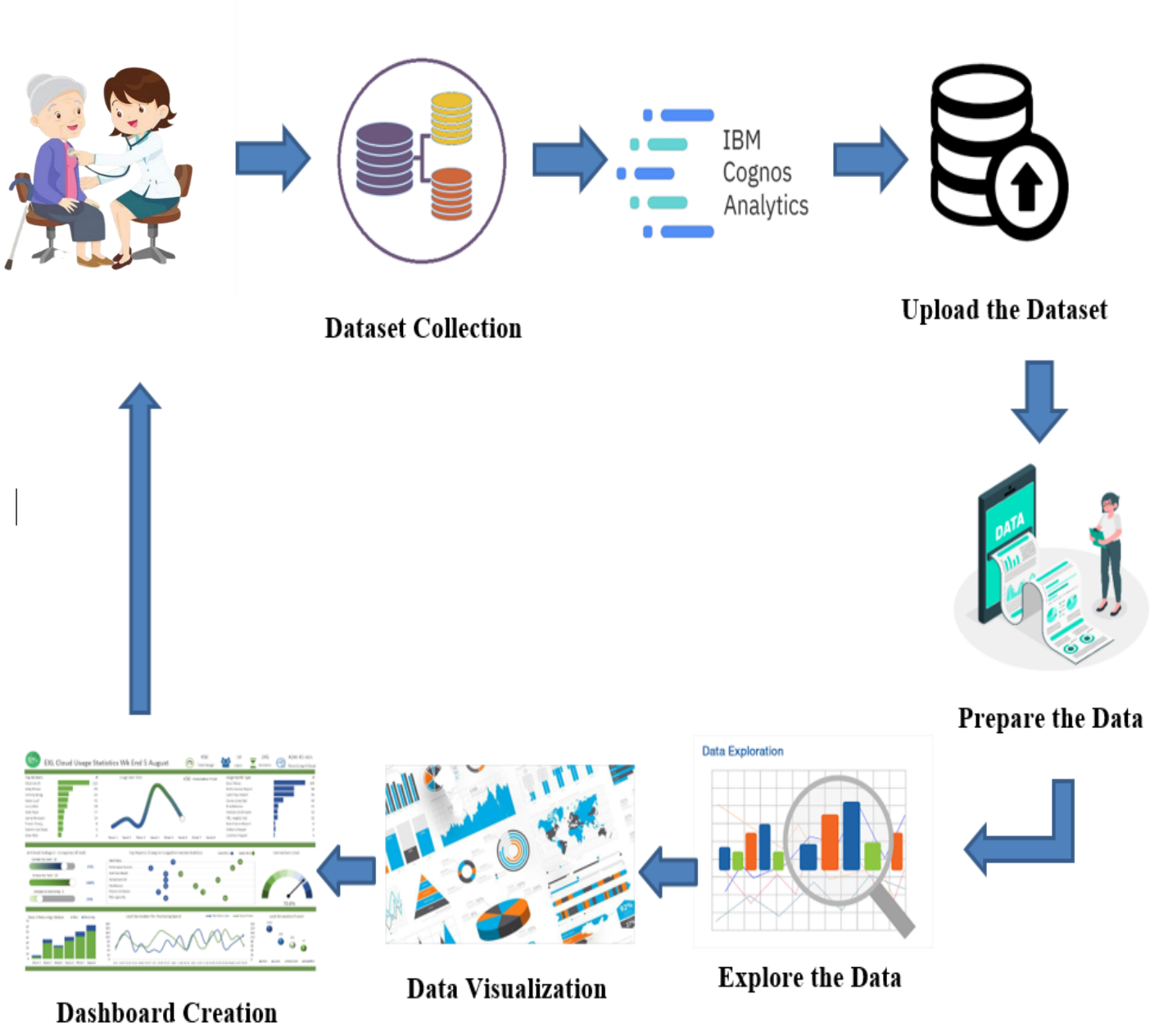
## 4.2 NON-FUNCTIONAL REQUIREMENTS

| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| **NFR-1** | **Usability** | • It is very easy to navigate.<br>• It can be used by anyone as the instructions are provided very clearly.<br>• Different charts can be easily made i.e we can easily pick and drop these charts.<br>• An interactive dashboard is created which provides the best decision that should be taken<br>• It requires a very less amount of time. |
| **NFR-2** | **Security** | • The user data is securely stored in the IBM cloud.<br>• Access to the resources through the two factor authentication.<br>• The passwords are securely managed.<br>• The user's information are authenticated.<br>• To authorize and monitor the use of the anonymous accounts and to remove them. |
| **NFR-3** | **Reliability** | • The Quality of the services provided are trustworthy.<br>• It can handle a lot of users at a single time.<br>• It can process and initialize most functions. |
| **NFR-4** | **Performance** | • It performs very faster and it is very easy to use.<br>• It provides the user with good interaction to make them understand the hidden patterns. |
| **NFR-5** | **Availability** | • It should be made available to access to anyone at any time.<br>• It should be able to work at any place where the user is present.<br>• It should be made compatible to work in all the devices. |
| **NFR-6** | **Scalability** | • To expand the server capacity, memory or disc space so that more people can use this at a time.<br>• It should be able to hold large datasets. |

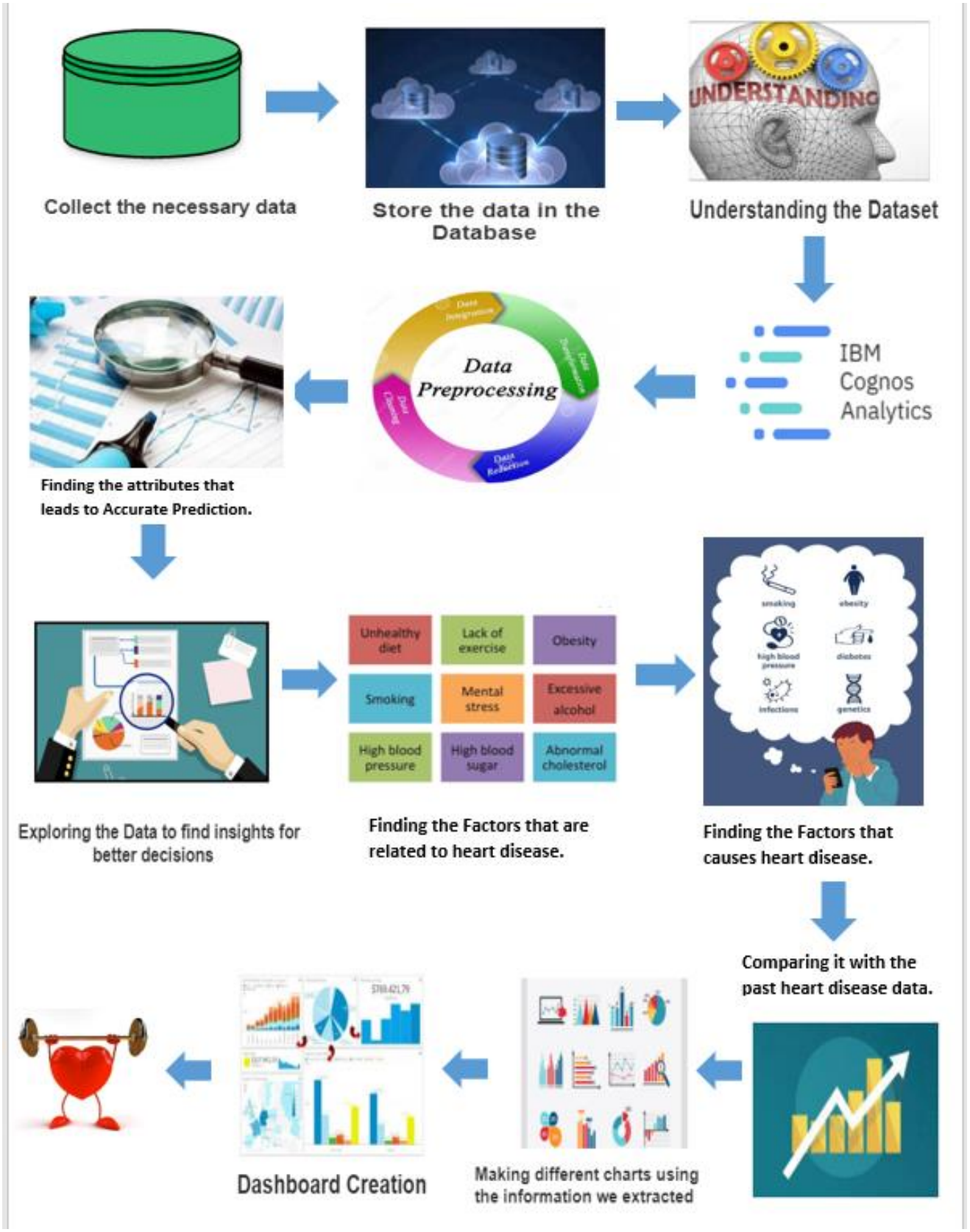
## 5. PROJECT DESIGN

### 5.1 DATA FLOW DIAGRAMS

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



## 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 Google. | I can register and access the dashboard through google login. | Medium | Sprint-1 |
| | Login | USN-4 | As a user, I can log into the application by entering email & Password. | I can access my account/ dashboard. | High | Sprint-1 |
| | Dashboard | USN-5 | As a user, I can upload, the dataset. | I can upload the dataset in the dashboard. | High | Sprint -1 |
| | | USN-6 | As a user, I can work with the dataset. | I can prepare my dataset. | High | Sprint -2 |
| | | USN-7 | As a user, I can make visualization charts for my dataset. | I can explore and visualize my dataset. | High | Sprint-3 |
| | | USN-8 | As a user, I can create a Dashboard. | I can create a dashboard and find the insights. | High | Sprint-4 |
| **Customer Care Executive** | Dashboard | USN-9 | As a customer care executive, I can access customer's information and solve their queries and issues | I can ask help if I face any issues while using the webpage. | Medium | Sprint-4 |
| **Administrator** | Application | USN-10 | As an administrator, I can manage and maintain the database. | I can assure that the database is secured. | Medium | Sprint -4 |
| | | USN-11 | As an administrator, I can manage the overall process and give updates. | I can manage and give updates. | Medium | Sprint -4 |

# 6. PROJECT PLANNING & SCHEDULING

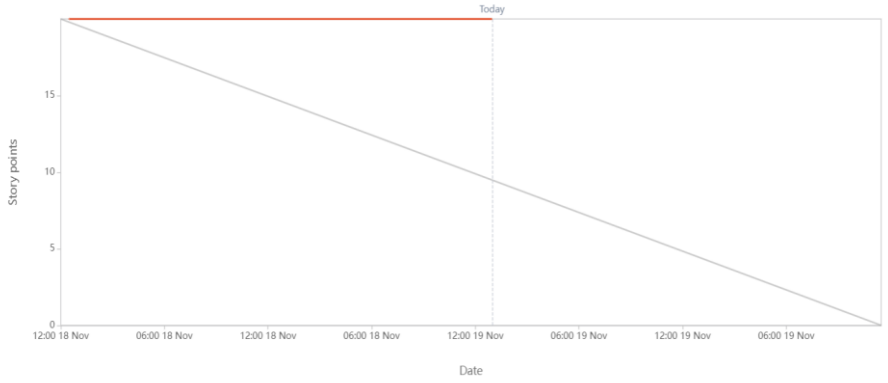
## 6.1 SPRINT PLANNING & ESTIMATION

| SPRINTS | FUNCTIONAL REQUIREMENTS (EPIC) | USER STORY NUMBER | USER STORY / TASK | STORY POINTS | PRIORITY | TEAM MEMBERS |
|---|---|---|---|---|---|---|
| Sprint – 1 | Working with the Dataset | USN – 1 | *Understanding the Dataset, Loading the Dataset and Exploring the Dataset.* | 20 | High | • Mukunthan Muthuraj<br>• Abhishek Periasamy<br>• Kamaludeen S<br>• Manoj Godwin M |
| Sprint – 2 | Visualization Charts | USN – 2 | *Creating the Data Visualization Charts.* | 20 | High | • Mukunthan Muthuraj<br>• Abhishek Periasamy<br>• Kamaludeen S<br>• Manoj Godwin M |
| Sprint – 3 | Dashboard | USN – 3 | *Creating an Interactive Dashboard.* | 20 | High | • Mukunthan Muthuraj<br>• Abhishek Periasamy<br>• Kamaludeen S<br>• Manoj Godwin M |
| Sprint – 4 | Export Dashboard | USN – 4 | *Exporting the Dashboard* | 20 | High | • Mukunthan Muthuraj<br>• Abhishek Periasamy<br>• Kamaludeen S<br>• Manoj Godwin M |

## 6.2 SPRINT DELIEVERY SCHEDULE

| SPRINTS | TOTAL STORY POINTS | DURATION | SPRINT START DATE | SPRINT END DATE (PLANNED) | STORY POINTS COMPLETED | SPRINT RELEASE DATE (ACTUAL) |
|---|---|---|---|---|---|---|
| Sprint – 1 | 20 | 3 Days | *08 November 2022* | *10 November 2022* | 20 | *10 November 2022* |
| Sprint – 2 | 20 | 3 Days | *11 November 2022* | *13 November 2022* | 20 | *13 November 2022* |
| Sprint – 3 | 20 | 3 Days | *14 November 2022* | *16 November 2022* | 20 | *16 November 2022* |
| Sprint – 4 | 20 | 3 Days | *17 November 2022* | *19 November 2022* | 20 | *19 November 2022* |

## 6.3 REPORTS FROM JIRA




Report: ECYUDA Sprint 1

*Issue added after sprint start

Scope changes log

| Date | Key | Summary | Issue type | Epic | Details of scope change | Change in estimation |
|---|---|---|---|---|---|---|

Report: ECYUDA Sprint 1

*Issue added after sprint start

Scope changes log

| Date | Key | Summary | Issue type | Epic | Details of scope change | Change in estimation |
|---|---|---|---|---|---|---|

There have been no scope changes this sprint

Incomplete issues

View in issue navigator

| Key | Summary | Issue type | Epic | Status | Assignee | Story points |
|---|---|---|---|---|---|---|
| ECYUDA-6 | Visualization Charts for Seasons with average productions | Story | DATA VISUALIZATI... | TO DO | AA | 4 |
| ECYUDA-7 | Visualization Charts for With Years Usage Of Area and Production | Story | DATA VISUALIZATI... | TO DO | AS | 4 |
| ECYUDA-8 | Visualization Charts for Top 10 states with Most Area | Story | DATA VISUALIZATI... | TO DO | M | 4 |

Incomplete issues

View in issue navigator

| Key | Summary | Issue type | Epic | Status | Assignee | Story points |
|---|---|---|---|---|---|---|
| ECYUDA-6 | Visualization Charts for Seasons with average productions | Story | DATA VISUALIZATI... | TO DO | AA | 4 |
| ECYUDA-7 | Visualization Charts for With Years Usage Of Area and Production | Story | DATA VISUALIZATI... | TO DO | AS | 4 |
| ECYUDA-8 | Visualization Charts for Top 10 states with Most Area | Story | DATA VISUALIZATI... | TO DO | M | 4 |
| ECYUDA-9 | Visualization Charts for State with Crop Production | Story | DATA VISUALIZATI... | TO DO | J | 4 |
| ECYUDA-10 | Visualization Charts for State with Crop Production Along with S... | Story | DATA VISUALIZATI... | TO DO | AA | 4 |

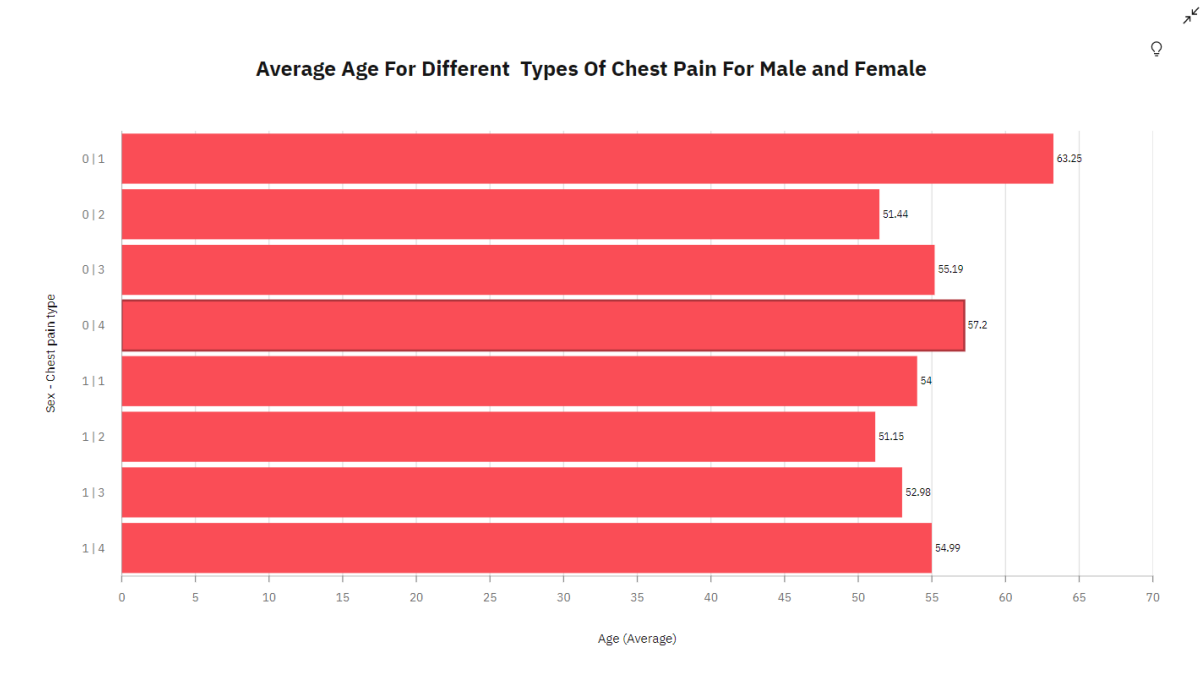
Completed issues

| Key | Summary | Issue type | Epic | Status | Assignee | Story points |
|---|---|---|---|---|---|---|

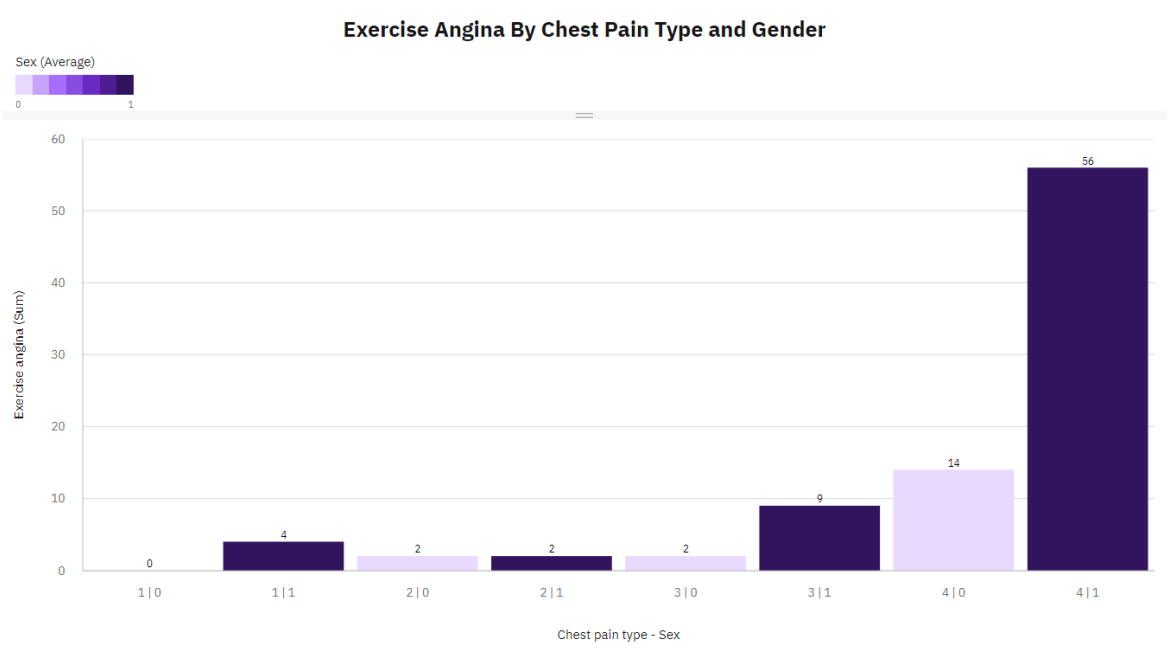
No issues in sprint have been completed

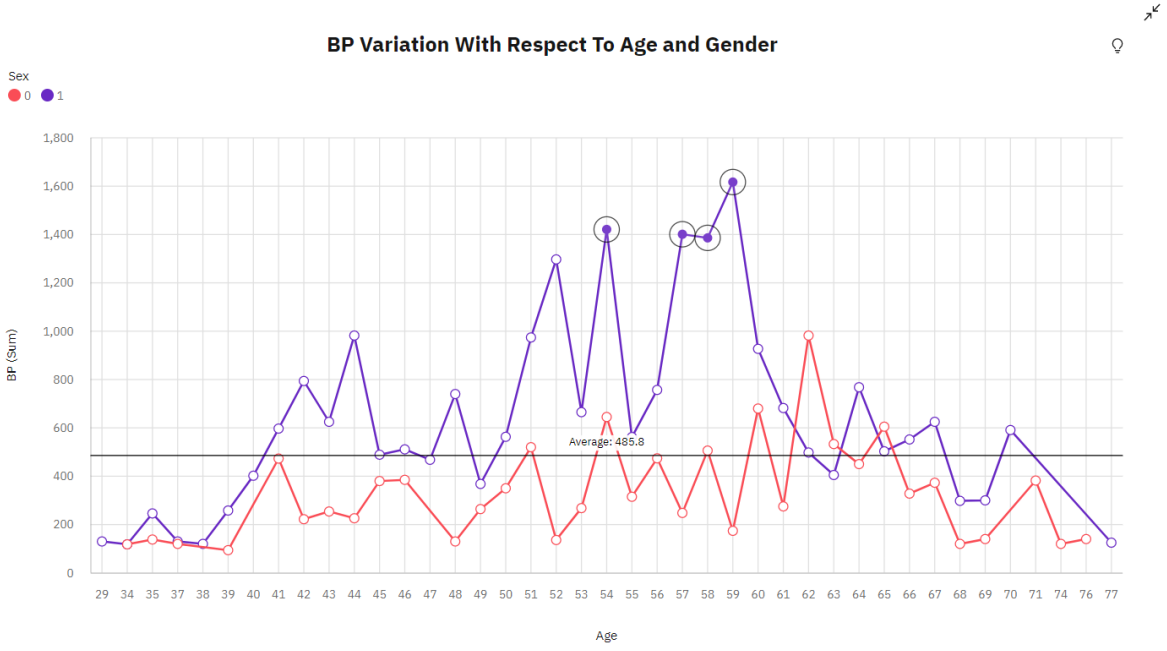
# 7. CODING & SOLUTIONING

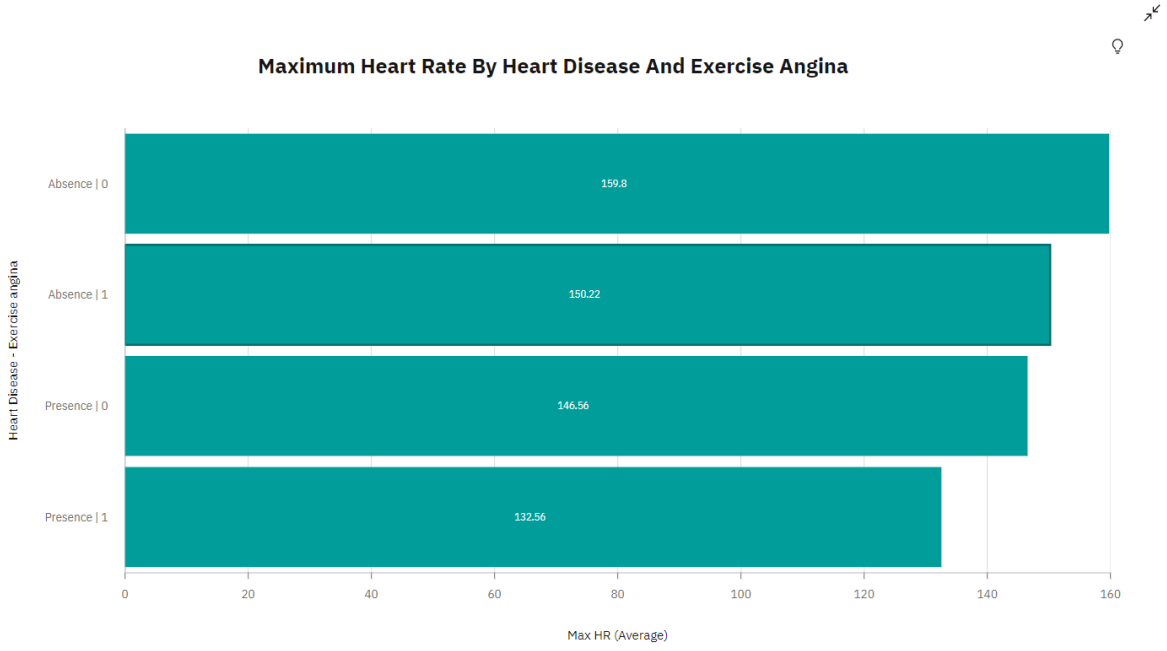
## 7.1 FEATURE 1




## 7.2 FEATURE 2



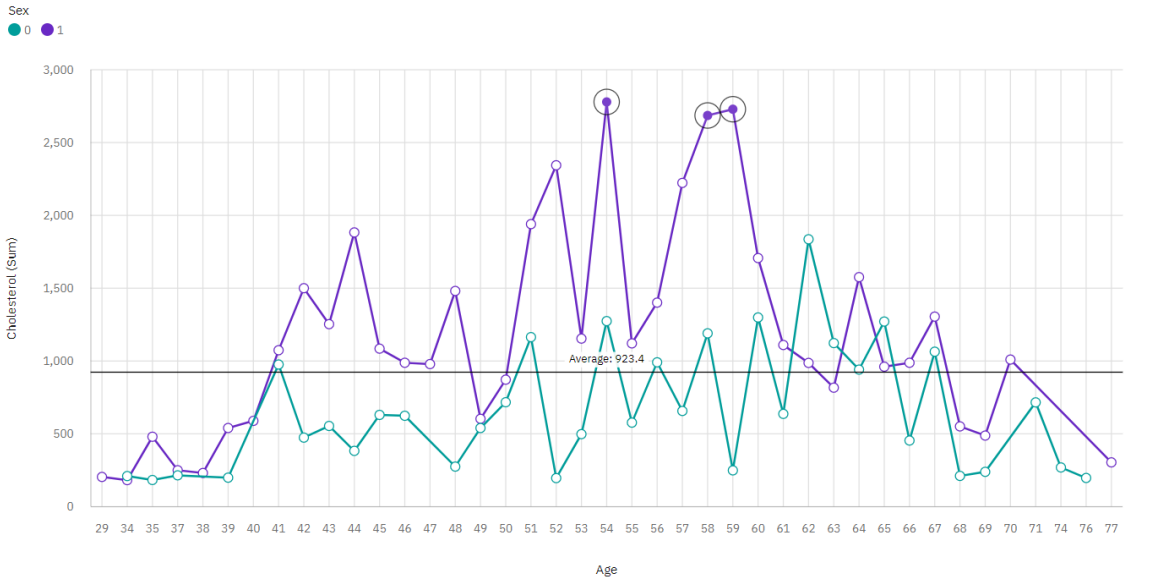

BP Variation With Respect To Age and Gender
Sex
0
1
BP (Sum)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Average: 485.8
29 34 35 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 74 76 77
Age


Maximum Heart Rate By Heart Disease And Exercise Angina
Heart Disease - Exercise angina
Absence | 0
159.8
Absence | 1
150.22
Presence | 0
146.56
Presence | 1
132.56
0 20 40 60 80 100 120 140 160
Max HR (Average)

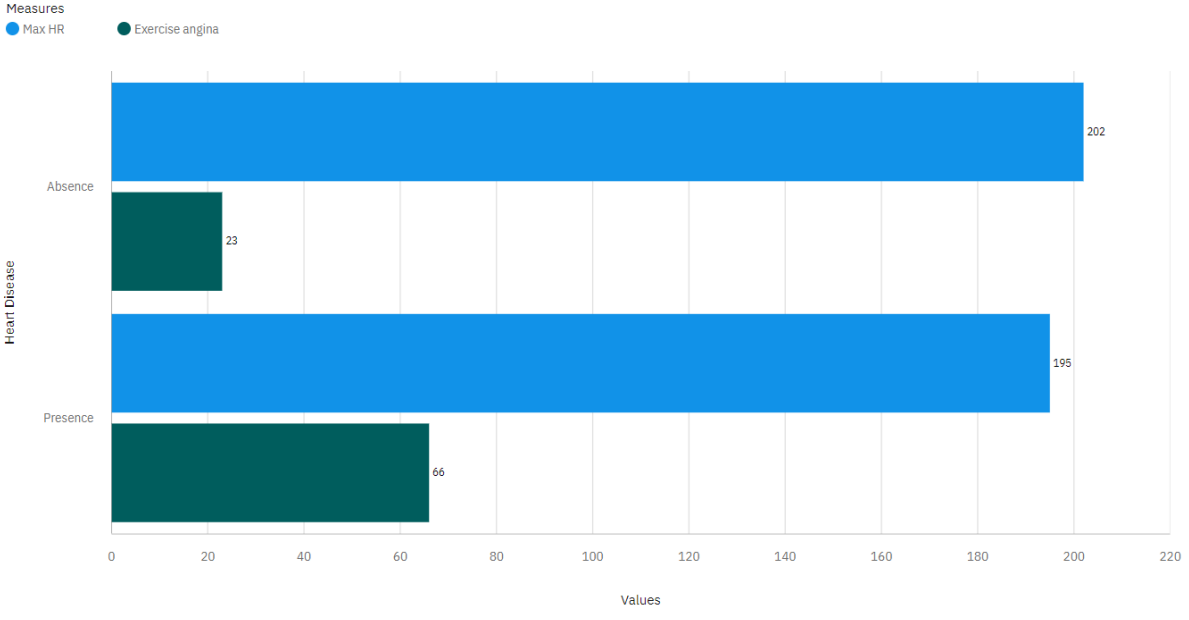
### Different Types Of Chest Pain In Existing Heart Diseases For Male And Female

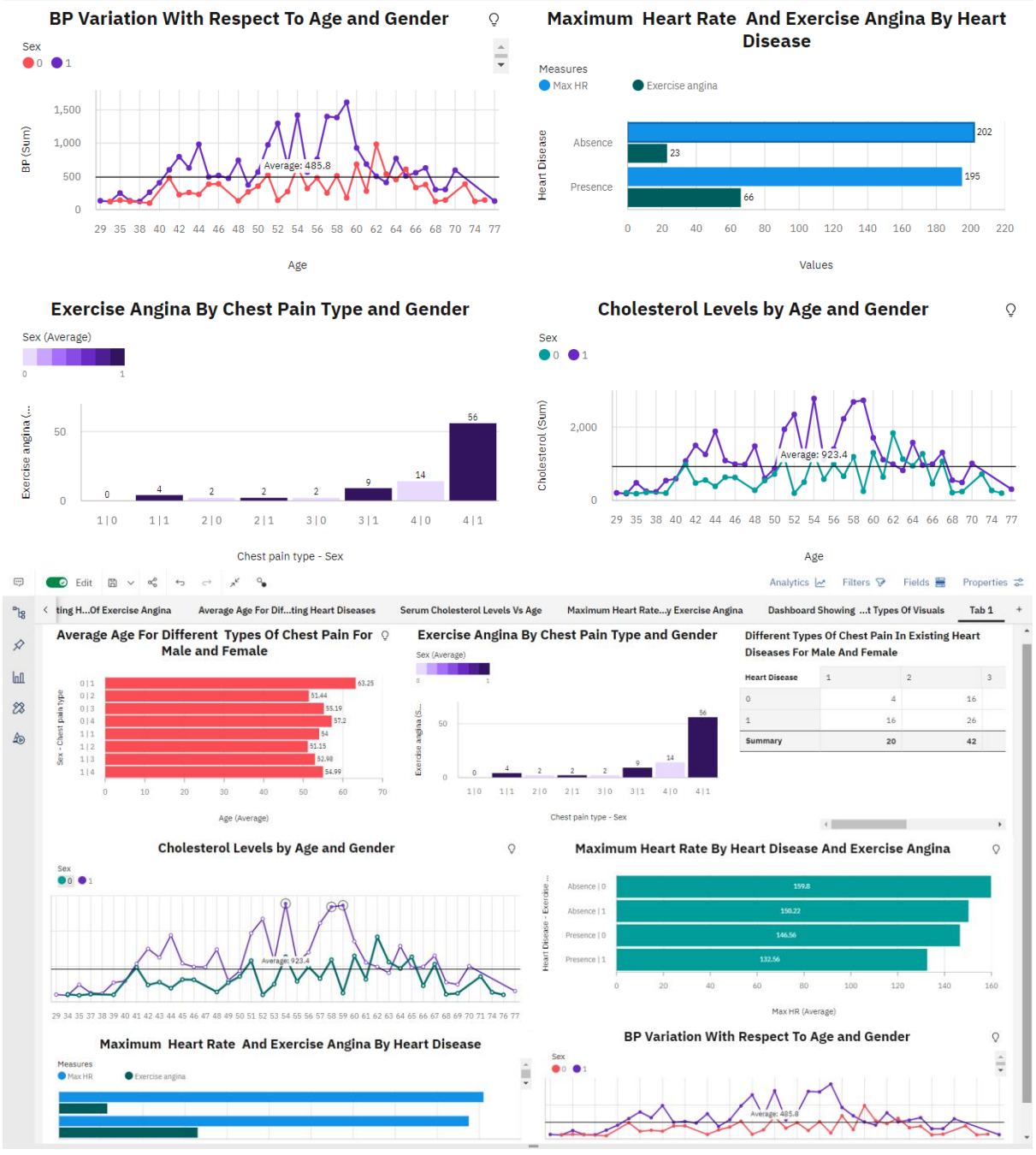
| Heart Disease | 1 | 2 | 3 | 4 | Summary |
|---|---|---|---|---|---|
| 0 | 4 | 16 | 32 | 35 | **87** |
| 1 | 16 | 26 | 47 | 94 | **183** |
| **Summary** | **20** | **42** | **79** | **129** | **270** |

### Cholesterol Levels by Age and Gender




### Maximum Heart Rate And Exercise Angina By Heart Disease




BP Variation With Respect To Age and Gender
Sex
0
1
BP (Sum)
1,500
1,000
500
0
Average: 485.8
29 35 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 74 77
Age
Maximum Heart Rate And Exercise Angina By Heart Disease
Measures
Max HR
Exercise angina
Heart Disease
Absence
Presence
202
23
195
66
0 20 40 60 80 100 120 140 160 180 200 220
Values
Exercise Angina By Chest Pain Type and Gender
Sex (Average)
0
1
Exercise angina (...
50
0
0
4
2
2
2
9
14
56
1 | 0
1 | 1
2 | 0
2 | 1
3 | 0
3 | 1
4 | 0
4 | 1
Chest pain type - Sex
Cholesterol Levels by Age and Gender
Sex
0
1
Cholesterol (Sum)
2,000
0
Average: 923.4
29 35 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 74 77
Age
Edit
Analytics
Filters
Fields
Properties
ting H...Of Exercise Angina
Average Age For Dif...ting Heart Diseases
Serum Cholesterol Levels Vs Age
Maximum Heart Rate...y Exercise Angina
Dashboard Showing ...t Types Of Visuals
Tab 1
Average Age For Different Types Of Chest Pain For Male and Female
Sex - Chest pain type
0 | 1
0 | 2
0 | 3
0 | 4
1 | 1
1 | 2
1 | 3
1 | 4
63.25
51.44
55.19
57.2
54
51.15
52.98
54.99
0 10 20 30 40 50 60 70
Age (Average)
Exercise Angina By Chest Pain Type and Gender
Sex (Average)
Exercise angina (S...
50
0
0
4
2
2
2
9
14
56
1 | 0
1 | 1
2 | 0
2 | 1
3 | 0
3 | 1
4 | 0
4 | 1
Chest pain type - Sex
Different Types Of Chest Pain In Existing Heart Diseases For Male And Female
Heart Disease
1
2
3
0
4
16
1
16
26
Summary
20
42
Cholesterol Levels by Age and Gender
Sex
0
1
Average: 923.4
29 34 35 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 74 76 77
Maximum Heart Rate By Heart Disease And Exercise Angina
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Absence | 0
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Presence | 0
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0 20 40 60 80 100 120 140 160
Max HR (Average)
Maximum Heart Rate And Exercise Angina By Heart Disease
Measures
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Exercise angina
BP Variation With Respect To Age and Gender
Sex
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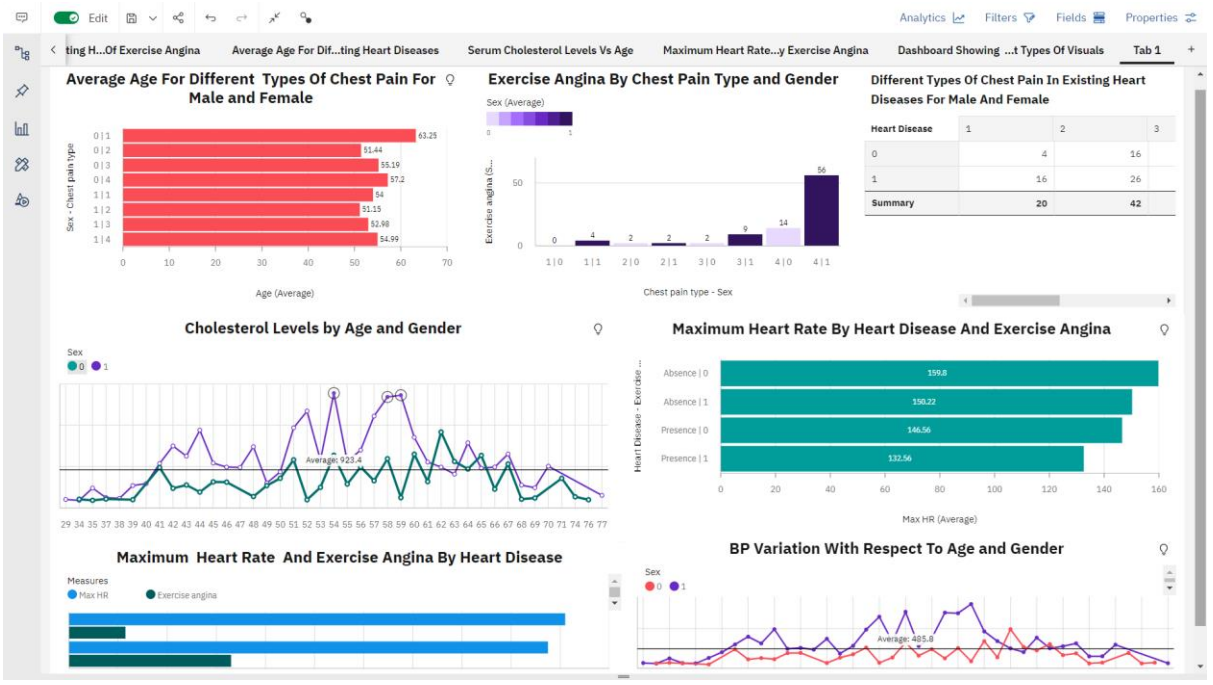
1
Average: 485.8


Edit
Analytics
Filters
Fields
Properties
ting H...Of Exercise Angina
Average Age For Dif...ting Heart Diseases
Serum Cholesterol Levels Vs Age
Maximum Heart Rate...y Exercise Angina
Dashboard Showing ...t Types Of Visuals
Tab 1
Average Age For Different Types Of Chest Pain For Male and Female
Sex - Chest pain type
Age (Average)
Exercise Angina By Chest Pain Type and Gender
Sex (Average)
Exercise angina (S...
Chest pain type - Sex
Different Types Of Chest Pain In Existing Heart Diseases For Male And Female
Heart Disease
Summary
Cholesterol Levels by Age and Gender
Sex
Maximum Heart Rate By Heart Disease And Exercise Angina
Heart Disease - Exercise ...
Max HR (Average)
Maximum Heart Rate And Exercise Angina By Heart Disease
Measures
Max HR
Exercise angina
BP Variation With Respect To Age and Gender
Sex

# 8. TESTING

## 8.1 TEST CASES

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

| Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|
| 5 | 0 | 0 | 5 |
| 7 | 0 | 0 | 7 |
| 2 | 0 | 0 | 2 |
| 3 | 0 | 0 | 3 |
| 9 | 0 | 0 | 9 |
| 4 | 0 | 0 | 4 |
| 2 | 0 | 0 | 2 |

## 8.2 USER ACCEPTANCE TESTING

### Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Smart Fashion Recommender Application project at the time of the release to User Acceptance Testing (UAT).

### 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 | 5 | 5 | 2 | 3 | 21 |
| Duplicate | 1 | 0 | 3 | 0 | 4 |
| External | 2 | 3 | 0 | 1 | 6 |
| Fixed | 11 | 2 | 4 | 20 | 37 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 0 | 5 | 2 | 1 | 8 |
| Totals | 24 | 14 | 13 | 26 | 77 |

## 9. RESULT

### 9.1 PERFORMANCE METRICS

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

In [ ]:

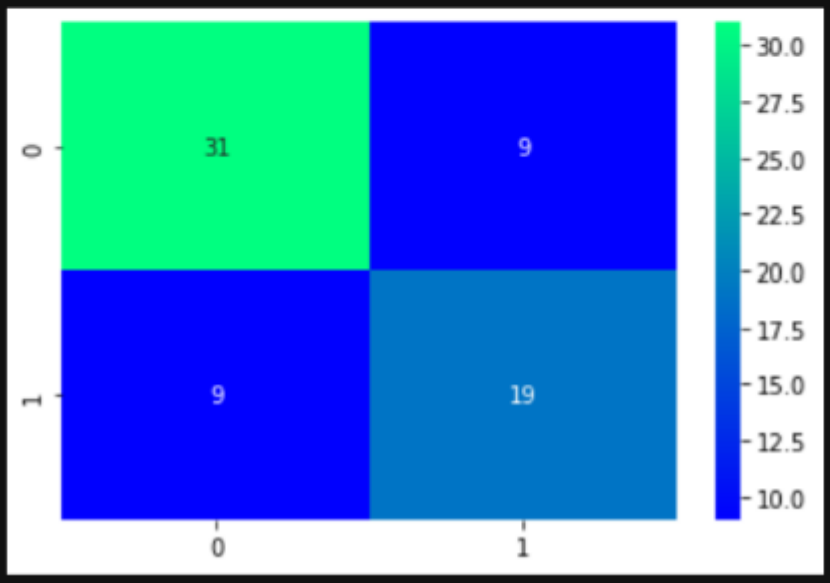
```
from sklearn.tree import DecisionTreeClassifier

dtclas=DecisionTreeClassifier()
modeldt=dtclas.fit(X_train,y_train)
predictiondt=modeldt.predict(X_test)
cmdt= confusion_matrix(y_test,predictiondt)
sns.heatmap(cmdt, annot=True,cmap='winter')
print(classification_report(y_test, predictiondt))
```

```
              precision    recall  f1-score   support

     Absence       0.78      0.78      0.78        40
    Presence       0.68      0.68      0.68        28

    accuracy                           0.74        68
   macro avg       0.73      0.73      0.73        68
weighted avg       0.74      0.74      0.74        68
```



## 10. ADVANTAGES & DISADVANTAGES

**ADVANTAGES:**

- Its helps the patient to discover the disease
- Its helps the doctor to cure or prevent disease

**DISADVANTAGES:**

- The  accuracy rates must be higher hence the data must be updated
- The prediction is not always true

## 11. CONCLUSION

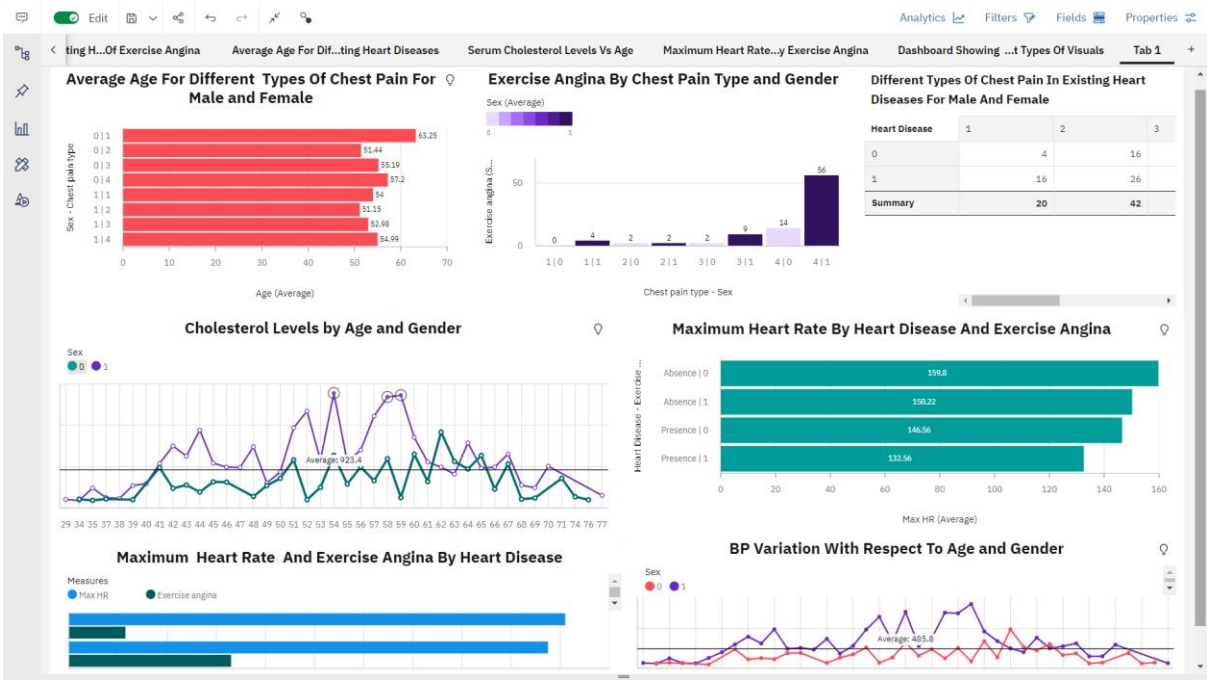
Heart disease is a very critical issue in the present growing world. So, there is a need for an automated system to predict heart disease at earlier stages. So that it will be useful for the physician to diagnose the patients efficiently, and it will be useful to the people also because they can track their health issues by using this automated system. Some of the expert automated systems were summarized in this paper. Feature selection and prediction, these two are essential for every automated system. By choosing features efficiently, we can achieve better results in predicting heart disease.

We have summarized some algorithms which are useful while selecting the features, like hybrid grid search algorithm and random search algorithm, etc. So, in the future, it is better to use search algorithms for selecting the features and then applying machine learning techniques for prediction will give us better results in the prediction of heart disease.

## 12. FUTURE SCOPE

There are many possible improvements that could be explored to improve the scalability and accuracy of this prediction system. As we have developed a generalized system, in future we can use this system for the analysis of different data sets. The performance of the health's diagnosis can be improved significantly by handling numerous class labels in the prediction process, and it can be another positive direction of research. In DM warehouse, generally, the dimensionality of the heart database is high, so identification and selection of significant attributes for better diagnosis of heart disease are very challenging tasks for future research.

# 13. APPENDIX


Edit
Analytics
Filters
Fields
Properties
Average Age For Dif...ting Heart Diseases
Serum Cholesterol Levels Vs Age
Maximum Heart Rate...y Exercise Angina
Dashboard Showing ...t Types Of Visuals
Tab 1
Average Age For Different Types Of Chest Pain For Male and Female
Sex - Chest pain type
Age (Average)
Exercise Angina By Chest Pain Type and Gender
Sex (Average)
Exercise angina (S...
Chest pain type - Sex
Different Types Of Chest Pain In Existing Heart Diseases For Male And Female
Heart Disease
Summary
Cholesterol Levels by Age and Gender
Sex
Average: 923.4
Maximum Heart Rate By Heart Disease And Exercise Angina
Heart Disease - Exercise ...
Max HR (Average)
Maximum Heart Rate And Exercise Angina By Heart Disease
Measures
Max HR
Exercise angina
BP Variation With Respect To Age and Gender
Sex
Average: 485.8

## 13.1 GITHUB & PROJECT DEMO LINK

- Our GitHub Repository Direct Link

  https://github.com/IBM-EPBL/IBM-Project-25880-1659975918

- Project Demonstration Video Direct Link