VISUALIZING AND PREDICTING HEART DISEASES

WITH AN INTERACTIVE DASHBOARD

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TABLE OF THE CONTENT

CHAPTER 1

INTRODUCTION

1.1 : PROJECT OVERVIEW

The terms "heart disease" and "cardiovascular disease" are frequently used interchangeably. Heart disease is a general term that covers a wide range of heart related medical conditions. Cardiovascular diseases are the most common cause of death worldwide over the last few decades in the developed as well as underdeveloped and developing countries. Building an important model for the medical system to forecast heart disease or cardiovascular disease requires the use of data mining and machine learning. Analytics is an essential technique for any profession as it forecast the future and hidden pattern. Data analytics is considered as a cost-effective technology in the recent past and it plays an essential role in healthcare which includes new research findings, emergency situations and outbreaks of disease. Our application helps the user in finding out if they have heart disease or not. They can find out by entering details such as their heart rate, cholesterol, blood pressure etc. A dashboard is also attached along with the results for better understanding. The project discusses the pre-processing methods, classifier performances and evaluation metrics. In the result section, the visualized data shows that the prediction is accurate.

1.2 : PURPOSE

This project's goal is to determine, depending on the patient's medical characteristics such as gender, age, chest pain, fasting blood sugar level, etc., whether they are likely to be diagnosed with any cardiovascular heart illnesses. The leading cause of death in the developed world is heart disease. Heart disease cases are rising quickly every day; thus, it is crucial to predict any potential illnesses in advance. This diagnosis is a challenging task that requires accuracy and efficiency. Therefore, there needs to be work done to help prevent the risks of having a heart attack or stroke. By using a person's medical history, our initiative can identify those who are most likely to be diagnosed with a cardiac condition. It can assist in identifying disease with less medical tests and effective therapies, so that patients can be treated appropriately. It can identify anyone who is experiencing any heart disease symptoms, such as chest pain or high blood pressure. Machine learning may be crucial in determining whether locomotor disorders, heart illnesses, and other conditions are present or absent. If foreseen well in advance, such information can offer valuable insights to doctors, who can then customize their diagnosis and care for each patient.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING PROBLEM

A quiet significant amount of works related to the diagnosis of heart disease using Machine Learning algorithms have been made. An efficient heart disease prediction has been made by using various algorithms some of them include Logistic Regression, KNN, Random Forest Classifier etc. It can be seen in results that each algorithm has its strength to register the defined objectives. The model incorporating IHDPS had the ability to calculate the decision boundary using the previous and new model of machine learning and deep learning. It facilitated the important and the most basic factors such as family history connected with any heart disease. But the accuracy that was obtained in such IHDPS model was far more less than the new upcoming model such as detecting coronary heart disease using artificial neural network and other algorithms of machine and deep learning.

2.2 REFERENCES

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CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP

3.2 IDEATION & BRAINSTORMING

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 tests and attributes the presence of heart disease.
2.	Idea / Solution description	➢ Analyzing data and identifying the heart disease using Cognos analysis.
3.	Novelty / Uniqueness	➢ Hoping to achieve maximum accuracy to provide prior treatment to the patients and reduce the fatality rate.
4.	Social Impact / Customer Satisfaction	➢ Saving lives, User friendly interactive dashboard. ➢ Reduces the exorbitant medical cost of the patients. ➢ Reduces the biases and mistakes caused by the decisions of doctors based on their intuitions and experiences.
5.	Business Model (Revenue Model)	➢ Data security. ➢ Easy to use. ➢ Constant updates according to necessity.
6.	Scalability of the Solution	➢ Can be used in any platform (Windows, mac, etc.,) ➢ Adding new feature does not affect the performance of thesystem. ➢ Scalable dataset.

3.4 PROBLEM SOLUTION FIT

1. Customer Segment(S) `CS`

- People who want to keep update of their heart condition
- Collaboration with Hospitals (Doctors)

6. Customer Constrains `CC`

- Network issues
- Lack of detailed medical knowledge of oneself
- It's not user friendly for remote village.

5. Available Solutions `AS`

Over the last decade, heart disease prediction is done using machine learning and data mining techniques. Many algorithms such as lift chart, classification matrix, KNN & k-mean clustering algorithms etc. But the prediction accuracy is not 100% accurate. The major challenges include integrating data mining and text mining while observing unstructured data vastly present. The relationship between attributes produces by neural networks is more difficult to understand. This practice rises ethical issues for organization that mine the data and privacy consents of consumer

2. JOBS-TO-BE-DONE / PROBLEMS `J&P`

The user needs 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.

9. PROBLEM ROOT CAUSE `RC`

- It is very difficult to turns the large collection of raw healthcare data into information that can help to make informed decisions and predictions.
- It consumes a lot of time for checking and cost is more. We cannot predict this disease Immediately.
- Even though, there is many existing solutions available in the market which has no 100% accurate prediction

7. BEHAVIOUR `BE`

Innovate good model to predict the heart disease with low budget, trustworthy, user friendly, improve quality of care which must better than hospitals

3. TRIGGERS `TR`

- By giving advertisement to people
- By approaching the students, they share maximum about this to their families/surroundings and in social media
- Hospital & doctor suggestion

4. EMOTIONS: BEFORE / AFTER `EM`

- Need to go to doctors for checking -> check their condition simply in home with mobile
- Prediction late-> earlier prediction which reduces death rate
- High cost -> minimizes the cost

10. YOUR SOLUTION `SL`

We are going to predict heart disease by analyzing symptoms which are causing heart disease. The prediction of heart disease is made with 14 independent features like age, chest pain type, blood pressure, blood glucose level, ECG in rest, FBS over 120, EKG results, Max HR, ST depression, Slope of ST, Number of vessels flour, Thallium, heart rate and four types of chest pain and the habitual of physical exercise. An informative & creative dashboard can be created to present the data and utilize it for future use. 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.

8. CHANNELS of BEHAVIOUR `CH`

Online:

Reach the customer online via

- Social media
- Advertisement platform like google ad sense
- Affiliate marketing
- Content marketing

Offline:

Reach the customer offline via

- Posters
- Local sponsorship
- Approaching people
- Free trial versions

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Facebook Registration through Gmail Registration through google
FR-2	Account creation	Gmail and password for account creation
FR-3	User Confirmation	Confirmation via Email Confirmation via OTP
FR-4	Personal details for account	Name, age, sex, height, weight, previous medical records, etc for health account basic details
FR-5	Regular medical condition updation in app	Entry present medical records, symptoms, etc..

4.2 NON-FUNCTIONAL   REQUIREMENTS

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Good mobile navigation will boost the usability of the entire product, helping users to enjoy all the features offered. Bad navigation will make it difficult to find things, making it less likely that users will ever experience the product the way the design team had envisioned. Our solution has better features in navigation such as hamburger menu, Bottom navigation, Top navigation, Cards, Tabs, Gesture-Based Navigation, Full-screen navigation, 3D touch. In our app, we are using general language English to make the app user-friendly

FR No.	Non-Functional Requirement	Description
NFR-2	Security	To preserve user trust and device integrity is done by making your app more secure. Our solution proposes 1. Provide the right permissions- Request only the minimum number of permissions necessary for your app to function properly. When possible, relinquish permissions when your app no longer needs them. 2. Store data safely- Store private data within internal storage 3. Ask for credentials before showing sensitive information 4. Keep services and dependencies up to date 5. Apply network security measures such as Add a network security configuration 6. Use WebView objects carefully- WebView objects in your app should not let users navigate to sites that are outside of your control. Whenever possible, use an allow list to restrict the content loaded by your app's WebView objects. 7. Disallow access to your app's content providers-Unless you intend to send data from your app to a different app that you do not own, explicitly disallow other developers' apps from accessing your app's Content Provider objects.
NFR-3	Reliability	1. Our app is made accessible whenever needed. 2. It Responds within the time frame needed 3. It is regularly updated or modified as needed by the user. 4. Provide security and privacy to the extent needed by the user. 5. Provide bug free operation that is simple and easily predictable
NFR-4	Performance	1. Our app responds quickly by making application size small, using CDN & app bundles and produces the output and it takes lesser session length 2. Our app provides unique solution than the present system in the software 3. Special team is formed to reply queries of the users 24/7 4. Our app provides real time notifications about the user condition.
NFR-5	Availability	By setting up An Application Performance Monitoring (APM) system that helps to monitor the availability of application. Consistent performance monitoring and optimization help you to tackle issues as quickly as they show up. Our app is designed in such a way that to emphasize availability

|		by spreading data across clusters so that if one fails the entirety of the data is not lost.
NFR-6	**Scalability**	A scalable app can easily accommodate double, triple, or even ten times its current number of users by withstanding no crashes, no downtime, Fast loading speeds, Top-notch security. We're going to make our app more scalable by using right Tech stack & Infrastructure scaling to process millions of data with bug free , multiple database servers that accommodate millions of user to secure our app's fail-safe performance, using caching and stateless approach to reduce the load, Content Delivery Networks (CDN) to minimal response time.

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS
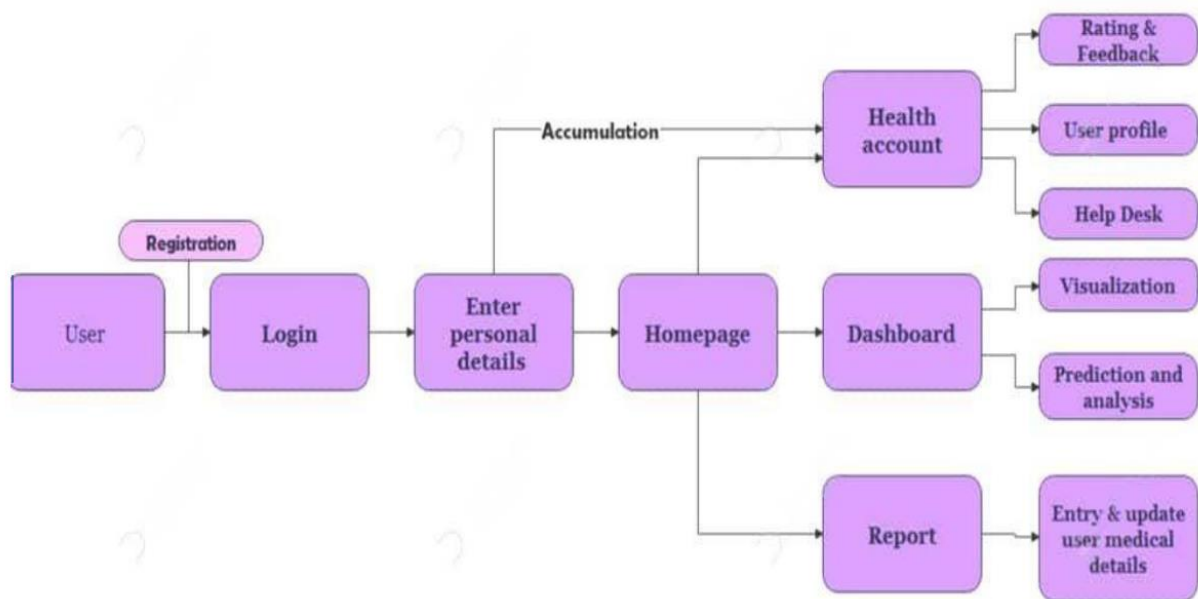
5.2 SOLUTION & TECHNICAL ARCHITECTURE
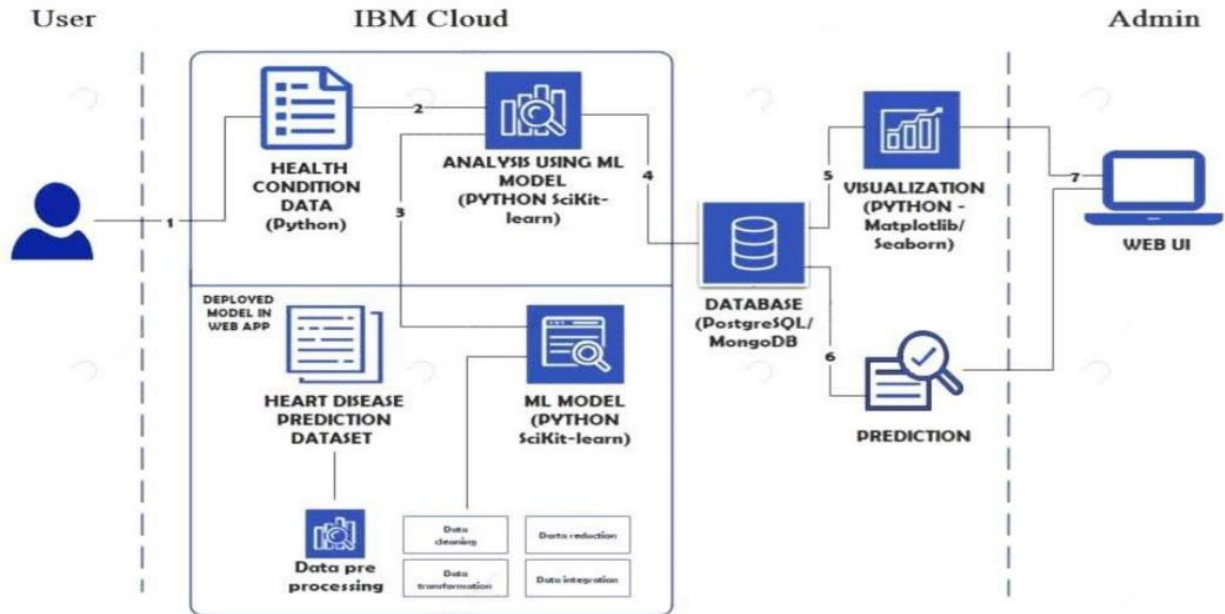
5.3 USER STORIES:

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

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
	User profile	USN-9	As a user, I can update the health details of users.	Administrator	User profile	USN-12
Customer Care Executive	Helpdesk	USN-10	As a user, I can post my queries & view the frequently asked question (FAQ)	I can view the queries & FAQ in a helpdesk	High	Sprint-3
		USN-11	As an admin, I can view the user queries	I can resolve the queries	High	Sprint-3
	Rating	USN-12	As a user, I can rate the app and give feedback	I can view in feedback page	Low	Sprint-4
Administrator	User profile	USN-13	As an admin, I can update the health details of users.	I can view the user updated health details	High	Sprint-4
		USN-14	As an admin, I can add or delete users.	I can access my account / Dashboard when logged in	High	Sprint-4
		USN-15	As an admin, I can manage the user details.	I can view the organized data of myself	High	Sprint-4

CHAPTER 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	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	5	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	3	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-1		USN-4	As a user, I can register for the application through Google	2	Medium	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	User entry	USN-7	As a User, I can enter my personal details for analysis	3	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-2		USN-8	As a User, I can entry my medical records & symptoms	3	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-3	User profile	USN-9	As a user, I can update the health details of users.	5	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-3	Helpdesk	USN-10	As a user, I can post my queries & view the frequently asked question (FAQ)	5	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-3		USN-11	As an admin, I can view the user queries	3	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-4	Rating	USN-12	As a user, I can rate the app and give feedback	2	Low	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-4	User profile	USN-13	As an admin, I can update the health details of users.	5	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Dashboard	USN-6	As a User, I can view my complete medical analysis & accuracy and prediction of heart disease in a dashboard	5	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4		USN-14	As an admin, I can add or delete users.	3	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K
Sprint-4		USN-15	As an admin, I can manage the user details.	3	High	Praveen Kanth S, Aditya K E, Ezhilarasan R, Janarthanan M, Sankaranarayanan K

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	13	6 Days	24 Oct 2022	29 Oct 2022	13	29 Oct 2022
Sprint-2	13	6 Days	31 Oct 2022	05 Nov 2022	13	05 Nov 2022
Sprint-3	13	6 Days	07 Nov 2022	12 Nov 2022	13	12 Nov 2022
Sprint-4	13	6 Days	14 Nov 2022	19 Nov 2022	13	19 Nov 2022

6.3 REPORTS FROM JIRA

Burndown Chart
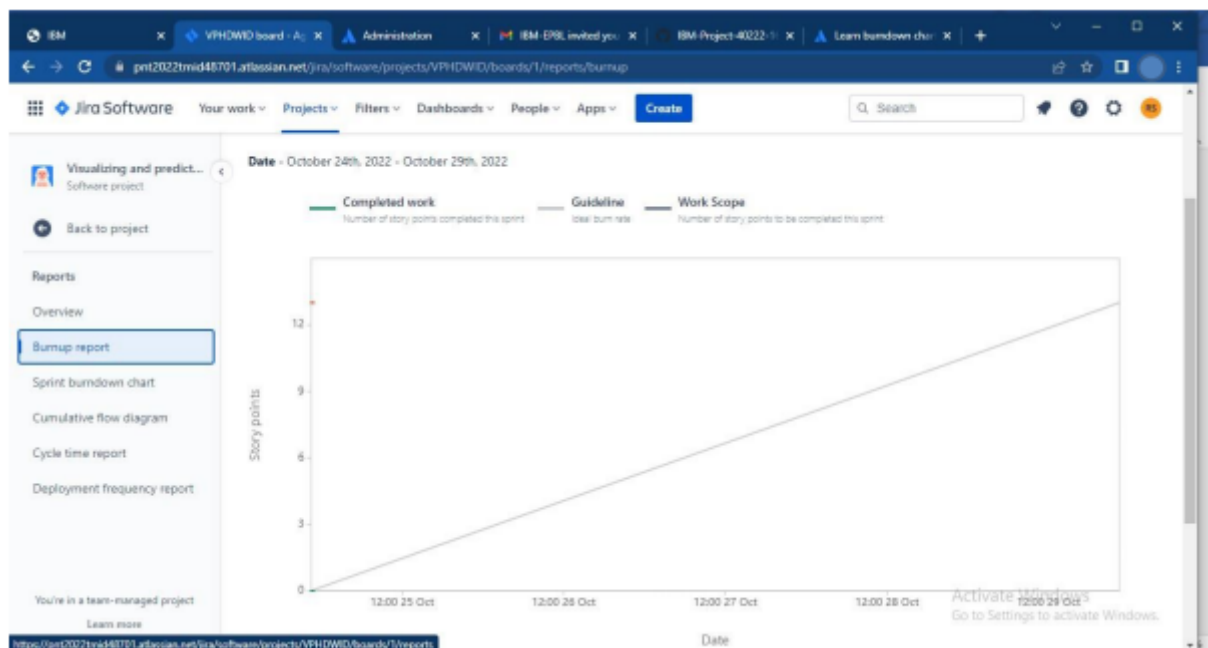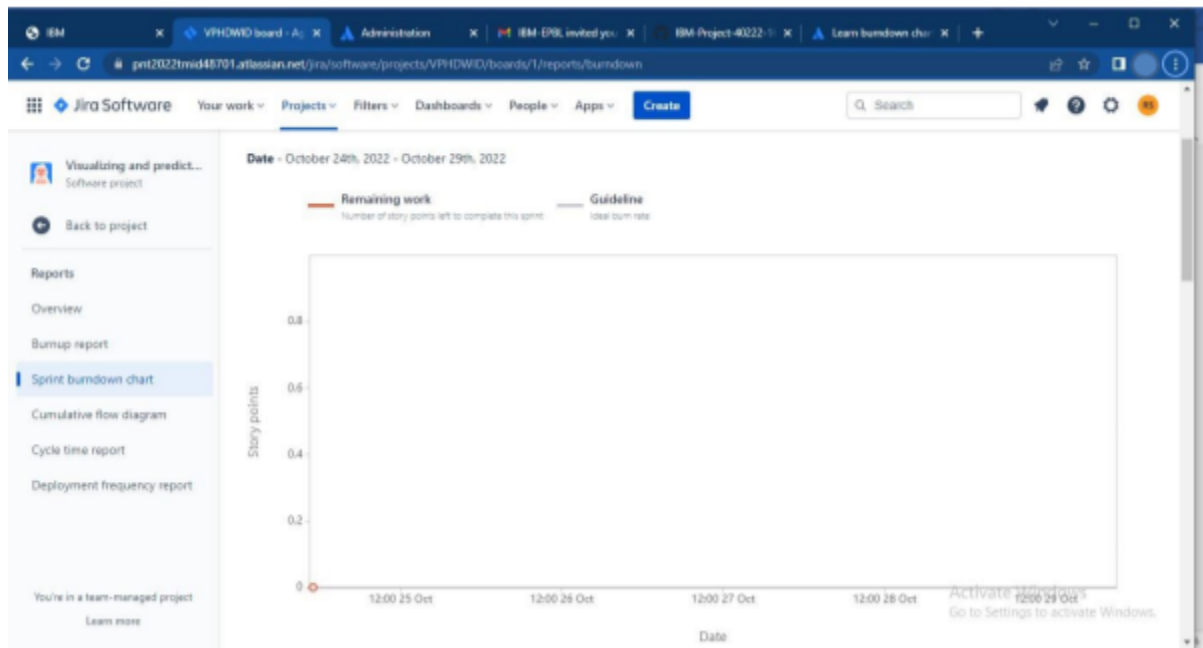
CHAPTER 7

TESTING

7.1 MODEL PERFORMANCE TESTING

S. No.	Parameter	Screenshot / Values
1.	Dashboard design	No of Visualizations/ Graphs - 12
2.	Data Responsiveness	Quick response
3.	Amount Data to Rendered (DB2 Metrics)	12
4.	Utilization of Data Filters	3
5.	Effective User Story	No of Scene Added - 14
6.	Descriptive Reports	No of Visualizations/ Graphs - 12

7.2 USER ACCEPTANCE TESTING

1. Purpose of Document

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

2. Defect Analysis

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	4	4	2	3	13
Duplicate	1	0	0	0	1
External	1	3	0	1	5
Fixed	6	2	2	6	16
Not Reproduced	0	0	0	0	0
Skipped	0	0	1	0	1
Won't Fix	0	0	0	0	0
Totals	12	9	5	10	36

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	2	0	0	2
Client Application	20	0	0	20
Security	1	0	0	1
Outsource Shipping	3	0	0	3
Exception Reporting	3	0	0	3
Final Report Output	2	0	0	2
Version Control	2	0	0	2

CHAPTER

8

RESULTS

8.1 PERFORMANCE METRICS

1. Hours worked: 50 hours

2. Stick to Timelines: 100%

3. Stay within budget: 100%

4. Consistency of the product: 85%

5. Efficiency of the product: 85%

6. Quality of the product: 85%

CHAPTER 9

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Smooth User Interface
- Accuracy is achieved quickly

DISADVANTAGES:

- Random forest can be used for both classification and regression tasks, but it is not more suitable for Regression tasks.

CHAPTER 10

CONCLUSION

This overview of the project conveys the idea that numerous methods have been investigated for diagnosing cardiovascular disease. Big data, machine learning, and data mining can be used to great success to analyse the prediction model with the highest degree of accuracy. The primary goal of this project is to diagnose cardiovascular disease or heart disease utilizing a variety of techniques and procedures to obtain a prognosis.

CHAPTER 11

FUTURE SCOPE

A future update shall comprise of section for viewing renowned cardiologists and scan centers in their city. The obtained output can be further processed and sent to smart devices to provide necessary assistance. Constant monitoring can provide necessary data to recommend to consult a doctor in case of an emergency.

CHAPTER 12

APPENDIX

PROJECT DEMONSTRATION LINK: https://youtu.be/_CY9-eFUTfc

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-14053-1659539617

THANKING YOU