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A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report "**ANALYTICS FOR HOSPITAL HEALTH CARE DATA"** is the bonafide work of

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ABSTRACT

The process of examining unprocessed data to draw inferences about that information is known as data analytics. Making more strategically-minded judgments or maximising performance are all benefits of data analytics.

Healthcare is one of the areas of focus after the post Covid-19 pandemic. Data Analytics techniques in health-related areas are being applied to improve the efficiency of clinical procedures, healthcare operations by gathering and analyzing clinical data.

The overall purpose of the project is to accurately predict the length of Stay for each patient on case by case basis so that the hospitals can use these information's for optimal resource allocation and better functioning.

By using Data Visualization techniques, we proposed a dashboard that supports clinicians and hospital managers in viewing and exploring data on processes and outcomes of care in interactive manner.

The proposed application helps the hospital management to identify patients who will stay longer at the time of admission. The identified patients can have their treatment plan and it will lower the chance of staff/visitor infection.

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

Data analytics (DA) is examining data sets to find trends and draw conclusions about the information they contain. Increasingly, data analytics is done with the aid of specialized systems and software. Data analytics technologies and techniques are widely used in commercial industries to enable organizations to make more-informed business decisions. Scientists and researchers also use analytics tools to verify or disprove scientific models, theories, and hypotheses.

As a term, data analytics predominantly refers to an assortment of applications, from basic business intelligence (BI), reporting and online analytical processing (OLAP) to various forms of advanced analytics. In that sense, it's similar in nature to business analytics, another umbrella term for approaches to analyzing data. The difference is that the latter is oriented to business uses, while data analytics has a broader focus. The expansive view of the term isn't universal, though: In some cases, people use data analytics specifically to mean advanced analytics, treating BI as a separate category.

Data Analytics has a key role in improving your business as it is used to gather hidden insights, generate reports, perform market analysis, and improve business requirements.

The Role of Data Analytics

- Gather Hidden Insights – Hidden insights from data are gathered and then analyzed with respect to business requirements.
- Generate Reports – Reports are generated from the data and are passed on to the respective teams and individuals to deal with further actions for a high rise in business.
- Perform Market Analysis – Market Analysis can be performed to understand the strengths and weaknesses of competitors.
- Improve Business Requirement – Analysis of Data allows improving Business to customer requirements and experience.

The Tools used in Data Analytics :

R programming This tool is the leading analytics tool used for statistics and data modeling. R compiles and runs on various platforms such as UNIX, Windows, and Mac OS.

Python – Python is an open-source, object-oriented programming language that is easy to read, write, and maintain.

Tableau Public - This free software connects to any data source such as Excel, corporate Data Warehouse, etc. It then creates visualizations, maps, dashboards etc with real-time updates on the web.

QlikView– This tool offers in-memory data processing with the results delivered to the end-users quickly.

SAS – A programming language and environment for data manipulation and analytics, this tool is easily accessible and can analyze data from different sources.

Dashboard

A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance.

Types of Dashboards

- Strategic Dashboards
- Analytical Dashboards
- Operational Dashboards

Key Characteristics of a Dashboard

➢ All visualizations can easily fit on a single computer screen since scrolling goes against the "consolidated" structure dashboards should have.

➢ The most important performance indicators which need constant monitoring are on display.

➢ Functions such as filtering and drill-down may be offered,but they shouldn't be necessary to identify which KPIs aren't performing optimally.

➢ They should be easy to understand regardless of which position the employee holds in the organization.

Concept of a Dashboard

A dashboard is a visual display of all of your data. While it can be used in all kinds of different ways, its primary intention is to provide information at-a-glance, such as KPIs. A dashboard usually sits on its own page and receives information from a linked database.

Data Visualization Dashboard

A dashboard is a data visualization tool that tracks, analyzes, and displays KPIs, metrics, and critical data points. Dashboards empower both technical and non-technical users to understand and leverage business intelligence to make more informed decisions. Users actively participate in the analytics process by compiling data and visualizing trends or occurrences, and uncovering an objective view of performance metrics that can be immediately understood.

Dashboards feature visualized data via charts, tables, and gauges. Viewers use these visualizations to monitor the health of the organization against established goals and industry benchmarks.

1.2 Purpose

The COVID-19 pandemic has resulted in uncontrollable havoc. Since this was an unexpected circumstance, many local hospitals were not prepared to handle this crisis.

The proper allocation of resources has become a tough challenge for hospitals. There is a possibility that many patients may not get proper treatment.

It created an urgent need for data analytics in the healthcare industry for Analysis of the current situation in terms of patient condition and hospital resources can help in the organized planning of any future waves of the pandemic.

The Main Objective of this Project is to accurately predict the length of stay for each patient on case by case basis so that the hospitals can use this information for optimal resource allocation and better functioning.

By using Data Visualization techniques,we proposed the dashboard that support clinicians and hospital managers in viewing and exploring data on processes and outcomes of care in interactive manner.

The proposed application helps the hospital management to identify patients who will stay longer at the time of admission. The identified patients can have their treatment plan and it will lower the chance of staff/visitor infection.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing Solution

S.NO	PRODUCT NAME	PRODUCT COMPANY	YEAR	DESCRIPTION	ACCURACY/ PRECISION
1	Bold Bi	Bold Bi for Syncfusion	2020	Health Care Dashboards and Data Analytics Hospital Analytics Dashboard Private Dashboards Patient Health Monitoring Dashboard	96%
2	Orange Mantra	Orange Mantra pvt Ltd, India	2001	Health Care Dashboards and Data Analytics Hospital Analytics Dashboard Private Dashboards Patient Health Monitoring Dashboard	93%

Table 2.1.1 Existing Solution

2.2 References

S.NO	PAPER	AUTHOR	YEAR	METHOD AND ALGORITHM	ACCURACY/ PRECISION
1	Development of the Health Information Analytics Dashboard Using Big Data Analytics	Anisatul Afifah	2020	The method of this study uses big data analytics. The data analysis results are visualized through display charts/graphs that make it easier for users to understand the data analysis results and interpretation. This dashboard is useful to facilitate decision making so that stakeholders can find out more quickly to be able to respond appropriately and also improve the quality of health services so as to improve the degree of public health.	98%
2	Health Data Analytics: A Proposal to Measure Hospitals Information Systems Maturity	Joao Vidal de Carvalho	2018	A maturity model in this conjuncture, is a way of identifying strengths and weaknesses of the HIS maturity and thus, find a way for improvement and evolution. This paper presents a proposal to measure Hospitals Information Systems maturity with regard to DA. The outcome of this paper is a maturity model, which includes six stages of HIS growth	94%

3	A Review of Qualitative Data Analysis Practices in Health Education and Health Behavior Researc	Ilana G Raskind	2018	This system describes Trajectories culminated in the iterative review of coded data to identify emergent themes. Few articles explicitly discussed trustworthiness or reflexivity. Member checks (n = 9), triangulation of methods (n = 8), and peer debriefing (n = 7) were the most common procedures. Variation in the type and depth of information provided poses challenges to assessing quality and enabling replication. Greater transparency and more intentional application of diverse analytic methods can advance the rigor and impact of qualitative research in our field about the	95%
4	The use of Big Data Analytics in healthcar	Kornelia Batko	2022	The research positively confirmed that medical facilities are working on both structural data and unstructured data. The following kinds and sources of data can be distinguished: from databases, transaction data, unstructured content of emails and documents, data from devices and sensors. However, the use of data from social media is lower as in their activity they reach for analytics,	97%

				not only in the administrative and business but also in the clinical area. It clearly shows that the decisions made in medical facilities are highly data-driven. The results of the study confirm what has been analyzed in the literature that medical facilities are moving towards data-based healthcare, together with its benefits.	
5	Predictive Analysis in Health Care	Conference: Predictive Analysis in Health Care At: Dubai, UAE	2019	Data mining is the convergence of multiple disciplines (such as Business Intelligence, AI, Analytics) by using statistics and Data Warehouse Technology to discover knowledge from a bulk of data. Certain corrective measure must be taken in order to correctly analyze the diseases and prescribing correct medicine after correct diagnosis. These challenges can be removed by appropriate data analytics. In this paper some of the techniques are discussed to predict diseases to improve health care.	97%
6	Data mining and predictive analytics applications for the delivery of healthcare services: a systematic literature review	Ruben Amarasingham	2014	This paper aims to achieve this by systematically reviewing the existing body of knowledge to categorize and evaluate the reported studies on healthcare operations and data mining frameworks. The outcome of this study is useful as a reference for the practitioners and as a research platform for the academia.	90%

7	Big Data In Health Care: Using Analytics To Identify And Manage High-Risk And High-Cost Patients	David W. Bates, Suchi Saria	2016	Discussing about the types of insights that are likely to emerge from clinical analytics, the types of data needed to obtain such insights, and the infrastructure— analytics, algorithms, registries, assessment scores, monitoring devices, and so forth—that organizations will need to perform the necessary analyses and to implement changes that will improve care while reducing costs. Our findings have policy implications for regulatory oversight, ways to address privacy concerns, and the support of research on analytics.	96%
8	Implementing Electronic Health Care Predictive Analytics: Considerations And Challenges	M. M. Malik, S. Abdallah & M. Ala'raj	2016	This article describes some of the considerations and challenges of implementing e-HPA, including the need to ensure patients' privacy, establish a health system monitoring team to oversee implementation, incorporate predictive analytics into medical education, and make sure that electronic systems do not replace or crowd out decision making by physicians and patients.	94%

Table 2.2.1 Reference

2.3 Problem Statement Definition

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Hospital Staff	View Patient Details	Missing of Old Data, Low Network Coverage	Improper Maintenance, Spyware and Virus	Frustrated, Anger
PS-2	Hospital Dean	Hospital Department Cases	Wrong and Misuse of Data	Negligence of Staffs in Hospital	To work the process again

Table 2.3.1 Problem Statement Definition

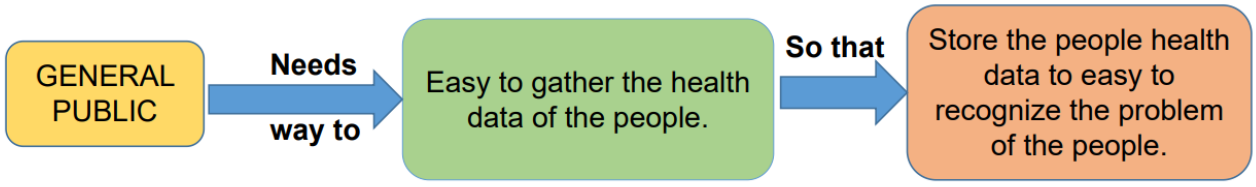


Fig 2.3.2 Problem Statement-1

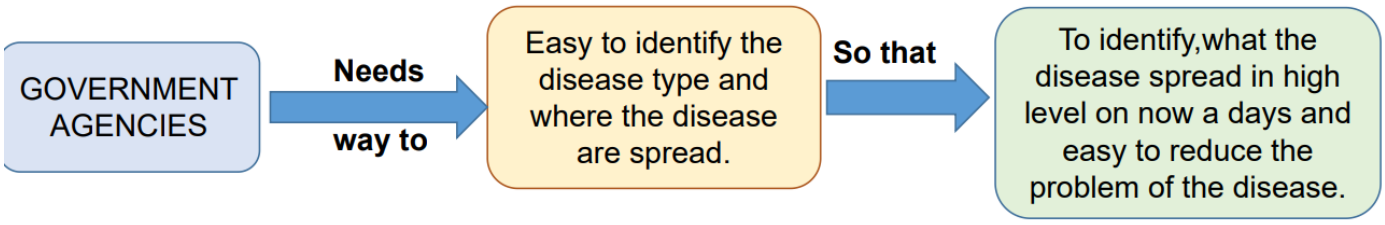


Fig 2.3.3 Problem Statement-2

The problem statement defines the essential characteristics of the Product like Who am I ?, what I am trying to do? , but what I am doing? , why I am doing this? And what makes me to feel after achieving the results from the product.

These characteristics are most important to develop the product to achieve its result after developing the product.

CHAPTER 3
IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

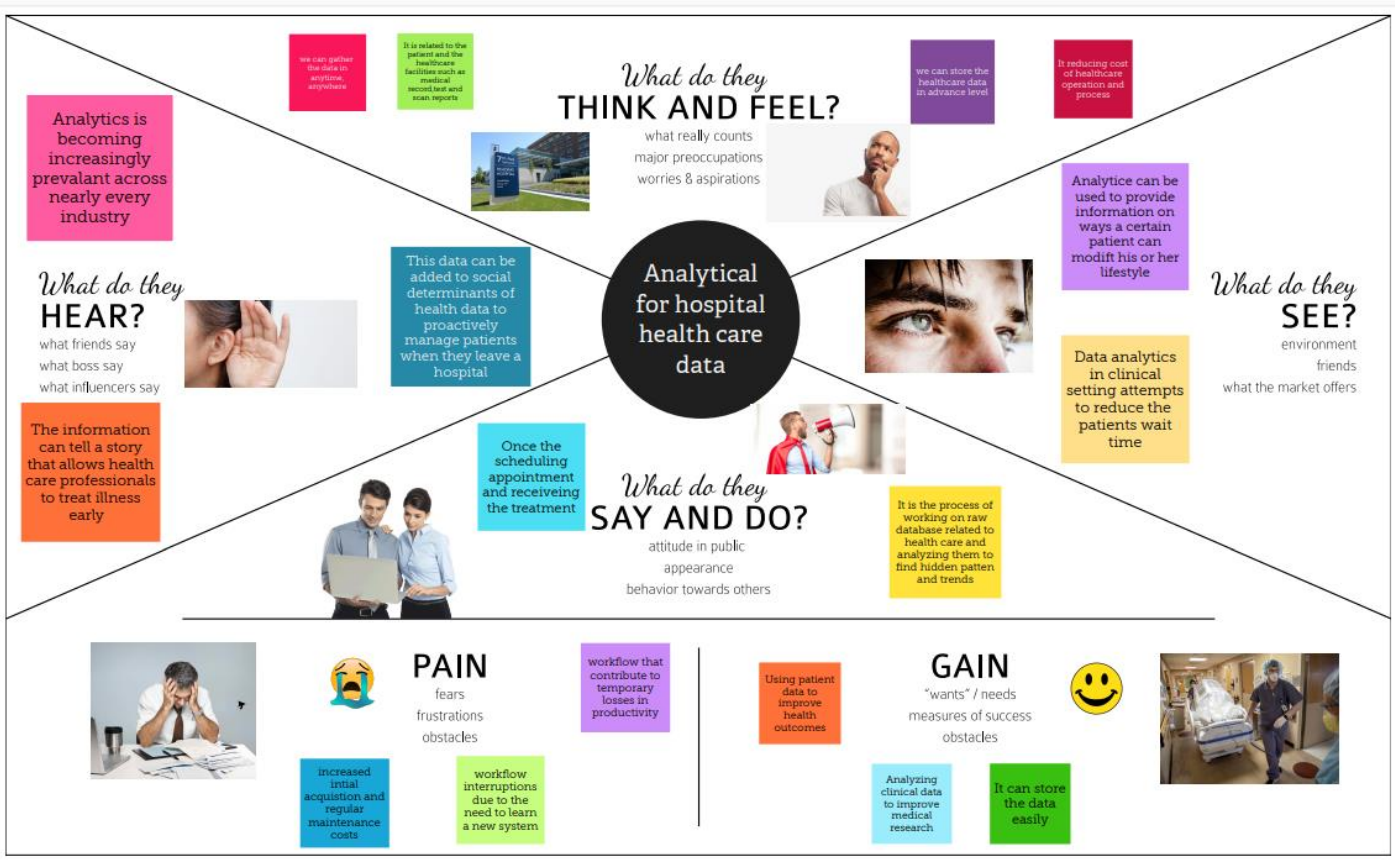


Fig 3.1.1 Empathy Map Canvas

Empathy Map Canvas describes the Customer's Feelings about the Proposed Product based on what they think and feel? , What do they see?, What do they Hear? And What do they say and do? And also the user's pains and gains about the Product. It also describes the clear-cut view of the idea of the product that the product which will be used by the user in the Market.

3.2 Ideation and Brainstorming

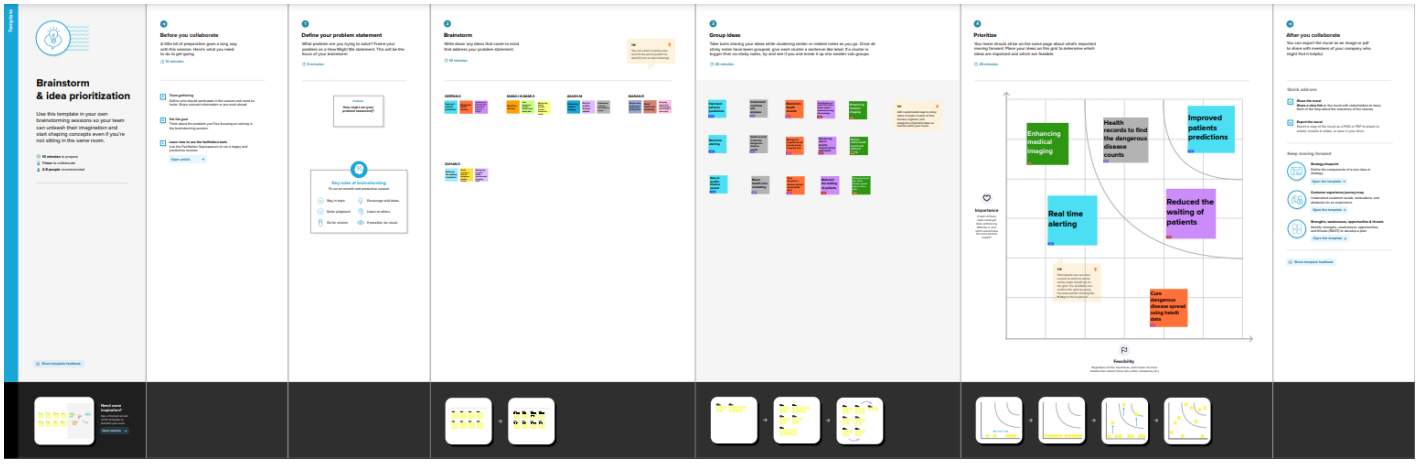


Fig 3.2.1 Ideation & Brainstroming

Brainstorming idea explains the overall idea of the developers who create and develops the idea of the product, it defines the importance and priorities of the idea based on that priority the developers develop and create the product.

It also gives a high level of priority to the problem statement of the product which helps to achieve the target that the product was proposed to.

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To Predict the Length of the stay for each patient on case by case basis so that the hospital can use the information for optimal resource allocation and better functioning.
2.	Idea / Solution description	To create a dashboard for monitoring the length of stay of patients and also include the necessary data which were provided by the hospital to create an effective virtual dashboard using Cognos analytics.
3.	Novelty / Uniqueness	By Using Data Visualization techniques, the dashboard supports clinicians and hospital managers in viewing and exploring data on processes and outcomes of care in an interactive manner.
4.	Social Impact / Customer Satisfaction	The hospitals can use this dashboard to view their daily hospital records and they can update the given inputs and get the expected output effectively.
5.	Business Model (Revenue Model)	While using this dashboard the hospitals can easily get regular updates on the patients and this was widely applicable in all departments of the hospitals. The Hospital staff can easily login into the dashboard and view the risk rate of the patients according to the length of stay in the hospital and can give proper treatment according to that.

6.	Scalability of the Solution	The scalability of this project was a. The hospitals can view the length of stay of the patient case by case basis b. The patient id, department name, other hospital-related details, etc. c. It also helped to visualize an interactive dashboard efficiently.

Fig 3.3.1 Proposed Solution

3.4 Problem Solution Fit

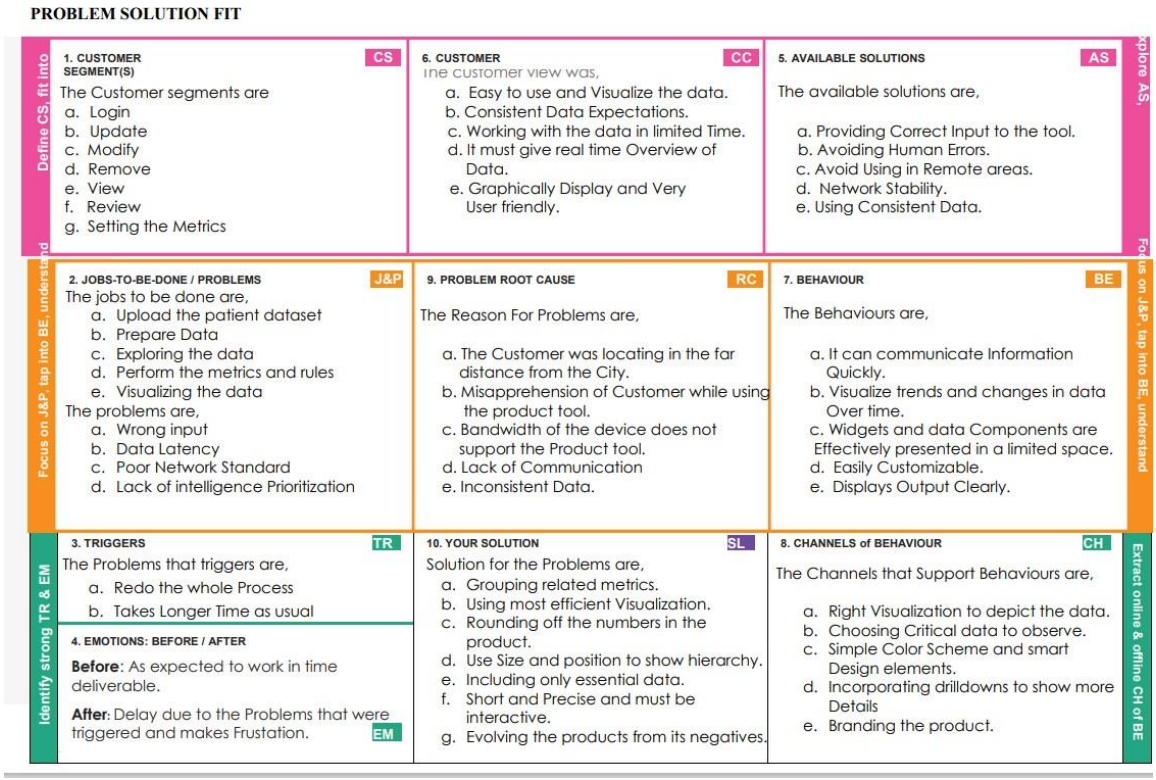


Fig 3.4.1 Problem Solution Fit

Problem Solution Fit explains about the what are the segments of the customer, What are the jobs to be done, what are the problems in the product, what are the reasons for the triggers and emotions based on the product, what are the solutions for the problem, what are the cause for the problem, what are behaviors and channels etc.

CHAPTER 4
REQUIREMENT ANALYSIS

4.1 Functional Requirements

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	Registration through Form Registration through Gmail
FR-2	**User Confirmation**	Confirmation via Email
FR-3	**Interoperability**	Dashboard helps to share the patient's information interoperable to the hospitals in timely manner.
FR-4	**Accuracy**	Dashboard helps predict the patient's Health risks accurately based on LOS(Length of Stay).
FR-5	**Compliance**	The compliance of a dashboard is like to use very interactively in real time by the hospitals.
FR-6	**Concise**	These dashboards are clear, intuitive, and customizable and interactive in manner.

Table 4.1.1 Functional Requirements

4.2 Non-Functional Requirements

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The project must be easy to use. The user needs tohave a good experience while working with the interface.
NFR-2	**Security**	Every user can access the website only if they possesthe password. The database is secured with encryption techniques which provides high levels of security
NFR-3	**Reliability**	The project must have minimal degree of failure under normal usage and how often does the user get access to this work
NFR-4	**Performance**	The project must respond quickly to the user's actions or even if the user has to wait the waitingperiod must be short.
NFR-5	**Availability**	The project is platform independent. It runsperfectly on almost every platform.
NFR-6	**Scalability**	The project allows multiple users to handle the dataat the same time. It is highly scalable since adding features and making advancements in the website is uncomplicated.

Table 4.2.1 Non – Functional Requirements

CHAPTER 5

PROJECT DESIGN

5.1 Data Flow Diagram

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.

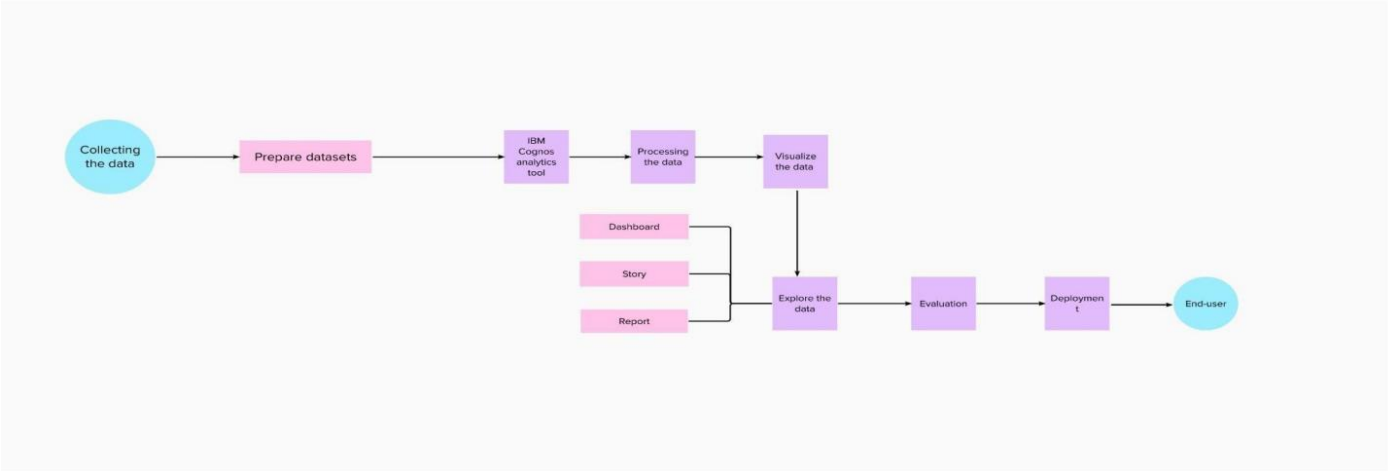


Fig 5.1.1 Data Flow Diagram

5.2 Solution & Technical Architecture

Solution Architecture

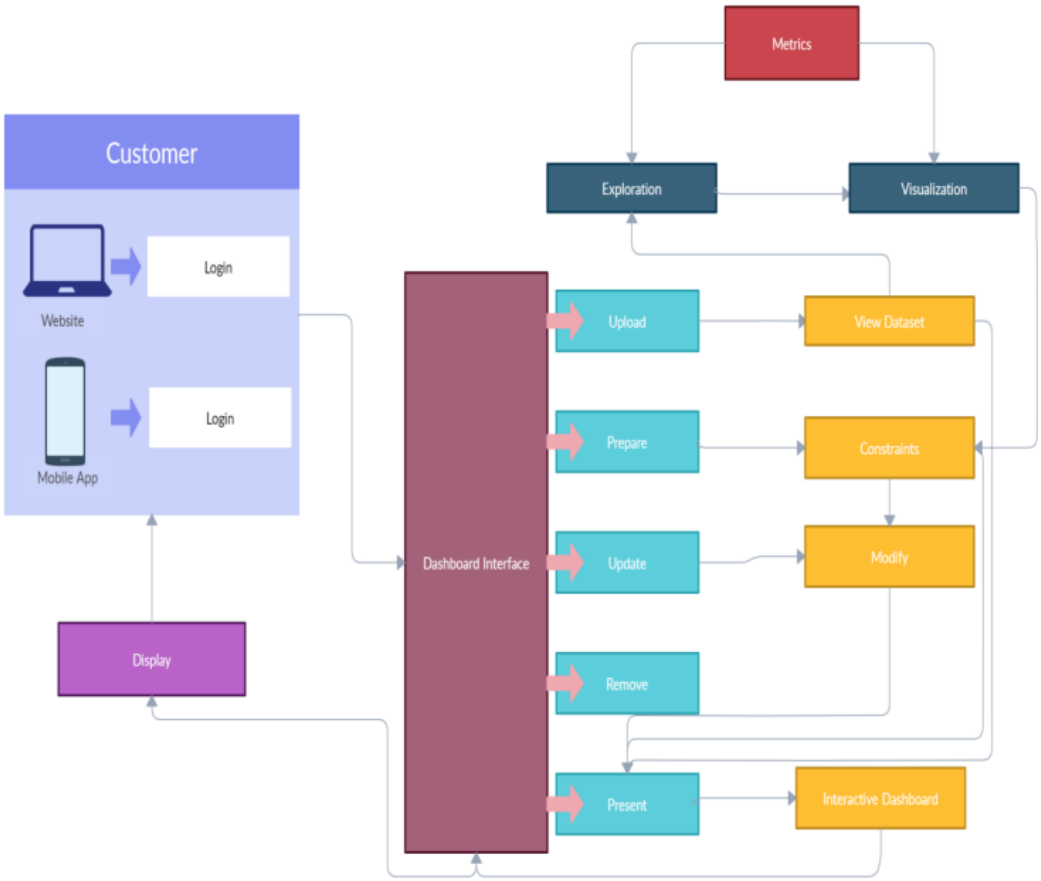


Fig 5.2.1 Solution Architecture

The Solution Architecture defines the overall process of product development and it also describes the features in the product which helps the users to navigate and use the product to gain outputs effectively.

Technical Architecture

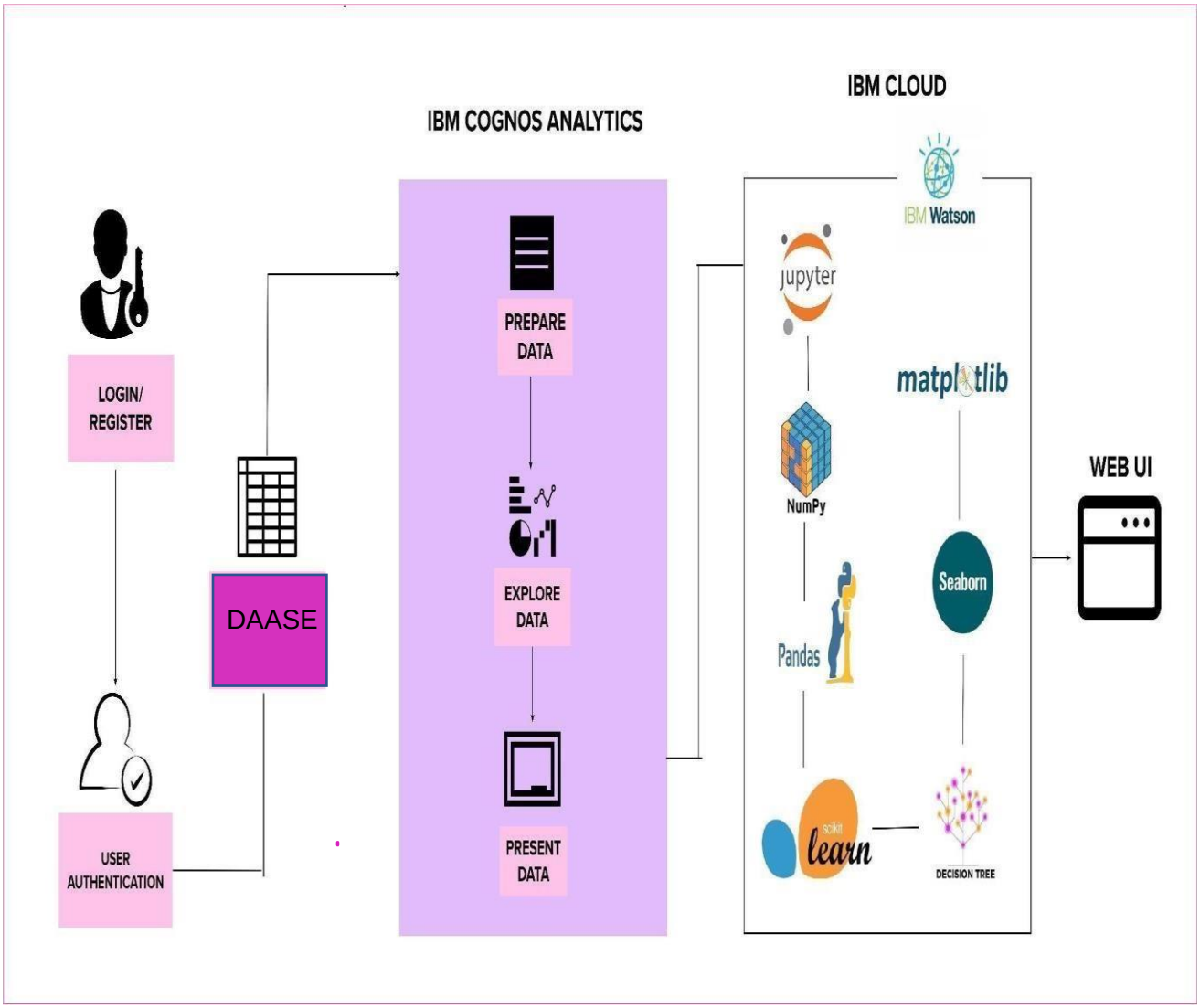


Fig 5.2.2 Technical Architecture

Table-1: Components & Technologies:

S.No.	Component	Description	Technology
1.	User Interface	User interacts with the application using IBM Cloud, which is used to analyze the dataset.	IBM Cloud
2.	Application Logic	The logic is to obtain useful insights about the Patient details of the Hospital.	Python
3.	Dataset	It contains the details about the Hospital Data.	Dataset from IBM
4.	Cloud Database	It is used to store all the datasets.	IBM Cloud Pak for Data
5.	Visualization	It is used to prepare, explore and present the data in the form of charts and graphs.	IBM Cognos Analytics
6.	Machine Learning Model	It allows the user to feed a computer algorithm, an immense amount of data and have the computer analyse and make data-driven recommendation and decision based on only the input data.	Model for Hospital Health(if Required)
7.	Infrastructure	It provides the platform for deployment and services.	Kubernetes (if required)

Table 5.2.3 Components and Technologies

Table-2: Application Characteristics:

S.No.	Characteristics	Description	Technology
1.	Open-Source Frameworks	A software for which the original source code made freely available and may be redistributed and modified according to the requirements of user.	Python, Google Colab/ Jupyter
2.	Security Implementatios	IBM Cloud Application provides security features that are in addition to many of the components identified in the security framework.	IBM Cloud Pak for Security
3.	Scalable Architecture	Python is a programming language that developers can use to do all the scaling work. To improve scalability, enable or disable server run by administrator to balance the load for a given computer by request type.	Python, IBM Cognos
4.	Availability	Availability is the ability of a system to withstand or recover from exceptional situation. The Google Colab/ Jupyter is interactive computing platform. It can support coding, visualisation, etc.	Google Colab/ Jupyter
5.	Performance	This is a fundamental step if we need to achieve the greatest benefit with the least amount of work. Designing for capacity means determining the hardware needed for your system to perform well under its workload	Python

Table 5.2.4 Application Characteristics

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 dashboard by entering my email, and password, and confirming my password.	I can access my account in the dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the dashboard	I can receive a confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the dashboard through Social Media	I can register & access the dashboard with Social Media Login	Low	Sprint-2
		USN-4	As a user, I can register for the dashboard through Gmail	I can register and access dashboard with Gmail	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login to the account in my email login.	High	Sprint-2
	Dashboard	USN-6	As a user ,I can use my account in my dashboard for uploading dataset.	I can login to the account for uploading dataset.	Medium	Sprint-3
Customer (Web user)	Website	USN-7	As a user ,I can use my dashboard in website	I can login into the dashboard by	Medium	Sprint-3

				visiting website.		
Customer Care Executive		USN-8	As a user ,I can contact Customer care Executive for my login.	I can contact customer executive for my login.	High	Sprint-4
Administrator		USN-9	As a user ,I can contact administrator for my queries.	I can contact administrator for solving my queries.	High	Sprint-4
Exploration	Dashboard	USN-10	As a user, I can prepare data by using Exploration Techniques.	I can prepare data by using Exploration Techniques.	High	Sprint-3
Presentation	Dashboard	USN-11	As a user, I can Present data in my dashboard.	I can present data by using my account in dashboard.	High	Sprint-4
Visualization	Dashboard	USN-12	As a user, I can Prepare Data by using Visualization Techniques.	I can prepare data by using Visualization Techniques.	High	Sprint-3

Table 5.3.1 User Stories

CHAPTER 6
PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation

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	3	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	5	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	18	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	15	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Table 6.1.1 Sprint Planning

Velocity:

Sprints	Sprint Duration	Velocity	Actual Velocity
Sprint-1	6	3	2
Sprint-2	6	5	1.2
Sprint-3	6	18	0.35
Sprint-4	6	15	0.4

Table 6.1.2 Velocity

Estimation:

Sprints	Total Points	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5
Sprint-1	3	3	2.25	1.5	0.75	0	0
Sprint-2	5	5	3.75	2.5	1.75	0	0
Sprint-3	18	18	15	9	5	0	0
Sprint-4	15	15	11.75	7.75	4	0	0

Table 6.1.3 Estimation

6.2. Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a health care provider I can create account inIBM cloud and the data arecollected.	20	High	2 Members
Sprint-2	Analyze	USN-2	As a health care provider all the data thatarecollected is cleaned and uploaded in the database or IBM cloud.	20	Low	2 Members
Sprint-3	Dashboard	USN-3	As a health care provider I can use my account in my dashboard for uploadingdataset.	10	Medium	2 Members
Sprint-3	Visualization	USN-4	As a health care provider I can prepare data forVisualization.	10	Medium	2 Members

Sprint-4	Visualization	USN-5	As a health care provider I canpresent data in mydashboard.	10	High	2 Member
Sprint-5	Prediction	USN-6	As a health care provider I can predict the length of stay	10	High	2 Member

Table 6.2.1 Sprint Delivery Schedule

6.2 Reports from JIRA

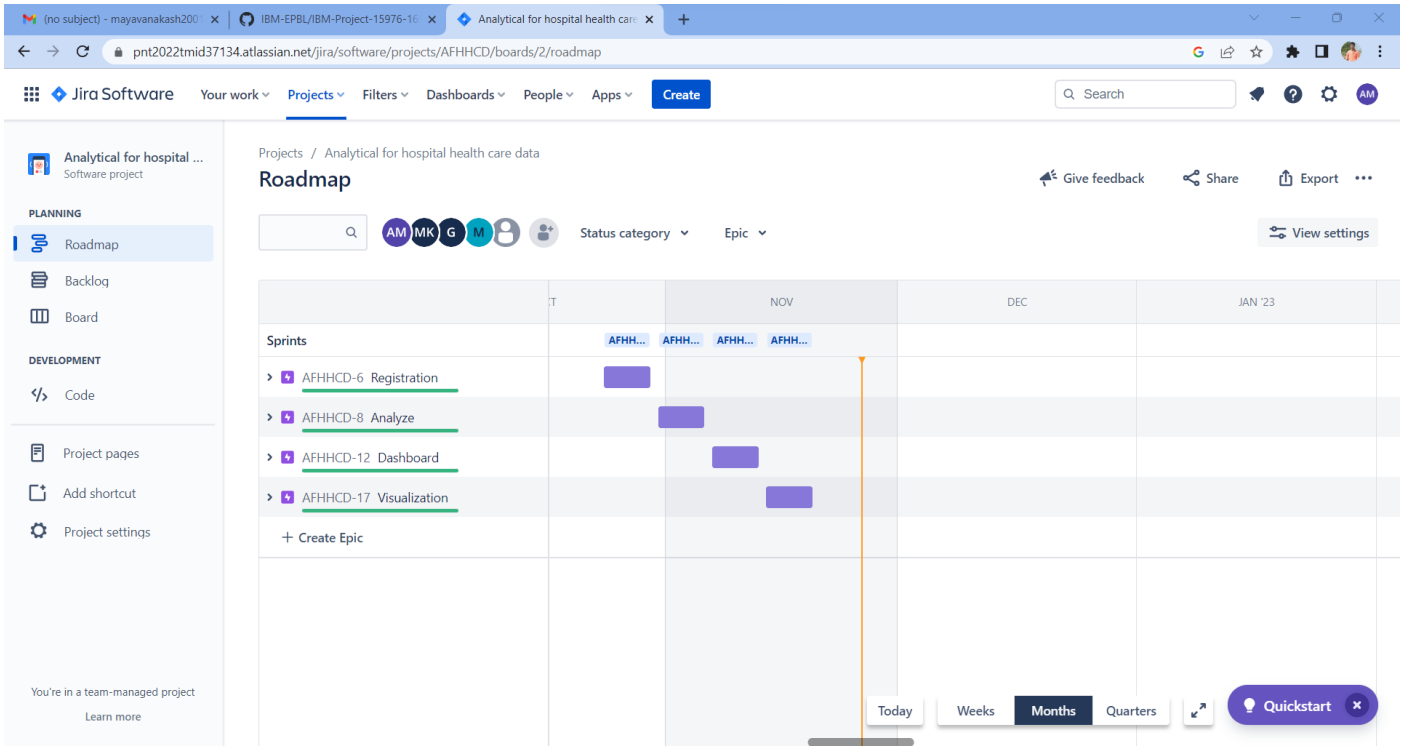


Fig 6.3.1 Roadmap

In Review

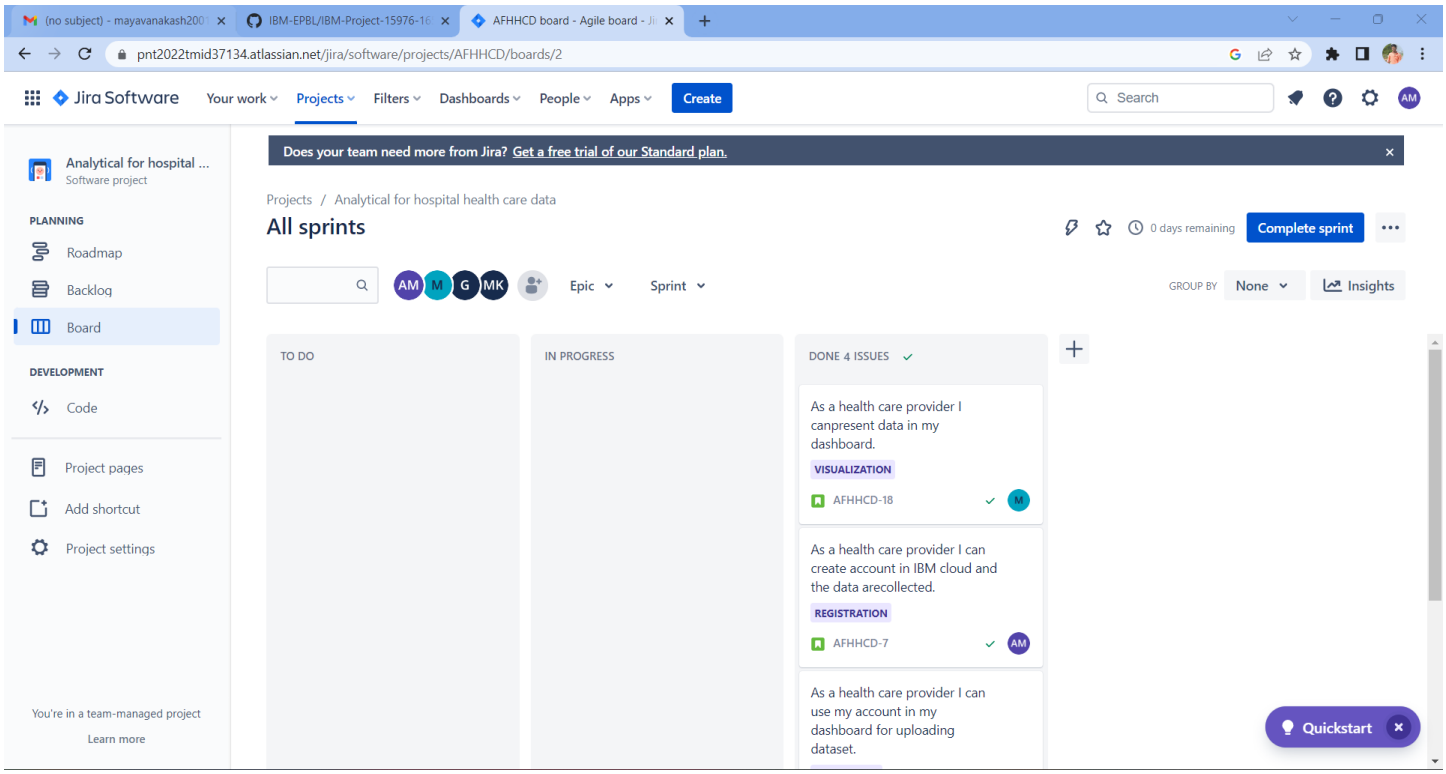


Fig 6.3.2 Sprint 1

Fig 6.3.3 Sprint 2

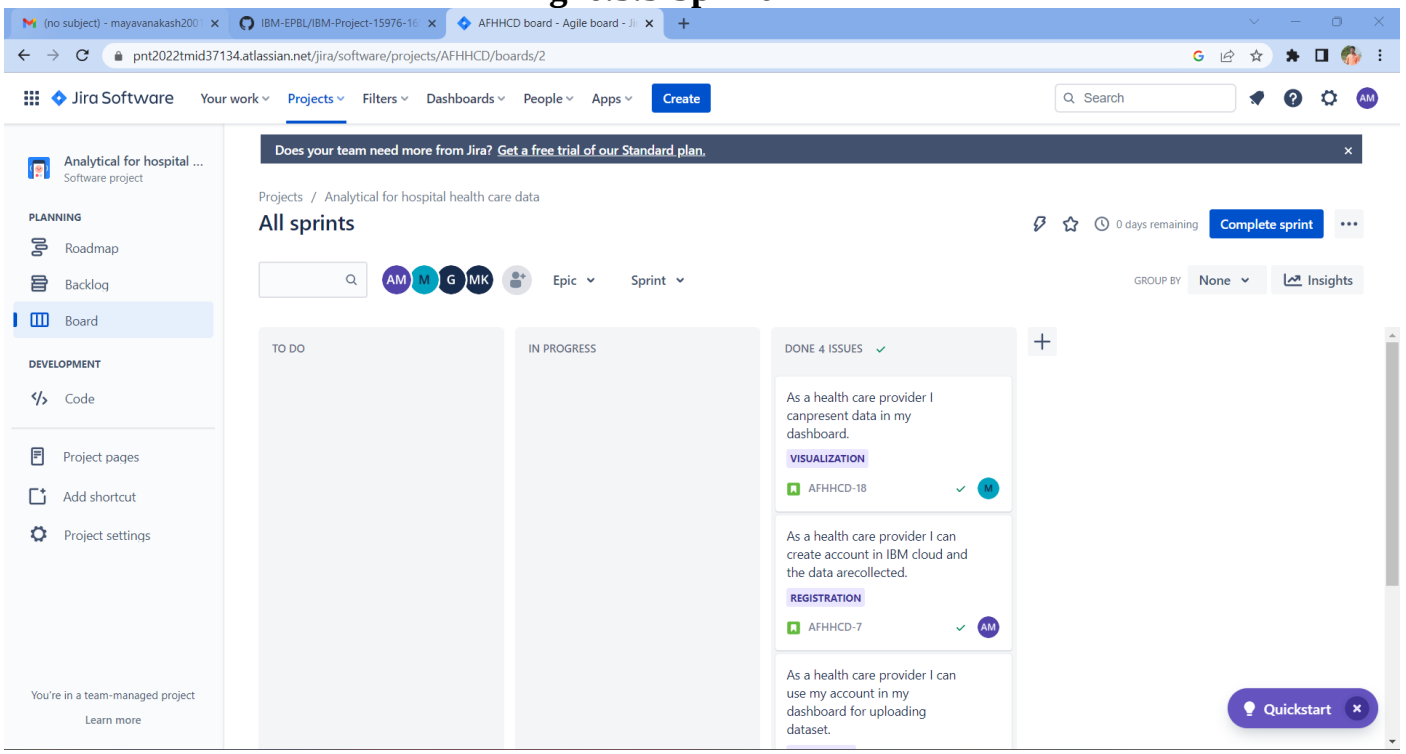


Fig 6.3.3 Sprint 2

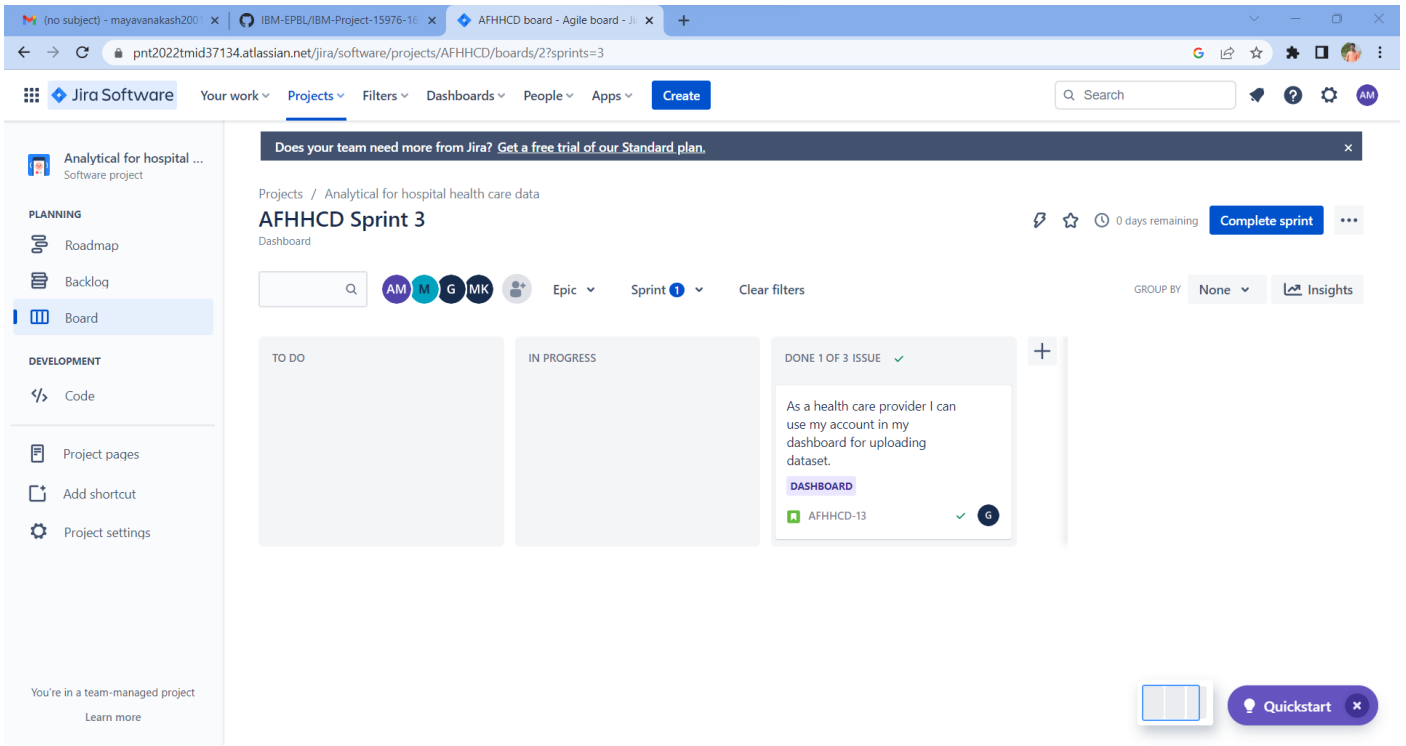


Fig 6.3.4 Sprint 3

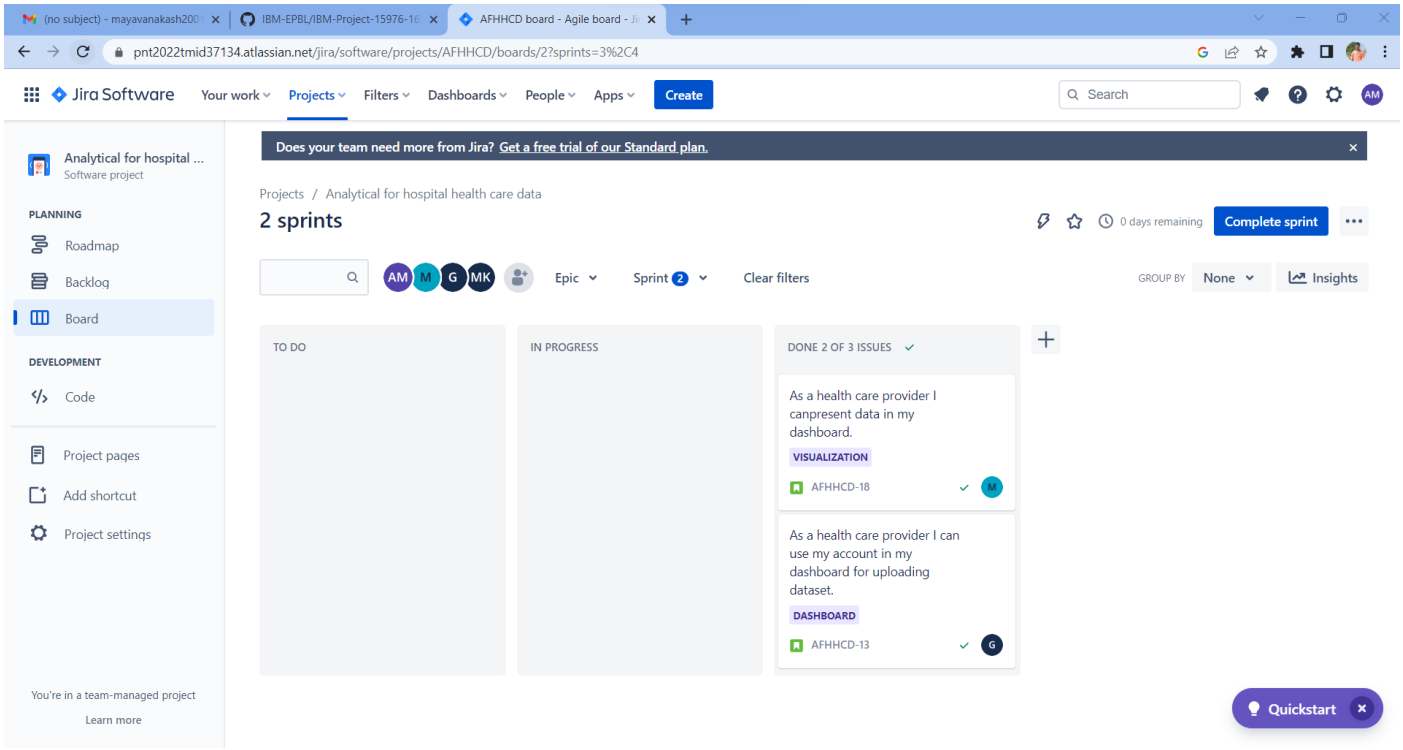


Fig 6.3.5 Sprint 4

Sprint Completion

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date	Story Points Completed	Status
Sprint-1	3	6 Days	24 Oct 2022	29 Oct 2022	3	Completed
Sprint-2	5	6 Days	31 Oct 2022	05 Nov 2022	5	Completed
Sprint-3	18	6 Days	07 Nov 2022	12 Nov 2022	18	Completed
Sprint-4	15	6 Days	14 Nov 2022	19 Nov 2022	15	Completed

Table 6.3.6 Sprint Completion

CHAPTER 7

CODING AND SOLUTIONING

7.1 Feature 1

DASHBOARD

A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance.

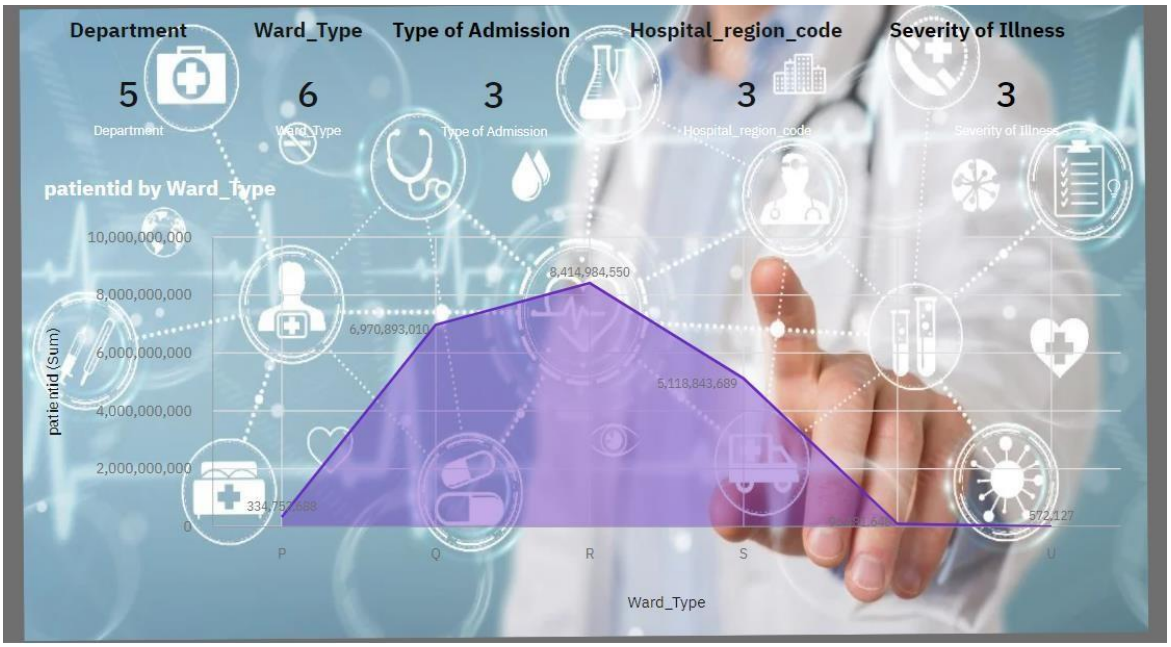


Fig 7.1.1 Area Chart - Patient id by Ward type

Bar Chart - Case id by ward type

Column Chart - **C**ase id by Department

Map Chart - City Hospital code and case id

Pie Chart - Case id by ward Facility code

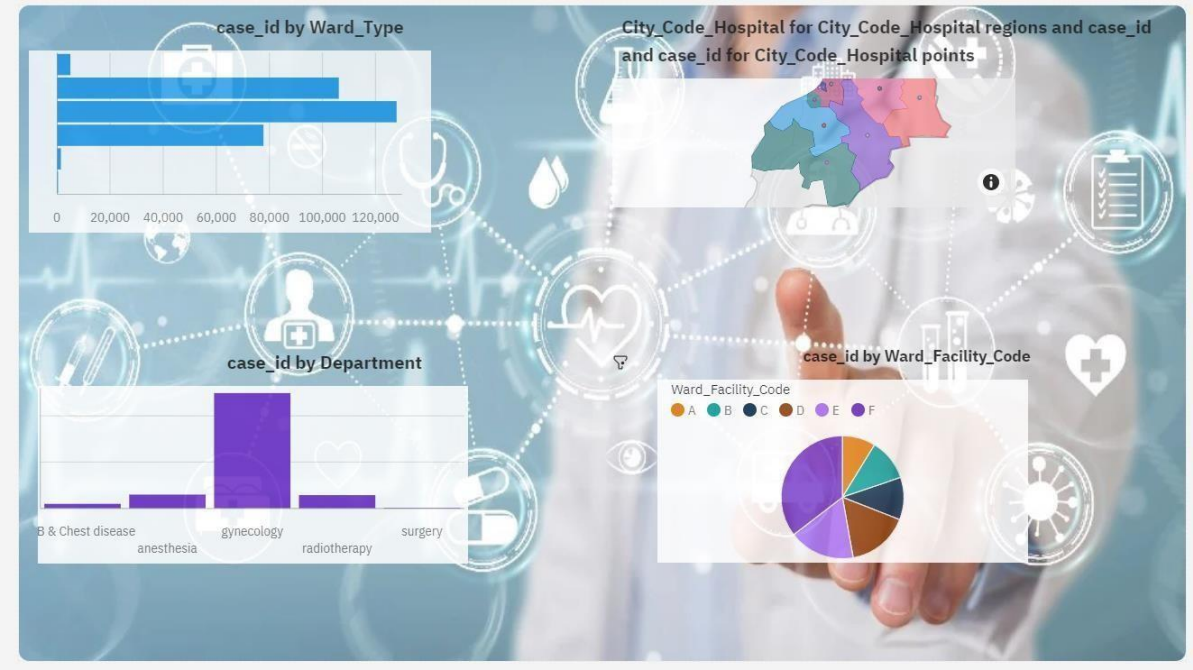


Fig 7.1.2 Bar, Column, Map and Pie Chart

Fig 7.1.3 Column Chart – Case id by age

Bubble - Bed Grade and ward hierarchy by case id

Radial Chart - Admission Deposit by Department

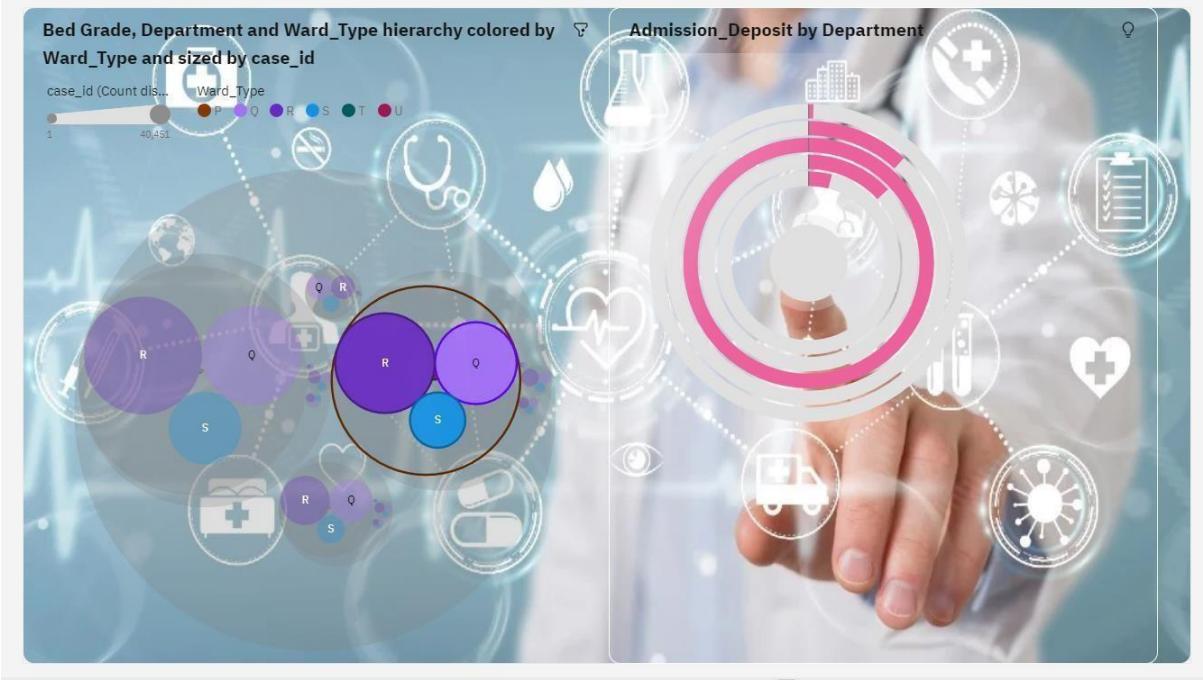


Fig 7.1.4 Bubble and Radial Chart

Pie - Case id by severity of illness

Stacked Bar - Case id age by department

Waterfall chart - Patient id by Department

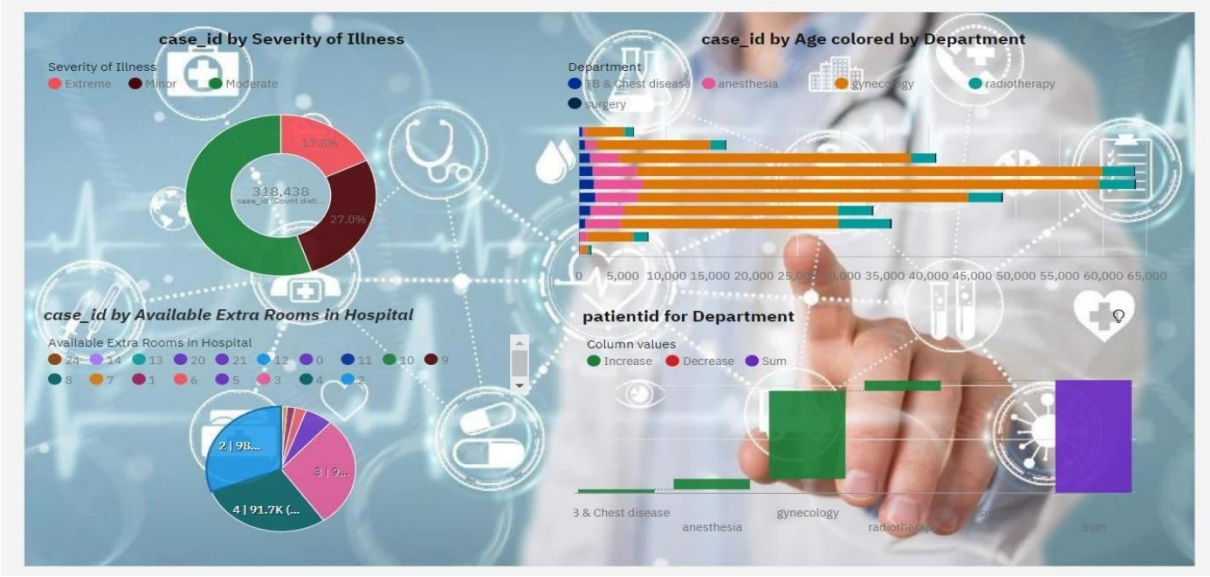


Fig 7.1.5 Pie, Stacked and Waterfall Chart

7.2 Feature 2

Story :

A story is a type of view. A story is composed of a set of scenes that are displayed in sequence over time. Stories can be used to provide your data with a visual narrative.

A scene can be considered as a container for a sequence of objects, such as widgets, data, or animations. The objects in a scene are also placed into a timeline, which dictates when the objects appear in the scene.

Fig 7.2.1 Scene 1

Bar Chart - Bed Grade

Pie Chart - Room Available

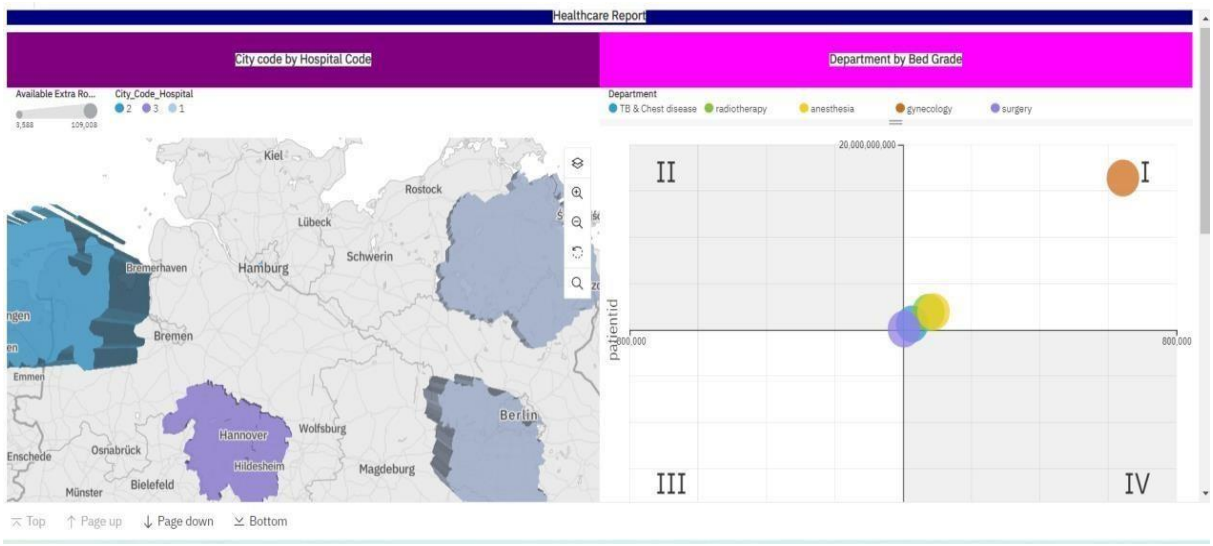
Bar Chart - Case id & severity of illness by age

Fig 7.2.2 Bar and Pie Chart

7.3 Feature 3

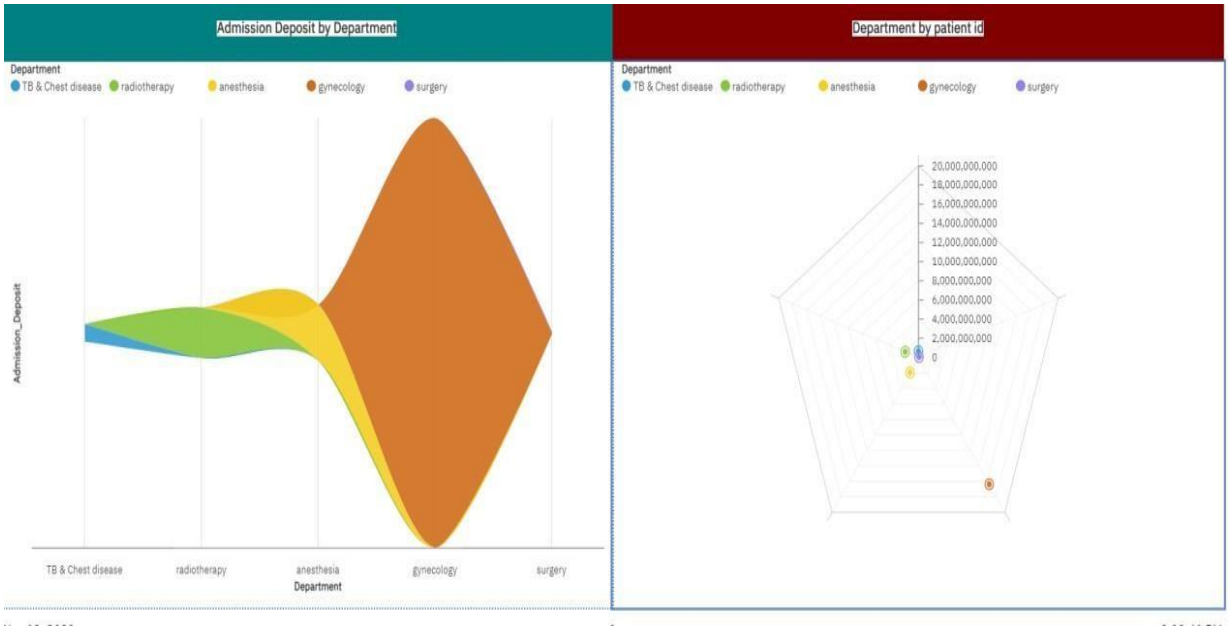
Report :

Reporting by creating a new report or by opening an existing report in the Cognos Analytics portal. Work in design, preview, or structure view IBM Cognos Analytics - Reporting has three views in which you can author reports: Page design view, Page preview view, and Page structure view. Report layout and queries



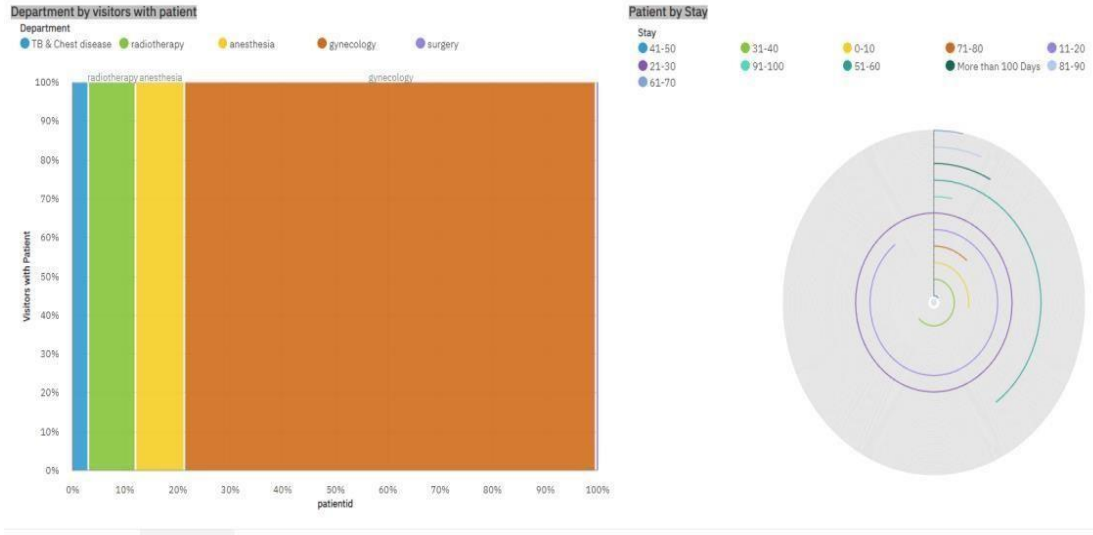
Map - City code by Hospital code
Quadrant - Department by Bed Grade

Fig 7.3.1 Map and Quadrant



River - Admission Deposit by Department
Radial - Patient by Stay

Fig 7.3.2 River and Radial



Stacked Bar - Department by visitors with Patient
Radial - Patient by Stay

Fig 7.3.3 Stacked and Radial

7.4 Machine Learning Algorithms

Machine learning (**ML**) is a field of inquiry devoted to understanding and building methods that 'learn', that is, methods that leverage data to improve performance on some set of tasks. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as training data, in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, agriculture, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

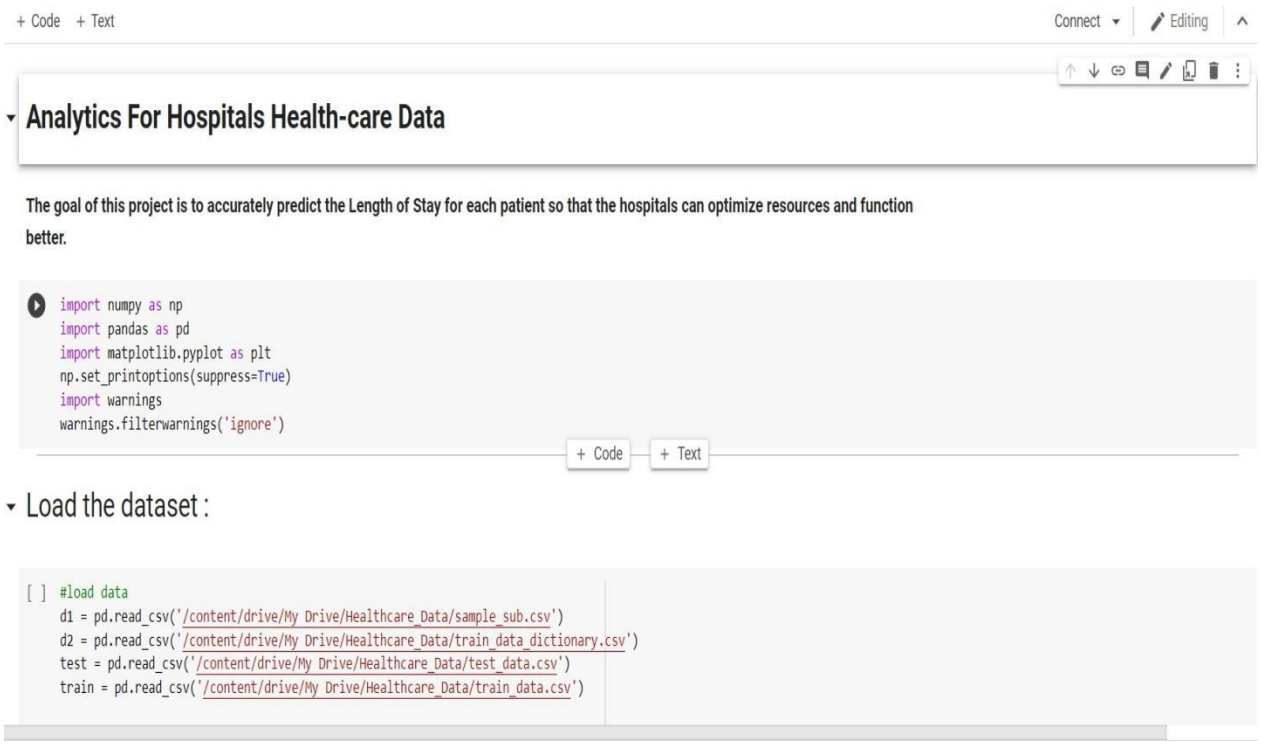


Fig 7.4.1 Loading the Data Set

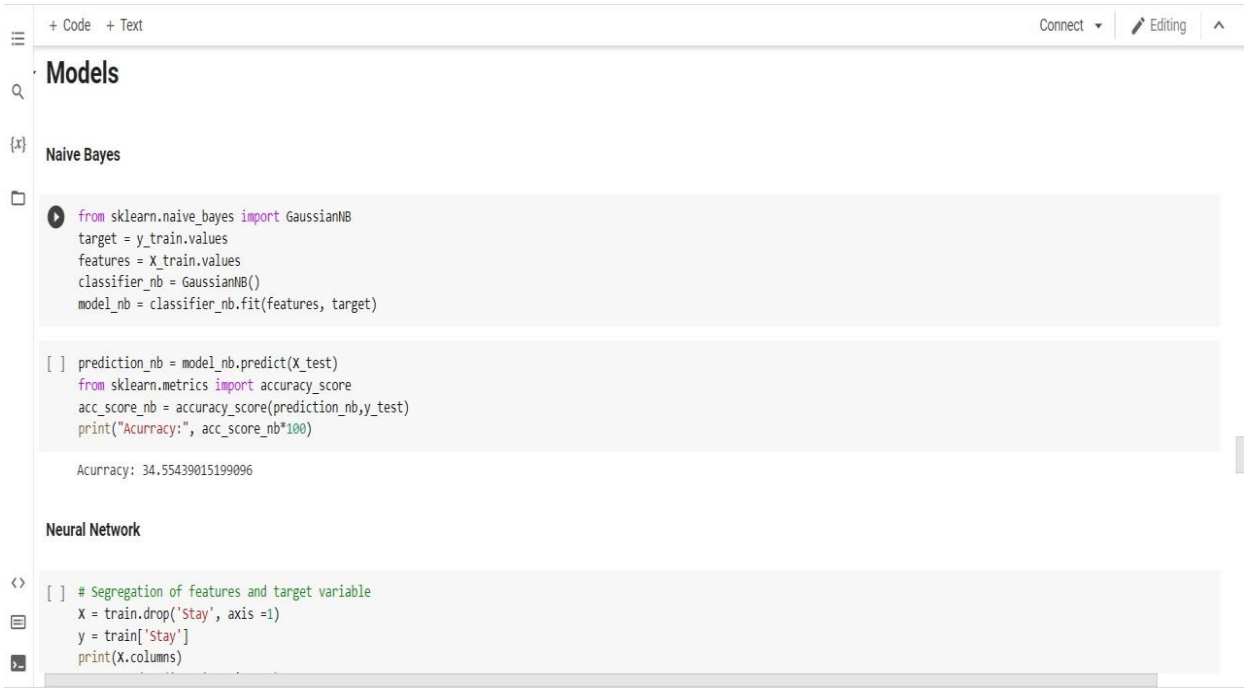


Fig 7.4.2 Models

Fig 7.4.3 Results

7.5 Database Schema

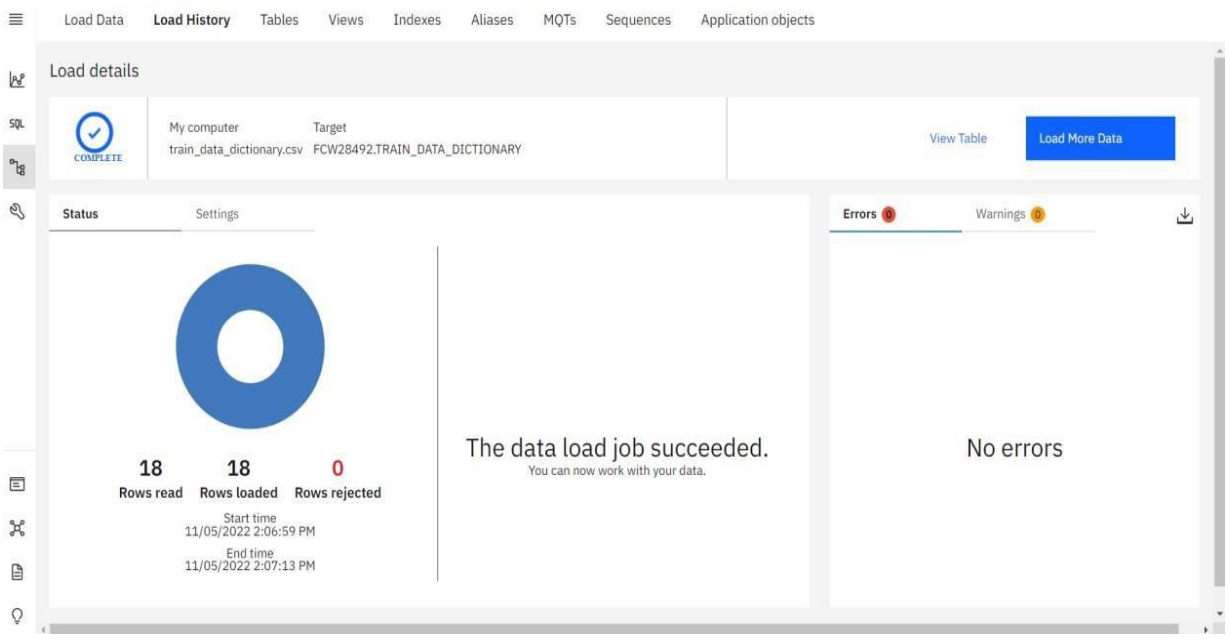


Fig 7.5.1 Db2 Load Data Set 1

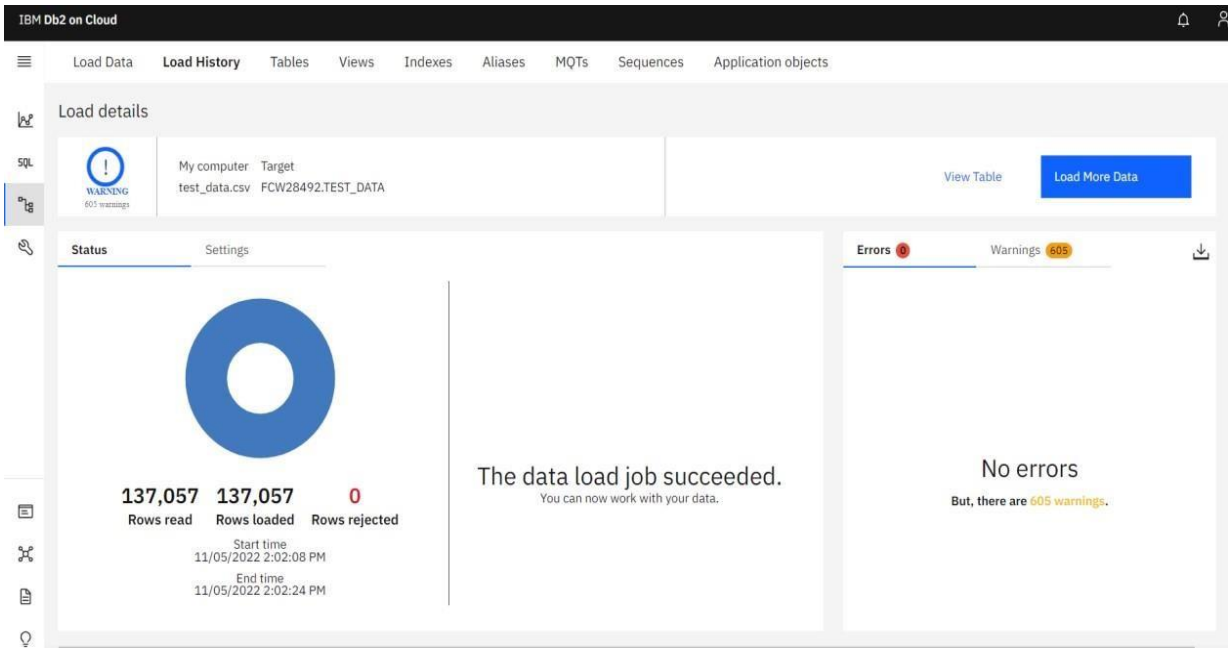


Fig 7.5.2 Db2 Load Data Set 2

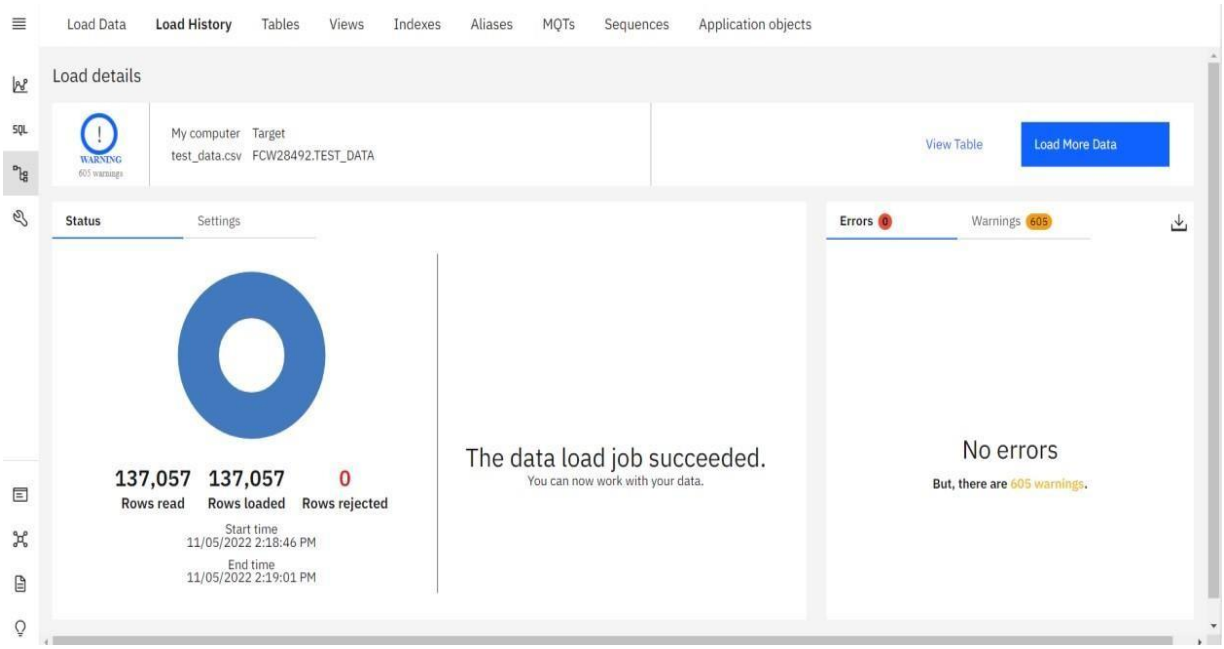


Fig 7.5.3 Db2 Load Data Set 3

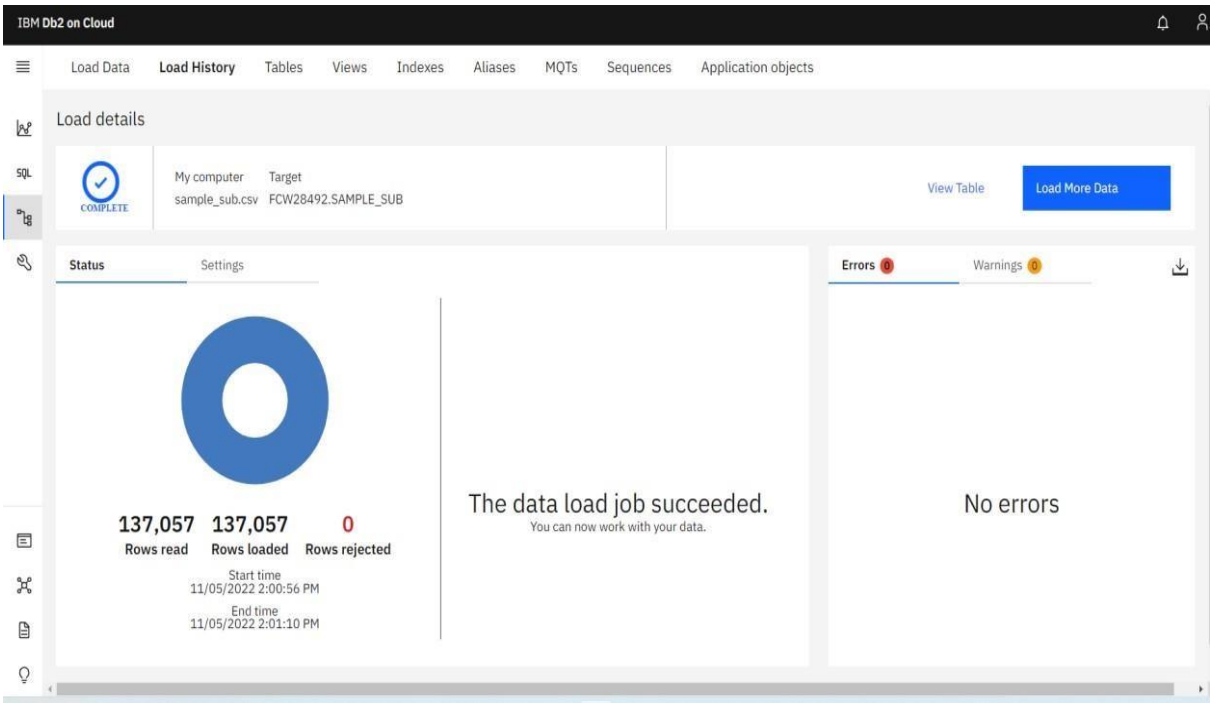
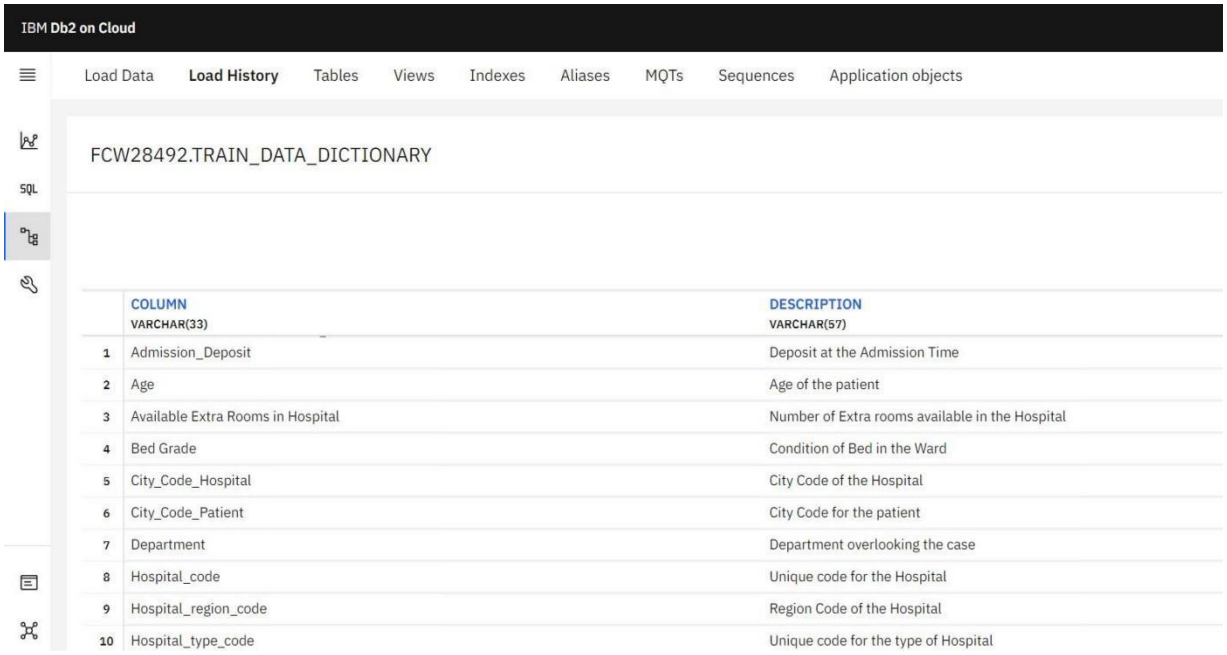
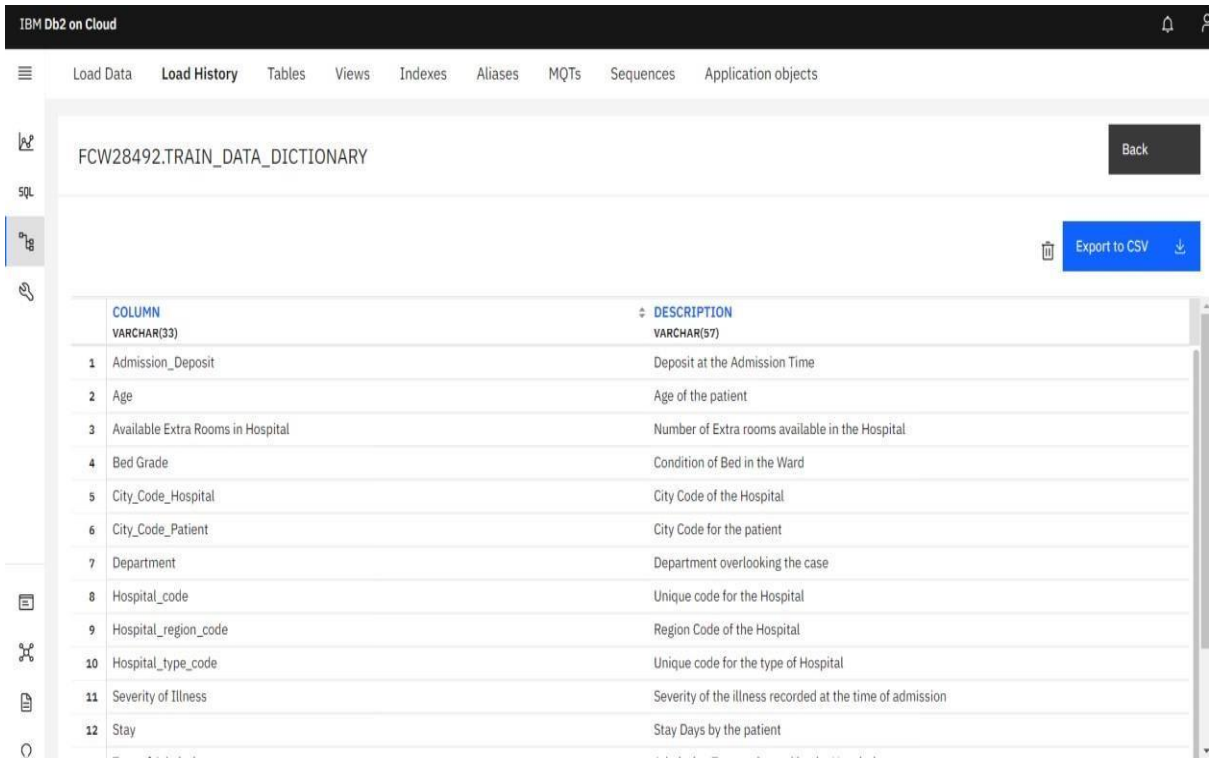


Fig 7.5.4 Db2 Load Data Set 4



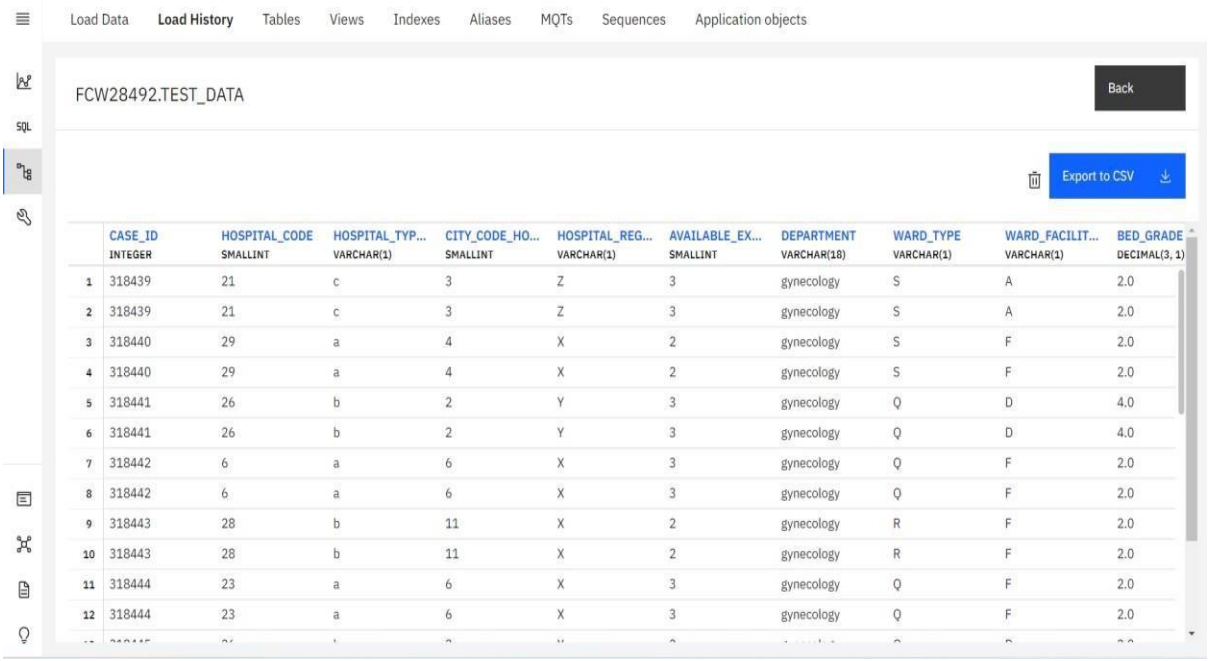
	COLUMN VARCHAR(33)	DESCRIPTION VARCHAR(57)
1	Admission_Deposit	Deposit at the Admission Time
2	Age	Age of the patient
3	Available Extra Rooms in Hospital	Number of Extra rooms available in the Hospital
4	Bed Grade	Condition of Bed in the Ward
5	City_Code_Hospital	City Code of the Hospital
6	City_Code_Patient	City Code for the patient
7	Department	Department overlooking the case
8	Hospital_code	Unique code for the Hospital
9	Hospital_region_code	Region Code of the Hospital
10	Hospital_type_code	Unique code for the type of Hospital

Fig 7.5.5 Viewing Data Set 1



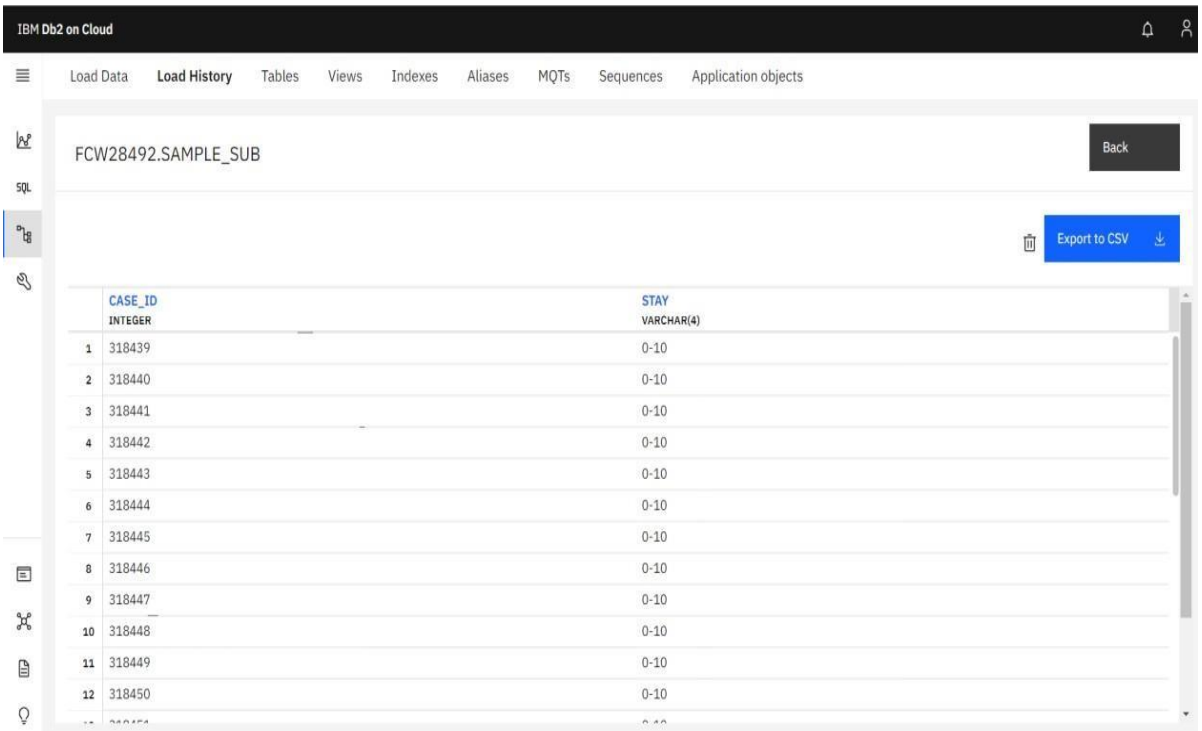
	COLUMN VARCHAR(33)	DESCRIPTION VARCHAR(57)
1	Admission_Deposit	Deposit at the Admission Time
2	Age	Age of the patient
3	Available Extra Rooms in Hospital	Number of Extra rooms available in the Hospital
4	Bed Grade	Condition of Bed in the Ward
5	City_Code_Hospital	City Code of the Hospital
6	City_Code_Patient	City Code for the patient
7	Department	Department overlooking the case
8	Hospital_code	Unique code for the Hospital
9	Hospital_region_code	Region Code of the Hospital
10	Hospital_type_code	Unique code for the type of Hospital
11	Severity of Illness	Severity of the illness recorded at the time of admission
12	Stay	Stay Days by the patient

Fig 7.5.6 Viewing Data Set 2



	CASE_ID INTEGER	HOSPITAL_CODE SMALLINT	HOSPITAL_TYP... VARCHAR(1)	CITY_CODE_HO... SMALLINT	HOSPITAL_REG... VARCHAR(1)	AVAILABLE_EX... SMALLINT	DEPARTMENT VARCHAR(18)	WARD_TYPE VARCHAR(1)	WARD_FACILIT... VARCHAR(1)	BED_GRADE DECIMAL(3, 1)
1	318439	21	c	3	Z	3	gynecology	S	A	2.0
2	318439	21	c	3	Z	3	gynecology	S	A	2.0
3	318440	29	a	4	X	2	gynecology	S	F	2.0
4	318440	29	a	4	X	2	gynecology	S	F	2.0
5	318441	26	b	2	Y	3	gynecology	Q	D	4.0
6	318441	26	b	2	Y	3	gynecology	Q	D	4.0
7	318442	6	a	6	X	3	gynecology	Q	F	2.0
8	318442	6	a	6	X	3	gynecology	Q	F	2.0
9	318443	28	b	11	X	2	gynecology	R	F	2.0
10	318443	28	b	11	X	2	gynecology	R	F	2.0
11	318444	23	a	6	X	3	gynecology	Q	F	2.0
12	318444	23	a	6	X	3	gynecology	Q	F	2.0

Fig 7.5.7 Viewing Data Set 3



	CASE_ID INTEGER	STAY VARCHAR(4)
1	318439	0-10
2	318440	0-10
3	318441	0-10
4	318442	0-10
5	318443	0-10
6	318444	0-10
7	318445	0-10
8	318446	0-10
9	318447	0-10
10	318448	0-10
11	318449	0-10
12	318450	0-10

Fig 7.5.8 Viewing Data Set 4

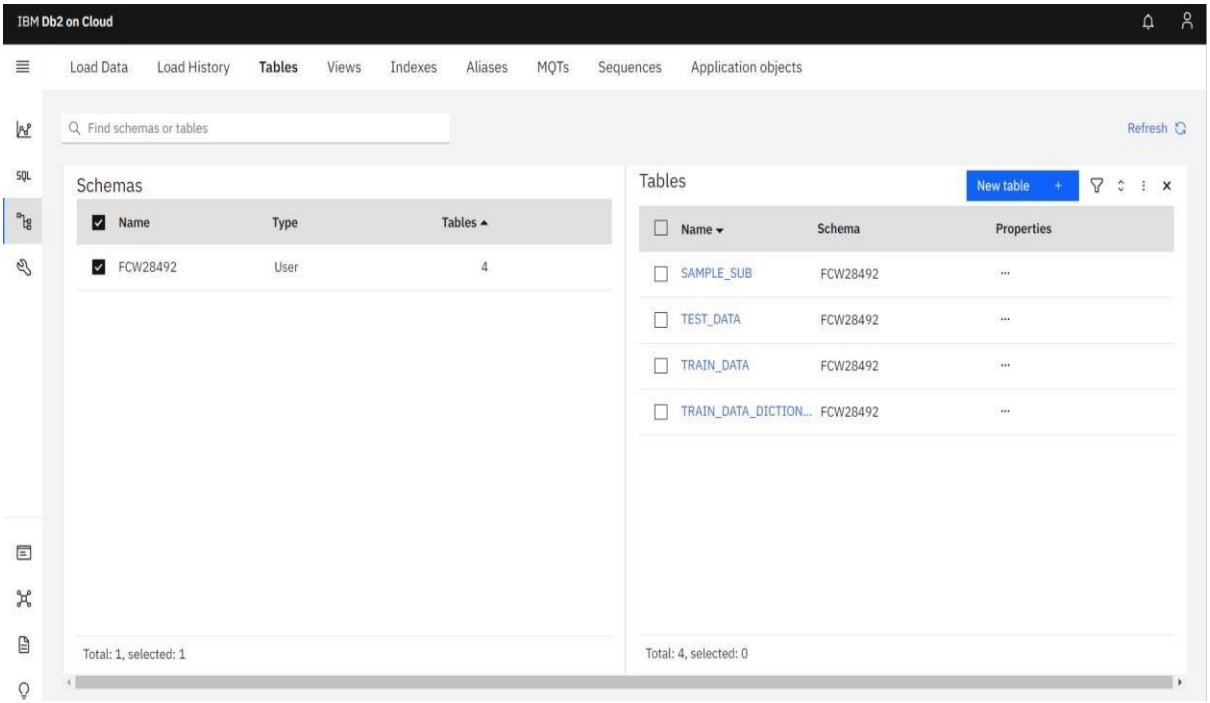


Fig 7.5.9 IBM Db 2 Tables

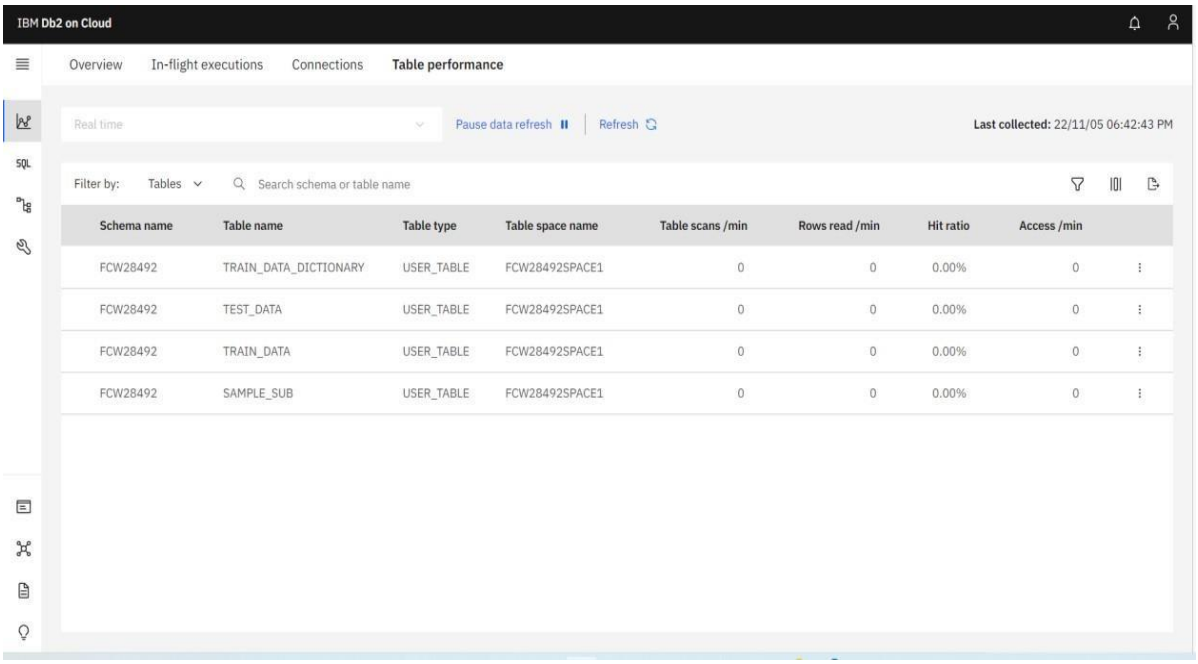


Fig 7.5.10 Table Performance

CHAPTER 8

TESTING

8.1 Test Cases

	A	B	C	D	E
1					Date
2					Team ID
3					Project Name
4	**Test case ID**	**Feature type**	**Component**	**Test Scenario**	**Pre-Requisite**
5	RegisterPage_TC_001	Functional	Register Page	Verify user is able to see register p	Internet , Webpage URL
6	RegisterPage_TC_002	UI	Register Page	Verify user is able to register into a	Internet , Webpage URL
7	RegisterPage_TC_003	Functional	Register Page	Verify user is able to navigate to c	Internet , Webpage URL
8	RegisterPage_TC_004	Functional	Functional	Verify register page elements	Internet , Webpage URL & Valid informations
9	RegisterPage_TC_005	Functional	Register Page	Verify user is able to login through	Internet, Webpage

Fig 8.1.1 Test Cases

	H	I	J	K	L	M	N
1							
2							
3							
4	**Expected Result**	**Actual Result**	**Status**	**Comments**	**TC for Automation(Y/N)**	**BUG ID**	**Executed By**
5	Sign up page must be displayed	Working as expected	Pass		Y		Ansline Lidiya
6	Web Application should show below UI elements: a.Email text box b .Password text box c.Confirm Password text box	Working as expected	Pass		Y		Susmitha Shree
7	Application should show below links :	Working as expected	Pass		Y		Sivasamy
8	User should navigate to user account homepage	Working as expected	Pass		Y		Dawood Ibrahim
9	Visible in Google	Working as expected			Y		Ansline Lidiya
10	Next page visible	Working as expected			Y		Susmitha Shree
11	Login/Signup popup should display	Working as expected	Pass		Y		Sivasamy

Fig 8.1.2 Test Cases 1

8.2 User Acceptance Testing

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	7	2	3	4	16
Duplicate	1	0	2	0	3
External	3	2	0	2	7
Fixed	9	2	4	17	32
Not Reproduced	0	0	2	0	2
Skipped	0	0	2	2	4
Won't Fix	0	3	1	2	6
Totals	20	9	14	27	70

Table 8.2.1 Defect Analysis

Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	45	0	0	45
Security	1	0	0	1
Outsource Shipping	2	0	0	2
Exception Reporting	7	0	0	7
Final Report Output	3	0	0	3
Version Control	1	0	0	1

Table 8.2.2 Test Case Analysis

Model Performance Testing:

S.No.	Parameter	Values
1.	Dashboard design	12
2.	Data Responsiveness	Good
3.	Amount Data to Rendered (DB2 Metrics)	4
4.	Utilization of Data Filters	Yes
5.	Effective User Story	3
6.	Descriptive Reports	8

Table 8.2.3 Model Performance Testing

CHAPTER 9

RESULTS

9.1 Performance Metrics

Login Page:

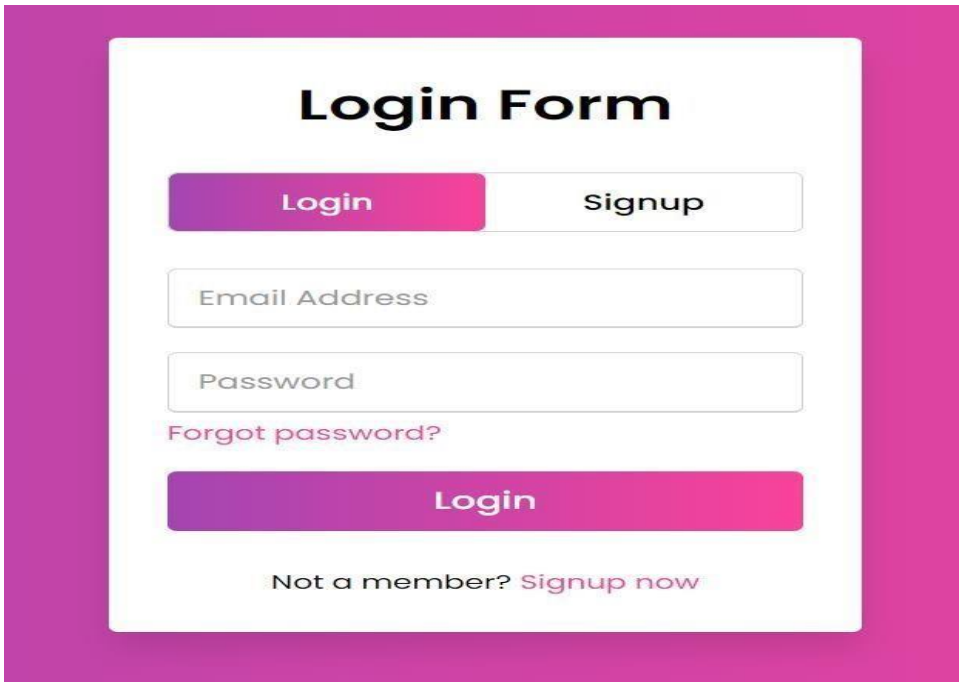


Fig 9.1 Login Page

Sign Up/Register Page:

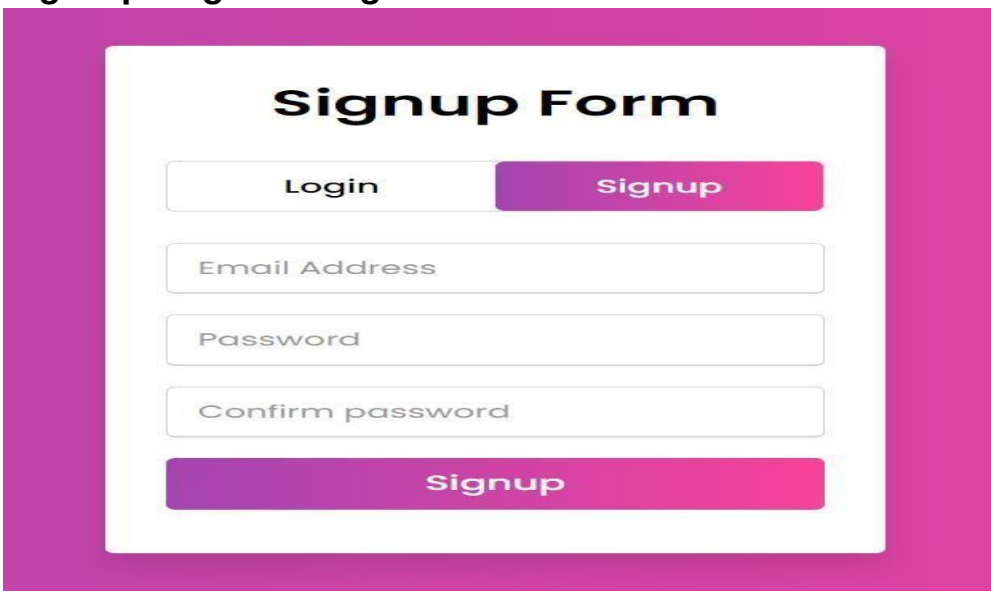


Fig 9.2 Sign Up Page

WEB INTERFACE :

Fig 9.3 Web Interface

DASHBOARD :

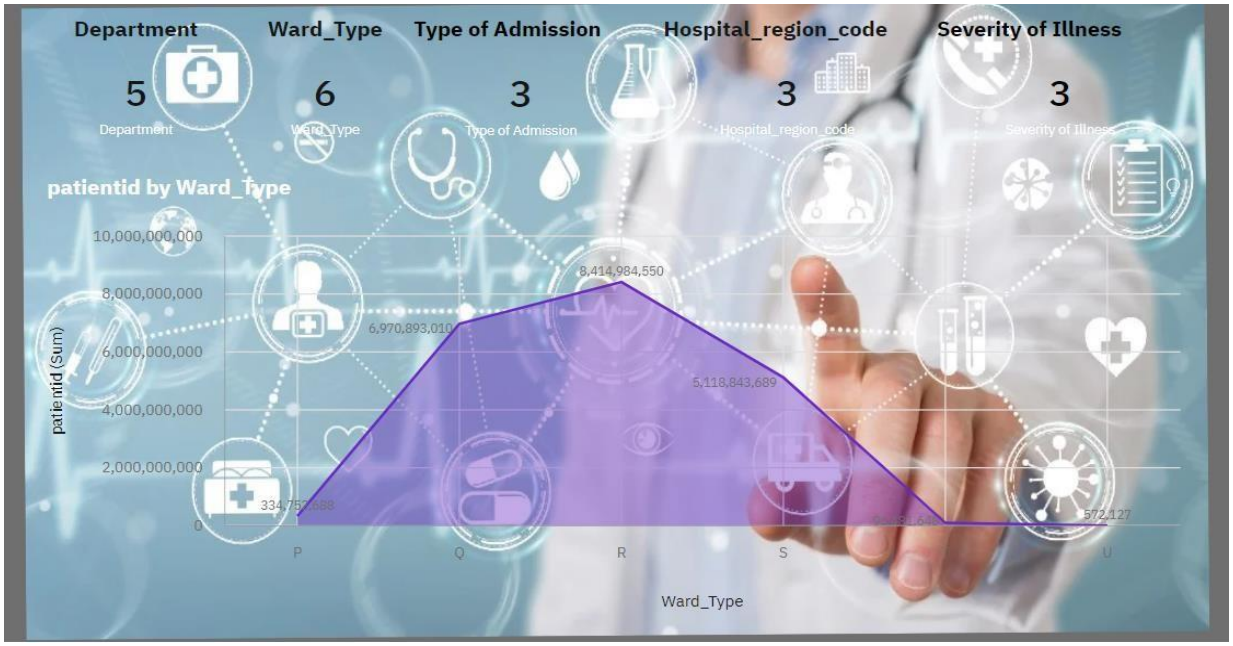


Fig 9.4 Area Chart - Patient id by Ward type

Bubble Chart - Bed Grade and ward hierarchy by case id

Radial Chart - Admission Deposit by Department

Fig 9.5 Bubble and Radial Chart

STORY :

Fig 9.6 Scene 1

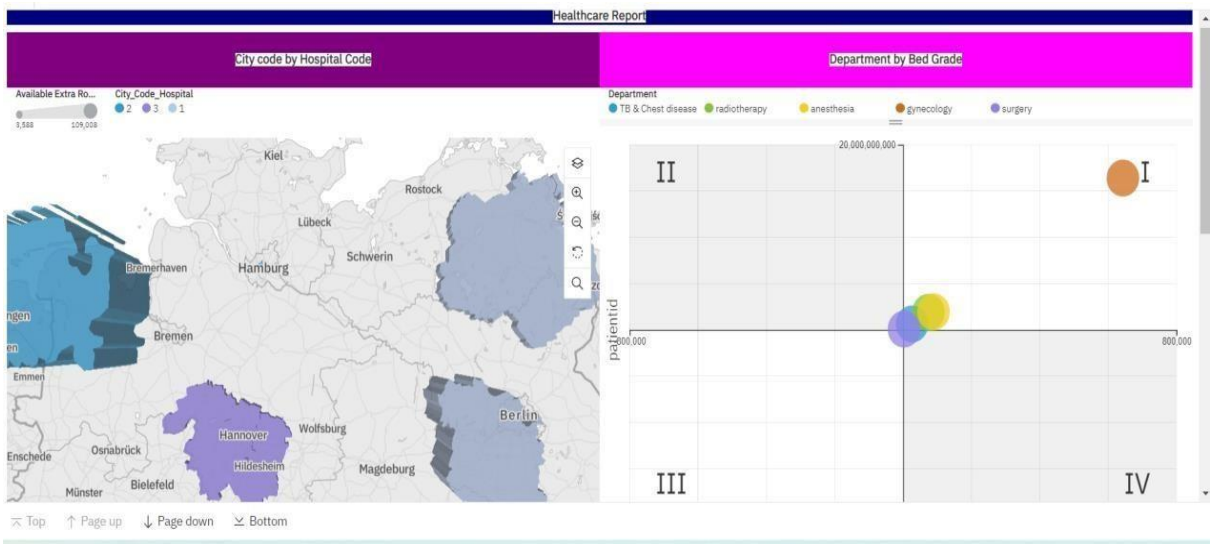
Bar Chart - Bed Grade

Pie Chart - Room Available

Bar Chart - Case id & severity of illness by age

Fig 9.7 Bar and Pie Chart

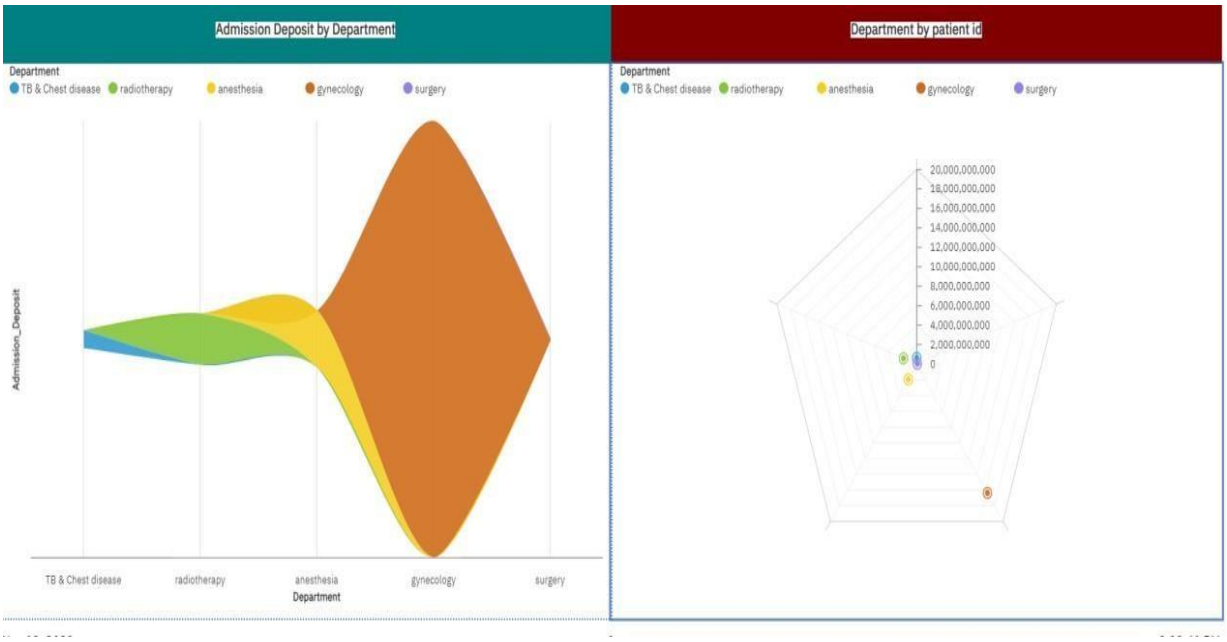
REPORT :



Map - City code by Hospital code

Quadrant - Department by Bed Grade

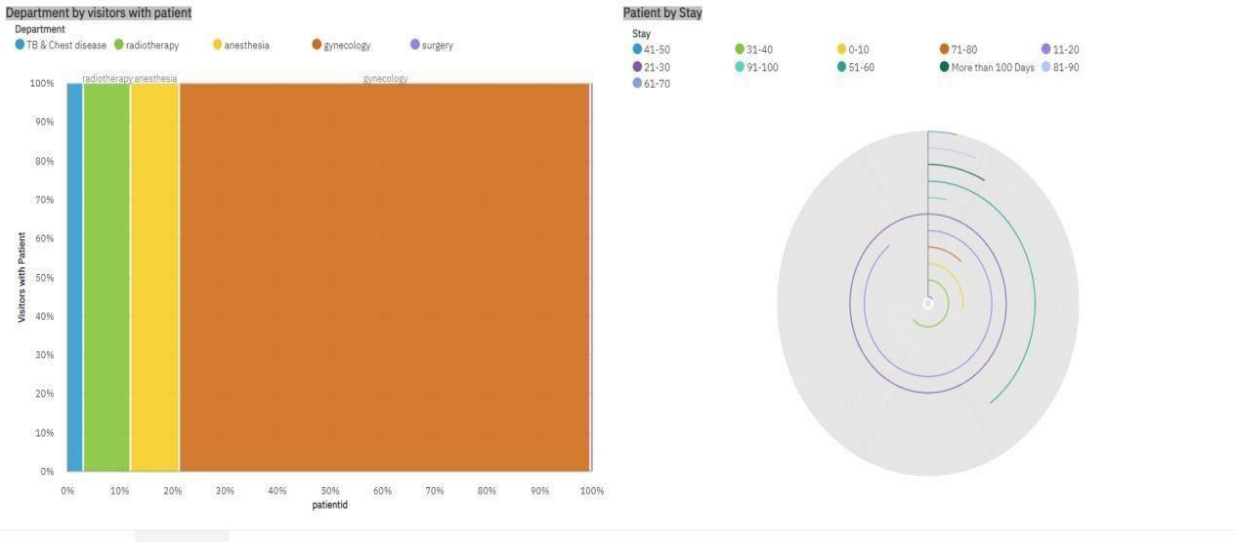
Fig 9.8 Map and Quadrant



River - Admission Deposit by Department

Radial - Patient by Stay

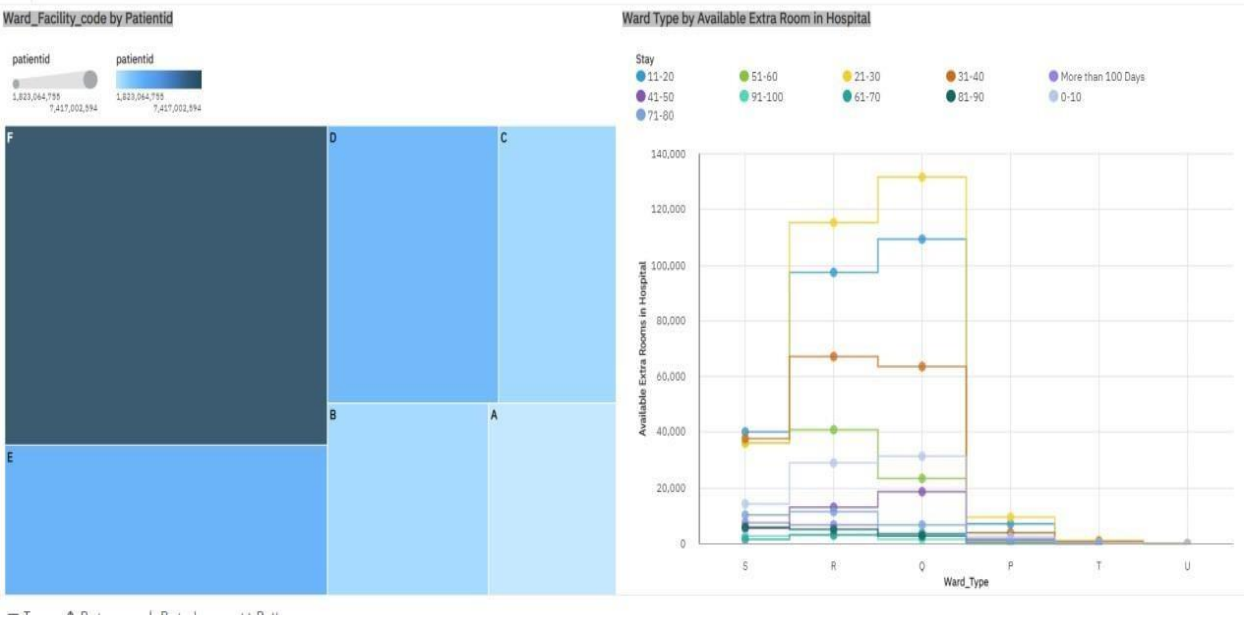
Fig 9.9 River and Radial



Stacked Bar - Department by visitors with Patient

Radial - Patient by Stay

Fig 9.10 Stacked and Radial



Stacked Bar Quadrant - Ward Facility by Patient id

Line Graph - Ward type by Available Rooms

Fig 9.11Stacked Bar and Line Graph

CHAPTER 10
ADVANTAGES AND DISADVANTAGES

ADVANTAGES

1. Improved diagnostics
2. Better patient care
3. Better health outcomes
4. Improved patient interactions
5. Increased health indicators
6. Enhanced patient experiences
7. Better decision making in procedures
8. Preventative care

DISADVANTAGES

1. Collecting the data? :

Data insights are often retrieved from some source, but for the healthcare industry,they lack data governance habits.

As a result, collecting data that is clean, accurate, and complete for use in multiple systems is a daunting task is

a daunting task to accomplish.??

2. Cleaning the data?

Data cleaning is referred to as cleansing or scrubbing the data to ensure the datasets are accurate,

consistent, relevant, and not influenced by any third party.?

3. Data storage?

Frontline doctors and health practitioners merely give a thought to where the data to be stored.

CHAPTER 11
CONCLUSION

After the post-Covid-19 epidemic, one area of concern is healthcare. While there are many applications for healthcare management, patient length of stay is one of the most important variables to track and forecast if one wishes to increase the effectiveness of healthcare management at a hospital.

In this project, we proposed application that helps to accurately predict the Length of Stay for each patient on case by case basis so that the Hospitals can use this information for optimal resource allocation and better functioning.

This helps the hospital management to identify patients who will stay longer at the time of admission. The identified patients can have their treatment plan and it will lower the chance of staff/visitor infection.

CHAPTER 12
FUTURE SCOPE

Data analytics techniques are being applied to improve research efforts in many health-related areas by gathering and analyzing clinical data.

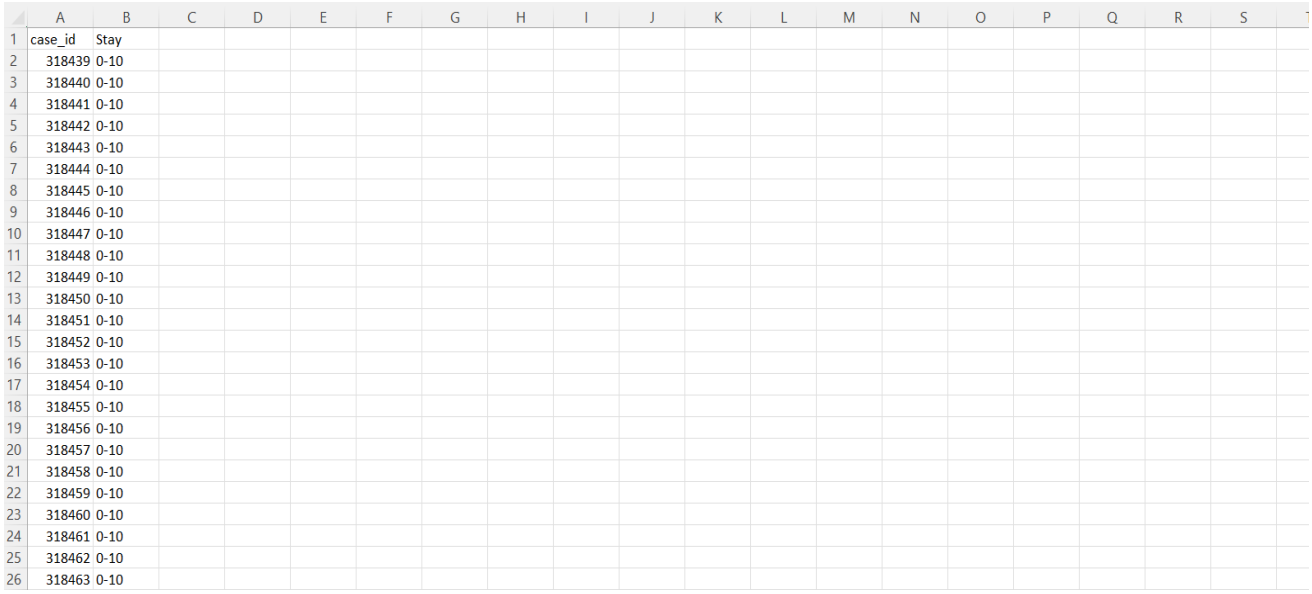
Here we created a dashboard for monitoring the length of stay of patients and also include the necessary data which were provided by the hospital to create an effective virtual dashboard using Cognos analytics. This dashboard supports clinicians and hospital managers in viewing and exploring data on processes and outcomes of care in an interactive manner.

As heading for the future work right now, we are planning to create an app that works in an efficient manner which helps the hospital management for optimal resource allocation and to improve the accuracy to 100% for better functioning.

CHAPTER 13

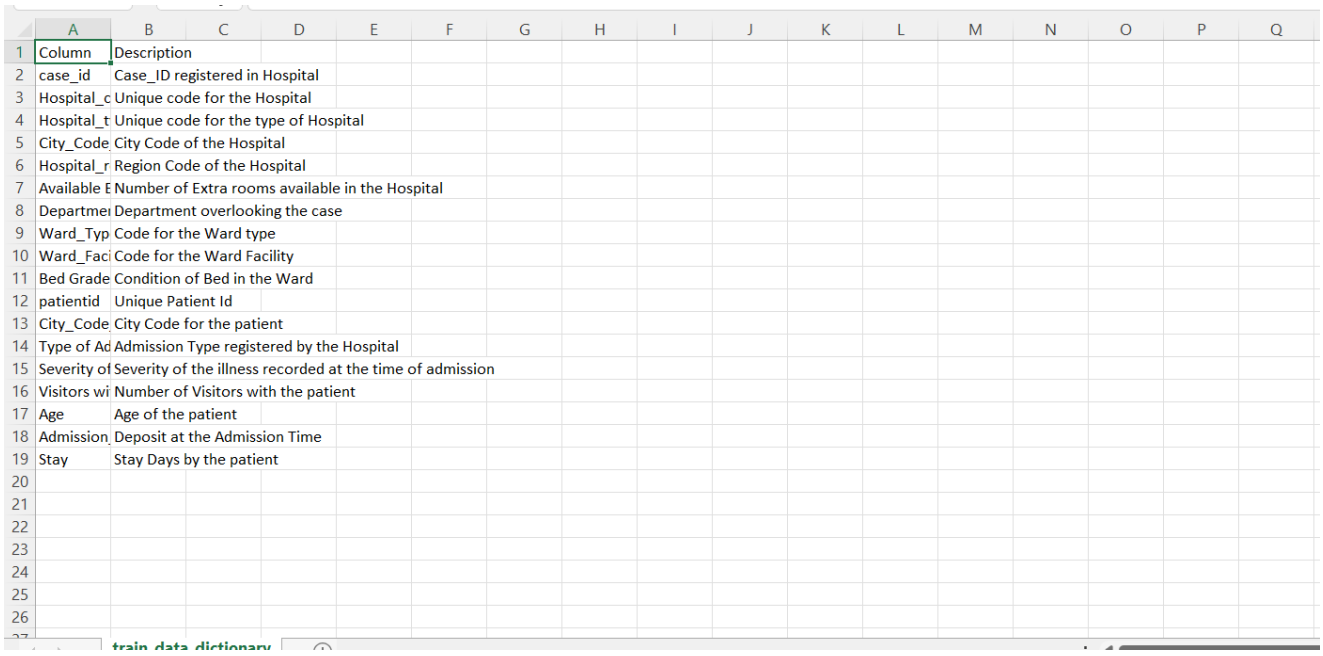
APPENDIX

A. SOURCE CODE



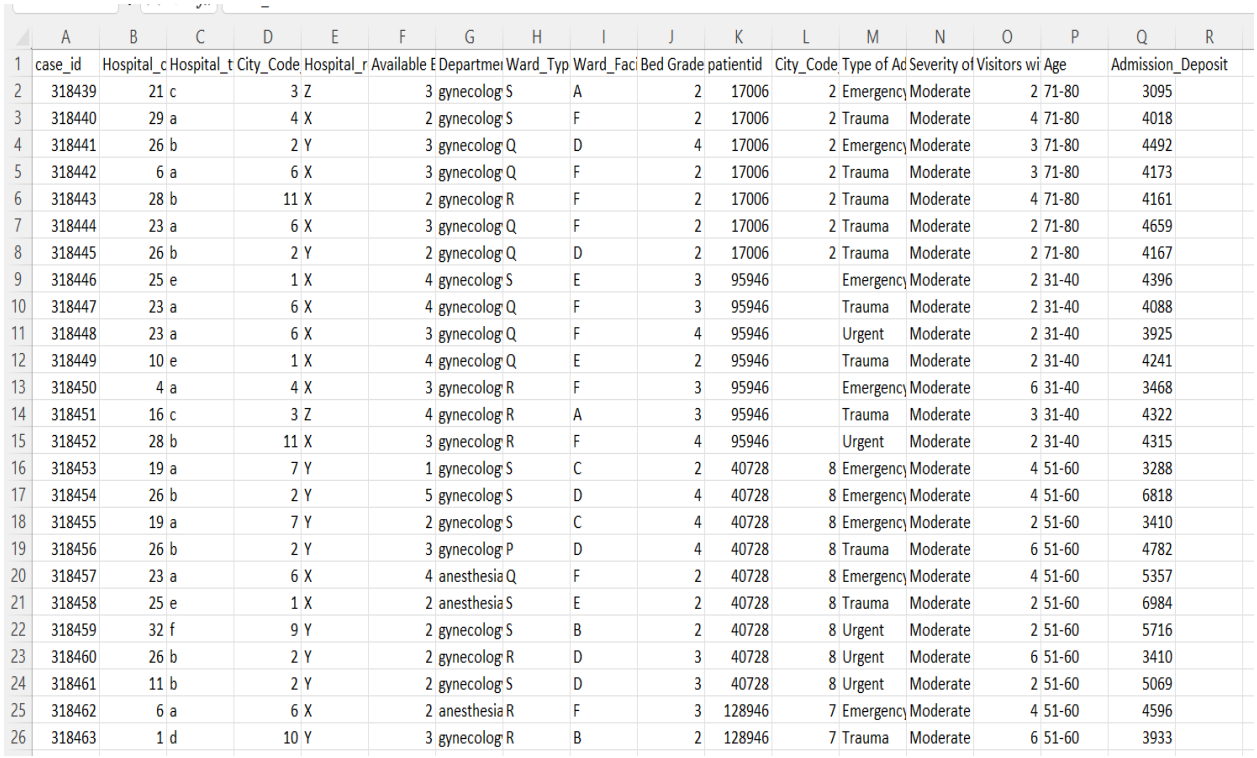
case_id	Stay
318439	0-10
318440	0-10
318441	0-10
318442	0-10
318443	0-10
318444	0-10
318445	0-10
318446	0-10
318447	0-10
318448	0-10
318449	0-10
318450	0-10
318451	0-10
318452	0-10
318453	0-10
318454	0-10
318455	0-10
318456	0-10
318457	0-10
318458	0-10
318459	0-10
318460	0-10
318461	0-10
318462	0-10
318463	0-10

Fig 13.1 Sample Data



Column	Description
case_id	Case_ID registered in Hospital
Hospital_c	Unique code for the Hospital
Hospital_t	Unique code for the type of Hospital
City_Code	City Code of the Hospital
Hospital_r	Region Code of the Hospital
Available E	Number of Extra rooms available in the Hospital
Departmei	Department overlooking the case
Ward_Typ	Code for the Ward type
Ward_Faci	Code for the Ward Facility
Bed Grade	Condition of Bed in the Ward
patientid	Unique Patient Id
City_Code	City Code for the patient
Type of Ad	Admission Type registered by the Hospital
Severity of	Severity of the illness recorded at the time of admission
Visitors wi	Number of Visitors with the patient
Age	Age of the patient
Admission	Deposit at the Admission Time
Stay	Stay Days by the patient

Fig 13.2 Train Data Dictionary



case_id	Hospital_c	Hospital_t	City_Code	Hospital_r	Available E	Departmer	Ward_Typ	Ward_Faci	Bed Grade	patientid	City_Code	Type of Ad	Severity of	Visitors wi	Age	Admission_Deposit
318439	21	c	3	Z	3	gynecolog	S	A	2	17006	2	Emergency	Moderate	2	71-80	3095
318440	29	a	4	X	2	gynecolog	S	F	2	17006	2	Trauma	Moderate	4	71-80	4018
318441	26	b	2	Y	3	gynecolog	Q	D	4	17006	2	Emergency	Moderate	3	71-80	4492
318442	6	a	6	X	3	gynecolog	Q	F	2	17006	2	Trauma	Moderate	3	71-80	4173
318443	28	b	11	X	2	gynecolog	R	F	2	17006	2	Trauma	Moderate	4	71-80	4161
318444	23	a	6	X	3	gynecolog	Q	F	2	17006	2	Trauma	Moderate	2	71-80	4659
318445	26	b	2	Y	2	gynecolog	Q	D	2	17006	2	Trauma	Moderate	2	71-80	4167
318446	25	e	1	X	4	gynecolog	S	E	3	95946		Emergency	Moderate	2	31-40	4396
318447	23	a	6	X	4	gynecolog	Q	F	3	95946		Trauma	Moderate	2	31-40	4088
318448	23	a	6	X	3	gynecolog	Q	F	4	95946		Urgent	Moderate	2	31-40	3925
318449	10	e	1	X	4	gynecolog	Q	E	2	95946		Trauma	Moderate	2	31-40	4241
318450	4	a	4	X	3	gynecolog	R	F	3	95946		Emergency	Moderate	6	31-40	3468
318451	16	c	3	Z	4	gynecolog	R	A	3	95946		Trauma	Moderate	3	31-40	4322
318452	28	b	11	X	3	gynecolog	R	F	4	95946		Urgent	Moderate	2	31-40	4315
318453	19	a	7	Y	1	gynecolog	S	C	2	40728	8	Emergency	Moderate	4	51-60	3288
318454	26	b	2	Y	5	gynecolog	S	D	4	40728	8	Emergency	Moderate	4	51-60	6818
318455	19	a	7	Y	2	gynecolog	S	C	4	40728	8	Emergency	Moderate	2	51-60	3410
318456	26	b	2	Y	3	gynecolog	P	D	4	40728	8	Trauma	Moderate	6	51-60	4782
318457	23	a	6	X	4	anesthesia	Q	F	2	40728	8	Emergency	Moderate	4	51-60	5357
318458	25	e	1	X	2	anesthesia	S	E	2	40728	8	Trauma	Moderate	2	51-60	6984
318459	32	f	9	Y	2	gynecolog	S	B	2	40728	8	Urgent	Moderate	2	51-60	5716
318460	26	b	2	Y	2	gynecolog	R	D	3	40728	8	Urgent	Moderate	6	51-60	3410
318461	11	b	2	Y	2	gynecolog	S	D	3	40728	8	Urgent	Moderate	2	51-60	5069
318462	6	a	6	X	2	anesthesia	R	F	3	128946	7	Emergency	Moderate	4	51-60	4596
318463	1	d	10	Y	3	gynecolog	R	B	2	128946	7	Trauma	Moderate	6	51-60	3933

Fig 13.3 Test Data

case_id	Hospital_c	Hospital_t	City_Code	Hospital_r	Available E	Departmer	Ward_Typ	Ward_Faci	Bed Grade	patientid	City_Code	Type of Ad	Severity of	Visitors wi	Age	Admission	Stay
1	8	c	3	Z	3	radiothera	R	F	2	31397	7	Emergency	Extreme	2	51-60	4911	0-10
2	2	c	5	Z	2	radiothera	S	F	2	31397	7	Trauma	Extreme	2	51-60	5954	41-50
3	10	e	1	X	2	anesthesia	S	E	2	31397	7	Trauma	Extreme	2	51-60	4745	31-40
4	26	b	2	Y	2	radiothera	R	D	2	31397	7	Trauma	Extreme	2	51-60	7272	41-50
5	26	b	2	Y	2	radiothera	S	D	2	31397	7	Trauma	Extreme	2	51-60	5558	41-50
6	23	a	6	X	2	anesthesia	S	F	2	31397	7	Trauma	Extreme	2	51-60	4449	Nov-20
7	32	f	9	Y	1	radiothera	S	B	3	31397	7	Emergency	Extreme	2	51-60	6167	0-10
8	23	a	6	X	4	radiothera	Q	F	3	31397	7	Trauma	Extreme	2	51-60	5571	41-50
9	1	d	10	Y	2	gynecolog	R	B	4	31397	7	Trauma	Extreme	2	51-60	7223	51-60
10	10	e	1	X	2	gynecolog	S	E	3	31397	7	Trauma	Extreme	2	51-60	6056	31-40
11	22	g	9	Y	2	radiothera	S	B	2	31397	7	Urgent	Extreme	2	51-60	5797	21-30
12	26	b	2	Y	4	radiothera	R	D	1	31397	7	Urgent	Extreme	2	51-60	5993	Nov-20
13	16	c	3	Z	2	radiothera	R	A	3	31397	7	Emergency	Extreme	2	51-60	5141	0-10
14	9	d	5	Z	3	radiothera	S	F	3	31397	7	Urgent	Extreme	2	51-60	8477	21-30
15	6	a	6	X	4	gynecolog	Q	F	3	63418	8	Emergency	Extreme	2	71-80	2685	0-10
16	6	a	6	X	3	gynecolog	Q	F	3	63418	8	Emergency	Extreme	2	71-80	9398	0-10
17	23	a	6	X	4	radiothera	Q	F	3	63418	8	Urgent	Extreme	4	71-80	2933	0-10
18	29	a	4	X	4	anesthesia	S	F	3	63418	8	Emergency	Extreme	2	71-80	5342	Nov-20
19	32	f	9	Y	4	radiothera	S	B	2	63418	8	Trauma	Extreme	2	71-80	7442	21-30
20	12	a	9	Y	4	radiothera	Q	B	2	63418	8	Trauma	Extreme	2	71-80	5155	31-40
21	16	c	3	Z	2	anesthesia	S	A	3	63418	8	Trauma	Extreme	2	71-80	8181	31-40
22	3	c	3	Z	2	anesthesia	R	A	3	63418	8	Trauma	Extreme	2	71-80	6672	21-30
23	21	c	3	Z	2	anesthesia	S	A	3	63418	8	Trauma	Extreme	2	71-80	6364	Nov-20
24	6	a	6	X	3	anesthesia	R	F	3	63418	8	Urgent	Extreme	2	71-80	4664	21-30
25	26	b	2	Y	4	radiothera	Q	D	1	63418	8	Trauma	Extreme	4	71-80	4091	31-40

Fig 13.4 Train Data

B. GITHUB AND PROJECT DEMO LINK

Github Link :

IBM-EPBL/SI-GuidedProject-13650-1662815624: Analytics for Hospitals' Health-Care Data (github.com)

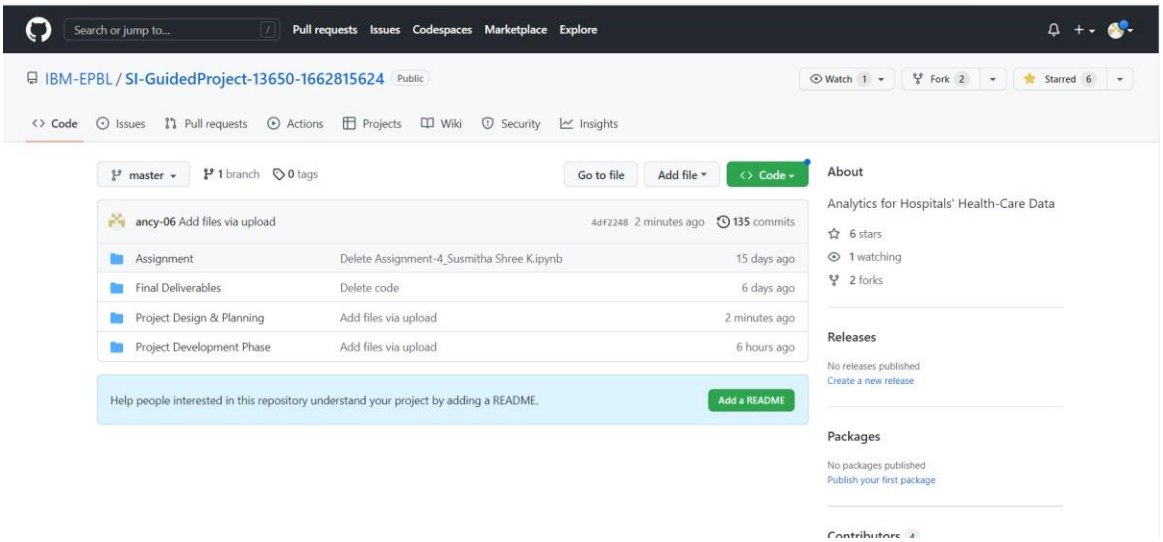


Fig 13.5 Github Page

Demo Link :

https://drive.google.com/drive/folders/1IP7LalfcphQIInYENQHvkFHY-f4mu0v7

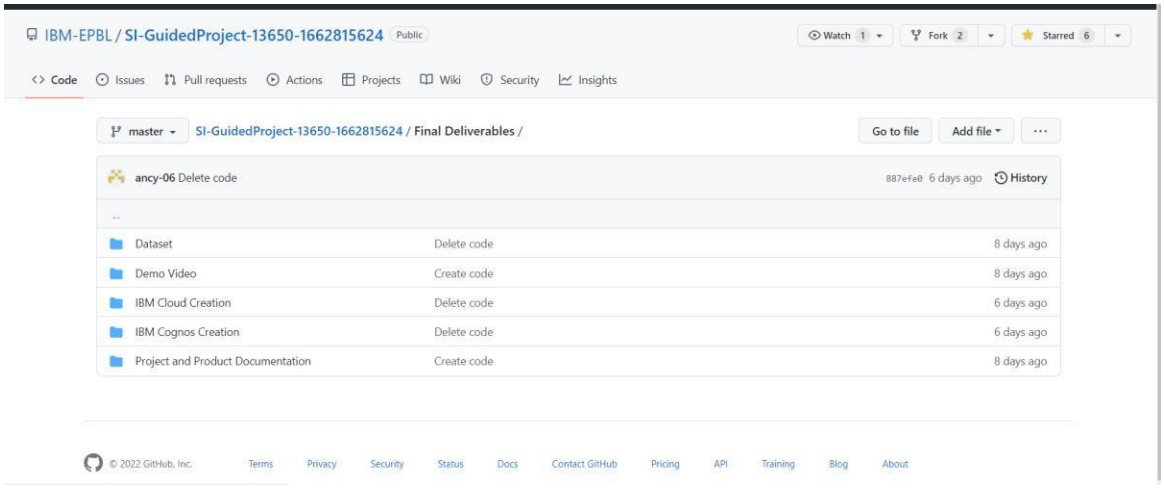


Fig 13.6 Demo Video Page