PROJECT REPORT

Team ID	PNT2022TMID09333
Project name	Analytics for Hospital Health Data

1. INTRODUCTION

1.1 Project Overview

- Data analytics in clinical settings attempts to reduce patient wait times via improved scheduling and staffing, give patients more options.
- when scheduling appointments and receiving treatment, and reduce readmission rates by using population health data to predict which patients are at greatest risk.

1.2 Purpose

This is the purpose of healthcare data analysis: using data-driven findings to predict and solve a problem before it is too late, but also assess methods and treatments faster, keep better track of inventory, involve patients more in their own health, and empower them with the tools to do so.

2. LITERATURE SURVEY

2.1 Existing problem

No remote access

- Healthcare is associated with in-person consultations. This problem obligates the patients to run to the nearest healthcare center for treatment.
- The COVID outbreak and lockdowns made it even worse.
- The contagion effect of the virus restrained people within the four walls of their homes.

So, what do they do if they need to see a doctor and have an emergency?
 The need for remote access or virtual consultations is the need of the hour, which needs to be taken care of to stay one step ahead in the technology adoption race.

Insufficiency and errors in data sharing

- In an age where medical science has made noteworthy advancements, inefficiencies and healthcare errors are still persistent because of the healthcare industry's traditional technology for management.
- This is not just a hurdle in medical science; it causes regression because of the waste it generates.
- Not only do patients pay the price in the form of inconvenience and health, but we also see a rise in administrative expenses and litigation owing to these inefficiencies and errors.
- An incomplete or inefficient exchange of this data can be dangerous in patients needing urgent or complicated treatment

Absence of supply management system

- Traditional supply chain management is often wasteful and inefficient.
- It leads to money wasted on lost and damaged inventory, improper delivery of equipment or medication, and the damage caused to patients, all of which amount to massive financial losses for healthcare services.
- Supply shortages, misplaced inventory, and less-than-stellar preventative measures regarding shrinkage, all play into the reality that hospitals are epicenters of wasteful operations without a proper supply management system.

Data security

- Another challenge mentioned by multiple respondents was data security.
 Between 2009 and 2020, 70% of the U.S. population was affected by healthcare data breaches—a trend that isn't likely to go away.
- Cigarillo believes the healthcare industry needs government funding to strengthen their IT resources.
- But there are also a number of best practices healthcare organizations can implement now that will help them more effectively secure valuable healthcare data, such as educating healthcare staff, restricting access to data and applications, implementing data usage controls, and more.

Lack of real time situation management

True crises used to be few and far between, but the past year has

- presented a perpetual state of crisis—a scenario that has posed an incredible challenge for healthcare organizations.
- According to Terry Zysk, CEO of LiveProcess, public health emergencies like COVID-19 require situation management: using real-time data analysis to understand how an event is unfolding, and reacting to it accordingly.
- It's the only way that critical healthcare resources can be delivered to the right people at the right time during emergencies and natural disasters.
- A major problem with hospital management systems is they don't provide access to the kind of real-time metrics that could improve response times and outcomes—for example, how many beds are available at a facility at any given time or the location of critical supplies.

2.2 References

TITLE: Healthcare

AUTHOR: Dr.leena V Gangloi

TITLE: Information System Healthcare Sectors

AUTHOR: Wager

TITLE: Data Analytics in Healthcare

AUTHOR: J. Archenaa

TITLE: Historical Review Of Health Policy Making

AUTHOR: Ravi Duggal

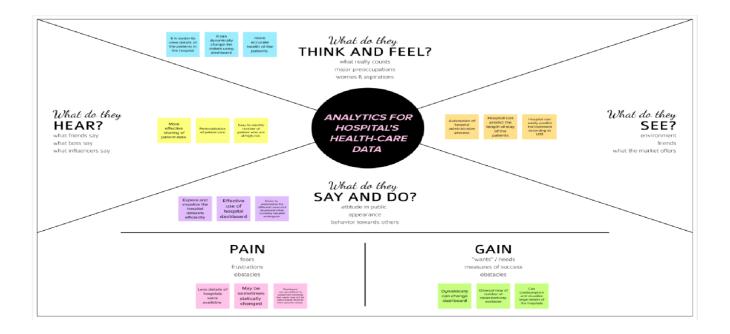
2.3 Problem Statement Definition

- Collection dataset.
- Upload the dataset into cognos.
- Open the properties->data module.
- > If null value is present in character field use mode method.
- > If the null value is present in continuous field use average or medium.
- Display the data in respective charts.
- Create conclusion using summary.

3. IDEATION & PROPOSED SOLUTION

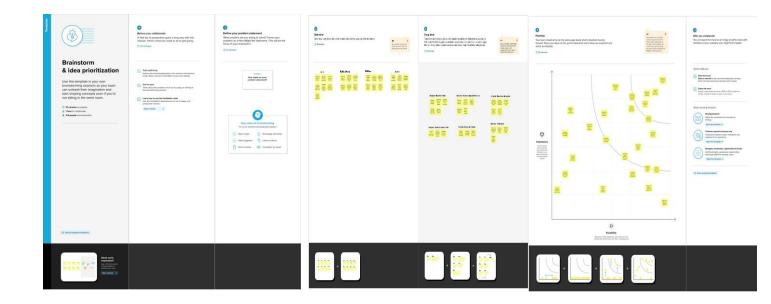
3.1 Empathy Map Canvas

- An empathy map is a tool which aids in understanding another person's perspective.
- > Empathy maps have up until now not been used in a medical education setting.
- Objective: To assess the attitudes towards, applicability and usefulness of empathy maps as part of medical student's communication skills training.



3.2 Ideation & Brainstorming

To try to solve a problem or come up with new ideas by having a discussion that includes all members of a group : to discuss a problem or issue and suggest solutions and ideas.



3.3 Proposed Solution

- Identify key hurdles to healthcare sustainability in india and propose a set of solutions that mutually benefit and the pharmaceutical industry Pragmatic literature review of 43 articles published by regional and international organizations.
- > UNIVERSAL HEALTHCARE COVERAGE Attainment of UHC comes with the hurdle of having to provide care to a higher number of patients.
- > EVOLVING DEMOGRAPHICS Population aging has resulted in a growing number of elderly dependents at higher risk of disease and complications.
- > RISING COST OF R&D Today, the cost of developing a medicine can exceed USD 2.6 B compared to USD 179 M in the 1970s.
- WIN-WIN SOLUTIONS ARE NEEDED TO ATTAIN SUSTAINABILITY Mutually beneficial solutions that allow for productive movement towards sustainable value-based healthcare systems should be explored.
- > VALUE ADDED SERVICES The pharmaceutical industry should move 'beyond the pill' and collaborate with to design and offer programs aimed at improving healthcare sustainability (e.g., training, administrative support, etc.
- > MULTI-STAKEHOLDER COALITIONS Multi-stakeholder coalitions can serve as a platform to discuss healthcare challenges and co-create healthcare solutions to achieve defined common goals..
- > INTEGRATED HEALTHCARE MODEL Investment in integrated healthcare systems that focus on prevention and early diagnosis is key to move towards sustainability in the LA region.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	EHR data matched patient-reported data in 23.5 percent of records in a study at an ophthalmology practise. Patients' EHR data did not agree in any way when they reported having three or more eye health complaints.
2.	Idea / Solution description	Predictive analytics can create patient journey dashboards and disease trajectories that can lead to effective, and resultdriven healthcare. It improves treatment delivery, cuts costs, improves efficiencies, and so on.
3.	Novelty / Uniqueness	Healthcare data frequently resides in several locations. from various departments, such as radiology or pharmacy, to various source systems, such as EMRs or HR software. The organisation as a whole contributes to the data. This data becomes accessible and usable when it is combined into a single, central system, such as an enterprise data warehouse (EDW).
4.	Social Impact / Customer Satisfaction	Enhanced diagnosis Improved
		Medical treatment Improved
		Health Results
		Improved relationships with patients More
		Positive Health indicators
5.	Business Model (Revenue Model)	The two factors that have the biggest negative effects on hospital income are claim denials and patient incapacity to pay their part. 90% more uncollectible claim denials were written off by hospitals and healthcare systems in 2017 compared to the preceding six years.
6.	Scalability of the Solution	A variety of institutions must store, evaluate, and take action on the massive amounts of data being produced by the health care sector as it expands quickly. India is a vast, culturally varied nation with a sizable population that is increasingly able to access centralised Health Care Services.

3.4 Problem Solution fit

- ➤ The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem
- ➤ In an age where medical science has made noteworthy advancements, inefficiencies and healthcare errors are still persistent because of the healthcare industry's traditional technology for management.
- One specific area of concern is the exchange of patient data in case of patient transfer from one department or hospital to another. Patient record sharing, when done the traditional way, is time-consuming and inefficient and exposes patient information to a breach.
- ➤ To deliver a holistic and satisfactory patient experience, different parties involved in healthcare doctors, scheme providers, insurance providers, doctors, and patients should be able to exchange information among themselves securely.

1. Customer Segments+ HospitalManagement	<u>5. Customer Limitation</u> Can't assure the effective utilization and	<u>6. Available Solution</u> Text mining Information retrieval
+ Patients	allocation of resources	
Problems/Pains Proper allocation of resources Predicting the length of stay of COVID patients Proper utilization and treatment to patients	9. Problem Efficient less calculatior and prediction of occurring situations	7. Behavior Data tracking with available methodologies such as text mining and information retrieval
3. Triggers to Act Prevailing emergency situations and Pandemic period	10. Your Solution Using predictive analysis powered by the Artificial Intelligence which is used in analytics technique	8. Channels of Behaviour 1. Online: Usage of data exploration 2. Offline: Preparing the dataset on the COVID patients.
4. Emotions Tensed and perplexed mind set to get rectified from the pandemic period		

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

Following are the functional requirements of the proposed solution:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1		
	Collect data	Data from various sources are collected using different methods in order to provide optimized results.
FR-2	Data Cleaning and Wrangling	When combining multiple data sources, there are many opportunities for data to be duplicated or mislabeled hence we cleanse the data
FR-3	Creating data model	The process of analyzing and defining all the data, as well as the relationships between those bits of data comes under this
FR-4	Prediction and Analysis	The hidden trends are analyzed and the final results are predicted using machine learning and Al algorithms

4.2 Non-Functional requirements

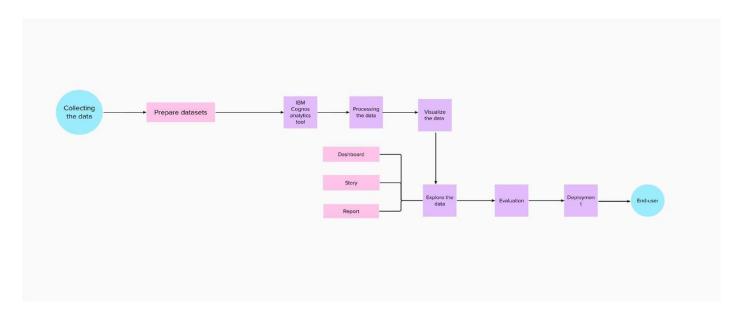
Following are the non-functional requirements of the proposed solution:

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The project must be easy to use. The user needs to have a good experience while working with the interface.
NFR-2	Security	
		Every user can access the website only if they possess the 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 waiting period must be short.
NFR-5	Availability	The project is platform independent. It runs perfectly on almost every platform.
NFR-6	Scalability	The project allows multiple users to handle the data at the same time. It is highly scalable since adding features and making advancements in the website is uncomplicated.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

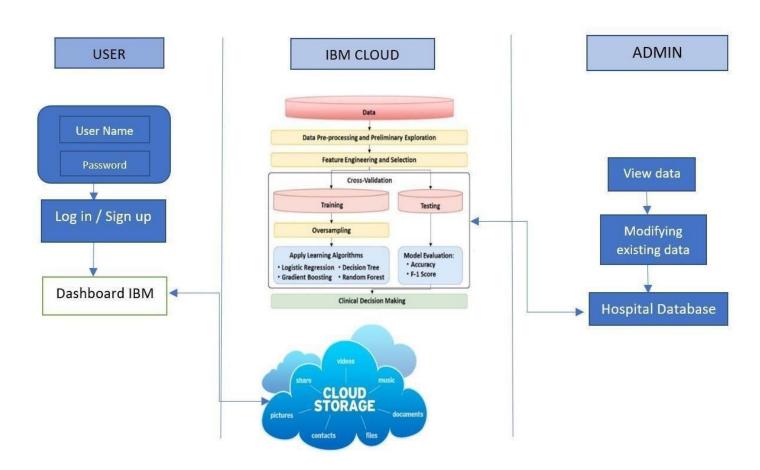
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 Solution & Technical Architecture

- Solution Architects are most similar to project managers, ensuring that all parties, including stakeholders, are on the same page and moving in the right direction at all stages.
- Technical architects manage all activities leading to the successful implementation of new application.





<u>Table-1 : Components & Technologies:</u>

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g., Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logging in as a patient / user in the application	Python
3.	Application Logic-2	Logging in as an admin in the application	IBM Watson Assistant
5.	Database	All the data about patients such as disease, address and etc	MySQL, NoSQL, etc.
6.	Cloud Database	IBM Watson cloud is used for storage, Cloud	IBM DB2, IBM Cloudant etc.
7.	External API-1	Purpose of External API used in the application	Aadhar API, etc
8.	Machine Learning Model	Purpose of Machine Learning Model	Regression Model, etc.
9.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration, Cloud Server Configuration	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Python
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	Encryption.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Can supports higher workloads
4.	Availability	Justify the availability of application (e.g., use of load balancers, distributed servers etc.)	Highly available
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	It performs good uses various tools and ideas in a scientific manner to meet the desired outcomes

5.3 User Stories

Use the below template to list all the user stories for the product:

	Login	USN-4	As a user, I can log into the application by entering email & password	I can access the dashboard	High	Sprint- 1
	Dashboard	USN-5	As a user, I can upload the datasets to the dashboard	I can access various operations	High	Sprint- 1
	View	USN-6	As a user, I can view the patient details	I can view the visual data and the result after the prediction	High	Sprint- 2
Admin	Analyze	USN-7	As an admin, I will analyze the given dataset	I can analyze the dataset	High	Sprint- 2
	Predict	USN-8	As an admin, I will predict the length of stay	I can predict the length of stay	High	Sprint- 2

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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

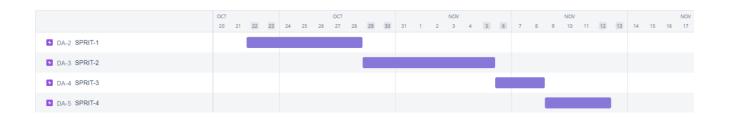
Use the below template to create product backlog and sprint schedule:

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 in IBM cloud and the data are collected.	20	High	2 Members
Sprint-2	Analyze	USN-2	As a health care provider all the data that are collected is cleaned and uploaded in the database or IBM cloud.	20	Medium	2 Members
Sprint-3	Dashboard	USN-3	As a health care provider I can use my account in my dashboard for uploading dataset.	10	Medium	2 Members
Sprint-3	Visualization	USN-4	As a health care provider I can prepare data for Visualization.	10	High	2 Members
Sprint-4	Visualization	USN-5	As a health care provider I can present data in my dashboard.	10	High	2 Members
Sprint-4	Prediction	USN-6	As a health care provider I can predict the length of stay	10	High	2 Members

6.3 Reports from JIRA

Road Map:

A roadmap is a strategic plan that defines a goal or desired outcome and includes the major steps or milestones needed to reach it. It also serves as a communication tool, a high-level document that helps articulate strategic thinking—the why—behind both the goal and the plan for getting there.

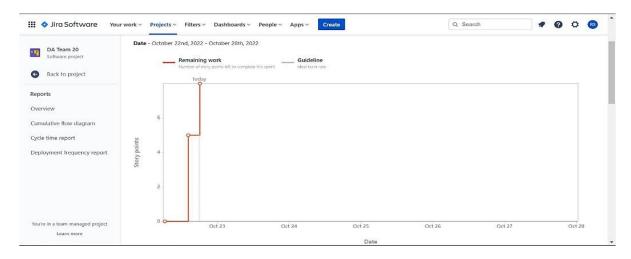


Kanban Board:

A kanban board is an agile project management tool designed to help visualize work, limit work-in-progress, and maximize efficiency (or flow). It can help both

agile and DevOps teams establish order in their daily work.

BURNDOWN CHART



VELOCITY

Average velocity for sprint - 1:

$$A\sqrt{=3/7} = 1.14$$

Average velocity for sprint - 2:

$$AV = 8/3 = 1$$

Average velocity for sprint - 3:

$$AV = 5/3 = 1.67$$

Average velocity for sprint - 4:

$$AV = 5/4 = 1.25$$

7. CODING & SOLUTIONING

7.1 Feature 1

- Fetched the data from DB2 database.
- Creating responsive dashboard.
- Inserting filter for each chart
- Creating report
- Created reports using multiple graphs and charts

7.2 Feature 2

- Creating stories and performed.
- Perform animation render image from website.
- Included graphs and charts.
- Creating web application using bootstrap.
- Embedded the cognos with web application.

7.3 Database Schema

- case_id
- Hospital_code
- Hospital_type_code
- City_Code_Hospital
- Hospital_region_code
- Available Extra Rooms in Hospital
- Department
- Ward_Type
- Ward_Facility_Code
- Bed Grade
- Patient id
- City_Code_Patient
- Type of Admission
- Severity of Illness
- Visitors with Patient
- Age
- Admission_Deposit
- Stay

8. TESTING

8.1 Test Cases

- Verify user is able to see Home page.
- Verify user is able to see Dashboard page.

- > Verify user is able to navigate to Report page.
- > Verify user is able to navigate to story page.
- > Verify filters are working

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] 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	8	5	0	3	16
Duplicate	1	0	5	0	6
External	0	3	2	1	6
Fixed	13	4	3	16	36
Not Reproduced	0	1	0	0	1
Skipped	0	1	0	1	2
Won't Fix	1	4	2	1	8
Totals	23	18	12	22	75

3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fall	Pass
Print Engine	9	0	0	9
Client Application	43	0	0	43
Security	1	0	0	1
Outsource Shipping	1	0	0	1

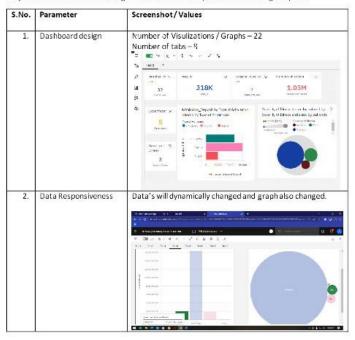
Exception Reporting	9	0	0	9
Final Report Output	10	0	0	10
Version Control	1	0	0	1

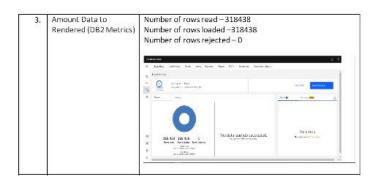
9. RESULTS

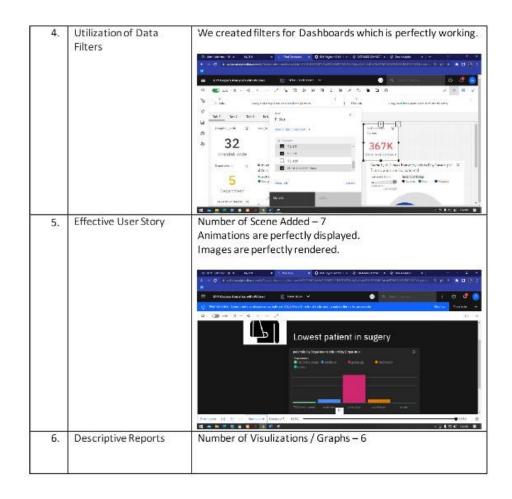
9.1 Performance Metrics

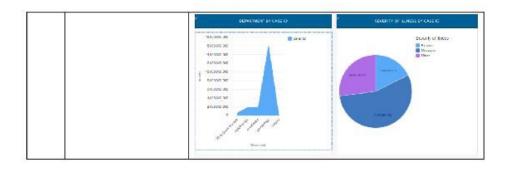
Model Performance Testing:

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









10. ADVANTAGES

- Improved research efforts
- Improved health outcomes
- Obtain operational insights
- Improved staffing
- Informed strategic planning
- > Higher-Quality Care

DISADVANTAGES

- > Privacy
- Replacing Doctors
- > Frustration with poor implementation.
- Cybersecurity risks
- Healthcare Regulatory Changes.
- Healthcare Staffing Shortages

11. CONCLUSION

- ➤ It also means describing how health plans, health care organizations, and clinicians should be accountable to patients and society and conversely.
- > How individuals can take appropriate responsibility for their own health.
- Data analytics is the science of analyzing raw datasets in order to derive a conclusion regarding the information they hold.
- > It enables us to discover patterns in the raw data and draw valuable information from them.

12. FUTURE SCOPE

- Improved Decision Making: Data Analytics eliminates guesswork and manual tasks. Be it choosing the right content, planning marketing campaigns, or developing products.
- Organizations can use the insights they gain from data analytics to make informed decisions. Thus, leading to better outcomes and customer satisfaction
- Data analytics to achieve business goals of pharmaceutical companies, payers,

insurance companies, physicians, hospitals, medical equipment companies, sales reps, and other stakeholders in the healthcare business, need for this have only increased after the Affordable Act came into being.

13. APPENDIX

Source Code

Dashboard

html

```
<!DOCTYPE html>
<html lang="en">
<head>
<title>Data Analytics</title>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
 <link rel="stylesheet"</pre>
href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
 <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.6.0/jquery.min.js"></script>
 <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></script>
<body>
<nav class="navbar navbar-inverse ">
  <div class="container-fluid">
   <div class="navbar-header">
     <a class="navbar-brand" href="#">Analytics for Hospitals' Health-Care Data</a>
   </div>
   <a href="index.html">Home</a>
     <a href="#">Dashboard</a>
     <a href="report.html">Report</a>
     <a href="story.html">Story</a>
```

```
</div>
</div>
</div>
</div class="container">
<iframe

src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRef=.my_folders%2F
Sprint%2B2%2FFinal%2BDashboard&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_n
avbar=false&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView=model000
00184774a03ac_00000002"
    width="1500" height="1000" frameborder="0" gesture="media" allow="encrypted-media"
allowfullscreen=""></iframe>
</div>
</body>
</body>
</br/>
</body>
</br/>
</body>
</br/>
</br/>
</body>
</br/>
</body>
```

Index html

```
<!DOCTYPE html>
<html lang="en">
<head>
 <title>Data Analytics</title>
 <meta charset="utf-8">
 <meta name="viewport" content="width=device-width, initial-scale=1">
 <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
 <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.6.0/jquery.min.js"></script>
 <script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></script>
</head>
<body>
<nav class="navbar navbar-inverse">
 <div class="container-fluid">
   <div class="navbar-header">
     <a class="navbar-brand" href="#">Analytics for Hospitals' Health-Care Data</a>
   </div>
   class="nav navbar-nav">
     <a href="#">Home</a>
     <a href="dashboard.html">Dashboard</a>
     <a href="report.html">Report</a>
     <a href="story.html">Story</a>
   </111>
 </div>
</nav>
<div class="jumbotron">
<center> <h4><i><b>Team ID : PNT2022TMID09333 </b></i></h4></center>
```

```
</div>
Team Leader
   RIAZ AHAMED K A
  Team member
   MUHAMMAD TARIQ PR
  <t.r>
   Team member
   MADHAVAN V
  <t.r>
   Team member
   SANJAY SUBRAMANIAN
  </body>
</html>
```

Report html

```
<!DOCTYPE html>
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          <head>
<title>Data Analytics</title>
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            <meta name="viewport" content="width=device-width, initial-scale=1">
            <link rel="stylesheet"</pre>
          href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
          src="https://ajax.googleapis.com/ajax/libs/jquery/3.6.0/jquery.min.js"></script>
          src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></script>
          </head>
          <body>
          <nav class="navbar navbar-inverse ">
            <div class="container-fluid">
              <div class="navbar-header">
                <a class="navbar-brand" href="#">Analytics for Hospitals' Health-Care Data</a>
```

```
<a href="index.html">Home</a>
              <a href="dashboard.html">Dashboard</a>
              <a href="#">Report</a>
              <a href="story.html">Story</a>
            </div>
         </nav>
         <div class="container">
           <iframe
         src="https://us1.ca.analytics.ibm.com/bi/?pathRef=.my folders%2FReport%2FFinal%2BRepor
         t&closeWindowOnLastView=true&ui appbar=false&ui navbar=false&shareMode
         =embedded&action=edit"
            width="1500" height="1000" frameborder="0" gesture="media" allow="encrypted-media"
         allowfullscreen=""></iframe>
         </br>
         </div>
         </body>
         </html>
Story html
  <!DOCTYPE html>
<html lang="en">
 <title>Data Analytics</title>
 <meta charset="utf-8">
 <meta name="viewport" content="width=device-width, initial-scale=1">
 <link rel="stylesheet"</pre>
href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
 <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.6.0/jquery.min.js"></script>
 <script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></script>
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 <div class="container-fluid">
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   </div>
   <a href="index.html">Home</a>
     <a href="dashboard.html">Dashboard</a>
     <a href="report.html">Report</a>
     <a href="#">Story</a>
<div class="container">
src="https://us1.ca.analytics.ibm.com/bi/?perspective=story&pathRef=.my folders%2Fstory%2FNew%2
Bstory&closeWindowOnLastView=true&ui_appbar=false&ui_navbar=false&shareMode=embedde
```

d&action=view&sceneId=model00000184574031b2 00000002&sceneTime=0"

width="1500" height="1000" frameborder="0" gesture="media" allow="encrypted-media"

</div>

<head>

</head> <body>

</111> </div> </nav>

<iframe

```
allowfullscreen=""></iframe>
</div>
</body>
</html>
```

GitHub link

https://github.com/IBM-EPBL/IBM-Project-37826-1660327216

Project Demo Link

https://drive.google.com/file/d/11wUYJoOmiTY0mvlPpD0fHhfZEyR44t9A/view?usp=sharing