ANALYTICS FOR HOSPITALS' HEALTH CARE DATA

A PROJECT REPORT

Submitted by

SHOBIKA.C (950819106709)

INDHU ESAKKIAMMAL.S (950819106712)

SANDHIYA ESAKKIAMMAL.S (950819106713)

JEGATHA.K (950819106501)

In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

GOVERNMENT COLLEGE OF ENGINEERING,TIRUNELVELI

1.INTRODUCTION:-

Project Overview:

- Users create multiple analytical graphs/charts/Visualizations.
- Using the Analytical Visualizations, build the required Dashboard(s).
- Saving and visualizing the final dashboard in the IBM Cognos Analytics.

Purpose:

The goal 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. The length of stay is divided into 11 different classes ranging from 0-10 days to more than 100 days.

2.LITERATURE SURVEY:-

Existing Problem:

While healthcare management has various use cases for using data science, patient length of stay is one critical parameter to observe and predict if one wants to improve the efficiency of the healthcare management in a hospital.

Reference:

1. Dibya JyotiBora (2019) "Big Data Analytics in Health Care "

2. Guandong Xu (2019) "Big Data Analytics for Preventive Measure"

3. N.Maniadakis (2019) "Efficiency measurement of health care: a review of non-parametric method and application.

4. Robert Andrews (2022) "Process Data Analytics for Hospital case-mix planning"

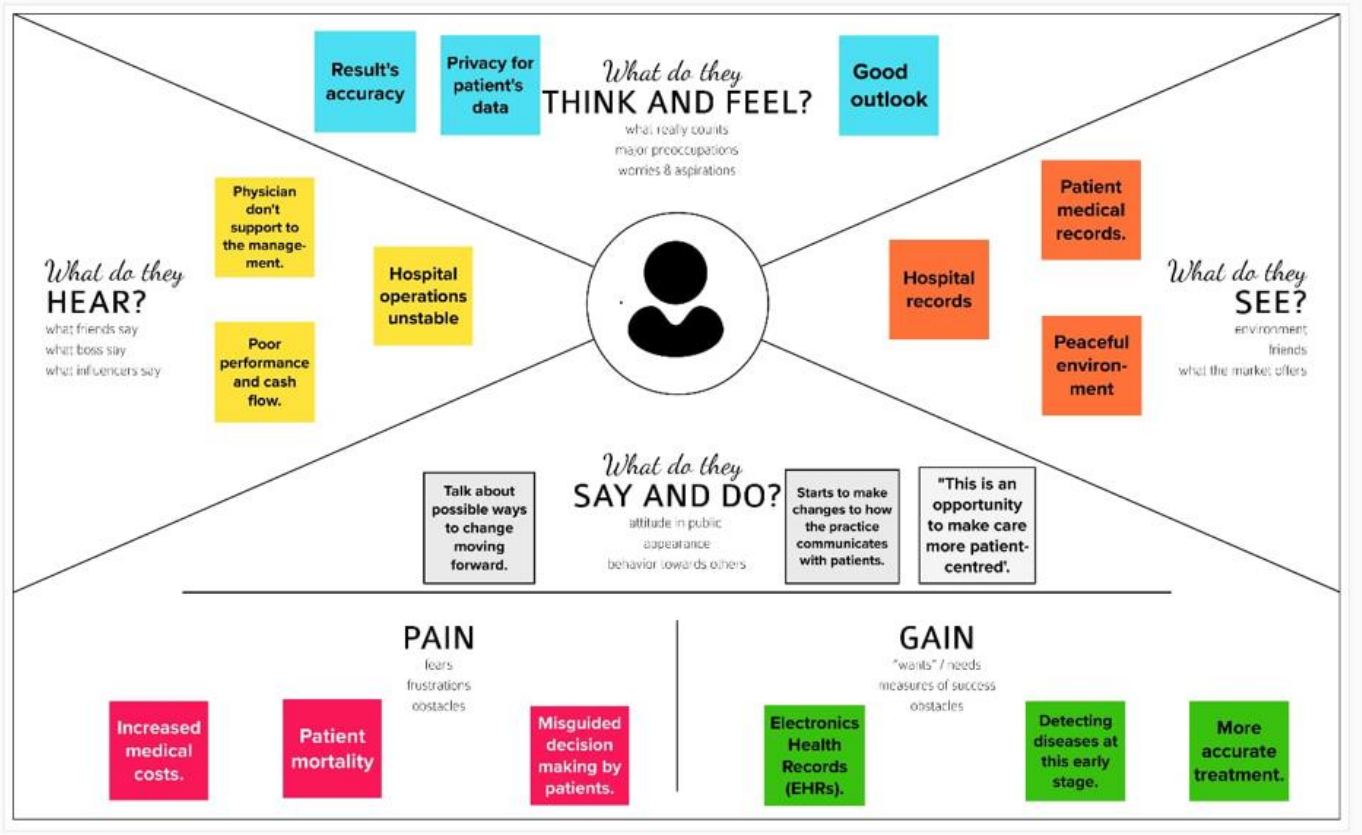
5. Yichuan Wang (2018) "Understanding its capabilities and potential benefits for Health Care organisations.

Problem Statement Definition:

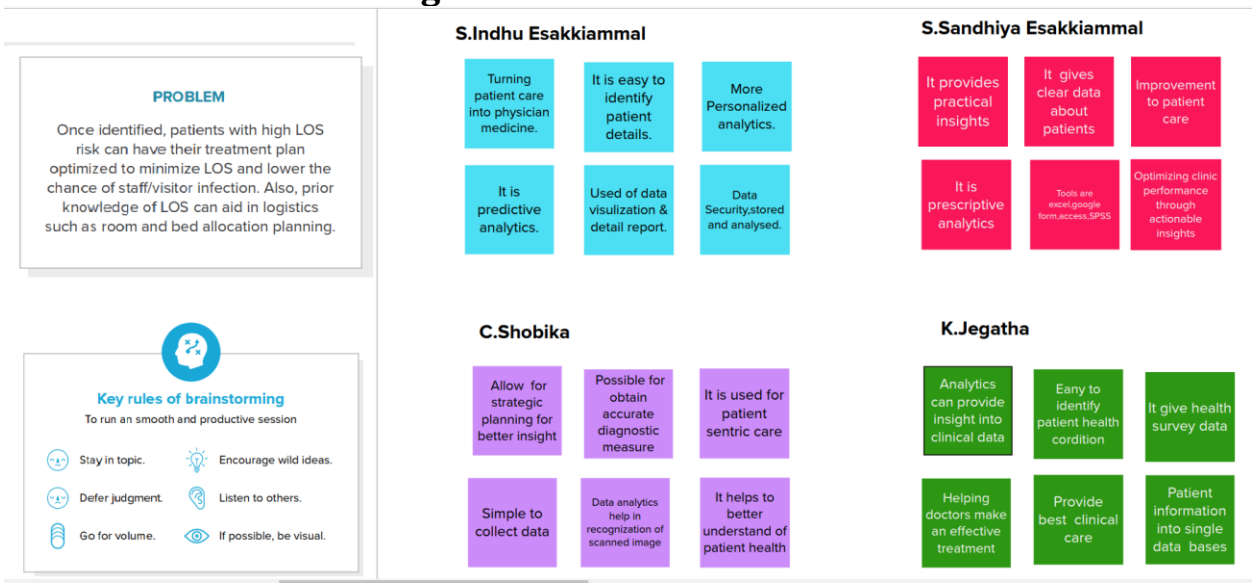
Health Care data desired to classify the patients using their patalogy data for their care management improve that facilitates to build and multiple classification model and Care Management Model (CMM) with write classification of patients.

3.IDEATION & PROPOSED SOLUTION:-

Empathy Map Canvas:



Ideation & Brainstorming:



Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	It is challenging for the people to collect their data, because Length of Stay(LOS) is increased during the Covid 19.
2.	Idea / Solution description	When it comes to collecting, sometimes manual calculation may lead to fluctuations. Such problems can be overcome by developing an application where users can add their data in the website.
3.	Novelty / Uniqueness	User can categories the patient according to their health issues and create a individual ID for patient.
4.	Social Impact / Customer Satisfaction	It will help the patient to track their data in fast manner by using their ID.
5.	Business Model (Revenue Model)	The details of the patient data the user can be create a report which will be easily recorded by the users.
6.	Scalability of the Solution	This application can able to withstand many number of user.

Problem Solution Fit:

4.REQUIREMENT ANALYSIS:

Functional Requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form
FR-2	User Confirmation	Confirmation via OTP
FR-3	Database	Every patient has some necessary data like phone number, their first and last name, personal health number, postal code, country, address, city, 'patient's ID number, etc
FR-4	Report Generation	The Hospital Management System generates a report on every patient regarding various information like patients name, Phone number, bed number, the doctor's name whom its assigns, ward name, and more. The Hospital Management system also helps in generating reports on the availability of the bed regarding information like bed numbers unoccupied or occupied, ward name, and more.
	Check Out	The staff in the administration section of the ward can delete the patient ID from the system when the patient checkout from the hospital. The Staff in the administration section of the ward can put the bed empty in the list of beds available.
	Adding Patients	The Hospital Management enables the staff at the front desk to include new patients in the system.

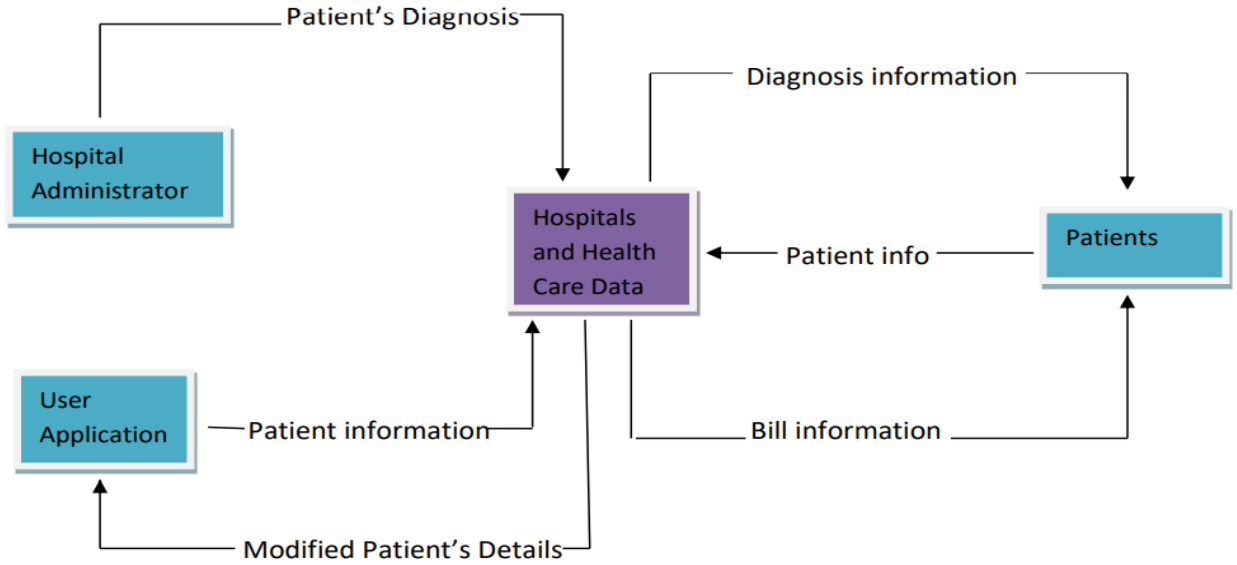
Non-Functional Requirement:

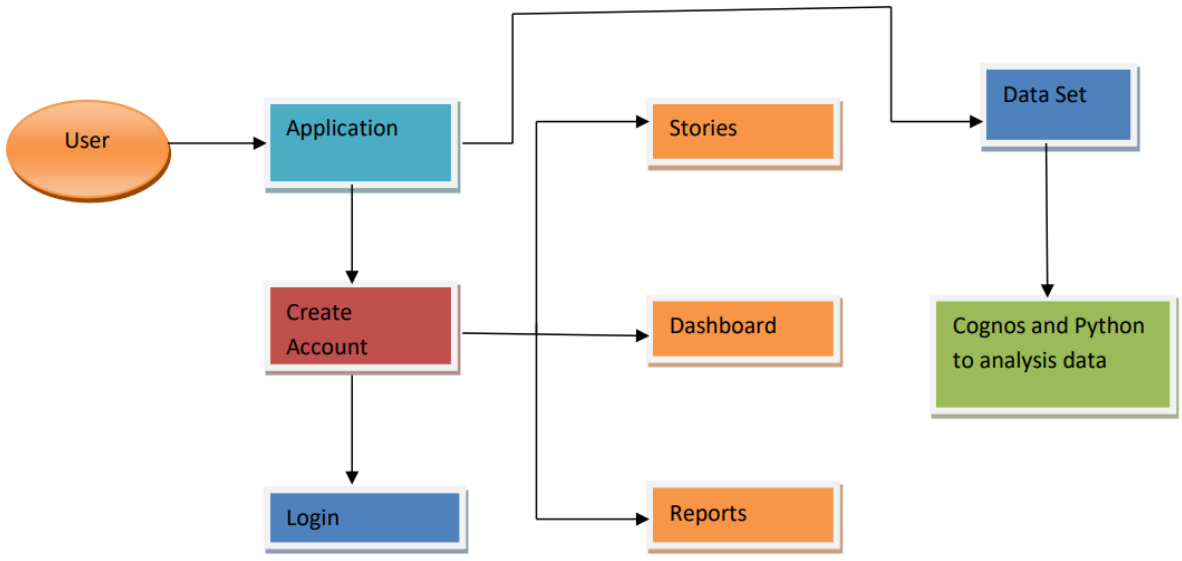
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The effectiveness, efficiency and satisfaction with which specific users can achieve a specific set of tasks in a particular environment.
NFR-2	**Security**	This process of protecting data from unauthorized access and data corruption throughout its lifecycle
NFR-3	**Reliability**	A highly reliable system has a lower risk of errors and process failures that can cause patients harm
NFR-4	**Performance**	performance measurements include: • Quality and efficiency of patient care • Cost of healthcare services • Disparities in performance • Care outcomes
NFR-5	**Availability**	inpatient, outpatient, pharmacy, and enrollment
NFR-6	**Scalability**	The ability of a health intervention shown to be efficacious on a small scale and/or under controlled conditions to be expanded under real world conditions to reach a greater proportion of the eligible population, while retaining effectiveness.

5.PROJECT DESIGN:

Data Flow Diagram:

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



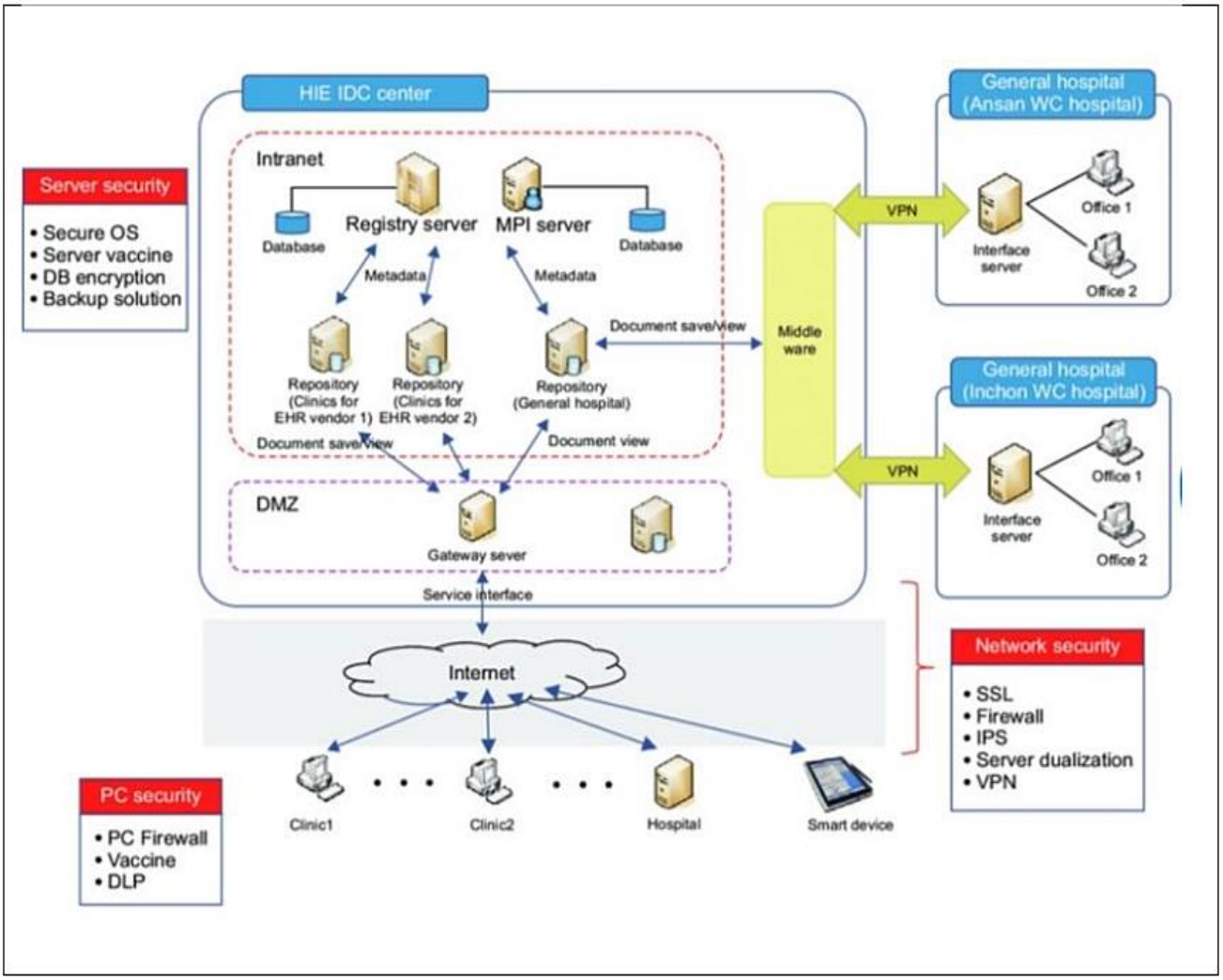


Solution & Techanical Architecture:

The Deliverable shall include the architecture diagram as below and the information as per the table 1 & table 2.

Example:

LOS of patients in Hospital



User Stories:

User Type	Functional Requirement (EPIC)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Customer(mobile User)	Registeration	USN-1	User can register for the application by entering my email and password.	User can access the platform and account.	High	Sprint-1
		USN-2	User will receive email if the registeration is successful.That the registeration has conformed.	I can receive confirmation email and click confirm.	High	Sprint-1
		USN-3	As a user,I can register by any browser.	I can access my resource,application by any browser.	Low	Sprint-2
	Data extract	USN-4	As a user,I can extract data.	I can access the data source.	Medium	Sprint-1
	Login	USN-5	As a User,I can log into the application by entering email and password.		High	Sprint-1
	Dashboard	USN-6	I can access the dashboard of mine		Medium	Sprint-2
Customer (Web user)	Activity	USN-7	I can register for the application through any web browser.	I can get an notification from the browser.	Low	Sprint-1
	Access resources	USN-8	I can use my credentials for accessing my resource.	Other than me, there is less chance to access my resources.	High	Sprint-1
	Set events	USN-9	As a user I can schedule events and set events		High	Sprint-2
Customer tools	Tools	USN-10	I can perform analysis by tools(cognos and python)	I have an ease of accessing tools	High	Sprint-1
Administrator		ADMIN-1	As an Administrator, I will manage backup and recovery, data modeling and design, distributed computing, database systems, and data security.	Administrator can evaluate, design, review and implementing a data and they are also responsible for updating and maintaining the data.	High	Sprint-2

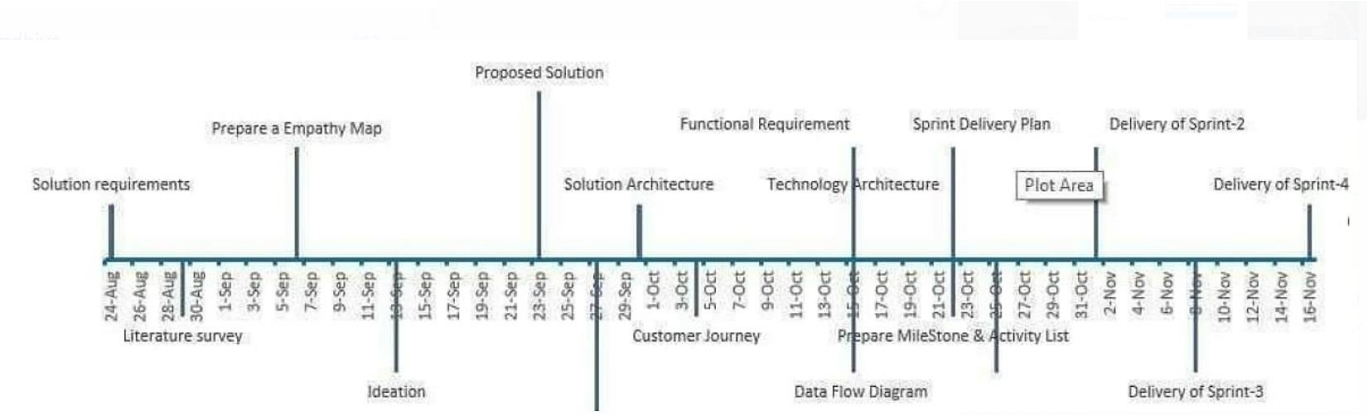
6.PROJECT PLANNING & SCHEDULING:

Sprint Planning & Estimation:

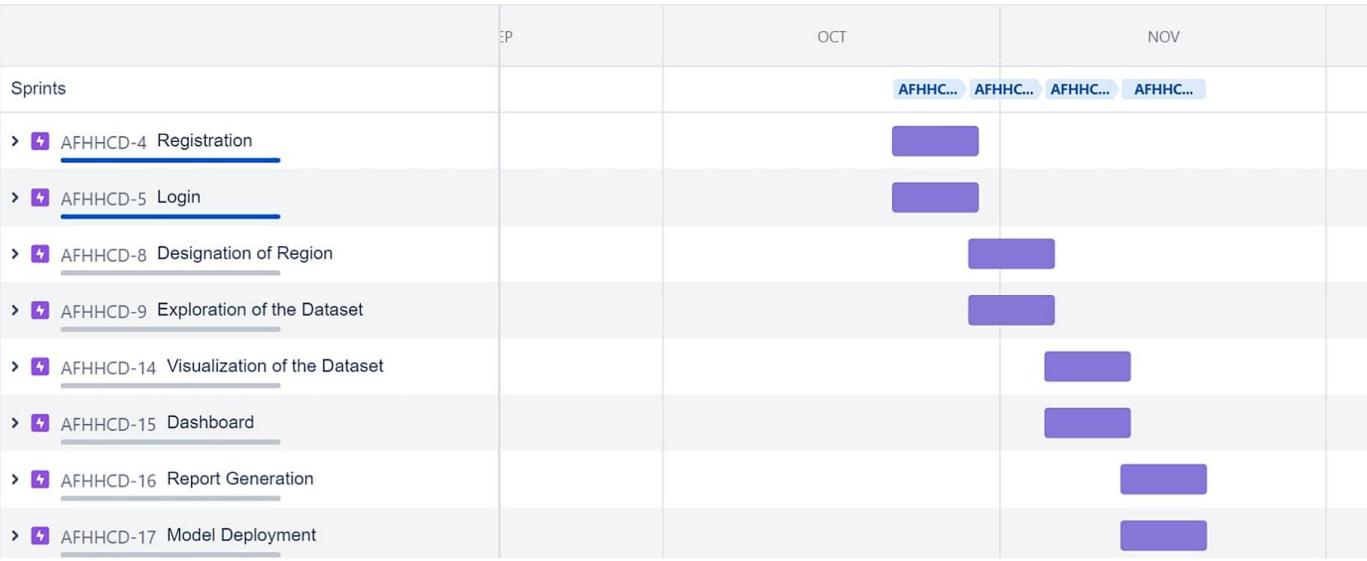
Sprint	Functional Requirement (Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	Indhu, Sandhiya,
Sprint-1		USN-2	As a User, I will receive confirmation email once I have registered for the application.	3	High	Indhu, Sandhiya, Jegatha
Sprint-1	Login	USN-3	As a User, I can log in into the application by entering email & Password.	2	Low	Shobika, Jegatha
Sprint-2	Designation of Region	USN-4	As a User, I can collect the data set and select the region.	3	High	Indhu, Sandhiya
Sprint-2	Exploration of the Dataset	USN-5	As a User, I will explore the dataset through cognos.	2	High	Indhu, Shobika
Sprint-3	Visualization of the Dataset	USN-6	As a User, I am visualized the dataset.	3	High	Sandhiya, Shobika
Sprint-3	Dashboard	USN-7	As a User, I can view my dashboard analysis.	1	Low	Indhu, Jegatha

Sprint	Functional Requirement (Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-4	Report Generation	USN-8	As a User, I can generate reports based on Patient's details.	3	Medium	Sandhiya, Indhu
Sprint-4	Model deployment	USN-9	As an administrator, I can maintain third party services.	3	High	Sandhiya, Indhu,

Sprint Delivery Schedule:



Report form jira:



7. WORKING WITH THE DATASET AND DATA VISUALIZATION:

Working with the Dataset:

- Understand Dataset
- Load the Dataset
- Explore the Data
- Visualize the Data.

Understanding The Dataset:

This project is based on understanding the Health Analytics dataset can be downloaded from Health

Download the Dataset

The data is spread across 3 data files (csv) and one data dictionary enclosed. The primary data file we use is test_data.csv consist of 17 Columns with 137057 Rows. The data dictionary is as follows:

Column	Description
case_id	Case_ID registered in Hospital
Hospital_code	Unique code for the Hospital
Hospital_type_code	Unique code for the type of Hospital
City_Code_Hospital	City Code of the Hospital
Hospital_region_code	Region Code of the Hospital
Available Extra Rooms in Hospital	Number of Extra rooms available in the Hospital
Department	Department overlooking the case
Ward_Type	Code for the Ward type
Ward_Facility_Code	Code for the Ward Facility
Bed Grade	Condition of Bed in the Ward
patientid	Unique Patient Id
City_Code_Patient	City Code for the patient
Type of Admission	Admission Type registered by the Hospital
Severity of Illness	Severity of the illness recorded at the time of admission
Visitors with Patient	Number of Visitors with the patient
Age	Age of the patient
Admission_Deposit	Deposit at the Admission Time
Stay	Stay Days by the patient

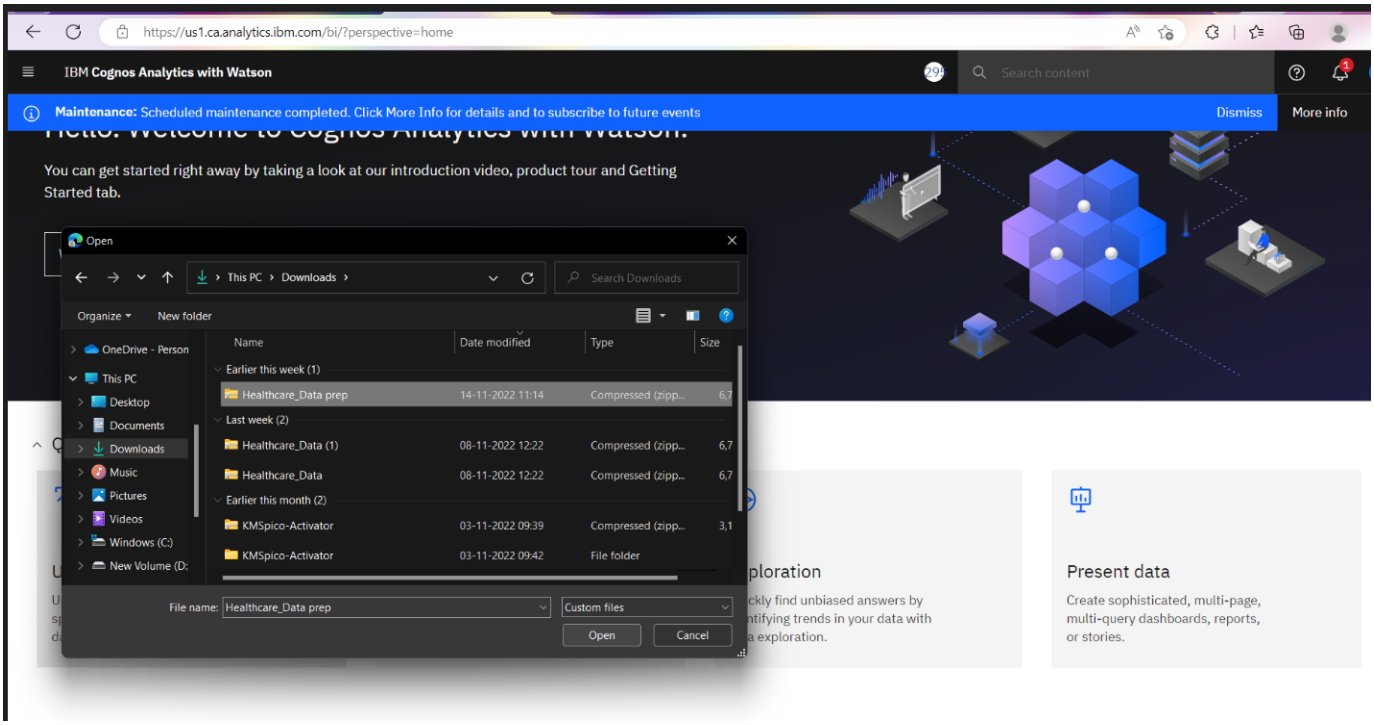
LOAD THE DATASET:-

Before you can build a view and analyze your data, you must first connect the data to IBM Cognos. Cognos supports connecting to a wide variety of data, stored in a variety of places.

The data might be stored on your computer in a spreadsheet or a text file, or in a big data, relational, or cube (multidimensional) database on a server in your enterprise.

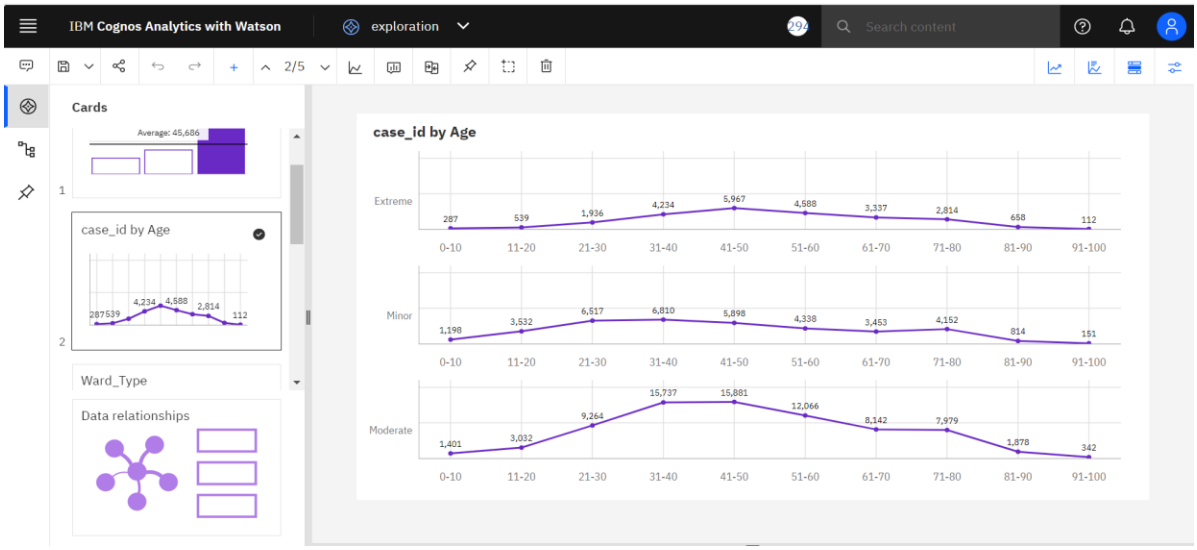
In our case, we will be using a spreadsheet or text file for making our analysis.

Load data from test_data.csv file which consist of 17 Columns with 137057 Rows.



EXPLORATION OF DATASET:-

- ☆ Explore from data directly or via an existing asset in a Dashboard or Story
- ☆ Leverage advanced analytics in an accessible way, opening the door for any user to surface compelling new insights
- ☆ Interact with contextual recommendations that guide users to greater understanding of their data
- ☆ Start exploring immediately with an intuitive, natural language tool that lowers the barriers to entry for the world of analytics.



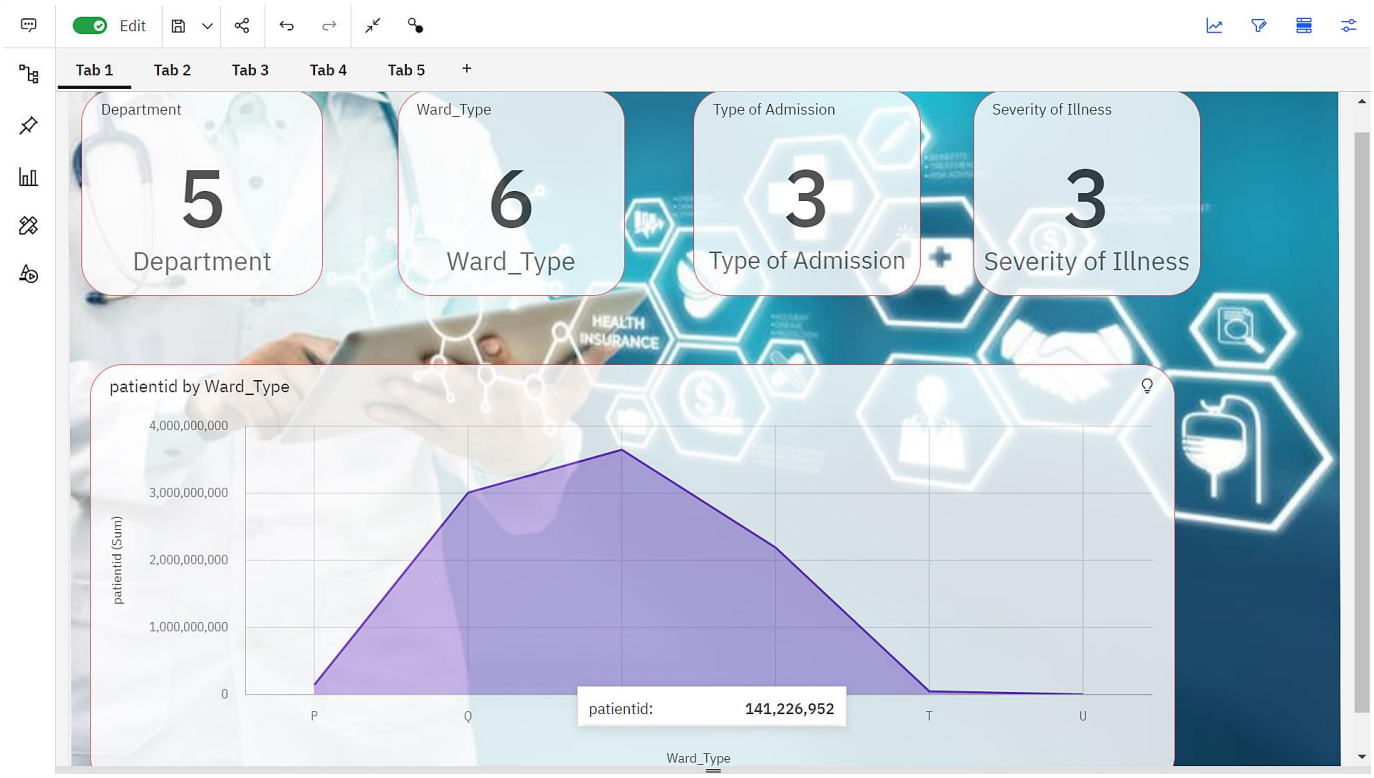
DATA VISUALIZATION:-

Using the given dataset, we plan to create various graphs and charts to highlight the insights and visualizations.

- Build the following visualizations
  - Length of Stay for each case of patients.
  - Stay by Patient ID using Column Chart
  - Severity of illness by Patient-Id using Tree Map
  - Age, Department Wise Patient using Table
  - Room Availability by Pie Chart
  - Dashboard Creation
  - Department wise no. of admissions by Waterfall Chart

NUMBER OF PATIENTS BY WARD TYPES:-

Number of patients by ward types



Dashboard To Show Number Of Patients:

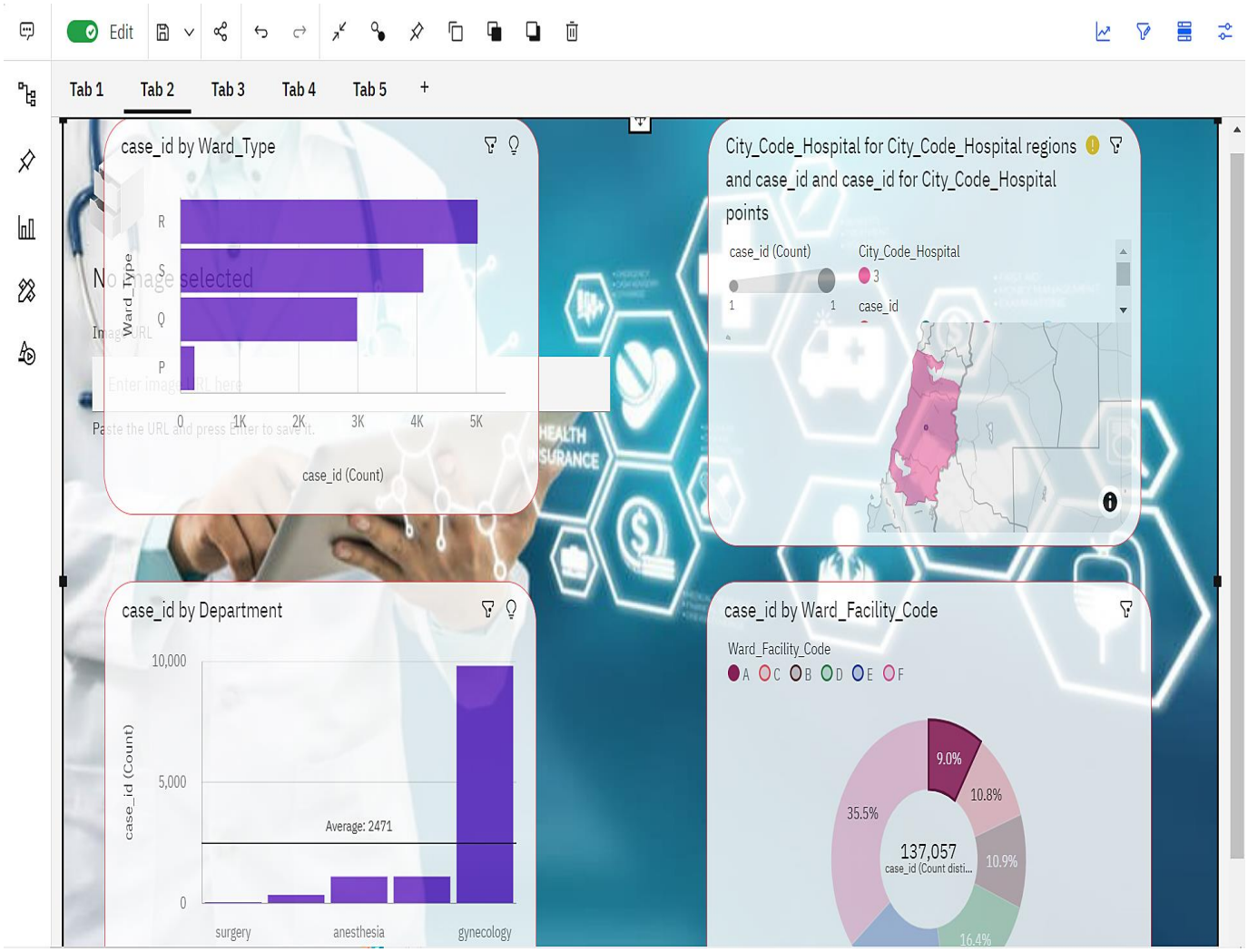
Build a dash board with the following visuals to present various analytics of Hospitals.

- a Bar Chart to show case number of Cases based on Ward Type

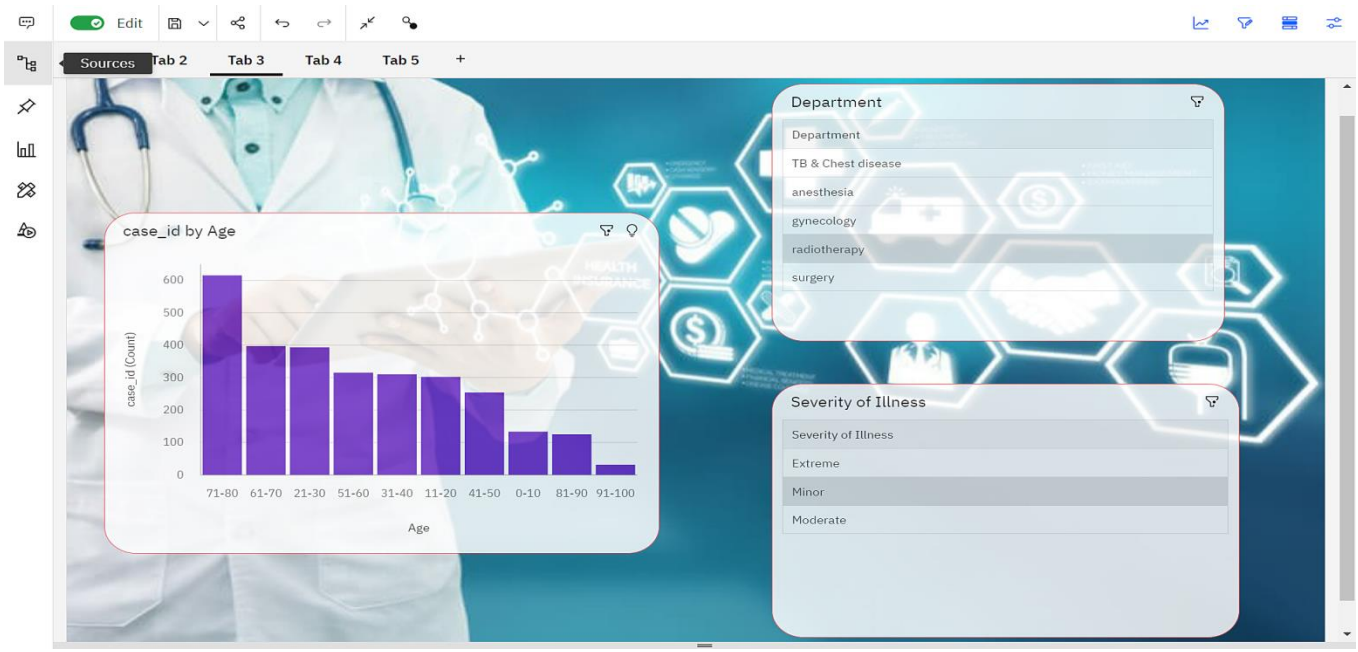
- a Geo Map to show case number of cases based on City, Hospital and Region

- a Column Chart to show case Number of Cases by each Department

- a Pie-Chart show case the Number of Cases by Ward Facility type.

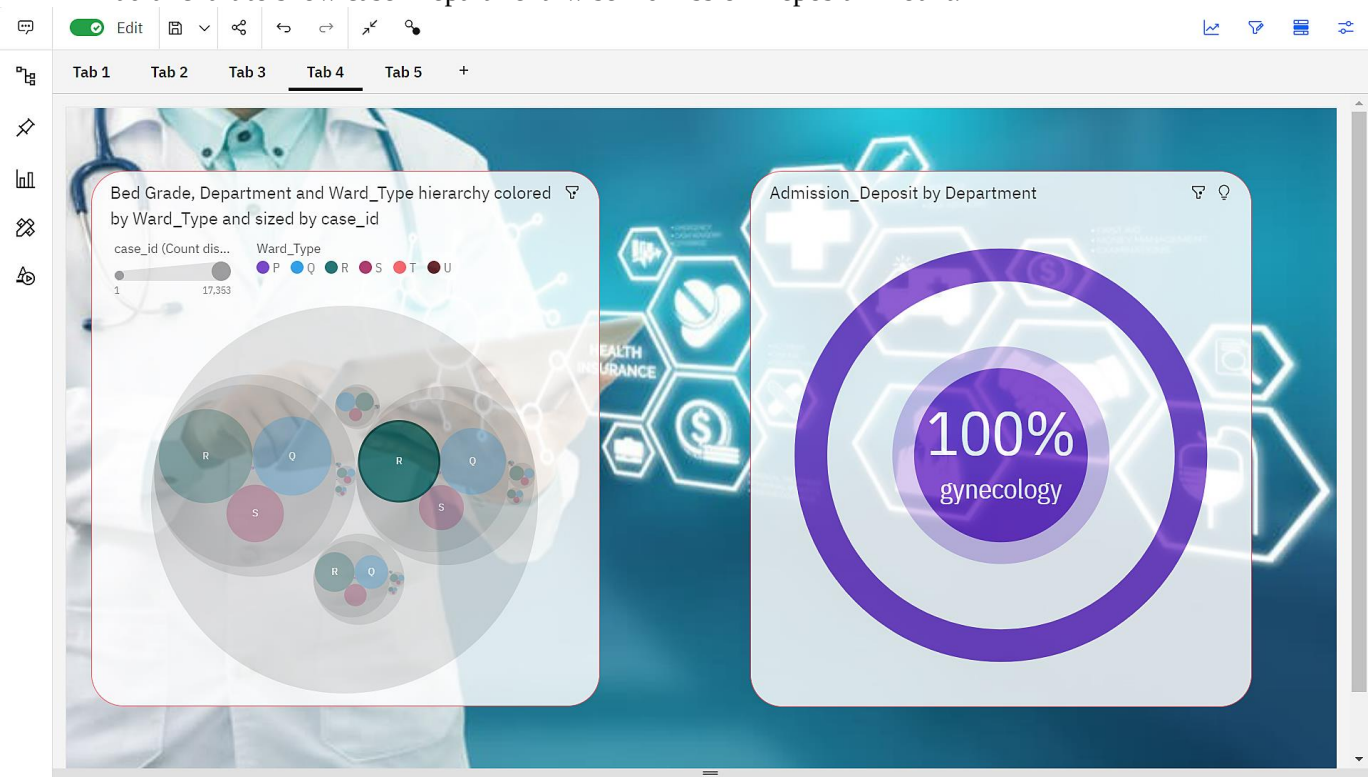


AGE WISE PATIENTS WITH DEPARTMENT AND SEVERITY FILTERS:



DATABOARD WITH HIERARCHY BUBBLE AND RADIAL VISUALS:

- Hierarchy Bubble to show case Bed Grade with Number of Cases by Department and Ward-wise.
- Radial chart to show case Department wise Admission Deposit Amount.



Dashboard Showing Pie, Stacked Bar, Waterfall And Pie Charts:

Build a Dashboard to show case the following analytical visuals.

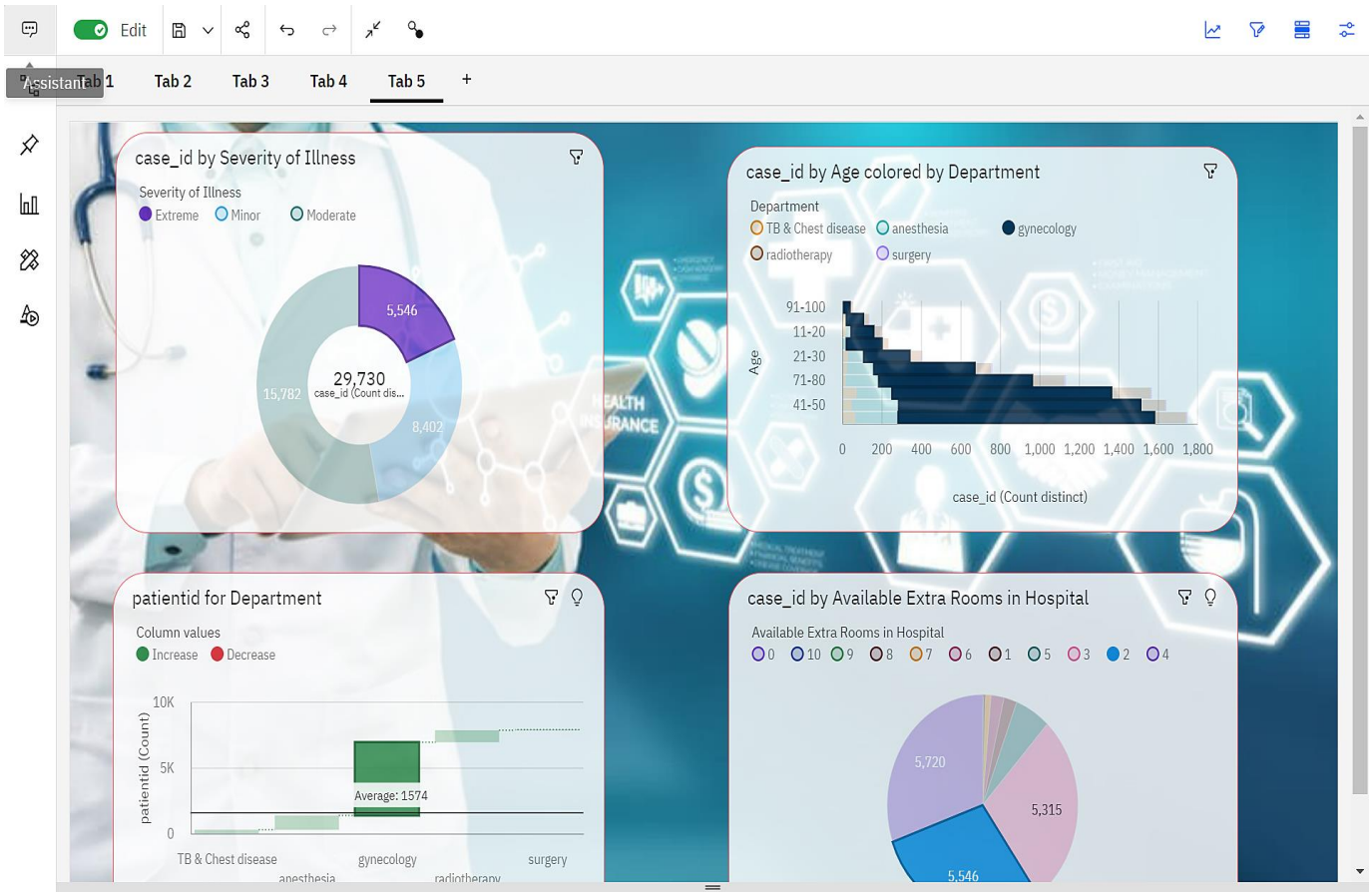
- a Pie-Chart showing Severity of illness by number of cases.

- a Stacked Bar Chart to visualize Department-wise, Age-wise number of cases

.

- a Waterfall chart visualizing the Department wise number of Patients.

- a Pie-Chart showing the Availability of Extra rooms with Analytics.



TESTING:

TEST CASES:

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Expected Result	Actual Result	Status
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Sign up popup when user clicked on My account button	1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	Login/Sign up popup should display	Working as expected	Pass
LoginPage_TC_OO2	UI	Dashboard page	Verify user is able to see Health Care report in dashboard page	1.Health care dashboard will be displayed. 2.Check if each tab can able to access. 3.Click on the required dataset. 4.Obtain the report.	Required visualization will be displayed on the dashboard	Working as expected	Pass

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	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

Test Case Analysis:

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

RESULTS:
PERFORMANCE MATRICES:

Model Performance Testing:

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

S.No.	Parameter	Screenshot / Values
1.	Dashboard design	No of Visulizations / Graphs - 18
2.	Data Responsiveness	It shows the output when any of the dataset is selected.
4.	Utilization of Data Filters	Various filter methods were used to filter the dataset values like sort,top or bottom,format data etc..,
5.	Effective User Story	No of Tap Added - 5
6.	Descriptive Reports	No of Visulizations / Graphs - 18

Advantages & Disadvantages:

Advantages:

- The Length of stay is an important indicator of the efficiency of hospital management.
- Reduction in the number of inpatients dates result in decreased risk of infection and medication side effects.
- A shorter stay will reduce the cost per discharge and shift care from inpatient to less expensive post acute settings.
- If you can get Length of stay to a prdictable place where patients are discharged precisely when they need to be and not a moment sooner or later, You can streamline your operation accordingly.

Disadvantages:

- The high cost of software develpment and deployment.

- One of the biggest cons is having to pay medical details for stranges.
- Understaffing of medicalstaff can lead to reduced quality of care.
- When implementing such a wellness plan, it is paramount to ensure the ratio of doctors to patients is manageable.

Conclusion:

Research on the duration of hospital stay is important because it helps hospitals to more effectively manage its resources and patients. Specifically, identifying factors which are associated with the LOS in order to accurately predict and manage the number of inpatient days, could be helpful in terms of managing hospital resources and may enable the development of a Clinical Pathway useful for inpatient treatment.

Based on the variables identified in this study, it may be necessary to improve the financial structure of hospitals and develop institutional approaches to reduce patient medical fees, by promoting the effective use of hospital resources and reducing the length of hospital stay via a system subject to continuous monitoring. Eliminating unnecessary hospital stays is a strategy to reduce overall national medical expenses.

Future Scope:

Analytics can assist doctors in establishing an accurate diagnosis or determining the likely results of treatments for people suffering from specific ailments. The Healthcare industry is probably one of the most promising ones when it comes to the future Scope of Data Analytics in India.

APPENDIX:

Source Code:

Source code for Login Page:

```
<!DOCTYPE
html>
                    <html lang="en">

                    <head>
                      <meta charset="UTF-8">
                      <meta name="viewport" content="width=device-width, initial-scale=1.0">
                      <title>Login Form</title>
                      <link rel="stylesheet" href="style.css">
                      <link rel="stylesheet" href="C:\Users\PC\OneDrive\Desktop\style.css" />
                    </head>

                    <body>
                      <div class="wrapper">
                        <header>Login Form</header>
                        <form action="https://papaya-peony-3833b7.netlify.app/">
                          <div class="field email">
                            <div class="input-area">
                              <input type="text" placeholder="Email Address">
                              <i class="icon fas fa-envelope"></i>
                              <i class="error error-icon fas fa-exclamation-circle"></i>
                            </div>
                            <div class="error error-txt">Email can't be blank</div>
                          </div>
                          <div class="field password">
                            <div class="input-area">
                              <input type="password" placeholder="Password">
                              <i class="icon fas fa-lock"></i>
                              <i class="error error-icon fas fa-exclamation-circle"></i>
                            </div>
                            <div class="error error-txt">Password can't be blank</div>
                          </div>
                          <div class="pass-txt"><a href="#">Forgot password?</a></div>
                          <input type="submit" value="Login">
                        </form>
                        <div class="sign-txt">Not yet member? <a href="#">Signup now</a></div>
                      </div>

                      <script src="script.js"></script>
```

```
</body>

</html>
```

Source code for Dashboard Page:

```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="utf-8">
  <meta content="width=device-width, initial-scale=1.0" name="viewport">

  <title>HEALTH CARE DASHBOARD</title>
  <meta content="" name="description">
  <meta content="" name="keywords">

  <!-- Favicons -->
  <link href="assets/img/favicon.png" rel="icon">
  <link href="assets/img/apple-touch-icon.png" rel="apple-touch-icon">

  <!-- Google Fonts -->
  <link
href="https://fonts.googleapis.com/css?family=Open+Sans:300,300i,400,400i,600,600i,700,700i|Montser
rat:300,400,500,700" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link href="assets/vendor/aos/aos.css" rel="stylesheet">
  <link href="assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
  <link href="assets/vendor/bootstrap-icons/bootstrap-icons.css" rel="stylesheet">
  <link href="assets/vendor/glightbox/css/glightbox.min.css" rel="stylesheet">
  <link href="assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">

  <!-- Template Main CSS File -->
  <link href="assets/css/style.css" rel="stylesheet">

  <!-- =======================================================
  * Template Name: NewBiz - v4.9.1
  * Template URL: https://bootstrapmade.com/newbiz-bootstrap-business-template/
  * Author: BootstrapMade.com
  * License: https://bootstrapmade.com/license/
  ======================================================== -->
</head>

<body>
```

```
<!-- ======= Header ======= -->
<header id="header" class="fixed-top d-flex align-items-center">
  <div class="container d-flex justify-content-between">

    <div class="logo">
      <!-- Uncomment below if you prefer to use an text logo -->
      <h1><a href="index.html">Analytics For Hospitals' Health Care Data</a></h1>

    </div>

    <nav id="navbar" class="navbar">
      <ul>
        <li><a class="nav-link scrollto active" href="#hero">Home</a></li>

        <li><a class="nav-link scrollto" href="#services">Dashboard</a></li>

        <li><a class="nav-link scrollto" href="#contact">Contact</a></li>
      </ul>
      <i class="bi bi-list mobile-nav-toggle"></i>
    </nav><!-- .navbar -->

  </div>
</header><!-- #header -->

<!-- ======= Hero Section ======= -->
<section id="hero" class="clearfix">
  <div class="container" data-aos="fade-up">

    <div class="hero-img" data-aos="zoom-out" data-aos-delay="200">
      <img src="assets/img/hero-img.svg" alt="" class="img-fluid">
    </div>

    <div class="hero-info" data-aos="zoom-in" data-aos-delay="100">
      <h2>Analytics<br><span>For Hospitals'</span><br>Health Care Data</h2>
      <div>
        <a href="#services" class="btn-services scrollto">View Dashboard</a>
      </div>
    </div>

  </div>
</section><!-- End Hero Section -->

  <main id="main">



    <!-- ======= Services Section ======= -->
    <section id="services" class="section-bg">
      <div class="container" data-aos="fade-up">
        <header class="section-header">
          <h3>HEALTH CARE DASHBOARD</h3>
```

```
        <iframe
src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRef=.my_folders%2FData%2
BModule%2FData%2Bvisualization&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;
ui_navbar=false&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView
=model00000183dc5a7e56_00000001" width="1300" height="1000" frameborder="0" gesture="media"
allow="encrypted-media" allowfullscreen=""></iframe>
        </iframe>
       </header>
      </div>
     </section><!-- End Services Section -->


    <!-- ======= Contact Section ======= -->
    <section id="contact">
     <div class="container-fluid" data-aos="fade-up">
      <div class="section-header">
       <h3>Contact Us</h3>
      </div>
      <div class="row">
       <div class="col-lg-6">
        <div class="row">
         <div class="col-md-5 info">
          <i class="bi bi-geo-alt"></i>
          <p>GCE TLY</p>
         </div>
         <div class="col-md-4 info">
          <i class="bi bi-envelope"></i>
          <p>https://github.com/indhu11082002</p>
         </div>
        </div>

      </div>

     </div>
    </section><!-- End Contact Section -->

  </main>
  <!-- End #main -->



  <a href="#" class="back-to-top d-flex align-items-center justify-content-center"><i class="bi bi-arrow-
up-short"></i></a>

  <!-- Vendor JS Files -->
  <script src="assets/vendor/purecounter/purecounter_vanilla.js"></script>
  <script src="assets/vendor/aos/aos.js"></script>
  <script src="assets/vendor/bootstrap/js/bootstrap.bundle.min.js"></script>
  <script src="assets/vendor/glightbox/js/glightbox.min.js"></script>
  <script src="assets/vendor/isotope-layout/isotope.pkgd.min.js"></script>
  <script src="assets/vendor/swiper/swiper-bundle.min.js"></script>
```

```
  <script src="assets/vendor/php-email-form/validate.js"></script>

  <!-- Template Main JS File -->
  <script src="assets/js/main.js"></script>

</body>

</html>
```

GITHUB & PROJECT DEMO LINK:

Github repository:

https://github.com/IBM-EPBL/IBM-Project-30945-1660193181

Project Demo Link:

https://youtu.be/1CNXd_WJSJA