Project Report

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# INTRODUCTION

## Project Overview:

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. 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.

## Purpose:

To build a system that helps hospital managements to understand about the hospital’s working and get a knowledge about the predicted length of stay of a patient which could help them in managing the resources in a better way and provide better treatment to the patients.

# LITERATURE SURVEY

## Existing Problem:

Clinical Pathways (CPs) have been created as a novel healthcare managing plan that contains all the steps in treating and following-up patients. CPs, as such, are capable of generating the big data needed to fuel IT and data science applications in healthcare. CPs aim to reduce variations, optimize the use of resources, and improve the quality of care. CPs also ensure patient safety because they contain agreed-on clinical practice guidelines and protocols.

Big data analytics tools play an essential role to analyze and integrate large volumes of structured, semi structured and unstructured vital data rapidly produced by the various clinical, hospitals, other social web sources and medical data lakes. However, there are several issues to be addressed in the current health data analytics platforms that offer technical mechanisms for data collection, aggregation, process, analysis, visualization, and interpretation. Due to lack of detailed study in the previous literature, this article inspects the promising field of big data analytics in healthcare. In this unique characteristics of big data, big data analytical tools, different phases followed by the healthcare economy from data collection to the data delivery stage are analysed.

In this a suite of data analytics is presented for T2D disease management that allows clinicians and researchers to identify associations between different patient biological markers and T2D related complications. The analytics suite consists of exploratory, predictive, and visual analytics with capabilities including multi-tier classification of T2D patient profiles that associate them to specific conditions, T2D related complication risk prediction, and prediction of patient response to a particular line of treatment. The analytics presented in this explore advanced data analysis techniques, which are potential tools for clinicians in decision-making that can contribute to better management of T2D.

An ontology-based approach of modeling clinical pathway workflows at the semantic level for facilitating computerized clinical pathway implementation and efficient delivery of high-quality healthcare services. A clinical pathway ontology (CPO) is formally defined in OWL web ontology language (OWL) to provide common semantic foundation for meaningful representation and exchange of pathway-related knowledge. A CPO-based semantic modeling method is then presented to describe clinical pathways as interconnected hierarchical models including the top-level outcome flow and intervention workflow level along a care timeline.

Diabetes is one of the most critical public health conditions worldwide. It has been shown that patients with diabetes are associated with a longer length of hospital stay (LOS) and increased associated healthcare cost. The uncertainty of diabetic patients’ LOS makes it difficult for hospitals to optimize their scheduling process.Hereapplies the stacked ensemble method, with deep learning as the meta-learning algorithm, to predict long vs. short LOS for diabetic patients. The obtained results show that stacked ensemble technique is promising in this field because stacking multiple classification learning algorithms resulted in a better predictive performance than that obtained from any of the constituent learning algorithms.

A knowledge-based variance management system that is developed using object-oriented analysis and design techniques, especially unified modeling language (UML), and implements effective analysis and handling of various variances through the construction and fuzzy reasoning of generalized fuzzy ECA (GFECA) rules and typed fuzzy Petri net extended by process knowledge (TFPN-PK) models related to the clinical pathway ontology and healthcare domain ontology. Abstract Variance management is important for computerized implementation of clinical pathways (CPs) to dynamically execute patient care processes and effectively provide high quality and efficient healthcare services. However, current related efforts are not adequate to support variance handling process involving two decision strategies, imprecise knowledge and the interaction with standardized CP workflow.

## References:

1. Ayman Alahmar and Rachid Benlamri“Optimizing Hospital Resources using Big Data Analytics with Standardized e-Clinical Pathways” in DOI 10.1109/DASC-PICom-CBDComCyberSciTech49142.2020.00112,IEEE 2020.
2. M. Ambigavathi and D. Sridharan”Big Data Analytics in Healthcare” IEEE,2018.
3. NADA Y.PHILIP and SUCHETHA. M “A Data Analytics Suite for Exploratory Predictive, and Visual Analysis of Type 2 Diabetes” in IEEE February 7, 2022.
4. Yan Ye, Zhibin Jianga, Xiaodi Diaoc, Dong Yanga and Gang Dua” An ontology-based hierarchical semantic modeling approach to clinical pathway workflows” 2009 Elsevier Ltd.
5. Ayman Alahmar, Emad A. Mohammed, Rachid Benlamri “Application of Data Mining Techniques to Predict the Length of Stay of Hospitalized Patients with Diabetes” in IEEE 2018.
6. Yan Ye, Zhibin Jiang and Gang Du”A Knowledge-Based Variance Management System for Supporting the Implementation of Clinical Pathways” in IEEE 2009.

## Problem Statement Definition:

To analyze the past health records of patients and find various hidden patterns and trends in it and use them to predict the length of stay of the patients using suitable machine learning algorithm.

Chart, treemap chart

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# IDEATION AND PROPOSED SOLUTION

## Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user’s behaviors and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user’s perspective along with his or her goals and challenges.

Diagram

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## Ideation and Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem-solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon. All participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions. Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Graphical user interface, application

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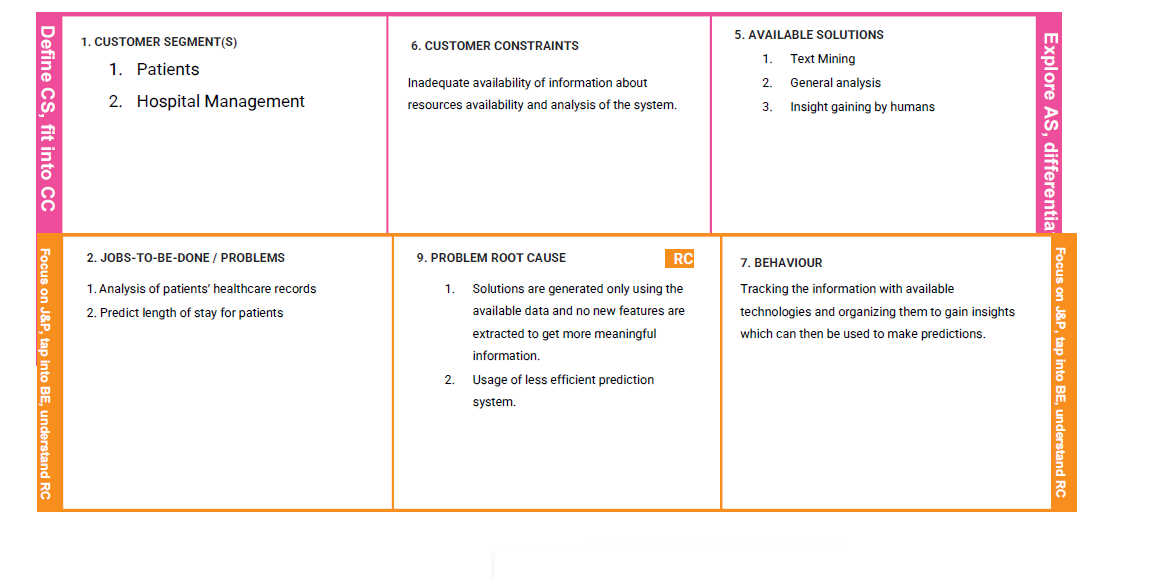
Table

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## Proposed Solution:

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
|  | Problem Statement (Problem to be solved) | 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. This parameter helps hospitals to identify patients of high LOS-risk at the time of admission. 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. |
|  | Idea / Solution description | Exploration of health care data helps in identifying the set of features that have high influence on determining the length of stay of the patients. Suitable methods are applied to make the data better for further processing. |
|  | Novelty / Uniqueness | Prediction of length of stay of the patients is done using decision tree classifier and parameters are fine tuned such that high accuracy is obtained. |
|  | Social Impact / Customer Satisfaction | * Patient gets an enhanced healthcare treatment based on the analysis report. * Hospitals can manage the available resources in a more efficient way. |
|  | Business Model (Revenue Model) | * Dashboard will be created to view trends in the patient admission at various locations. * Better decision can be made by hospitals. |
|  | Scalability of the Solution | This solution can be used by small hospitals to multi-speciality hospitals. The solution can be found with less memory requirement and computation cost. |

* 1. **Problem Solution Fit:**



1. **REQUIREMENT ANALYSIS**

## Functional Requirement:

|  |  |  |  |
| --- | --- | --- | --- |
| **Functional Requirements:** | |  |  |
|  |  |  | |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** | |
|  |  |  | |
| FR-1 | Collect data | Data is collected from various sources using different | |
|  |  | methods in order to provide optimized results. | |
| FR-2 | Data cleaning | Raw data is converted into data that is suitable | |
|  |  | for analysis. | |
| FR-3 | Data analysis | Data slicing and dicing is done to make data fit for further | |
|  |  | processing. Processed data is then analysed and the | |
|  |  | results are visualized. | |
| FR-4 | Building prediction model | A model is built to predict the length of stay of the | |
|  |  | patients using machine learning and AI algorithms. | |

**Non-functional Requirements:**

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

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
|  |  |  |
| NFR-1 | Usability | The system is used to analyse the healthcare data of |
|  |  | . the patients and find the length of stay to provide |
|  |  | resources. |
| NFR-2 | Security | The system provides utmost security and the patient |
|  |  | details are in a very secured environment under the |
|  |  | control of the administrator. |
| NFR-3 | Reliability | The dashboard of the system is highly reliable and |
|  |  | chances of data loss is low. |
| NFR-4 | Performance | The system is highly interactive and has very small |
|  |  | delay. The system is highly consistent. |
| NFR-5 | Availability | The system is available anytime and can be accessed |
|  |  | anywhere. |
| NFR-6 | Scalability | The application is set to handle an increase in |
|  |  | workload without performance degradation. |

# PROJECT DESIGN

## Data Flow Diagrams:

Diagram

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* 1. **Solution Architecture:**

**Diagram

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## Technological Architecture:

**Diagram

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**Table-1 : Components & Technologies:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Component** | **Description** | **Technology** |
|  | User Interface | How user interacts with application e.g.  Web UI, Mobile App, etc. | HTML, CSS, Java, PHP |
|  | Application Logic-1 | Logging in as a user or patient in the application. | Python |
|  | Application Logic-2 | Logging in as an admin in the application. | IBM Watson STT service |
|  | Database | All the data about the patient like disease, address,  Details and etc,. | MySQL |
|  | Cloud Database | Database Service on Cloud | IBM Cloud |
|  | File Storage | IBM Watson cloud is used for storage, Cloud | IBM Block Storage or Other Storage Service or Local Filesystem |
|  | Machine Learning Model | Machine Learning Models are used to predict the length of the stay of patient using available data | Logistic Regression, Decision Tree, SVM, |
|  | Uploading and Presentation | Using Exploration and Visualization | IBM Cognos Analytics |

**Table-2: Application Characteristics:**

| **S.No** | **Characteristics** | **Description** | **Technology** |
| --- | --- | --- | --- |
|  | Open-Source Frameworks | Numpy,Pandas,Scikit,Matplotlib. | Python, IBM Cloud |
|  | Security Implementations | security / access controls implemented, use of firewalls etc. | Authentication and Authorization |
|  | Scalable Architecture | 3-tier Architecture can be implemented so that the project can be worked by splitting up into 3 tiers namely presentation tier, application tier, data tier. | 3 tier |
|  | Availability | The application will be for 24/7. It can be used anywhere using smart devices. | HTML, CSS, Java and IBM Cloud |

**User Stories:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| User Type | Functional Requirement | User Story Number | User Story/Task | Acceptance criteria | Priority | Release |
| Customer | Registration | USN-1 | As a user, I can register myself by entering my details and data of my hospital | I can access my account’s dashboard | High | Sprint-1 |
|  | Login | USN-2 | As a user, I can login to the application by entering email and password | I can access my account’s dashboard along with the analysis report | High | Sprint-1 |
|  | Dashboard | USN-3 | As a user, I can use my account’s dashboard to upload my data | I can login to the account to upload the dataset | High | Sprint-2 |
| Administrator |  | USN-4 | As a user, I can contact my administrator for my queries | I can contact administrator for solving my queries | Medium | Sprint-2 |
| Exploration | Dashboard | USN-5 | As a user, I can view results obtained after data exploration | I can prepare data using the results obtained by exploration | High | Sprint-2 |
| Visualization | Dashboard | USN-6 | As a user, I can view presentations obtained from the exploration results | I can make inference from the presentation results | High | Sprint-3 |
| Prediction | Prediction model | USN-7 | As a user, I can view the prediction results | I can gain knowledge about what to expect in the future | High | Sprint-3 |

# PROJECT PLANNING AND SCHEDULING

## Sprint Planning and Estimation:

**Product Backlog, Sprint Schedule, and 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 myself by entering my details and data of my hospital | 2 | High | 4 |
| Sprint-1 | Login | USN-2 | As a user, I can login to the application by entering email and password | 1 | High | 4 |
| Sprint-2 | Dashboard | USN-3 | As a user, I can use my account’s dashboard to upload my data | 2 | Low | 4 |
| Sprint-2 | Dashboard | USN-4 | As a user, I can contact my administrator for my queries | 2 | Medium | 4 |
| Sprint-2 | Dashboard | USN-5 | As a user, I can view results obtained after data exploration | 2 | High | 4 |
| Sprint-3 | Dashboard | USN-6 | As a user, I can view presentations obtained from the exploration results | 3 | High | 4 |
| Sprint-3 | Prediction model | USN-7 | As a user, I can view the prediction results | 3 | High | 4 |

* 1. **Sprint Delivery Schedule**

| **Sprint** | **Total Story Points** | **Duration** | **Sprint Start Date** | **Sprint End Date (Planned)** | **Story Points Completed (as on Planned End Date)** | **Sprint Release Date (Actual)** |
| --- | --- | --- | --- | --- | --- | --- |
| Sprint-1 | 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 |

**Roadmap :**

****

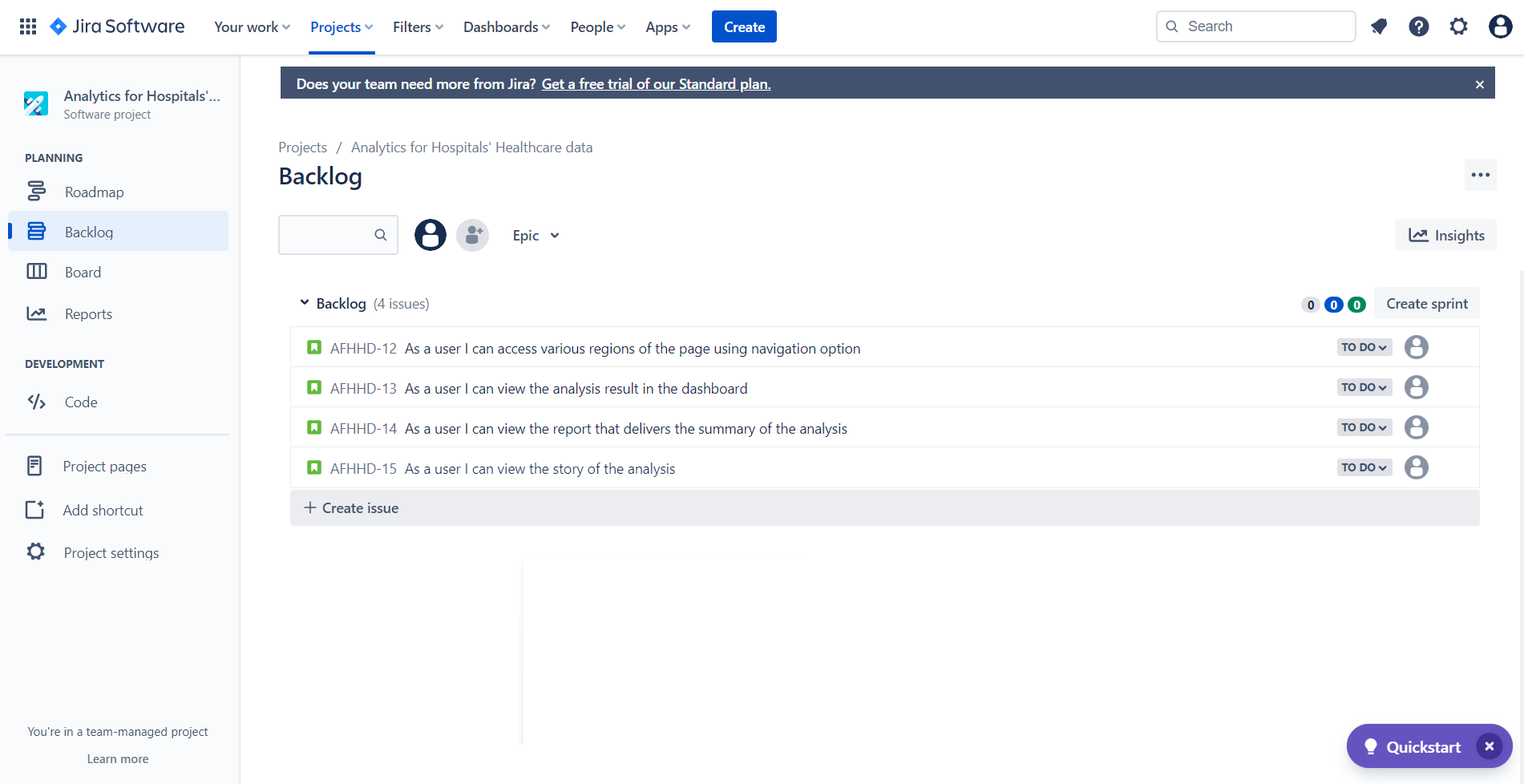
* 1. **Reports from JIRA:**

**Sprint 1 :**

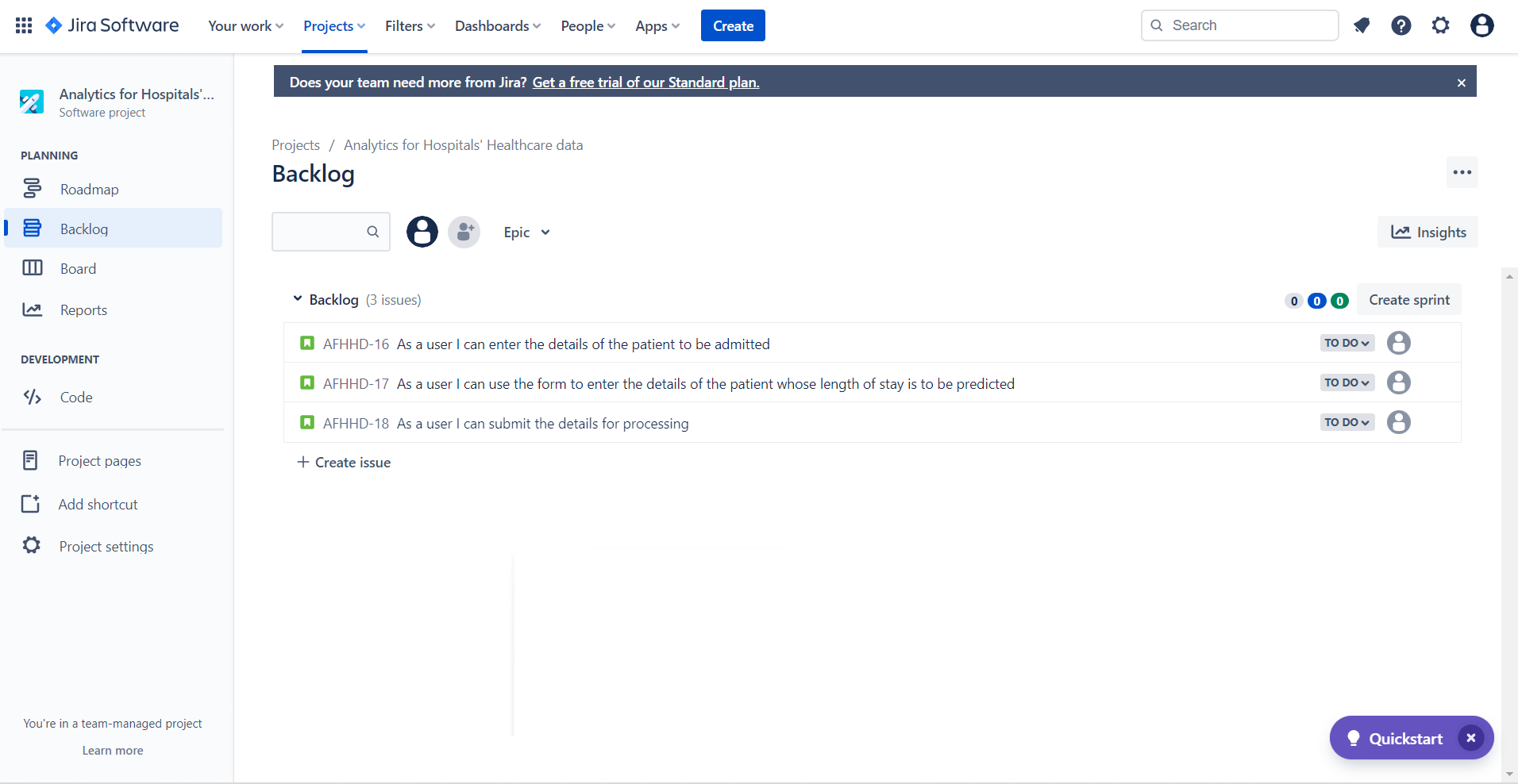
**Graphical user interface, text, application, email

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**Sprint 2 :**

****

**Sprint 3 :**

****

**Sprint 4 :**

**Graphical user interface, text, application, email

Description automatically generated**

# CODING & SOLUTIONING

## Feature 1

The hospital management can obtain the predicted length of stay of the patient to make arrangements to manage the resources effectively.

**Main page containing visualizations :**

<!-- ======= Header ======= -->

<header id="header" class="fixed-top">

<div class="container d-flex align-items-center">

<nav id="navbar" class="navbar order-last order-lg-0">

</div>

</header><!-- End Header -->

<!-- ======= Hero Section ======= -->

<section id="hero">

<div id="heroCarousel" data-bs-interval="5000" class="carousel slide carousel-fade" data-bs-ride="carousel">

<ol class="carousel-indicators" id="hero-carousel-indicators"></ol>

<div class="carousel-inner" role="listbox">

<div class="carousel-item active" style="position:relative;left:500px;font-size:larger;">

<div class="container">

<h1 style="position:relative;left:100px;">Welcome to LRNJ HealthCare</h1>

<p style="position:relative;left:10px;">We provide the best healthcare support and help you lead a healthy and happy life !</p><br/><br/>

<p style="position:relative;left:200px;font-size:x-large;">

<a class="nav-link scrollto " href="#hero">Home</a><br/>

<a class="nav-link scrollto" href="#dashboard">Dashboard</a><br/>

<a class="nav-link scrollto" href="#report">Report</a><br/>

<a class="nav-link scrollto" href="#story">Story</a><br/>

<a class="nav-link scrollto" href="#predict">Predict</a><br/>

</p>

</div>

</div>

</div>

</div>

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

<main id="main">

<!-- ======= Dashboard Section ======= -->

<section id="dashboard" class="dashboard">

<div class="container" data-aos="fade-up">

<div class="section-title">

<h2>Dashboard</h2>

</div>

<iframe style="width:100%;border:0;height:750px;" src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRef=.public\_folders%2FVisualizations%2FVisualizations%2B1&amp;closeWindowOnLastView=true&amp;ui\_appbar=false&amp;ui\_navbar=false&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView=model000001837fe87c93\_00000001" width="320" height="200" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

</div>

</section><!-- End Dashboard Section -->

<!-- ======= Report Section ======= -->

<section id="report" class="report">

<div class="container" data-aos="fade-up">

<div class="section-title">

<h2>Report</h2>

</div>

<iframe style="width:100%;border:0;height:750px;" src="https://us1.ca.analytics.ibm.com/bi/?pathRef=.my\_folders%2Fhealthcare%2Breport&amp;closeWindowOnLastView=true&amp;ui\_appbar=false&amp;ui\_navbar=false&amp;shareMode=embedded&amp;action=run&amp;format=HTML&amp;prompt=false" width="320" height="200" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

</div>

</section><!-- End Report Section -->

<!-- ======= Story Section ======= -->

<section id="story" class="story">

<div class="container" data-aos="fade-up">

<div class="section-title">

<h2>Story</h2>

</div>

<iframe style="width:100%;border:0;height:750px;" src="https://us1.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.public\_folders%2FVisualizations%2Fhealthcare%2Bstory&amp;closeWindowOnLastView=true&amp;ui\_appbar=false&amp;ui\_navbar=false&amp;shareMode=embedded&amp;action=view&amp;sceneId=model000001837fe87c93\_00000001&amp;sceneTime=0" width="320" height="200" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

</div>

</section><!-- End Story Section -->

<!-- ======= Predict Section ======= -->

<section id="predict" class="predict">

<div class="container" data-aos="fade-up">

<div class="predictform">

<h2>Predict</h2>

<form action="{{ url\_for('result') }}" method="POST" >

<label for="HospitalCode">Hospital Code : </label>

<input type="text" name="hospitalcode" id="hospitalcode" required><br/>

<label for="CityCodeHospital">City Code Hospital : </label>

<input type="text" name="citycodehospital" id="citycodehospital" required><br/>

<label for="ExtraRooms">Available Extra Rooms : </label>

<input type="text" name="extrarooms" id="extrarooms" required><br/>

<label for="HospitalTypeCode">Hospital Type Code : </label>

<input type="text" name="hospitaltypecode" id="hospitaltypecode" required><br/>

<label for="Department">Department : </label>

<input type="text" name="department" id="department" required><br/>

<label for="WardType">Ward Type : </label>

<input type="text" name="wardtype" id="wardtype" required><br/>

<label for="WardFacilityCode">Ward Facility Code : </label>

<input type="text" name="wardfacilitycode" id="wardfacilitycode" required><br/>

<label for="AdmissionType">Admission type : </label>

<input type="text" name="admissiontype" id="admissiontype" required><br/>

<label for="SeverityOfIllness">Severity of Illness : </label>

<input type="text" name="severityofillness" id="severityofillness" required><br/>

<label for="Age">Age : </label>

<input type="text" name="age" id="age" required><br/>

<input type="submit" value="Predict" name="predict"/>

</form>

</div>

</div>

<p style="position:relative;left:300px;color:red;font-size:larger">Predicted length of stay of patient : {{result}}</p>

</section>

</body>

## Prediction:

Prediction of length of stay of a patient is done using the patient and hospital details based on previous records of length of stay using decision tree model.

def result():

temp=[]

columns=['Hospital\_code','City\_Code\_Hospital','Available Extra Rooms in Hospital','Hospital\_type\_code','Department','Ward\_Type','Ward\_Facility\_Code','Type of Admission','Severity of Illness','Age']

hospitaltypecode\_dict={'a':0,'b':1,'c':2,'d':3,'e':4,'f':5,'g':6}

department\_dict={"TB & Chest disease":0,"anesthesia":1,"gynecology":2,"radiotherapy":3,"surgery":4}

wardtype\_dict={'p':0,'q':1,'r':2,'s':3,'t':4,'u':5}

wardfacilitycode\_dict={'a':0,'b':1,'c':2,'d':3,'e':4,'f':5}

admissiontype\_dict={"emergency":0,"trauma":1,"urgent":2}

severityofillness\_dict={"extreme":0,"minor":1,"moderate":2}

age\_dict={"0-10":0,"11-20":9,"21-30":1,"31-40":2,"41-50":3,"51-60":4,"61-70":5,"71-80":6,"81-90":7,"91-100":8}

temp.append(int(request.form['hospitalcode']))

temp.append(int(request.form['citycodehospital']))

temp.append(int(request.form['extrarooms']))

temp.append(hospitaltypecode\_dict[request.form['hospitaltypecode']])

temp.append(department\_dict[request.form['department']])

temp.append(wardtype\_dict[request.form['wardtype']])

temp.append(wardfacilitycode\_dict[request.form['wardfacilitycode']])

temp.append(admissiontype\_dict[request.form['admissiontype']])

temp.append(severityofillness\_dict[request.form['severityofillness']])

temp.append(age\_dict[request.form['age']])

print(temp)

df=pd.DataFrame(columns=columns)

df=pd.concat((df,pd.DataFrame(data=[temp],columns=columns)))

data=pd.read\_csv("D:/LANAARD 7/ACADEMICS/SEM 7/NAALAYA THIRAN/Dataset/train/train.csv")

arr=['Hospital\_type\_code','Hospital\_region\_code','Department','Ward\_Type','Ward\_Facility\_Code','Type of Admission','Severity of Illness','Age','Stay']

le = LabelEncoder()

for ele in arr:

label = le.fit\_transform(data[ele])

data.drop(ele, axis=1, inplace=True)

data[ele]=label

data.drop('Bed Grade',axis=1,inplace=True)

data.drop('City\_Code\_Patient',axis=1,inplace=True)

features=['Hospital\_code','City\_Code\_Hospital','Available Extra Rooms in Hospital','Hospital\_type\_code','Department','Ward\_Type','Ward\_Facility\_Code','Type of Admission','Severity of Illness','Age','Stay']

X\_train, X\_test, y\_train, y\_test = train\_test\_split(data[features[:-1]], data['Stay'], test\_size=0.1, random\_state=42)

dtree = DecisionTreeClassifier()

dtree = dtree.fit(X\_train, y\_train)

result=dtree.predict(df)

print("result : ",result)

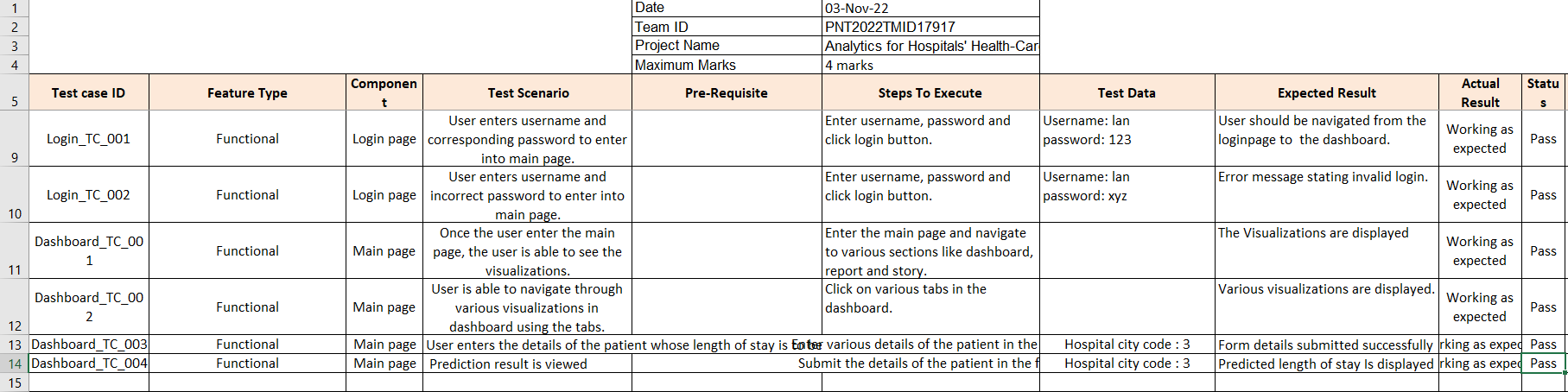
result\_dict={0:"0-10 days",1:"10-20 days",2:"20-30 days",3:"30-40 days",4:"40-50 days",5:"50-60 days",6:"60-70 days",7:"70-80 days",8:"80-90 days",9:"90-100 days",10:"more than 100 days"}

result=result\_dict[result[0]]

return render\_template("index.html",result=result)

# TESTING

## Test Cases:



* 1. **User Acceptance Testing:**

# Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of analysing the healthcare reports of a hospital through data analysis project at the time of the release to User Acceptance Testing (UAT).

# Defect Analysis

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Resolution** | **Severity 1** | **Severity 2** | **Severity 3** | **Severity 4** | **Subtotal** |
| By Design | 7 | 5 | 3 | 2 | 17 |
| Duplicate | 1 | 0 | 2 | 0 | 3 |
| External | 3 | 2 | 0 | 1 | 6 |
| Fixed | 11 | 3 | 5 | 15 | 34 |
| Not Reproduced | 0 | 0 | 0 | 1 | 1 |
| Skipped | 0 | 1 | 0 | 1 | 2 |
| Won't Fix | 0 | 3 | 5 | 1 | 9 |
| Totals | 22 | 14 | 15 | 21 | 72 |

# 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 | 40 | 0 | 0 | 40 |
| Security | 2 | 0 | 0 | 2 |
| Outsource Shipping | 3 | 0 | 0 | 3 |
| Exception Reporting | 9 | 0 | 0 | 9 |
| Final Report Output | 3 | 0 | 0 | 3 |
| Version Control | 1 | 0 | 0 | 1 |

# RESULTS

* 1. **Performance Metrics:**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Screenshot / Values** |
| 1. | Dashboard design | 1. Login Page      1. Main Page |

|  |  |  |
| --- | --- | --- |
| 2. | Data Responsiveness | 1.Sample Visualizations  Dashboard : |

|  |  |  |
| --- | --- | --- |
|  |  |  |

|  |  |  |
| --- | --- | --- |
|  |  |  |

|  |  |  |
| --- | --- | --- |
|  |  |  |

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| --- | --- | --- |
|  |  |  |
| 3. | Report generation | Report is generated to view various trends and hidden patters in the data and comparing them to gain insights. |

|  |  |  |
| --- | --- | --- |
| 5. | Effective User Story | No of Scene Added - 9 |
| 6. | Prediction | A form is created for the user to enter the details of a new patient whose length of stay is to be predicted.  Graphical user interface  Description automatically generated    The predicted result is displayed below the form after prediction using the trained decision tree model.  Graphical user interface, application  Description automatically generated |

# ADVANTAGES & DISADVANTAGES

## ADVANTAGES:

This application enables the hospital management to view the relationship between various patient attributes and the hospital’s facilities. It helps them get an idea about the estimated length of stay of a patient newly admitted in the hospital, which in turn could be used to manage the hospital resources in a better way to provide better healthcare and also make a judicious use of the resources.

## DISADVANTAGES:

Usage of this application requires knowledge about the field of medical science.

# CONCLUSION

Healthcare sector plays a vital role in the life of every human and thus requires utmost care and attention to make it effective and efficient. In order to achieve this various measures are taken worldwide which is constantly improving the healthcare sector. Contributing to this, the developed application helps the hospital management to get a better understanding of the hospital’s operation, their patient details and relationship between them. This in turn helps in the process of better decision making for solving future problems.

# FUTURE SCOPE

The application is designed in such a way that it provides opportunities for making enhancements in the future by adding features like medicine prescription, online consultations, medicine ordering, etc.

# APPENDIX

## SOURCE CODE:

## app.py

# import math

# #import matplotlib.pyplot as plt

# import numpy as np

# import pandas as pd

# from flask import Flask, render\_template,request

# from sklearn import tree

# from sklearn.metrics import (accuracy\_score, classification\_report,

# confusion\_matrix)

# from sklearn.model\_selection import train\_test\_split

# from sklearn.preprocessing import LabelEncoder

# from sklearn.tree import DecisionTreeClassifier

# app=Flask(\_\_name\_\_)

# @app.route("/")

# def home():

# return render\_template("login.html")

# @app.route("/index",methods=["POST","GET"])

# def index():

# return render\_template("index.html")

# @app.route("/result",methods=["POST","GET"])

# def result():

# temp=[]

# columns=['Hospital\_code','City\_Code\_Hospital','Available Extra Rooms in Hospital','Hospital\_type\_code','Department','Ward\_Type','Ward\_Facility\_Code','Type of Admission','Severity of Illness','Age']

# hospitaltypecode\_dict={'a':0,'b':1,'c':2,'d':3,'e':4,'f':5,'g':6}

# department\_dict={"TB & Chest disease":0,"anesthesia":1,"gynecology":2,"radiotherapy":3,"surgery":4}

# wardtype\_dict={'p':0,'q':1,'r':2,'s':3,'t':4,'u':5}

# wardfacilitycode\_dict={'a':0,'b':1,'c':2,'d':3,'e':4,'f':5}

# admissiontype\_dict={"emergency":0,"trauma":1,"urgent":2}

# severityofillness\_dict={"extreme":0,"minor":1,"moderate":2}

# age\_dict={"0-10":0,"11-20":9,"21-30":1,"31-40":2,"41-50":3,"51-60":4,"61-70":5,"71-80":6,"81-90":7,"91-100":8}

# temp.append(int(request.form['hospitalcode']))

# temp.append(int(request.form['citycodehospital']))

# temp.append(int(request.form['extrarooms']))

# temp.append(hospitaltypecode\_dict[request.form['hospitaltypecode']])

# temp.append(department\_dict[request.form['department']])

# temp.append(wardtype\_dict[request.form['wardtype']])

# temp.append(wardfacilitycode\_dict[request.form['wardfacilitycode']])

# temp.append(admissiontype\_dict[request.form['admissiontype']])

# temp.append(severityofillness\_dict[request.form['severityofillness']])

# temp.append(age\_dict[request.form['age']])

# print(temp)

# df=pd.DataFrame(columns=columns)

# df=pd.concat((df,pd.DataFrame(data=[temp],columns=columns)))

# data=pd.read\_csv("D:/LANAARD 7/ACADEMICS/SEM 7/NAALAYA THIRAN/Dataset/train/train.csv")

# arr=['Hospital\_type\_code','Hospital\_region\_code','Department','Ward\_Type','Ward\_Facility\_Code','Type of Admission','Severity of Illness','Age','Stay']

# le = LabelEncoder()

# for ele in arr:

# label = le.fit\_transform(data[ele])

# data.drop(ele, axis=1, inplace=True)

# data[ele]=label

# data.drop('Bed Grade',axis=1,inplace=True)

# data.drop('City\_Code\_Patient',axis=1,inplace=True)

# features=['Hospital\_code','City\_Code\_Hospital','Available Extra Rooms in Hospital','Hospital\_type\_code','Department','Ward\_Type','Ward\_Facility\_Code','Type of Admission','Severity of Illness','Age','Stay']

# X\_train, X\_test, y\_train, y\_test = train\_test\_split(data[features[:-1]], data['Stay'], test\_size=0.1, random\_state=42)

# dtree = DecisionTreeClassifier()

# dtree = dtree.fit(X\_train, y\_train)

# result=dtree.predict(df)

# print("result : ",result)

# result\_dict={0:"0-10 days",1:"10-20 days",2:"20-30 days",3:"30-40 days",4:"40-50 days",5:"50-60 days",6:"60-70 days",7:"70-80 days",8:"80-90 days",9:"90-100 days",10:"more than 100 days"}

# result=result\_dict[result[0]]

# return render\_template("index.html",result=result)

# @app.route("/login",methods=["POST","GET"])

# def login():

# return render\_template("login.html")

# if \_\_name\_\_=='\_\_main\_\_':

# from waitress import serve

# serve(app, host="0.0.0.0", port=8080)

# index.html

# <!DOCTYPE html>

# <html lang="en">

# <head>

# <style type="text/css">

# body{

# background-color: turquoise;

# }

# .predictform{

# font-family: 'Open Sans Condensed', arial, sans;

# width: 500px;

# padding: 30px;

# background: #FFFFFF;

# margin: 50px auto;

# box-shadow: 0px 0px 15px rgba(0, 0, 0, 0.22);

# -moz-box-shadow: 0px 0px 15px rgba(0, 0, 0, 0.22);

# -webkit-box-shadow: 0px 0px 15px rgba(0, 0, 0, 0.22);

# }

# .predictform h2{

# background: #4D4D4D;

# text-transform: uppercase;

# font-family: 'Open Sans Condensed', sans-serif;

# color: #797979;

# font-size: 18px;

# font-weight: 100;

# padding: 20px;

# margin: -30px -30px 30px -30px;

# }

# .predictform input[type="text"],

# .predictform input[type="date"],

# .predictform input[type="datetime"],

# .predictform input[type="email"],

# .predictform input[type="number"],

# .predictform input[type="search"],

# .predictform input[type="time"],

# .predictform input[type="url"],

# .predictform input[type="password"],

# .predictform textarea,

# .predict select

# {

# box-sizing: border-box;

# -webkit-box-sizing: border-box;

# -moz-box-sizing: border-box;

# outline: none;

# display: block;

# width: 100%;

# padding: 7px;

# border: none;

# border-bottom: 1px solid #ddd;

# background: transparent;

# margin-bottom: 10px;

# font: 16px Arial, Helvetica, sans-serif;

# height: 45px;

# }

# .predictform textarea{

# resize:none;

# overflow: hidden;

# }

# .predictform input[type="button"],

# .predictform input[type="submit"]{

# -moz-box-shadow: inset 0px 1px 0px 0px #45D6D6;

# -webkit-box-shadow: inset 0px 1px 0px 0px #45D6D6;

# box-shadow: inset 0px 1px 0px 0px #45D6D6;

# background-color: #2CBBBB;

# border: 1px solid #27A0A0;

# display: inline-block;

# cursor: pointer;

# color: #FFFFFF;

# font-family: 'Open Sans Condensed', sans-serif;

# font-size: 14px;

# padding: 8px 18px;

# text-decoration: none;

# text-transform: uppercase;

# }

# .predictform input[type="button"]:hover,

# .predictform input[type="submit"]:hover {

# background:linear-gradient(to bottom, #34CACA 5%, #30C9C9 100%);

# background-color:#34CACA;

# }

# </style>

# <meta charset="utf-8">

# <meta content="width=device-width, initial-scale=1.0" name="viewport">

# <title>Hospital Healthcare Management System</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|Roboto:300,300i,400,400i,500,500i,600,600i,700,700i|Poppins:300,300i,400,400i,500,500i,600,600i,700,700i" rel="stylesheet">

# <!-- Vendor CSS Files -->

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/fontawesome-free/css/all.min.css" rel="stylesheet">

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/animate.css/animate.min.css" rel="stylesheet">

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/aos/aos.css" rel="stylesheet">

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/bootstrap-icons/bootstrap-icons.css" rel="stylesheet">

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/boxicons/css/boxicons.min.css" rel="stylesheet">

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/glightbox/css/glightbox.min.css" rel="stylesheet">

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">

# <!-- Template Main CSS File -->

# <link href="file:///C:/Users/LANAARD/OneDrive/Desktop/healthcareApp/templates/assets/css/style.css" rel="stylesheet">

# <script src="https://ajax.googleapis.com/ajax/libs/jquery/1.12.3/jquery.min.js"></script>

# <!-- =======================================================

# \* Template Name: Medicio - v4.9.1

# \* Template URL: https://bootstrapmade.com/medicio-free-bootstrap-theme/

# \* Author: BootstrapMade.com

# \* License: https://bootstrapmade.com/license/

# ======================================================== -->

# </head>

# <body>

# <!-- ======= Header ======= -->

# <header id="header" class="fixed-top">

# <div class="container d-flex align-items-center">

# <nav id="navbar" class="navbar order-last order-lg-0">

# </div>

# </header><!-- End Header -->

# <!-- ======= Hero Section ======= -->

# <section id="hero">

# <div id="heroCarousel" data-bs-interval="5000" class="carousel slide carousel-fade" data-bs-ride="carousel">

# <ol class="carousel-indicators" id="hero-carousel-indicators"></ol>

# <div class="carousel-inner" role="listbox">

# <div class="carousel-item active" style="position:relative;left:500px;font-size:larger;">

# <div class="container">

# <h1 style="position:relative;left:100px;">Welcome to LRNJ HealthCare</h1>

# <p style="position:relative;left:10px;">We provide the best healthcare support and help you lead a healthy and happy life !</p><br/><br/>

# <p style="position:relative;left:200px;font-size:x-large;">

# <a class="nav-link scrollto " href="#hero">Home</a><br/>

# <a class="nav-link scrollto" href="#dashboard">Dashboard</a><br/>

# <a class="nav-link scrollto" href="#report">Report</a><br/>

# <a class="nav-link scrollto" href="#story">Story</a><br/>

# <a class="nav-link scrollto" href="#predict">Predict</a><br/>

# </p>

# </div>

# </div>

# </div>

# </div>

# </section><!-- End Hero -->

# <main id="main">

# <!-- ======= Dashboard Section ======= -->

# <section id="dashboard" class="dashboard">

# <div class="container" data-aos="fade-up">

# <div class="section-title">

# <h2>Dashboard</h2>

# </div>

# <iframe style="width:100%;border:0;height:750px;" src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRef=.public\_folders%2FVisualizations%2FVisualizations%2B1&amp;closeWindowOnLastView=true&amp;ui\_appbar=false&amp;ui\_navbar=false&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView=model000001837fe87c93\_00000001" width="320" height="200" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

# </div>

# </section><!-- End Dashboard Section -->

# <!-- ======= Report Section ======= -->

# <section id="report" class="report">

# <div class="container" data-aos="fade-up">

# <div class="section-title">

# <h2>Report</h2>

# </div>

# <iframe style="width:100%;border:0;height:750px;" src="https://us1.ca.analytics.ibm.com/bi/?pathRef=.my\_folders%2Fhealthcare%2Breport&amp;closeWindowOnLastView=true&amp;ui\_appbar=false&amp;ui\_navbar=false&amp;shareMode=embedded&amp;action=run&amp;format=HTML&amp;prompt=false" width="320" height="200" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

# </div>

# </section><!-- End Report Section -->

# <!-- ======= Story Section ======= -->

# <section id="story" class="story">

# <div class="container" data-aos="fade-up">

# <div class="section-title">

# <h2>Story</h2>

# </div>

# <iframe style="width:100%;border:0;height:750px;" src="https://us1.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.public\_folders%2FVisualizations%2Fhealthcare%2Bstory&amp;closeWindowOnLastView=true&amp;ui\_appbar=false&amp;ui\_navbar=false&amp;shareMode=embedded&amp;action=view&amp;sceneId=model000001837fe87c93\_00000001&amp;sceneTime=0" width="320" height="200" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

# </div>

# </section><!-- End Story Section -->

# <!-- ======= Predict Section ======= -->

# <section id="predict" class="predict">

# <div class="container" data-aos="fade-up">

# <div class="predictform">

# <h2>Predict</h2>

# <form action="{{ url\_for('result') }}" method="POST" >

# <label for="HospitalCode">Hospital Code : </label>

# <input type="text" name="hospitalcode" id="hospitalcode" required><br/>

# <label for="CityCodeHospital">City Code Hospital : </label>

# <input type="text" name="citycodehospital" id="citycodehospital" required><br/>

# <label for="ExtraRooms">Available Extra Rooms : </label>

# <input type="text" name="extrarooms" id="extrarooms" required><br/>

# <label for="HospitalTypeCode">Hospital Type Code : </label>

# <input type="text" name="hospitaltypecode" id="hospitaltypecode" required><br/>

# <label for="Department">Department : </label>

# <input type="text" name="department" id="department" required><br/>

# <label for="WardType">Ward Type : </label>

# <input type="text" name="wardtype" id="wardtype" required><br/>

# <label for="WardFacilityCode">Ward Facility Code : </label>

# <input type="text" name="wardfacilitycode" id="wardfacilitycode" required><br/>

# <label for="AdmissionType">Admission type : </label>

# <input type="text" name="admissiontype" id="admissiontype" required><br/>

# <label for="SeverityOfIllness">Severity of Illness : </label>

# <input type="text" name="severityofillness" id="severityofillness" required><br/>

# <label for="Age">Age : </label>

# <input type="text" name="age" id="age" required><br/>

# <input type="submit" value="Predict" name="predict"/>

# </form>

# </div>

# </div>

# <p style="position:relative;left:300px;color:red;font-size:larger">Predicted length of stay of patient : {{result}}</p>

# </section>

# </body>

# </html>

# login.html

# <!DOCTYPE html>

# <html lang="en">

# <head>

# <link href='http://fonts.googleapis.com/css?family=Open+Sans+Condensed:300' rel='stylesheet' type='text/css'>

# <meta charset="UTF-8">

# <title>Login</title>

# <link rel="stylesheet" type="text/css" href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css">

# <style>

# body{

# background-color: turquoise;

# }

# .login{

# position:relative;top:200px;left:50%;

# }

# .login input[type="text"],

# .login input[type="password"],

# {

# box-sizing: border-box;

# -webkit-box-sizing: border-box;

# -moz-box-sizing: border-box;

# outline: none;

# display: block;

# width: 100%;

# padding: 7px;

# border: none;

# border-bottom: 1px solid #ddd;

# background: transparent;

# margin-bottom: 10px;

# font: 16px Arial, Helvetica, sans-serif;

# height: 45px;

# }

# .login input[type="button"]{

# -moz-box-shadow: inset 0px 1px 0px 0px #45D6D6;

# -webkit-box-shadow: inset 0px 1px 0px 0px #45D6D6;

# box-shadow: inset 0px 1px 0px 0px #45D6D6;

# background-color: #2CBBBB;

# border: 1px solid #27A0A0;

# display: inline-block;

# cursor: pointer;

# color: #FFFFFF;

# font-family: 'Open Sans Condensed', sans-serif;

# font-size: 14px;

# padding: 8px 18px;

# text-decoration: none;

# text-transform: uppercase;

# }

# .login input[type="button"]:hover{

# background:linear-gradient(to bottom, #34CACA 5%, #30C9C9 100%);

# background-color:#34CACA;

# }

# </style>

# </head>

# <body>

# <div class="container">

# <div class="row">

# <div class="col-lg-10">

# <div class="page-header">

# </div>

# <form id="login-form">

# <script type="text/javascript">

# var loginCheck=function(){

# const loginForm = document.getElementById("login-form");

# const loginButton = document.getElementById("login-form-submit");

# const loginErrorMsg = document.getElementById("login-error-msg");

# const username = loginForm.username.value;

# const password = loginForm.password.value;

# if (username === "lan" && password === "123") {

# alert("Successful Login !");

# window.open("/index");

# } else {

# alert("Login unsuccessful !");

# console.log("login error");

# }

# }

# </script>

# <div class="login">

# <h2>Login</h2><br/><br/>

# <form>

# <label>Username </label>

# <input type="text" name="username" id="username-field" class="login-form-field" placeholder="Username"><br/><br/>

# <label>Password </label>

# <input type="password" name="password" id="password-field" class="login-form-field" placeholder="Password"><br/><br/>

# <button type="button" value="Login" id="login-form-submit" onclick="loginCheck()">Login</button>

# </form>

# </div>

# </form>

# </div>

# </div>

# </div>

# </body>

# </html>

# result.html

<html>

<head>

<title>Prediction Output</title>

<style>

p{

position:relative;

left:300px;

top:400px;

}

</style>

</head>

<body>

<p>Predicted Length of Stay of Patient : {{result}}</p>

</body>

</html>

## GITHUB AND PROJECT DEMO LINK:

**Github Link:**

https://github.com/[IBM-EPBL/IBM-Project-2536-1658473856](https://github.com/IBM-EPBL/IBM-Project-2536-1658473856)

**Project Demo**

https://drive.google.com/file/d/1suTBs7HbBE4FVIWPmanI2Ixt6f-IM3gQ/view?usp=share\_link