

# **Airlines Data Analytics for Aviation Industry**

**Team ID:** PNT2022TMID18548

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# **1. INTRODUCTION:**

## **1.1 Project Overview:**

Passenger airlines, cargo airlines, and air traffic control systems are the main elements of any transportation system in the modern world. Nations all around the world have attempted to develop a variety of methods over time to enhance the aviation transportation system. The way airlines operate has drastically changed as a result. Modern travellers occasionally experience difficulty from flight delays. Around 20% of airline flights are cancelled or delayed annually, costing customers more than \$20 billion in lost time and money.

## **1.2 Purpose:**

Airport capacity is sometimes described as being determined by the average aircraft delay. One of the most common problems in the globe is flight delays. The delay's cause is quite difficult to articulate. Infrequent causes of aircraft delays include runway maintenance and heavy traffic, although inclement weather appears to be a typical culprit. Some flights have reactionary delays as a result of the prior flight's tardy arrival. Because businesses rely on consumer loyalty to maintain their frequent flying programmes, it hurts airports, airlines, and has an impact on their marketing tactics.

## **2. Literature Survey:**

### **1. Towards a maturity model for big data analytics in airline network planning (Iris Hausladen, Maximilian Schosser -2020)**

- In this study, Iris Hausladen, Maximilian Schosser address this challenge by developing a maturity model for big data readiness for airline network planning.
- The transfer steps have been combined with the model evaluation. In the second stage, the maturity levels are conceptualized and formulated, before the complete model is evaluated by the practitioner group.

### **2. Life Data Analytics with Application for the Airline Industry (Julio Pulido, NortekDana Moore, William Hill -2020)**

- In this study, Julio Pulido, NortekDana Moore, William Hill proposed the analysis of non-repairable systems.
- The three techniques, namely the time to failure, stress-strength or condition-based approach, is generally adopted.
- The mixed Weibull distribution (also known as a multimodal Weibull) is used to model data that do not fall on a straight line on a Weibull probability plot.

### **3. Exploratory Data Analysis on Aviation Dataset**

#### **(Saba Firdous, Haseeba Fathiya, Lipsa Sadath -2021)**

- In this work, Saba Firdous, Haseeba Fathiya, Lipsa Sadath performed Aviation informational collection and performed analytics.
- The first step was to organize all the events into categories depending on their risk level.
- The next step was to use an SVM to learn the relationships between the events.
- The third step was to combine the results from both models to improve the accuracy of the predictions made

#### **4. Applying Machine Learning to Aviation Big Data for Flight Delay Prediction (Yushan Jiang, Yushan Jiang -2020)**

- In this study, Yushan Jiang, and Yushan Jiang developed several machine learning models to predict flight arrival delays.
- Firstly data pre-processing is needed including data merging and cleansing.
- Next, data visualization can be performed to extract and visualise the graphic representation of data clearly and efficiently.

#### **5. Transportation Research Part E IN Aviation (Xu et al- 2020)**

- In this work, Xu et al proposed a hybrid model to forecast statistical indicators in the aviation industry, which employs the seasonal autoregressive integrated moving average (SARIMA) and support vector regression (SVR) methods
- SARIMA is employed to analyze the raw time series. Gaussian White Noise is then used for calculation according to the SARIMA's results.

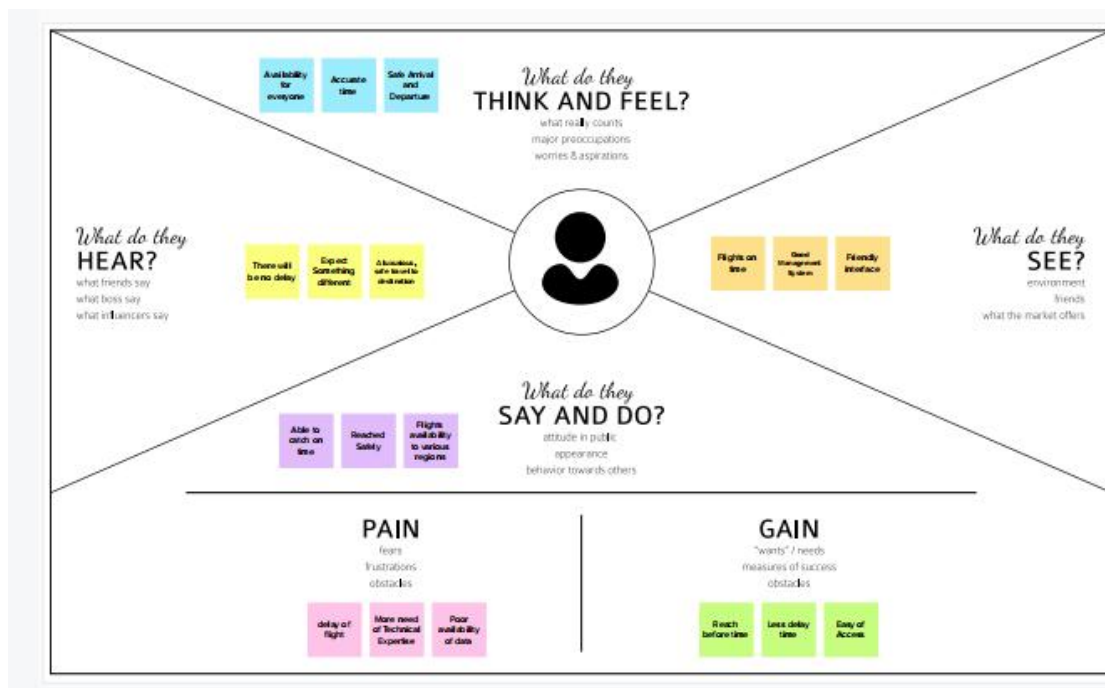
## **2.2 References:**

1. Iris Hausladen, Maximilian Schosser “ **Towards a maturity model for big data analytics in airline network planning**”, ELSEVIER-Journal of Air Transport Management, Volume 82,(2020).
2. Julio Pulido, NortekDana Moore, William Hill “**Life Data Analysis with Applications for the Airline Industry**”, IEEE XPLOREPublished in 2016 Annual Reliability and Maintainability Symposium (RAMS)
3. Saba Firdous, Haseeba Fathiya, Lipsa Sadath “ **Exploratory Data Analysis on Aviation Dataset** ”, IEEE XPLORE, Conferences-2021
4. Yushan Jiang, Yushan Jiang “**Applying Machine Learning to Aviation Big Data for Flight Delay Prediction**” IEEE XPLORE, Conferences -2021
- 5.Xu et al “**Transportation Research Part E IN AVIATION**”, SCIENCE DIRECT-Journals and books, Volume 167,(2022)

### 3.IDEATION AND PROPOSED SOLUTION:

#### 3.1. Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours 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.



#### 3.2. Brainstroming and Ideation:

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, and 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.

#### Avudai Nandhu

No two airline  
should not have  
same arrival and  
departure time

#### Nitin Singh

Monitoring  
airlines  
schedule  
frequently

If collision in  
time occurs,  
reschedule  
the timing of  
airlines

#### Mohana Rudhran

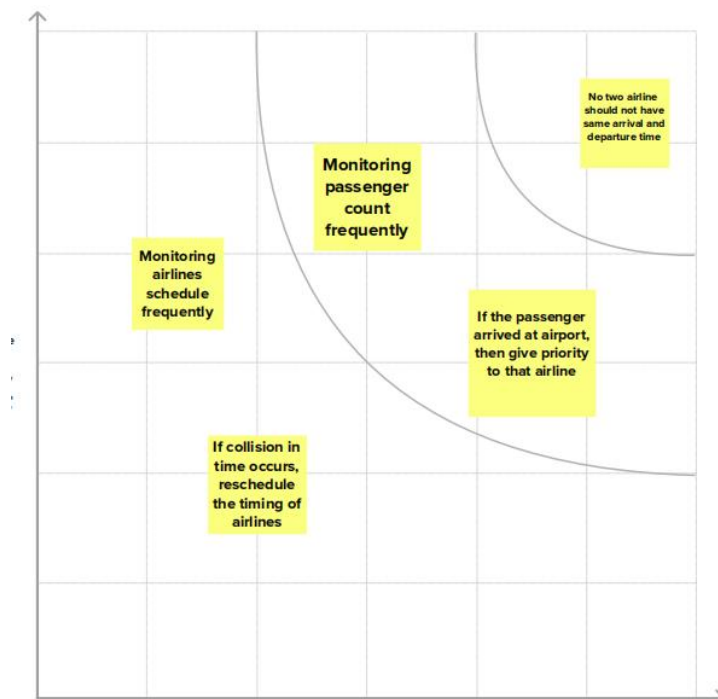
Monitoring  
passenger  
count  
frequently

If the passenger  
arrived at airport,  
then give priority  
to that airline

#### Surya

Make the  
passenger  
get entertain  
at airports

### 3.2.2 Idea Prioritization:



### 3.4.Proposed Solution:

S.NO	Parameter	Description
1.	Problem Statement(Problem to be solved)	With the increasing demand of air transportation and the finite ability to amplify capacity at some key points in the air transportation system, there are concerns that in the future the system will not scale to meet demand.This situation will result in the generation and the propagation of delays throughout the system, impacting passengers' quality of travel and more broadly the economy
2.	Idea/Solution Description	To understand the consciousness traveler demand for specific city pairs and pricing flights can be done using data analytics project. Airlines use the biometric technology as a boarding option. The equipment scans travelers' faces and matches them with photos stored in border control agency databases. These can be handled with the aforementioned project.
3.	Novelty/Uniqueness	The ultimate benefits of big data analytics include strictly timely responses to current and future market demands, improved planning and strategically aligned

		<p>decision making, as well as crystal clear comprehension and monitoring of all main performance drivers relevant to the airline industry.</p> <p>Due to the useage of smart data analytics, passengers will avoid many issues with baggage tracking. While radio frequency identification prevents mishandling the baggage, predictive analysis assists in improving the predictability of fleet reliability</p>
4.	Social Impact/Customer Satisfaction	<p>Data analytics helps the industry to understand customers' preferences and other maintenance issues.</p> <p>For instance, analysis of ticket booking helps the industry to target the customers with personalised offers while optimising the price in real-time using predictive analysis techniques. As a result, by gathering meaningful data, airlines can fetch more bookings in the given timeframe</p>
5.	Business Model(Revenue Model)	<p>Business models innovation in airlines can contribute to the creation of value, competitive advantage and profitability with new possibilities of action.</p> <p>A revenue model is a blueprint that</p>



		shows how a startup business will earn revenue or gross income from its standard business operations, and how it will pay for operating costs and expenses.
6.	Scalability of the Solution	<p>The Cloud Cognos Analytics is not only for particular organization/governments.</p> <p>Aviation industry acting under international, domestic or private are also getting satisfied with the aviation data analysing process provided as per their needs.</p>

### 3.4.Problem Solution:

Define CS, fit into CC into BE, understand RC	<b>1. CUSTOMER SEGMENT(S)</b> <span>CS</span> <ul style="list-style-type: none"> <li>✓ The customer segmentation that merely takes into account the passengers' travel objectives.</li> <li>✓ Airlines will divide their clientele into several seating categories, such as economy, business, and first class.</li> </ul>	<b>6. CUSTOMER CONSTRAINTS</b> <span>CC</span> <ul style="list-style-type: none"> <li>✓ Low-cost travel has taken the lead in recent years in place of onboard smoking, quieter service, and premium class flights.</li> <li>✓ Artificial intelligence will play a role in how goods are distributed and how customers are served.</li> </ul>	<b>5. AVAILABLE SOLUTIONS</b> <span>AS</span> <ul style="list-style-type: none"> <li>✓ Instead of imposing indirect taxes, they can impose small-scale</li> <li>✓ For each type of aircraft operated, the operator is required to give operations staff and the flight crew access to an aircraft operating manual that details normal, abnormal, and emergency flight operations.</li> </ul>	Explore AS, differentiate into BE, understand RC
	<ul style="list-style-type: none"> <li>✓ C Airline and aircraft safety, emergency exit seating not provided, difficulties linked to low flying aircraft, pilot licensing, etc.</li> <li>✓ Issues relating to low-flying aircraft, pilot licensing, emergency exit seating, and other related topics are not provided.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Revenue from airport taxes is used for facility maintenance so customers has to pay the taxes.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Applied technology of behavior change based on these laws and principles.</li> </ul>	
Identify strong TR & EM	<b>3. TRIGGERS</b> <span>TR</span> <p>In the airport, airlines have problem solvers known as Customer Service Representatives who can handle a variety of issues right away. There will be issues if they don't accomplish that.</p>	<b>10. YOUR SOLUTION</b> <span>SL</span> <p>The examination of the steps taken when a person or group makes a decision that matches customer behavior and solves an issue. To fulfill needs and desires, one may acquire, use, or discard goods, services, concepts, or experiences.</p> <ul style="list-style-type: none"> <li>✓ Airlines are stepping up their game with technology and are trying not just to meet customer expectations but exceed them.</li> </ul>	<b>8. CHANNELS of BEHAVIOUR</b> <span>CH</span> <ul style="list-style-type: none"> <li>✓ Allow customers to search for flights and choose their travel</li> <li>✓ Network airlines still rely heavily on offline agency distribution, and low cost airlines are starting to embrace it as well.</li> </ul>	Identify strong TR & EM
	<b>4. EMOTIONS: BEFORE / AFTER</b> <span>EM</span> <p>Prior to it, customers in the airline business will file complaints with customer service...</p> <p>Customers have the right to file a complaint if airline customer service does not act appropriately.</p>			

#### 4.Requirement Analysis:

##### 4.1.Functional Requirements:

S.No	Functional Requirements(Epic)	Sub Requirement(Story/Sub-Task)
FR-1	Customer Registration	Customer can make Registration through Gmail
FR-2	User Conformation	After the Registration the customer will get confirmation through mail.
FR-3	Visualizing Data	User can visualize the Regular trends of delay of flights Using IBM cognos Analytics
FR-4	Generating Report	User can view the flight delay report

##### 4.2.Non-Functional Requirements:

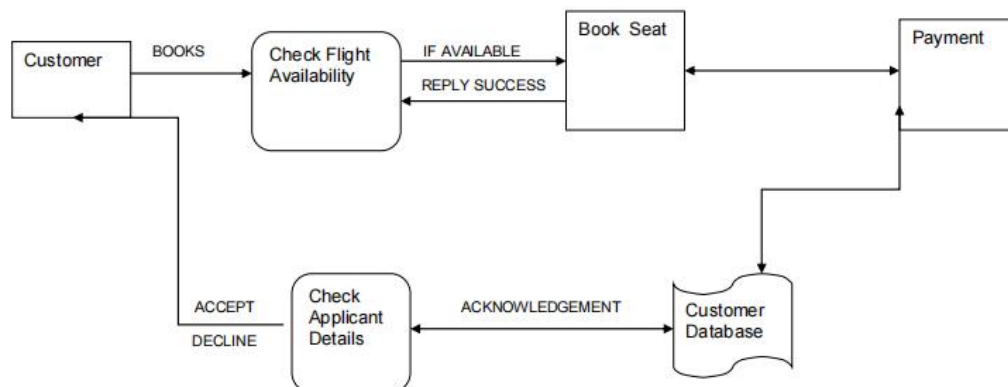
NFR-NO	Non-Functional Requirement	Description
NFR-1	Usability	The application will have a simple and user-friendly graphical interface. Users will be able to understand and use all the features of the application easily. Any action has to be performed with just a few clicks
NFR-2	Security	The main security concern is for users account hence proper login mechanism should be used to avoid hacking. The organization system should not disclose personal information of users and other organization details to public.

NFR-3	Reliability	When the system is disconnected or frozen due to over access at the same time, it should save all the process of the users made up to the point of abnormal happenings.
NFR-4	Performance	When the system is disconnected or frozen due to over access at the same time, it should save all the process of the users made up to the point of abnormal happenings.
NFR-5	Availability	The system shall be available 24 hours a day 7 days a week. User can access at anytime.
NFR-6	Scalability	Large Number of users can access the website

## 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



### 5.1.User Stories:

User Type	Functional Requirement(Epic)	User Story Number	User Story/Task	Acceptance Criteria	Priority	Release
Customer (Web user)	Login	USN-1	As a user, I can log into the application by entering my email & password.	I can get to access my web portal	High	Sprint-3
	Dashboard	USN-2	As a user, I can get to know how much time my flight's delay is in.	I can get details of my registration .	Low	Sprint-3
Customer Care Executive	Delay Analysis	USN-3	Aviation industry which owns this aeroplane analysissystem will enable the option to customers to reach out to the organization if there is any delay issue. Prediction of delays is the main concept here.	The customer care workers will help the customers in trouble.	High	Sprint-4
Customer Care Executive	Delay Analysis(Report Generation)	USN-4	The analyzed report is then sent to the airline's aviation industryfor the	The customer care workers	Low	Sprint-4

			<p>customers to get to know the delay status.</p> <p>The DGCA ( Directorate General of Civil Aviation ) will get to know the delays of flights and redirect safely with high customer safety</p>	<p>will provide the users with the report.</p>		
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### 5.3 User Stories:

**Table 1: Components and Technologies:**

<b>S.No</b>	<b>Components</b>	<b>Description</b>	<b>Technology</b>
1.	User Interface	How user interacts with application. Example: Mobile App	HTML, CSS, Java Script, Excel
2.	Application Logic-1	Logic for a process in the application	IBM Watson STT service, Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson Assistant
4.	Database	Data Type, Configurations	MySQL, NSQL

5.	Cloud Database	Database service on cloud	IBM DB2, IBM Cloudant
6.	File Storage	File Storage requirements	IBM Blocks Storage or other storage service or Local File systems
7.	External API-1	Purpose of External API used in the application	IBM Weather API
8.	External API-1	Purpose of ExternalAPI used in the application	Aadhar API
9.	Infrastructure (Server/Cloud)	Application Deployment on LocalSystem/Cloud Local Server Configuration:Cloud Server Configuration	Local, Cloud Foundry

## 5.2. Application Components:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology ofopen-source framework

2.	Security Implementation s	List all the security/access controls implemented, use of firewalls.	Example: SHA-256, Encryption, IAM Controls, OWASP
3.	Scalable Architecture	Justify the scalability of architecture	Cognos Used
4.	Availability	Justify the availability of application (e.g: use of load balancers, distributed servers)	AWS Used
5.	Performance	Design consideration for the performance of the application (number of requests per second, use of Cache, use of CDN's)	Dashboard, Reports, Stories

## 6. Project Planning And Scheduling:

Activity Name	Activity Number	Activity Description	Tasks Assigned	Status
Preparation Phase	1	a) Access the resources in project dashboard. b) Explore the dataset provided in workspace. c) Create GitHub account & collaborate with Project Repository in project workspace. d) Set-up the prerequisites for the project.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed

Ideation Phase	2	a) Literature survey relevant to theselected project. b) Preparation of Empathy Map toidentify the user pros and cons. c) List the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility& importance.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
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<b>Project Design Phase-I</b>	3			
Proposed Solution	3.1	Preparation of proposed solution document, which includes the Problem statement , Idea description, novelty,feasibility of idea, business model, social impact and scalability of the solution.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
Problem Solution Fit	3.2	Prepared problem solution fit documentwhich have designed a value proposition that addresses the customers' job, pros and cons to theparticular application.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
Solution Architec ture	3.3	Develop effective architecture for theproposed solution which provides ground for application development projects.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
<b>Project Design Phase-II</b>	4			
Solution Requirements	4.1	Identify the Functional and Non-Functional requirements of the proposed solution.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
Customer Journey	4.2	Preparation of customer journey mapto understand the user interactions which describes the stages that the customer experiences over time.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed



Data Flow Diagram and User stories	4.3	Generate Data flow diagram for the Project which maps out the flow of information for the application.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
Technology Architecture	4.4	Develop effective technical architecture for the proposed solution which describes the logical software and hardware capabilities that are required to support the development of the application.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed

Project Planning Phase	5			
Milestones & Activity List	5.1	Prepare Milestone and Activity list of the project.	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
Sprint Plan	5.2	Prepare Sprint Delivery plan of the project	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	Completed
Project Development	6			
Delivery of Sprint-1	6.1	Implement the coding phase of Sprint-1	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	In Progress
Delivery of Sprint-2	6.2	Implement the coding phase of Sprint-2	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	In Progress
Delivery of Sprint-3	6.3	Implement the coding phase of Sprint-3	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	In Progress
Delivery of Sprint-4	6.4	Implement the coding phase of Sprint-4	AVUDAI NANDHU S MOHANA RUDHRAN NITIN SINGH R SURYA S S	In Progress

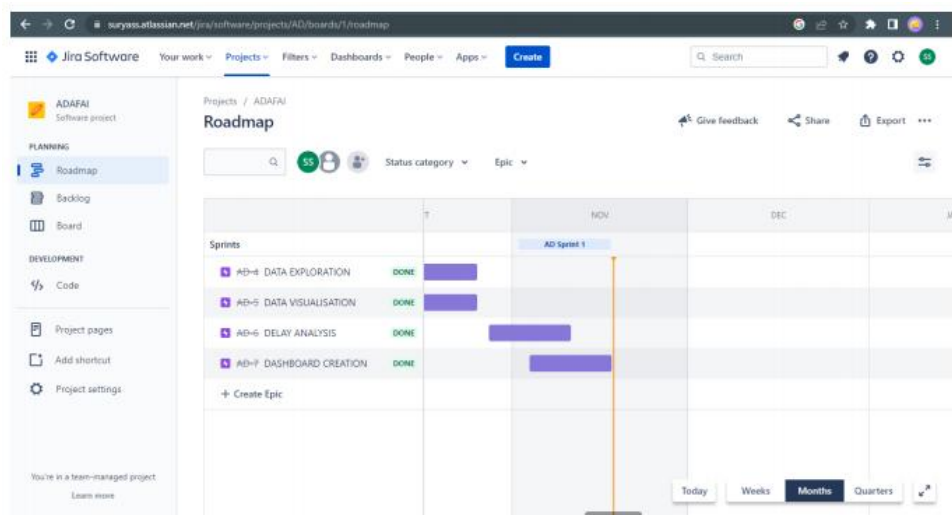
## 6.2.Sprint Delivery Schedule:

A milestone schedule, or milestone chart, is a timeline that uses milestones to divide a project schedule into major phases. A milestone chart is a way to visualize the most important steps of our project. Each milestone the team achieves brings us closer to completing the project. As a result, milestones provide a sense of accomplishment and show the team how the work they’re doing contributes to the overarching project objective

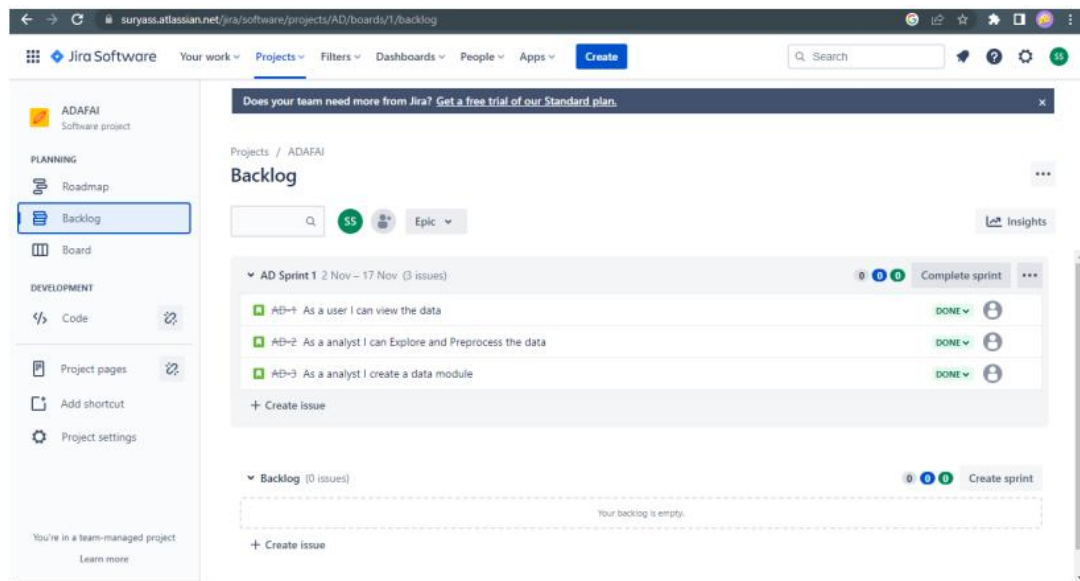


## 7. Report From JIRA:

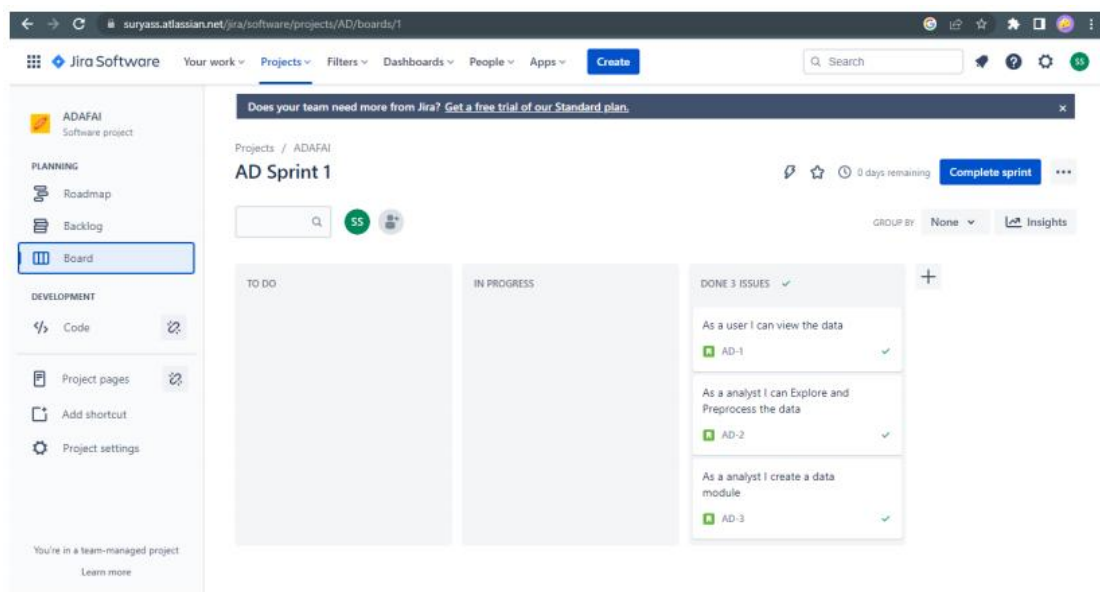
### Project RoadMap:



## Project BackLog:



## Project Board:



## 8. .Coding and Solutioning:

### 8.1. Feature 1:

The user can enter the Elevation feet of the flight to predict whether the delay has occurred or not.

```
from flask import render_template, Flask, request
```

```

import pickle
appl=Flask(__name__)
file=open("model.pkl","rb")
knn=pickle.load(file)
file.close()
@app.route("/", methods=["GET","POST"])
def index():
    if request.method=="POST":
        myDict = request.form
        type1= myDict["elevation_ft"]pred = [type1]
        res=knn.predict([pred])[0]
        return render_template('result.html',elevation_ft=type1,res=res)
    return render_template('index.html')
    return 'OK'
if __name__ == "__main__":
    appl.run(debug=True)

```

## 8.2. Feature 2:

If a delay occurred, the delay is predicted using the Elevation\_ft parameter given in the dataset which provides the delay, in minutes.

### CODE:

```

from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split

import pandas as pd
import numpy as np
import pickledt = pd.read_csv(r"C:/Users/Nitin/Downloads/airports.csv")

dt = dt.dropna()
dt=dt.replace('NaN',0)
dt=dt.replace('OC',1)
dt=dt.replace('AF',2)
dt=dt.replace('AN',3)

```

```
dt=dt.replace('EU',4)
```

```
dt=dt.replace('AS',5)
```

```
dt=dt.replace('SA',6)
```

```
#feature and target arrays
```

```
train=dt['elevation_ft']
```

```
target=dt['elevation_ft']
```

```
train=np.array(train)
```

```
target=np.array(target)X_train, X_test, y_train, y_test = train_test_split(train,target,  
test_size = 0.2, random_state=42)
```

```
knn = KNeighborsClassifier(n_neighbors=5)
```

```
knn.fit(X_train.reshape(-1,1), y_train)
```

```
file = open("model.pkl","wb")
```

```
pickle.dump(knn,file)
```

```
file.close()
```

## 9. Testing:

### 9.1. Test Cases:

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
Main Page	UI	Home Page	User can explore the Web App .		Visit the web page URL and click GO		Elevation details entries should be displayed.	Working as expected	Pass
Entering parameter_TC_001	Functional	Home Page	Verify the UI elements in the main page.		1.Click on the CHECK button displayed on the bottom of the application to check the delay.		Application should show below UI elements: a.Elevation feet Entry Area b.Checking the delay by CHECK button.	Working as expected	Pass
Navigation to Resultpage_TC_002	Functional	Home Page	Results will displayed with the analysed delay.		Delay analysis is done if occurs.	Elevation_ft ID: 200 Delay predicted: 10 mins	Application should show correct delay time in minutes.	Working as expected	Pass
Return to Homepage_TC_001	Functional	Second page	To check the delay for another elevation feet .		1.Click on the CHECK button displayed on the bottom of the application to check the delay.	Elevation_ft ID: 2391 Delay predicted: 100 mins	User should be navigated from the loginpage to the dashboard. The Dashboard displays the User Name.	Working as expected	Pass

## 9.2. User Acceptance Testing:

### 1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Airlines Data Analytics for Aviation Industry 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	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

### 3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	30	0	0	30
Security	2	0	0	2

## 10. ADVANTAGES AND DISADVANTAGES:

### Advantages:

1. This application helps users predict the delays if they occur.
2. As a result, they can accurately predict these flight delays allowing passengers to be well prepared for the deterrent caused to Their journey.
3. Enabling airlines to respond to the potential causes of flight delays in advance to diminish the negative impact.

4. Therefore, predicting flight delays can improve airline operations and passenger satisfaction, which will result in a positive impact on the economy

#### **Disadvantages:**

1. The people who are unaware of this application will have no idea about their flight delay unless they have been notified

#### **11.CONCLUSION:**

In civil aviation, there are many issues with flight delays. Both direct and indirect expenses are incurred by them, including gate upkeep, crew fees, meal service, and accommodation. They also have an impact on patron satisfaction. Flight delays are unavoidable, and they significantly affect the carriers' profits and losses. For airlines, estimating flight delays accurately is essential since the data may be used to boost customer happiness and revenue for airline agencies. Therefore, airlines, passengers, and airports all place a high value on the study and prediction of flight delays. By anticipating delays, an airport can change resource allocations, swiftly identify the root reasons, and take action to minimise or completely eliminate delays. Therefore, It delivers a well-friendly graphical UI and gives a proper delay rate to the users.

#### **12.FUTURE SCOPE:**

There are still deficiencies in this application. Furthermore, this application can be enhanced for allocating various resources to the customers if a delay has occurred and they can also book tickets for their flights through this application.

#### **13.APPENDIX:**

##### **Source Code:**

##### **Temp.py:**

```
from sklearn.neighbors import KNeighborsClassifier
```

```

from sklearn.model_selection import train_test_split
import pandas as pd
import numpy as np
import pickle

dt = pd.read_csv(r"C:/Users/Anjana/Downloads/airports.csv")
dt = dt.dropna()
dt=dt.replace('NaN',0)
dt=dt.replace('OC',1)
dt=dt.replace('AF',2)
dt=dt.replace('AN',3)
dt=dt.replace('EU',4)
dt=dt.replace('AS',5)
dt=dt.replace('SA',6)
#feature and target arrays
train=dt['elevation_ft']
target=dt['elevation_ft']
train=np.array(train)
target=np.array(target)
X_train, X_test, y_train, y_test = train_test_split(train,target, test_size = 0.2,
random_state=42)
knn = KNeighborsClassifier(n_neighbors=5)
knn.fit(X_train.reshape(-1,1), y_train)
file = open("model.pkl","wb")
pickle.dump(knn,file)
file.close()

```

### Main.py

```

from flask import render_template,Flask,request
import pickle
appl=Flask(__name__)
file=open("model.pkl","rb")

```



```

knn=pickle.load(file)
file.close()
@app.route("/", methods=["GET","POST"])
def index():
    if request.method=="POST":
        myDict = request.form
        type1= myDict["elevation_ft"]
        pred = [type1]
        res=knn.predict([pred])[0]
        return render_template('result.html',elevation_ft=type1,res=res)
        return render_template('index.html')
    return 'OK'
if __name__ == "__main__":
    appl.run(debug=True)

```

Index.html:

```

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

<head>
<meta charset="UTF-8">
<link rel="stylesheet"
href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css"
integrity="sha384-
ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2M
Zw1T"
crossorigin="anonymous">

<title>Airline Delay Prediction</title>
</head>

```

```
<style>
body{
background-image: url('im1.gif') ;
background-repeat: no-repeat;
background-attachment: fixed;
background-size: cover;
}
</style>
```

```
<body>
<br>
<br>
<br>
<br>
<div class="container">
<h1 class="text-center m-3 badge-dark text-w
p">
Airlines Delay Prediction
</h1>
```

```
<div class="card container" style="width: 65%; ">
<div class="card-body">
<form action="/" method="post">
<div class="form-group">
<label for="formGroupExampleInput1">Elevation feet</label>
<input
type="text"
class="form-control"
id="formGroupExampleInput1"
name="elevation_ft"
required
/>

</div>
```

```
<center><button type="submit" class="btn btn-  
dark">CHECK</button></center>  
</form>  
</div>  
</div>  
</div>  
</body>  
</html>
```

**Result.html:**

```
<!DOCTYPE html>  
<html lang="en">  
  
<head>  
<meta charset="UTF-8">  
<link rel="stylesheet"  
href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css"  
integrity="sha384-  
ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2M  
Zw1T"  
crossorigin="anonymous">  
<title>Delay-Prediction</title>  
</head>  
  
<style>  
body{  
background-image: url('im2.gif') ;  
background-repeat: no-repeat;  
background-attachment: fixed;  
background-size: cover;  
}
```

</style>

<body >

<br>

<br>

<br>

<br>

<div class="container" >

<h1 class="text-center m-3 badge-dark text-wrap">Airlines Delay  
Prediction</h1>

<div class="card container" style="width: 50%;">

<div class="card-body" >

<form action="/" method="post">

<div class="form-group">

<label for="formGroupExampleInput1">Elevation feet</label>

<input

type="text"

class="form-control"

id="formGroupExampleInput1"

name="elevation\_ft"

placeholder="{{elevation\_ft}}"

required

/>

</div>

<h2 class="text-center text-wrap" >The Delay rate is {{res}} minutes </h2>

</form>

</div>

<center><a href="/"><button type="submit" class="btn btn-  
dark">Back</button></a></center>

</div>

</div>

**</body>**

**</html>**

**Login.HTML:**

**<!DOCTYPE html>**

**<html lang="en">**

**<head>**

**<meta charset="UTF-8">**

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

**<title>Login Form validation using HTML CSS & JS </title>**

**<link rel="stylesheet" href="style.css">**

**<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.3/css/all.min.css"/>**

**</head>**

**<body>**

**<div class="wrapper">**

**<header>Login Form</header>**

**<form action="#">**

**<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>

```

Style.css:

```

/* @import
url('https://fonts.googleapis.com/css2?family=Poppins:wght@400;500;600&displ
ay=swap') */

```

```

*{
  margin: 0;
  padding: 0;
  box-sizing: border-box;
  font-family: "Poppins", sans-serif;
}

```

```

body{
  width: 100%;
  height: 100vh;
  display: flex;
  align-items: center;
  justify-content: center;
}

```

```
background-image: url('254381.jpg');  
background-attachment: fixed;  
background-size: cover;  
}
```

```
::selection{  
color: #fff;  
Background: #3853bf;  
}
```

```
.wrapper{  
width: 380px;  
padding: 40px 30px 50px 30px;  
background: #fff;  
border-radius: 5px;  
text-align: center;  
box-shadow: 10px 10px 15px rgba(0,0,0,0.1);  
}
```

```
.wrapper header{  
font-size: 35px;  
font-weight: 600;  
}
```

```
.wrapper form{  
margin: 40px 0;  
}
```

```
form .field{  
width: 100%;  
margin-bottom: 20px;  
}
```

```
form .field.shake{
```

```
    animation: shake 0.3s ease-in-out;
}
```

```
@keyframes shake {
  0%, 100%{
    margin-left: 0px;
  }
```

```
  20%, 80%{
    margin-left: -12px;
  }
```

```
  40%, 60%{
    margin-left: 12px;
  }
}
```

```
form .field .input-area{
  height: 50px;
  width: 100%;
  position: relative;
}
```

```
form input{
  width: 100%;
  height: 100%;
  outline: none;
  padding: 0 45px;
  font-size: 18px;
  background: none;
  caret-color: #5372F0;
  border-radius: 5px;
  border: 1px solid #bfbfbf;
  border-bottom-width: 2px;
```



```
    transition: all 0.2s ease;
}
```

```
form .field input:focus,
form .field.valid input{
    border-color: #5372F0;
}
```

```
form .field.shake input,
form .field.error input{
    border-color: #dc3545;
}
```

```
.field .input-area i{
    position: absolute;
    top: 50%;
    font-size: 18px;
    pointer-events: none;
    transform: translateY(-50%);
}
```

```
.input-area .icon{
    left: 15px;
    color: #bfbfbf;
    transition: color 0.2s ease;
}
```

```
.input-area .error-icon{
    right: 15px;
    color: #dc3545;
}
```

```
form input:focus ~ .icon,
form .field.valid .icon{
```

```
    color: #5372F0;
}
```

```
form .field.shake input:focus ~ .icon,
form .field.error input:focus ~ .icon{
    color: #bfbfbf;
}
```

```
form input::placeholder{
    color: #bfbfbf;
    font-size: 17px;
}
```

```
form .field .error-txt{
    color: #dc3545;
    text-align: left;
    margin-top: 5px;
}
```

```
form .field .error{
    display: none;
}
```

```
form .field.shake .error,
form .field.error .error{
    display: block;
}
```

```
form .pass-txt{
    text-align: left;
    margin-top: -10px;
}
```

```
.wrapper a{
```

```
color: #5372F0;
text-decoration: none;
}
```

```
.wrapper a:hover{
text-decoration: underline;
}
```

```
form input[type="submit"]{
height: 50px;
margin-top: 30px;
color: #fff;
padding: 0;
border: none;
background: #5372F0;
cursor: pointer;
border-bottom: 2px solid rgba(0,0,0,0.1);
transition: all 0.3s ease;
}
```

```
form input[type="submit"]:hover{
background: #2c52ed;
};
```

Script.js:

```
const form = document.querySelector("form")
eField = form.querySelector(".email"),
eInput = eField.querySelector("input"),
pField = form.querySelector(".password"),
pInput = pField.querySelector("input");
```

```
form.onsubmit = (e)=>{
```

```

e.preventDefault(); //preventing from form submitting
//if email and password is blank then add shake class in it else call specified
function
(eInput.value == "") ? eField.classList.add("shake", "error") : checkEmail();
(pInput.value == "") ? pField.classList.add("shake", "error") : checkPass();

setTimeout(()=>{ //remove shake class after 500ms
    eField.classList.remove("shake");
    pField.classList.remove("shake");
}, 500);

eInput.onkeyup = ()=>{checkEmail();} //calling checkEmail function on email
input keyup
pInput.onkeyup = ()=>{checkPass();} //calling checkPassword function on pass
input keyup

function checkEmail(){ //checkEmail function
    let pattern = /^[^ ]+@[^ ]+\.[a-z]{2,3}$/; //pattern for validate email
    if(!eInput.value.match(pattern)){ //if pattern not matched then add error and
remove valid class
        eField.classList.add("error");
        eField.classList.remove("valid");
        let errorTxt = eField.querySelector(".error-txt");
        //if email value is not empty then show please enter valid email else show
Email can't be blank
        (eInput.value != "") ? errorTxt.innerText = "Enter a valid email address" :
errorTxt.innerText = "Email can't be blank";
    }else{ //if pattern matched then remove error and add valid class
        eField.classList.remove("error");
        eField.classList.add("valid");
    }
}

```

```
}
```

```
function checkPass(){ //checkPass function
```

```
    if(pInput.value == ""){ //if pass is empty then add error and remove valid  
class
```

```
        pField.classList.add("error");
```

```
        pField.classList.remove("valid");
```

```
    }else{ //if pass is empty then remove error and add valid class
```

```
        pField.classList.remove("error");
```

```
        pField.classList.add("valid");
```

```
    }
```

```
}
```

```
//if eField and pField doesn't contains error class that mean user filled details  
properly
```

```
if(!eField.classList.contains("error") && !pField.classList.contains("error")){
```

```
    window.location.href = form.getAttribute("action"); //redirecting user to the  
specified url which is inside action attribute of form tag
```

```
}
```

```
};
```

**Github Repo Link:**

**Github Link: <https://github.com/IBM-EPBL/IBM-Project-4825-1658740747>**