# Airlines Data Analytics for Aviation Industry

**Team ID**:  PNT2022TMID22116

**Team Leader:**  Harishankari .M

**Team member 1**:  Mathivadhanii .R

**Team member 2**:  Sowjanya .B

**Team member 3:** Veena Kumari

## 1. INTRODUCTION

### 1.1 Project Overview

In the present world, the major components of any transportation system include passenger airline, cargo airline, and air traffic control system. With the passage of time, nations around the world have tried to evolve numerous techniques for improving the airline transportation system. This has brought a drastic change in airline operations. Flight delays occasionally cause inconvenience to modern passengers. Every year approximately 20% of airline flights are canceled or delayed, costing passengers more than 20 billion dollars in money and time.

**1.2 Purpose**

Average aircraft delay is regularly referred to as an indication of airport capacity. Flight delay is a prevailing problem in the world. It's very tough to explain the reason for the delay. A few factors responsible for the flight delays like runway construction and excessive traffic are rare, but bad weather seems to be a common cause. Some flights are delayed because of reactionary delays, due to the late arrival of the previous flight. It hurts airports, and airlines, and affects a company's marketing strategies as companies rely on customer loyalty to support their frequent flying programs.

## 2. LITERATURE SURVEY

1. **Predictive Analytics Platform for Airline Industry**

   - In this study, inquire about saying to plan and create the most excellent fit forecast flight   OD level   passenger request based on the verifiable information.
   - A precise instrument to anticipate income for future months of OD (Origin Goal) is   done utilizing admission and traveller information.
   - The income is inferred by the number of traveller and the fare they pay which shift for   each flight.

2. **Big Data Analytics in airlines: Opportunities and challenges**

   - Big data technology; Big data analytics; Airlines; Aviation industry; Data Driven Culture.
   - The development of big data management research has generated a range of analytical tools that could be utilized to better respond to such sudden 'black swan' risks, like COVID19 pandemic (Ienca and Vayena, 2020).
   - In aviation, very large amount of flight data is generated and there is an essential need to analyse such data in real time (Kasturi et al., 2016). Technological advances allow firms to use various types of structured, semi-structured, and unstructured data (Lee, 2017).

3. **MAS Flight: A Global Aviation Data Warehouse and Big-Data Analytics Platform**

- Examine diversions, cancellations, delays and determine root causes. Deep-dive into       airport gates, taxi times, and runway patterns analyse air space usage and air traffic management.
- Arrival weather Destination information Landing/taxi times Arrival date/time Diversion data Aircraft information.
- Enhanced Traffic Management System Counts (ETMS), including Airport operations counts by type (commercial, freight, etc.), departure & arrival.

4. **Air Transportation in 2030-50 and Data Analytics in Aviation Asst. Prof. Nazim Kemal Ure\*, Asst. Prof. Emre Koyuncu\* Prof. Gokhan Inalhan\* and Cengiz Pasaogl:**

- Aircraft and ATM Equipment Manufacturers / Suppliers –New engine Technologies – Advanced robotics, unmanned workspaces, flexible automation –Instantaneously switch between components, totally reconfigurable factory. –Advanced manufacturing equipment, smart materials.

- Society –Equity of access, safe and seamless flights –Reduced environmental impact on society –Passengers will be able to pick the optimum way of transportation by easily providing their requirements and constraint.

**2.2 References**

- P. H. K Tissera;A.N.M.R.S.P. llwana;K.T. Waduge;M.A.l. Perera;D.P. Nawinna Kasthurirathna  2020  "**Predictive Analytics Platform For Airline Industry**" 2nd International Conference on Advancements in Computing  (ICAC)Year: 2020
Volume: 1 Conference Paper Publisher: IEEE

- **Sofiyat Bakreena, Elizaveta Markovskayaa, Igor Merzlikinb, Asiiat Mottaeva**

  **"Development of the approach to the analysis of aviation industry's adaptation to seasonal disruptions"** **2020 The Authors. Published by ELSEVIER B.V**

- **Azib Anees, Wei Huang "Flight Delay Prediction: Data Analysis and Model Development"**
  **Published in:** 2021 26th International Conference on Automation and Computing (ICAC) **Publisher:** IEEE
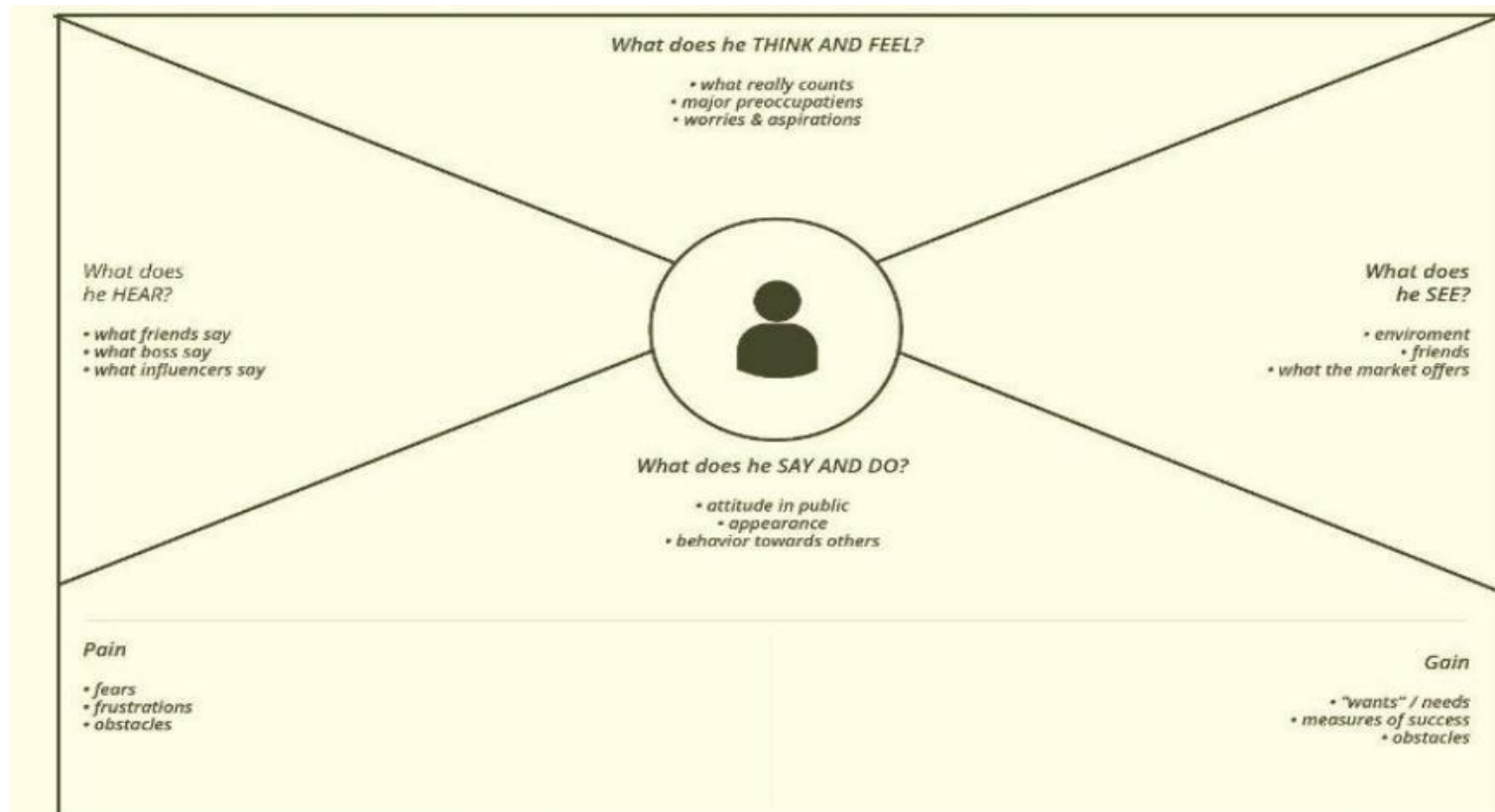
**2.3 Problem Statement Definition**

Flight delays in air transportation are a major concern that has adverse effects on the economy, the passengers, and the aviation industry. This matter critically requires an accurate estimation for future flight delays that can be implemented to improve airport operations and customer satisfaction. Thus, we propose an interactive dashboard in which user can predict the delays if occurs.

To build a user interface application to analyze the delays so airports organizations can adjust and allocate the resources(airports) nearby quickly.

**3. IDEATION & PROPOSED SOLUTION**

**3.1 Empathy Map Canvas**

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment.

*What does he THINK AND FEEL?*
*• what really counts*
*• major preoccupatiens*
*• worries & aspirations*

*What does
he HEAR?*
*• what friends say*
*• what boss say*
*• what influencers say*

*What does
he SEE?*
*• enviroment*
*• friends*
*• what the market offers*

*What does he SAY AND DO?*
*• attitude in public*
*• appearance*
*• behavior towards others*

*Pain*
*• fears*
*• frustrations*
*• obstacles*

*Gain*
*• "wants" / needs*
*• measures of success*
*• obstacles*

**3.2 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, 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

## 3.2.1 Brainstorm, Idea Listing and Grouping

### HARISHANKARI. M

| | | |
|---|---|---|
| Prevent from plane crashing by specific service. | | Identify the unique country details |
| | Security for passengers safe departure | |
| Specific local coders for easier identification by passengers | | Airports to be specified to the passengers using GPS |

### MATHIVATHANII. R

| | | |
|---|---|---|
| To better customer service | | Installing high quality product in airplanes |
| | Advanced aircraft display systems | |
| Virtual passengers safety system | | Automatic safety system |

### SOWJANYA. B

| | | |
|---|---|---|
| Follow up with passengers protection | | Manual checkup on airport and aircraft |
| | Measurement of automated fuel-efficient alert | |
| Detail about regression details | | Reduced queue time and chech in counter |

### VEENA KUMARI

| | | |
|---|---|---|
| Automated aircraft inspection using data analytics | | Automated artificial intelligence conducting robot speciality |
| | Keep track on the controls, alerts, signals, etc | |
| Longer devoloped engines | | Dealing with region name |

### 3.2.2 Idea Prioritization
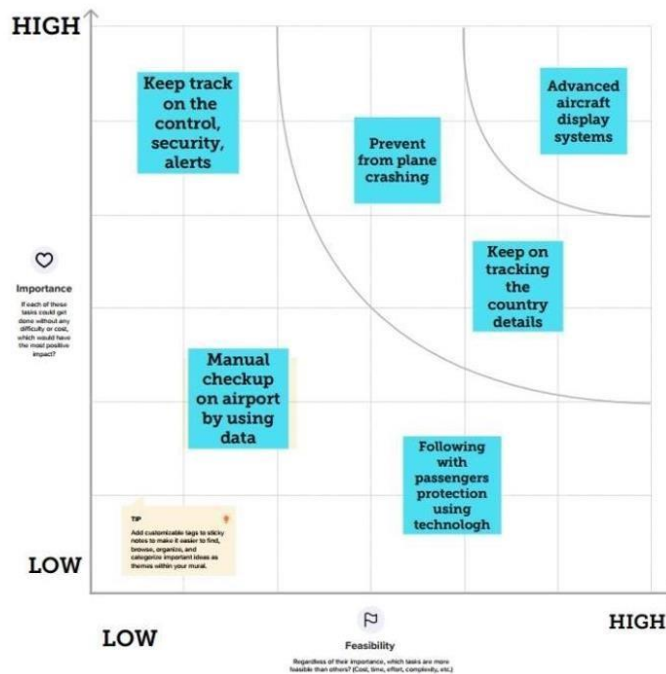


## 3.4 Proposed Solution

Project team shall fill in the following information in the proposed solution template

| S.No. | Parameter | Description |
|-------|-----------|-------------|
|       |           |             |

| 1. | Problem Statement (Problem to be solved) | • Passengers not consider to knowing the status will be solved or not. |
| | | The generation of the delay was impacting the passengers of result of delays |
| | | • throughout the system in economy. |
| | | |
| | | • Transportation and the limited ability to increase capacity at some key points in the air transportation system, it is found to be difficult that in the future the system will scale to meet demand. |
| | | • This will result in the generation of delays throughout the system impacting passengers' travel and more broadly the economy. |
| 2. | Idea / Solution description | • The climate changes of air forces were measured perfectly. |
| | | • Traveler demand for specific city pairs and pricing flights can be done. |
| | | • The particular data can reduce the delay of the airlines. |
| | | • Airlines use this biometric technology as a boarding option. The equipment scans travelers' face and matches them with photos stored in border control agency database. |

| 3. | Novelty / Uniqueness | • It will include crystal clear comprehension and monitoring of all main performance drives relevant to the airline industry.<br><br>•<br><br>  The radio frequency identification it secured the mishandling the baggage.<br><br>• Due to the use of smart data analytics, passengers will avoid many issues with baggage tracking. |
|----|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4. | Social Impact / Customer Satisfaction | • Passenger satisfaction is obtained. No passenger undergoes discomfort during travel or post or pr-travel traumas.<br><br>• Data analytics helps the industry to understand customers' preferences and other maintenance issues. |

| 5. | Business Model (Revenue Model) | This solution can be implemented in various government and private sectors which helps enable predictive measures.<br><br>Innovation in airlines can contribute to the creation of value, competitive advantage and profitability with new possibilities of action. |
|----|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| | | |
|---|---|---|
| | | • A revenue model is a blueprint that 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 | • This process would be the more scalable for any platform increase the development and application. . <br><br> • <br> The Cloud Cognos Analytics is not only for organization/governments. <br><br> • Aviation industry acting internationally, domestically, or <br> privately is also getting satisfied with the aviation data analyzing process provided. |

**Define CS, fit into CC**

**Explore AS, differentiate**

### 1. CUSTOMER SEGMENT(S) `CS`

- People who want to travel abroad for accomplishing the work
- Who is in need of faster travelling time

### 6. CUSTOMER CONSTRAINTS `CC`

- The customers should book the tickets in online mode.

### 5. AVAILABLE SOLUTIONS `AS`

- When delay occurs due to weather conditions, information will be conveyed through flight attendant.
- Providing evacuation methods when midway emergency happens.

**Focus on J&P, tap into BE, understand RC**

**Focus on J&P, tap into BE, understand RC**

### 2. JOBS-TO-BE-DONE / PROBLEMS `J&P`

- In order to get the right boarding pass to travel
- Provide valid details

### 9. PROBLEM ROOT CAUSE `RC`

- The application of the process cannot be very easy to the customer ,unless the money is attainable to pay .

### 7. BEHAVIOUR `BE`

- Ensuring the identities are same as when the customer provided their information.
- When the passenger faces issues during the travel, flight crew solves them respectively.

### 3. TRIGGERS `TR`

- when the customer gets to know about the profits of travelling in airways
- Curiosity for knowing how the travel feels for the customers

### 4. EMOTIONS: BEFORE / AFTER `EM`

- During the beginning the system and technologies were not sufficient in aviation Industry, hence it resulted in numerous loss
- Improvements in aviation industry with the help of data analytics has helped to Reduce the errors

### 10. YOUR SOLUTION `SL`

- The point of the project is to sketch the data analytics report for the aviation industry using cognos analytics.
- It shows the flight arrival or delay process and provides the picturesque view for aviation industry.

### 8. CHANNELS of BEHAVIOUR `CH`

**8.1 ONLINE**

- Some web applications are unauthorized.
- There are some security process for aviation industry that non can loot the personals details .

**8.2 OFFLINE**

- The airlines management should have the demand in increasing the growth which engage to the customers for their managerial roles.

# 4. REQUIREMENT ANALYSIS

## 4.1 Functional requirements

Following are the functional requirements of the proposed solution.

| FR No | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR -1 | customer Registration | customer can make Registration through Gmail |
| FR-2 | User Confirmation | After the Registration the customer will get confirmation through the 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

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

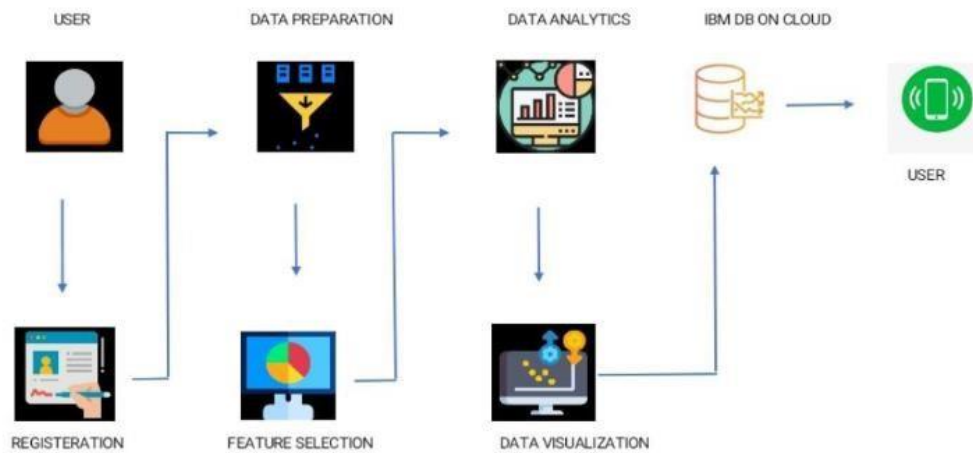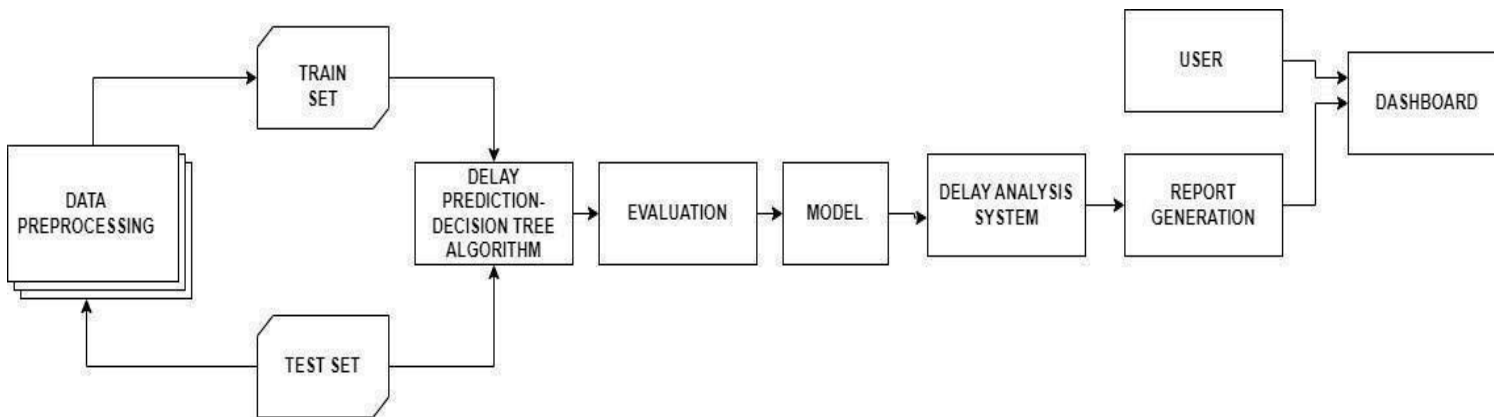| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | The application will have a simple and user-friendly graphical interface. Users will be able to understand and use all the features of the application easily. Any action has to be performed with just a few clicks |
| NFR-2 | **Security** | The main security concern is for users' accounts hence proper login mechanism should be used to avoid hacking. The organization system should not disclose the personal information of users and other organization details to the 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** | The system should require a fair amount of speed, especially while browsing through the catalogue. |

| NFR-5 | **Availability** | The system shall be available 24 hours a day 7 days a week. Users can access it at any time. |
|-------|------------------|-----------------------------------------------------------------------------------------------|
| NFR-6 | **Scalability** | Large Number of users can access the website |

## 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

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|-----------|-------------------------------|-------------------|-------------------|---------------------|----------|---------|
| Customer (Web user) | Login | USN1 | ● As a user, I can log into the application by entering my email & password. | can get to access my web portal | High | Sprint- |
| | Dashboard | USN-2 | ● As a user, I can get to know how much time my flight's delay is in. | can get details of my registration. | Low | Sprint- |

information, and where data is stored

TRAIN SET

DATA PREPROCESSING

TEST SET

DELAY PREDICTION-DECISION TREE ALGORITHM

EVALUATION

MODEL

DELAY ANALYSIS SYSTEM

REPORT GENERATION

USER

DASHBOARD



USER

DATA PREPARATION

DATA ANALYTICS

IBM DB ON CLOUD

USER

REGISTERATION

FEATURE SELECTION

DATA VISUALIZATION

| | | |
|---|---|---|
| Availability | The system will be available 24 hours a day 7 days a week. Users can access it at any time. | |

| Component | Description | Technology |
|---|---|---|
| User Interface | User can Interact with web Applications | HTML, CSS, JavaScript. |
| Data Preparation | Pre-processing of data should be done | Python |
| Feature Selection | Feature selection of the Dataset using the Correlation Feature Selection method. | Python |
| Data Analytics | Prediction of Flight delay using Decision Tree. | Python |
| Data Visualization | Data Type, Configurations etc. | Python |
| Data Storage | Database Service on Cloud | IBM DB2, IBM Cloudant etc. |

| User Interface | Dashboard showing the details of the flight delay | | HTML, CSS, JavaScript. |
|---|---|---|---|
| Performance | The system should require a fair amount of speed, especially while browsing through the catalogue. | | |

**5.3 User Stories Table-1: Components &**

**Technologies**:

**Table 2: Application Characteristics**:

# 6. PROJECT PLANNING AND SCHEDULING

## 6.1 Sprint Planning & Estimation

| Activity Name | Activity Number | Activity Description | Tasks Assigned | Status |
|---|---|---|---|---|
| | 1 | | | Completed |

| Preparation Phase | | a) Access the resources in the project dashboard. <br><br> b) Explore the dataset provided in the workspace. <br><br> c) Create a GitHub account & collaborate with Project Repository in the project workspace. <br><br> d) Set up the prerequisites for the project. | Harishankari M <br><br> Mathivadhanii R <br><br> Sowjanya B <br><br> Veena Kumari | |
|---|---|---|---|---|
| Ideation Phase | 2 | a) Literature survey relevant to the selected project. <br><br> b) Preparation of an Empathy Map to identify the user pros and cons. | Harishankari M <br><br> Mathivadhanii R <br><br> Sowjanya B <br><br> Veena Kumari | Completed |
| | | c) List the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on their feasibility & importance. | | |
| | 3 | | | |

| Project Design Phase-I | | | | |
|---|---|---|---|---|
| Proposed Solution | 3.1 | Preparation of proposed solution document, which includes the Problem statement, Idea description, novelty, feasibility of the idea, business model, social impact and scalability of the solution. | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |
| Problem SolutionFit | 3.2 | Prepared problem solution fit document which has designed a value proposition that addresses the customers' job, pros and cons to the particular application. | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |
| Solution Architecture | 3.3 | Develop effective architecture for the proposed solution which provides ground for application development projects. | Harishankari<br><br>Mathivadhanii<br><br>Sowjanya<br><br>Veena Kumari | Completed |

| Project Design Phase-II | 4 | | | |
|---|---|---|---|---|
| Solution Requirements | 4.1 | Identify the Functional and Non- Functional requirements of the proposed solution. | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |
| Customer Journey | 4.2 | Preparation of customer journey map to understand the user interactions which describes the stages that the customer experiences over time. | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | 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. | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | 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. | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |

| | | | | |
|---|---|---|---|---|
| **Project Planning Phase** | 5 | | | |
| Milestones & Activity List | 5.1 | Prepare Milestone and Activity list o the project. | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |
| Sprint Plan | 5.2 | Prepare Sprint Delivery plan of the project | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |

| | | | | |
|---|---|---|---|---|
| **Project Development** | 6 | | | |
| Delivery of Sprint-1 | 6.1 | Implement the coding phase of Sprint-1 | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |

| | | | | |
|---|---|---|---|---|
| Delivery of Sprint-2 | 6.2 | Implement the coding phase of Sprint- 2 | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |
| Delivery of Sprint-3 | 6.3 | Implement the coding phase of Sprint-3 | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |

| | | | | |
|---|---|---|---|---|
| Delivery of Sprint-4 | 6.4 | Implement the coding phase of Sprint-4 | Harishankari M<br><br>Mathivadhanii R<br><br>Sowjanya B<br><br>Veena Kumari | Completed |

**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.
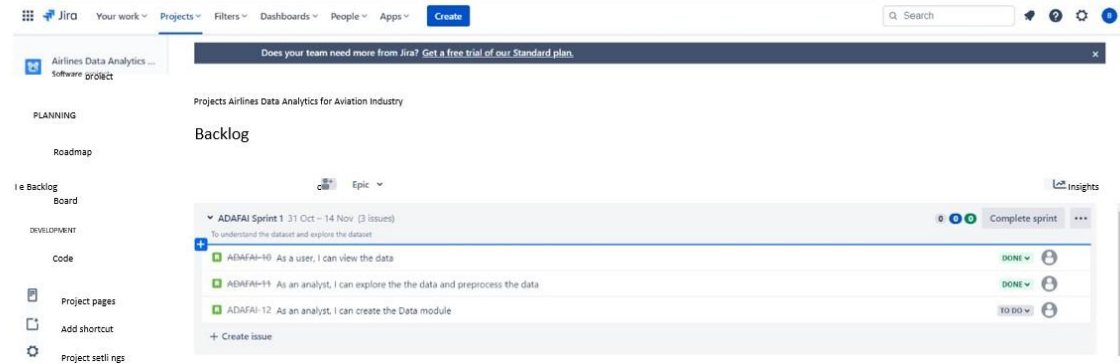


Milestone Timeline Chart

# 6. REPORT FROM JIRA

### Project RoadMap
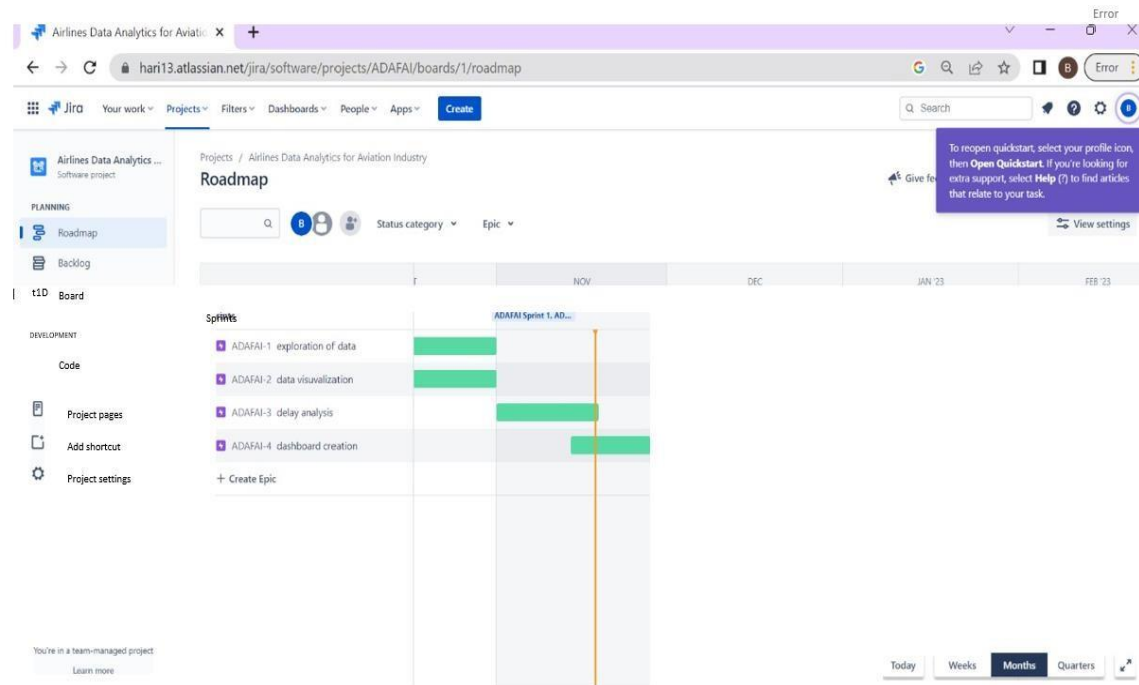


### Project Backlog

Error

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Airlines Data Analytics ...
Software project

pro iEt

PLANNING
Roadmap

1    Backlog
     8O a rd

DEVELOPMENT

Code

Projects / Airlines Data Analytics for Aviation Industry

Backlog Z

🔍 o Epic ⌄                                                                    Insights

ADAFAI Sprint3 31      -14 Nov (2 issues)                          0 🔵🟢  Complete sprint  •••
Flight

🟩 ADAFAI-15 1 will create various models an an analyst to accurately predict the flight delay    IN PROGRESS ⌄  👤

🟩 ADAFAI-16 As an analyst, will select the most effective model to accurately to predict the flight delay    IN PROGRESS ⌄  👤

+ Create issue

Project pages
Add shortcut
Project settings

v ADAFAI sprint4 21 oct- 14 Nov (2 issues)                        0 🔵🟢  Complete sprint  •••
To reate an Interactive Dashboard for Flight Nay Prediction

🟩 ADAPAI-17 As an analyst, will import the suitable model into the framework    TO DO ⌄  👤

🟩 ADAFAI-18 As an analyst, will generate the result of flight delay prediction and i will develop a dashboard that display all the flight delays    TO DO ⌄  👤
+ Create issue

---

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Airlines Data Analytics ...
Software project

PLANNING
Roadmap

EM

DEVELOPMENT

Code

Projects / Airlines Data Analytics for Aviation Industry

All sprints                    📋 Backlog                          🖊 ☆ 🕐 0 days remaining   Complete sprint

                               ⊞ Board

                        None                                                  Insights

TO DO 3 ISSUES          IN PROGRESS 2 ISSUES        DONE 4 ISSUES ✓

As an analyst, I can create the    I will create various models an    As a user, can view the data

Data module              an analyst to accurately predict

O ADAFAI1-12             the flight delay                  O ADAFALIO

Project pages
As an analyst. I will import thethe data and preprocess the
Add shorcut              suitat
                         fram      O ADAFAI-17             del ay

Project settings                                          🟩 ADAfl1-11

                              ADAFA1-16                   As an analyst. I will visualize the

As an analyst will create the exploratory                number Of Airport present in    ADAFA1-1e
data analysis to identify the Number of
Airports in particular Country a ADAFA1-14    As an analyst, I will generate the    different cc-ulntries
result of flight delay prediction
You're in a team-managed project
Learn more              and i will devebop a dashboard

                        that display all the flight delays        O ADAFA'-13

**Board**

# 7. CODING & SOLUTIONING  (Explain the features added in the project along with code)

## 7.1 Feature 1

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

**CODE:**

```
from flask import render_template,Flask,request

import pickle


appl=Flask(__name__)

file=open("model.pkl","rb")


knn=pickle.load(file)

file.close()


@appl.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',e
```

```
levation_ft=type1,res=res)

return

render_template('index.html')

return 'OK' if __name__ ==

"__main__":

appl.run(debug=True)
```

**7.2 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 pickle dt =

pd.read_csv(r"C:/Users/Anjana/Downloads/airports.csv") dt

= dt.dropna()
```

```python
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()
```

# 8. TESTING

## 8.1. Test                                                                                    Cases

| Date | 03-Nov-22 |
|---|---|
| Team ID | PNT2022TMID17847 |
| Project Name | Project - Flight Aviation Industry |
| Maximum Marks | 4 marks |

| 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 detalis 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 | Funtional | 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 |

## 8.2 User Acceptance Testing:

# 1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the 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

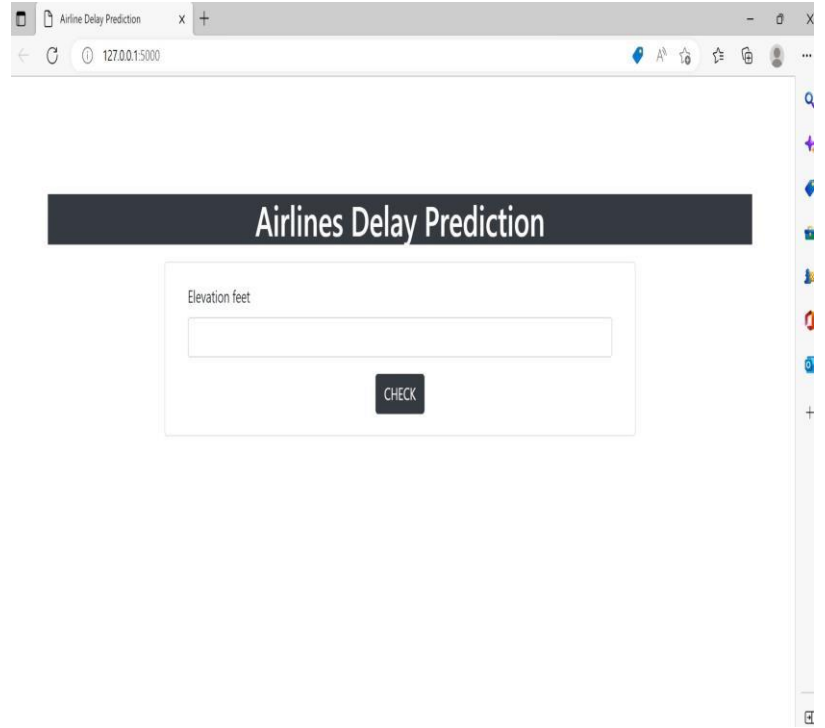This report shows the number of test cases that have passed, failed, and untested

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| Print Engine | 7 | 0 | 0 | 7 |
| Client Application | 30 | 0 | 0 | 30 |
| Security | 2 | 0 | 0 | 2 |
| 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 |
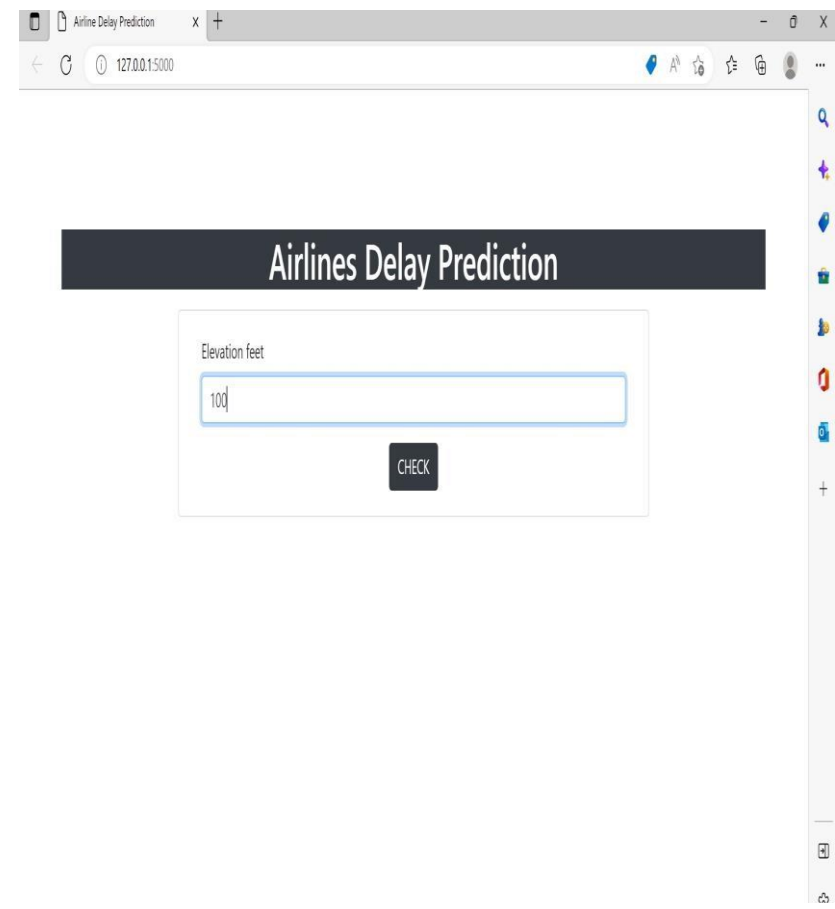
## 9. RESULTS

## 9.1 Performance Metrics

**Model Performance Testing:**

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

| S.No | Parameter | Screenshot |
|------|-----------|------------|
| 1 | Dashboard design |  |

| 2 | Data entry |  |
|---|---|---|
| 3 | Data responsiveness | The Delay rate is 67.0 minutes |

| 4 | **Descriptive report of delay analysis** |  |

## 10. ADVANTAGES & 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

Flight delays are a major problem in civil aviation. They incur direct and indirect costs, such as maintenance at the gate, extra fees for crew, food service, and lodging. They also affect passenger satisfaction. Flight delay is inevitable and it plays an important role in both profits and losses of the airlines. An accurate estimation of flight delay is critical for airlines because the results can be applied to increase customer satisfaction and the incomes of airline agencies. So, the prediction and analysis of flight delays are of great significance to airlines, passengers,

and airports. Predicting delays will help an airport to adjust resource allocations, quickly analyse the causes, and take measures to reduce or 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: 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()

@appl.route("/", methods=["GET","POST"])

def index():

  if request.method=="POST":

    myDict = request.form type1= myDict["elevation_ft"] pred =

```python
[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)
```

**temp.py:**

```python
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)
```

```python
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()
```

**index.html:**

```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/iJTQUOhcWr7x9JvoRxT2MZw1T"
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

```html
</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="formcontrol"

            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:**

```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/iJTQUOhcWr7x9JvoRxT2MZw1T"
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="formcontrol"

                    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>
```

**GITHUB AND PROJECT DEMO LINK:**

**Github Link:**

    **https://github.com/IBM-EPBL/IBM-Project-2038-1658424365**

**Project Demo Link:**

    **https://drive.google.com/file/d/1ndOjp3JAZEWnH4M4csyHGg68NGQUwrCg/view?usp=share_link**