

PROJECT REPORT

**PROJECT TITLE : DEVELOPING A FLIGHT DELAY
PREDICTION MODEL USING MACHINE LEARNING.**

TEAM ID : PNT2022TMID02840

**TEAM MEMBERS : VIGNESH B (TEAM LEAD)
SUDHARSON
YASHWANTH
VARDHMAN JAIN**

INTRODUCTION

1. Project overview

In the past two decades, air travel has become increasingly popular and has become increasingly accessible to people all over the world. Aviation has evolved to become one of the most important forms of transportation, with its efficiency and reliability making it the preferred choice for long-distance travel. However, flight delays are a major problem in the aviation industry, and they are becoming more and more common. In the United States, the average delay has increased by 30% since 2000, and the cost of delays has risen to \$32 billion per year. There are many factors that can contribute to flight delays, such as weather, air traffic control, and maintenance. However, the most common cause of delays is simply that the plane is not ready to take off on time. This is usually due to the fact that the plane is not fully loaded with passengers, baggage, and fuel. It can also be due to technical problems with the plane itself. The goal of this project is to develop a machine learning model that can predict flight delays. The model will be trained on a dataset of historical flight data, and it will be used to predict the delay of a flight before it even takes off.

2. Purpose

The purpose of this project is to develop a machine learning model that can predict flight delays. The model will be trained on a dataset of flight information, and will be used to predict the arrival delay of flights. The project is divided into two parts:

1. Data pre-processing and feature engineering
2. Model training and testing

In the first part, the data will be pre-processed and features will be engineered. This part will be focused on cleaning the data and making sure that the features are suitable for training the machine learning model. In the second part, the machine learning model will be trained and tested. This part will focus on tuning the model to get the best performance possible.

LITERATURE SURVEY

1. Existing problem

Airlines, airports, and passengers would all benefit from a more accurate flight delay prediction model. Currently, models used by airlines to predict flight delays are based on historical data and do not take into account real-time data such as weather conditions. This can lead to delays and cancellations, as well as increased costs for airlines.

2. References

1. Khaksar, H., & Sheikholeslami, A. (2017). Airline delay prediction by machine learning algorithms. *Scientia*
2. Esmaeilzadeh, E., & Mokhtarimousavi, S. (2020). Machine learning approach for flight departure delay prediction and analysis. *Transportation*

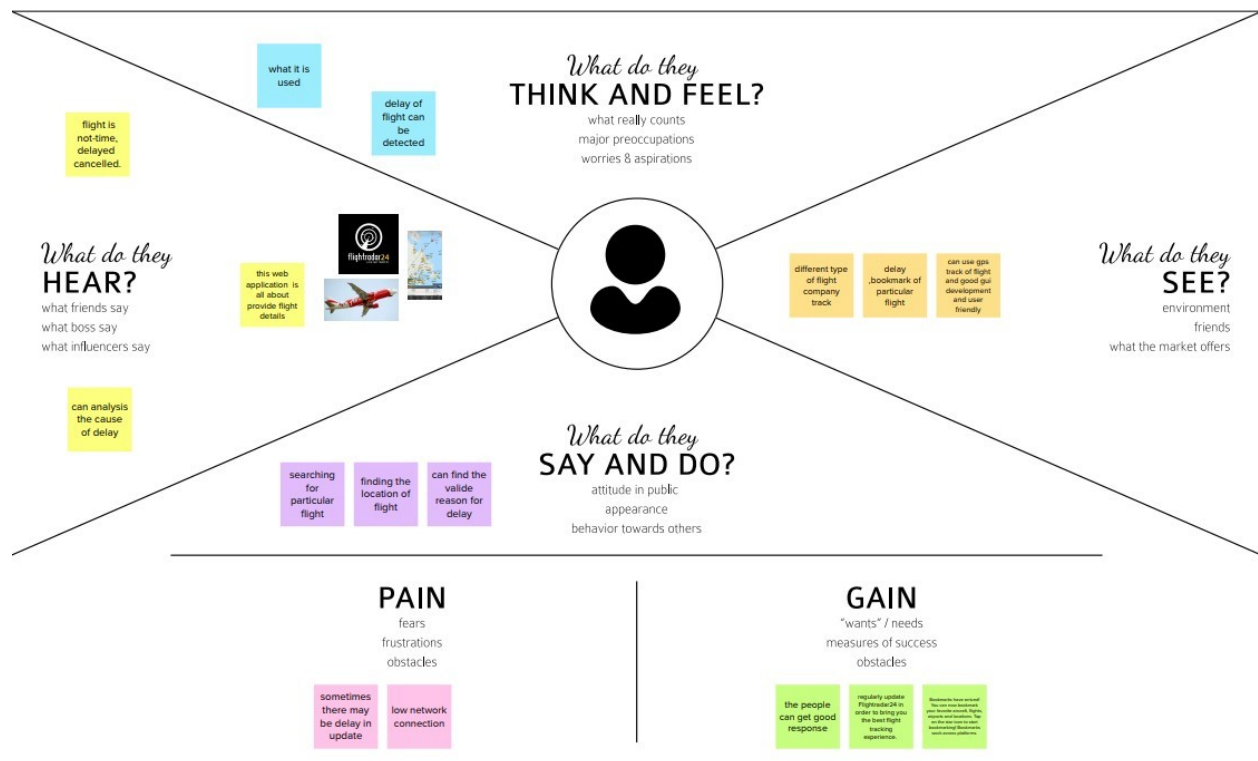
Research Record: Journal of the Transportation Research Board, 2674(8), 145–159.

- [3] M. Al-Tabbakh, S., M. Mohamed, H., & H. El, Z. (2018). Machine learning techniques for analysis of Egyptian flight delay. *International Journal of Data Mining & Knowledge Management Process*, 8(3), 01–14’
4. Ye, B., Liu, B., Tian, Y., & Wan, L. (2020). A methodology for predicting aggregate flight departure delays in airports based on supervised learning. *Sustainability*, 12(7), 2749.
5. ATLIOĞLU, M. C., BOLAT, M., ŞAHİN, M., TUNALI, V., & KILINÇ, D. (2020). Supervised learning approaches to flight delay prediction. *Sakarya University Journal of Science*.
6. Yu, B., Guo, Z., Asian, S., Wang, H., & Chen, G. (2019). Flight delay prediction for commercial air transport: A deep learning approach. *Transportation Research Part E: Logistics and Transportation Review*, 125, 203–221.

Problem Statement Definition

The main objective of the model is to predict flight delays accurately in order to optimize flight operations and minimize delays. These delays are responsible for large economic and environmental losses.

IDEATION AND PROPOSED SOLUTION



Empathy Map Canvas

Ideation and Brainstorming

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

Yashwanth

- Airport capacity
- Airport location
- Killboard
- Random forest

Sudharson

- Flight direction
- Cascading delay
- Random forest
- Stacking algorithm

Vardhman

- Date & time
- Airplane frequency
- Statistical
- Neural Network

Vignesh

- Weather conditions
- Time of the year
- Neural based
- Time series

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

10 minutes

Factors influencing flight delay

- Weather conditions
- Time of the year
- Date & time
- Airplane frequency
- Flight direction
- Cascading delay
- Airport capacity
- Airport location

Prediction models

- Linear
- Ada
- Ada
- Neural network

Classification models

- Naive Bayes
- K-Nearest
- Stacking algorithm
- Random Forest

Other models

- SV
- Neural Network
- Support Vector
- Neural Net

Prioritize

Now rank each idea on the same page about which is most important. Moving forward, place your ideas on this grid to determine which ideas are important and which are feasible.

10 minutes

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

Weather

- Choose different routes when the weather conditions are bad

Facilities and resources in airport

- Construct large runways
- Construct bigger airports to support large number of flights
- Arrange alternate flights
- Construct many check-in counters to avoid queues

Customer

- Use apps to find out how often flight is typically delayed
- Avoid travelling during peak season
- Schedule flights for the middle of the week to avoid traffic
- Always book a back up flight
- Choose right airlines

Airlines

- Inform the range of timing beforehand
- Check the flight conditions before take off
- Avoid many flights in the runway
- Flights should be checked for any mechanical issues

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mind.



Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

- A. Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
- B. Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

- Strategy blueprint**
Define the components of a new idea or strategy.
[Open the template](#)
 - Customer experience journey map**
Understand customer needs, motivations, and obstacles for an experience.
[Open the template](#)
 - Strengths, weaknesses, opportunities & threats**
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
[Open the template](#)
- [Share template feedback](#)



Proposed Solution

S.No	Parameter	Description
1.	Problem Statement	The main objective of the model is to predict flight delays accurately in order to optimize flight operations and minimize delays. These delays are responsible for large economic and environmental losses.
2.	Idea/Solution description	Using a machine learning model, we can predict flight arrival delays. A flight is considered to be delayed when the difference between scheduled and actual arrival times is greater than 15 minutes.
3.	Novelty/Uniqueness	A user friendly app that provides accurate predictions of the delay time which can be easily accessible.
4.	Social Impact/Customer Satisfaction	Predicting flight delays can improve airline operations and passenger satisfaction, which will result in a positive impact on the economy.
5.	Business Model (Revenue Model)	Make revenue from commercial advertisements and sell the model to airline companies.
6.	Scalability of the solution	This model can handle any number of inputs and provide the respective outputs.

Problem Solution Fit

Project Title: Flight delay prediction using ML

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMID02840

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) Who is your customer? i.e. working parents of 0-5 y.o. kids All passengers using our flight and the hospitality centers and other businesses in the airport are our potential customers	6. CUSTOMER CONSTRAINTS What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices Maintaining a separate application for receiving information about flight delays	5. AVAILABLE SOLUTIONS Which solutions are available to the customers when they face the problem? as needed to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notepad Existing solutions does not include a machine learning algorithm to predict delays and customers are not alerted in an automated manner.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different ones To predict flight delays accurately so that passengers could adjust their time and schedule their events accordingly	9. PROBLEM ROOT CAUSE What is the real reason that this problem exists? What is the basic story behind the need to do this job? i.e. customers have to do it because of the change in regulations The problem exists because of the unexpected delays of flights such as due to unforeseen weather conditions, cascading delays, etc...	7. BEHAVIOUR What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer; calculate usage and benefits; indirectly associated: customers spend free time on voluntary work (e.g. Greenpeace) To develop a model that is good at predicting flight delays and cancellation of flights considering various factors that could potentially affect the deviation of flights from their scheduled time	
Focus on J&P, tap into BE, understand RC	3. TRIGGERS What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news Waiting for a flight for too long time makes them get frustrated and distressed Prior information of flight delays would help.	10. YOUR SOLUTION If you are working on an existing business, write down your current solution first. Fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. Our solution uses machine learning models such as Isolation forest algorithm so as to capture anomalies in the dataset thereby predicting the delays and cancellation details. Users will be able to check the available and delayed flight details in the app/website in real-time	8. CHANNELS OF BEHAVIOUR 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. Users will check for flight delay and cancellation information	Focus on J&P, tap into BE, understand RC
	4. EMOTIONS: BEFORE / AFTER How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design. Before : Customers are disappointed and annoyed by the delay of flights. After : Customers now know the delay information in prior and therefore they use it to adjust their plan(passengers) and provide appropriate services to passengers(businesses)	Identify strong TR & EM		
Identify strong TR & EM		Identify strong TR & EM		

REQUIREMENT ANALYSIS

1. Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User registration & login	Registration & login of passengers via Google with email id and password
FR-2	Detailed arrival and departure time of flights	With the flight no and name, the passenger can see the details (time, boarding station, etc) of his/her in the dashboard.

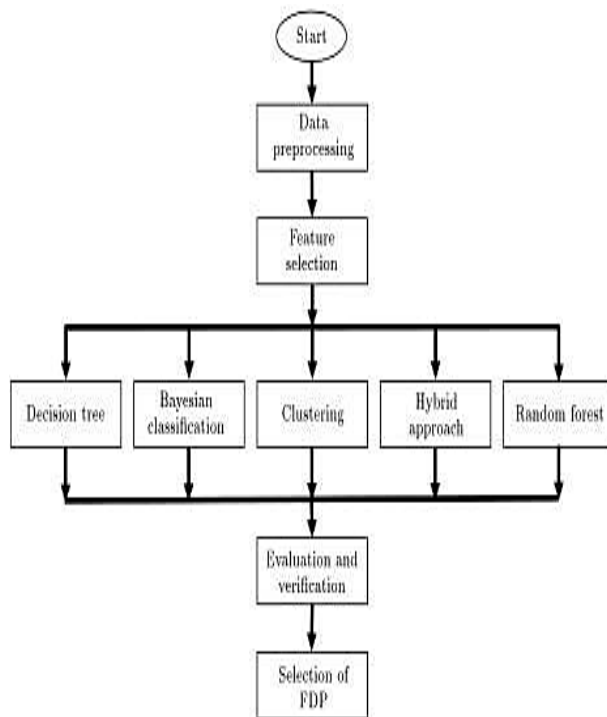
FR-3	Intimate the accurate flight timings to passengers	With the help of various machine learning algorithms, when given the right input features (actual arrival time & departure time, scheduled time, etc) we can predict the delay in time of the flight which will also be shown in the dashboard and updated time-to-time.
FR-4	Airline helpdesk provide alternatives	The contact details of different airlines will be provided, The passenger will also be able to look for any alternative flight in case the flights get cancelled.
FR-5	Passenger feedback	The feedback will be got from the users or how the application was to use, with their feedback and suggestions, we can improve the application further.

2. Non-Functional requirement

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The application will have an easy-to-use GUI. Users will find it simple to comprehend and utilize all the capabilities of the application.
NFR-2	Security	The technique known as database replication will be utilised for the application security to ensure the safety of all crucial data
NFR-3	Reliability	The application will be consistent in all scenarios and work without fail in any environment
NFR-4	Performance	The applications response time is direct & faster which is determined by the efficiency of the implemented machine algorithm.
NFR-5	Availability	The application will be accessible to users 24 hours a day, 7 days a week without interruption. They can access it from any part of the world with proper internet.
NFR-6	Scalability	The application will be able to handle a rise in the no. of users & generate higher versions.

PROJECT DESIGN

Data Flow Diagram



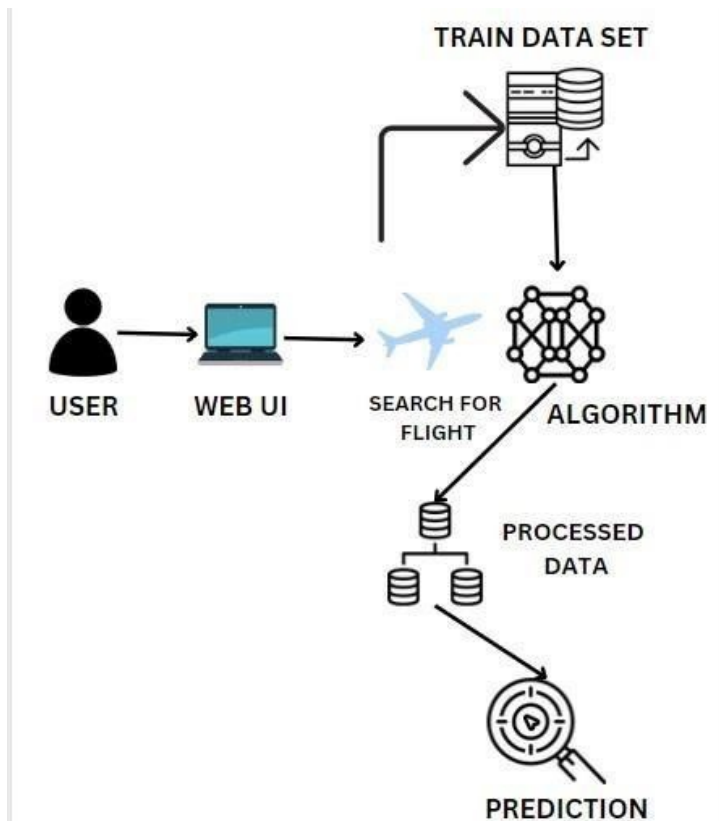
Solution Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.

- Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture Diagram:



User Stories

User Type	Functional requirement	User story number	User story/task	Acceptance criteria	Priority	Release
Customer (Mobile user, Web user, Care executive,	Registration	USN-1	As a user, I can register for the application by entering	I can access my account/ dashboard	High	Sprint-1

Administrator)			my mail, password, and confirming my password			
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
	Dashboard	USN-3	As a user, I can register for the application through internet	I can register & access the dashboard with Internet login	Low	Sprint-2
			application through Gmail can log into	Gmail Log in with my id	Medium	Sprint-1

			application through Gmail	Gmail		
	Login	USN-5	As a user, I can log into	I can login with my id	High	Sprint-1

			the application by entering email & password	and password		
--	--	--	--	--------------	--	--

PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration and Login	USN-1	As a new user, I can register for the application by entering my email and my password.	2	High	Vignesh
Sprint-2	Confirmation email	USN-2	As a user, I will receive confirmation email once I have registered for the application	2	Medium	Yashwanth
Sprint-1	User login	USN-3	As a user, I can login into the application by entering the registered email-id and password	2	High	Vardhman
Sprint-2	Admin Panel	USN-4	As an admin, I can authenticate the registration and login credentials of the passengers	2	High	Sudharson
Sprint-3	Arrival and Departure time of flights	USN-5	As a user, I can find all the details of a specific flight with its number or name	2	High	Vignesh
Sprint-3		USN-6	As a user, I can find exactly how long the flight will be delayed	2	High	Yashwanth
Sprint-4	Helpdesk	USN-7	As a customer care executive, I can provide the contact details of the airlines	1	Medium	Sudharson

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4		USN-8	As a passenger, I can find alternative flights to the destination that are available	1	High	Vardhman Sudharson Vignesh Yashwanth
Sprint-4	Feedback	USN-9	As a user, I can provide my suggestions and feedback for the improvement of the application	2	Medium	Vignesh

CODING & SOLUTIONING

Feature 1

- IBM Watson Platform
- Node red
- Web UI

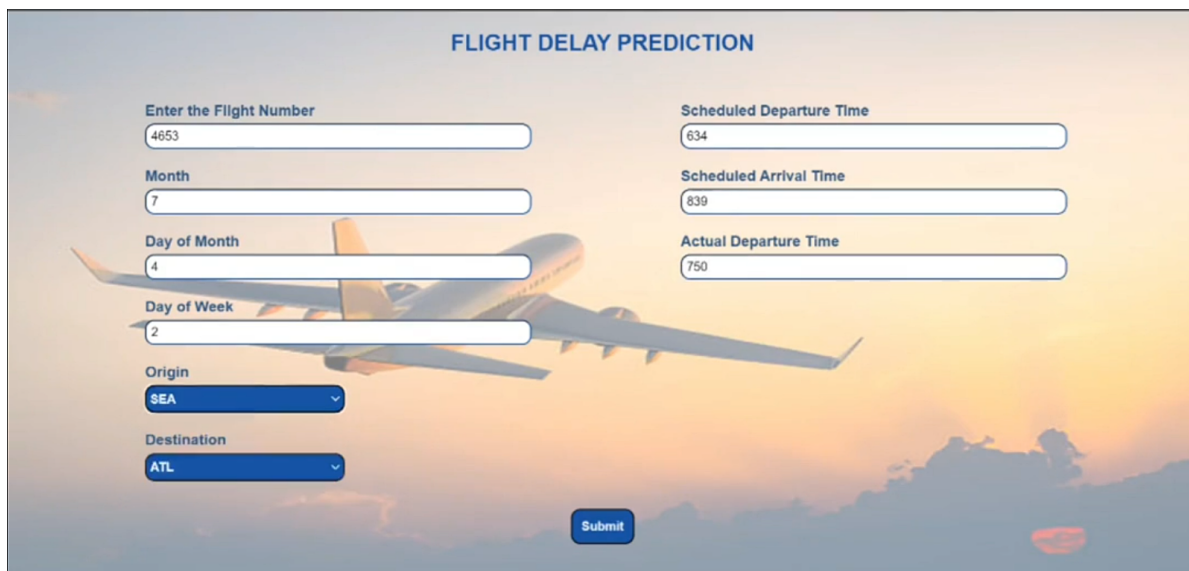
- Python code-Flask
- HTML
- CSS

Feature 2

- Data entry page
- Prediction result page

TESTING AND RESULTS

Test Cases Test case 1:



The screenshot shows a web form titled "FLIGHT DELAY PREDICTION" set against a background image of an airplane flying over a sunset sky. The form contains several input fields and dropdown menus for flight data entry.

Field Label	Value
Enter the Flight Number	4653
Month	7
Day of Month	4
Day of Week	2
Origin	SEA
Destination	ATL
Scheduled Departure Time	634
Scheduled Arrival Time	839
Actual Departure Time	750

A "Submit" button is located at the bottom center of the form.

Test case 2:



ADVANTAGES

- Machine learning can predict flight delays with a high degree of accuracy.
- Machine learning can help identify causes of flight delays.
- Machine learning can help reduce the number of flight delays.
- Machine learning can help improve the efficiency of airport operations.

DISADVANTAGES

- Machine learning models can be complex and difficult to understand.
- Machine learning models require a large amount of data to train and can be time-consuming to develop.
- Machine learning models can be prone to overfitting, meaning they may not generalize well to new data.
- Machine learning models can be expensive to develop and maintain.

CONCLUSION

In this project, we use flight data, weather, and demand data to predict flight departure delay. Our result shows that the Logistic Regression yields the best performance compared to the SVM model. Somehow the SVM model is very time consuming and does not necessarily produce better results. In the end, our model correctly predicts 91% of the non-delayed flights. However, the delayed flights are only correctly predicted 41% of time. As a result, there can be additional features related to the causes of flight delays that have not yet been discovered using our existing data sources.

In the second part of the project, we can see that it is possible to predict flight delay patterns from just the volume of concurrently published tweets, and their sentiment and objectivity. This is not unreasonable; people tend to post about airport delays on Twitter; it stands to reason that these posts would become more frequent, and more profoundly emotional, as the delays get worse. Without more data, we cannot make a robust model and find out the role of related factors and chance on these results. However, as proof of concept, there is potential for these results. It may be possible to routinely use tweets to ascertain an understanding of concurrent airline delays and traffic patterns, which could be useful in a variety of circumstances.

FUTURE SCOPE

This project is based on data analysis from the year 2008. A large dataset is available from 1987-2008 but handling a bigger dataset requires a great amount of preprocessing and cleaning of the data. Therefore, the future work of this project includes incorporating a larger dataset. There are many ways to preprocess a larger dataset like running a Spark cluster over a server or using

cloud-based services like AWS and Azure to process the data. With the new advancement in the field of deep learning, we can use Neural Networks algorithm on the flight and weather data. Neural Network works on the pattern matching methodology. It is divided into three basic parts for data modelling that includes feed forward networks, feedback networks, and self-organization network. Feed-forward and feedback networks are generally used in the areas of prediction, pattern recognition, associative memory, and optimization calculation, whereas self-organization networks are generally used in cluster analysis. Neural Network offers distributed computer architecture with important learning abilities to represent nonlinear relationships.

Also, the scope of this project is very much confined to flight and weather data of United States, but we can include more countries like China, India, and Russia. Expanding the scope of this project, we can also add the flight data from international flights and not just restrict ourselves to domestic flights.

APPENDIX

1. Source Code

Flightdelay.html:

```
<!DOCTYPE
html>

<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link rel="stylesheet" href="{{ url_for('static',filename='styles/styles.css') }}">
    <script src="{{url_for('static', filename='styles/delaypredict.js')}}"></script>
    <title>Flight Delay Prediction</title>
</head>
<body id="flight-form">
<h2 id="main-head" class="centered-head">FLIGHT DELAY PREDICTION</h2>

```

```
<form name="flightForm" action="/result" method="POST" target="_blank">
  <div id="form-content">
    <div id="block1">
      <div class="detail-container">
        <label for="fno" class="label-item">Enter the Flight Number</label>
        <br>
        <input type="number" id="fno" name="fno" class="text-input">
      </div>
      <div class="detail-container">
        <label for="month" class="label-item">Month</label>
        <br>
        <input type="number" id="month" name="month" class="text-input">
        <div class="alert-text" id="month-valid">Enter a valid month</div>
      </div>
      <div class="detail-container">
        <label for="daym" class="label-item">Day of Month</label>
        <br>
        <input type="number" id="daym" name="daym" class="text-input">
        <div class="alert-text" id="daym-valid">Enter a valid day</div>
      </div>
      <div class="detail-container">
        <label for="dayw" class="label-item">Day of Week</label>
        <br>
        <input type="number" id="dayw" name="dayw" class="text-input">
        <div class="alert-text" id="dayw-valid">Enter a valid day</div>
      </div>
      <div class="detail-container">
        <label for="org" class="label-item">Origin</label>
        <br>
        <select id="org" name="org" class="select-input">
          <option value="ATL" class="option-item">ATL</option>
          <option value="SEA" class="option-item">SEA</option>
          <option value="DTW" class="option-item">DTW</option>
          <option value="MSP" class="option-item">MSP</option>
          <option value="JFK" class="option-item">JFK</option>
        </select>
      </div>
      <div class="detail-container">
        <label for="dest" class="label-item">Destination</label>
        <br>
        <select id="dest" name="dest" class="select-input" onblur="validateDest()">
          <option value="ATL" class="option-item">ATL</option>
```

```
<option value="SEA" class="option-item">SEA</option>
<option value="DTW" class="option-item">DTW</option>
<option value="MSP" class="option-item">MSP</option>
<option value="JFK" class="option-item">JFK</option>
</select>
<div class="alert-text" id="dest-valid">Enter different
</div>
</div>
<div id="block2">
  <div class="detail-container">
    <label for="sdt" class="label-item">Scheduled Departure
    <br>
    <input type="number" id="sdt" name="sdt" class="text-input" value="0" />
    HHMM">
    <div class="alert-text" id="sdt-valid">Enter a valid time
    </div>
    <div class="detail-container">
      <label for="sat" class="label-item">Scheduled Arrival Time
      <br>
      <input type="number" id="sat" name="sat" class="text-input" value="0" />
      HHMM">
      <div class="alert-text" id="sat-valid">Enter a valid time
      </div>
      <div class="detail-container">
        <label for="adt" class="label-item">Actual Departure Time
        <br>
        <input type="number" id="adt" name="adt" class="text-input" value="0" />
        HHMM">
        <div class="alert-text" id="adt-valid">Enter a valid time
        </div>
      </div>
    </div>
    <div id="submit-button">
      <input type="submit" value="Submit" id="submit" class="button" onclick="submitForm()" />
    </div>
  </form>
</body>
</html>
```

Result.html:

```
<!doctype
html>

<html>
<head>
    <title>Flight Delay Prediction - Result</title>
    <link rel="stylesheet" href="{{
url_for('static',filename='styles/result_styles.css') }}">
</head>
<body>
    Your flight will likely be on time</div>
    {% endif %}
    {% if prediction == 1.0 %}
    <div class="pred_result" id="result_1">Your flight is likely to be delayed</div>
    {% endif %}
</body>
</html>
```

lbm_app.py:

```
from flask import Flask, render_template,
request

import csv, pickle
import pandas as pd
import joblib
import numpy as np

import requests

# NOTE: you must manually set API_KEY below using i
API_KEY = "I6vmW4nmyS35HD92jVtP81M_Ltw4dt5YoSFGBSpT
token_response = requests.post('https://iam.cloud.i
    API_KEY, "grant_type": 'urn:ibm:params:oauth:grant
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Auth
```

```

app = Flask(__name__)

@app.route('/')
def home():
    return render_template('Flightdelay.html')

@app.route('/result', methods = ['POST'])
def predict():
    fl_num = int(request.form.get('fno'))
    month = int(request.form.get('month'))
    dayofmonth = int(request.form.get('daym'))
    dayofweek = int(request.form.get('dayw'))
    sdeptime = request.form.get('sdt')
    adeptime = request.form.get('adt')
    arrtime = int(request.form.get('sat'))
    depdelay = int(adeptime) - int(sdeptime)
    inputs = list()
    inputs.append(fl_num)
    inputs.append(month)
    inputs.append(dayofmonth)
    inputs.append(dayofweek)
    if (depdelay < 15):
        inputs.append(0)
    else:
        inputs.append(1)
    inputs.append(arrtime)
    origin = str(request.form.get("org"))
    dest = str(request.form.get("dest"))
    if(origin=="ATL"):
        a=[1,0,0,0,0]
        inputs.extend(a)
    elif(origin=="DTW"):
        a=[0,1,0,0,0]
        inputs.extend(a)
    elif(origin=="JFK"):
        a=[0,0,1,0,0]
        inputs.extend(a)
    elif(origin=="MSP"):
        a=[0,0,0,1,0]
        inputs.extend(a)
    elif(origin=="SEA"):
        a=[0,0,0,0,1]
        inputs.extend(a)

```

```

        if(dest=="ATL"):
            b=[1,0,0,0,0]
            inputs.extend(b)
        elif(dest=="DTW"):
            b=[0,1,0,0,0]
            inputs.extend(b)
        elif(dest=="JFK"):
            b=[0,0,1,0,0]
            inputs.extend(b)
        elif(dest=="MSP"):
            b=[0,0,0,1,0]
            inputs.extend(b)
        elif(dest=="SEA"):
            b=[0,0,0,0,1]
            inputs.extend(b)

# NOTE: manually define and pass the array(s)
payload_scoring = {"input_data": [{"fields":

        response_scoring = requests.post('https://us
        'Bearer ' + mltoken})
        print("Scoring response")
        predictions = response_scoring.json()
        print(response_scoring.json())

        predict = predictions['predictions'][0]['val

        return render_template('/result.html', predi

if __name__ == '__main__':
    app.run(debug=True)

```

Github Link

Github Link : <https://github.com/IBM-EPBL/IBM-Project-24445-1659942916>

Project demo Link : <https://github.com/IBM-EPBL/IBM-Project-24445-1659942916/tree/main/FInal%20Deliverables>