Project Report Format

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PROJECT REPORT

Airlines Data Analytics for Avaition Industry

1. INTRODUCTIO

1.1PROJECT OVERVIEW

In simple words, Airlines Data Analytics for Avaition Industry entails all the delays and activities that makes your life easier by helping you by giving analysis of flight delays, departure time , arrival time.
The project mainly focuses on the air traffic and problems based on the events that causes discomfort to passengers and to reduce the high prolific economic losses. This applications will provide better Airline and AirPort services and to avoid delays in Air Travel across different locations at Municipality level. The aim is to provide airports, airlines, and the travelling public with a neutral, third-party view of which airlines are delivering on their promise to get passengers from Point A to Point B on-time.

1.2 PURPOSE

A flight delay is when an airline flight takes off and/or lands later than its scheduled time. The Federal Aviation Administration (FAA) considers a flight to be delayed when it is 15 minutes later than its scheduled time. A cancellation occurs when the airline does not operate the flight at all for a certain reason. This has led to phenomenal growth in air traffic and on the ground. An increase in air traffic growth has also resulted in massive levels of aircraft delays on the ground and in the air. These delays are responsible for large economic and environmental losses. The main objective of the model is to predict flight delays accurately in order to optimize flight operations and minimize delays. The problem of flight delay prediction is approached most often by predicting a delay class or value. However, the aviation industry can benefit greatly from probabilistic delay predictions on an individual flight basis, as these give insight into the uncertainty of the delay predictions.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

1.AIRLINE MEMBER CUSTOMER VALUE ANALYSIS:

In recent years, the vigorous development of the transportation industry has attracted a large number of customers, especially those in the aviation industry. However, for airlines, the pressure of competition has increased year by year; on the other hand, there are also competing relationships among different airlines. Therefore, for airlines, how to retain customers has become the key to the problem. In fact, using the various customer factors provided by the existing churn customer information data set can use the data visualization means of data analysis to analyse the behaviour of churn customers. In addition, relevant marketing strategies can be proposed to improve the business level as much as possible.

2.PREDICTIVE ANALYTICS PLATFORM FOR AIRLINE INDUSTRY:

The research is to develop accurate demand forecasting model to control the availability in Airline industry. The primary outcome of the model is that the airline organization can maximize the revenue by controlling the availability. The product in airline industry is the seat, which is an expensive, unstock able product. The demand for the seats is almost uncertain, the capacity is constraint and difficult to increase and the variable costs are very high. Hence the priority of the expected demand forecast is very high for airline industry. An accurate mechanism is to predict the revenue for future months of ODs is done using fare and passenger data. The revenue is derived by the number of passengers and fares they pay which vary for each flight. Hence most of the information is available, however changing market conditions is an unknown variable which can have a significant impact on passenger travel patterns. Through this research they are going to design and develop the best fit model to forecast flight OD level passenger demand based on the historical data.

3. EXPLORATORY DATA ANALYSIS ON AVIATION DATASET

The usage of big data analytics is booming today, with its ability to be used to draw useful insights from past data research. Its uses in the aviation industry have a wide array of applic ations ranging from predicting flight delays to detecting faults in airplane parts. In this paper, we conducted exploratory data analysis on flight dataset to draw inferences on arrival and departure delays and to identify relationships between flight timings and delays. Using the flight delay data, we identified which flight is mostly prone to delays.
The arrived upon conclusions are useful for selecting flights in the future.

4. DATA SCIENCE AND ANALYTICS IN AVIATION

Data science and analytics are attracting more and more attention from researchers and practitioners in recent years. Due to the rapid development of advanced technologies nowadays, a massive amount of

real time data regarding flight information, flight performance, airport conditions, air traffic conditions, weather, ticket prices, passenger's comments, crew comments, etc., are all available in different flight performance monitoring systems, operational systems of airlines and airports, and social media platforms. Development of data analytics in aviation and related applications are also growing rapidly. This paper concisely examines data science and analytics in aviation studies in several critical areas, namely big data analysis, air transport network management, forecasting, and machine learning. The papers featured in this special issue are also introduced and reviewed, and future directions for data science and analytics in aviation are discussed.

2.2 REFERENCES.

https://ieeexplore.ieee.org/document/9410686
https://ieeexplore.ieee.org/document/9357244
https://ieeexplore.ieee.org/document/9738868

AIRLINE MEMBER CUSTOMER VALUE ANALYSIS:
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Publisher: IEEE
Conference Location: Malabe, Sri Lanka
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Publisher: IEEE
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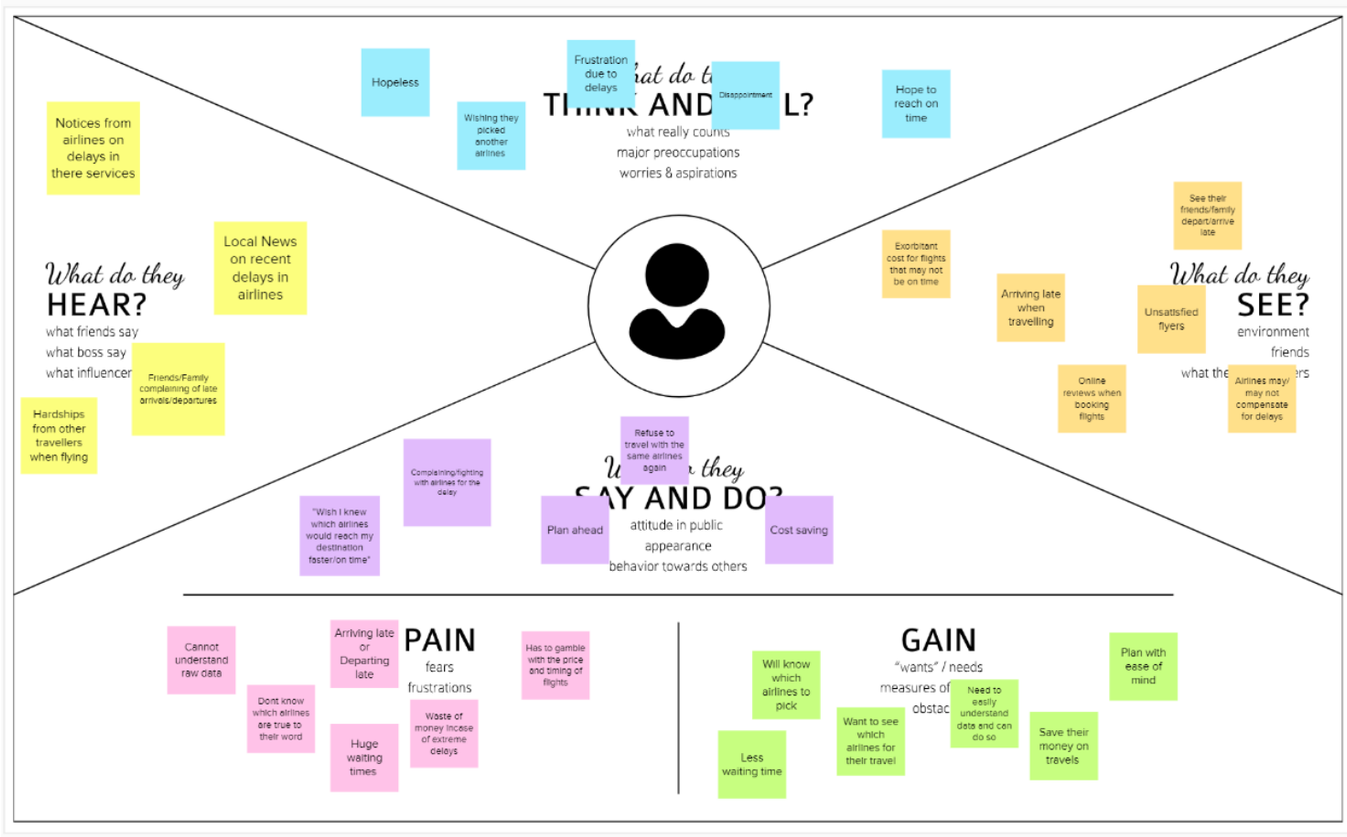
2.3 PROBLEM STATEMENT DEFINITION

Analysis of flight delay and causal factors is crucial in maintaining airspace efficiency and safety. However, delay samples are not independent since they always show a certain aggregation pattern. Therefore, this study develops a novel spatial analysis approach to explore the delay and causal factors which is able to take dependence and the possible problem involved including error correlation and variable lag effect of causal factors on delay into account using data Analytics. Air travel has been increasingly preferred among travellers, mainly because of its speed and in some cases comfort. This has led to phenomenal growth in air traffic and on the ground.An increase in air traffic growth has also resulted in massive levels of aircraft delays on the ground and in the air.

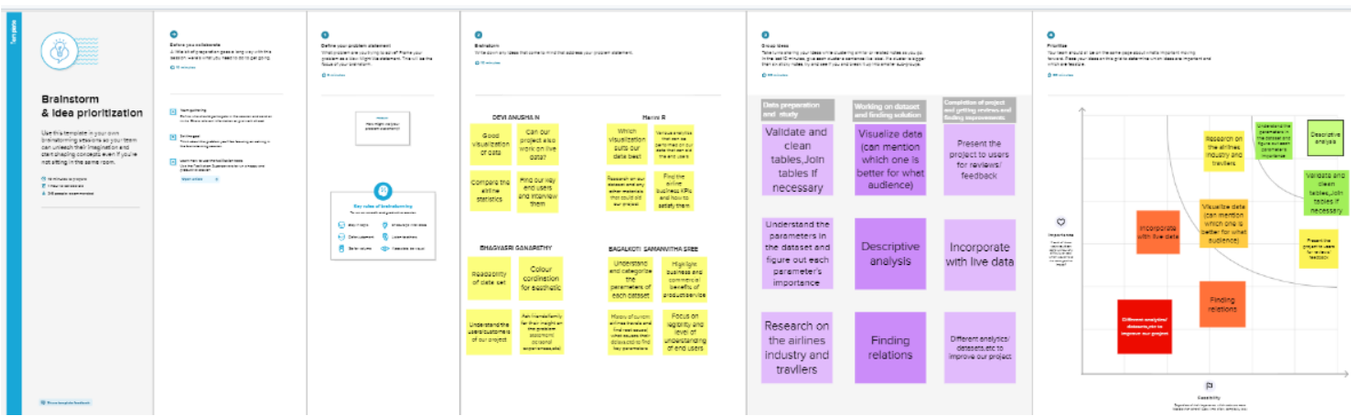
- These delays are responsible for large economic losses. It's important to provide better Airline and AirPort services and avoid delays in Air Travel across different locations and promise to get passengers from Location A to Location B on time.

IDEATION & PROPOSED SOLUTION

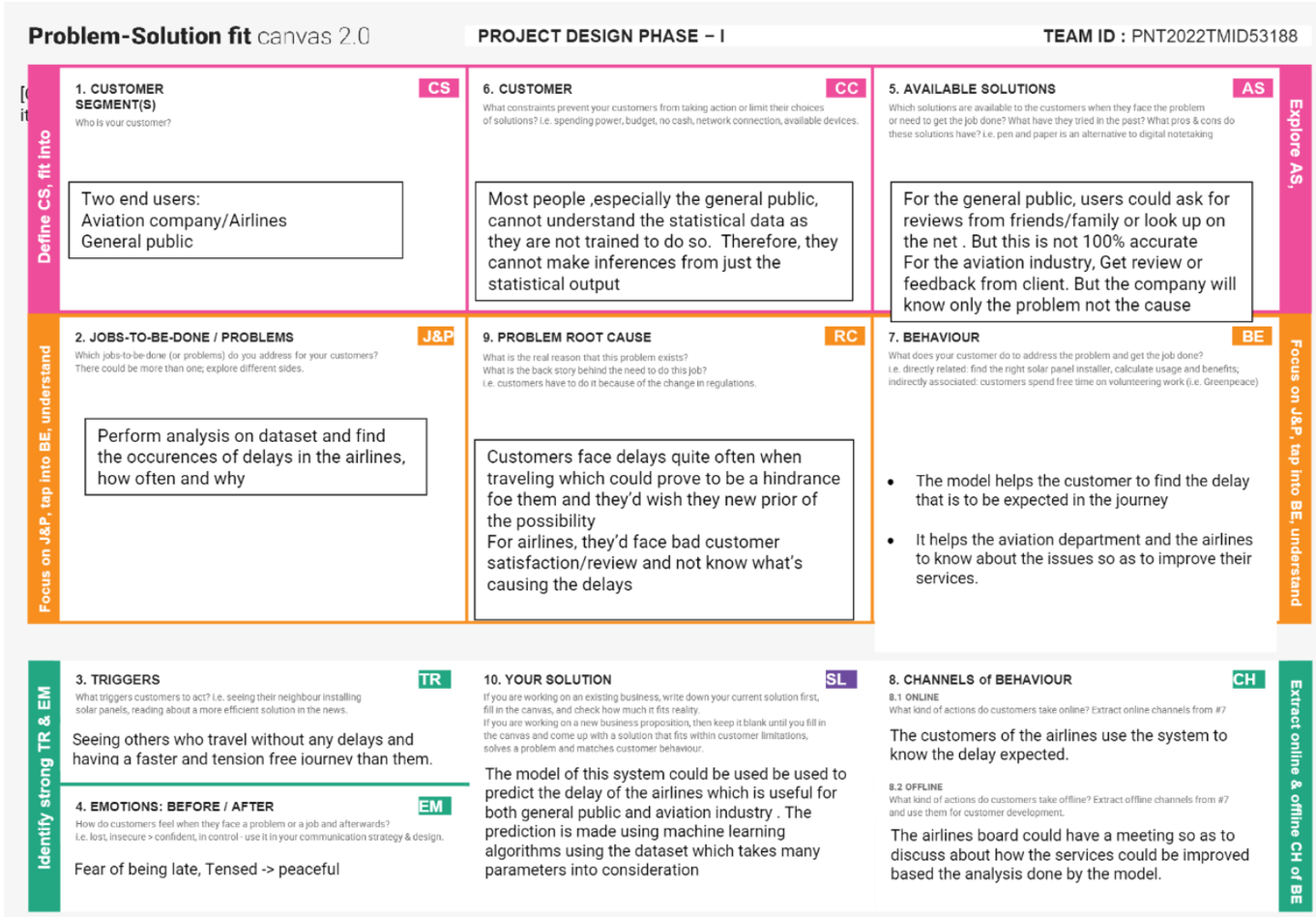
3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING



3.3 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS
4.1Functional Requirements And Non Functional Requirements

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Website
FR-2	User Authentication	Authenticate users's attempt to login using the database
FR-3	Data Analysis	Performing Predictive and Diagnostic analysis on the dataset
FR-4	Visualization	Perform various visualizationntechniques after dataset has been worked on
F4-5	Display	Display the visualization to the user via the website

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The interface will be easy to use and understandable
NFR-2	**Security**	Website will authenticate the user via user id and password
NFR-3	**Reliability**	Software can run on any platform under any conditions
NFR-4	**Portability**	Website is portable as it can be seen from any device
NFR-5	**Availability**	Website will be available as long as there is internet connection
NFR-6	**Scalability**	Possible to scale this further with some more data analytics and features to the website

5.PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

Data Flow Diagrams:

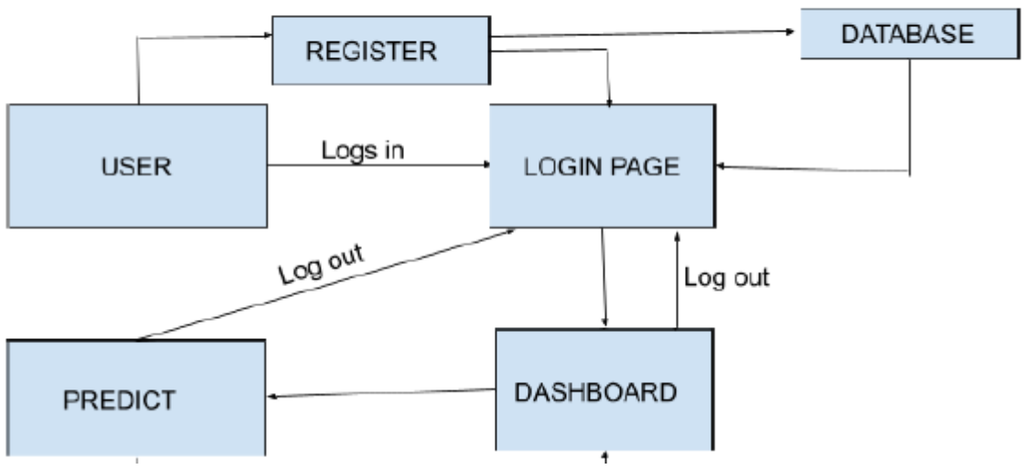
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

The general flow goes like this:

- The user can create a signup or Log in
- After logging in the user can view analysis of flights delay ,departure delay , arrival etc.,
- The user can view the analysis in the form of graphs as the data entered will be visualized.
- Then the user can logout.

5. PROJECT DESIGN

5.1 Data Flow Diagram

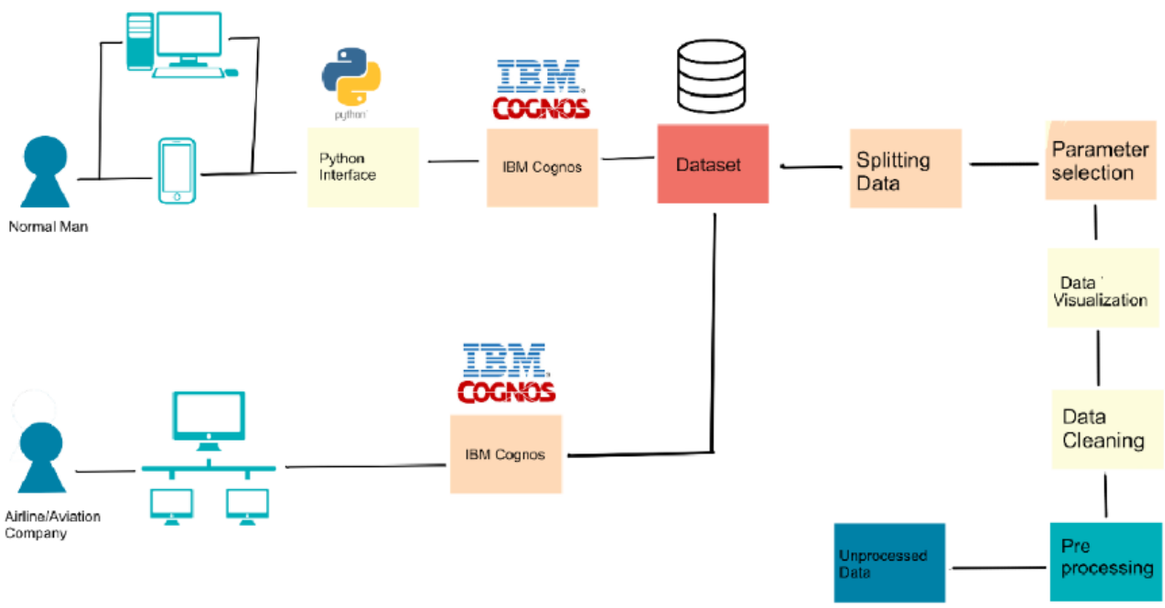


5.2 SOLUTION AND TECHNICAL

ARCHITECTURE Solution Architecture:

S.No	Component	Description	Technology
1	User Interface	User interacts using web application UI	HTML,CSS,JavaScript
2	Application logic1	Logic for preprocessing	Python,numpy
3	Application logic2	Logic for analyzing	Data visualization analysis using bigdata python
4	Application Logic3	Delay prediction	Python using pandas and matplotlib,seaborn
5	Database	Data base contains flight details and user credentials	Mysql
6	storage	File storage requirements	IBM block storage ,local file system

TECHNICAL ARCHITECTURE



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	Medium	Sprint-1
		USN-3	As a user, I can register for the application mail ID		High	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password	I can get to access my web portal	High	Sprint-1
	Dashboard	USN-5	As a user ,I can get to know what my dashboard consists of.	I can register & access the dashboard with Successful Login	Low	Sprint-2
Customer Care Executive	Aviation Department	USN-6	As a customer, I will be assisted in case of any issues faced. The aviation department will be aviation department will be responsible for the process.	The customer can reach the support in case of any issues.	Low	Sprint-4
Customer	General Public	USN-7	As a customer, I will be able to check about the delays in the website.	I can check for any delays that could occur.	High	Sprint-3
	Airlines	USN-8	As a customer(airlines), I should be able to see the analysis, i.e., the trends and the dashboards.	I can view the interactive dashboards	High	Dprint-4

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password. Once registered, I can either log in as an airlines employee or an ordinary man(based on details submitted)	2	High	Devi Anusha Harini R
Sprint-2	Analyze	USN-2	Data from the dataset will be cleaned and analyzed(parameter selection,etc)	1	High	Samanvitha Sree Harini R
Sprint-3	Visualization	USN-3	Perform various visualization techniques and present said data	2	High	G Bhagyashri Devi Anusha
Sprint-4	Prediction/Analysis	USN-4	From data predictive and diagnostic analysis is performed	2	Medium	Samanvitha Sree Devi Anusha
Sprint-5	Visualization	USN-5	As a user, I can view the visualization of the dataset	1	High	G Bhagyashr Harini Ri

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	7 Nov 2022	10 Novt 2022	20	10 Nov 2022
Sprint-2	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-3	20	6 Days	24 Oct 2022	29 Oct 2022	20	30 Oct 2022
Sprint-4	20	6 Days	7 Nov 2022	10 Novt 2022	20	10 Nov 2022
Sprint-4	20	6 Days	7 Nov 2022	10 Novt 2022	20	10 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

6.2 Sprint Delivery Schedule

Phase 1

- Register or sign in the application by entering username , new password and confirming the same password
- Receive confirmation alert message once registered for the application.
- Log into the application by entering email and password

Phase 2

- Analytics to show delay of flights
- Comparing with other airlines which flights are frequently delayed
- Analytics to show weekly and everyday flight arrival,departure,airtime

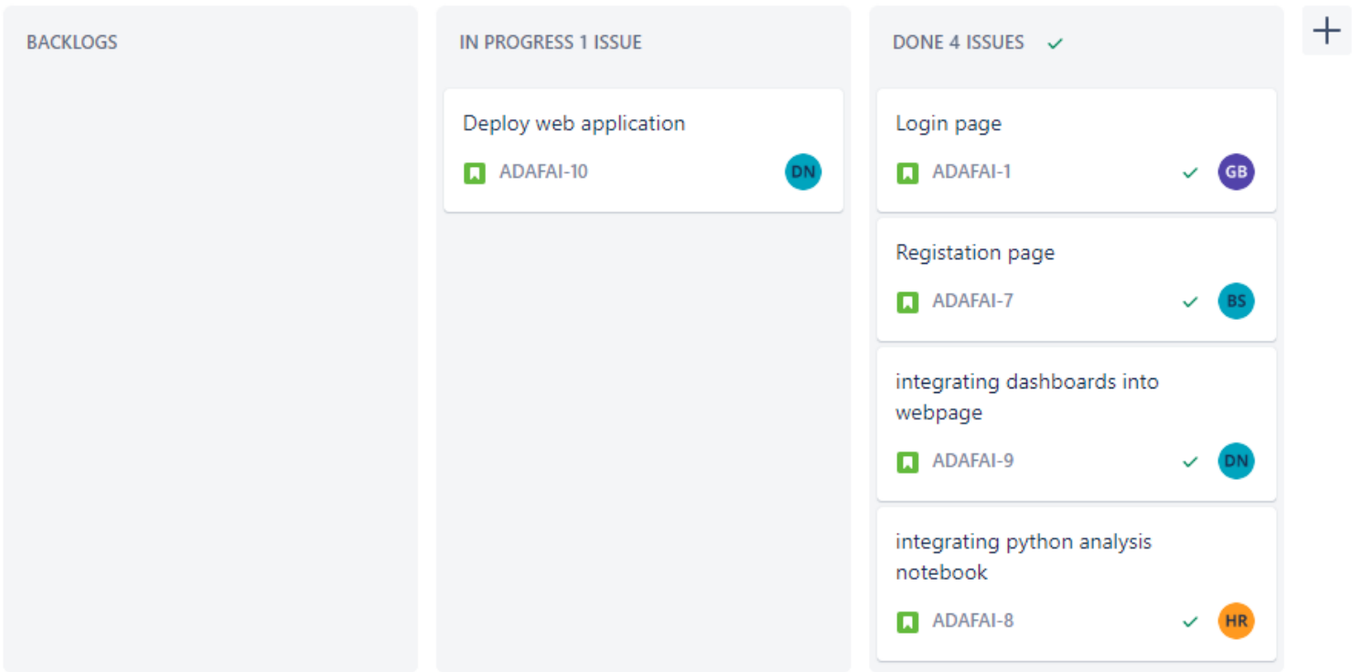
Phase 3

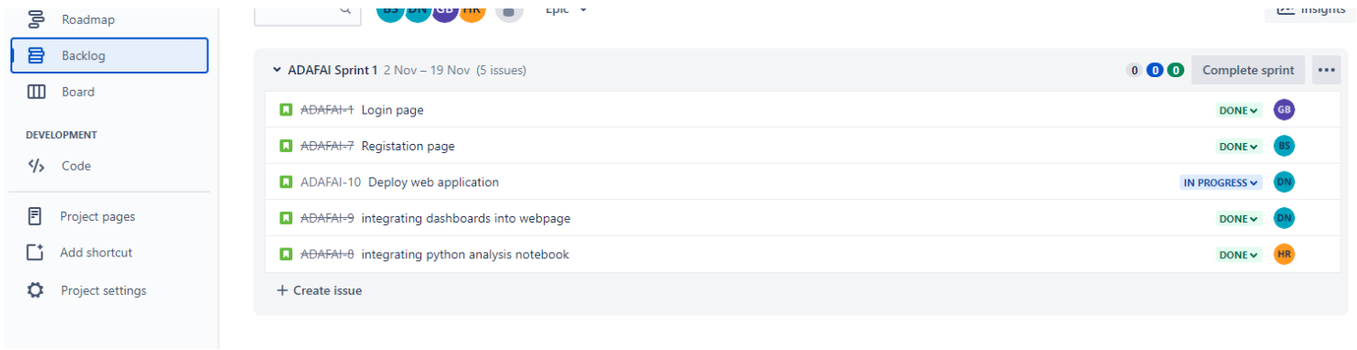
- Linking database with dashboard
- Secure the passwords
- Keep track of the delays

Phase 4

- Intergrate the IBM DB2, Sendgrid and other services
- Containerize the app and use IBM cloud to host the web app

6.3Reports from JIRA





7. CODIND AND SOLUTIONING

Analysis:

Login.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-
scale=1.0">
    <!--<title> Responsive Login and Signup Form </title>-->

    <!-- CSS -->
    <link rel="stylesheet" href="style.css">

    <!-- Boxicons CSS -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css'
rel='stylesheet'>

</head>
<body style=" background: url(plane.png);background-size: auto;">
    <section class="container forms">
        <div class="form login">
            <div class="form-content">
                <header>Login</header>
                <div id="login-error-msg-holder">
                    <p id="login-error-msg"></p>
                </div>
                <form id="login_form">
                    <div class="field input-field">
                        <input type="text" id="username"
placeholder="User name" class="input">
                    </div>
                    <div class="field input-field">
                        <input type="password" id="password"
placeholder="Password" class="password">
                        <i class='bx bx-hide eye-icon'></i>
                    </div>

                    <div class="form-link">
                        <a href="#" class="forgot-pass">Forgot
password?</a>
                    </div>

                    <div id="login-form-submit" class="field button-
field">
                        <button onclick="login()">Login</button>
                    </div>
                </form>

                <div class="form-link">
```

```
                        <span>Don't have an account? <a href="main2.html"
class="link signup-link">Signup</a></span>
                    </div>
                </div>



            <!-- Signup Form -->

        </section>

        <!-- JavaScript -->
      <script src="script.js"></script>
    </body>
</html>
```

SCRIPT.js

```
const loginForm = document.getElementById("login-form");
const loginButton = document.getElementById("login-form-submit");
const loginButton1 = document.getElementById("login-form-submit1");

var valid={"ad":"ad123","admin":"admin123","ibm":"ibm123"}
function login(){
    event.preventDefault();
    var u = document.getElementById("username").value;
    var p = document.getElementById("password").value;
    console.log(u);
    console.log(p);
    if(u=="" && p==""){
        alert("Enter username and password")
    }
    else if(u==""){
        alert("Enter username")
    }
    else if(p==""){
        alert("Enter password")
    }
    f=0
    for (let x in valid){
      if(x==u){
          if(valid[x]==p){
           location.replace("index.html")
          f=1;
          break;
          }
          else{
            document.getElementById("login-error-msg").innerHTML='Invalid
password';
            document.getElementsByName("username").value="";
            document.getElementsByName("username").value="";
          }
        }
    }
    if(f==0){
        document.getElementById("login-error-msg").innerHTML='Invalid
username';
        document.getElementsByName("username").value="";
        document.getElementsByName("username").value="";
    }
}

function signup(){
    event.preventDefault();
    var un = document.getElementById("uname").value;
    var ps = document.getElementById("pass").value;
    var rps = document.getElementById("rpass").value;
    var i=1;
```

```
    for (let x in valid) {
        if(x==un) {
            i=0;
            document.getElementById("login-error-msg1").innerHTML='User
already exists';
            document.getElementsByName("username").value="";
            document.getElementsByName("username").value="";
        }
    }
    if(i==1) {
        if(ps!=rps) {
            document.getElementById("login-error-msg1").innerHTML='Password
Mismatch';
            document.getElementsByName("uname").value="";
            document.getElementsByName("username").value="";
        }
        else {
            valid[un]=ps;
            console.log(valid)
            window.alert("Signup successful")
            event.preventDefault();
            location.replace("main.html")
        }
    }
}
```

SIGNUP.html

```
<!DOCTYPE html>
<!-- Coding by CodingLab | www.codinglabweb.com-->
  <html lang="en">
  <head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <!--<title> Responsive Login and Signup Form </title>-->

    <!-- CSS -->
    <link rel="stylesheet" href="style.css">

    <!-- Boxicons CSS -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>

  </head>
  <body>
    <section class="container forms">
      <div class="form login">
        <div class="form-content">
          <header>Sign up</header>
          <div id="login-error-msg-holder1">
            <p id="login-error-msg1"></p>
          </div>
          <form id="signinform">
            <div class="field input-field">
              <input type="text" placeholder="Username" id="uname" class="input">
            </div>

            <div class="field input-field">
              <input type="password" placeholder="Password" id="pass" class="password">
              <i class='bx bx-hide eye-icon'></i>
            </div>

            <div class="field input-field">
              <input type="password" placeholder="Retype Password" id="rpass"
class="password">
              <i class='bx bx-hide eye-icon'></i>
            </div>
```

```
                <div class="form-link">
                  <a href="#" class="forgot-pass">Forgot password?</a>
                </div>

                <div id="login-form-submit1" class="field button-field">
                  <button onclick="signup()">Sign up</button>
                </div>
              </form>

              <div class="form-link">
                <span>Don't have an account? <a href="main.html" class="link signup-
link">SignUp</a></span>
              </div>
            </div>



        <!-- Signup Form -->

      </section>

      <!-- JavaScript -->
      <script src="script.js"></script>

    </body>
</html>
<!--
      <!DOCTYPE html>

          <html lang="en">
          <head>
            <meta charset="UTF-8">
            <meta http-equiv="X-UA-Compatible" content="IE=edge">
            <meta name="viewport" content="width=device-width, initial-scale=1.0">

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


            <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>

          </head>
          <body>
            <section class="container forms">
        <div class="form signup">
            <div class="form-content">
              <header>Signup</header>
              <form action="#">
                <div class="field input-field">
                  <input type="email" placeholder="Email" class="input">
                </div>

                <div class="field input-field">
                  <input type="password" placeholder="Create password" class="password">
                </div>

                <div class="field input-field">
                  <input type="password" placeholder="Confirm password" class="password">
                  <i class='bx bx-hide eye-icon'></i>
                </div>

                <div class="field button-field">
                  <button>Signup</button>
                </div>
              </form>

              <div class="form-link">
```

```
                    <span>Already have an account? <a href="main.html" class="link login-
link">Login</a></span>
                </div>
            </div>

        </div>
    </section>

    <!-- JavaScript -->

  </body>
</html>-->
```

Style.css

```
@import
url('https://fonts.googleapis.com/css2?family=Poppins:wght@300;400;500;600&display=swap');

body{
   background: url(plane.png);
  background-size: auto;
}
*{
   margin: 0;
   padding: 0;
   box-sizing: border-box;
   font-family: 'Poppins', sans-serif;
}
.container{
   height: 100vh;
   width: 100%;
   display: flex;
   align-items: center;
   justify-content: center;
  background-image: url(plane.png);
  background-size: auto;

   column-gap: 30px;
}
.form{
   position: absolute;
   max-width: 430px;
   width: 100%;
   padding: 30px;
   border-radius: 6px;
   background-color:rgba(255, 255, 255, 0.75);


}
.form.signup{
   opacity: 0;
   pointer-events: none;
}
.forms.show-signup .form.signup{
   opacity: 1;
   pointer-events: auto;
}
.forms.show-signup .form.login{
   opacity: 0;
   pointer-events: none;
}
header{
   font-size: 28px;
   font-weight: 600;
   color: #232836;
   text-align: center;
}
```

```
form{
   margin-top: 30px;
}
.form .field{
   position: relative;
   height: 50px;
   width: 100%;
   margin-top: 20px;
   border-radius: 6px;
}
.field input,
.field button{
   height: 100%;
   width: 100%;
   border: none;
   font-size: 16px;
   font-weight: 400;
   border-radius: 6px;
}
.field input{
   outline: none;
   padding: 0 15px;
   border: 1px solid#CACACA;
}
.field input:focus{
   border-bottom-width: 2px;
}
.eye-icon{
   position: absolute;
   top: 50%;
   right: 10px;
   transform: translateY(-50%);
   font-size: 18px;
   color: #8b8b8b;
   cursor: pointer;
   padding: 5px;
}
.field button{
   color: #fff;
   background-color: #0171d3;
   transition: all 0.3s ease;
   cursor: pointer;
}
.field button:hover{
   background-color: #016dcb;
}
.form-link{
   text-align: center;
   margin-top: 10px;
}
.form-link span,
.form-link a{
   font-size: 14px;
   font-weight: 400;
   color: #232836;
}
.form a{
   color: #0171d3;
   text-decoration: none;
}
.form-content a:hover{
   text-decoration: underline;
}
.line{
   position: relative;
   height: 1px;
   width: 100%;
```

```
    margin: 36px 0;
    background-color: #d4d4d4;
}
.line::before{
    content: 'Or';
    position: absolute;
    top: 50%;
    left: 50%;
    transform: translate(-50%, -50%);
    background-color: #FFF;
    color: #8b8b8b;
    padding: 0 15px;
}
.media-options a{
    display: flex;
    align-items: center;
    justify-content: center;
}
a.facebook{
    color: #fff;
    background-color: #4267b2;
}
a.facebook .facebook-icon{
    height: 28px;
    width: 28px;
    color: #0171d3;
    font-size: 20px;
    border-radius: 50%;
    display: flex;
    align-items: center;
    justify-content: center;
    background-color: #fff;
}
.facebook-icon,
img.google-img{
    position: absolute;
    top: 50%;
    left: 15px;
    transform: translateY(-50%);
}
img.google-img{
    height: 20px;
    width: 20px;
    object-fit: cover;
}
a.google{
    border: 1px solid #CACACA;
}
a.google span{
    font-weight: 500;
    opacity: 0.6;
    color: #232836;
}

@media screen and (max-width: 400px) {
    .form{
        padding: 20px 10px;
    }

}
```

Analysis.ipynb

```
from mpl_toolkits.mplot3d import Axes3D
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt # plotting
import numpy as np # linear algebra
```

```
import os # accessing directory structure
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt
import seaborn as sns
```

There are 3 csv files in the current version of the dataset:

In [40]:

```
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))
```

```
/kaggle/input/airports.csv
/kaggle/input/airlines.csv
/kaggle/input/flights.csv
```

In [41]:

```
# Distribution graphs (histogram/bar graph) of column data
def plotPerColumnDistribution(df, nGraphShown, nGraphPerRow):
    nunique = df.nunique()
    df = df[[col for col in df if nunique[col] > 1 and nunique[col] < 50]] # For displaying
purposes, pick columns that have between 1 and 50 unique values
    nRow, nCol = df.shape
    columnNames = list(df)
    nGraphRow = (nCol + nGraphPerRow - 1) / nGraphPerRow
    plt.figure(num = None, figsize = (6 * nGraphPerRow, 8 * nGraphRow), dpi = 80, facecolor
= 'w', edgecolor = 'k')
    for i in range(min(nCol, nGraphShown)):
        plt.subplot(nGraphRow, nGraphPerRow, i + 1)
        columnDf = df.iloc[:, i]
        if (not np.issubdtype(type(columnDf.iloc[0]), np.number)):
            valueCounts = columnDf.value_counts()
            valueCounts.plot.bar()
        else:
            columnDf.hist()
        plt.ylabel('counts')
        plt.xticks(rotation = 90)
        plt.title(f'{columnNames[i]} (column {i})')
    plt.tight_layout(pad = 1.0, w_pad = 1.0, h_pad = 1.0)
    plt.show()
```

In [42]:

```
# Correlation matrix
def plotCorrelationMatrix(df, graphWidth):
    filename = df.dataframeName
    df = df.dropna('columns') # drop columns with NaN
    df = df[[col for col in df if df[col].nunique() > 1]] # keep columns where there are
more than 1 unique values
    if df.shape[1] < 2:
        print(f'No correlation plots shown: The number of non-NaN or constant columns
({df.shape[1]}) is less than 2')
        return
    corr = df.corr()
    plt.figure(num=None, figsize=(graphWidth, graphWidth), dpi=80, facecolor='w',
edgecolor='k')
    corrMat = plt.matshow(corr, fignum = 1)
    plt.xticks(range(len(corr.columns)), corr.columns, rotation=90)
    plt.yticks(range(len(corr.columns)), corr.columns)
    plt.gca().xaxis.tick_bottom()
    plt.colorbar(corrMat)
    plt.title(f'Correlation Matrix for {filename}', fontsize=15)
    plt.show()
```

In [43]:

```
# Scatter and density plots
def plotScatterMatrix(df, plotSize, textSize):
    df = df.select_dtypes(include =[np.number]) # keep only numerical columns
    # Remove rows and columns that would lead to df being singular
    df = df.dropna('columns')
    df = df[[col for col in df if df[col].nunique() > 1]] # keep columns where there are
more than 1 unique values
    columnNames = list(df)
    if len(columnNames) > 10: # reduce the number of columns for matrix inversion of kernel
density plots
        columnNames = columnNames[:10]
    df = df[columnNames]
    ax = pd.plotting.scatter_matrix(df, alpha=0.75, figsize=[plotSize, plotSize],
diagonal='kde')
    corrs = df.corr().values
    for i, j in zip(*plt.np.triu_indices_from(ax, k = 1)):
        ax[i, j].annotate('Corr. coef = %.3f' % corrs[i, j], (0.8, 0.2), xycoords='axes
fraction', ha='center', va='center', size=textSize)
    plt.suptitle('Scatter and Density Plot')
    plt.show()
```

Now you're ready to read in the data and use the plotting functions to visualize the data.

In [44]:

```
nRowsRead = 1000 # specify 'None' if want to read whole file
```

```
# airlines.csv may have more rows in reality, but we are only loading/previewing the first
1000 rows
df1 = pd.read_csv('/kaggle/input/airlines.csv', delimiter=',', nrows = nRowsRead)
df1.dataframeName = 'airlines.csv'
nRow, nCol = df1.shape
print(f'There are {nRow} rows and {nCol} columns')
```

```
There are 14 rows and 2 columns
```

In [45]:

Out[45]:

In [46]:

```
plotPerColumnDistribution(df1, 10, 5)
```

In [47]:

```
nRowsRead = 1000 # specify 'None' if want to read whole file
# airports.csv may have more rows in reality, but we are only loading/previewing the first
1000 rows
df2 = pd.read_csv('/kaggle/input/airports.csv', delimiter=',', nrows = nRowsRead)
df2.dataframeName = 'airports.csv'
nRow, nCol = df2.shape
print(f'There are {nRow} rows and {nCol} columns')

nRowsRead = 1000 # specify 'None' if want to read whole file
# flights.csv may have more rows in reality, but we are only
loading/previewing the first 1000 rows
df3 = pd.read_csv('/kaggle/input/flights.csv', delimiter=',', nrows =
nRowsRead)
df3.dataframeName = 'flights.csv'
nRow, nCol = df3.shape
print(f'There are {nRow} rows and {nCol} columns')

plotPerColumnDistribution(df3, 10, 5)
plotCorrelationMatrix(df3, 8)
plotScatterMatrix(df3, 20, 10)
def get_shape(df):
    print('Now there are', df3.shape[0], 'rows and',df3.shape[1],'columns in
this dataset')
from mpl_toolkits.mplot3d import Axes3D
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt # plotting
import numpy as np # linear algebra
import os # accessing directory structure
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt
import seaborn as sns
nRowsRead =100

df3 = pd.read_csv('/kaggle/input/flights.csv', delimiter=',', nrows =
nRowsRead)
df3.dataframeName = 'flights.csv'
fig, axss = plt.subplots(5,4, figsize=[15,10])
sns.boxplot(x='WEATHER_DELAY', y ='AIRLINE', data=df3,
ax=axss[0][0],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='FLIGHT_NUMBER', data=df3,
ax=axss[0][1],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='TAIL_NUMBER', data=df3,
ax=axss[0][2],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='ORIGIN_AIRPORT', data=df3,
ax=axss[0][3],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='DESTINATION_AIRPORT', data=df3,
ax=axss[1][0],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='SCHEDULED_DEPARTURE', data=df3,
ax=axss[1][1],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='DEPARTURE_TIME', data=df3,
ax=axss[1][2],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='DEPARTURE_DELAY', data=df3,
ax=axss[1][3],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='DISTANCE', data=df3,
ax=axss[2][0],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='SCHEDULED_ARRIVAL', data=df3,
ax=axss[2][1],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='ARRIVAL_TIME', data=df3,
ax=axss[2][2],palette="Blues")
```

```
sns.boxplot(x='WEATHER_DELAY', y ='ARRIVAL_DELAY', data=df3,
ax=axss[2][3],palette="Blues")

sns.boxplot(x='WEATHER_DELAY', y ='CANCELLATION_REASON', data=df3,
ax=axss[3][0],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='AIR_SYSTEM_DELAY', data=df3,
ax=axss[3][1],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='SECURITY_DELAY', data=df3,
ax=axss[3][2],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='AIRLINE_DELAY', data=df3,
ax=axss[3][3],palette="Blues")
sns.boxplot(x='WEATHER_DELAY', y ='LATE_AIRCRAFT_DELAY', data=df3,
ax=axss[4][0],palette="Blues")
#sns.boxplot(x='Attrition', y ='', data=df, ax=axss[4][1],palette="Blues")

plt.tight_layout()
plt.savefig('numerical_dist.png');
from mpl_toolkits.mplot3d import Axes3D
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt # plotting
import numpy as np # linear algebra
import os # accessing directory structure
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt
import seaborn as sns
fig,axss = plt.subplots(2,4, figsize=[15,10])
nRowsRead = 10
df2 = pd.read_csv('/kaggle/input/airports.csv', delimiter=',', nrows =
nRowsRead)
df2.dataframeName = 'airports.csv'
sns.countplot(x='COUNTRY', hue='CITY', data=df2, ax=axss[0][0])
sns.countplot(x='COUNTRY', hue='STATE', data=df2, ax=axss[0][1])
sns.countplot(x='COUNTRY', hue='AIRPORT', data=df2, ax=axss[0][2])
sns.countplot(x='COUNTRY', hue='IATA_CODE', data=df2, ax=axss[0][3])
#sns.countplot(x='COUNTRY', hue='LALITUDE', data=df2, ax=axss[1][0])
#sns.countplot(x='COUNTRY', hue='LONGITUDE', data=df2, ax=axss[1][1])
plt.tight_layout()
plt.savefig('cate_dist.png');
df2 = pd.read_csv('/kaggle/input/airports.csv')
df2.dataframeName = 'airports.csv'
nRow, nCol = df2.shape
print(f'There are {nRow} rows and {nCol} columns')
sns.heatmap(df2.corr(),annot=True)
```

splitting_data.ipynb

```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/" directory
# For example, running this (by clicking run or pressing Shift+Enter) will
list all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/) that
gets preserved as output when you create a version using "Save & Run All"
# You can also write temporary files to /kaggle/temp/, but they won't be
saved outside of the current session
```

In [3]:

```
import datetime, warnings, scipy
import pandas as pd
import numpy as np
import seaborn as sns
```

```
import matplotlib.pyplot as plt
```

In [4]:

```
import pandas as pd
data = pd.read_csv("../input/flight-delays/flights.csv")
keep_col=['MONTH','WEATHER_DELAY','ORIGIN_AIRPORT','DESTINATION_AIRPORT']
new_f=data[keep_col]
new_f.to_csv("weather.csv",index=False)
new_f.head()
keep_col=['ORIGIN_AIRPORT','DEPARTURE_DELAY','ARRIVAL_DELAY']
new_f=data[keep_col]
new_f.to_csv("airportdelay.csv",index=False)
new_f.info()
keep_col=['AIRLINE','DIVERTED','CANCELLED','CANCELLATION_REASON','AIR_SYSTEM_
DELAY','SECURITY_DELAY','AIRLINE_DELAY','LATE_AIRCRAFT_DELAY']
new_f=data[keep_col]
new_f.to_csv("airline.csv",index=False)
new_f.head()
```

index.html

```
<body
border="10px">
                    <title >AIRLINES ANALYSIS FOR AVIATION INDUSTRY</title>
                    <center><h3>AIRLINES ANALYSIS FOR AVIATION INDUSTRY</h3>
                <div style="width: 500px;height:20px; border:1px solid
                black;padding:20px;postion:absolute;left:35%;top:100px;background-
                color:#016dcb"><a href="main1.html"><button>Merged
                Analysis</button></a>
                <a href="analysisAirlines.html"><button>Simple Analysis</button></a>
                <a href="dash.html"><button>Dashboard2</button></a></div></center>
                <br><br>
                <embed src="Sprint_dashboard.pdf" width="100%" height="2100px" />
                </body>
```

8. TESTING

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the project - Airlines Data Analytics for Aviation Industry website 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	0	0	0	0	0
Duplicate	0	0	0	0	0
External	0	0	0	0	0
Fixed	5	3	2	0	10
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	5	3	2	0	10

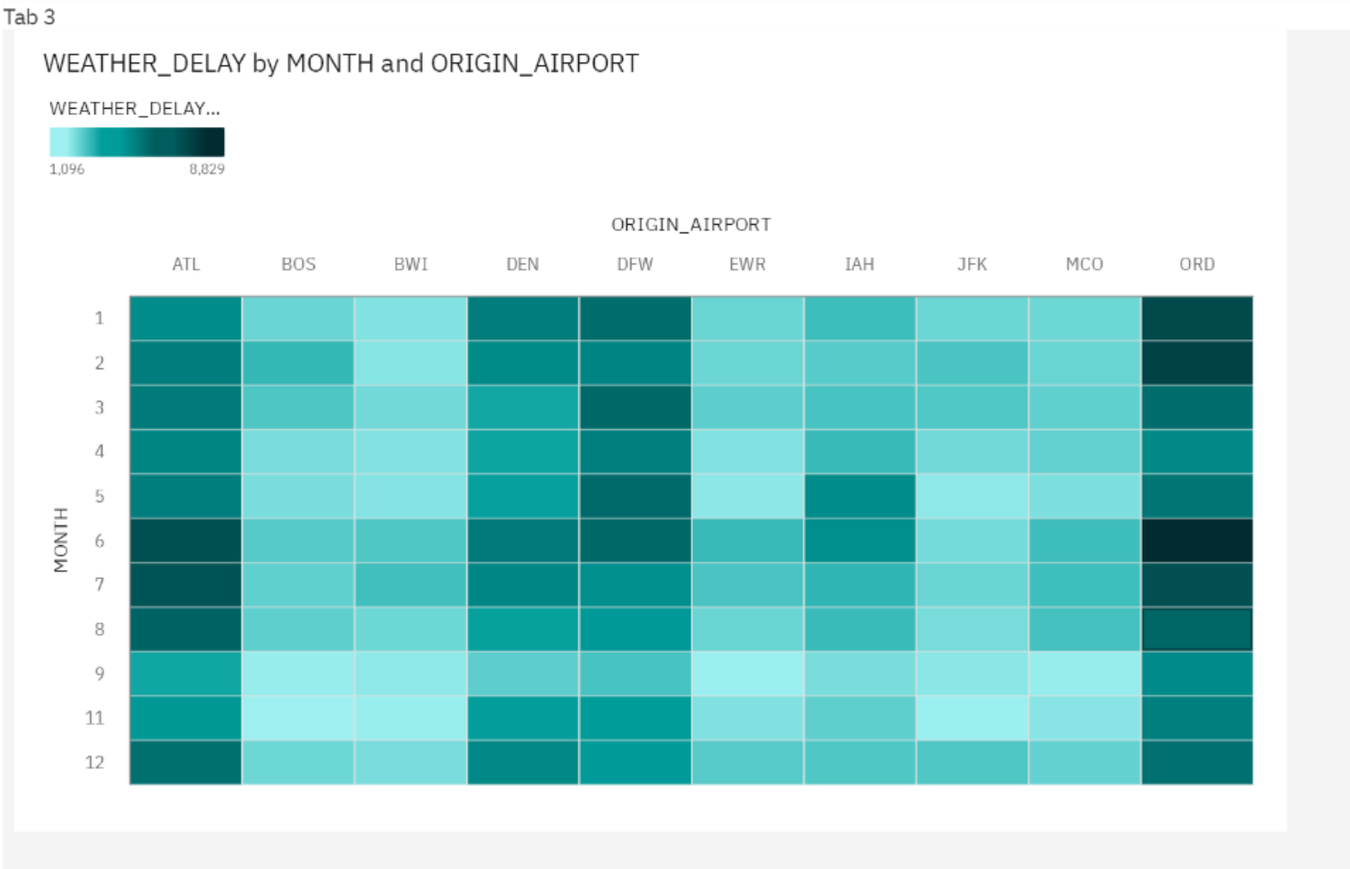
3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	12	0	0	12
Client Application	13	0	0	13
Security	0	0	0	0
Outsource Shipping	0	0	0	0
Exception Reporting	4	0	0	4
Final Report Output	4	0	0	4
Version Control	0	0	0	0

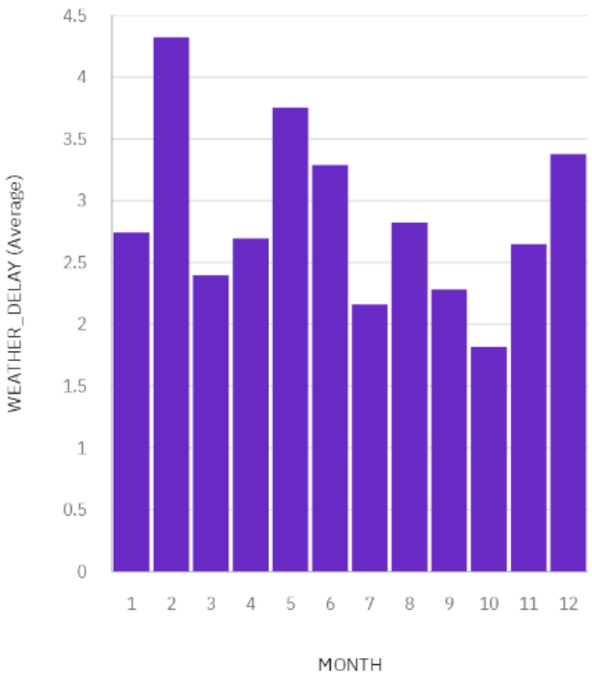
9.RESULTS

Tab 3

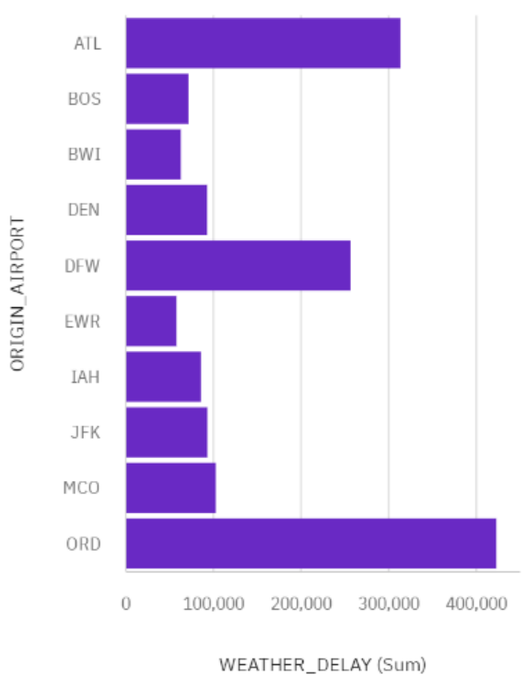


Tab 1

WEATHER_DELAY by MONTH

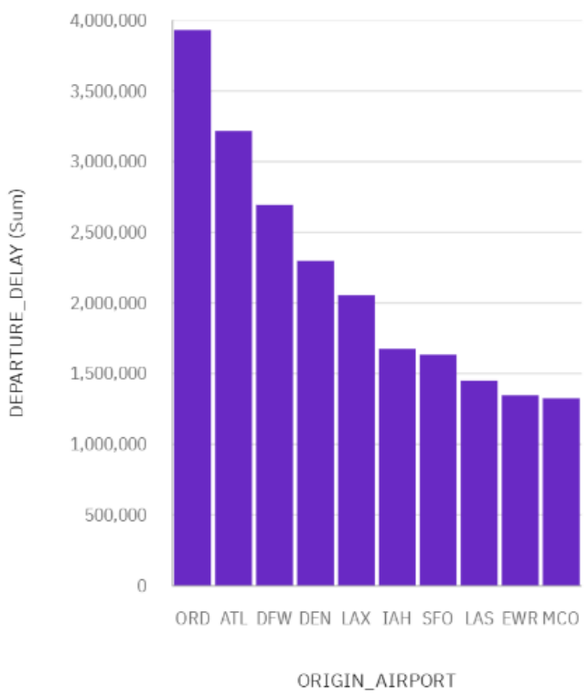


WEATHER_DELAY by ORIGIN_AIRPORT

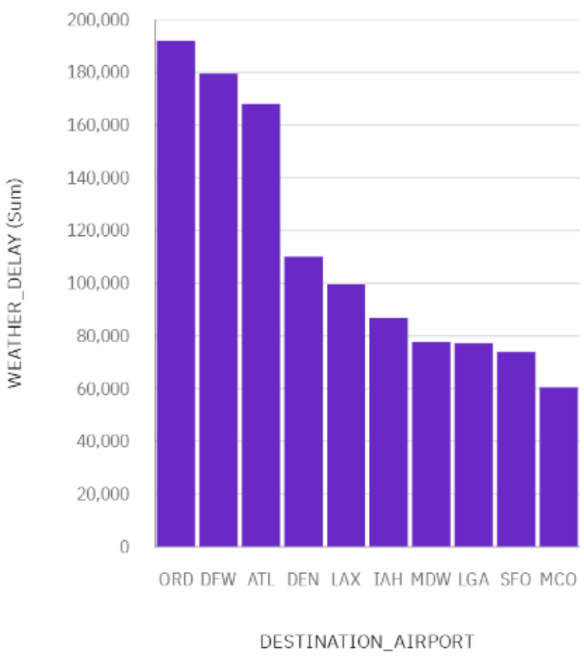


Tab 2

DEPARTURE_DELAY by ORIGIN_AIRPORT

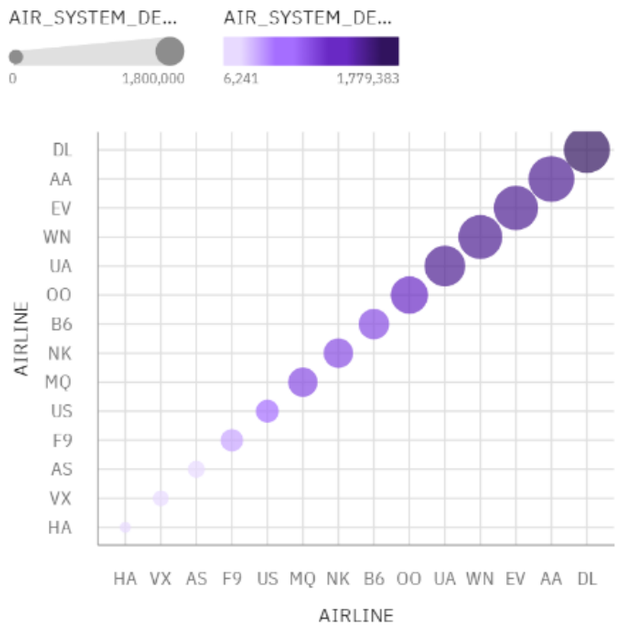


WEATHER_DELAY by DESTINATION_AIRPORT

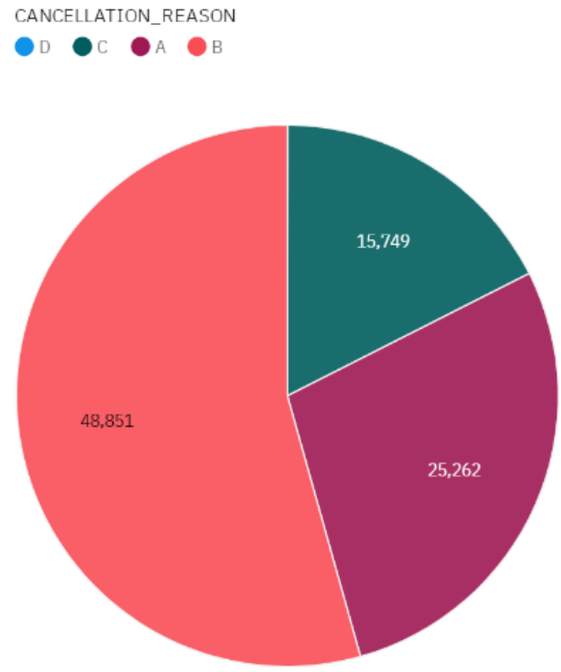


Tab 4

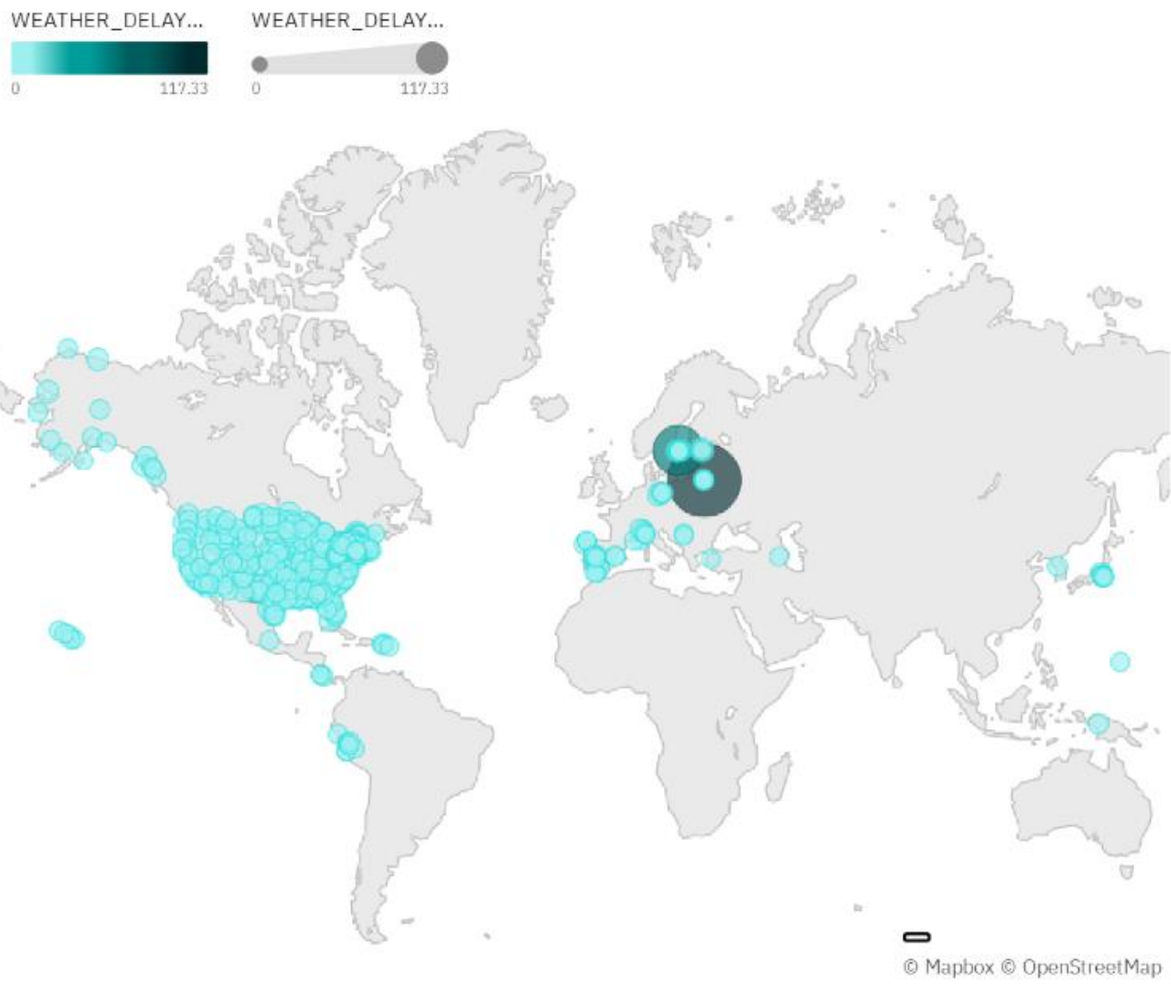
AIRLINE by AIRLINE colored by AIR_SYSTEM_DELAY and sized by AIR_SYSTEM_DELAY



A - Airline/Carrier; B - Weather; C - National Air System; D - Security



WEATHER_DELAY and WEATHER_DELAY for ORIGIN_AIRPORT points



10.ADVANTAGES AND DISADVANTAGES

Advantage:

1) With this application, we can easily analyze flight delays and simplify the extensive traffic at the airport and can prevent the major confusions over flight delays.
2) This can enable customer satisfaction and incomes of major airlines.
3) Accuracy is measured with the previous models and we have analyzed that this model is much more effective in every way.
4) The delay prediction can make the concerned authorities be well prepared for any possible problem.
5) can easily be understood by a layman: the model is simple and effective.

Disadvantages

1.This application needs to be more compact and flexible. The interoperability feature should be more enhanced.
2. The application can be automated instead of static data from the user(airport authorities).

11. CONCLUSION

In the present world, the major components of any transportation system include passenger airline, cargo airline and air traffic control system. They all face difficulties due to some sort of miscommunication. Our model has been made with the motive of simplifying complex situations due to flight delays and increasing customer satisfaction. With delays being predicted before, the passengers can easily schedule their plans well before.

12. FUTURE SCOPE

The project can be extended to a wider range of airports. Current model only supports the data from 5 airports. If the dataset is extended by a vast quantity that has data from airports worldwide then the model can predict any flight delay across the globe. But to do so the complexity of power required will be much greater and the model needs to be trained better to have a higher speed and accuracy of computing results.

13.APPENDIX

GITHUB AND PROJECT DEMO LINK

https://github.com/IBM-EPBL/IBM-Project-17084-1659627709
https://drive.google.com/file/d/1yhyH--etS100ISxFwgF-5-JMIJetO7dI/view?usp=share_link