

DEVELOPING A FLIGHT DELAY PREDICTION MODEL USING MACHINE LEARNING

SNS COLLEGE OF TECHNOLOGY, COIMBATORE.

PROJECT REPORT

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

Over the last twenty years, air travel has been increasingly preferred among travelers, 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 and environmental losses. The main objective of the model is to predict flight delays accurately in order to optimize flight operations and minimize delays. Using a machine learning model, we can predict flight arrival delays.

1.2 PURPOSE:

- To predict if the flight arrival will be delayed or not.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

A flight is considered to be delayed when the difference between scheduled and actual arrival times is greater than 15 minutes. Moreover, the economic impact of flight delays for domestic flights in the US is estimated to be more than \$19 Billion per year to the airlines and over \$41 Billion per year to the national economy. In response to growing concerns about fuel emissions and their negative impact on health, there is active research in the aviation industry for finding techniques to predict flight delays accurately in order to optimize flight operations and minimize delays.

2.2 REFERENCE

<http://cs229.stanford.edu/proj2017/final-reports/5243248.pdf>

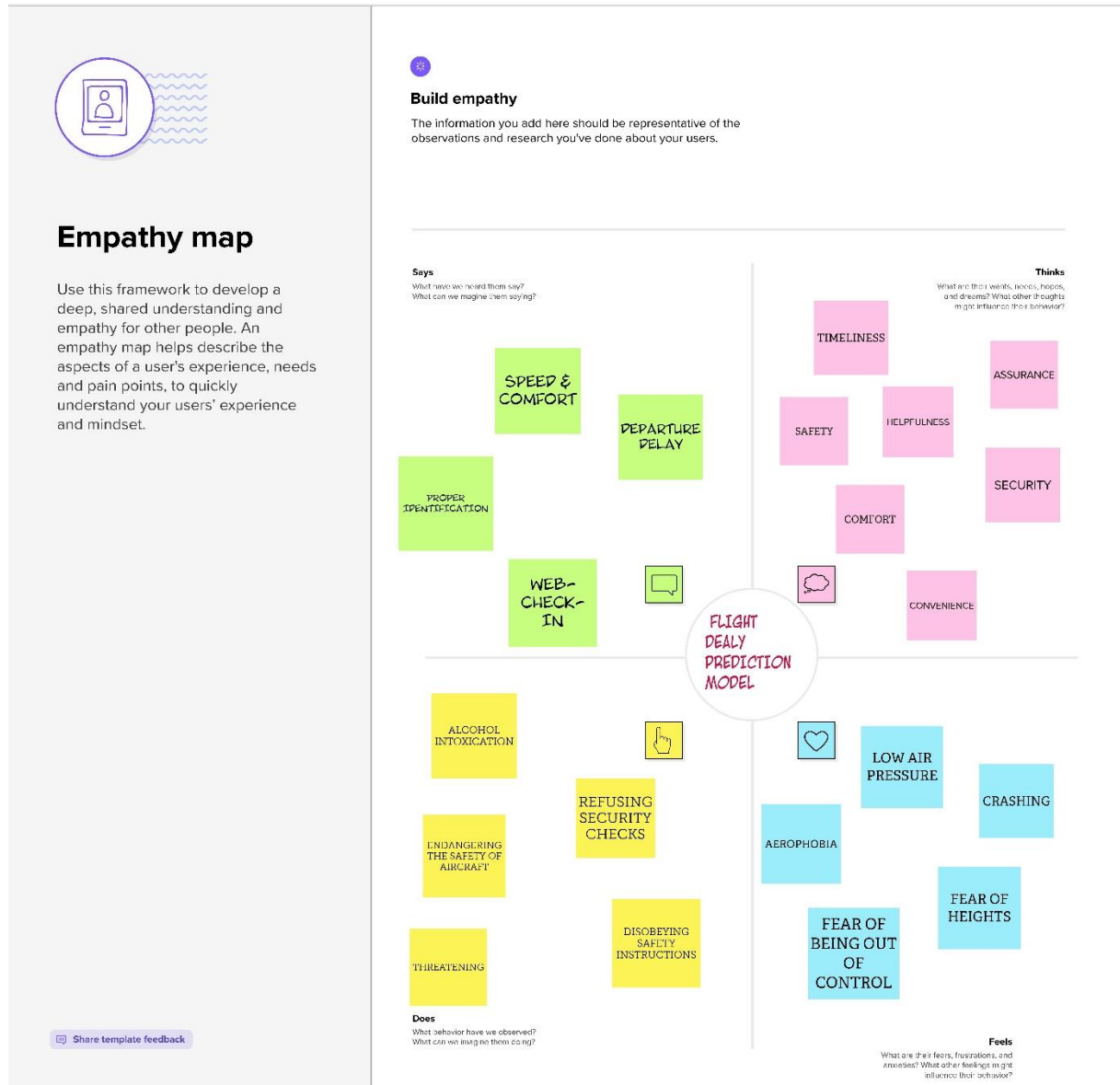
2.3 PROBLEM STATEMENT DEFINITION

Flight delays represent a common problem in everyday air traffic practice. The impact of flight delay can be a risk and this risk represents financial losses, the dissatisfaction of passengers, time losses, loss of reputation and bad business relations. Flight delays not only irritate air passengers and disrupt their schedules but also cause a decrease in efficiency, an increase in capital costs, reallocation of flight crews and aircraft, and additional crew expenses.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

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



3.2 IDEATION & BRAINSTORMING

Step:1 Team gathering. Collaboration and select the problem statement.

The team was gathered in mural app for collaboration.

The team members are:

K. Tamaraiselvi

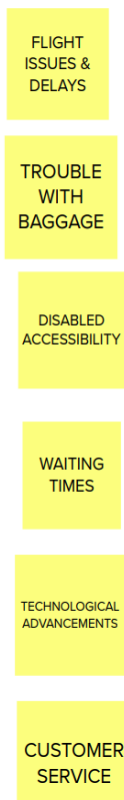
T. Pavithiravalavan

S. Sandeep

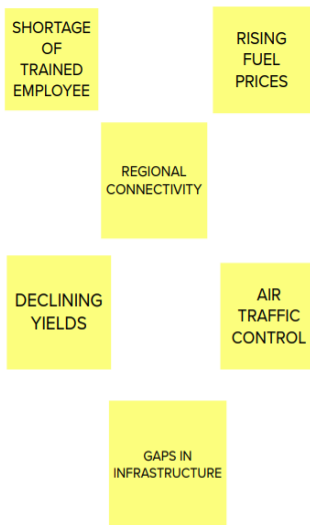
M.R. Vyshnav

Step 2: Brainstorming

TAMARAISELVI



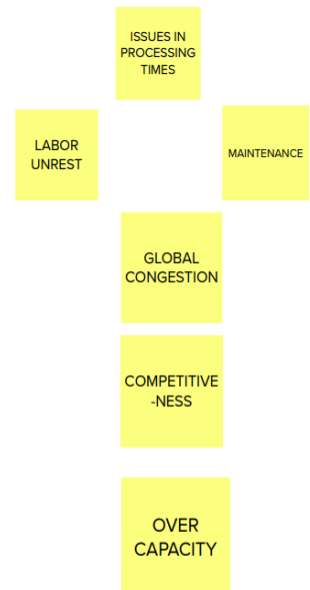
SANDEEP



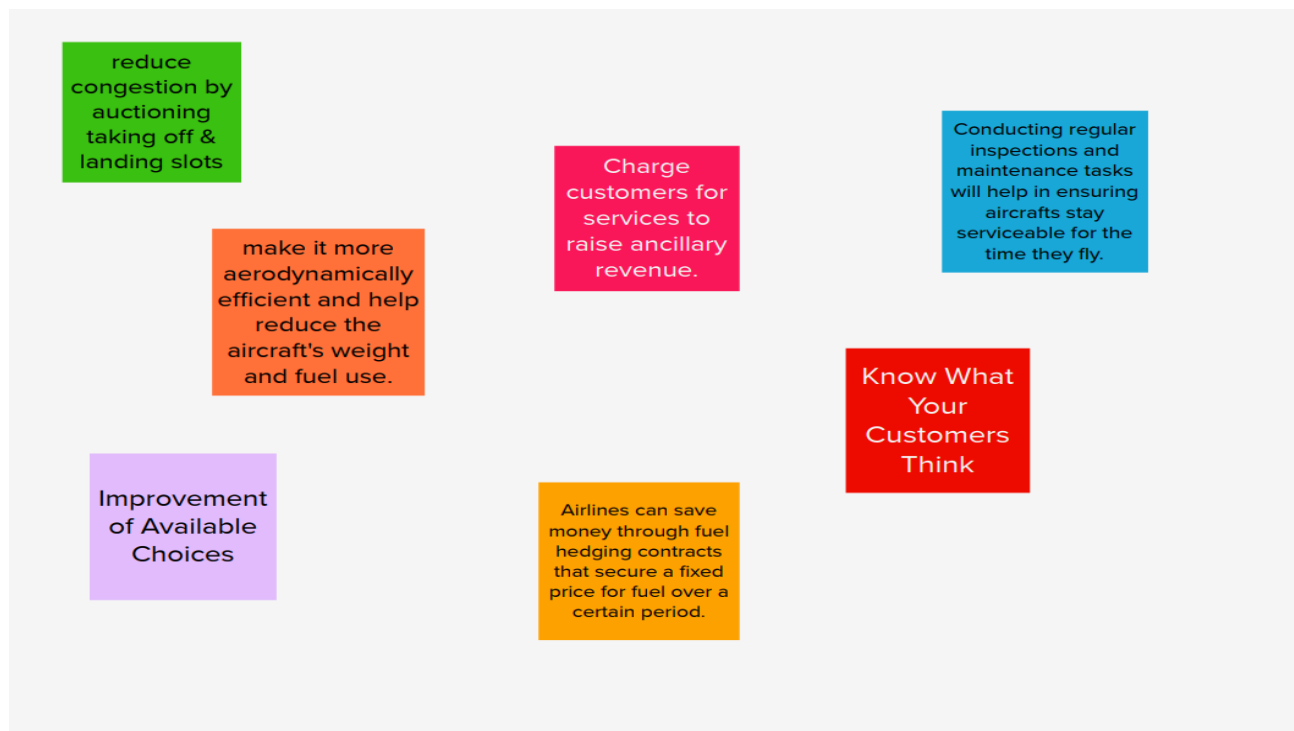
PAVITHIRAVALAVAN



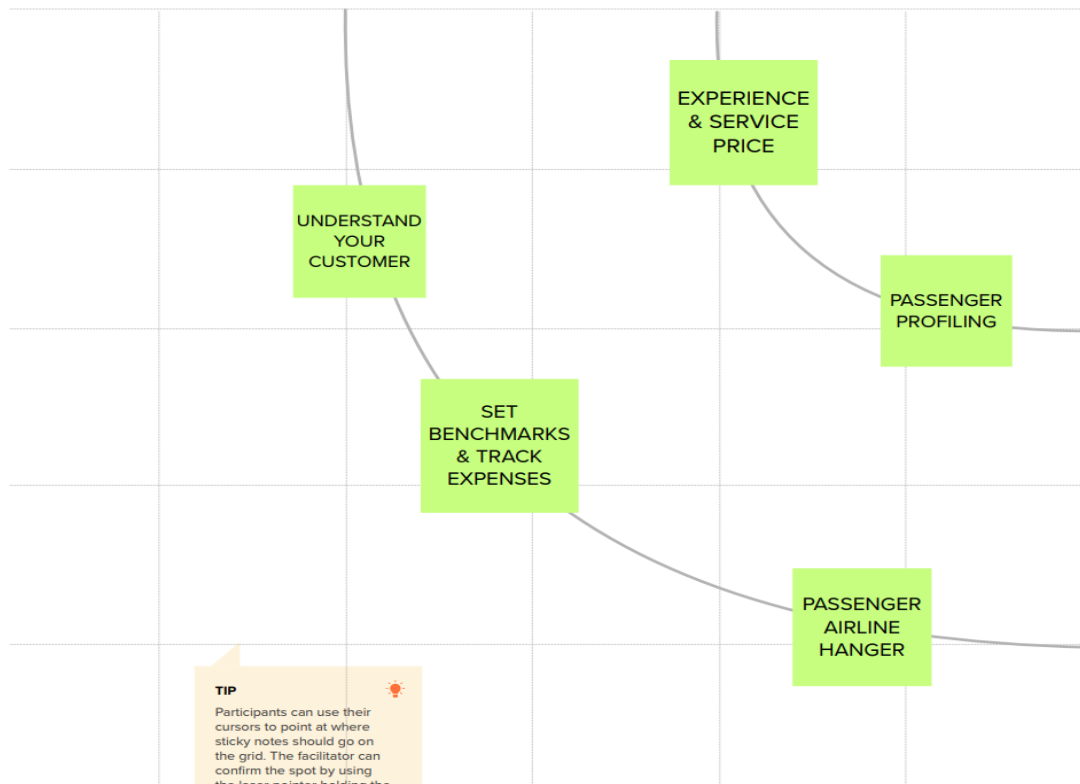
VYSHNAV



Grouping ideas



Step 3: Idea Prioritization



3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The main objective of the model is to predict flight delays accurately in order to optimize flight operations and minimize delays.
2.	Idea / Solution description	Using a machine learning model, we can predict flight arrival delays. The input to our algorithm is rows of feature vector like departure date, departure delay, distance between the two airports, scheduled arrival time etc.
3.	Novelty / Uniqueness	We then use decision tree classifier to predict if the flight arrival will be delayed or not. we compare decision tree classifier with logistic regression and a simple neural network

4.	Social Impact / Customer Satisfaction	It makes the air transportation more efficient and saves more time for the passengers
5.	Business Model (Revenue Model)	Using this model, we can create a revenue by giving appropriate solution about the delay to the people
6.	Scalability of the Solution	This makes the people to take the action according to the delay and it improves time management, business value and more

3.4 PROBLEM SOLUTION FIT

Project Title:

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMID17753

<p>Define CS, fit into CC</p> <p>Focus on J&P, fit into BE, understand</p>	<p>1. CUSTOMER SEGMENT(S)</p> <p>Who is your customer? CS</p> <p>Le working parents of 0-5 kids</p> <p>The airline customer segmentation is divided into the following segments: Old Travelers, Business Travelers, Budget conscious Travelers, Loyal Travelers, Urgent Travelers. Traditionally, airlines segment their customers into business and economy passengers and align their product strategy with flexibility for business passengers and price.</p>	<p>6. CUSTOMER CONSTRAINTS</p> <p>What constraints prevent your customers from taking action or influencing their choices of solutions? Le spending power, budget, no cash, network connection, available devices.</p> <p>The Airline Delay Management Problem (ADMP), which can be described as the task of dealing with daily airline operational delays and deciding whether to delay subsequent flights at a hub airport or to have them departing on time. An innovative integer linear programming approach is presented to the capacitated case of the ADMP and airport limitations in terms of bay availability, taxiway capacity and runway separation are incorporated to represent capacity constraints.</p>	<p>5. AVAILABLE SOLUTIONS</p> <p>Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? Le pen and paper is an alternative to digital notetaking</p> <p>Using a machine learning model, we can predict flight arrival delays. We then use decision tree classifier to predict if the flight arrival will be delayed or not. we compare decision tree classifier with logistic regression and a simple neural network for various figures of merit.</p>	<p>Explore AS, differentiate</p> <p>Focus on J&P, fit into BE, understand</p>
	<p>2. JOBS-TO-BE-DONE / PROBLEMS</p> <p>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.</p> <p>Air and ground congestion are a major factor why flights get delayed. If a scheduled flight pushes back from the gate late, that flight could impact the departure of other flights, such as the next flight scheduled to arrive at the gate occupied by the late flight departure. Flight delays cause a decrease in efficiency, an increase in capital costs, reallocation of flight crews and aircraft, and additional crew expenses</p>	<p>9. PROBLEM ROOT CAUSE</p> <p>What is the real reason that this problem exists? What is the back story behind the need to do this job? Le customers have to do it because of the change in regulations.</p> <ul style="list-style-type: none"> > Maintenance issues > Crew problems > Aircraft cleaning and preparation > Baggage loading > Extreme Weather > Non-extreme weather > Air Traffic Control (ATC) restrictions 	<p>7. BEHAVIOUR</p> <p>What does your customer do to address the problem and get the job done?</p> <p>Le directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)</p> <p>Delays affect airline operations, resulting in increased block times on routes and, in general, higher carrier costs and airfares. Delays are calculated against scheduled block times as well as against more idealized feasible flight times. Based on econometric estimations, welfare impacts of flight delays are calculated. flight delays on a route reduce passenger demand and raise airfares, producing significant decreases in both consumer and producer welfare.</p>	
	<p>3. TRIGGERS</p> <p>What triggers customers to act? Le seeing their neighbours installing solar panels, reading about a more efficient solution in the news.</p> <p>Adverse weather conditions, knock-on effect due to a delayed aircraft. Waiting for connecting passengers. Waiting for cargo. Getting security clearance. the crew needs to ensure the aircraft is ready for boarding. Basis requisites have to be checked and filled before passengers board a flight.</p>	<p>10. YOUR SOLUTION</p> <p>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.</p> <p>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.</p> <p>The delay ratio is calculated by summing all the flights that have been delayed at the origin, and dividing by the total number of flights made at the origin. The trick is narrowing your scope by location and time.</p>	<p>8. CHANNELS of BEHAVIOUR</p> <p>8.1 ONLINE</p> <p>What kind of actions do customers take online? Extract online channels from #7</p> <p>8.2 OFFLINE</p> <p>What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</p> <p>ONLINE:</p> <p>The flight delay is notified in web applications such as: Your airline's app, Flight aware, Lounge Buddy and Airhelp.</p> <p>OFFLINE:</p> <p>The gate agents should be transparent about the cause of the flight delay.</p>	
	<p>4. EMOTIONS: BEFORE / AFTER</p> <p>How do customers feel when they face a problem or a job and afterwards? Le lost, insecure > confident, in control - use it in your communication strategy & design.</p> <p>Delays and cancellations affect both passengers and air carriers. By resulting in increased travel time and increased expenses on food and lodging, they cause stress among passengers. Further, they disrupt the purpose of air travel — rapid, affordable and safe — and make the passengers distrust airlines. On the other hand, airlines suffer from extra crew costs, costs associated with accommodating disrupted passengers, and aircraft re-positioning, as airline fleet and crew schedules are largely based on the scheduled times.</p>			

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

- A functional requirement defines a function of a system or its component, where a function is described as a specification of behaviour between inputs and outputs.
- It specifies “what should the software system do?”
- Defined at a component level
- Usually easy to define
- Helps you verify the functionality of the software

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Registered User -Login	Login through password Login through Gmail Login through LinkedIn
FR-4	Verify the link provided by the user	User inputs the link to be verified
FR-5	Display the result	If the site link is a prediction site, user must be aware and read the precautions displayed If the site link is legit exit the application
FR-6	Share Queries	If any doubts, send query Read FAQs

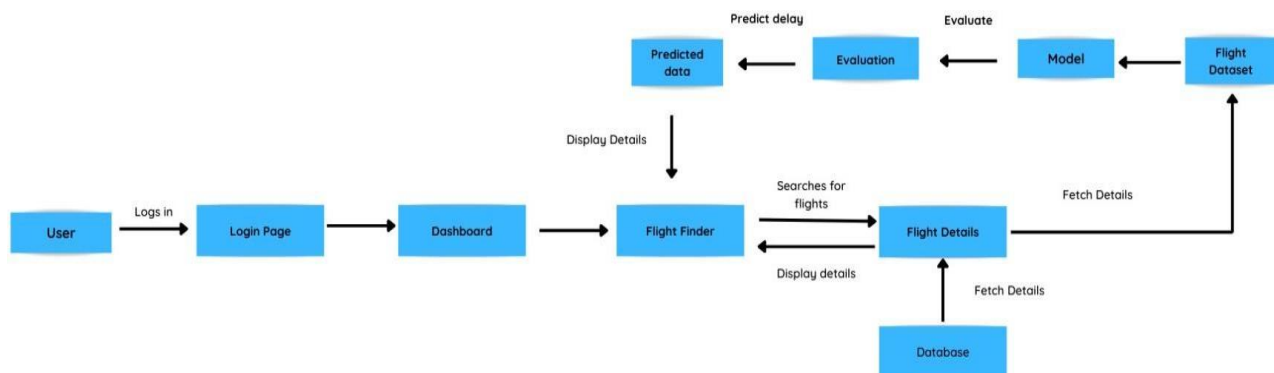
4.2 NON-FUNCTIONAL REQUIREMENTS

- A non-functional requirement defines the quality attribute of a software system
- It places constraint on “How should the software system fulfil the functional requirements?”
- It is not mandatory
- Applied to system as a whole
- Usually more difficult to define
- Helps you verify the performance of the software

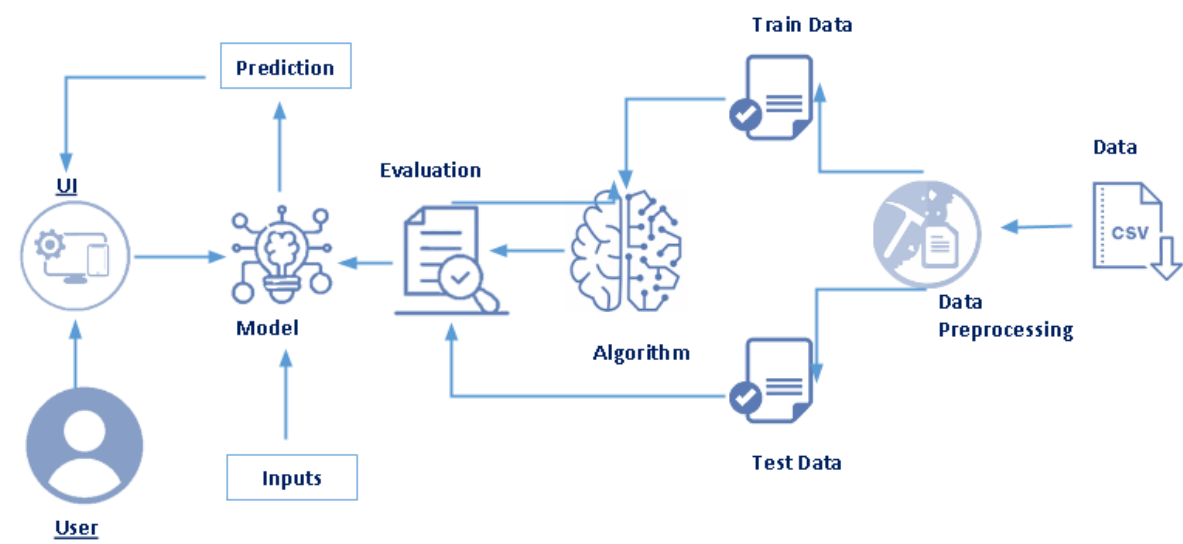
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Describes the ease of use for the customers.
NFR-2	Security	Assures all data inside the system or its part will be protected against malware attacks or unauthorized attacks.
NFR-3	Reliability	Specifies the probability of the software performing without failure for a specific number of uses or amount of time.
NFR-4	Performance	Deals with the measure of the system's response time under different load conditions.
NFR-5	Availability	Describes how likely the system is accessible for a given user at a given point of time.
NFR-6	Scalability	Assesses the highest workloads under which the system will still meet the performance requirements.

5. PROJECT DESIGN

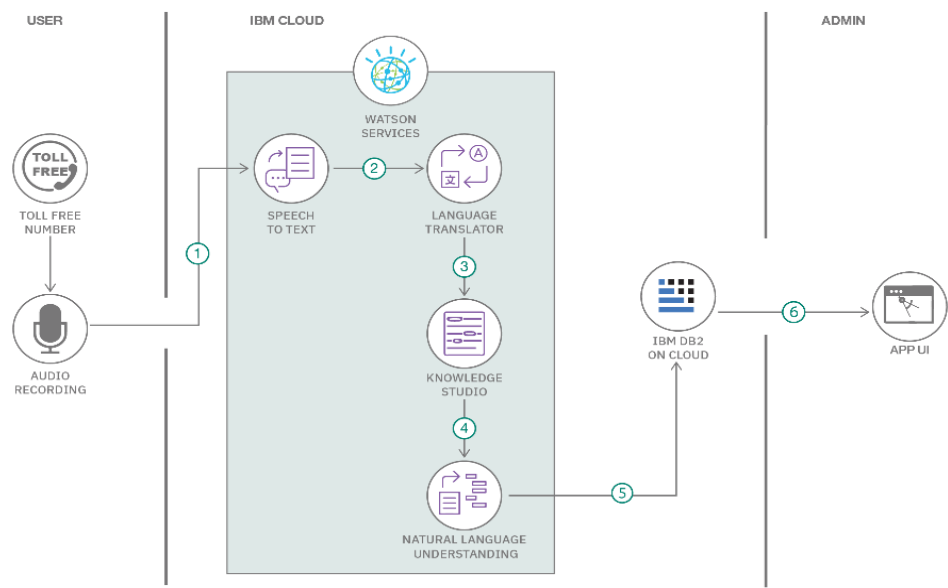
5.1 DATA FLOW DIAGRAM



5.2 SOLUTION ARCHITECTURE



TECHNOLOGY ARCHITECTURE



5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web 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 <u>account / dashboard</u>	High	Sprint-1
		USN-2	As a user, I will receive <u>confirmation email</u> once I have registered for the application	I can receive <u>confirmation email</u> & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the	Low	Sprint-2
				dashboard with Facebook Login		
	Login	USN-5	As a user, I can log into the application by entering <u>email</u> & password	I can access the dashboard	High	Sprint-1
	Dashboard	USN-6	As a user, I can navigate through different pages using the dashboard	I can access <u>various pages</u>	High	Sprint-1
	Search	USN-7	As a user, I can search for flights <u>for different locations</u>	I can receive information on different flights for various locations.	High	Sprint-2
	View	USN-8	As a user, I can view the details of flights.	I will get the information such as flight number, departure and <u>arrival time</u> .	High	Sprint-2
	Receive notifications	USN-9	As a user, I will receive notifications about the flight.	I will get frequent updates <u>of the flight's location</u>	Low	Sprint-3
	Track	USN-10	As a user, I will track the location of my flight.	I can track my flight.	High	Sprint-3,4
Administrator	GPS	USN-11	As an admin, I will need the location of flights	I can track my flight.	High	Sprint-3,4

6. PROJECT DESIGNING AND PLANNING

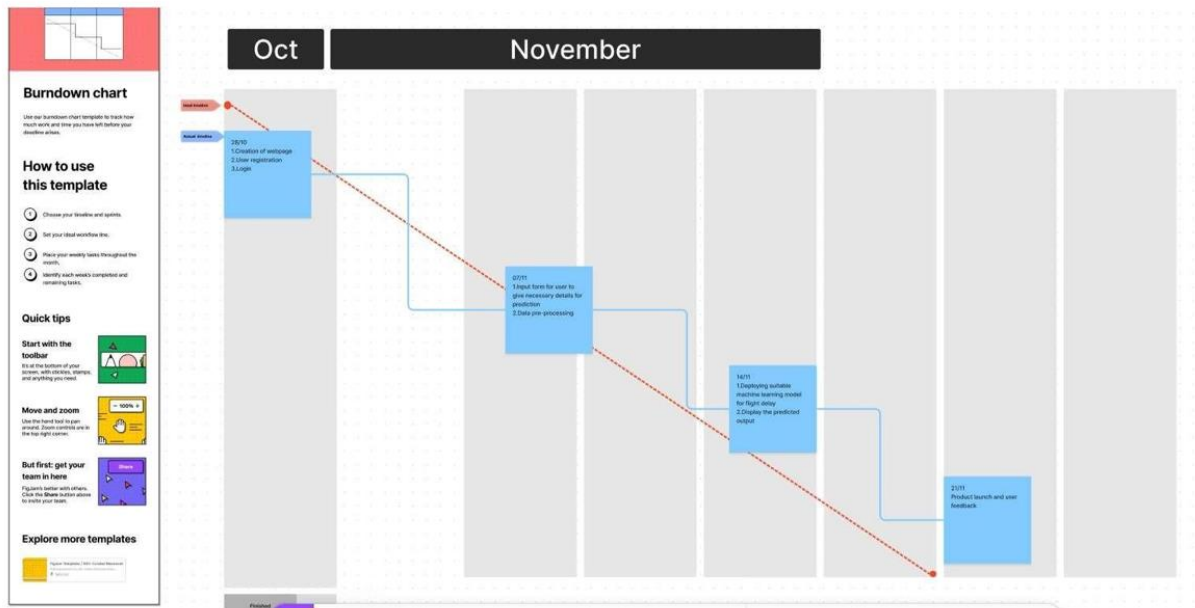
6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration and login	USN-1	As a user, I can register for the application by entering my email, <u>password</u> , and confirming my password.	2	High	K. <u>Tamaraiselvi</u>
Sprint-2	Confirmation email	USN-2	As a user, I will receive <u>confirmation</u> email once I have registered for the application	1	High	T. <u>Pavithiravalavan</u>
Sprint-1	User login	USN-3	As a user, I can register for the application through Facebook	2	Low	S. Sandeep
Sprint-2	Admin Panel	USN-4	As a user, I can register for the application through Gmail	2	Medium	M.R. <u>Vyshnav</u>
Sprint-3	Arrival and Departure <u>time</u> of flights	USN-5	As a user, I can log into the application by entering <u>email</u> & password	1	High	K. <u>Tamaraiselvi</u>
Sprint-3	Dashboard	USN-6	As a user, I can find <u>exactly</u> how long the flight will be delayed	2	High	T. <u>Pavithiravalavan</u>
Sprint-4	Helpdesk	USN-7	As a customer care executive, I can provide the contact details of the airlines	1	Medium	S. Sandeep
Sprint-4		USN-8	As a passenger, I can find alternative flights to the <u>destination</u> that are available	1	High	M.R. <u>Vyshnav</u>
Sprint-4	Feedback	USN-9	As a user, I can provide my suggestions and feedback for the improvement of the application	2	Medium	T. <u>Pavithiravalavan</u>

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	31 Oct 2022	4 Nov 2022	4	4 Nov 2022
Sprint-2	20	6 Days	5 Nov 2022	7 Nov 2022	4	7 Nov 2022
Sprint-3	20	6 Days	8 Nov 2022	9 Nov 2022	4	9 Nov 2022
Sprint-4	20	6 Days	10 Nov 2022	12 Nov 2022	4	12 Nov 2022

6.3 REPORTS FROM JIRA



7.CODING & SOLUTIONING

7.1 FEATURE 1

```
import pandas as pd
```

```
import numpy as np
```

```
import os, types
```

```
import pandas as pd
```

```
from botocore.client import Config
```

```
import ibm_boto3
```

```
def __iter__(self): return 0
```

```
data = pd.read_csv(body)
```

```
data.head()
```

```
type(data)
```

```
data.head(10)
```

```
data['Gender'].fillna(data['Gender'].mode()[0],inplace = True)
```

```

data['Age'],fillna(data['Age'],mean(),inplace = True)
data['CreditScore'],fillna(data['CreditScore'],median(),inplace = True)
data.isnull().any()
data.head(10)
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
data["Geography"] = le.fit_transform(data["Geography"])
data["Gender"] = le.fit_transform(data["Gender"])
x = data.iloc[:,3:13].values
y = data.iloc[:,13].values
data
x
from sklearn.preprocessing import OneHotEncoder
one = OneHotEncoder()
z = one.fit_transform(x[:,1:2]).toarray()
x = np.delete(x,1,axis = 1)
x = np.concatenate((z,x),axis = 1)
z
x
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size = 0.2,random_state = 42)
x.shape
x_train.shape
x_test.shape
from sklearn.model_selection import train_test_split
x1 = [1,2,3,4,5,6,7,8,9,10]
y1 = [1,0,1,0,1,0,1,0,1,0]
for l in range(5):
    x_train1,x_test1,y_train1,y_test1 = train_test_split(x1,y1,test_size = 0.2,random_state = 2)

```

```

    print(x_train1, "with random state")
for l in range(5):
    x_train1,x_test1,y_train1,y_test1 = train_test_split(x1,y1,test_size = 0.2)
    print(x_train1,"without random state")
from sklearn.ensemble import RandomForestClassifier
forest_reg = RandomForestClassifier(n_estimators=10,criterion='entropy',random_state=42)
forest_reg.fit(x_train,y_train)
x_train[0]
from ibm_watson_machine_learning import APIClient
wml_credentials = {
    "url":"https://us-south.ml.cloud.ibm.com",
    "apikey":"Wv3aXu7-agz7OrqIjR-btR10N_5Zncy7TqDdiM55xfyN"
}
client = APIClient(wml_credentials)
def guid_from_space_name(client,space_name):
    space = client.spaces.get_details()
    return(next(item for item in space['resources'] if item['entity']['name'] == space_name)['metadata']['id'])
space_uid = guid_from_space_name(client, "models")
print("Space UID = " + space_uid)
client.set.default_space(space_uid)
client.software_specifications.list()
    software_spec_uid = client.software_specifications.get_uid_by_name("default_py3.7")
software_spec_uid
df_data_1 = pd.read_csv(body)
df_data_1.head()
etaNames.NAME:"Churn_modelling",
client.repository.ModelMetaNames.TYPE:"scikit-learn_0.22",
client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_spec_uid}

)

```



```

model_id = client.repository.get_model_uid(model_details)
model_id
x_train[0]
forest_reg.predict([[1.0000000e+00, 0.0000000e+00, 0.0000000e+00, 6.8600000e+02,
1.0000000e+00, 3.2000000e+01, 6.0000000e+00, 0.0000000e+00,
2.0000000e+00, 1.0000000e+00, 1.0000000e+00, 1.7909326e+05]])

```

7.2 FEATURE 2

```

def home():
return render_template('index.html')

def y_predict():
geography = request.form("geography")
gender= request.form("gender")
age= request.form("age")
tenure= request.form("tenure")
creditscore= request.form("creditscore")
balance= request.form("balance")
noof = request.form["no of"]
hascreditcard = request.form["has credit card"]
isactivemember = request.form["isactivemember"]
estimatedsalary = request.form["estimated salary"]
if(geography == "Spain"):
s1,s2,s3 = 0,0,1
if(geography == "Germany"):
s1,s2,s3 = 0,1,0
if(geography == "Newyork"):
s1,s2,s3 = 0,1,0
if(gender == "female"):
gender = 0

```

```

if(gender == "male"):
    gender = 1
if(isactivemember == "no"):
    isactivemember = 0
if(isactivemember == "yes"):
    isactivemember = 1
if(hascrreditcard == "no"):
    hascrreditcard = 0
if(hascrreditcard == "yes"):
    hascrreditcard = 1

t=[[int(s1),int(s2),int(s3),int(creditscore),int(gender),int(age),int(tenure),int(balance),int(noof),int(hascrreditcard),int(isactivemember),int(estimatedsalary)]]

print(t)

payload_scoring =
("input_data":[{"field":["G1","G2","G3","CreditScore","Gender","Age","Tenure","Balance","numofproducts","HasCrCard","IsActiveMember"])

print("Scoring response')

predictions = response_scoring.json()

print(predictions)

pred = predictions['predictions'][0]['values'][0][0]

if(pred == 0):
    output = "he will not get excited"
    print(" he will not get excited")
else:
    output = "he gets excited"
    print("he gets excited")

return render_template("index.html",prediction_text=output)

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

```

8.TESTING

8.1 TEST CASES

Flight Delay Prediction

AboutLogOut

Enter Flight Number

Enter Flight Number

Month

Origin

India

Destination

India

Scheduled
Departure Time

--:--

Scheduled Arrival
Time

--:--

Actual Departure
Time

--:--

Submit

PREDICTION VALUE = 1 (FLIGHT IS DELAYED)

model_deploy

Deployed

Online

API reference

Test

Enter input data

Text input

JSON input

Enter data manually or use a CSV file to populate the spreadsheet. Max file size is 50 MB.

Download CSV template

Browse local files

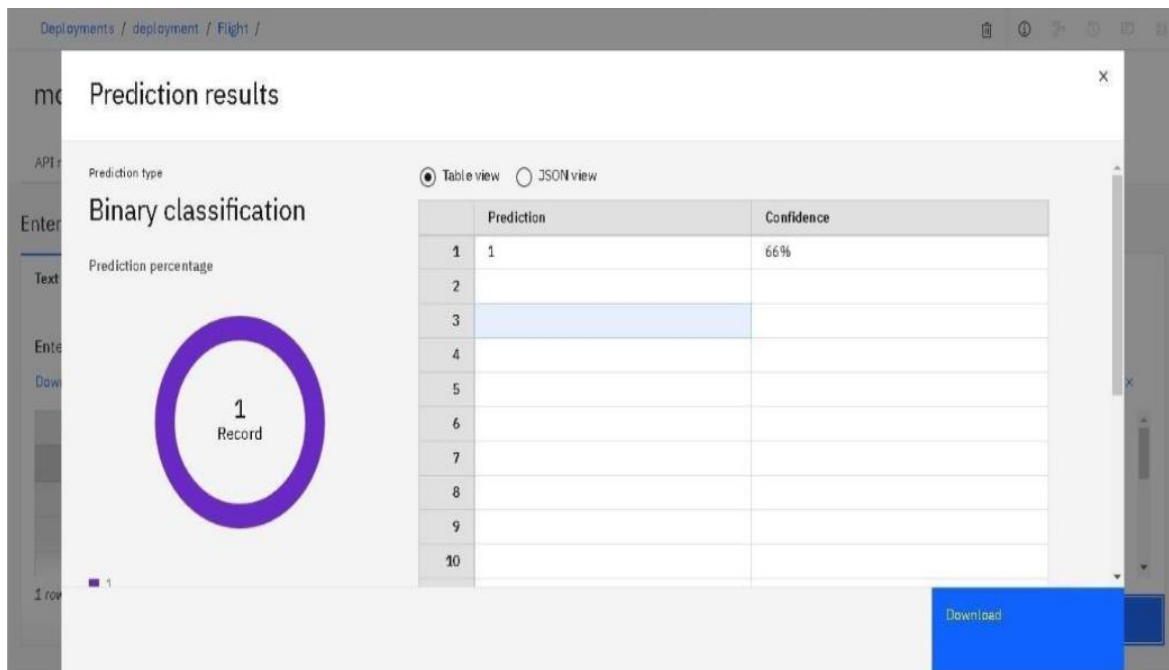
Search in space

Clear all

	f0 (int)	f1 (int)	f2 (int)	f3 (int)	f4 (int)	f5 (int)
1	2013	1	1	11	0	48
2						
3						
4						

1 row, 6 columns

Predict



PREDICTION VALUE = 0 (FLIGHT WILL BE ON TIME)

model_deploy Deployed Online

API reference **Test**

Enter input data

Text input **JSON input**

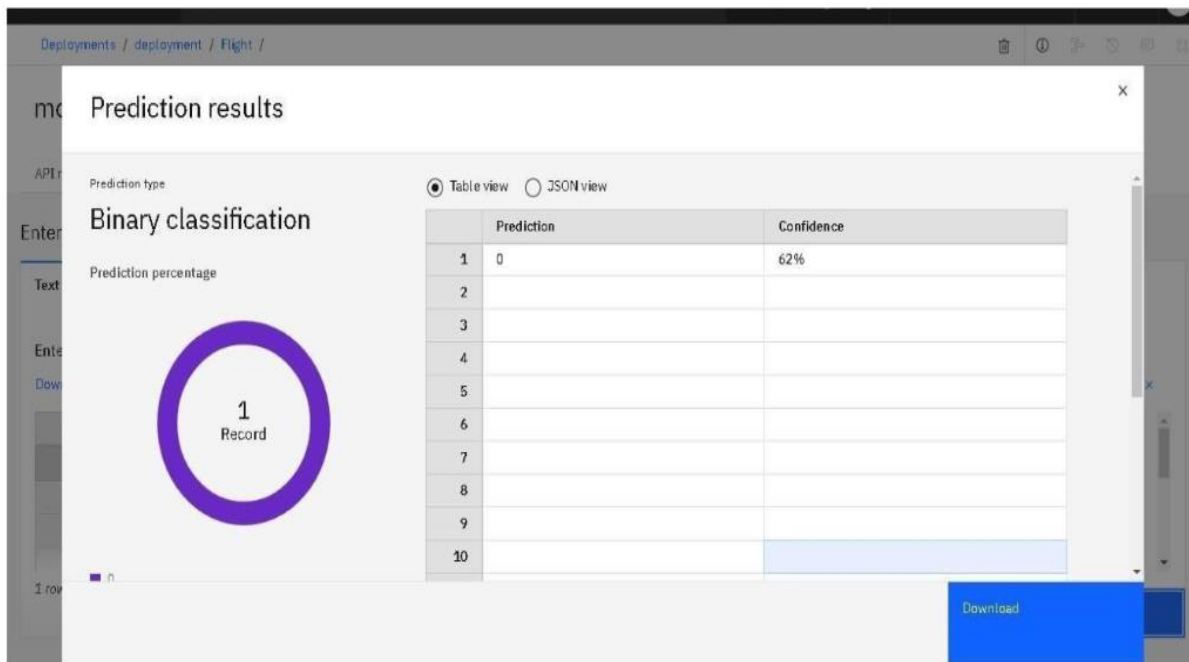
Enter data manually or use a CSV file to populate the spreadsheet. Max file size is 50 MB.

[Download CSV template](#) [Browse local files](#) [Search in space](#) [Clear all](#)

	f0 (int)	f1 (int)	f2 (int)	f3 (int)	f4 (int)	f5 (int)
1	2013	1	1	11	12	7
2						
3						
4						

1 row, 6 columns

Predict



9.RESULTS

9.1 PERFORMANCE METRICS

CPU usage

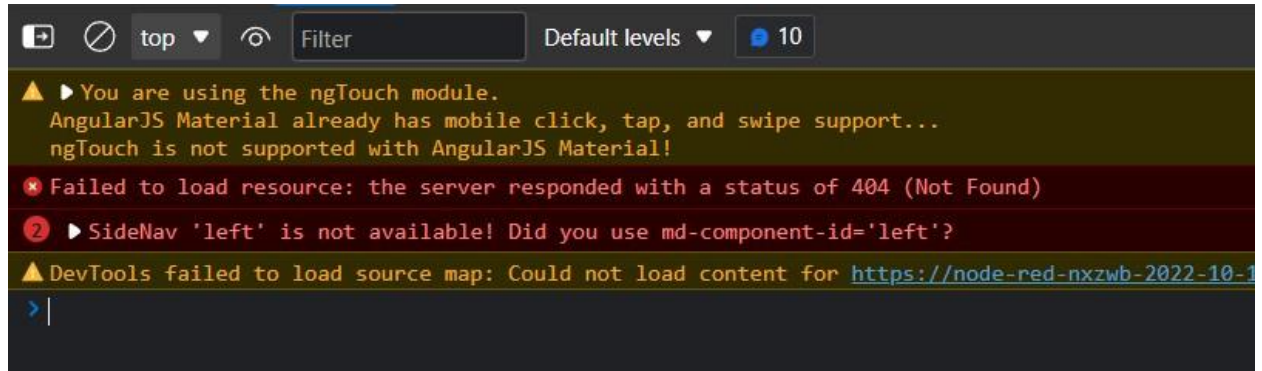
The micro version of c++ is make the best use of the CPU. For every loop the program runs in $O(1)$ time, neglecting the network and communication. The program sleeps for every 1 second for better communication with MQTT. As the program takes $O(1)$ time and the compiler optimizes the program during compilation there is less CPU load for each cycle. The upcoming instructions are on the stack memory, so they can be popped after execution.

Memory usage

The sensor values , networking data are stored in sram of the ESP32 . It's a lot of data because ESP32 has only limited amount of memory (520 KB) .For each memory cycle the exact addresses are overwritten with new values to save memory and optimal execution of the program

Error rates

The errors rates are very low as the backend and dashboard is handled with node-red. The exceptions are handled in a proper way as it does not affect the usability of the system

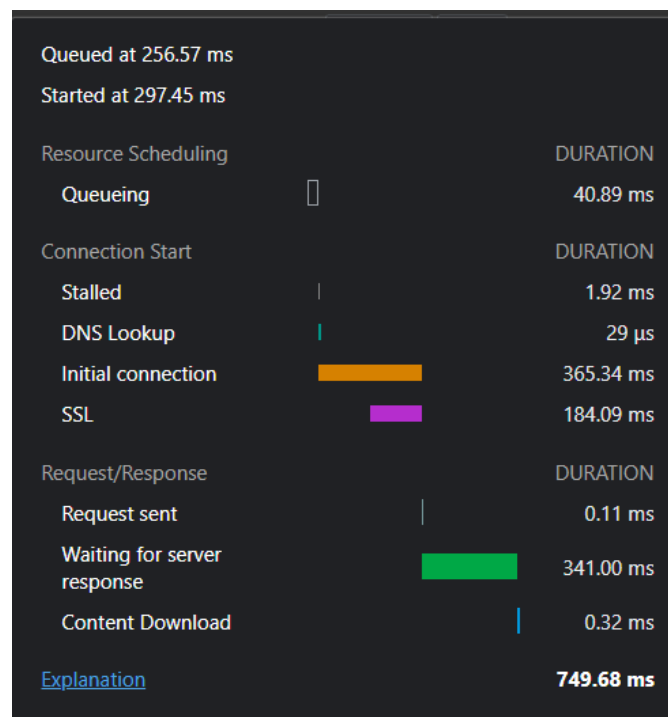


Latency and Response Time

The DOM handling of the received data is optimal and latency is low. After the DOM is loaded the entire site is loaded to the browser

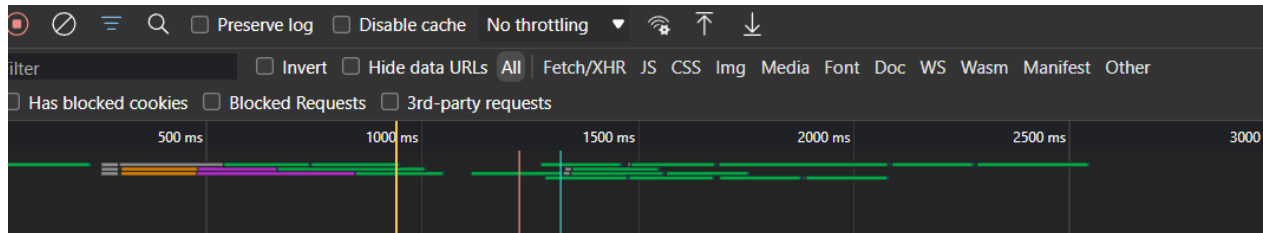
19 requests 10.1 kB transferred 2.2 MB resources Finish: 2.53 s DOMContentLoaded: 1.21 s Load: 1.31 s

The server also responses quickly. The average time of response is respectable



For the data sent from the IoT device (considering the sleep of one second from the IoT), the response is much quicker. We can easily see the delay caused by the sleep function

The average time is well over optimal value
Average time = $(5ms + 2600ms)/2$
= 1302.5



Garbage collection

In the server-side garbage collection is done by the Node framework. In the IoT device, C++ does not have any garbage collection features. But it is not necessary in this scenario as the memory is used again for storing the data. Any dangling pointer or poorly handled address space is not allocated.

10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- By watching the ripples that are created when delays in one area occur, we could follow those aircraft and provide passengers with an estimation of what to expect when they arrive at their gate.
- Predicting flight delays can improve airline operations and passenger satisfaction, which will result in a positive impact on the economy.
- Data science technologies like AI and machine learning can help airlines get fuel-burn, weather, navigation, and operations data to deliver actionable insights to optimize fuel utilization and reduce operational costs.

DISADVANTAGES:

- Needs massive amount of data.
- Usage of various analysis such as statistical analysis and probabilistic models.
- Many algorithms are used to analyze the data.

11. CONCLUSION

There is a requirement to develop a system to predict the delay in flights to scale back monetary loss and for the higher and smooth operation. Classification or regression ways are often accustomed to determine the delay which includes Feed forward network, Neural Network, Random Forest, decision tree, Naïve Bayes Classification Tree, Regression Tree etc. Comparison of decision tree classifier with logistic regression and a simple neural network for various figures of merit.

12. APPENDIX

MACHINE LEARNING WITH PYTHON:

Machine learning is a field of computer science that uses statistical techniques to give computer programs the ability to learn from past experiences and improve how they perform specific tasks. Machine Learning is simply recognizing patterns in your data to be able to make improvements and intelligent decisions on its own.

DECISION TREE CLASSIFIER:

A decision tree is a flowchart-like tree structure where an internal node represents feature(or attribute), the branch represents a decision rule, and each leaf node represents the outcome. The topmost node in a decision tree is known as the root node. It learns to partition on the basis of the attribute value.

DATA PREPROCESSING IN MACHINE LEARNING:

Data pre processing is a process of preparing the raw data and making it suitable for a machine learning model. It is the first and crucial step while creating a machine learning model. A real-world data generally contains noises, missing values, and maybe in an unusable format which cannot be directly used for machine learning models. Data pre processing is required tasks for cleaning the data and making it suitable for a machine learning model which also increases the accuracy and efficiency of a machine learning model.

SOURCE CODE:

login.php

```
<?php
include 'config.php';

use PHPMailer\PHPMailer\PHPMailer;use
PHPMailer\PHPMailer\SMTP;

use PHPMailer\PHPMailer\Exception;

require 'vendor/autoload.php';

session_start();

error_reporting(0);
if (isset($_SESSION["user_id"]))
    {header("Location:
    welcome.php"); }

if (isset($_POST["signup"])) {
    $full_name = mysqli_real_escape_string($conn, $_POST["signup_full_name"]);
    $email = mysqli_real_escape_string($conn, $_POST["signup_email"]);

    $password = mysqli_real_escape_string($conn, md5($_POST["signup_password"]));

    $cpassword = mysqli_real_escape_string($conn, md5($_POST["signup_cpassword"]));
    if ($password !== $cpassword) {
        echo "<script>alert('Password did not match.');
```



```

    } elseif ($check_email > 0) {
        echo "<script>alert('Email already exists in our database.');

```

```

//Create an instance; passing `true` enables exceptions
$mail = new PHPMailer(true);

try {

    //Server settings

    $mail->SMTPDebug = 0;

    $mail->isSMTP();
    $mail->Host      = $smtp['host'];
    $mail->SMTPAuth  = true;
    $mail->Username  = $smtp['user'];
    $mail->Password  = $smtp['pass'];
    $mail->SMTPSecure = PHPMailer::ENCRYPTION_SMTPS;

    $mail->Port      = $smtp['port']; //TCP port to connect to; use 587 if
you have set `SMTPSecure = PHPMailer::ENCRYPTION_STARTTLS`

    //Recipients
    $mail->setFrom($my_email);

    $mail->addAddress($email, $full_name); //Add a recipient
    //Content
    $mail->isHTML(true); //Set email format to HTML

    $mail->Subject = $subject;

    $mail->Body    = $message;
    $mail->send();
    echo "<script>alert('We have sent a verification link to your email - {$email}.');</script>";

} catch (Exception $e) {
    echo "<script>alert('Mail not sent. Please try again.');"</script>";

}
} else {
    echo "<script>alert('User registration failed.');"</script>";
}

```

```
    }  
  }  
}
```

```
if (isset($_POST["signin"])) {
```

```
    $email = mysqli_real_escape_string($conn, $_POST["email"]);  
    $password = mysqli_real_escape_string($conn, md5($_POST["password"]));
```

```
    $check_email = mysqli_query($conn, "SELECT id FROM users WHERE email='$email' AND  
password='$password' AND status='1'");
```

```
    if (mysqli_num_rows($check_email) > 0) {  
        $row = mysqli_fetch_assoc($check_email);
```

```
        $_SESSION["user_id"] = $row['id'];
```

```
        header("Location: welcome.php");
```

```
    } else {
```

```
        echo "<script>alert('Login details is incorrect. Please try again.');
```

```
    }
```

```
}
```

```
?>
```

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
    <meta charset="UTF-8" />
```

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

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

```
    <title>Find Me</title>
```

```
</head>
```

```
<body>
```

```

<div class="container">
  <div class="forms-container">

    <div class="signin-signup">
      <form action="" method="post" class="sign-in-form">
        <h2 class="title">Sign in</h2>

        <div class="input-field">
          <i class="fas fa-user"></i>

          <input type="text" placeholder="Email Address" name="email" value="<?php echo
$_POST['email']; ?>" required />

        </div>
        <div class="input-field">
          <i class="fas fa-lock"></i>
          <input type="password" placeholder="Password" name="password" value="<?php echo
$_POST['password']; ?>" required />

        </div>
        <input type="submit" value="Login" name="signin" class="btn solid" />

        <p style="display: flex;justify-content: center;align-items: center;margin-top: 20px;"><a
href="forgot-password.php" style="color: #4590ef;">Forgot Password?</a></p>

      </form>

      <form action="" class="sign-up-form" method="post">
        <h2 class="title">Sign up</h2>

        <div class="input-field">
          <i class="fas fa-user"></i>
          <input type="text" placeholder="Full Name" name="signup_full_name" value="<?php
echo $_POST['signup_full_name']; ?>" required />

        </div>

        <div class="input-field">
          <i class="fas fa-envelope"></i>

```

```
<input type="email" placeholder="Email Address" name="signup_email" value="<?php echo
$_POST["signup_email"]; ?>" required />
</div>
<div class="input-field">
  <i class="fas fa-lock"></i>
  <input type="password" placeholder="Password" name="signup_password"
value="<?php echo $_POST["signup_password"]; ?>" required />

  </div>
  <div class="input-field">

    <i class="fas fa-lock"></i>
    <input type="password" placeholder="Confirm Password" name="signup_cpassword"
value="<?php echo $_POST["signup_cpassword"]; ?>" required />

    </div>

    <input type="submit" class="btn" name="signup" value="Sign up" />

  </form>
</div>
</div>
```

```
<div class="panels-container">
  <div class="panel left-panel">
    <div class="content">

      <h3>New here ?</h3>

      <br>

      <button class="btn transparent" id="sign-up-btn">

        Sign up

      </button>

    </div>
```

```

    
</div>

<div class="panel right-panel">
  <div class="content">
    <h3>One of us ?</h3>

    <br>

    <button class="btn transparent" id="sign-in-btn">

      Sign in

    </button>

  </div>
  
</div>
</div>
</div>
<script src="https://kit.fontawesome.com/64d58efce2.js" crossorigin="anonymous"></script>
  <script src="app.js"></script>
</body>
</html>

```

logout.php

```

<?php

session_start();

session_unset();

session_destroy(

);

header("Location: login.php");

?>

```

Verify-email.php

```
<?php
session_start();

if (isset($_GET["token"]))
    {
        include 'config.php';
        $sql = "UPDATE users SET status='1' WHERE token='{$_GET["token"]}'";

        mysqli_query($conn, $sql);

        $showUserId = mysqli_fetch_assoc(mysqli_query($conn, "SELECT id FROM users WHERE
token='{$_GET["token"]}'"));

        $_SESSION["user_id"] = $showUserId['id'];

        header("Location: welcome.php");
    } else {

        header("Location: login.php");

    }

?>
reset-password.php
```

```
<?php

include 'config.php';

error_reporting(0);

session_start();

if (isset($_SESSION["user_id"]))
    {
        header("Location:
welcome.php");
    }
}
```

```

if (isset($_POST["resetPassword"])) {
    $password = mysqli_real_escape_string($conn, md5($_POST["new_password"]));
    $cpassword = mysqli_real_escape_string($conn, md5($_POST["cnew_password"]));
    if ($password === $cpassword) {
        $sql = "UPDATE users SET password='$password' WHERE token='{$_GET["token"]}'";
        mysqli_query($conn, $sql);
        header("Location: login.php");
    } else {
        echo "<script>alert('Password not matched.');

```

```

?>
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0" />
    <link rel="stylesheet" href="style.css" />
    <title>Find Me</title>
</head>
<body>
    <div class="container">
        <div class="forms-container">
            <div class="signin-signup">
                <form action="" method="post" class="sign-in-form">
                    <h2 class="title">Reset Password</h2>

```



```

        <div class="input-field">
            <i class="fas fa-lock"></i>

            <input type="password" placeholder="New Password" name="new_password"
value="<?php echo $_POST['new_password']; ?>" required />

        </div>
        <div class="input-field">

            <i class="fas fa-lock"></i>
            <input type="password" placeholder="Confirm New Password" name="cnew_password"
value="<?php echo $_POST['cnew_password']; ?>" required />

        </div>

        <input type="submit" value="Reset Password" name="resetPassword" class="btn solid" />
    </form>
</div>

</div>

<div class="panels-container">

    <div class="panel left-panel">
        <div class="content">
            <h3>Reset Password ?</h3>
        </div>

        
    </div>
</div>

</div>
<script src="https://kit.fontawesome.com/64d58efce2.js" crossorigin="anonymous"></script>
    <script src="app.js"></script>

</body>
</html>

```

GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-46479-1660747642>

DEMO VIDEO:

<https://youtu.be/C7bWyl5mCDE>

