**FORCAST COMMUTERS INFLOW FOR AIRLINE INDUSTRY**

**USING IBM CLOUD SERVICES**

**1.INTRODUCTION**

**1.1 OVERVIEW**

An aircraft operation is defined as either a take-off or a landing; thus each flight is comprised of two operations. Forecasting operations relies on determining the historical average number of commercial enplaned passengers per scheduled aircraft departure, projects changes in this ratio, and applies these changes to the forecast of enplaned passengers.

Enplaned passengers are defined as those that are boarding the aircraft at the airport. Enplaned passenger levels are doubled to calculate the total number of passengers using the airport. Using the enplaned passengers in airport planning is the common practice. The forecasts are used to program terminal area requirements, assess the state of the commercial service and develop assumptions as to the evolution of the size of commercial aircraft to be used as well as to project the number of daily flights to be offered in the future.

**1.2 PURPOSE**

Air passenger traffic forecast is of great importance for airlines and civil aviation authorities. For airlines, accurate forecasts play an increasingly important role in revenue management. It helps to reduce the airlines’ risk by objectively evaluating the demand of the air transportation business. For civil aviation authorities, air passenger traffic forecast provides a concrete basis for planning decisions in air transport infrastructure. The main objective of this project is to build a prophet time series model that forecasts the passenger traffic for a given date.

**2. LITERATURE SURVEY**

**2.1 Existing problem**

**. Fuel Efficiency**

**.Global Economy**

**. Passenger Comfort and Experience**

**. Airline Infrastructure**

**. Global Congestion**

**. Technological Advancements**

**. Terrorism**

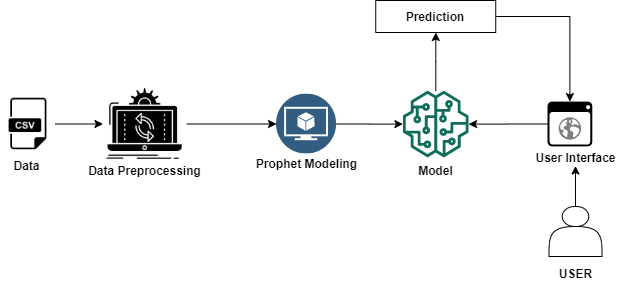
**. Climate Change**

The aviation industry forms an important part of the global economy. Pre-COVID, airline companies had to deal with considerable challenges, the solutions of which were being thought out and assessed by industry experts periodically. The advent of the pandemic however, brought forth a set of ground breaking challenges for the airline industry that it hadn’t encountered in any of the previous global disasters such as the 9/11 attack or the economic recession of 2008. It has not only brought about an entire 180-degree change in the way previous challenges were perceived, but a new set of risks that will now form the base of how the industry will function in the forthcoming decades.

* 1. **Proposed solution**
* User friendly
* Easy to access
* Take a passenger-first approach
* Focus on knowing your target audiences
* Always listen, then talk
* Meet specific and unique customer needs
* Engage customers in a variety of ways
* Create a bond with them throughout the entire journey
* Make smart customer-targeted decisions based on data

**3. THEORITICAL ANALYSIS**

**3.1 Block diagram**



**3.2 Hardware / Software designing**

∙ IBM Watson Studio - IBM Watson Studio helps data scientists and analysts prepare data and build models at scale across any cloud.

∙ IBM Watson Machine Learning - IBM Watson Machine Learning helps data scientists and developers in deploying the model

∙ IBM Cloud Object Storage - IBM Cloud Object Storage makes it possible to store practically limitless amounts of data, simply and cost effectively.

**4. EXPERIMENTAL INVESTIGATIONS**

A machine learning model is built that predicts value based on following parameters:

* Month
* Date
* Flight cost

These are the parameters which affect the prediction of commuters for airline industry. All these values are the factors which predict the inflow of the customers.

**5. FLOW CHART**

Collect dataset

Date preprocessing

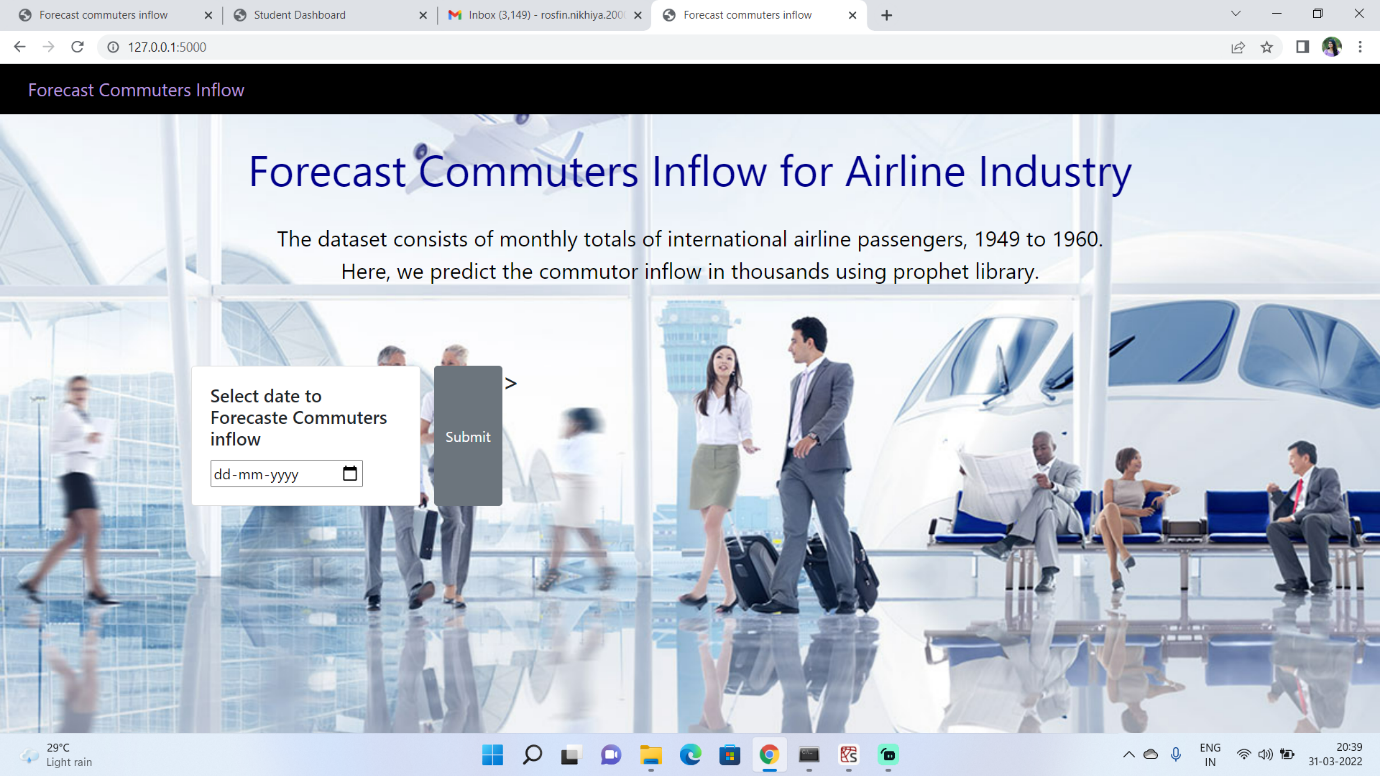
Model Building

Application Building

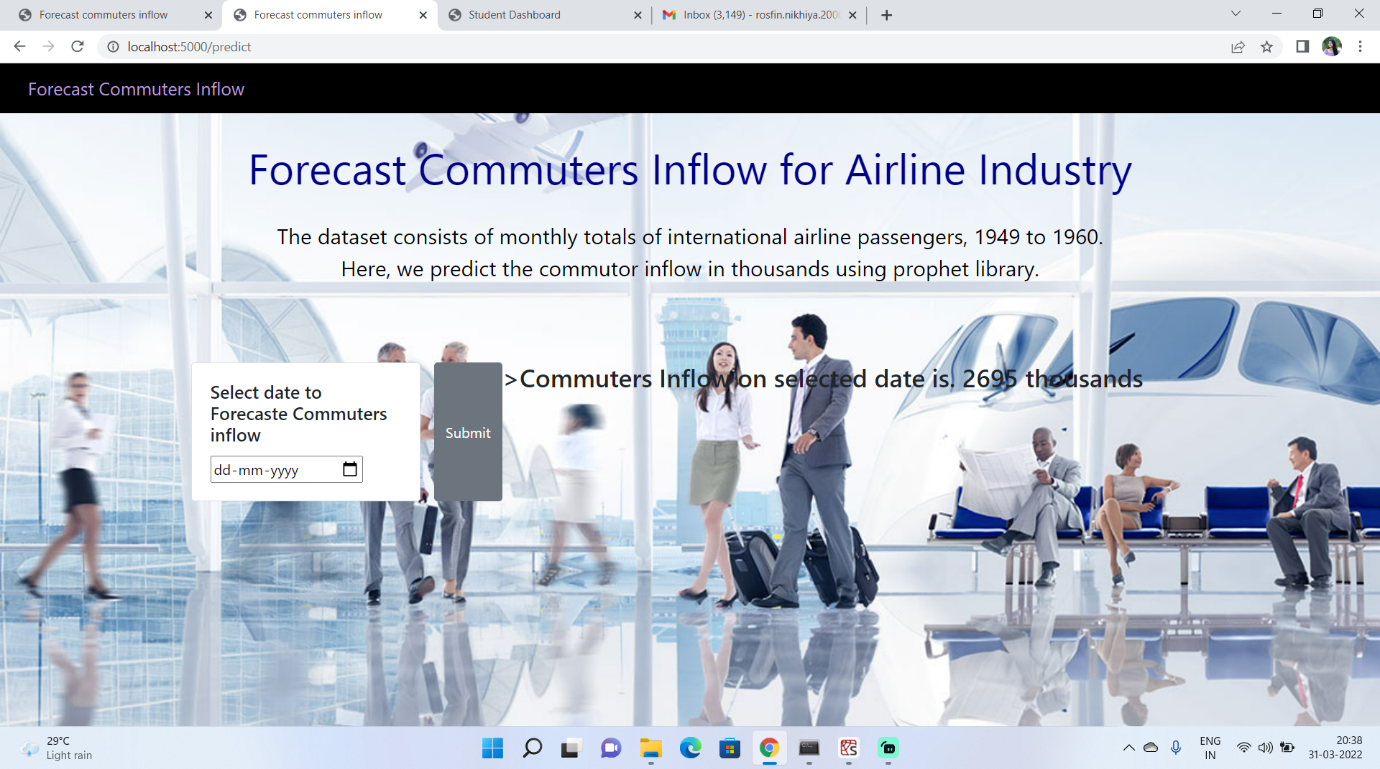
Deployment

**6. RESULTS**

This is the home page of the application

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This is the resulting page of the application. The user can select date from the given time period. The number of commuter inflow is predicted by clicking the submit button.



**7. ADVANTAGES & DISADVANTAGES**

**ADVANTAGES:**

* **Insight Creation** - Gaining insight is a must for operations that are seeking to generate adequate forecasts. Forecasting gets you into the habit of looking at the past and real-time data to predict future demand. While doing this, you will be able to anticipate demand fluctuations more effectively. It also will provide insight into your company’s supply chain health and provide you with an opportunity to make any corrections or adjustments based off of new information that is received through real-time data.
* **Learning From Past Mistakes** - Forecasting also enables you to make decisions based off of past errors and could provide insight on how to correct these in the future. You don’t start from scratch after each forecast. Even if your prediction was nowhere close to what ended up coming to pass, it provides a starting point. It is common to review where and why things didn’t happen the way you had predicted and you should be able to see an improvement in your forecasts. You will also get into the habit of reflecting upon past performance as a whole.
* **Cost Decrease** - Cost decrease is another substantial factor within manufacturing operations considering that forecasting can reduce the amount of errors due to following a schedule based off of the past. Anticipating demand will aid you with tweaking your processes to increase efficiency all along the supply chain. Because you are able to predict what customers will want and when they’ll want it, you will ultimately be able to decrease excess inventory levels and increase overall profitability.

**DISADVANTAGES:**

* **Forecasts are Never Completely Accurate** - Forecasts are never 100% and it is almost impossible to predict the future with certainty. Even if you have a great process in place and forecasting experts on your payroll, your forecasts will never be spot on. Some products and markets will have a high level of volatility, especially during times of crisis. The coronavirus has definitely enhanced and increased this volatility within the market - which is why understanding what factors influence your demand can potentially aid with developing forecasts during this time. Having said that, the main drawback of forecasts are that they are almost always wrong - which leads to excess or shortage of inventory.
* **It can be Time-Consuming and Resource-Intensive** - Forecasting pertains to data gathering, data organizing, and coordination. Companies will employ a team of demand planners who are responsible for coming up with the forecast. In order to adequately conduct this function, demand planners will need a substantial amount of input from sales and marketing teams. It is also not uncommon for process to be manual and labor-intensive, which will ultimately take up a lot of time. If you have the correct technology in the right place, it is much less of an issue.
* **Could be Costly** - Forecasting can be extremely costly - especially if it is done right. If you want adequate and close-to-accurate forecast, you have to spend the money, time, and resources to do so. Hiring a team of demand planners is a significant investment and adds to the cost of utilizing quality tools. While it is costly, you should easily see a return on this investment over time and your forecast should be much more accurate, thus saving you money and paying for itself in the long run.

**8. APPLICATIONS**

* A prototype for real-time forecasting of passenger connection times was developed using a Python IBM cloud interface.
* Airlines commuters inflow can easily identify which passengers are at risk of missing their onward flight based on the forecast probabilities. Given this information, they would be able to expedite late passengers and facilitate early re-booking.
* Forecasting gets you into the habit of looking at the past and real-time data to predict future demand. While doing this, you will be able to anticipate demand fluctuations more effectively.
* Anticipating demand will aid you with tweaking your processes to increase efficiency all along the supply chain. Because you are able to predict what customers will want and when they’ll want it, you will ultimately be able to decrease excess inventory levels and increase overall profitability.

**9. CONCLUSION**

For airlines, accurate forecasts play an increasingly important role in revenue management. It helps to reduce the airlines’ risk by objectively evaluating the demand of the air transportation business. For civil aviation authorities, air passenger traffic forecast provides a concrete basis for planning decisions in air transport infrastructure. The main objective of this project is to build a prophet time series model that forecasts the passenger traffic for a given date.

**10. FUTURE SCOPE**

As we know that day to day all the requirements are changing and getting more flexible so in the future we can add more parameters if we needed to predict and analyze forecast commuters inflow per minute.

**11. BIBLIOGRAPHY**

**12. APPENDIX**

**App.py code**

import numpy as np

import pandas as pd

from flask import Flask, request, jsonify, render\_template

#import pickle

import requests

# NOTE: you must manually set API\_KEY below using information retrieved from your IBM Cloud account.

API\_KEY = "MzXQpiZerFG8QjlceAXxVzaTYOPCpcnl9b11\_iiRWOuJ"

token\_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey": API\_KEY, "grant\_type": 'urn:ibm:params:oauth:grant-type:apikey'})

mltoken = token\_response.json()["access\_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}

app = Flask(\_\_name\_\_)

#model = pickle.load(open('airpassengers.pkl', 'rb'))

@app.route('/')

def home():

return render\_template('home.html')

@app.route('/predict',methods=['POST'])

def y\_predict():

if request.method == "POST":

ds = request.form["Date"]

print(ds)

print(type(ds))

a={"ds":[ds]}

#print(a)

ds=pd.DataFrame(a)

#prediction = model.predict(ds)

#print(prediction)

#output=round(prediction.iloc[0,15])

#print(ds)

ds['year'] = pd.DatetimeIndex(ds['ds']).year

ds['month'] = pd.DatetimeIndex(ds['ds']).month

ds['day'] = pd.DatetimeIndex(ds['ds']).day

#print(ds)

year= ds['year']

#print(year)

y=year.values.tolist()

#print(y[0])

month= ds['month']

#print(month)

m=month.values.tolist()

#print(m[0])

# NOTE: manually define and pass the array(s) of values to be scored in the next line

payload\_scoring = {"input\_data": [{"fields": [["year", "month"]], "values": [[y[0],m[0]]]}]}

response\_scoring = requests.post('https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/173b7d08-7851-4204-9cec-2732559c0764/predictions?version=2022-03-31', json=payload\_scoring, headers={'Authorization': 'Bearer ' + mltoken})

print("Scoring response")

pred= response\_scoring.json()

print(pred)

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

print(output)

return render\_template('home.html',prediction\_text="Commuters Inflow on selected date is. {} thousands".format(output))

return render\_template("home.html")

if \_\_name\_\_ == "\_\_main\_\_":

app.run(debug=False)

**Flask code**

import numpy as np

import pandas as pd

from flask import Flask, request, jsonify, render\_template

import pickle

app = Flask(\_\_name\_\_)

model = pickle.load(open('airpassengers.pkl', 'rb'))

@app.route('/')

def home():

return render\_template('home.html')

@app.route('/predict',methods=['POST'])

def y\_predict():

if request.method == "POST":

ds = request.form["Date"]

a={"ds":[ds]}

ds=pd.DataFrame(a)

prediction = model.predict(ds)

print(prediction)

output=round(prediction.iloc[0,15])

print(output)

return render\_template('home.html',prediction\_text="Commuters Inflow on selected date is. {} thousands".format(output))

return render\_template("home.html")

if \_\_name\_\_ == "\_\_main\_\_":

app.run(debug=True)