Flight price prediction using IBM watson

Submitted by:

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Introduction:

Air travel has become an integral part of our lives, Right from the business trips, vacations to visiting loved ones we use Air travel a lot. However, the constantly changing prices of flight tickets can make it challenging to plan the budget effectively.

The aim of this project is to harness the power of Data analysis and Machine learning models to predict the flight prices to an extent accurately. By using previous history of flight ticket price, type of airline, Duration of the travel, flights available and some other relevant factors, We can develop a model that can predict the future flight prices.

We used different analysis to find out the factors that influence the flight ticket prices, providing us to make smarter choices when it comes to booking your flights.

Literature Survey:

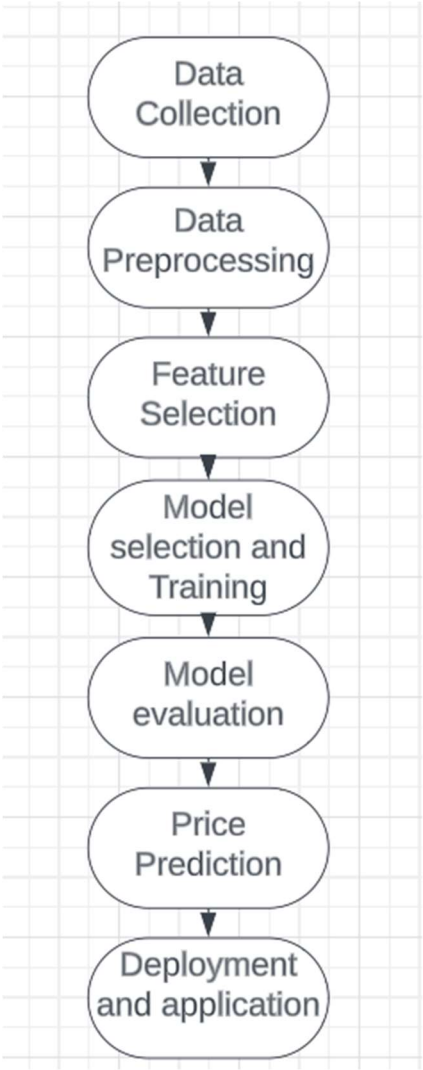
We read a couple of research papers regarding this project and browsed on the internet. We analyzed problems that contribute to the dynamic flight ticket price changing, such as the fuel prices, competition and market demand. Also the factors such as seat availability, booking time, travel seasons we often notice that prices during the peak travel times goes up because the demand for the tickets is more and competition is also high, Understanding this price volatility is much important for prediction of ticket price.

We have to also check for the data limitations we have, we can only predict the price of the ticket based on the previous history of prices, In reality the situation can be different. Addressing the issues related to price volatility, dynamic pricing, seasonality, profit or financial management and data quality, Considering all these we tried to develop a robust prediction regression model that can provide more reliable results.

Theoretical analysis:

We used multiple platforms Visual studio, Google colab and used flask library in python to deploy the project for use.

BLOCK DIAGRAM:



Experimental Investigations:

The first step is Defining the problem:

The price prediction depends upon many factors and some of them like fuel cost vary daily and some of them vary based on the duration of travel and some factors like season makes it difficult to predict the price accurately. We evaluate all these factors and developed a Machine learning model using Random forest classifier algorithm to predict the price.

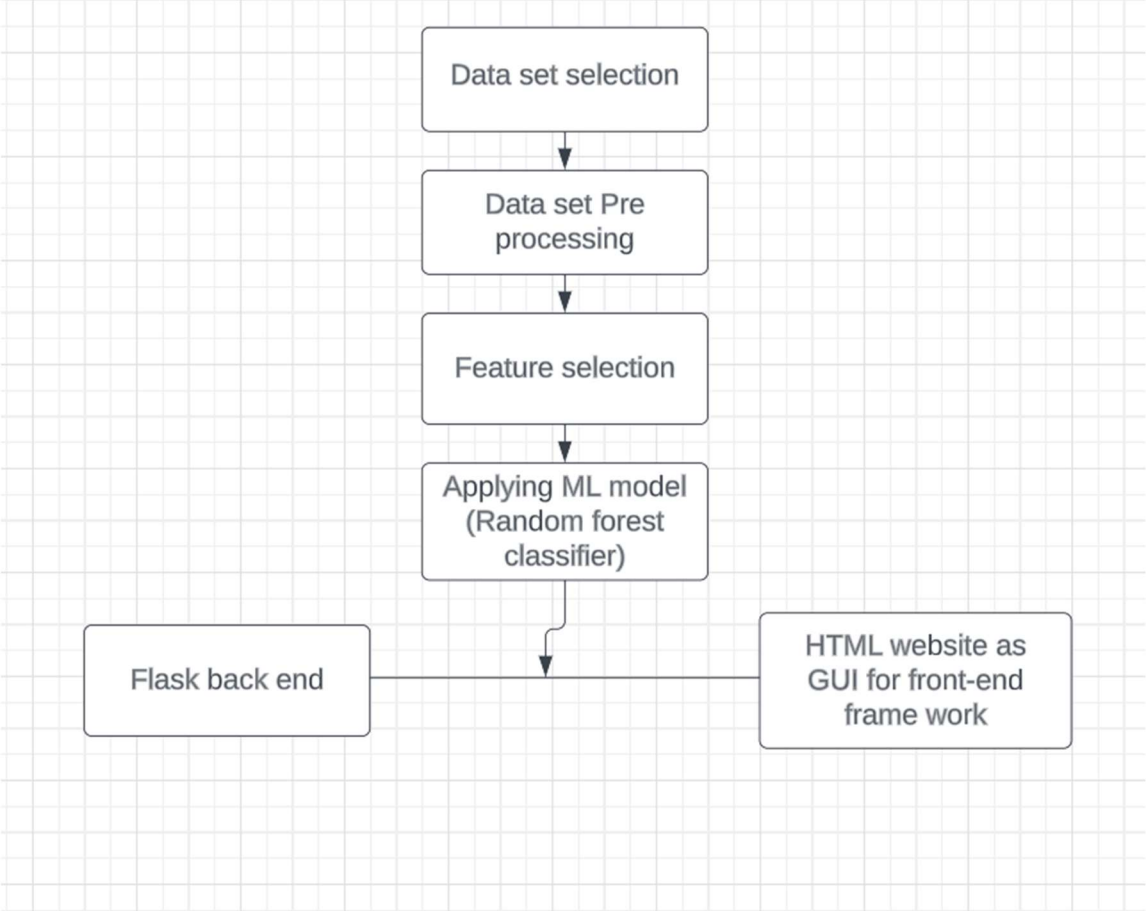
Data Collection and preprocessing is the second step:

We took flight price dataset and applied pre processing techniques to make sure the dataset is free from null values and other inappropriate formats.

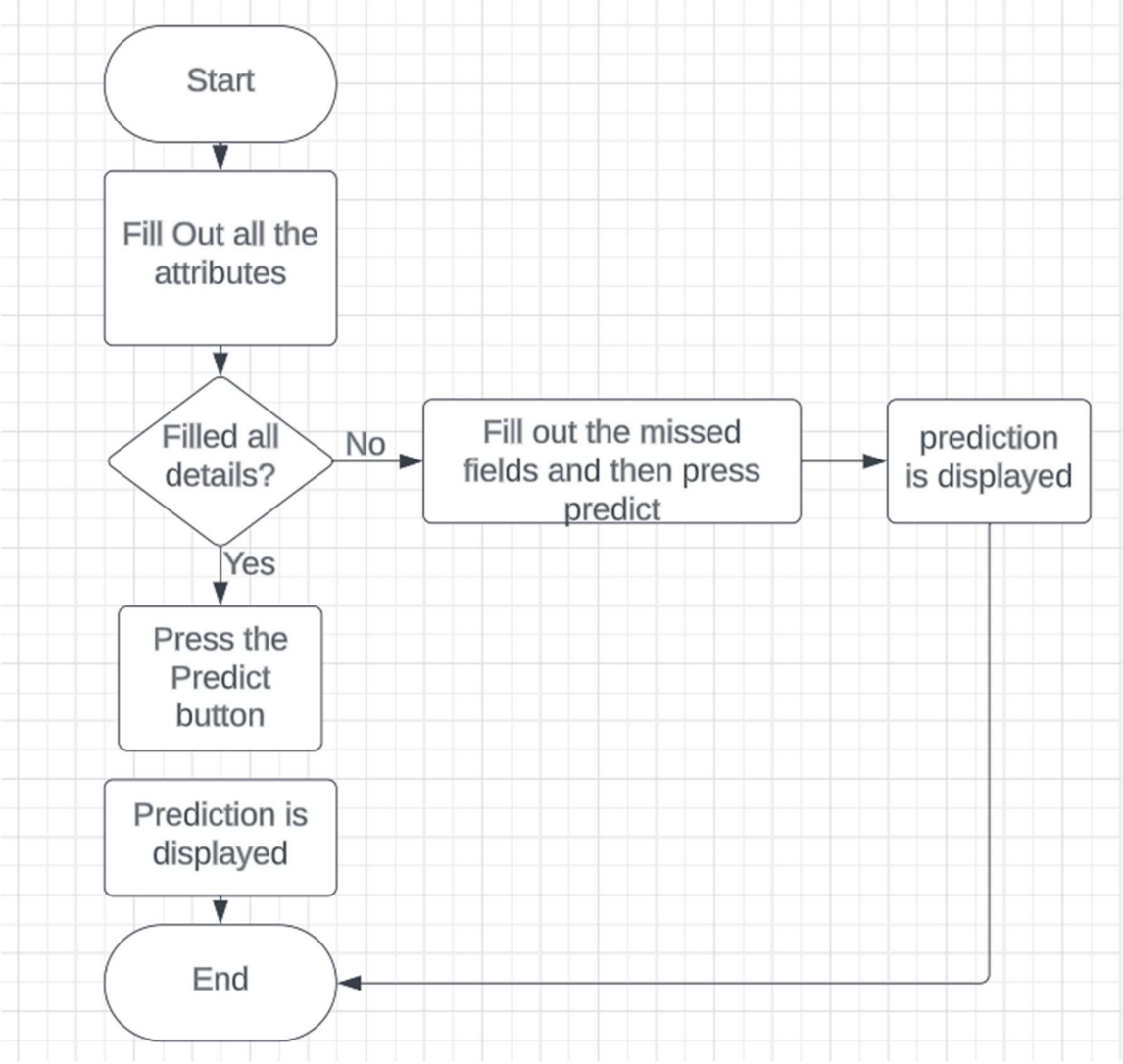
We used Heatmap, K-best and feature map selection to find out which feature in the provided dataset will provide best relation with the target variable.

We applied Random forest classifier algorithm to find out the best feature to predict the price correctly. We used performance metrics like MSE, RMSE, MAE to assess the accuracy the model is producing.

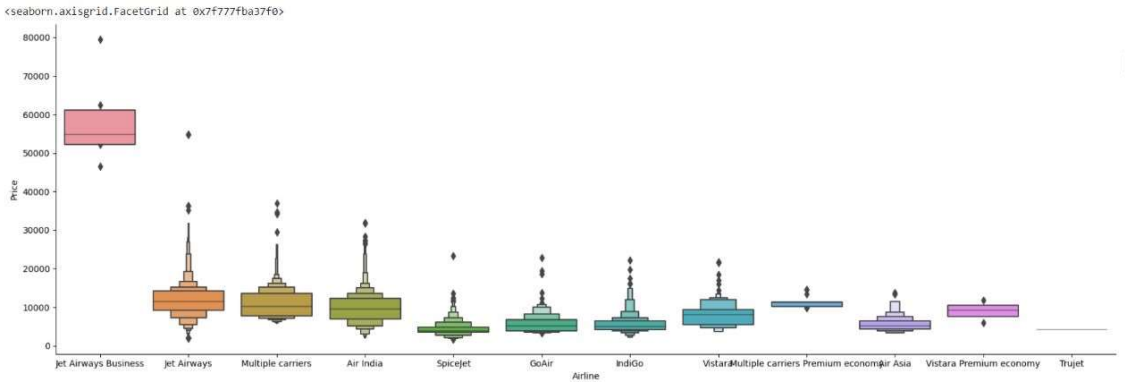
Flow Chart:



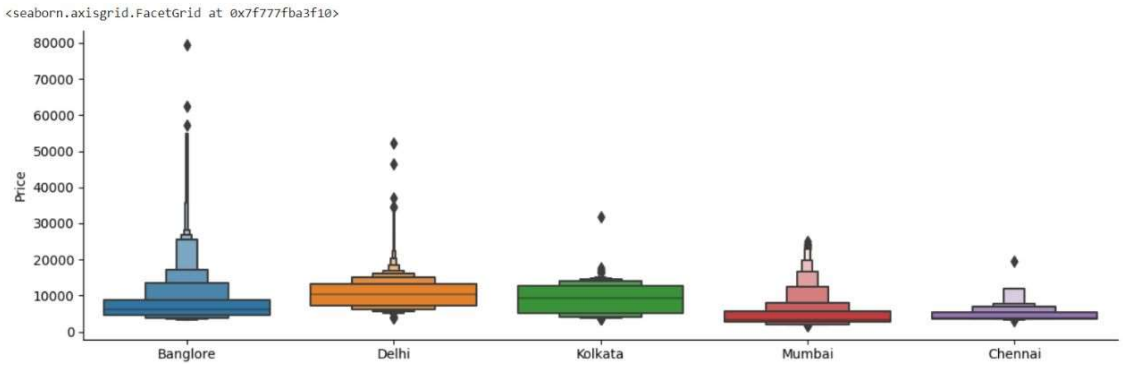
GUI WORKING:



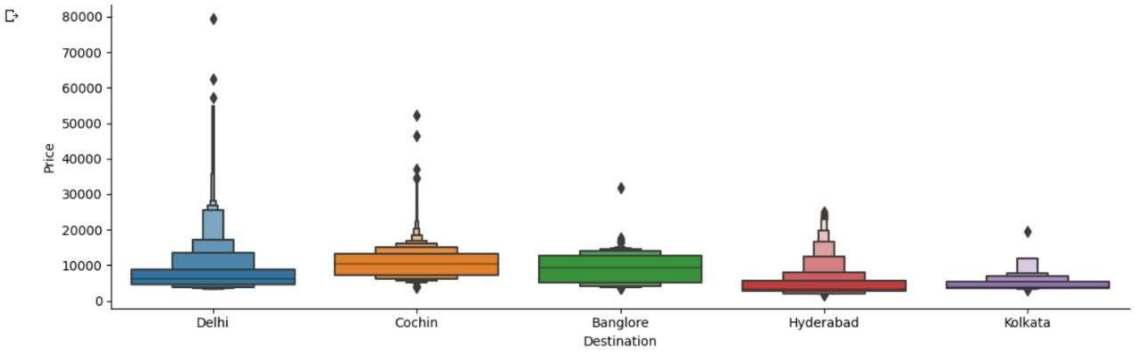
Results:



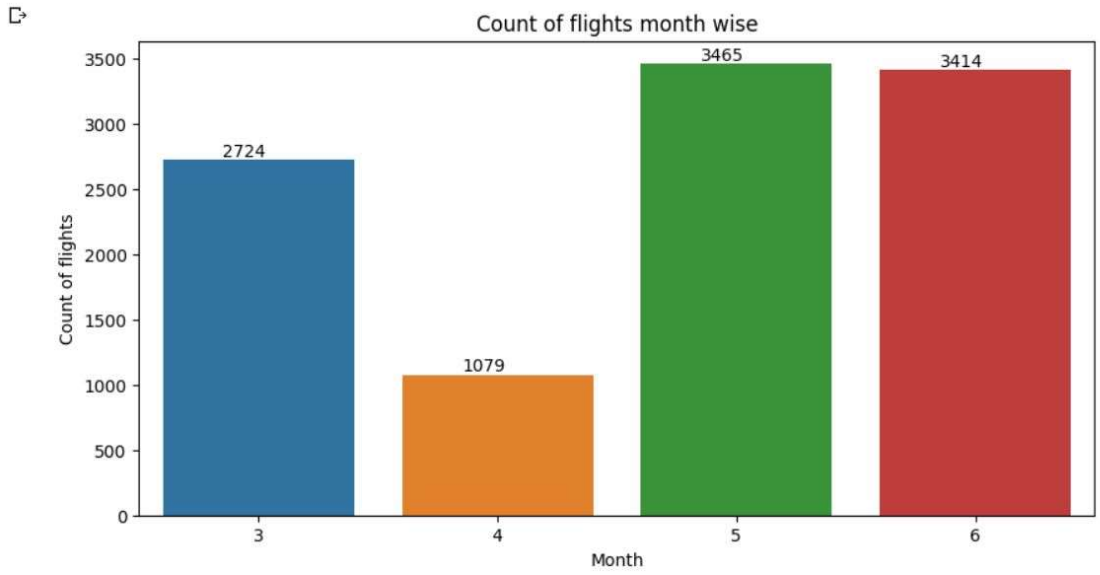
we can observe that jet airways bussiness is he costliest airways



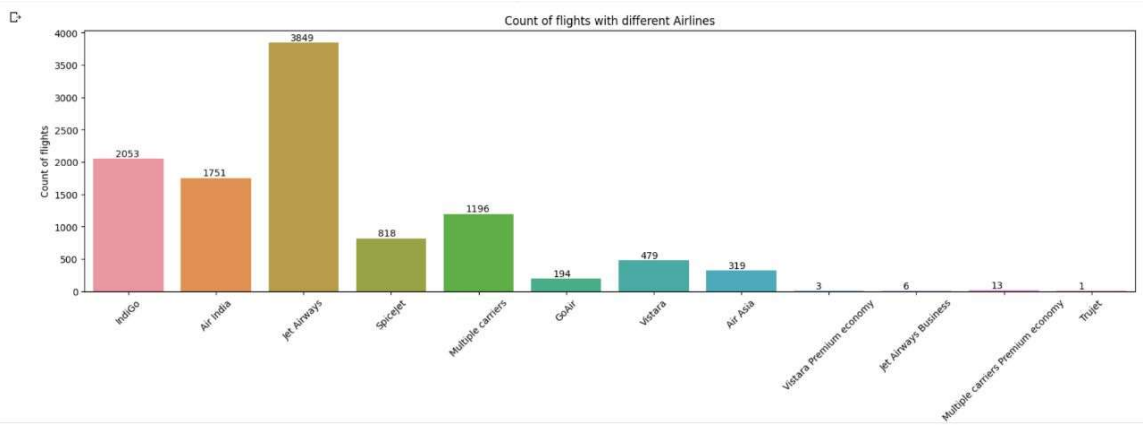
If we are going from Banglore the prices are slightly higher as compared to other cities



If we are going to New Delhi the prices are slightly higher as compared to other cities



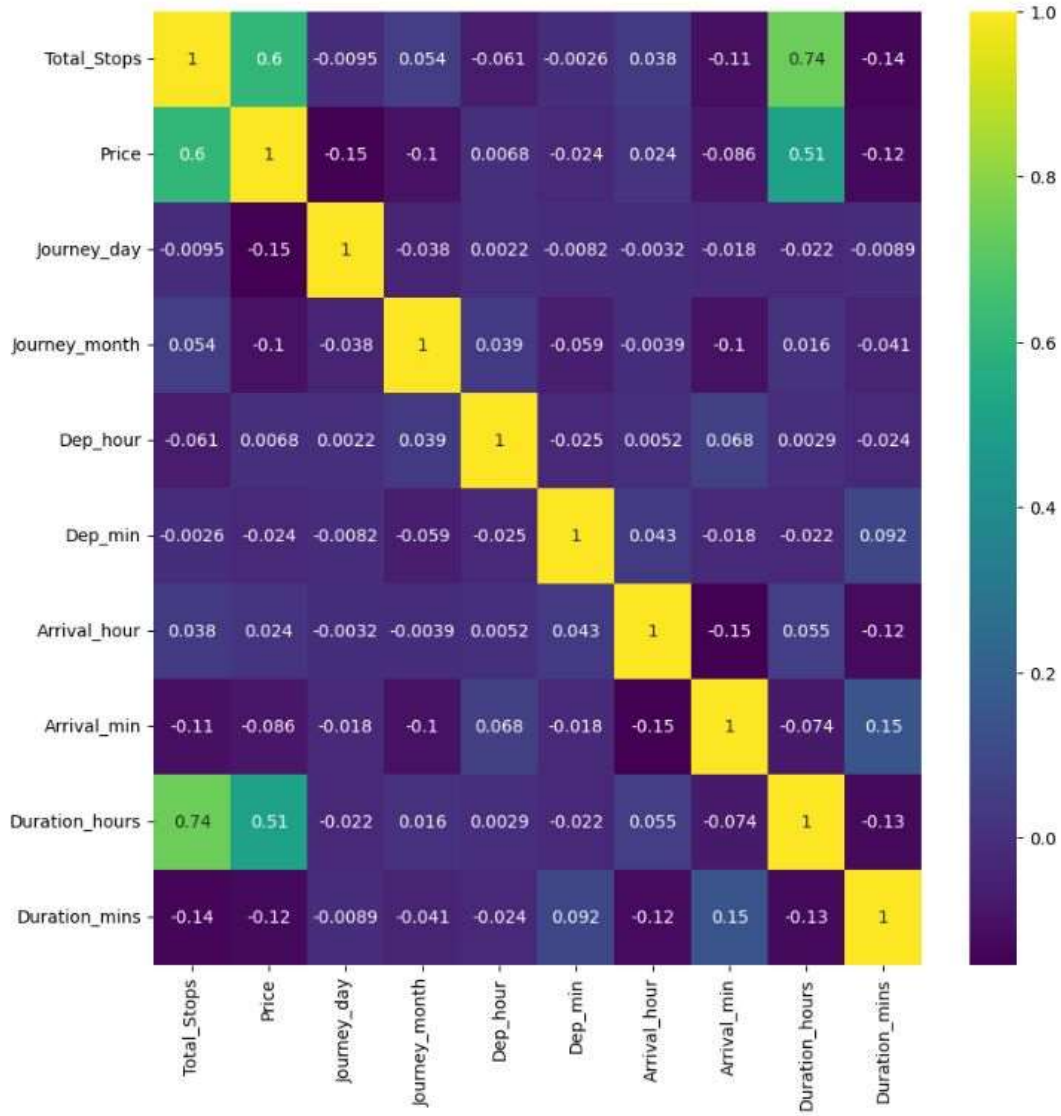
we can observe that month 5 has the highest count of flights as compared to other months



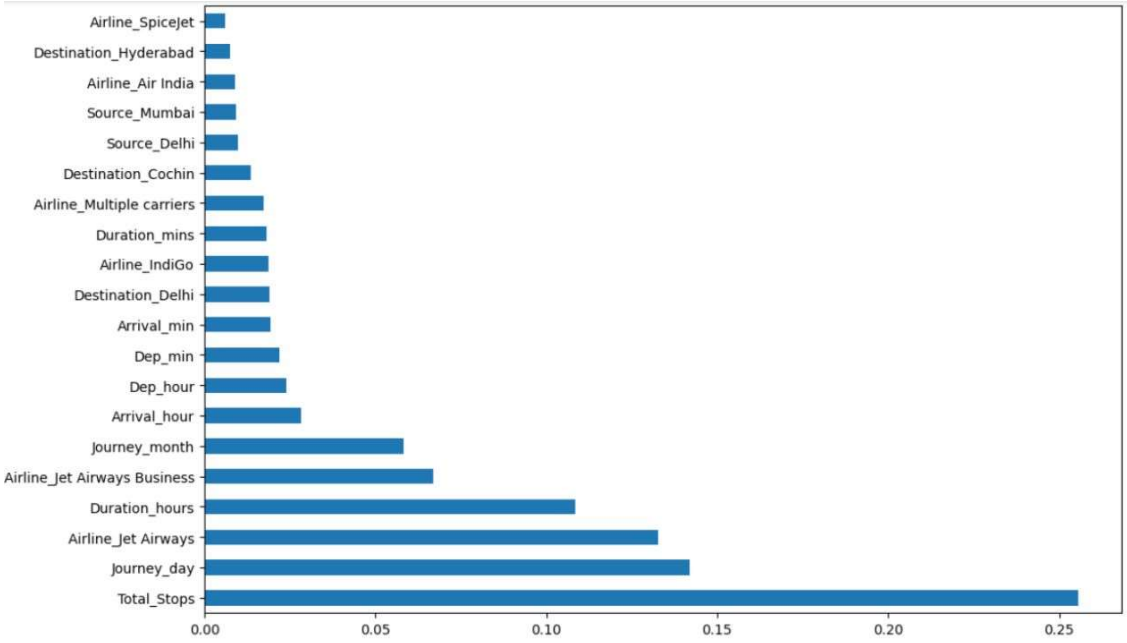
we can observe that the jet airways run the hightest number of flights

	Airline	Source	Destination	Total_Stops	Price	Journey_day	Journey_month	Dep_hour	Dep_min	Arrival_hour	Arrival_min	Duration_hours	Duration_mins
0	IndiGo	Banglore	Delhi	0	3897	24	3	22	20	1	10	2	50
1	Air India	Kolkata	Banglore	2	7662	1	5	5	50	13	15	7	25
2	Jet Airways	Delhi	Cochin	2	13882	9	6	9	25	4	25	19	0
3	IndiGo	Kolkata	Banglore	1	6218	12	5	18	5	23	30	5	25
4	IndiGo	Banglore	Delhi	1	13302	1	3	16	50	21	35	4	45

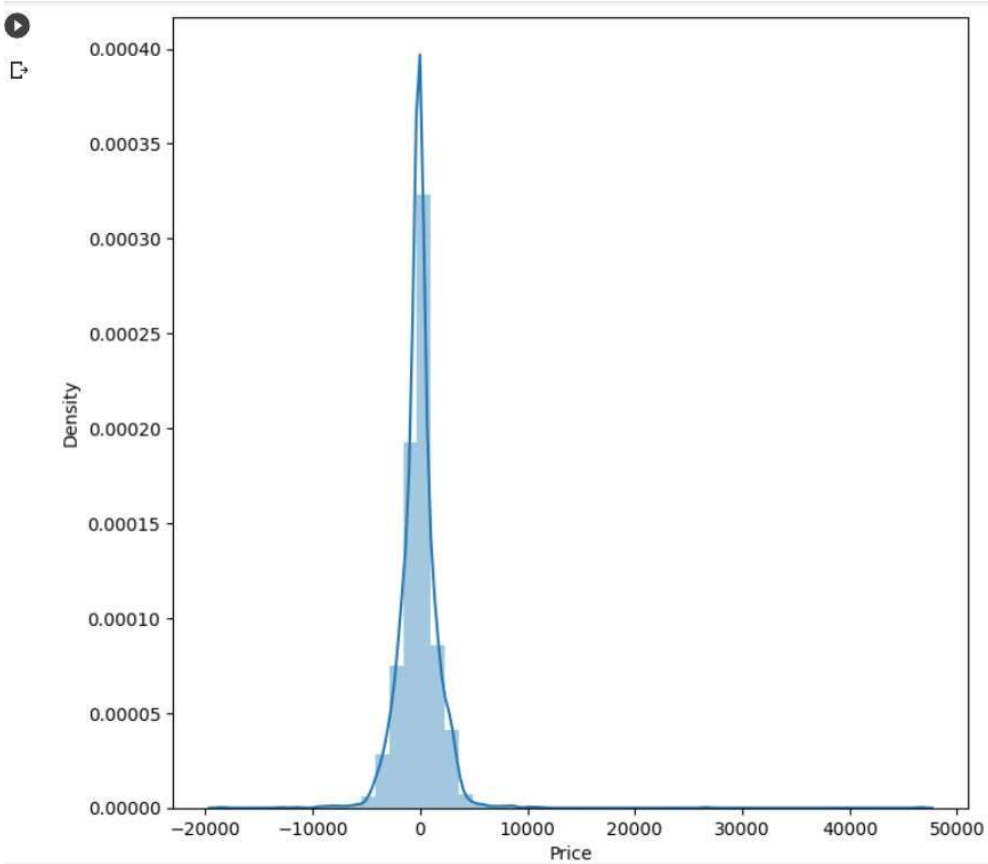
acc to the data, price is directly prop to the no. of stops

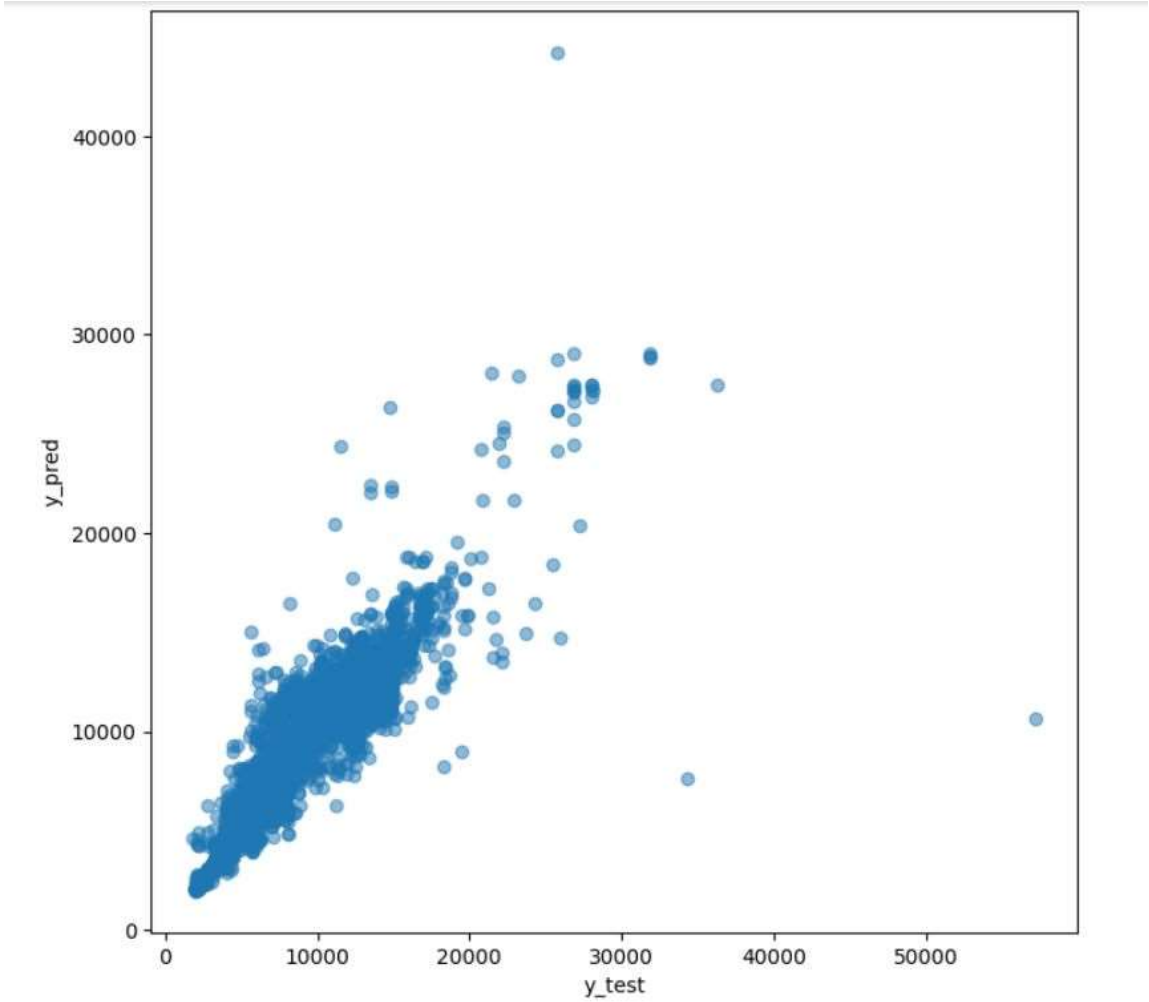

Total_Stops 1 0.6 -0.0095 0.054 -0.061 -0.0026 0.038 -0.11 0.74 -0.14
Price 0.6 1 -0.15 -0.1 0.0068 -0.024 0.024 -0.086 0.51 -0.12
Journey_day -0.0095 -0.15 1 -0.038 0.0022 -0.0082 -0.0032 -0.018 -0.022 -0.0089
Journey_month 0.054 -0.1 -0.038 1 0.039 -0.059 -0.0039 -0.1 0.016 -0.041
Dep_hour -0.061 0.0068 0.0022 0.039 1 -0.025 0.0052 0.068 0.0029 -0.024
Dep_min -0.0026 -0.024 -0.0082 -0.059 -0.025 1 0.043 -0.018 -0.022 0.092
Arrival_hour 0.038 0.024 -0.0032 -0.0039 0.0052 0.043 1 -0.15 0.055 -0.12
Arrival_min -0.11 -0.086 -0.018 -0.1 0.068 -0.018 -0.15 1 -0.074 0.15
Duration_hours 0.74 0.51 -0.022 0.016 0.0029 -0.022 0.055 -0.074 1 -0.13
Duration_mins -0.14 -0.12 -0.0089 -0.041 -0.024 0.092 -0.12 0.15 -0.13 1
Total_Stops
Price
Journey_day
Journey_month
Dep_hour
Dep_min
Arrival_hour
Arrival_min
Duration_hours
Duration_mins
1.0
0.8
0.6
0.4
0.2
0.0

Heatmap



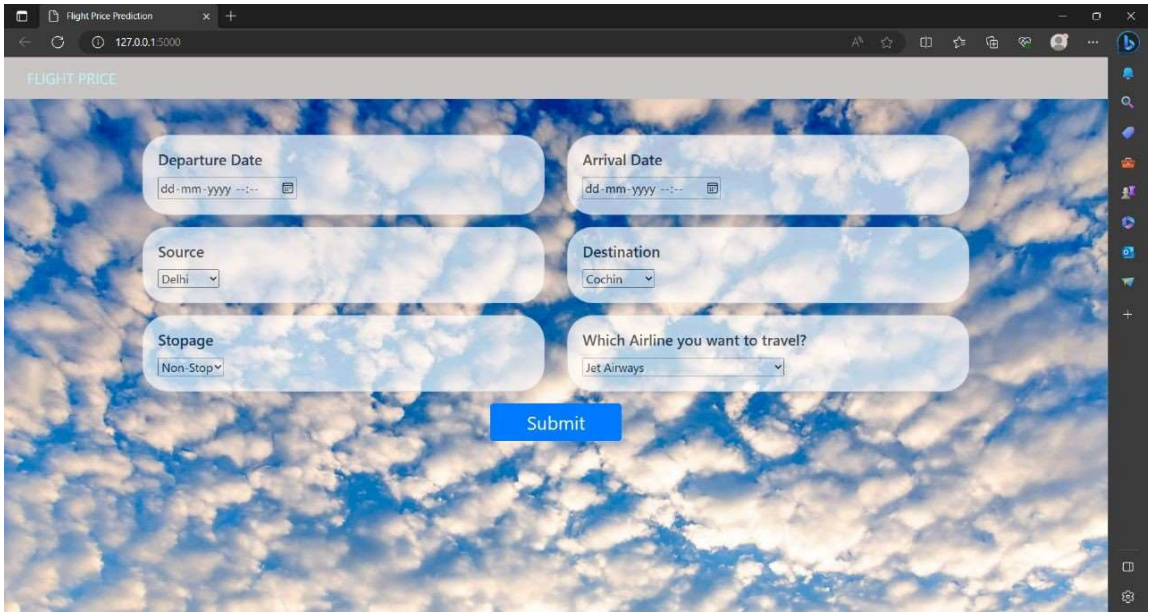
lot graph of feature importances for better visualization

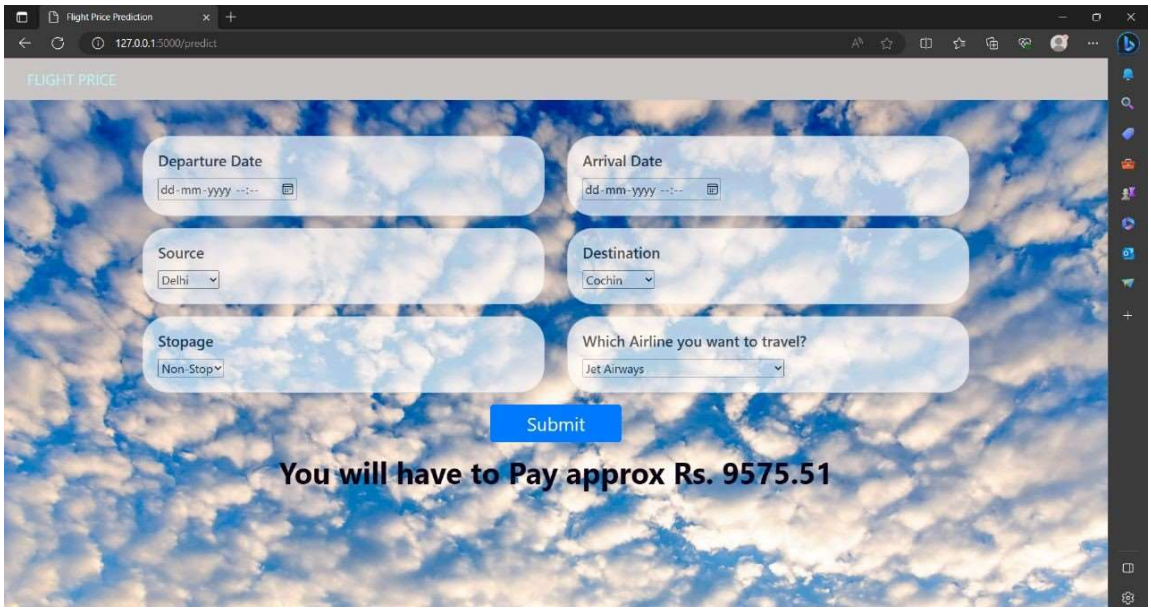




last two are for random forest ml model

HTML FRONT END:





PREDICTION:

```
r2 score:  0.8113485163969612
```

Advantages:

1. Cost Savings: Accurate flight predictions can help the passengers to get the tickets at a lower price.
2. Planning: With the help of price trends, travellers can plan their trips better, selecting the best cost effective date of travel and airlines etc..,
3. Insights to Dynamic pricing: Analyzing historical flight data, valuable insights can be gained into the factors influencing flight prices, such as seasonality, demand patterns and other market dynamics.

Disadvantages:

1. We may be able to predict the traavelling charges but not the overall cost which may include baggage costs etc.,
2. Due to dynamic functioning of the airline industry it becomes difficult to predict the price of the ticket accurately
3. Flight ticket prices also depends upon the nature and natural disasters which are entirely unpredictable
4. Obtaining Flaw free, reliable flight price history is not an easy task and error in the data can make the prediction go wrong

Applications:

Predicting flight ticket prices has applications in travel industry and beyond:

1. Travel planning websites such as MakeMyTrip(MMT), Trivago, etc.., allows users to search for flights and receive real-time predictions n future price trends. This helps travellers to select the most cost effective option.
2. Price alert notifications can be generated using this data and enables the users to take advantage of favourable prices and plan their trips accordingly
3. Travel insurance companies can leverage flight price prediction to determine the coverage and pricing for trip cancellation or trip interruption policies
4. Predictions can be used to determine the future prices enabling us to compare different airline prices over different times and plan the trip accordingly
5. Flight price prediction models generate valuable insights into market trends and pricing dynamics. Researchers and industry analysts can utilize this information to conduct market research, identify pricing patterns, and understand the factors driving price fluctuations in the airline industry.

Conclusion:

In conclusion, flight price prediction projects offer valuable insights and benefits both travellers and the travel industry. By using historical flight data and employing Machine Learning algorithms, these projects aim to provide accurate predictions of future flight prices.

For travellers, it enables them to plan their trips better and choose cost effective prices.
However they can also sometimes face challenges as the weather, Dynamic nature of prices makes it difficult to predict the prices.
Overcoming these challenges requires careful collection of data and preprocessing, robust model development and training, and continuous refinement of the prediction algorithms.
Despite these challenges, flight price prediction has practical applications in travel planning websites and apps, booking platforms, Travel insurance and etc..,
Overall, the flight price prediction has the power to revolutionize the way travellers plan and book flights, offering them more cost-saving options.
With the ongoing advancements in data Analytics and machine learning techniques, the accuracy and applicability of flight price prediction is expected to improve further.

Future Scope:

The flight price prediction continues to evolve, and there is so much scope for further advancement in this area. Some of them are:

1. Integration of Real Time Data:
   Incorporating real time data such as fuel prices, weather conditions, market trends and etc.., can further result in accurate results in predicting flight prices.
2. Ensemble Methods:

Exploring ensemble techniques such as combining multiple algorithms can result in more accurate predictions and robustness of flight price predictions.

3. Incorporating Customer preferences:

   By Considering the merging of Customer preferences and historical booking data we can personalize the flight price predictions, by considering individual travel booking history, layover preferences, class of travel, etc.., we can offer more tailored reccomendations.
4. Advancement of machine learning techniques: With the enhancement of algorithms we would enable us to analyze complex relationships among data resulting in higher accuracy.
5. Sentiment Analysis: Analyzing social media data and incorporating sentiment analysis and finding out the customers opinion on a particular airline and integrating such data can help us in identifying the factors that influence pricing decisions.
6. Dynamic pricing Strategies: Integrating dynamic pricing strategies, such as demand based or personalized pricing, into flight prediction models can enable airlines to optimize their revenue generation.
7. Collaboration with Industry Stakeholders: Collaboration with airlines, travel agencies and other industry stakeholders can provide access to proprietary data and domain expertise, leading to more accurate and relevant prediction models.

Bibliography:

1. https://medium.com/@skillcate/flight-fare-prediction-machine-learning-project-bc7363e6d9eb
2. https://www.ijser.in/archives/v10i11/SE221105023044.pdf
3. https://www.analyticsvidhya.com/blog/2022/01/flight-fare-prediction-using-machine-learning/

CODE:

```
<html lang="en">
<style>
  body {
    background-image: url('/static/img/bg5.jpg');
    background-repeat: no-repeat;
    background-attachment: fixed;
    background-size: cover;
  }

  img {
    display: block;
    margin-left: auto;
```

```
        margin-right: auto;
        align-self: center;
    }

    .navbar {
        background-color: #c9c5c5;
    }

    a {
        color: #d2f8f8;
    }

    a:hover {
        color: #604f4f;
    }

    .card {
        border-radius: 1rem;
        background-color: rgb(241, 12, 127);
    }
<html lang="en">
<style>
    body {
        background-image: url('/static/img/bg5.jpg');
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    }
```

```
    .card {
        border-radius: 1rem;
        background-color: rgb(241, 12, 127);
    }
</style>



<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Flight Price Prediction</title>


    <!-- BootStrap -->
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href="https://stackpath.bootstrapcdn.com/bootstrap/4.5.0/css/bootstrap.min.css"
        integrity="sha384-
9aIt2nRpC12Uk9gS9baDl411NQApFmC26EwAOH8WgZl5MYYxFfc+NcPb1dKGj7Sk
" crossorigin="anonymous">


</head>

<body>

    <nav class="navbar navbar-inverse navbar-fixed-top">
        <div class="container-fluid">
            <div class="navbar-header">
                <a class="navbar-brand" href="/" style='color: #b7f8f5;'>FLIGHT PRICE</a>
            </div>
        </div>
    </nav><div class="container my-5">
        <form action="\predict" method="post">

            <div class="row my-3">

                <div class="col-sm-6">
                    <div class="card" style='border-radius: 2.15rem;opacity: 0.7;'>
                        <div class="card-body">
                            <h5 class="card-title">Departure Date</h5>
                            <input    type="datetime-local"    name="Dep_Time"    id="Dep_Time"
required="required">
                        </div>
                    </div>
                </div>
```

```
            <div class="col-sm-6">
               <div class="card" style='border-radius: 2.15rem;opacity: 0.7;'>
                  <div class="card-body">
                     <h5 class="card-title">Arrival Date</h5>
                     <input type="datetime-local" name="Arrival_Time" id="Arrival_Time"
required="required">
                  </div>
               </div>
            </div>
         </div>

<div class="row my-3">

            <div class="col-sm-6">
               <div class="card" style='border-radius: 2.15rem;opacity: 0.7;'>
                  <div class="card-body">
                     <h5 class="card-title">Source</h5>
                     <select name="Source" id="Source" required="required">
                        <option value="Delhi">Delhi</option>
                        <option value="Kolkata">Kolkata</option>
                        <option value="Banglore">Banglore</option>
                        <option value="Mumbai">Mumbai</option>
                        <option value="Chennai">Chennai</option>
                     </select>
                  </div>
               </div>
            </div>

            <div class="col-sm-6">
               <div class="card" style='border-radius: 2.15rem;opacity: 0.7;'>
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                     <select name="Destination" id="Destination" required="required">
                        <option value="Cochin">Cochin</option>
                        <option value="Delhi">Delhi</option>
                        <option value="Banglore">Banglore</option>
                        <option value="Hyderabad">Hyderabad</option>
                        <option value="Kolkata">Kolkata</option>
                     </select>
                  </div>
               </div>
            </div>
         </div>

<div class="row my-3">

            <div class="col-sm-6">
               <div class="card" style='border-radius: 2.15rem;opacity: 0.7;'>
```

```
                <div class="card-body">
                  <h5 class="card-title">Stopage</h5>
                  <select name="stops" required="required">
                    <option value="0">Non-Stop</option>
                    <option value="1">1</option>
                    <option value="2">2</option>
                    <option value="3">3</option>
                    <option value="4">4</option>
                  </select>
                </div>
              </div>
            </div>

            <div class="col-sm-6">
              <div class="card" style='border-radius: 2.15rem;opacity: 0.7;'>
                <div class="card-body">
                  <h5 class="card-title">Which Airline you want to travel?</h5>
                  <select name="airline" id="airline" required="required">
                    <option value="Jet Airways">Jet Airways</option>
                    <option value="IndiGo">IndiGo</option>
                    <option value="Air India">Air India</option>
                    <option value="Multiple carriers">Multiple carriers</option>
                    <option value="SpiceJet">SpiceJet</option>
                    <option value="Vistara">Vistara</option>
                    <option value="Air Asia">Air Asia</option>
                    <option value="GoAir">GoAir</option>
                    <option value="Multiple carriers Premium economy">Multiple
carriers Premium economy
</option>
                    <option value="Jet Airways Business">Jet Airways
Business</option>
                    <option value="Vistara Premium economy">Vistara Premium
economy</option>
                    <option value="Trujet">Trujet</option>
                  </select>
                </div>
              </div>
            </div>



            <div style='text-align:center'>
              <button type="submit" value='Submit' class="btn btn-primary px-5"
style="font-size: 25px;">Submit</button>
            </div>
          </form>
```

```
      <h1 style='text-align: center;color: rgb(122, 43, 234);'><b>{{ predictions }}</b></h1>


      <footer class='text-light bg-dark position-fixed fixed-bottom '>
        <p class='text-center py my-0'>

        </p>
      </footer>
    </div>

<!-- JavaScript -->
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      crossorigin="anonymous"></script>

</body>

</html>
```

FLASK FILE:

```
from flask import Flask,request,render_template
from flask_cors import cross_origin
import pickle
import pandas as pd

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

app = Flask(_name_)

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

@app.route('/predict',methods=['GET','POST'])
@cross_origin()
def predict():
```

```
    if request.method=='POST':
        dep_time = request.form['Dep_Time']

        Journey_day = pd.to_datetime(dep_time,format="%Y-%m-%dT%H:%M").day
        Journey_month = pd.to_datetime(dep_time,format="%Y-%m-%dT%H:%M").month

        Departure_hour = pd.to_datetime(dep_time,format="%Y-%m-%dT%H:%M").hour
        Departure_min = pd.to_datetime(dep_time,format="%Y-%m-%dT%H:%M").minute

        arrival_time = request.form['Arrival_Time']
        Arrival_hour =  pd.to_datetime(arrival_time,format="%Y-%m-%dT%H:%M").hour
        Arrival_min = pd.to_datetime(arrival_time,format="%Y-%m-
%dT%H:%M").minute

        Total_stops = int(request.form['stops'])

        dur_hour = abs(Arrival_hour-Departure_hour)
        dur_min = abs(Arrival_min-Departure_min)
    airline=request.form['airline']
        if(airline=='Jet Airways'):
            Jet_Airways = 1
            IndiGo = 0
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 0
            Multiple_carriers_Premium_economy = 0
            Jet_Airways_Business = 0
            Vistara_Premium_economy = 0
            Trujet = 0

        elif (airline=='IndiGo'):
            Jet_Airways = 0
            IndiGo = 1
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 0
            Multiple_carriers_Premium_economy = 0
            Jet_Airways_Business = 0
            Vistara_Premium_economy = 0
            Trujet = 0
    elif (airline=='Air India'):
            Jet_Airways = 0
            IndiGo = 0
            Air_India = 1
```

```
    Multiple_carriers = 0
    SpiceJet = 0
    Vistara = 0
    GoAir = 0
    Multiple_carriers_Premium_economy = 0
    Jet_Airways_Business = 0
    Vistara_Premium_economy = 0
    Trujet = 0

elif (airline=='Multiple carriers'):
    Jet_Airways = 0
    IndiGo = 0
    Air_India = 0
    Multiple_carriers = 1
    SpiceJet = 0
    Vistara = 0
    GoAir = 0
    Multiple_carriers_Premium_economy = 0
    Jet_Airways_Business = 0
    Vistara_Premium_economy = 0
    Trujet = 0
      elif (airline=='SpiceJet'):
    Jet_Airways = 0
    IndiGo = 0
    Air_India = 0
    Multiple_carriers = 0
    SpiceJet = 1
    Vistara = 0
    GoAir = 0
    Multiple_carriers_Premium_economy = 0
    Jet_Airways_Business = 0
    Vistara_Premium_economy = 0
    Trujet = 0

elif (airline=='Vistara'):
    Jet_Airways = 0
    IndiGo = 0
    Air_India = 0
    Multiple_carriers = 0
    SpiceJet = 0
    Vistara = 1
    GoAir = 0
    Multiple_carriers_Premium_economy = 0
    Jet_Airways_Business = 0
    Vistara_Premium_economy = 0
    Trujet = 0

elif (airline=='GoAir'):
```

```
            Jet_Airways = 0
            IndiGo = 0
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 1
            Multiple_carriers_Premium_economy = 0Jet_Airways_Business = 0
            Vistara_Premium_economy = 0
            Trujet = 0

        elif (airline=='Multiple carriers Premium economy'):
            Jet_Airways = 0
            IndiGo = 0
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 0
            Multiple_carriers_Premium_economy = 1
            Jet_Airways_Business = 0
            Vistara_Premium_economy = 0
            Trujet = 0

        elif (airline=='Jet Airways Business'):
            Jet_Airways = 0
            IndiGo = 0
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 0
            Multiple_carriers_Premium_economy = 0
            Jet_Airways_Business = 1
            Vistara_Premium_economy = 0
            Trujet = 0
    elif (airline=='Vistara Premium economy'):
            Jet_Airways = 0
            IndiGo = 0
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 0
            Multiple_carriers_Premium_economy = 0
            Jet_Airways_Business = 0
            Vistara_Premium_economy = 1
            Trujet = 0
```

```
        elif (airline=='Trujet'):
            Jet_Airways = 0
            IndiGo = 0
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 0
            Multiple_carriers_Premium_economy = 0
            Jet_Airways_Business = 0
            Vistara_Premium_economy = 0
            Trujet = 1
    else:
            Jet_Airways = 0
            IndiGo = 0
            Air_India = 0
            Multiple_carriers = 0
            SpiceJet = 0
            Vistara = 0
            GoAir = 0
            Multiple_carriers_Premium_economy = 0
            Jet_Airways_Business = 0
            Vistara_Premium_economy = 0
            Trujet = 0

        Source = request.form["Source"]
        if (Source == 'Delhi'):
            s_Delhi = 1
            s_Kolkata = 0
            s_Mumbai = 0
            s_Chennai = 0

        elif (Source == 'Kolkata'):
            s_Delhi = 0
            s_Kolkata = 1
            s_Mumbai = 0
            s_Chennai = 0

        elif (Source == 'Mumbai'):
            s_Delhi = 0
            s_Kolkata = 0
            s_Mumbai = 1
            s_Chennai = 0 elif (Source == 'Chennai'):
            s_Delhi = 0
            s_Kolkata = 0
            s_Mumbai = 0
            s_Chennai = 1
```

```
else:
    s_Delhi = 0
    s_Kolkata = 0
    s_Mumbai = 0
    s_Chennai = 0


Destination = request.form["Destination"]
if (Destination == 'Cochin'):
    d_Cochin = 1
    d_Delhi = 0
    d_Hyderabad = 0
    d_Kolkata = 0

elif (Destination == 'Delhi'):
    d_Cochin = 0
    d_Delhi = 1
    d_Hyderabad = 0
    d_Kolkata = 0

elif (Destination == 'Hyderabad'):
    d_Cochin = 0
    d_Delhi = 0
    d_Hyderabad = 1
    d_Kolkata = 0 elif (Source == 'Chennai'):
    s_Delhi = 0
    s_Kolkata = 0
    s_Mumbai = 0
    s_Chennai = 1

else:
    s_Delhi = 0
    s_Kolkata = 0
    s_Mumbai = 0
    s_Chennai = 0


Destination = request.form["Destination"]
if (Destination == 'Cochin'):
    d_Cochin = 1
    d_Delhi = 0
    d_Hyderabad = 0
    d_Kolkata = 0

elif (Destination == 'Delhi'):
    d_Cochin = 0
    d_Delhi = 1
```

```
            d_Hyderabad = 0
            d_Kolkata = 0

        elif (Destination == 'Hyderabad'):
            d_Cochin = 0
            d_Delhi = 0
            d_Hyderabad = 1
            d_Kolkata = 0
elif (Destination == 'Kolkata'):
            d_Cochin = 0
            d_Delhi = 0
            d_Hyderabad = 0
            d_Kolkata = 1

        else:#Banglore
            d_Cochin = 0
            d_Delhi = 0
            d_Hyderabad = 0
            d_Kolkata = 0

        output = model.predict([[Total_stops,
            Journey_day,
            Journey_month,
            Departure_hour,
            Departure_min,
            Arrival_hour,
            Arrival_min,
            dur_hour,
            dur_min,
            Air_India,
            GoAir,
            IndiGo,
            Jet_Airways,
            Jet_Airways_Business,
            Multiple_carriers,
            Multiple_carriers_Premium_economy,
            SpiceJet,
            Trujet,
Vistara,
            Vistara_Premium_economy,
            s_Chennai,
            s_Delhi,
            s_Kolkata,
            s_Mumbai,
            d_Cochin,
            d_Delhi,
            d_Hyderabad,
            d_Kolkata]])
```

```
    output = round(output[0],2)
    return render_template('home.html',predictions='You will have to Pay approx Rs. {}'.format(output))


if _name_ == '_main_':
app.run(debug=True)
```