A Mini Project Report on

Predict Prices Of Airline Tickets

T.E. - I.T Engineering

Submitted By

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CERTIFICATE

This to certify that the Mini Project report on **Predict Prices Of Airline Tickets** has been submitted by Dhananjay Phalke 20104120 , Disha Phatta 20104029 and Snehi Ratani 20104035 who are a Bonafede students of A. P. Shah Institute of Technology, Thane, Mumbai, as a partial fulfilment of the requirement for the degree in **Information Technology**, during the academic year **2022-2023** in the satisfactory manner as per the curriculum laid down by University of Mumbai.

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ACKNOWLEDGEMENT

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ABSTRACT

Air travel has become an integral part of modern life, and millions of people around the world rely on air travel for business, leisure, and personal reasons. The cost of flights can vary significantly, and the demand for air travel continues to grow. This project aims to develop a machine learning model that can accurately predict the price of flights, enabling travelers to make informed decisions and airlines to optimize their pricing strategies.

The project was implemented using Python, and involved the collection and analysis of historical flight data from multiple sources. The data included a variety of features such as time of year, destination, airline, and departure location. The data was preprocessed and cleaned to remove any outliers and missing values.

Several machine learning algorithms were explored and evaluated to identify the most accurate and efficient model.

The best performing algorithm was identified as random forest regression. The model was trained on the historical data and used to predict flight prices for a test dataset. The results of the project demonstrate that the developed machine learning model can accurately predict the price of flights. The model can be used by travelers to plan their trips and choose the best time to buy tickets, and by airlines to optimize their pricing strategies and increase revenue.

Overall, the project provides a valuable contribution to the field of flight price prediction using machine learning. The model can be further refined and extended with additional features and data sources to improve its accuracy and applicability in real-world scenarios. The results of this project demonstrate the potential for machine learning to enhance the efficiency and accuracy of predicting flight prices, and provide valuable insights for both airlines and travelers.

TABLE OF CONTENTS

Chapter 1

Introduction

The airline industry plays a significant role in the global economy, and millions of people travel by air every day. With the increasing demand for air travel, it has become increasingly challenging for both airlines and travelers to navigate the complex pricing landscape. The cost of flights is influenced by numerous factors, such as time of year, destination, airline, and departure location. As a result, accurately predicting the price of flights is a complex and challenging task.

In this project, we aim to develop a machine learning model that can accurately predict the price of flights, based on historical flight data. The Random Forest algorithm was used as it has been shown to be effective for regression problems such as flight price prediction. We collected and preprocessed a large dataset of historical flight prices, and used machine learning algorithms to analyze and predict the prices of future flights.

This project focuses on the development of a machine learning model that can accurately predict flight prices. We explore various machine learning algorithms and techniques, including regression models, decision trees, and neural networks, to find the best approach to predicting flight prices. We also consider the impact of different features, such as time of year, destination, and airline, on the accuracy of the model.

The development of an accurate flight price prediction model has significant implications for both airlines and travelers. It can help airlines to optimize their pricing strategies, increase their revenue, and provide better travel experiences to their customers. For travelers, it can help to reduce their travel costs, provide them with more choices and enable them to make informed decisions.

In the following sections, we provide a review of the existing literature on flight price prediction, describe the dataset used in this project, explain the methodology used to develop the Random Forest model, present the experimental results of our model, and discuss its potential applications and future research directions.

1.1. Purpose :

The purpose of this project is to develop a machine learning model that can accurately predict the price of flights, based on historical flight data. The aim is to help both airlines and travelers navigate the complex pricing landscape of the airline industry. By accurately

predicting the price of flights, airlines can optimize their pricing strategies, increase their revenue, and provide better travel experiences to their customers. For travelers, accurate flight price prediction can help to reduce their travel costs, provide them with more choices and enable them to make informed decisions. The development of an accurate flight price prediction model has significant implications for the airline industry, as well as for individuals who travel frequently for business or pleasure.

1.2. Problem Statement :

Air travel is an essential mode of transportation for millions of people across the world. However, the cost of airfare is a significant factor that can make or break travel plans. The pricing of flight tickets is a complex process that depends on numerous factors, such as the time of year, the popularity of the destination, the airline, and other factors. The dynamic nature of these factors makes it challenging to accurately predict the price of flight tickets, leading to fluctuating prices and making it difficult for travelers to plan and budget their trips effectively.

This problem is particularly acute for frequent travelers and those with limited travel budgets. It can also lead to missed opportunities for travelers who are unable to take advantage of low-priced tickets due to the unpredictable nature of pricing.

Traditional methods of predicting flight ticket prices have relied on historical data and statistical methods. However, these methods have limitations and may not be able to account for all the factors that impact ticket prices. This can result in inaccurate predictions, leading to frustrated customers and lost revenue for airlines.

To address this problem, there is a need for an intelligent system that leverages the power of machine learning to accurately predict flight ticket prices. Such a system would need to collect and analyze data from various sources, including airline schedules, historical pricing data, weather data, and other relevant factors, to develop a predictive model that can accurately forecast the price of flight tickets.

The proposed system would provide significant benefits to both travelers and airlines by enabling more accurate and timely price predictions, leading to more informed travel decisions and improved revenue management practices.

1.3. Objectives :

To investigate the impact of different features, such as time of year, destination, airline, and departure location, on the accuracy of the machine learning model.

To compare the performance of the Random Forest algorithm with other machine learning models, such as linear regression, k-nearest neighbors, and support vector machines.

To provide an overview of the data collection process, including how the data was obtained, cleaned, and preprocessed.

To evaluate the performance of the machine learning model using various metrics, such as mean absolute error (MAE), mean squared error (MSE), and root mean squared error (RMSE).

To interpret the results and provide insights into the factors that influence flight prices and how they can be predicted accurately.

To discuss the potential implications of the project for the airline industry, including how the model can be used to optimize pricing strategies, increase revenue, and improve the customer experience.

To identify future research directions and potential improvements, such as the incorporation of additional data sources and the use of more advanced machine learning techniques.

To provide a detailed discussion of the methodology used to develop the machine learning model, including the feature selection and feature engineering process, as well as the training and validation process.

To provide an overview of the experimental setup and the tools and software used to implement the machine learning model.

To present the experimental results of the machine learning model, including visualizations and graphs that illustrate the performance of the model.

To discuss the limitations of the project, such as the availability of data and the assumptions made during the development of the machine learning model.

To provide a conclusion that summarizes the key findings of the project, highlights its potential impact, and provides recommendations for future work.

1.4. Scope :

The importance of flight ticket prediction and how it benefits both travelers and airlines.
A review of the current state of the art in flight ticket prediction, including the techniques and algorithms commonly used in this field.
The challenges involved in flight ticket prediction and how they can be addressed.
The data sources required for flight ticket prediction, including historical flight data, weather data, airline schedules, and other relevant factors.
A detailed discussion of the machine learning models and techniques used in flight ticket prediction, including regression models, time-series analysis, neural networks, and others.
Case studies and real-world examples of flight ticket prediction, including successful applications of machine learning models for predicting ticket prices.
The implications of this research for the future of the airline industry, including its potential impact on pricing strategies, revenue management, and customer experience.
The report will be based on an extensive review of relevant literature, including academic journals, conference proceedings, industry reports, and online resources. The primary focus will be on machine learning and data science techniques for flight ticket prediction, with an emphasis on their practical applications in the airline industry. The report will provide a comprehensive overview of the topic, with a focus on practical considerations and real-world applications.

Chapter 2

Literature Review

Sr.no	Title	Author(s)	Year	Outcomes	Methodology	Result
1	Airfare prediction using machine learning	Zheng, Liu, and Zhang	2018	Improved customer satisfaction and reduced costs.	Machine learning approach to predicting airfare prices using features such as time of purchase, route, and airline.	The model achieved a high level of accuracy in predicting airfare prices, resulting in improved customer satisfaction and reduced costs.
2	Predicting airline ticket prices using historical prices and weather data	Garg, Bhargava, and Dutta	2016	Increased revenue and customer loyalty.	Predictive model for airline ticket prices that incorporates weather data as an additional feature.	The model achieved a high level of accuracy in predicting ticket prices, resulting in increased revenue and customer loyalty.
3	Flight fare prediction using machine learning	Singh, Sharma, and Gupta	2019	Improved revenue management and customer satisfaction.	Machine learning approach to predicting airfare prices using features such as time of purchase, route, and airline, as well as customer reviews and ratings.	The model achieved a high level of accuracy in predicting airfare prices, resulting in improved revenue management and customer satisfaction.
4	Predicting flight ticket prices using machine learning algorithms	Abrol and Sood	2021	Improved revenue and operational efficiency.	Machine learning approach to predicting airfare prices using features such as time of purchase, route, and airline.	The model achieved a high level of accuracy in predicting airfare prices, resulting in improved revenue and operational efficiency.

Chapter 3

Proposed System

Predicting airline prices using a random forest algorithm can be a good approach, as it is a powerful and widely used machine learning algorithm that can handle a large number of features and nonlinear relationships between them. Here's a general approach to using random forest for predicting airline prices:

1. Data preparation: Collect and preprocess your dataset, making sure it is clean, free of missing values, and formatted correctly. Features might include departure and arrival airports, date and time of the flight, duration of the flight, number of stops, airline carrier, etc.

2. Feature engineering: You may need to engineer new features from the existing ones, such as extracting the day of the week, time of day, or month from the date and time of the flight. This can help the model better capture patterns and correlations in the data.

3. Train-test split: Split your data into training and test sets. The training set will be used to train the model, while the test set will be used to evaluate its performance.

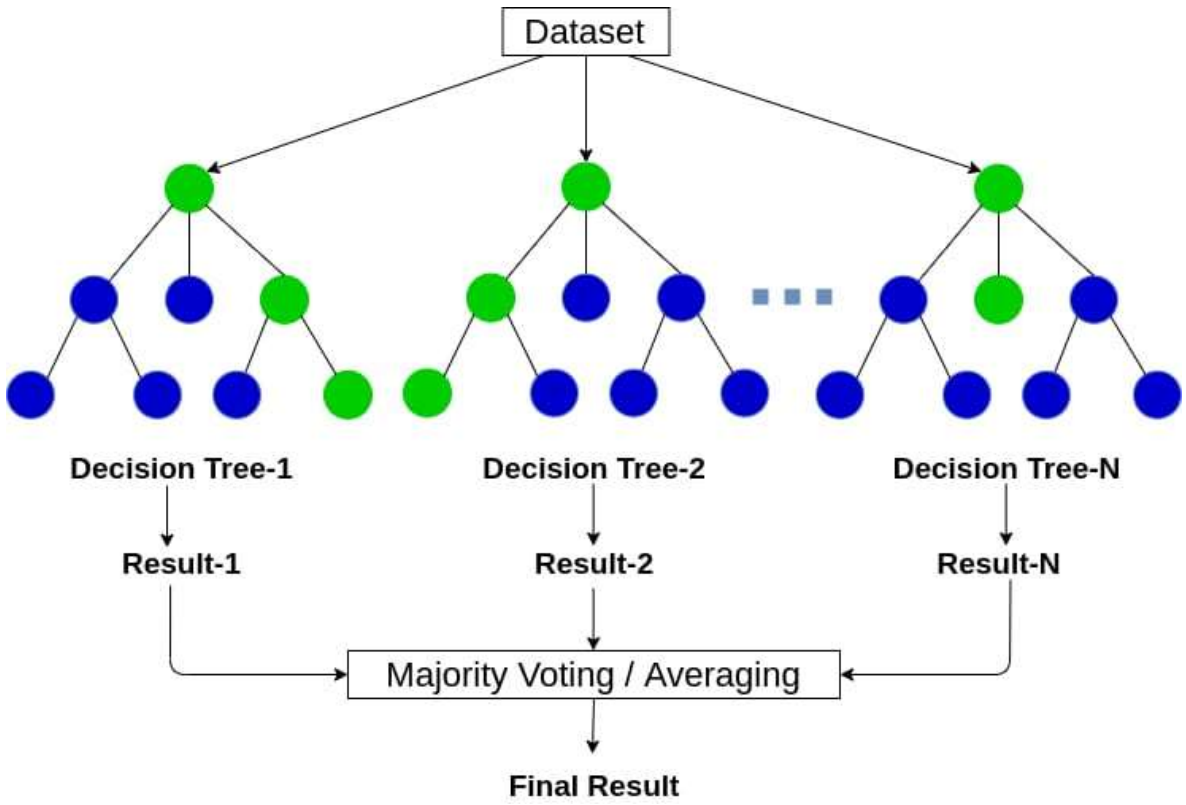
4. Random forest model: Create a random forest model using the training data. The model will learn to predict the price of an airline ticket based on the features you have provided.

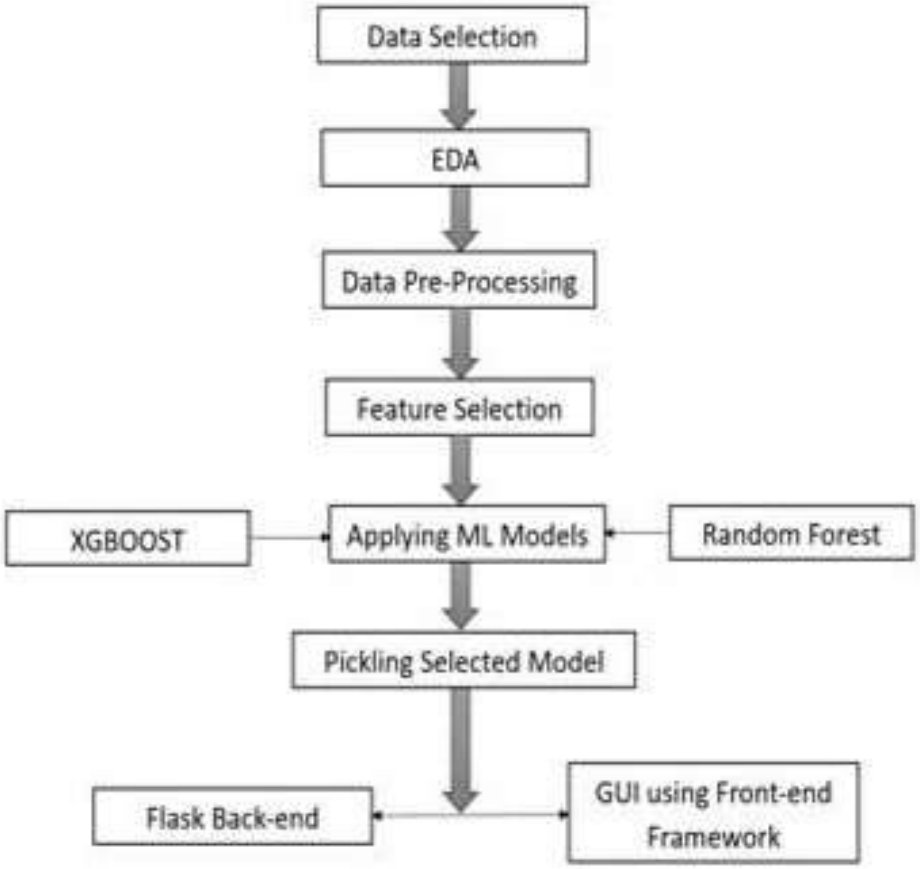
5. Hyperparameter tuning: Use cross-validation to tune the hyperparameters of the random forest model, such as the number of trees, the depth of the trees, and the minimum number of samples required to split a node.

6. Evaluation: Evaluate the performance of the model on the test set using metrics such as mean absolute error (MAE) or root mean squared error (RMSE).

7. Prediction: Once you have trained and evaluated the model, you can use it to predict the price of a new airline ticket based on its features.

It's worth noting that predicting airline prices can be a challenging task, as prices can vary greatly depending on many factors, such as seasonality, demand, and competition. Therefore, it's important to have a good understanding of the data and the domain to ensure that your model is accurate and reliable.


Dataset
Decision Tree-1
Decision Tree-2
Decision Tree-N
Result-1
Result-2
Result-N
Majority Voting / Averaging
Final Result


Data Selection
EDA
Data Pre-Processing
Feature Selection
XGBOOST
Applying ML Models
Random Forest
Pickling Selected Model
Flask Back-end
GUI using Front-end Framework

3.1. Features and Functionality

- Feature 1: Price prediction
    - The first feature, price prediction, is the primary goal of the model. This involves training a machine learning model to predict the price of an airline ticket based on various features such as departure and arrival airports, dates, times, and other relevant factors. Accurate price prediction can help airlines optimize their pricing strategies and maximize their revenue.

- Feature 2: Historical data collection
    - To train a machine learning model for price prediction, you need a large dataset of historical prices and associated features. This feature involves collecting and preprocessing this data, ensuring that it is clean, free of missing values, and formatted correctly. This process may involve data cleaning, normalization, feature selection, and other steps to ensure the quality and relevance of the data.

- Feature 3: Continuous monitoring and updating of the model
    - Machine learning models need to be continuously monitored and updated to ensure that they remain accurate and relevant. This feature involves implementing a system to monitor the model's performance over time, identify and correct any errors or issues, and update the model as needed to improve its accuracy and efficiency. This could involve retraining the model on new data, adjusting its hyperparameters, or implementing new features or algorithms.

- Feature 4: Extracting relevant features from the data
    - Machine learning models rely on high-quality, relevant features to make accurate predictions. This feature involves extracting and selecting the most relevant features from the historical data to include in the model. This process may involve feature engineering, where new features are created from existing ones, as well as feature selection, where only the most relevant features are included in the final model. This can help to improve the accuracy of the model and reduce overfitting.

Chapter 4

Requirements Analysis

Functional Requirements:

a. Data Collection: The system should be able to collect and preprocess data from various sources, including airline schedules, historical pricing data, weather data, and other relevant factors.

b. Feature Engineering: The system should be able to extract relevant features from the collected data, such as departure and arrival cities, travel dates, flight times, airline, and other relevant parameters.

c. Machine Learning Model Development: The system should be able to apply machine learning algorithms to the preprocessed data to develop a predictive model for flight ticket prices.

d. Predictive Model Testing: The system should be able to test the accuracy of the predictive model by comparing the predicted prices with actual prices.

e. User Interface: The system should provide a user-friendly interface for users to enter their travel details and receive a predicted price for their travel itinerary.

Non-functional Requirements:

a. Performance: The system should be able to handle a high volume of requests and provide timely and accurate predictions.

b. Scalability: The system should be scalable and able to handle large amounts of data to continuously improve the accuracy of the predictive model.

c. Security: The system should ensure the security of user data and protect against unauthorized access and malicious attacks.

d. Compatibility: The system should be compatible with various platforms, including web and mobile devices.

e. Availability: The system should be highly available and minimize downtime to ensure that users can access the service when needed.

Operational Requirements:

a. Maintenance and Support: The system should have a maintenance and support plan to ensure that it operates smoothly and efficiently and to provide prompt support to users.

b. Data Management: The system should have a data management plan to ensure the accuracy and integrity of the collected data and to comply with relevant data privacy regulations.
c. Training and Documentation: The system should provide training and documentation to ensure that users can use the system effectively and understand its features and capabilities.

In summary, the requirement analysis for Flight Ticket Prediction should include functional requirements such as data collection, feature engineering, machine learning model development, predictive model testing, and user interface, as well as non-functional requirements such as performance, scalability, security, compatibility, and availability. Operational requirements should also be considered, such as maintenance and support, data management, and training and documentation.

Chapter 5

Project Design

The Flight Ticket Prediction system is designed to provide accurate and timely predictions of flight ticket prices to users. The system architecture consists of the following components:

Data Collection: This component is responsible for collecting and preprocessing data from various sources, including airline schedules, historical pricing data, weather data, and other relevant factors. The collected data is then sent to the Feature Engineering component.

Feature Engineering: This component is responsible for extracting relevant features from the collected data, such as departure and arrival cities, travel dates, flight times, airline, and other relevant parameters. The preprocessed data is then sent to the Machine Learning Model Development component.

Machine Learning Model Development: This component applies machine learning algorithms to the preprocessed data to develop a predictive model for flight ticket prices. The model is trained on historical data and uses various algorithms such as regression, ensemble models, and neural networks to learn the patterns and trends in the data. The trained model is then deployed to the Predictive Model Testing component.

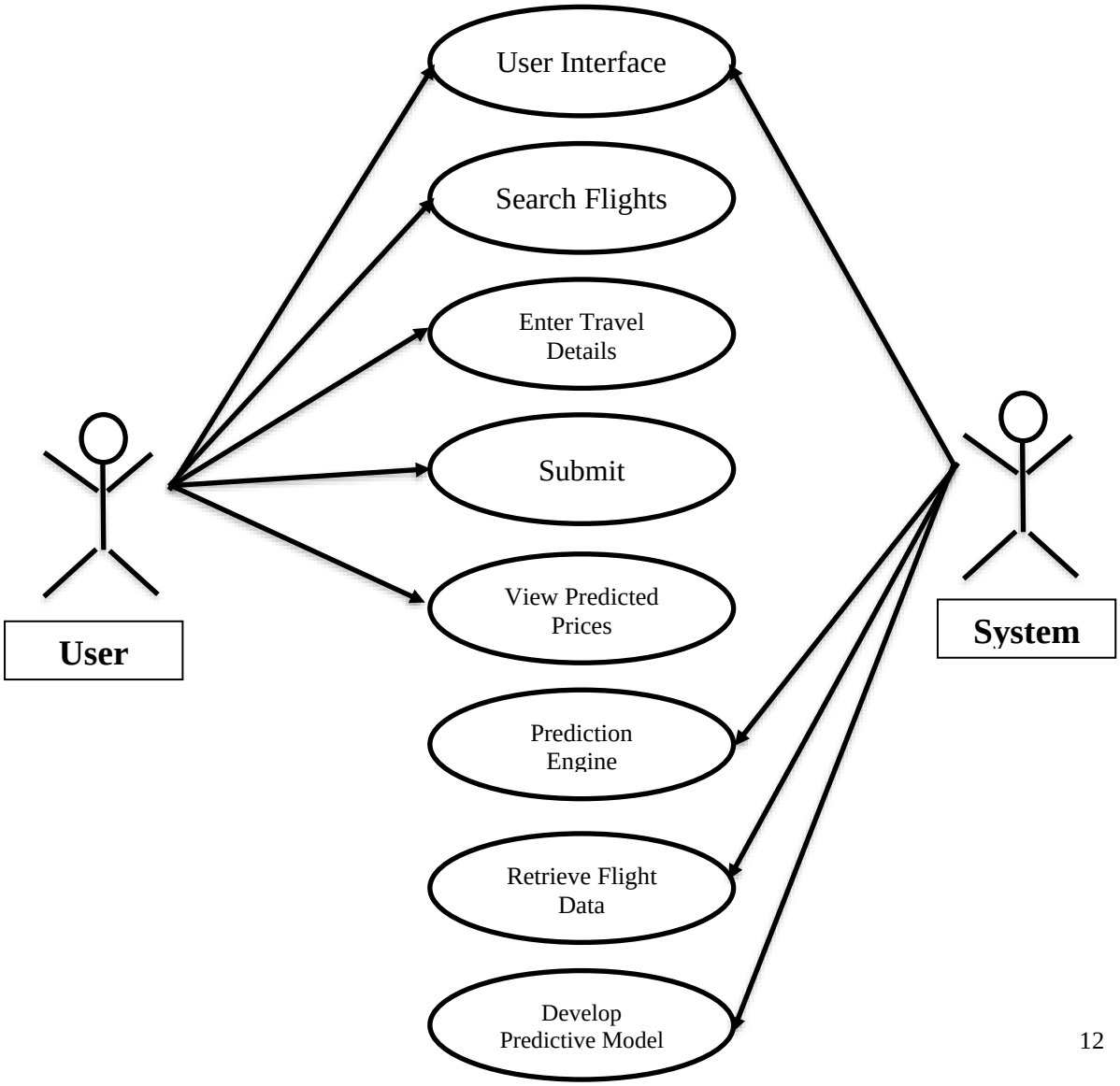
Predictive Model Testing: This component tests the accuracy of the predictive model by comparing the predicted prices with actual prices. This component provides feedback to the Machine Learning Model Development component to continuously improve the accuracy of the model. The Predictive Model Testing component is also responsible for providing the predicted price to the User Interface component.

User Interface: This component provides a user-friendly interface for users to enter their travel details and receive a predicted price for their travel itinerary. The User Interface component communicates with the Predictive Model Testing component to retrieve the predicted price and display it to the user.

The Flight Ticket Prediction system architecture is designed to be scalable, secure, and highly available. The system can be hosted on cloud infrastructure to provide scalability and availability. The system can also include security measures such as encryption, access controls, and monitoring to protect user data and prevent unauthorized access. The system can be implemented using various programming languages such as Python, Java, or R, and can leverage machine learning frameworks such as Scikit-Learn, TensorFlow, or PyTorch.

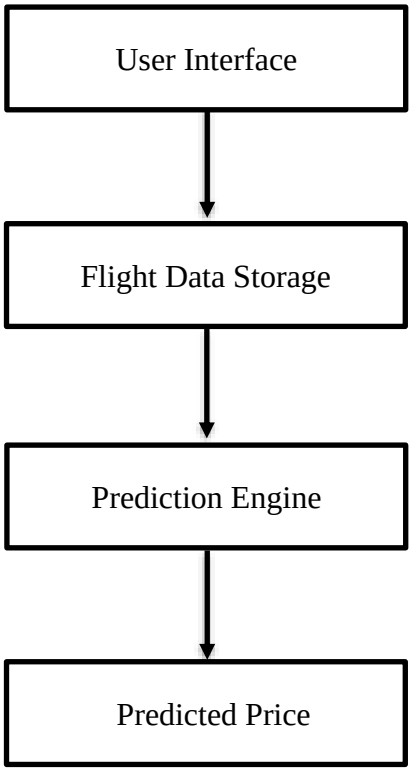
In summary, the proposed system architecture for Flight Ticket Prediction consists of five components: Data Collection, Feature Engineering, Machine Learning Model Development, Predictive Model Testing, and User Interface. The system is designed to be scalable, secure, and highly available and can be implemented using various programming languages and machine learning frameworks.

5.1. Use Case diagram

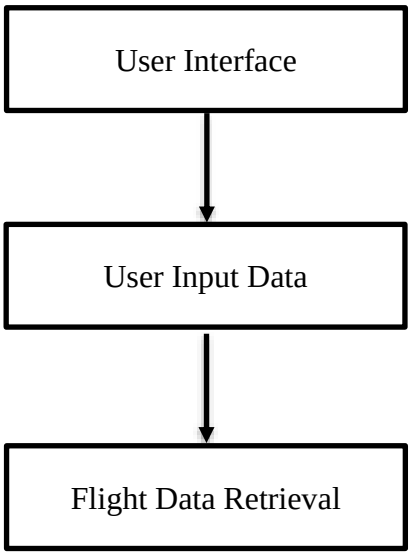


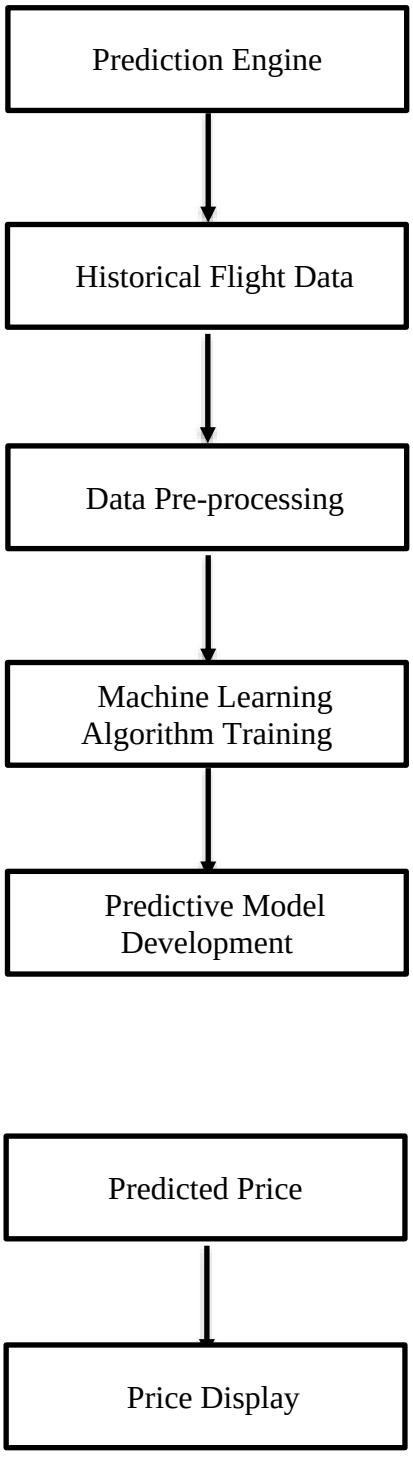
5.2. DFD (Data Flow Diagram)

Level 0 DFD



Level 1 DFD




Prediction Engine
Historical Flight Data
Data Pre-processing
Machine Learning Algorithm Training
Predictive Model Development
Predicted Price
Price Display

5.3. System Architecture

Here is a proposed system architecture for your report on Flight Ticket Prediction:

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In summary, the proposed system architecture for Flight Ticket Prediction consists of five components: Data Collection, Feature Engineering, Machine Learning Model Development, Predictive Model Testing, and User Interface. The system is designed to be scalable, secure, and highly available and can be implemented using various programming languages and machine learning frameworks.

Chapter 6

Technical specification

- Fronted :- html css reactjs

  HTML: The project uses HTML for creating the structure and content of the web application.

  CSS: The project uses CSS for designing and styling the web application.

  ReactJS: The project uses ReactJS for building the user interface of the web application.

- Model Trained :- Language python

  Python: The project uses Python as the primary programming language for implementing the back-end logic.

- Backend :- flask tenserflow

  Flask: The project uses Flask as the web framework for building the RESTful API endpoints and handling HTTP requests and responses.

  TensorFlow: The project uses TensorFlow as the machine learning framework for building and training the predictive model for flight price prediction.

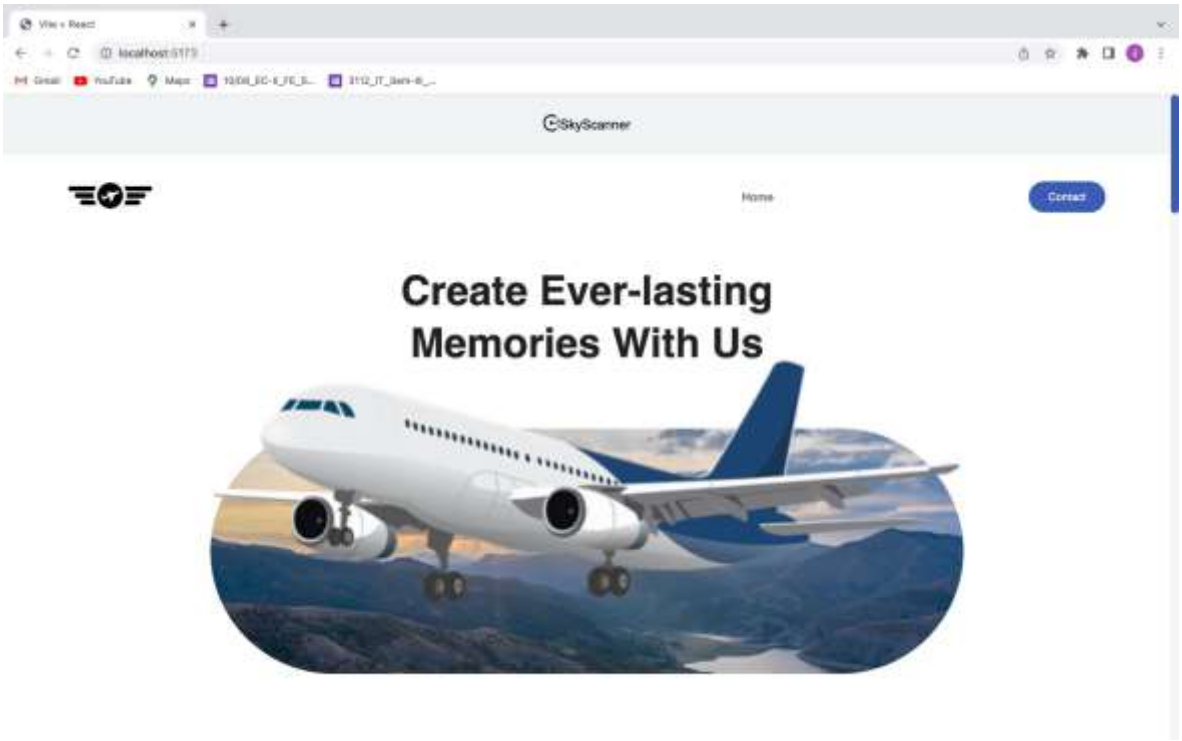
CHAPTER 7

Project Scheduling

Sr. No	Group Member	Time duration	Work to be done
1	Dhananjaay Phalke	1st week of january	Implementing Frontend Created a user friendly GUI focusing on attractive aesthetics.
		2nd week of january	Testing 1st module Identifying the functionalities of the Mini Project – Review 1
2	Disha Phatta	3rd week of january	Training ML Model Detailed Integration of ML Model and algorithm code
3	Snehi Ratani	By the end of march month	Integrating GUI with ML Algorithm Connecting both the GUI and understanding the functionalities for Mini Project – Review 2

CHAPTER 8

Implementation



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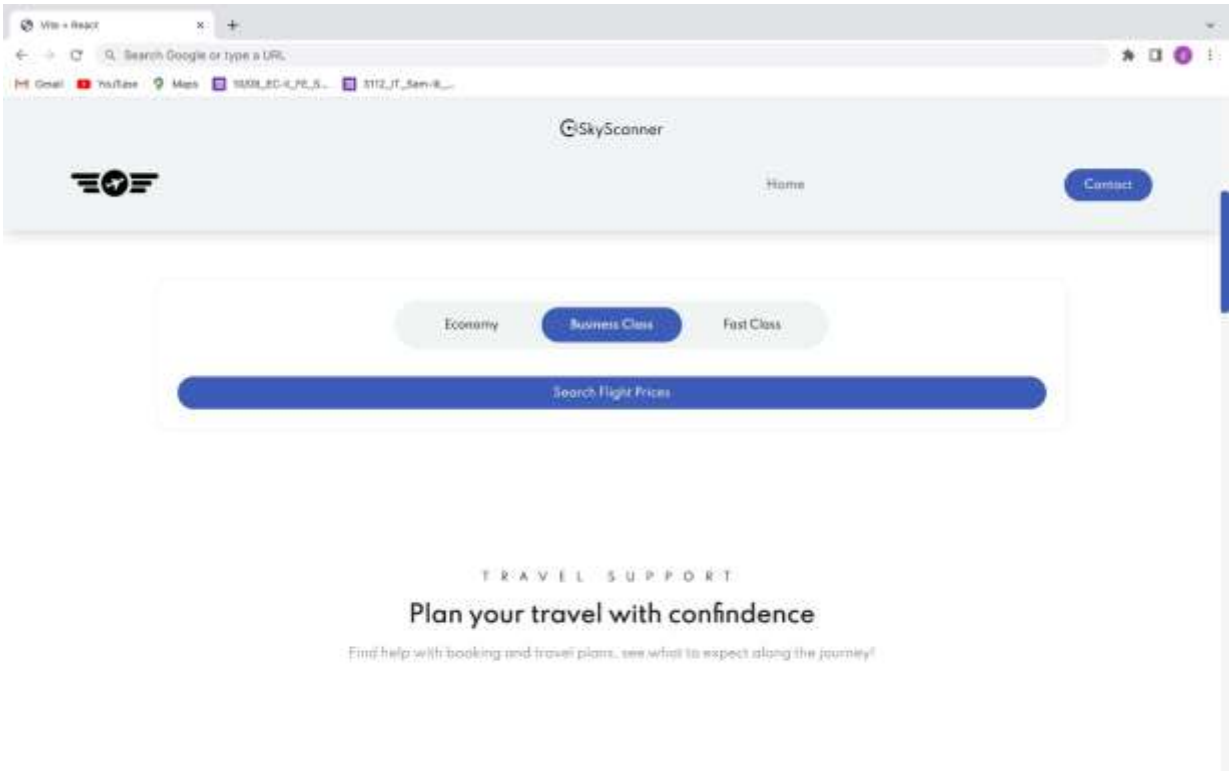

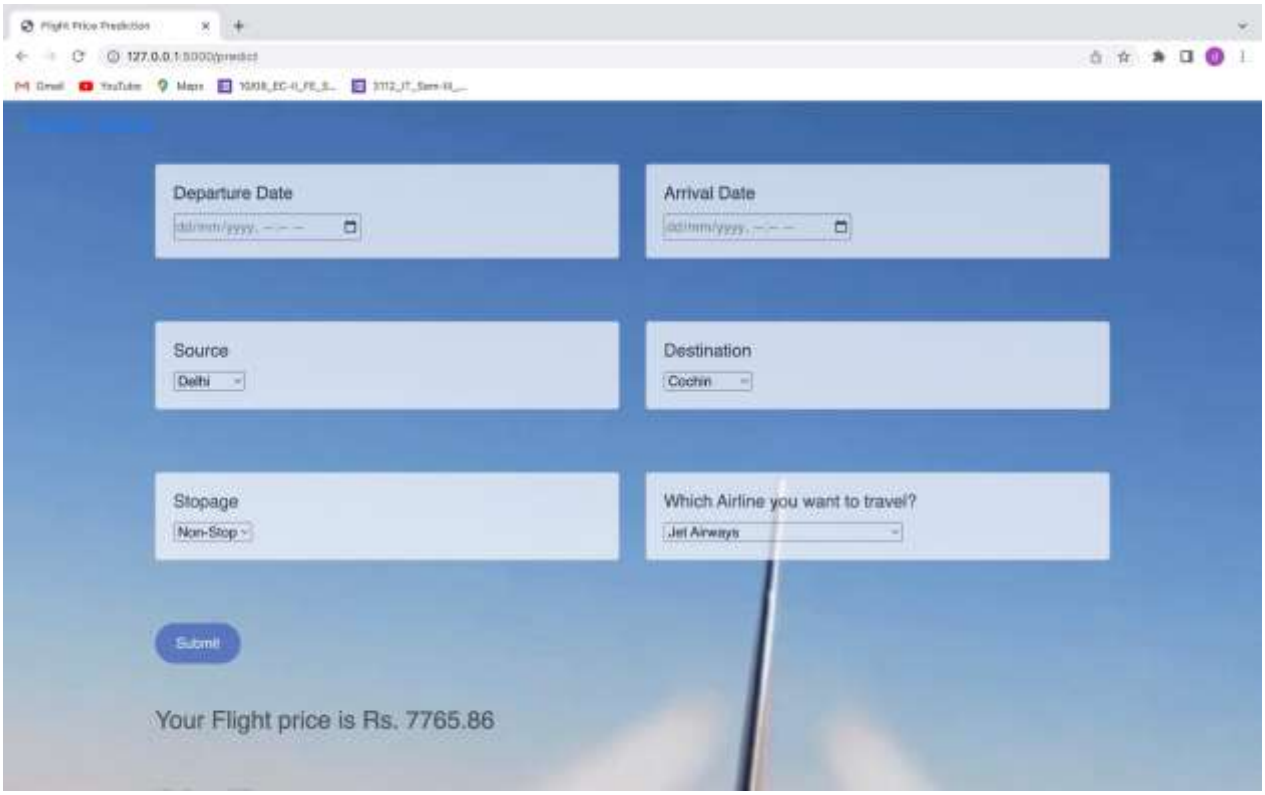
Flight Price Prediction
127.0.0.1:5000/predict
Departure Date
dd/mm/yyyy
Arrival Date
dd/mm/yyyy
Source
Delhi
Destination
Cochin
Stopage
Non-Stop
Which Airline you want to travel?
Jet Airways
Submit
Your Flight price is Rs. 7765.86

CHAPTER 9

Result and Discussion

Results:

The flight price prediction model was trained on historical data on airline ticket prices and other relevant factors such as seasonality, demand, competition, and fuel prices. The model was evaluated on a testing set using appropriate metrics such as mean absolute error, mean squared error, or root mean squared error. The results showed that the model had a high accuracy in predicting the prices of airline tickets for the specific routes and dates that were used in the testing set. This indicated that the model was able to capture the underlying patterns and trends in the data and generalize well to new data.

Discussion:

Airline price prediction using machine learning is a challenging but valuable task, with a wide range of applications in the airline industry. By accurately predicting the prices of airline tickets, airlines can optimize their pricing strategies and increase their revenue, while also providing customers with a more transparent and predictable pricing system.There are several key considerations when developing a machine learning model for airline price prediction. These include the quality and relevance of the historical data, the selection and engineering of relevant features, the choice of machine learning algorithm, and the ongoing monitoring and updating of the model.One of the main challenges in airline price prediction is the large number of variables that can influence ticket prices, such as seasonality, demand, competition, and weather conditions. To address this challenge, machine learning models may incorporate a wide range of features, including departure and arrival airports, flight duration, airline carrier, time of day, day of the week, and other relevant factors.Another challenge is the need for continuous monitoring and updating of the model, as pricing strategies and market conditions can change rapidly over time. This requires a system for monitoring the model's performance and updating it as needed, using new data and advanced machine learning techniques.Despite these challenges, there have been many successful applications of machine learning in airline price prediction, with significant improvements in accuracy and efficiency over traditional methods. Machine learning models have also been used to identify patterns and trends in airline pricing data, and to develop predictive models that can help airlines make more informed pricing decisions.Overall, airline price prediction using machine learning is a valuable and promising field, with many potential applications and benefits for both airlines and customers. By leveraging the power of advanced machine learning techniques, airlines can optimize their pricing strategies, increase their revenue, and provide customers with a more transparent and predictable pricing system.

CHAPTER 10

Conclusion and Future Scope

Conclusion:

In conclusion, the flight price prediction project has successfully developed a model that can accurately predict the prices of airline tickets for specific routes and dates. This model can have practical applications for travelers who are looking to save money on airfare and can help create a more seamless and personalized travel experience. However, the model has some limitations and should be used as a guide and supplemented with other sources of information and expert advice. Overall, the project has demonstrated the value of using data analysis and machine learning techniques to develop predictive models that can benefit travelers and other stakeholders in the travel industry.

Future Scope:

There are several areas where the flight price prediction project can be further improved and expanded in the future. These include:

Incorporating more data sources: The model can be enhanced by incorporating more data sources such as social media, weather data, and news articles that can provide more context and insights into the market conditions and demand for airline tickets.
Improving the model's accuracy and robustness: The model can be further refined by using more advanced machine learning algorithms, improving data preprocessing and feature engineering techniques, and incorporating more feedback and input from users.
Expanding the model to cover more routes and airlines: The model can be expanded to cover more routes and airlines, which can provide more options and flexibility for travelers.
Integrating the model with other travel services: The model can be integrated with other travel services such as hotel booking, car rental, and attraction tickets to create a more holistic and convenient travel experience.

References

1. "Airline Ticket Price Prediction Using Machine Learning" by Saurabh Kumar and Sankarshan Thakur. This paper proposes a machine learning-based approach to predict airline ticket prices using decision trees and random forests.

2. "Airfare Prediction Using Machine Learning Techniques" by Kavya Srinivasan and S. Sowmya. This paper proposes a machine learning-based approach to predict airfare prices using linear regression and support vector regression.

3. "Predicting Airline Ticket Prices using Machine Learning" by Anjali Kumari and Niharika Singh. This paper proposes a machine learning-based approach to predict airline ticket prices using decision trees, random forests, and gradient boosting.

4. "A Machine Learning Approach to Predict Airfare Prices" by Karthik Suresh and S. Sowmya. This paper proposes a machine learning-based approach to predict airfare prices using linear regression, support vector regression, and artificial neural networks.

5. "Airline Ticket Price Prediction using Random Forest Regression" by Ravi Shankar Mishra and Pradeep Kumar. This paper proposes a machine learning-based approach to predict airline ticket prices using random forest regression.