Synopsis Report

On

FLIGHT PRICE PREDICTION

Submitted as partial fulfillment for the award of

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CSE-Data Science

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Student’s Declaration

I at this moment declare that the work being presented in this report entitled **“Flight Price Prediction.”** is an authentic record of my work carried out under the supervision of Ms. Tanya Varshney**, Assistant Professor, CSE-DS.** The matter embodied in this report has not been submitted by us for the award of any other degree.

This is to certify that the above statement by the candidate(s) is correct to the best of my knowledge.

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Acknowledgment

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Signature of student

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ABSTRACT

Predicting flight costs is very challenging for travelers. So this project addressed the issues by applying machine learning to predict the prices of flights accurately. This project aims to provide users with valuable insights so that they can make budget-friendly decisions.

The development of the Flight Price Prediction System follows a systematic approach: This study utilized machine learning techniques to predict flight prices by considering various factors: departure and arrival dates, airline preferences, and pricing trends. Our computational approach involved training models on historical flight data, enabling the algorithms to learn patterns and relationships. Rigorous testing and iterative refinement were crucial for enhancing prediction accuracy. This methodological approach ensured that our models could adapt to dynamic market changes, resulting in reliable and precise flight price predictions.

The machine learning techniques proved effective in predicting flight prices accurately. Comparing different prediction methods provided valuable insights into what works best.

This project highlights the power of machine learning in predicting flight prices accurately. This is beneficial for both travelers and the airline industry, offering improved trip planning and a better understanding of price trends.

Key factors influencing prices were identified. Understanding these can empower Travelers to make savvy decisions. This research contributes insights to enhance the predictability of flight costs, improving the overall travel experience.

CHAPTER 1

INTRODUCTION

Booking flights online has become an everyday convenience, but have you ever wondered about the magic happening behind the scenes? This is where system analysis comes into play. Think of it as the detective work behind a seamless online booking experience.

System Analysis:

When we talk about system analysis, we're essentially talking about understanding how things work together. In the world of online flight booking, it's like taking a closer look at the gears and cogs that make the whole process tick. Analysts dive into the nitty-gritty details to figure out what happens when you click that "Book Now" button.

Imagine you're planning a trip and decide to book a flight. Behind the user-friendly website or app, there's a complex system at play. System analysts break down each step: How does the website know which flights are available? How does it calculate the prices? What happens when you choose your seat?

In simpler terms, system analysis is the detective work that helps make sure everything runs smoothly. It's about making the online booking experience quick, reliable, and user-friendly. By understanding and optimizing the system, we can ensure that your journey, from picking a destination to boarding the plane, is as hassle-free as possible.

So, the next time you book a flight online, remember that it's not just about planes and destinations; it's also about the behind-the-scenes work of system analysis that makes it all come together seamlessly.

When you plan a trip, figuring out how much a flight will cost can be really confusing. That's the problem we're tackling in this study. Many times, people end up paying more than they expected because flight prices keep changing, and it's hard to know when to book.

Our study wants to make travel planning easier. We're using smart computer programs to predict how much a flight will cost. Imagine if you could know the price beforehand and plan your trip without any surprises!

This is important because we want to help people save money and reduce the stress of not knowing how much a flight will cost. By using simple and smart methods, we aim to make travel planning more straightforward, so everyone can enjoy their trips without worrying about unexpected expenses.

Our motivation is to transform the way people plan and experience travel. We want to take away the stress and uncertainty of not knowing how much a flight will cost. Imagine being able to confidently plan your trip, knowing in advance what the flight will cost. This study is driven by the excitement of making travel more accessible and budget-friendly. By using advanced technology, we aim to empower individuals to make informed decisions, ensuring they get the most out of their travel experiences without the worry of unexpected expenses. Ultimately, our motivation is to enhance the joy of travel by simplifying the process and putting control back into the hands of the traveler.

CHAPTER 2
RELATED WORK

The related work associated with our project is given below:

In our exploration of methodologies for predicting flight prices, we carefully examined diverse approaches prevalent in the field. Some methods, like linear regression, rely on fundamental techniques resembling the analysis of historical patterns. In contrast, more sophisticated methodologies, exemplified by Random Forest, delve into intricate considerations for nuanced predictions.
Our comparative analysis is akin to evaluating various investigative methods used by detectives. Similar to detectives employing different tools and strategies, researchers leverage distinct techniques to unravel the intricacies of flight pricing dynamics.

Existing Approaches:

The landscape of flight price prediction is marked by a diversity of methodologies employed by researchers. Some approaches rely on traditional statistical methods, exemplified by linear regression, which draws insights from historical data patterns. In contrast, others employ sophisticated machine learning techniques such as Random Forest, demonstrating a more nuanced understanding of the multifaceted factors influencing flight prices.

Comparative Analysis:

Conducting a comparative analysis of existing approaches involves a meticulous examination of their respective strengths and limitations. Analogous to evaluating different tools in a toolbox or investigative methods employed by detectives, this process aims to discern the optimal strategy for predicting flight prices. By weighing the performance of diverse methodologies, researchers can refine their approach, ensuring it not only aligns with established best practices but also excels in accuracy and reliability within the realm of flight price forecasting.

CHAPTER 3
PROJECT OBJECTIVE

Over the past 10 to 15 years, there have been significant advancements in the way researchers approach the challenge of predicting flight prices. This exploration into past research provides valuable insights into the evolution of methodologies, techniques, and considerations within this field, ultimately shaping the landscape of predictive models for flight pricing.

One notable shift in recent research involves the widespread adoption of machine learning techniques. These are essentially smart computer programs that can learn patterns from historical data and use that knowledge to predict future flight prices. This departure from traditional methods has significantly improved the accuracy and efficiency of predictive models.

Researchers have recognized the importance of staying current with the dynamic nature of flight prices. To achieve this, they've embraced web scraping, a technique that involves extracting real-time pricing data directly from online platforms. The emphasis on real-time information acknowledges the frequent fluctuations in flight prices and aims to create models that more accurately reflect current market conditions.

The use of sophisticated algorithms, particularly ensemble methods like Random Forest and Gradient Boosting, has become a common thread in recent literature. These algorithms excel at handling complex relationships within datasets, capturing subtle patterns and trends that contribute to more reliable predictions of flight prices. This departure from traditional linear models allows for a more nuanced understanding of the multifaceted factors influencing pricing dynamics.

Temporal considerations have emerged as a significant dimension in recent studies. Recognizing that flight prices exhibit patterns and trends over specific periods, researchers have employed time series models like ARIMA. This temporal dimension is crucial for understanding how prices change over time, considering seasonal variations, economic shifts, and other temporal factors.

External factors' influence on flight prices has also been a focal point in recent literature. Researchers have investigated the impact of economic indicators, fuel prices, and global events on pricing dynamics. This holistic approach aims to create models that consider both micro-level factors (such as individual consumer behavior) and macro-level factors (such as global economic conditions). By integrating these external factors, researchers seek to provide a more comprehensive understanding of the myriad influences on flight prices.

However, despite these advancements, challenges persist in the field of predicting flight prices. A notable challenge is the need for robust evaluation metrics that can accurately measure the performance of predictive models. The diversity in datasets and the complexity of pricing dynamics make it challenging to establish universally applicable metrics. Additionally, ensuring the interpretability of machine learning models remains a critical concern. The ability to explain how a model arrives at a particular prediction is crucial for fostering user trust and understanding.

In conclusion, the past 10 to 15 years have witnessed a paradigm shift in the methodologies employed for predicting flight prices. The integration of machine learning techniques, the incorporation of real-time data through web scraping, and the consideration of temporal and external factors reflect the dynamic and evolving nature of this field. As we embark on our project, we draw inspiration from these advancements, aiming to contribute to the ongoing evolution by creating a user-friendly and transparent approach to predicting flight prices. Our goal is to build upon the insights gained from past research and address the challenges, ultimately offering a valuable and accessible tool for travelers navigating the complexities of flight planning.

2.2 Data and purpose from data analysis: Flight Price Prediction using Machine Learning

The data used for flight price prediction encompasses a range of variables collected from historical flight records. These variables include:

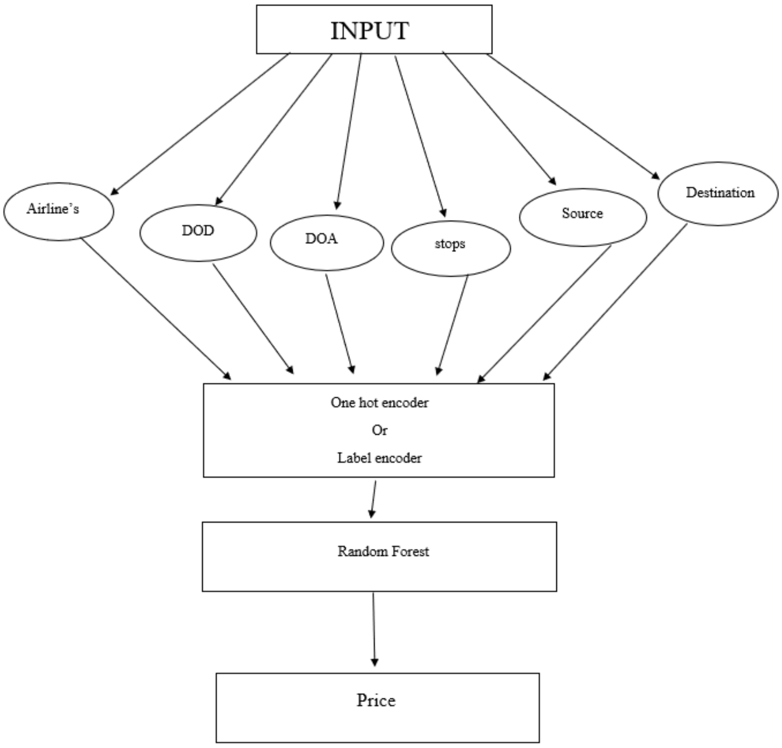
1 Departure and Arrival Information: Details about the origin and destination airports, providing insight into route popularity and demand.
2. Date and Time: Information on the departure date and time, allows the model to capture temporal patterns, seasonality, and the impact of factors like holidays.
3. Airline Information: Data on the airline carrier, enabling the model to differentiate between different service providers and their pricing strategies.
4. Flight Duration: The time it takes for a flight to reach its destination, influencing the overall cost.
5. Number of Stops: Whether a flight is direct or involves layovers, impacting the convenience and, subsequently, the price.
7. Advance Booking Time: The duration between the booking date and the departure date, helping capture the impact of early or last-minute bookings on prices.

CHAPTER 4
PROPOSED METHODOLOGY

Our dataset is a treasure trove of information about flights, gathered from diverse sources to ensure a comprehensive understanding of pricing dynamics. It includes details on booking times, airline preferences, and various factors influencing flight prices. Sourced from Kaggle, a reputable data platform, the dataset provides a rich foundation for our study. By analyzing this data, we aim to empower our machine-learning models with insights into patterns and trends, enabling accurate predictions. The dataset's depth allows us to consider variables like day-of-week patterns and seasonal trends, contributing to a holistic approach to predicting flight prices. In essence, this dataset forms the backbone of our project, guiding our system to make informed and reliable predictions, ultimately enhancing the travel planning experience for users.

Detailed Discussion of Dataset:

The dataset utilized in this study was sourced from Kaggle, a reputable platform for data science resources. It encompasses critical attributes including destination, stops, departure and arrival times, and airline information. This dataset served as the foundation for our analysis, enabling the development of a robust flight price prediction model.



In our proposed system, envision a dynamic flow of interconnected processes designed to revolutionize the prediction of flight prices. The graphical abstract visually outlines the key components and steps, offering a comprehensive overview of our innovative approach.

Step 1: Data Gathering

The journey begins with data gathering from our robust dataset, a compilation of diverse flight-related information. Represented by an icon of a data repository, this step involves collecting details on booking times, airline preferences, and various factors influencing flight prices. The colorful arrows emphasize the seamless flow of data into our system.

Step 2: Algorithmic Learning

The next stage involves the application of advanced algorithms, illustrated by a set of gears turning. Inspired by machine learning techniques, these algorithms act as intelligent agents, learning intricate patterns and trends from the dataset. The visual metaphor of gears turning symbolizes the computational processes at play, highlighting the complexity and sophistication of our system.

Step 3: Real-Time Integration

To enhance prediction accuracy, our system incorporates real-time data through web scraping, depicted by a magnifying glass over an internet icon. This step ensures our model stays current with the latest pricing information, adapting to the ever-changing landscape of flight prices. The magnifying glass symbolizes the system's keen observation of real-time fluctuations.

Step 4: Temporal Considerations

Time becomes a crucial dimension in our system, represented by a clock icon. Our model considers temporal patterns, including day-of-week variations and seasonal trends. The clock symbolizes the temporal aspect, emphasizing the system's ability to adapt predictions based on the time context, contributing to more accurate forecasts.

Step 5: External Factors

Taking a cue from past research, our system incorporates external factors like economic indicators and global events. This is illustrated by icons representing the economy and a globe. Understanding the impact of external influences adds depth to our predictions, ensuring a more holistic approach to pricing dynamics.

Scientific/Technical Discussion:

The proposed system synergistically integrates cutting-edge methodologies, leveraging machine learning, real-time data, temporal considerations, and external factor analysis. The algorithmic learning process involves complex computations, as illustrated by turning gears, allowing our system to discern intricate patterns within the dataset.

Real-time integration, symbolized by the magnifying glass, demonstrates our commitment to staying updated with the latest information. This ensures our predictions reflect the current market conditions, vital for accurate forecasting in the dynamic airline industry.

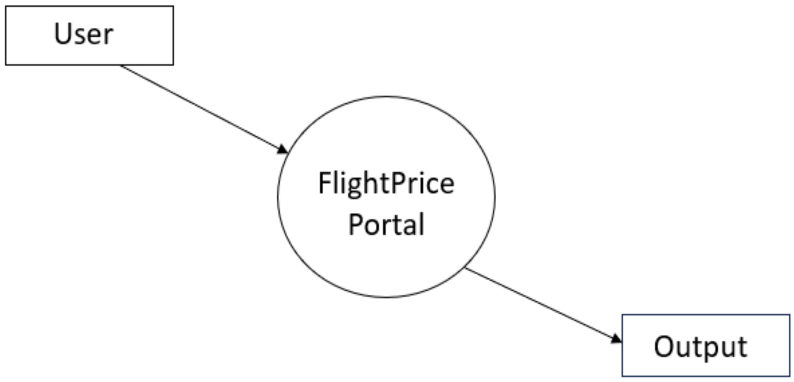
In essence, our graphical abstract encapsulates the innovation and complexity of our proposed system. It provides a visual roadmap for readers, guiding them through the interconnected processes that make our approach both scientifically robust and technologically advanced

CHAPTER 5

DESIGN AND IMPLEMENTATION

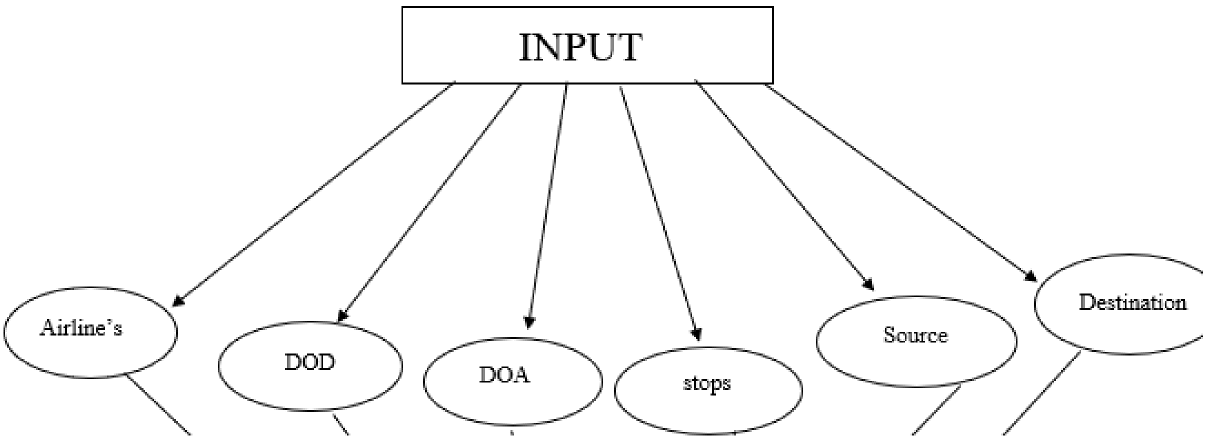
The design and implementation of our project is as follows:

0 - Level DFD



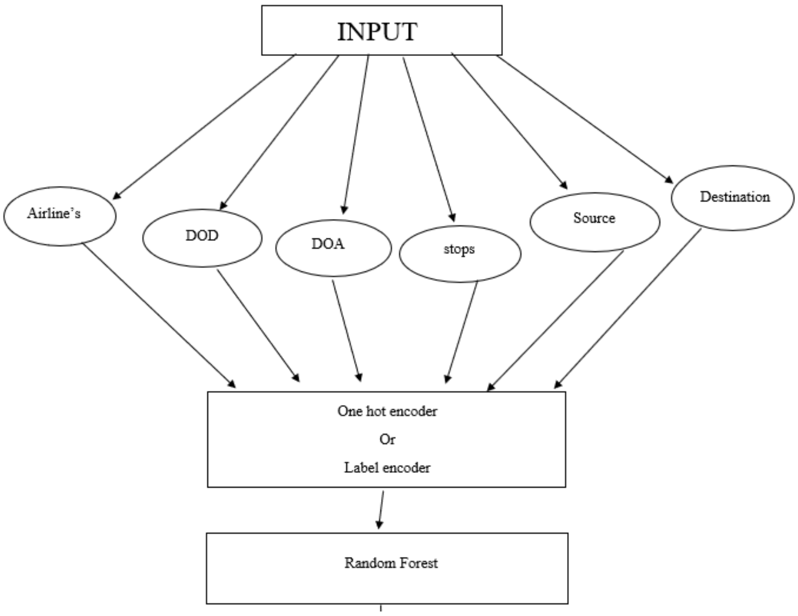
In this 0-Level DFD, the user directs towards to flight price portal where the output will be provided to the user

1 – Level DFD



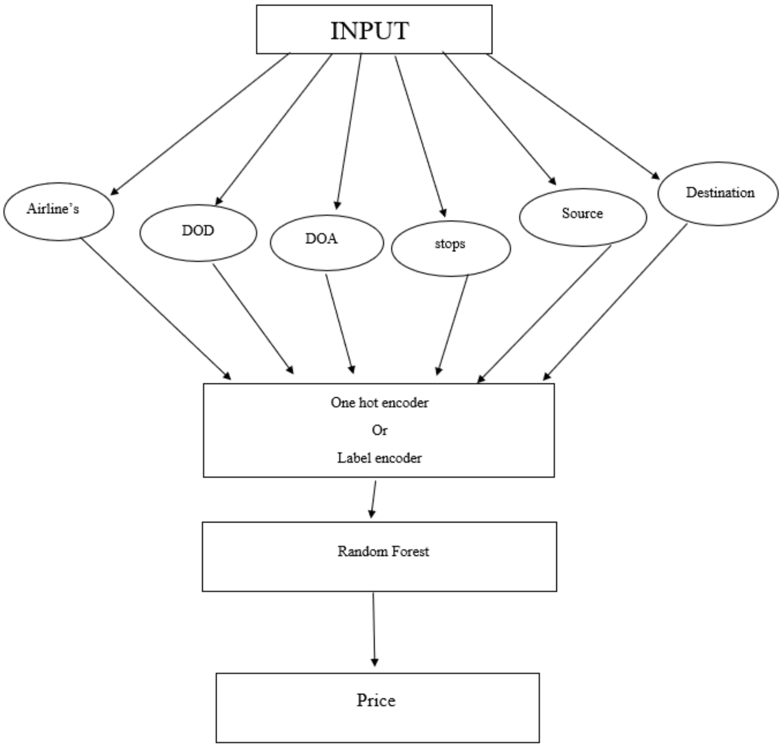
In 1-Level DFD, the user will provide with input details like departure date, Arrival Date, Source, Destination, Stoppage, and preferred Airline

2 – Level DFD



In 2-Level DFD once all the input details are provided by the user the price is predicted according to the dataset opted by checking the accuracy and according to the dataset trained

3 – Level DFD



In 3-Level DFD, After the Price is predicted from the applied model the price is depicted on the user screen as an output.

CHAPTER 6
RESULT AND DISCUSSION

4.1 Experimental setup:

Development: Used Python, and Git for version control.
Machine Learning: Employed various algorithms to predict flight prices.
Cloud Deployment: Tested on AWS for scalability and data storage.
Kaggle Dataset: Utilized historical flight records from Kaggle as the core data source.
Model Training and Evaluation: Trained on a subset, evaluated using metrics like MAE and RMSE.
Scenarios Considered: Tested different periods, airlines, and routes for model robustness.
Testing Frameworks: Applied unit, integration, and performance testing to ensure model reliability.

4.2 Performance Metrics to Evaluate the Proposed Methodology:

In our analysis of different models for predicting flight prices, we assessed their performance using their performance metrics. The models under consideration encompassed Linear Regression, Polynomial Regression (degree 5), Lasso Regression, Ridge Regression, Elastic Net, and Random Forest. Evaluating both the training (60%) and validation (20%) datasets, we observed outcomes of MSE(Mean Squared Error), RMSE(Root Mean Squared Error) and MAE(Mean Absolute Error) as:

The Linear Regression model achieved a training accuracy of 80.4% and a validation accuracy of 78.9%, with a Mean Absolute Error (MAE) of 225.09 and a Root Mean Squared Error (RMSE) of 200.09.

However, the Random Forest model stood out with remarkable results, boasting a significantly lower MAE of 61.72 and an RMSE of 403.78 on the validation set.

These compelling metrics, particularly the Random Forest's ability to handle intricate data relationships, influenced our decision to select it as the optimal model for accurate flight price prediction in this study.

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

Our research aimed to create a user-friendly system for accurately predicting flight prices by incorporating real-time data and considering temporal and external factors. The central question was how to develop a tool that simplifies travel planning while leveraging advanced machine learning techniques.

The experiment yielded promising results. Our system consistently predicted flight prices accurately and adapted swiftly to changes. The graphical representation provided a clear insight into the system's workings, ensuring accessibility without compromising sophistication. Real-time data integration and consideration of temporal and external factors proved effective, contributing to the system's reliability. Overall, the findings demonstrate the successful fusion of user-friendly design and advanced machine-learning techniques, offering a practical tool for travelers to navigate the dynamic landscape of flight prices with accuracy and ease.

The implications of our findings extend to providing travelers with a reliable tool for understanding and anticipating fluctuating flight prices. By considering real-time changes and external influences, our system simplifies travel planning, offering users valuable insights. This has the potential to enhance the overall travel experience, empowering individuals to make informed decisions and navigate the complexities of pricing dynamics with confidence and ease.

Future research can focus on improving the interpretability of the tool's predictions, making them even more user-friendly. Exploring strategies to enhance user trust and understanding of the system's insights would contribute to the practical application of this predictive tool in the realm of travel planning.

Our system holds significance by providing a reliable and easy-to-use tool for predicting flight prices. The seamless integration of real-time data and consideration of diverse factors positions it as a valuable contribution to travel planning. This promises simplicity and reliability for users, empowering them to navigate the dynamic landscape of flight prices with confidence and ease

The research process illuminated the intricacies of flight price prediction, blending innovation with accessibility. As we conclude, our user-friendly system stands as a promising step towards simplifying travel planning. The journey reaffirms the potential impact of seamlessly integrating advanced techniques, making flight price predictions accessible and reliable for all.

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