

ANALYZING AIRLINE DELAYS USING INTERACTIVE DASHBOARDS IN TABLEAU

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ABSTRACT

Airline delays have become a major source of worry in the aviation sector since they have a considerable influence on passenger happiness, airline operations, and airport efficiency. Analysing aircraft delay trends has become crucial for enhancing operational planning and service quality due to the growing volume of air traffic. The main goal of this project is to use interactive Tableau dashboards to analyze airline delay data. The system uses historical flight data to determine delay trends based on a variety of elements including airlines, origin and destination airports, and time constraints. Users can quickly examine the data and obtain insightful information thanks to interactive visualization approaches. Through visual analytics, the suggested strategy facilitates efficient decision-making and aids stakeholders in understanding the reasons behind delays.

KEY WORDS: *Airline Delay, Tableau, Data Visualization, Flight Analysis, Machine Learning*

INTRODUCTION

Air travel is essential for establishing connections between various regions of the world and promoting economic expansion. Nevertheless, one of the most frequent problems that travellers and airlines deal with is flight delays. In addition to being inconvenient for passengers, delays cost airlines money and lead to operational inefficiencies. Spreadsheets and static reports are a major component of traditional flight data analysis techniques, which makes it challenging to effectively spot trends and patterns. Large datasets can now be studied more successfully thanks to the development of data visualization tools. One such potent technology that makes interactive data analysis possible through dashboards is Tableau. The goal of this project is to use Tableau to visually present and analyze airline delay data, making the study more comprehensible and informative.

LITERATURE REVIEW

The study of airline delay prediction has become increasingly important because of

the aviation industry's growing operational issues and the rapid rise of air traffic. Xiaotong Dou (2020) emphasized how increased aviation traffic results in greater operating costs and decreased efficiency and suggested an ensemble learning-based method to forecast flight arrival delays. When compared to conventional methods, the study showed that ensemble models increase prediction accuracy.

In order to forecast on-time arrivals, Noriko Etani (2019) concentrated on finding relationships between flight information and meteorological conditions. According to the study, delays and lower passenger satisfaction are mostly caused by bad weather, technical problems, and delayed aircraft arrivals. The model's prediction performance was enhanced by combining flight and meteorological data.

RELATED WORK

Several researchers have investigated airline delays utilizing data visualization and analytical techniques to improve operational efficiency. Previous research has shown that typical data analysis approaches are insufficient to manage enormous amounts of flight data adequately. With the advancement of business intelligence tools, Tableau has evolved as a formidable platform for visual analytics in aviation research. Despite these advances, little work has been done to

integrate machine learning-based analysis with interactive dashboards in a single system. As a result, a comprehensive approach combining data analysis, prediction, and visualization is required. The suggested method seeks to close this gap by utilizing Tableau for interactive analysis of airline delays.

This approach improves knowledge, decision-making, and overall flight performance analysis. Interactive dashboards are extensively used to analyze aircraft performance based on departure time, airline type, and airport congestion. Some research employed visual comparisons of on-time and delayed flights to aid operational planning. Tableau's ability to combine numerous data sources has enabled researchers to easily evaluate historical flight records.

Heat maps, bar charts, and geographical maps were often utilized to identify delay patterns. Researchers discovered that visual analytics enhances knowledge when compared to typical data reports. A few studies have integrated machine learning outputs into Tableau dashboards to aid in the interpretation of prediction outcomes. This research showed that interactive dashboards improve decision-making while reducing analysis complexity. However, little research has focused on merging real-time data and visualization.

EXISTING SYSTEM

The existing system relies heavily on traditional data analysis approaches such as spreadsheets and static reports for aircraft delay assessments. Flight data is received from a variety of sources and manually processed, making the procedure time consuming and inefficient. Existing systems also do not provide real-time or predictive analysis, which limits their usefulness in decision making. Furthermore, manual data handling increases the likelihood of errors and lowers accuracy. Because of these restrictions, traditional approaches are ineffective for studying large-scale airline datasets. As a result, an advanced analytical system with the ability to process enormous amounts of data and visually convey insights is required. This constraint prompts the use of visualization and machine learning-based techniques for better airline delay analysis.

PROPOSED SYSTEM

The proposed system focuses on analyzing airline delays using interactive dashboards developed in Tableau. It takes previous flight data and preprocesses it to eliminate missing and inconsistent values. Machine learning techniques are used to examine delay patterns and identify key driving elements. To facilitate understanding, the processed data is visualized via interactive charts, graphs, and maps. To acquire more precise insights, users can filter data by airline,

airport, date, and kind of delay. The dashboard facilitates better decision-making for airlines and passengers. The technology saves manual effort while increasing analytical efficiency. Overall, the proposed approach provides an effective and simple solution for airline delay analysis.

SYSTEM ARCHITECTURE

The system architecture of the proposed airline delay analysis system is designed to efficiently process, analyze, and visualize flight delay data using Tableau.

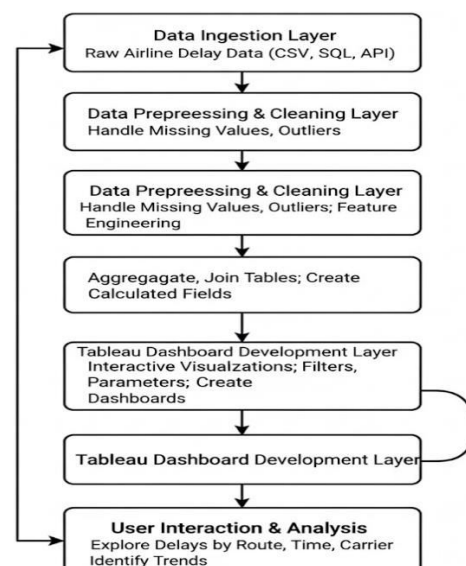


Fig1: System Architecture

METHODOLOGY DESCRIPTION

1. Data Ingestion Layer:

Gathering unprocessed airline data from multiple sources, such as live APIs, SQL databases, and CSV files.

2. Data preprocessing and cleaning:

Improving the data by eliminating duplicates, addressing missing numbers,

and correcting formatting mistakes for precision.

3. Aggregate & Join Tables:

Creating custom computed fields in Tableau and connecting various datasets (such as weather and flight records).

4. Tableau Dashboard Development:

Creating an interactive visual interface with charts, filters, and settings. User Interaction & Analysis: Giving end users the ability to examine the data, delve into particular routes, and spot trends in delays that can be put to use.

RESULTS AND DISCUSSIONS

The Airline Delay Prediction system assists passengers and airlines in making informed decisions by projecting potential delays in advance. The algorithm estimates flight punctuality accurately by taking into account parameters such as route, carrier performance, and weather conditions temperature and wind speed.

Fig2: Input Details

Based on the inputs route (Hyderabad to Bengaluru), flight date, airline (Air India), and weather conditions (temperature and wind speed), the system analyzes past flight data and weather trends to estimate the risk of a delay.

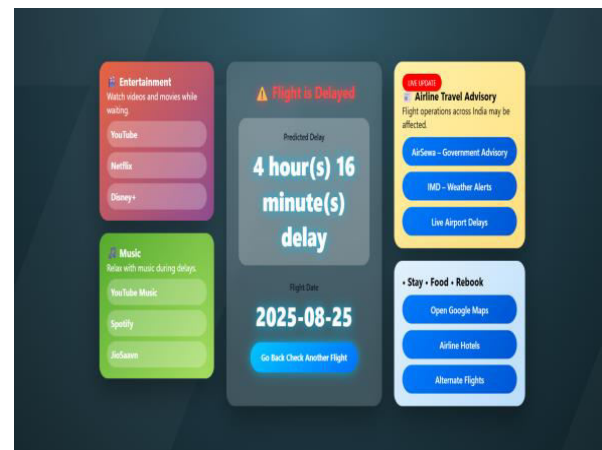


Fig 3: Results Page

This page presents the expected outcome based on the flight information and conditions submitted by the user. It not only displays the delay prediction but also offers important advise and assistance alternatives for travelers throughout the delay.

The results page displays the final outcome of the airline delay prediction system, clearly indicating that the selected flight is delayed, with an anticipated delay of 4 hours and 16 minutes and the flight date. In addition to the prediction, the portal improves the user experience by recommending entertainment platforms like YouTube, Netflix, and Disney+, as well as music options like YouTube Music, Spotify, and JioSaavn, to

assist passengers unwind during the waiting time of passenger.

CONCLUSION

The Airline Delay Prediction system clearly demonstrates how data-driven models may be used to anticipate flight delays before they occur. The algorithm predicts delay duration based on critical criteria such as route, airline, flight date, and weather conditions, allowing passengers to set realistic expectations. The results page improves usability by displaying the delay status in a clear and visually appealing manner, as well as providing real-time advisories, weather updates, and practical support alternatives such as alternate flights, lodging, and transportation aid. Overall, our method not only predicts airline delays more accurately, but it also converts the predictions into useful, passenger-focused information, allowing for better planning, less uncertainty, and a more informed travel experience.

FUTURE ENHANCEMENT

Future versions may feature mobile app integration and push alerts to notify passengers of delays, gate changes, and cancellations. Adding personalized advice, such as ideal rebooking alternatives or reimbursement eligibility depending on airline policy, will help travelers even more. Finally, upgrading the system to include international routes, bilingual interfaces, and

airline-specific performance statistics would make it more scalable, intelligent, and helpful to both passengers and airlines.

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