

Exploring Insights From Synthetic Airline Data using Qlik

1. Introduction

1.1 Overview

The project "Exploring Insights from Synthetic Airline Data Analysis with Qlik" aims to harness the power of Qlik, a leading business intelligence and data visualization tool, to analyze airline data. This data, which emulates real-world airline operations, encompasses a broad range of information such as flight schedules, passenger demographics, ticket sales, and performance metrics. By leveraging Qlik's advanced analytical capabilities, the project seeks to identify and interpret patterns, trends, and correlations within the dataset, providing valuable insights for improving airline operations and decision-making.

The synthetic dataset offers a comprehensive view of various operational aspects including detailed flight schedules, diverse passenger profiles along with key performance indicators. By thoroughly analyzing these dimensions, stakeholders can gain a deeper understanding of the factors influencing airline efficiency, passenger satisfaction, and financial performance. This holistic approach allows for a more nuanced exploration of operational dynamics, ultimately aiding in the optimization of airline strategies.

Utilizing Qlik's robust data visualization and analytical tools, the project endeavors to transform raw data into actionable insights. Interactive dashboards, real-time analytics, and intuitive visual representations enable users to drill down into specific areas of interest, uncover hidden trends, and make data-driven decisions. Overall, the project underscores the critical role of data analytics in modern airline management and strategy development.

1.2 Purpose

The three primary goals of carrying out this analysis lies in:

a. Revenue Optimization

The revenue of the organization can be optimized by examining past ticket sales data, determining popular destinations, peak travel periods, and pricing methods. With Qlik, they can segment clients based on their purchase patterns, see long-term revenue trends, and modify pricing plans to maximize profitability.

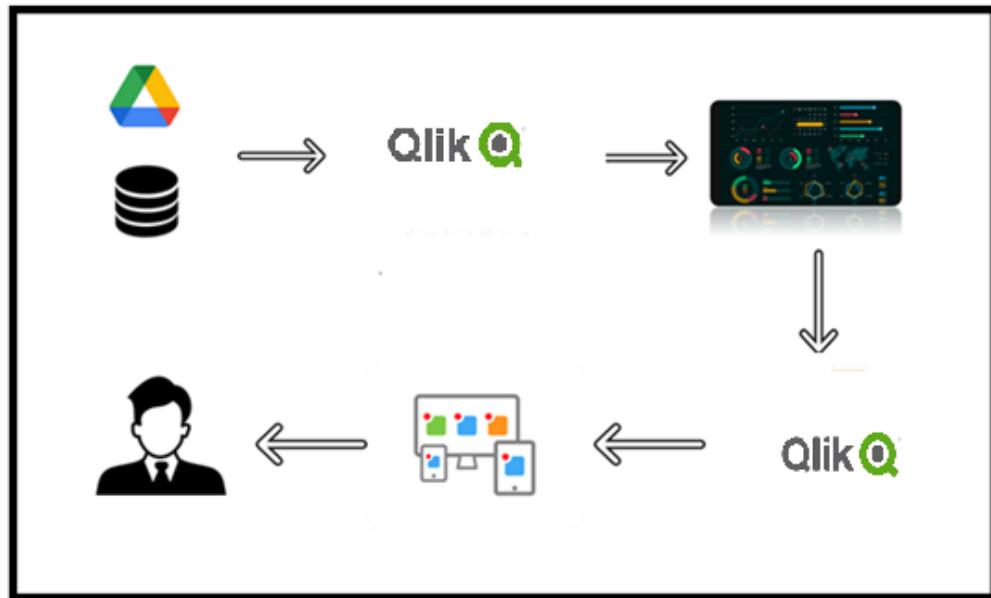
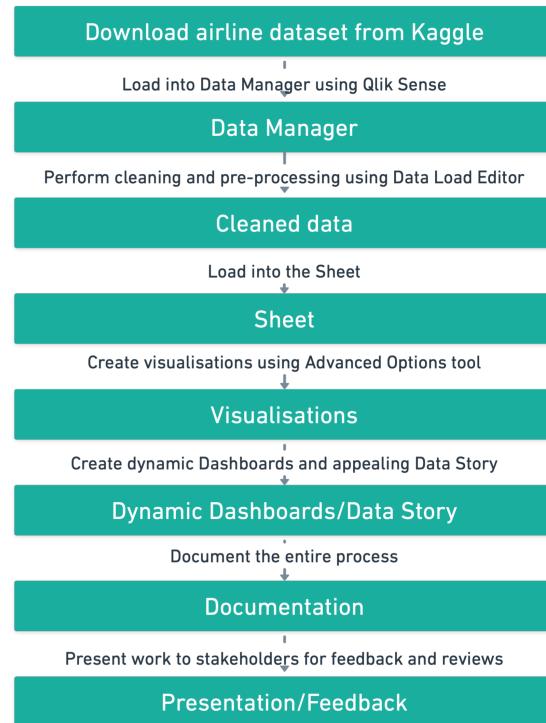
b. Operational Efficiency

By examining flight schedules, passenger flows, and baggage handling procedures, an airport authority seeks to improve operational efficiency. Through the integration of Qlik with an airline dataset, it is possible to pinpoint operational bottlenecks in airports, forecast periods of high traffic, and efficiently deploy resources to optimize workflows and enhance overall productivity.

c. Customer Experience Enhancement

Airlines are eager to learn about their customers' preferences, levels of happiness, and trouble spots in order to improve the passenger experience. Airlines may enhance customer happiness and loyalty by identifying areas for improvement, personalizing services, and adjusting marketing efforts through sentiment analysis on customer feedback data coupled with Qlik.

1.3 Technical Architecture



2. Understanding the Problem Statement

2.1 Business Problem

Airline operations involve managing complex and multifaceted data related to flight schedules, passenger demographics, ticket sales, and performance metrics. However, extracting actionable insights from this vast dataset to optimize operations, improve customer satisfaction, and enhance financial performance remains a significant challenge.

The project addresses this issue by leveraging Qlik's advanced data visualization and analytical capabilities. The primary objective is to uncover hidden patterns, trends, and correlations within synthetic airline data to support data-driven decision-making for airlines, airports, and related stakeholders.

By transforming raw data into meaningful insights through Qlik, the project aims to enhance operational efficiency, improve strategic planning, and elevate customer experience in the airline industry.

2.2 Business Requirements

1. Data Integration and Preparation: From the technical architecture, we can see that we need to first import and integrate the data into Qlik Sense following which we can clean, transform, and preprocess the data to ensure consistency and accuracy for analysis.

2. Analytical Capabilities: Using Qlik's data visualization tools, we can create interactive dashboards and reports to facilitate comprehensive analysis. Real-time analytics will monitor key performance indicators (KPIs), while custom calculations will support detailed analysis of airline operations and customer satisfaction.

3. Pattern and Trend Analysis: The project aims to identify patterns in flight schedules and operational performance to optimize operations. Analyzing passenger demographics will enhance customer segmentation and service personalization.

4. Correlation and Root Cause Analysis: Correlation analysis will uncover

relationships between variables, such as the impact of flight delays on customer satisfaction. Root cause analysis will identify underlying issues affecting performance metrics, enabling targeted improvements in operational efficiency.

5. Decision Making: Provide actionable insights and recommendations based on the data analysis to support strategic and operational decision-making to keep stakeholders informed of critical changes and trends in real-time.

2.3 Literature Survey

The literature survey covers crucial topics for the airline industry's success. Firstly, it examines dynamic pricing models, focusing on strategies to adjust ticket prices dynamically in response to market demand. This research area evaluates different pricing strategies' effectiveness in revenue maximization and managing demand fluctuations, providing insights into evolving airline pricing dynamics.

Secondly, the survey explores studies on peak travel time prediction and customer segmentation techniques. These are vital for airlines' operational efficiency and marketing strategies. Understanding peak travel times and segmenting customers based on preferences and behaviors enable airlines to optimize resource allocation, customize marketing efforts, and enhance the passenger experience.

3. Data Collection

3.1 Collect the Data

Data collection is the process of gathering information from various sources to build a dataset that serves a specific research or analytical purpose. For the completion of the analysis of our project, the dataset downloaded from Kaggle provides a comprehensive collection of synthetic airline data, representing various facets of airline operations.

Here is a column description of the Dataset:

- Passenger ID - Unique identifier for each passenger
- First Name - First name of the passenger
- Last Name - Last name of the passenger
- Gender - Gender of the passenger
- Age - Age of the passenger
- Nationality - Nationality of the passenger
- Airport Name - Name of the airport where the passenger boarded
- Airport Country Code - Country code of the airport's location
- Country Name - Name of the country the airport is located in
- Airport Continent - Continent where the airport is situated
- Continents - Continents involved in the flight route
- Departure Date - Date when the flight departed
- Arrival Airport - Destination airport of the flight
- Pilot Name - Name of the pilot operating the flight
- Flight Status - Current status of the flight (e.g., on-time, delayed, canceled)

3.2 Connect Data with Qlik Sense

Connecting data with Qlik Sense involves integrating diverse datasets into the Qlik Sense platform to enable comprehensive analysis and visualization.

Steps include:

- Go to Qlik Sense -> Click on Add new -> Choose New Analytics App
- Fill in the Name of the App -> Click Create
- Open the App -> Add your Data Files to the space in the Data Manager
- The dataset is now added to your workspace.

4. Data Preparation

4.1 Prepare data for Visualization

The process typically begins with data preparation, where datasets are cleaned, transformed, and structured to ensure compatibility with Qlik Sense. This may involve tasks such as data normalization, joining tables, and resolving data quality issues to create a unified dataset ready for analysis.

In order to achieve the above, we can use the Data Load Editor, where we can add chunks of code to clean, transform and structure our data. Another way is to edit the table in Data Manager by editing the table. We can rename the columns, split the values in the table by the delimiter to create new columns, remove null values, etc.

Once the data is cleaned, click on 'Load Data' to load the data into the Sheet where it can be utilised to create visualisations and identify trends and patterns in the data.

5. Data Visualization

5.1 Visualizations

Data visualization is the graphical representation of data and information using visual elements such as charts, graphs, and maps. In Qlik Sense, data visualizations are created using the drag-and-drop interface of the app's built-in Data Visualization module.

List of Visualisations created for this project:

Sr. No.	Visualisation	Screenshot	
1.	KPI - Total Passenger Count	Total Passengers No. of Passengers 97.74k	

2.	KPI - Average Age of Passengers	<p>Average Age</p> <p style="text-align: center;">Average Age</p> <p style="text-align: center;">45.51</p>																					
3.	Pie Chart - Proportion of Female to Male Passengers	<p>Proportion of Female to Male Passengers</p> <table border="1"> <thead> <tr> <th>Gender</th> <th>Proportion</th> </tr> </thead> <tbody> <tr> <td>Female</td> <td>49.7%</td> </tr> <tr> <td>Male</td> <td>50.3%</td> </tr> </tbody> </table>	Gender	Proportion	Female	49.7%	Male	50.3%															
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Table 1. List of Visualisations

- [Click Here to Access the Complete Visualisation Sheet](#)

6. Dashboard

6.1 Responsive and Design of Dashboard

Dashboards in Qlik Sense are dynamic and interactive displays of data visualizations, providing users with a comprehensive view of their data and enabling them to explore insights, trends, and patterns quickly and intuitively.

Using Qlik's advanced options, I created three dashboards utilizing the filters to dynamically represent the data through the visualisations. Below are the screenshots of the dashboards created:

Sr. No.	Dashboard Description	Screenshot
1.	<p>KPI, Pie and Donut Chart dashboard displays four charts giving an insight into the Total Passengers, Ratio of Female and Male Passengers and their respective ages in each flight status category. The use of filters in the Gender and Flight Status columns can dynamically change the values. (Link)</p>	
2.	<p>This dashboard shows the distribution of Passengers based on various attributes: Nationality, Country, Departure Date and Month, Age. The use of filters in the Gender and Flight Status columns can dynamically change the values. (Link)</p>	

3. The following dashboard represents the distribution of airports around the world and distributes flights according to their status: Cancelled, On-time or Delayed. The use of filters in the Flight Status column can dynamically change the values. ([Link](#))

The dashboard includes a sidebar with fields like 'Age', 'Gender', 'Flight Status' (Cancelled, Delayed, On Time), and 'Passenger'. It features a map of continents with flight routes, a bar chart of passengers by country, and a table of flight details.

Table 2. List of Dashboards

7. Story

7.1 Story Creation

Data storytelling features in Qlik Sense enable us to create narrative-driven presentations that guide viewers through the data and highlight key insights or findings. We can add text, images, and annotations to enhance the storytelling experience.

To highlight the key findings of my project, I made a data story with three slides giving appropriate insights into the Airline Analysis which could be utilised to achieve the three goals mentioned before. To watch the narration of the story, click the following link: [Link](#)

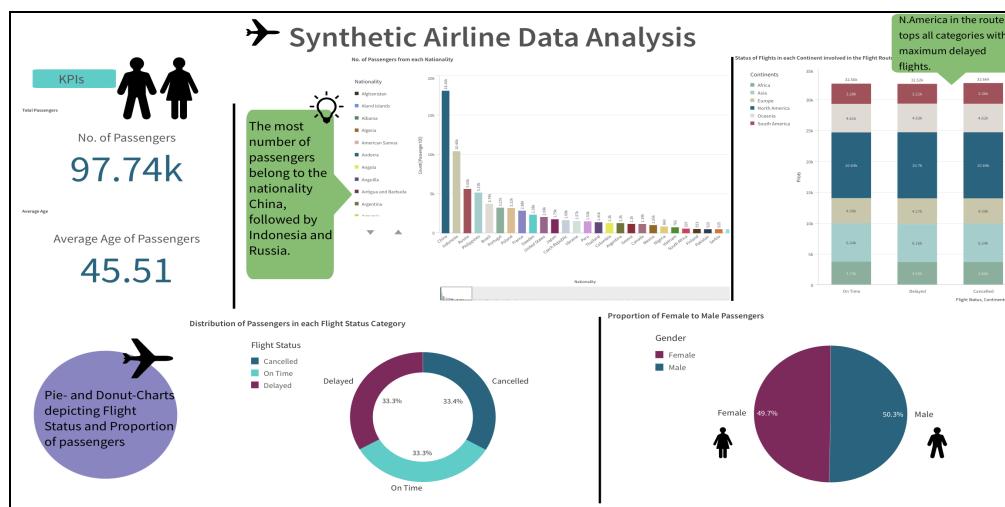


Figure 1. Story Slide 1



Figure 2. Story Slide 2

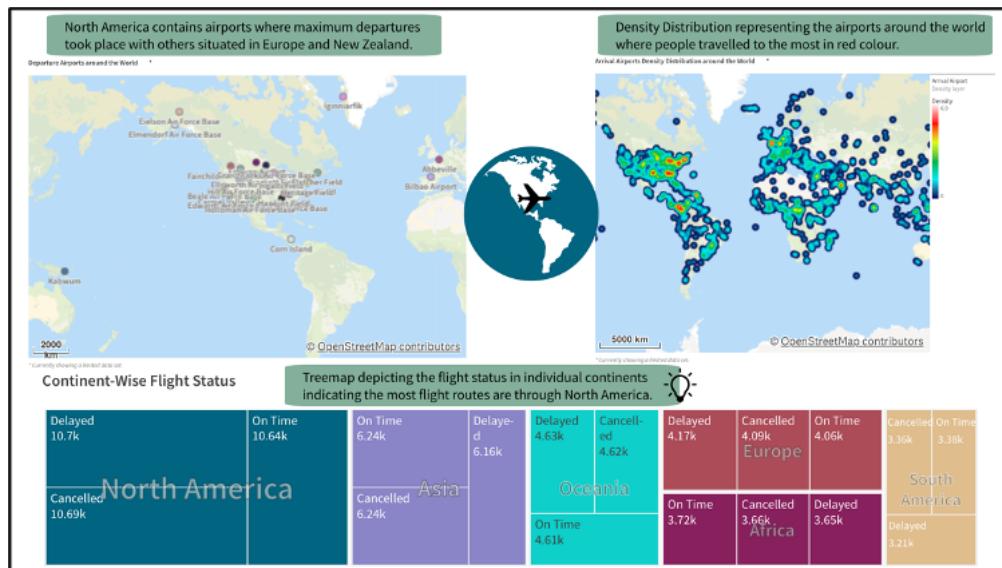


Figure 3. Story Slide 3

The story highlights the visualisations and a differing characteristic of each with the help of annotations and symbols. It demonstrates the distribution of passengers, the country with the maximum number of passengers departing and arriving, the month that observed maximum departures and many more.

8. Performance Testing

Performance testing in Qlik Sense involves evaluating the responsiveness, efficiency, and scalability of dashboards and visualizations when handling large datasets and complex interactions. This ensures that the application performs optimally under various conditions and provides a smooth user experience.

8.1 Amount of Data rendered

The objective is to assess how well Qlik Sense handles and renders large volumes of data without compromising performance. We need to identify the different datasets and their sizes to be used for testing. For this, we need to import datasets of varying sizes into Qlik Sense and ensure that they reflect real-world scenarios with variety of data types and structures.

For the Airline Dataset, the datasets imported include: 'Airline Dataset.csv' and 'Airline Dataset Updated - v2.csv'.

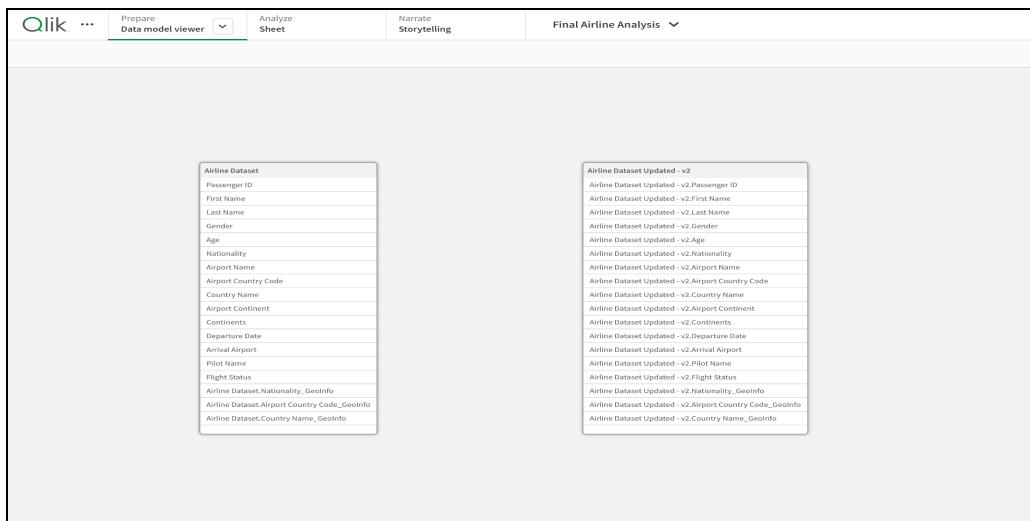


Figure 4. Amount of Data loaded into Qlik

8.2 Utilization of Data Filters

The objective is to evaluate the effectiveness and performance impact of applying data filters in Qlik Sense dashboards. We can create dashboards using multiple visualisations and then apply filters to specific columns to simulate typical user interactions. Using a combination of filters, we can analyse the performance impact as well.

For our project, I used filters for the Gender and Flight Status columns to get the particular values.

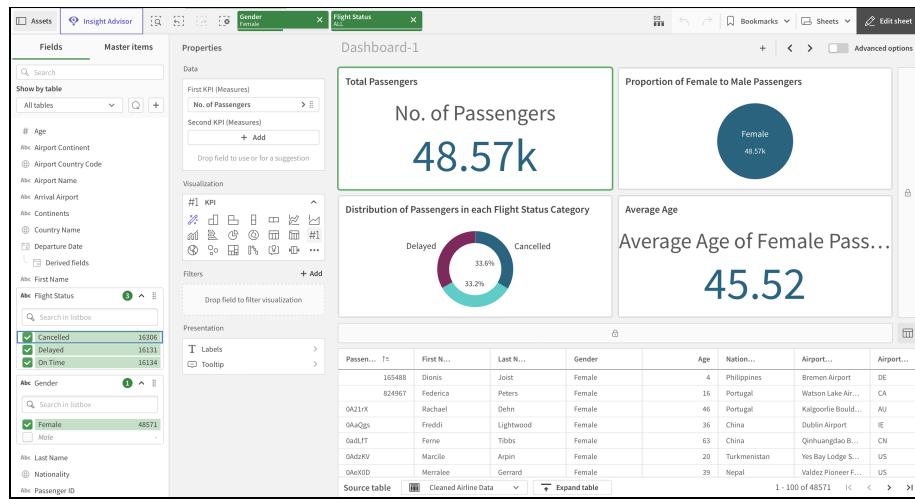


Figure 5. The dashboard specifically shows the females in each flight status category.

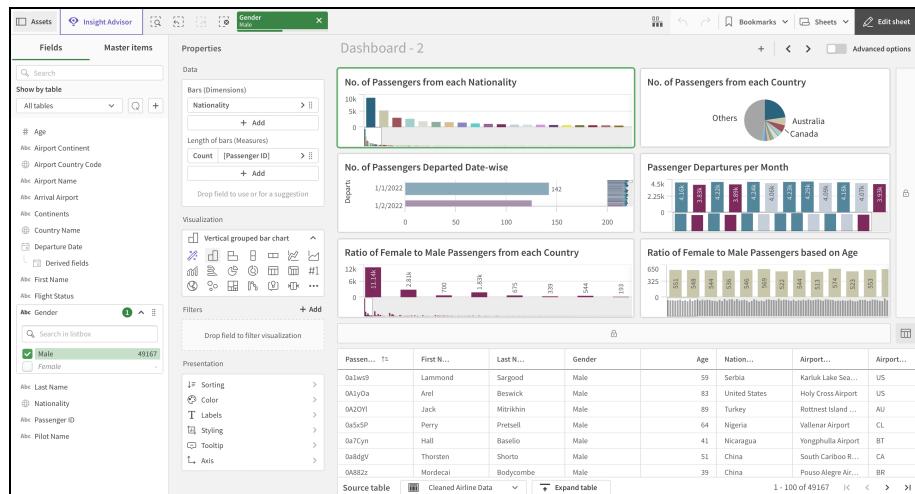


Figure 6. The dashboard specifically shows the proportion of males in each visualisation.