Project Report

Unlocking Insights into global Air Transportation using Tableau

Mopuru Vinay Reddy , Maharaja Vannia Moorthi.

Redderi mohith reddy, Usha Sree Peketi

Unlocking Insights into The Global Air Transportation Network with Tableau

1. Introduction

1.1 Overview of the project

The global air transportation network is a complex system with numerous interconnected routes, airlines, airports, and passenger flows. Unlocking insights into this network is crucial for understanding travel patterns, optimizing operations, and making informed decisions in the aviation industry. Tableau, a powerful data visualization and analytics platform, provides a valuable tool for exploring and analysing data related to the global air transportation network.

1.2 Purpose of the project

By leveraging Tableau, analysts and industry professionals can gather and analyse a wide range of data points, including flight routes, airline performance, passenger volumes, aircraft types, and airport operations. This data-driven approach allows for a comprehensive understanding of the global air transportation landscape and the factors that influence it.

Tableau's visual analytics capabilities enable users to create interactive dashboards, maps, and charts that provide a clear and intuitive representation of the air transportation network. This visualization not only helps in identifying trends and patterns but also enables the exploration of complex relationships and the detection of outliers or anomalies.

2. Literature Survey

This literature survey aims to provide a comprehensive analysis of the Global air transportation exploring the factors that influence compensation in the field of Aviation. The Air transportation has witnessed significant growth and transformation in recent years, making it crucial to understand the dynamics of routes, airports, airlines and equipment used. This survey will review relevant studies, reports, and articles to explore various factors such as routes, airplanes and active airlines which impact the sector.

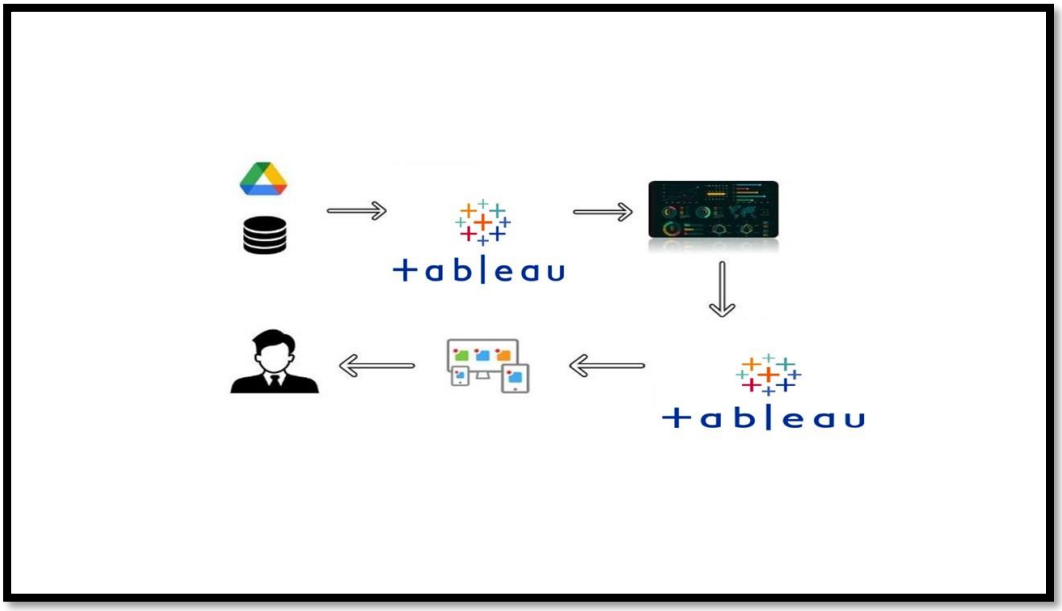
By analysing existing literature, this survey will contribute to an enhanced understanding of Aviation sector organizations, and policymakers in making informed decisions.

Existing problems and solutions

- Increased connectedness
- Trade and commerce boost economic development and job creation
- Tourism and Travel
- Air travel causes greenhouse gas emissions, noise pollution, and land utilisation
- Accessibility and Inequality
- Public Health and Safety
- Technological Advancements: Aircraft design, artificial intelligence, and automation may affect the global air transportation network.
- GDP growth, currency rates, and fuel costs might affect air travel demand. Airline passenger counts may drop during economic downturns due to lower travel costs.
- Technology may benefit or hurt the aviation sector. Open skies agreements and new safety standards
- competitiveness, route allocations, and industry costs

3. THEORITICAL ANALYSIS

3.1 Block Diagram



3.2 Hardware/software requirements

- **Tableau Desktop**
- **Flask**
- **Web integration using Html, css**

4. Research Investigation:

To unlock insights into global air transport visualization in Tableau by leveraging available data sources, with the aim of understanding patterns, trends, and key factors influencing the industry.

Specifically, the research objectives include:

1. Data Collection and Preparation: Gather relevant data on global air transport, including flight routes, passenger volumes, cargo volumes, aircraft types, and other related variables. Ensure the data is accurate, comprehensive, and covers a significant time period.

2. Visualization Design: Develop an effective visualization framework in Tableau that enables the representation of global air transport data in an intuitive and interactive manner. Consider various visual elements, such as maps, charts, graphs, and animations, to effectively convey information.

3. Identify Key Patterns and Trends: Analyze the visualized data to identify significant patterns and trends within the global air transport industry. Explore factors such as passenger demand, flight frequencies, popular routes, seasonal variations, and emerging markets.

4. Geographical Analysis: Utilize Tableau's geographic capabilities to examine the spatial distribution of air transport activity, highlighting hotspots, connectivity between regions, and potential areas for growth or improvement.

5. Comparative Analysis: Conduct comparative analysis between different airlines, regions, and time periods to uncover insights regarding market share, operational efficiency, growth rates, and potential areas for competitive advantage.

6. Factors Influencing Air Transport: Investigate various factors that influence global air transport, such as economic indicators, geopolitical events, regulatory changes, and technological advancements. Explore their impact on air travel patterns and identify potential correlations.

By achieving these research objectives, we aim to unlock valuable insights into global air transport, enabling a deeper understanding of the industry and informing evidence-based decision making.

Data Collection & Extraction from Database:

- Dataset was collected through google drive link provided by the
- Dataset has 4 sub data sets i.e.airport.csv, routes.csv, airlines.csv, airplanes.csv
- Then dataset was exported to MySQL Database

Data Visualizations

- What is the distribution of active and inactive airlines in the world?

  Active and count of airlines.csv. Color shows details about Active. Size shows count of airlines.csv. The marks are labeled by Active and count of airlines.csv. The view is filtered on Active, which keeps N and Y.
  Video link:
  https://drive.google.com/file/d/1ljnKIlEgvBmr8NF7xGPljidmXy9FS_b5/view?usp=sharing
- Which country has the most no of inactive airlines?
  Active, Country and count of airlines.csv. Color shows count of airlines.csv. Size shows count of airlines.csv. The marks are labeled by Active, Country and count of airlines.csv. The view is filtered on Active, which keeps Y.
  Video link:
  https://drive.google.com/file/d/16HQipXKGOu1rG5ckJgHqJhTvZYJdJeP3/view?usp=sharing

- How is IATA code distributed across each country?
  Count of airlines.csv for each Country. Color shows details about IATA. The data is filtered on Active, which keeps Y. The view is filtered on IATA, which excludes Null.
  Video link:
  https://drive.google.com/file/d/1BM-hOqDYjSefwDOBQAlDc8oaHkrTABe0/view?usp=sharing

- Show the airline distribution of each country?
  Map based on Longitude (generated) and Latitude (generated). Color shows count of airlines.csv. The marks are labeled by count of airlines.csv and Country. Details are shown for Country.
  Video link:
  https://drive.google.com/file/d/1C5RU0NWEkaEQVy9L5fA7XySPwN0IhMRv/view?usp=sharing

- List of airlines that are most operating with the most equipment?
  Airline (color) broken down by Airline vs. Equipment. The view is filtered on Equipment and Airline. The Equipment filter keeps 20 of 1,144 members. The Airline filter keeps 20 of 106 members.
  Video Link:
  https://drive.google.com/file/d/1Hz1a4QPfCiE53nf1GmEn6f-pF3GsJ7zp/view?usp=sharing

- List of airlines that are sharing the aircraft on codeshare bases?
  Airline and Codeshare. Color shows details about Airline. Size shows count of routes. The marks are labeled by Airline and Codeshare. The view is filtered on Codeshare and Airline. The Codeshare filter keeps Y. The Airline filter keeps 20 of 106 members.
  Video Link:

https://drive.google.com/file/d/1RcxfM4USufuqP4P6C95xkTlg3gBlyGpp/view?usp=sharing

- Airlines between two destinations are predicted using indicators.
  Airline broken down by Destination airport vs. Source airport. Color shows details about Airline. The marks are labeled by Airline. The view is filtered on Destination airport, Source airport and Airline. The Destination airport filter keeps 10 of 1,683 members. The Source airport filter keeps 10 of 1,679 members. The Airline filter keeps 10 of 106 members.
  Video Link:
  https://drive.google.com/file/d/18WiDAt0XWD1FwO4SOqHbUvKueuTy8X5u/view?usp=sharing

- Airlines with most services available in data
  Count of routes, Source airport ID and Destination airport ID for each Airline. Color shows details about Airline. Details are shown for Airline and Source airport. The view is filtered on Airline, which keeps 15 of 106 members.
  Video Link:
  https://drive.google.com/file/d/1E4c5hQjXARivgEo13kxGpRpd_1yoMuf2/view?usp=sharing

- Total number of airports present in each country?
  Count of airports.csv for each Country.
  https://drive.google.com/file/d/1Sqvl8tPy9QAEdHLJXRR8AmaiR8QlcGGQ/view?usp=sharing

- what are the Time zones of airports present in each country?
  Map based on Longitude (generated) and Latitude (generated). Color shows sum of Timez one. The marks are labeled by Country and sum of Timezone.
  https://drive.google.com/file/d/1k4WTqsE1J_-GMkBU9Nr5ONlwKFRhlKOd/view?usp=sharing

- Show the airports visualization of each country and each city?
  Map based on Longitude (generated) and Latitude (generated). Color shows details about Country. The marks are labeled by Country. Details are shown for Country.
  https://drive.google.com/file/d/1DltPXu6yVV_C1NRtgqoTx9igtIj7Xn2H/view?usp=sharing

- Explain distribution of airports across different time zones?
  Tz database time zone. Color shows details about Tz database time zone. Size shows count of airports.csv. The marks are labeled by Tz database time zone. The view is filtered on Tz database time zone, which excludes \N.
  https://drive.google.com/file/d/1c7y0mTVL_NTj-a6RkT0Pg6rW3BkB9RFZ/view?usp=sharing

- Describe the Altitude of airports in each city?
  Sum of Altitude for each City. The view is filtered on City, which excludes Null.
  https://drive.google.com/file/d/1WPucdbvzMH8ebyDeRgv1tdzXsxdBJO7t/view?usp=sharing

- Which Airplane has the highest Index?
  Among all the Airplanes given Yakovlev Yak-42 has the highest Index leading all the other planes.
  https://drive.google.com/file/d/1XBPQXnf__3O-35wkFNXe3mC4X2JCmnVQ/view?usp=drive_link

- Describe count of Airplanes according to IATA?
  The number of airplanes can fluctuate due to various factors such as airline fleet expansions, retirements, and market conditions.
  https://drive.google.com/file/d/11xVSIAO-CLpgdHJVOaj2YRsu9jlTbH_9/view?usp=drive_link

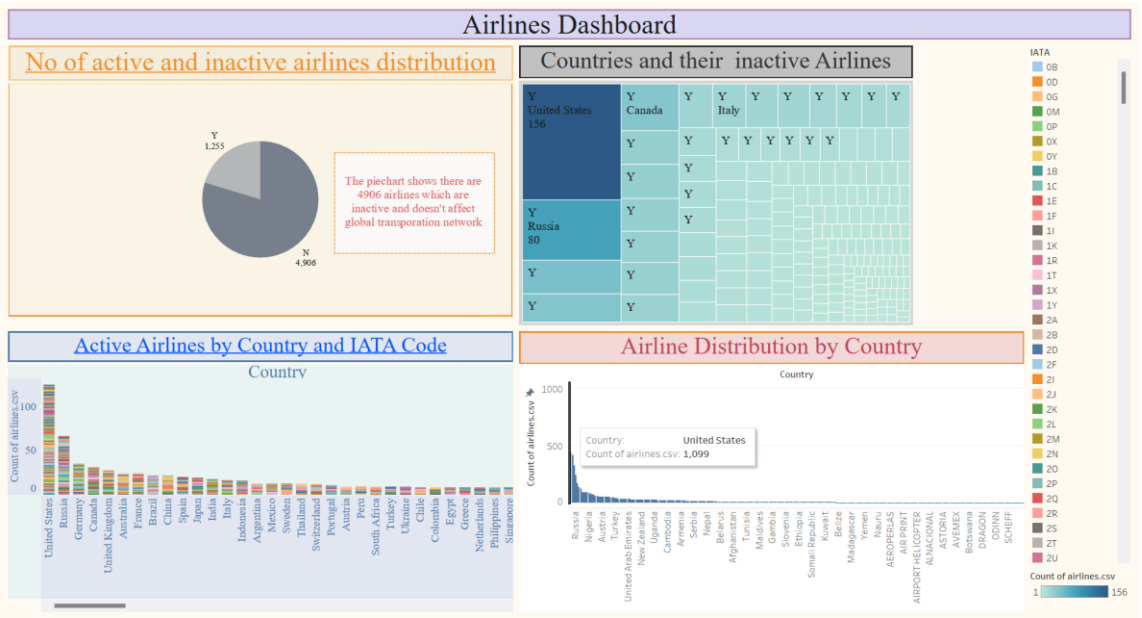
- Describe the Airplane Index according to IACO.
  These codes are primarily used for aviation regulatory and operational purposes, facilitating communication and standardization across the global aviation industry.
  https://drive.google.com/file/d/1vJ5t6PF04Gx2by2G1ye7LFA4GyWX3osf/view?usp=sharing

- Describe the Airplane Index according to IATA.
  The IATA codes are widely recognized and used within the industry, there may be additional codes used by specific airlines or operators for internal purposes.
  https://drive.google.com/file/d/1whVGx3h3XeAijiEGwy_6bGNymQyqdHoW/view?usp=sharing

Dashboard

Welcome to our Dashboard Section, where we invite you to explore our comprehensive visualizations featuring four distinct dashboards: Airports, Airlines, Routes, and Airplanes. Immerse yourself in rich data insights as we take you on a journey through the world of aviation, providing a holistic view of the industry's key components, performance metrics, and interconnections.

Airlines Dashboard



Video link:

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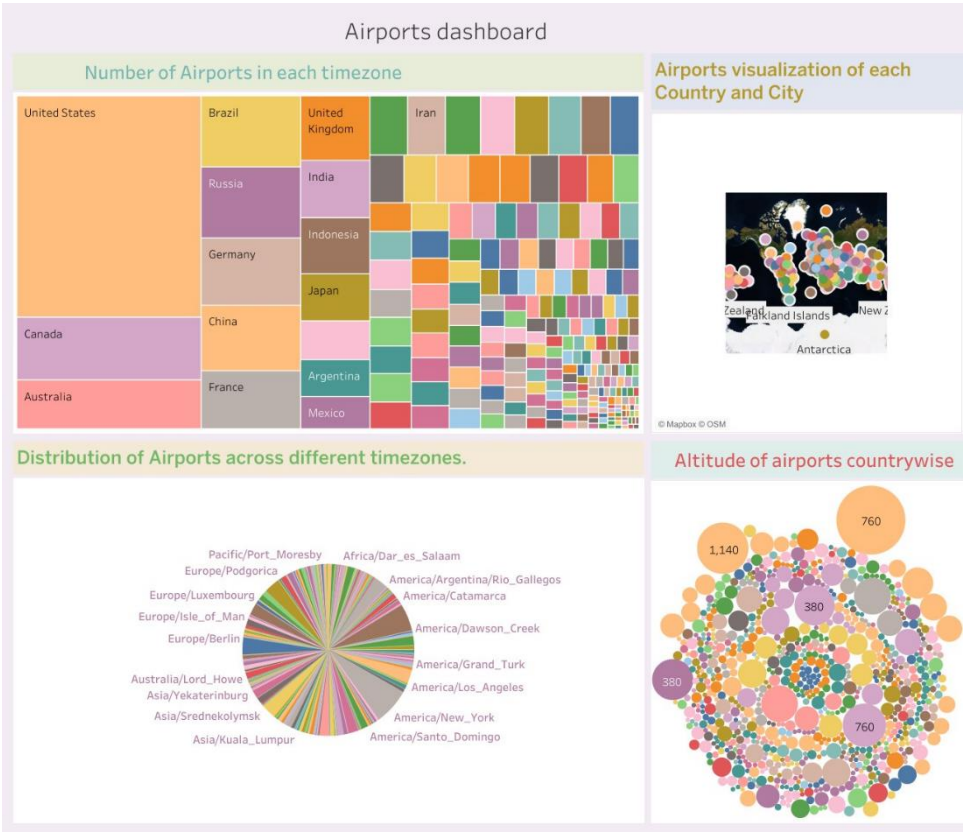
Airports Dashboard



Video link:

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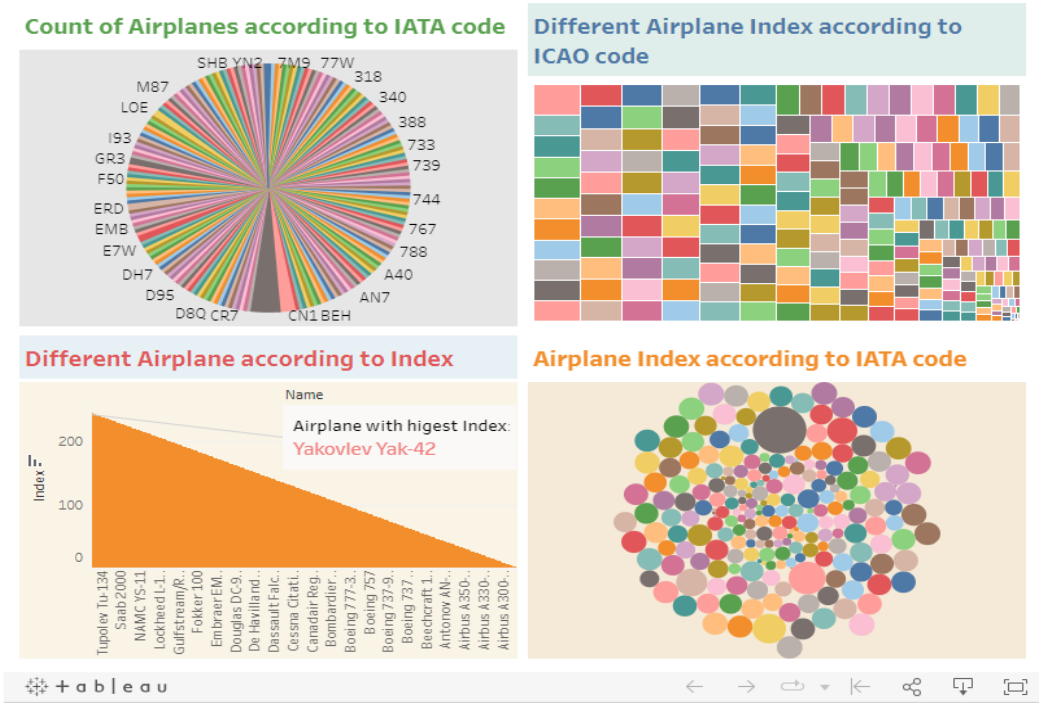
Airplanes Dashboard



Video link:

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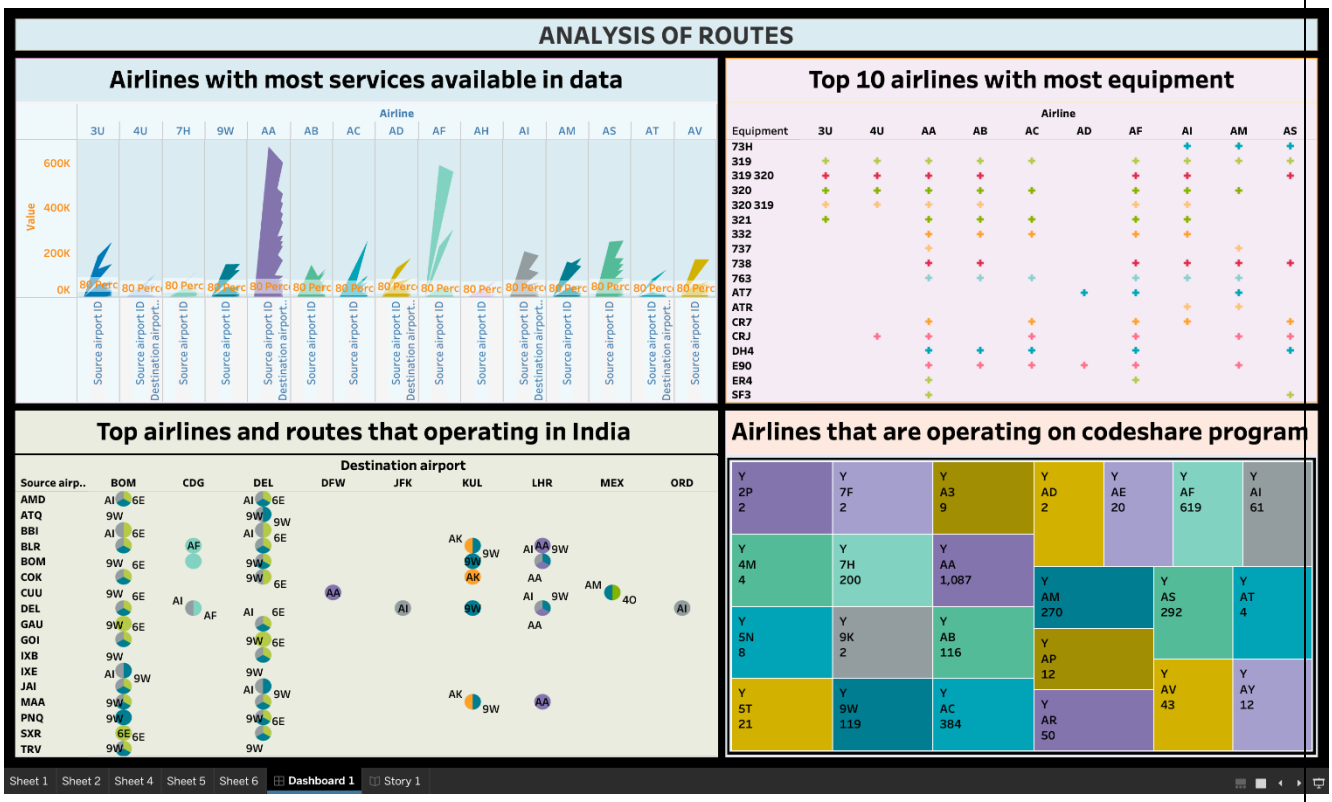
ROUTES DASHBOARD:



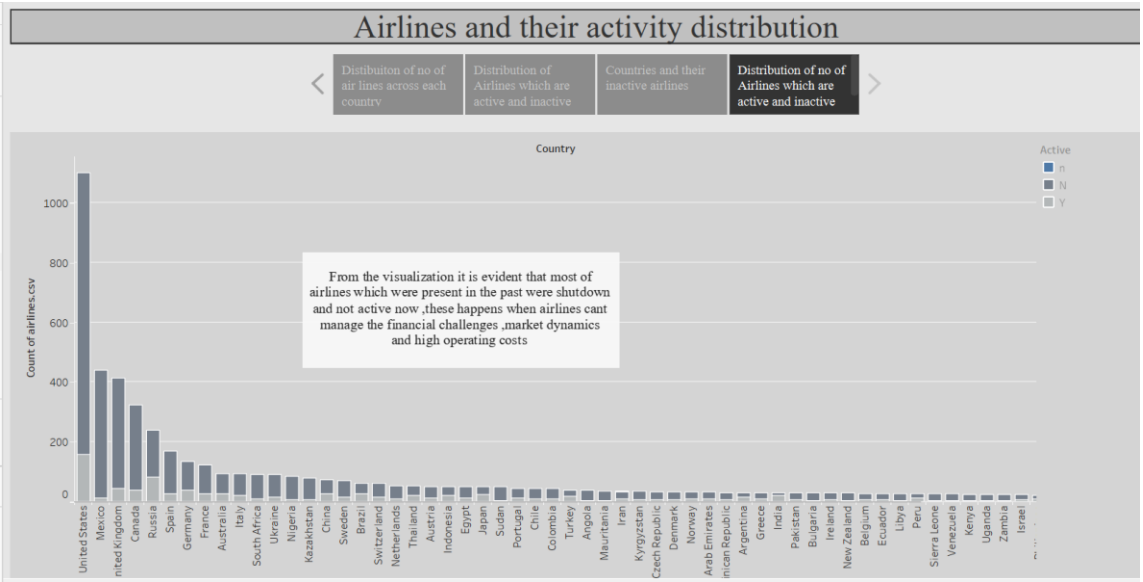
Video Link:

https://drive.google.com/file/d/1siRT5gG9q5VRDChWzj4Ze1KfZIRJg7op/view?usp=sharing

Stories:

Welcome to our Tableau Stories, a captivating collection that unfolds the narratives of the aviation world. Delve into our immersive visualizations featuring four compelling story dashboards: Airports, Airlines, Routes, and Airplanes. Each dashboard unveils a unique tale, intertwining data and visuals to provide a deeper understanding of the industry's intricacies, trends, and remarkable journeys. Embark on this visual voyage as we bring the stories of aviation to life, one captivating dashboard at a time.

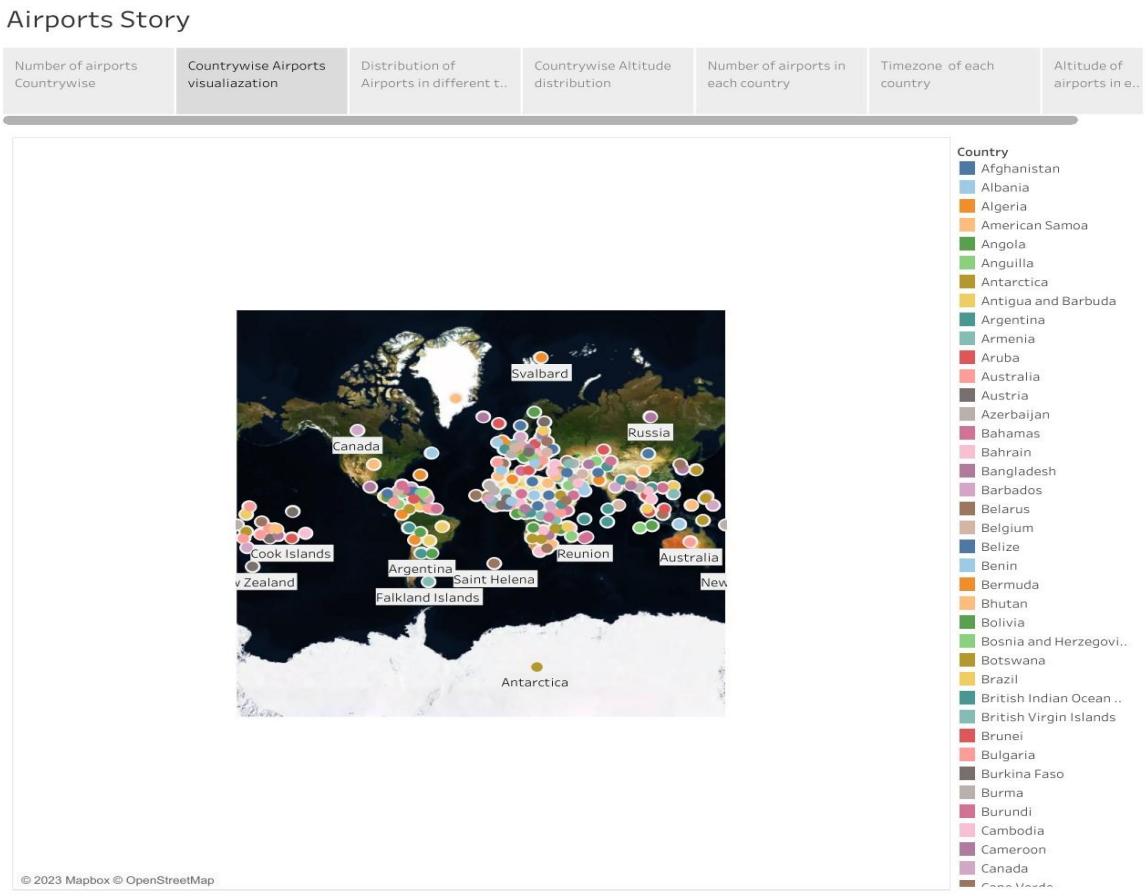
Airlines story:



Video link:

https://drive.google.com/file/d/1TMHewnL-VZAgDS6iyn7hkdhsDettTJuv/view?usp=sharing

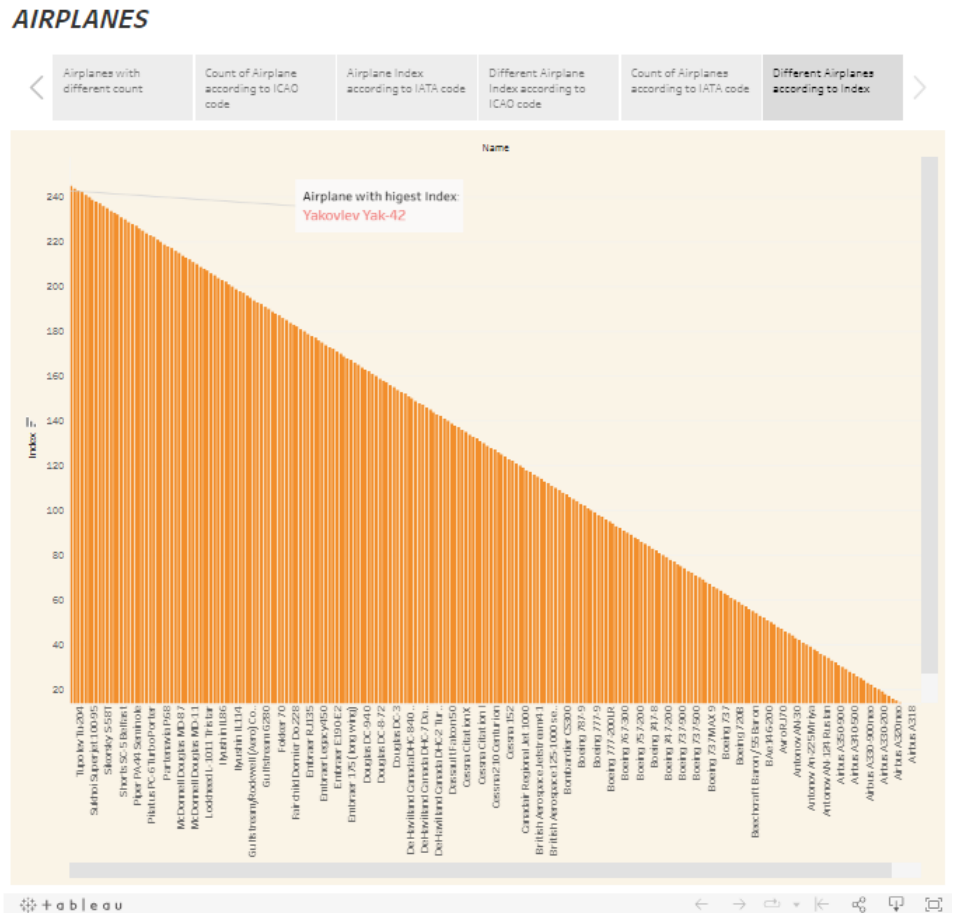
Airports story:



Video link:

https://drive.google.com/file/d/1frbYTwAl8c1B-0UeOgg0xwIMYwk2OJ88/view?usp=sharing

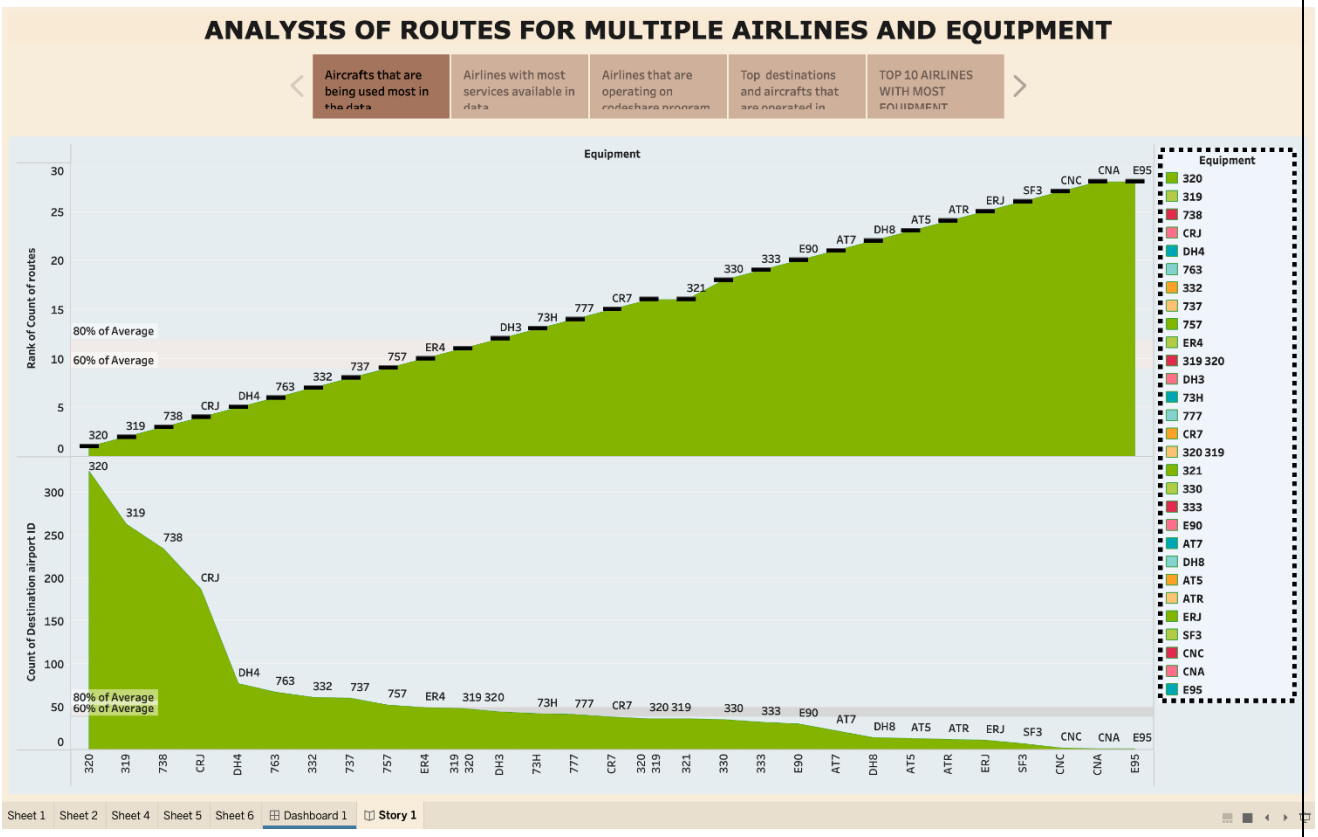
Airplanes story:



Video link:

https://drive.google.com/file/d/1Dmf0C71QnC0Sme5Xmk6ah_TnLaZwT1af/view?usp=sharing

ROUTES STORY:



Video Link:

https://drive.google.com/file/d/1siRT5gG9q5VRDChWzj4Ze1KfZIRJg7op/view?usp=sharing

Web Integration

The following steps were completed for web integration.

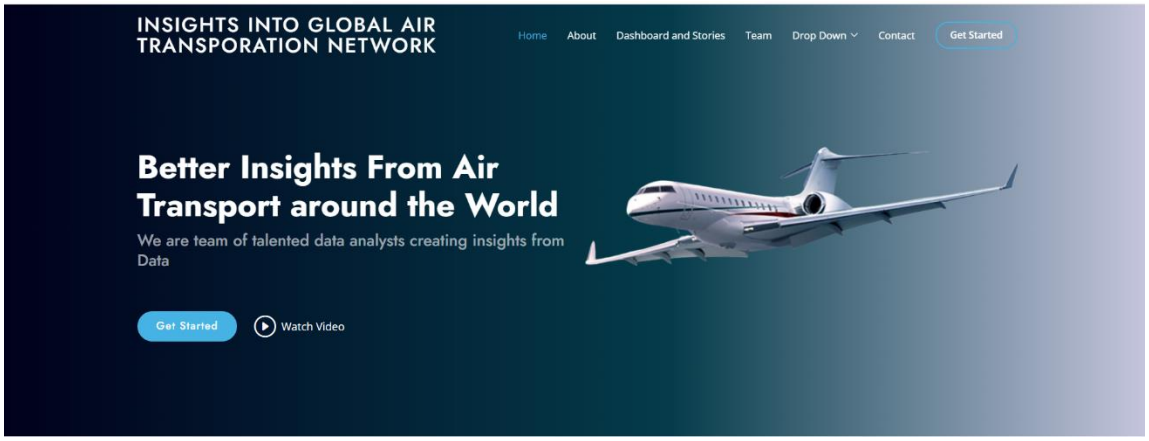
1. Integrating with Tableau Public
2. Integrating with bootstrap website
3. Implementing Flask

Video link:

https://drive.google.com/file/d/1UmyEYOuifHwfOs3Ql22-8ZJ5yy016u7R/view?usp=drive_link

https://drive.google.com/file/d/1sb8lzGVGzqy6ujuMBlNAGReV1FVVtMjy/view?usp=drive_link

First page of the website:



5. Result

The results of unlocking insights into the global air transportation network with Tableau can vary based on the specific research objectives and analyses conducted.

1. From the airlines story it is evident that most of airlines which were present in the past were shutdown and not active now ,these happens when airlines cant manage the financial challenges ,market dynamics and high operating costs
2. From the airports story we have seen that mostly the developed countries like us,uk are having maximum number of airports compared to other countries this is due to Infrastructure and Capacity, Security and Safety, Technological Advancements and Regulatory Compliance
3. With the routes story and dashboard we can see the trends in Usage of equipment by different companies and also codeshare can be detected, airports with most airlines operation can be found
4. From the Airplanes story it is noticeable that most of the planes are in United States than any other country given. And also there are no planes with different count, where all are similar in number.

1. Advantages

- Powerful Data Visualization: Tableau offers a wide range of visualization options, enabling the creation of interactive and visually appealing dashboards. This helps in effectively conveying complex information and insights to stakeholders.
- Ease of Use: Tableau has a user-friendly interface that makes it accessible to users with varying levels of technical expertise. It provides a drag-and-drop functionality, allowing users to quickly create visualizations without extensive programming knowledge.
- Data Exploration and Analysis: Tableau's data exploration capabilities enable users to dig deeper into the data, identify patterns, correlations, and trends. It offers various analytical features and functions that facilitate in-depth analysis of the global air transportation network.
- Real-time Updates: Tableau can connect to live data sources, allowing for real-time updates and analysis. This is particularly useful for monitoring flight data,

weather conditions, and other dynamic factors that impact the air transportation network.

- Interactivity and Collaboration: Tableau's interactive features enable users to interact with visualizations, drill down into specific data points, and explore different dimensions. It also supports collaboration by allowing users to share dashboards, reports, and insights with stakeholders

Disadvantages

- Data Size and Performance: Large datasets with millions of records may slow down Tableau's performance or require additional hardware resources. Processing and visualizing such massive data can be challenging without proper optimization.
- Data Integration: Integrating multiple data sources and formats in Tableau may require additional preprocessing and cleansing. Handling data inconsistencies or merging data from different sources can be time-consuming.

- Steep Learning Curve for Advanced Features: While Tableau offers user-friendly features, mastering advanced functionalities and calculations may require a learning curve. Complex analyses or customizations might require more technical expertise.
- Licensing Costs: Tableau is a commercial software, and depending on the edition and deployment model chosen, it may involve licensing costs. Small-scale or budget-constrained projects may find it challenging to allocate resources for Tableau licenses.
- Data Security and Privacy: When dealing with sensitive data, ensuring data security and privacy becomes crucial. Organizations need to implement appropriate measures to protect data within Tableau and adhere to relevant regulations and policies

2. APPLICATIONS

- Airline Operations Optimization: Insights gained from Tableau can help optimize flight scheduling, route planning, crew management, and resource allocation, leading to increased efficiency and cost savings.
- Airport Planning and Management: Tableau can aid in analyzing airport data, including passenger traffic, runway utilization, and terminal capacity.
- Network Planning and Expansion: Analyzing flight patterns, connectivity, and passenger demographics using Tableau can assist in network planning and expansion strategies. Airlines and airport authorities can identify potential new routes, target specific markets, and make informed decisions about route optimization and fleet allocation.

- Customer Experience and Engagement: By analyzing customer feedback, satisfaction ratings, and demographic data, Tableau can help airlines and airports understand customer preferences, identify pain points, and improve the overall customer experience. Insights can inform targeted marketing campaigns, personalized services, and loyalty programs.
- Revenue Management: Tableau's data visualization capabilities enable revenue analysts to identify demand patterns, pricing trends, and passenger behavior. These insights can assist in optimizing pricing strategies, revenue forecasting, and seat inventory management for airlines.
- Regulatory Compliance and Safety: Tableau can be utilized to monitor compliance with aviation regulations and safety standards. By analyzing data related to air traffic control, flight operations, and safety incidents, stakeholders can identify areas for improvement and ensure adherence to regulatory requirements.
- Market Analysis and Competitive Intelligence: Tableau can support market analysis by providing insights into market share, competitive landscape, and industry trends. Airlines, airports, and travel agencies can leverage these insights for market positioning, competitive benchmarking, and strategic decision-making.
- Research and Policy Development: Researchers, policymakers, and industry analysts can utilize Tableau to unlock insights into the global air transportation network.

3. Conclusion

- In conclusion, Tableau unlocks insights into the worldwide air transportation network, providing aviation sector advantages and prospects. Stakeholders may better comprehend the air transportation network's complex dynamics with Tableau's data visualisation and analysis.
- Interactive visualisations in Tableau let users discover patterns, trends, and connections in large datasets. Airlines, airports, and industry experts may use this data to optimise operations.
- Aviation uses Tableau extensively. It optimises airline operations, airport management, network growth, customer experience, revenue management, regulatory compliance, market analysis, and research.
- Stakeholders may use Tableau to analyse flight, airline performance, passenger demographics, weather, and air traffic control data. These insights improve efficiency, safety, resource allocation, and growth potential.
- Tableau has performance issues with huge datasets and a learning curve for sophisticated features. When using Tableau for global air transportation network insights, organisations should carefully analyse their requirements, resources, and aspirations.
- Tableau helps stakeholders turn complicated data into useful insights for strategic planning and decision-making. It unlocks data in the aviation sector, improving efficiency, customer happiness, and competitiveness in the dynamic global air transportation network.

4. Future Scope

- Tableau may be used for sophisticated predictive analytics as data collection and processing improve. Stakeholders may predict trends, passenger demand, flight delays, and operational planning using machine learning and predictive modelling.
- Tableau may develop to give real-time monitoring and alerting. Stakeholders may actively analyse important performance metrics, spot abnormalities, and get early information regarding crucial occurrences like extreme weather, security threats, and air transportation network interruptions.
- Improved Collaboration and Data Sharing: Tableau can help aviation stakeholders collaborate better. Cloud-based platforms and secure data sharing allow many organisations to interact and share information, improving air transportation network decision-making.
- Environmental effect Visualisation: As environmental sustainability becomes more important the aviation sector must analyse and reduce its environmental effect. Tableau can visualise and analyse environmental data including carbon emissions, noise pollution, and fuel usage, helping stakeholders monitor and improve their environmental performance.
- Social Media and Customer Feedback: social media and customer feedback reveal passenger preferences, contentment, and emotion. Tableau may be designed to combine and analyze numerous sources, allowing airlines and airports
- Airspace Management Visualization: Congested airspace requires airspace management and optimization. This helps stakeholders detect airspace bottlenecks, optimize aircraft patterns, and increase air traffic control efficiency.

5. BIBILOGRAPHY

- International Civil Aviation Organization (ICAO): The ICAO website provides valuable information on global aviation statistics, reports, and publications that may include insights related to the air transportation network.

- International Air Transport Association (IATA): The IATA website offers industry reports, research papers, and publications covering various aspects of the aviation industry, including network planning, operations, and performance.
- Airline and Airport Management Journals: Journals such as the Journal of Air Transport Management, Transportation Research Part C: Emerging Technologies, and Journal of Airport Management often publish research papers and studies related to air transportation network analysis.
- Tableau Resources and Community: Tableau's official website, blog, and community forums provide a wealth of information, case studies, and best practices on using Tableau for data visualization and analysis in various industries, including aviation.
- Academic Databases: Explore academic databases such as IEEE Xplore, ScienceDirect, or Google Scholar to find scholarly articles and research papers related to data analysis in the aviation industry.