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Data-Visualization

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README

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Phase1 Project
# Aviation Data Analysis

## Overview
This project analyzes aviation accident data to identify trends and patterns that can help improve aviation safety.
The dataset includes records of aviation accidents, detailing factors such as injury severity, weather conditions,
aircraft types, and more..

## Business Understanding

Our company is expanding into the aviation industry, seeking to purchase and operate aircraft for both commercial and
private enterprises. To ensure this venture is both safe and financially sustainable, we need to assess the risks
associated with different aircraft models, operational environments, and structural designs. Specifically, the
objectives of this analysis are to answer these questions:

 1. Which aircraft models have historically demonstrated a lower likelihood of severe accidents or operational
failures, and what design or maintenance factors contribute to their safety record?

 2. Which geographic regions or airports pose higher risks for aircraft operations, and what environmental or
infrastructural factors influence these risks?
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3. What is the optimal number of engines for an aircraft to ensure stable and safe flight operations, considering factors such as fuel efficiency, redundancy, and failure risk?

Stakeholders involved;
Investors
Insurers
Airlines

Methods Used in the Project
Data Preprocessing & Cleaning – Handled missing values, aggregated data, and transformed variables for analysis.

Exploratory Data Analysis (EDA) – Used grouping, sorting, and filtering to identify key trends in accident data.

Data Visualization – Created pie charts, bar charts, and color-mapped graphs using Matplotlib & Seaborn for insights.

Business Intelligence – Identified safest aircraft models, high-risk locations, and optimal engine configurations.

Decision-Making & Recommendations – Translated insights into actionable strategies for aviation safety and efficiency.
Key Business Questions
1. Which Aircraft Models Demonstrate the Highest Safety Standards and Least Risk of Severe Accidents?

2. Which geographic regions or airports pose higher risks for aircraft operations, and what environmental or infrastructural factors influence these risks?

3. What is the Ideal Number of Engines for Maximizing Aircraft Safety and Efficiency?

Data Understaning
This dataset, sourced from Kaggle, contains over 3,000 aviation incident records from 1948 to 1982, mainly focused on U.S.-based incidents with some international cases. It includes the following key information:

(i) Aircraft Information: Model, engine count, type, and manufacturer.

(ii) Accident Details: Type, severity, fatalities, injuries, and location.

(iii) Operational Context: Weather conditions, flight phase, route, and aircraft load.

The dataset provides insights into accident trends, aircraft safety, weather and operational context impacts, and regional risk analysis, helping to identify patterns and correlations that can improve aviation safety.

Source of Data
The dataset, `AviationData.csv`, contains records of aviation accidents, including details such as event dates, locations, injury severity, aircraft models, and weather conditions.

Description of Data
The dataset includes the following key columns:
- `Event.Id`: Unique identifier for each event.
- `Investigation.Type`: Type of investigation (e.g., Accident, Incident).
- `Event.Date`: Date of the accident.
- `Location`: Geographic location of the accident.
- `Injury.Severity`: Severity of injuries (Fatal, Non-Fatal, Incident).
- `Aircraft.damage`: Extent of damage to the aircraft.
- `Make` and `Model`: Manufacturer and model of the aircraft.
- `Weather.Condition`: Weather conditions at the time of the accident.

Visualizations
1. **A subplot of 'aircraft makes and models with a lower likelihood of severe accidents'
2. **A chart of "Locations that poses risks for aircraft operations"
3. ** A chart of "Fatal Accident Rate vs. Engine Count"

Conclusion
From the objectives above i can conclude that:

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 Safer Aircraft Models: Single-engine planes (e.g., Cessna 172, Piper PA-28) are frequently involved in accidents but
with lower fatality rates. Beechcraft models and helicopters also show relatively safer outcomes in certain
conditions.

High-Risk Locations: Mountainous regions (e.g., Alaska, Colorado) and urban areas (e.g., Los Angeles, New York) see
more accidents due to weather, terrain, and traffic complexity. Rural areas also pose risks due to limited
infrastructure.

Optimal Engine Count: Single-engine aircraft are safe in good conditions but riskier in emergencies. Twin-engine
planes offer redundancy but face more severe conditions. Turbojet/turboprop aircraft are highly reliable but have
higher fatality rates in accidents.
### Summary of Findings
1. **Fatal Accidents**: A significant proportion of accidents result in fatalities, with weather conditions like IMC
(Instrument Meteorological Conditions) being a common factor.
2. **Weather Impact**: Accidents are more likely to occur under VMC (Visual Meteorological Conditions), but
fatalities are higher under IMC.
3. **Aircraft Models**: Certain aircraft models, such as the Cessna 172 and Piper PA-28, are frequently involved in
accidents, highlighting potential areas for safety improvements.
# Tableau Link for visualisation of the analysis:
https://public.tableau.com/app/profile/hanifa.chepchirchir/viz/AviationDataAnalysis_17431167089150/Dashboard1
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- **Jupyter Notebook** 100.0%