Impact of Weather on Air Travel: An Analysis

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Introduction

Traveling is an integral part of daily life, with air travel serving as a pivotal mode of transportation for over 30 million people each day. The impact of weather on air transport is a crucial factor that directly influences travel patterns and demand. In this project, we analyze Munich city weather data and air traffic from Munich airport spanning from 2000 to 2023 to discern the correlation between passenger numbers and weather conditions.

Analysis

Data Sources and Transformations

Munich weather data

We extracted and translated weather data from German to English, removing null values and sorting important metrics like air temperature, humidity, precipitation, and sunshine. The dataset was restructured to accurately capture monthly variations.

Munich airport air traffic data

Similar processes were followed for airport data, including extraction, translation, removal of irrelevant columns, and the addition of a passenger count column. Both datasets were then merged on common columns for further analysis.

Data Pipeline and Testing

Data pipeline creation

An automated data pipeline was developed using a Python script, fetching and processing datasets to generate SQLite databases. The pipeline ensures consistent data processing and maintenance, enhancing efficiency.

Testing and validation

The pipeline's reliability was verified through automated tests, including system-level scenarios ensuring the successful execution and output generation. Best practices like version control and data separation were also adhered to.

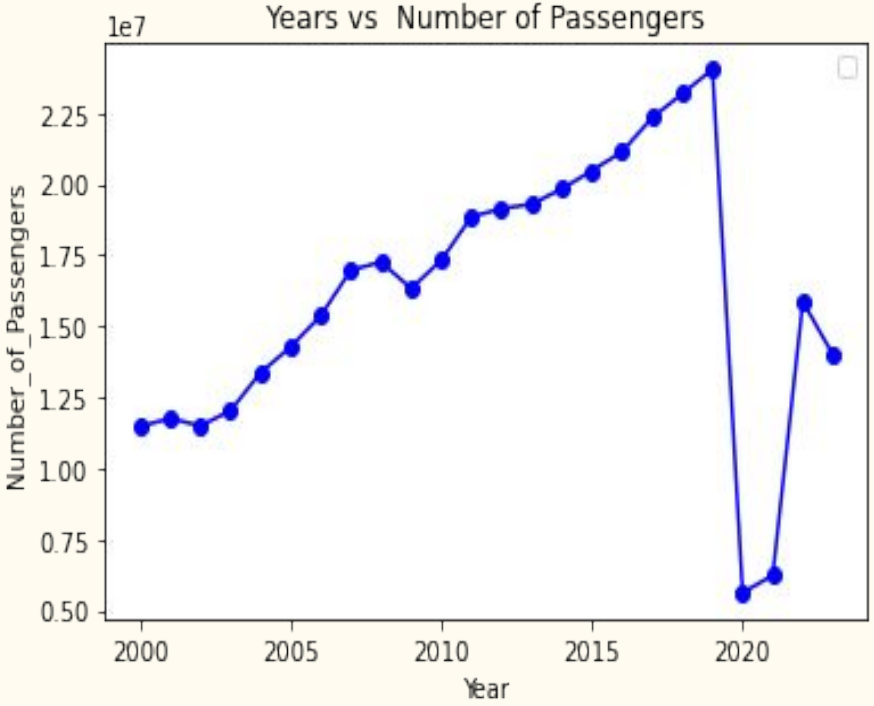
Analysis of Findings

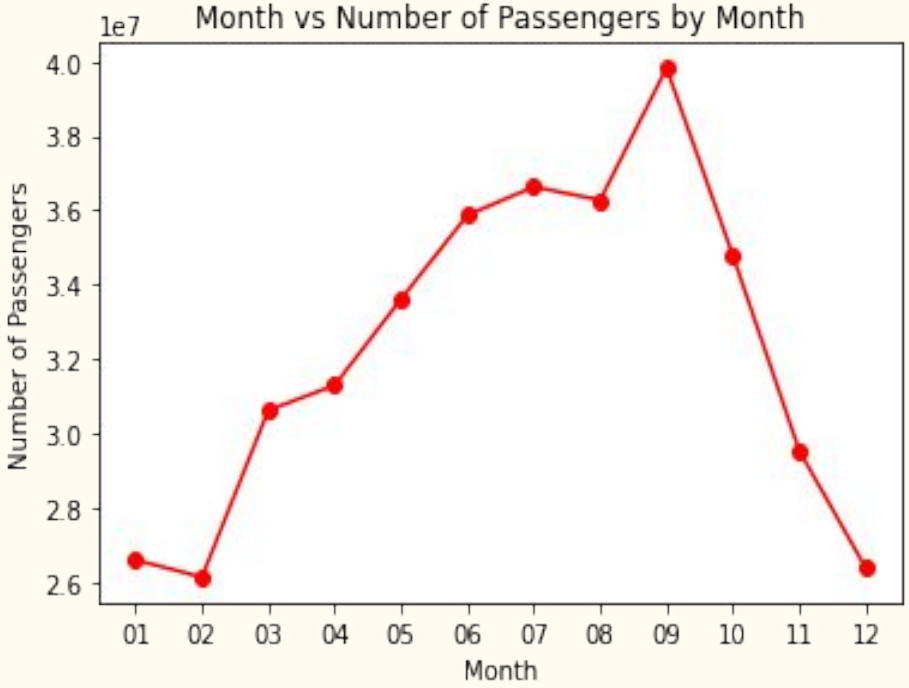
Passenger trends over the years

The analysis revealed a consistent rise in passenger numbers, with a significant decline in 2020 due to the COVID-19 pandemic. However, thereafter, a resilient recovery was evident, especially in 2022 and 2023.

Monthly variation in passenger numbers

The data showcased a peak in travel during September, indicating a steady increase in passenger volume leading up to that month. Conversely, a decline was observed from September to December, reflecting seasonal travel patterns.

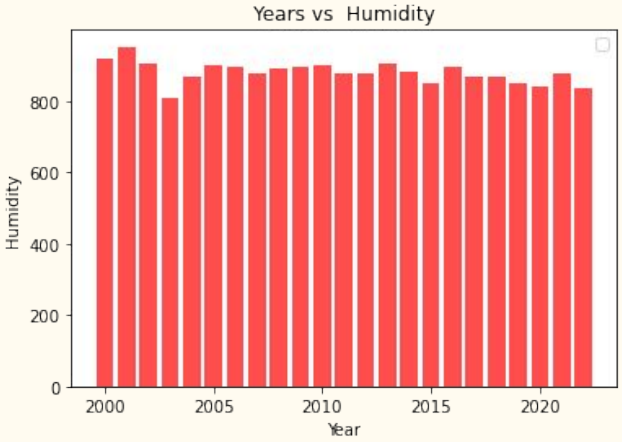

Years vs Number of Passengers
1e7
Number_of_Passengers
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
2000
2005
2010
2015
2020
Year

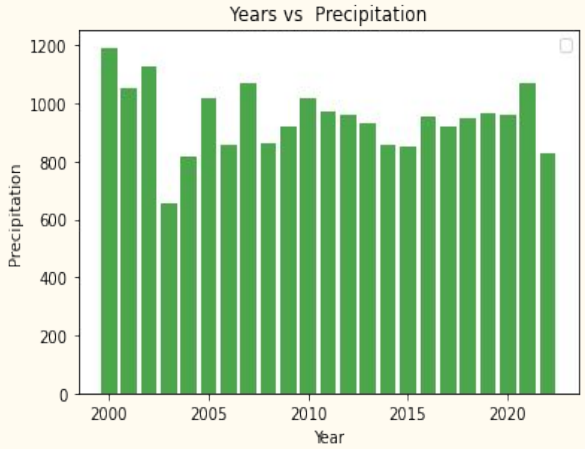

Month vs Number of Passengers by Month
1e7
Number of Passengers
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
01
02
03
04
05
06
07
08
09
10
11
12
Month

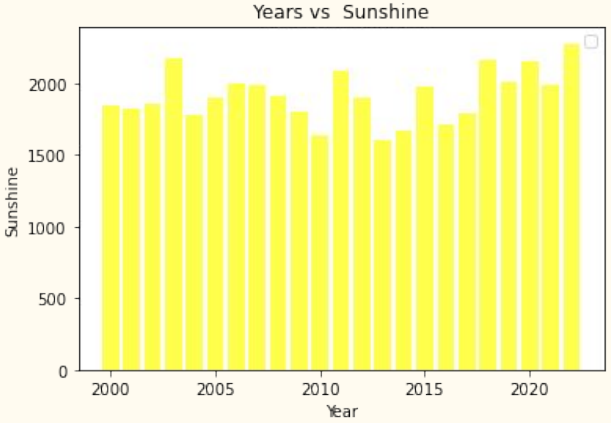
Impact of Weather on Passenger Travel

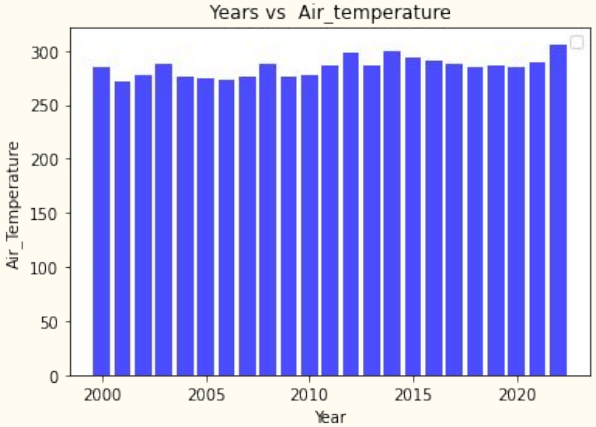
Weather influence on passenger arrivals

The study demonstrated that higher sunlight, humidity, and air temperature were positively associated with increased passenger arrivals at the airport, while increased precipitation had a negative correlation with passenger numbers.


Years vs Humidity
Humidity
Year
0
200
400
600
800
2000
2005
2010
2015
2020


Years vs Precipitation
Precipitation
Year
0
200
400
600
800
1000
1200
2000
2005
2010
2015
2020


Years vs Sunshine
Sunshine
Year
0
500
1000
1500
2000
2000
2005
2010
2015
2020


Years vs Air_temperature
Air_Temperature
Year
0
50
100
150
200
250
300
2000
2005
2010
2015
2020

Conclusion

The comprehensive analysis revealed a strong interplay between weather conditions and passenger travel, with significant impacts observed during the COVID-19 pandemic. The insights gained from weather dynamics and their correlation with travel demand provide valuable guidance for operational and strategic decision-making in the air transportation industry.