Analyzing Global Road Accidents Using Power BI: A Data Science Journey

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Introduction:

As a Data Science student, I am constantly exploring tools that help in data transformation, visualization, and analysis. One of the most powerful tools for this purpose is Power BI, a business intelligence platform that allows me to work with real-world data, uncover trends, and generate actionable insights.

For this project, I was tasked with selecting a public dataset, preparing the data, and conducting an in-depth analysis. I chose Global Road Accidents (2000-2024) as my dataset because road safety is a critical global issue. By leveraging Power BI, I aimed to identify accident hotspots, high-risk weather conditions, and key demographic factorscontributing to accidents. This project serves as a practical case study on how data-driven decision-making can enhance road safety.

Dataset Overview & Source

The dataset for this study was sourced from Kaggle, a popular platform for open datasets. I selected the Global Road Accident dataset, which contains 132K records of accidents across eight countries:
🇨🇳 China | 🇺🇸 USA | 🇬🇧 UK | 🇮🇳 India | 🇩🇪 Germany | 🇧🇷 Brazil | 🇦🇺 Australia | 🇨🇦 Canada

This dataset spans from 2000 to 2024 and includes valuable information such as accident severity, weather conditions, driver demographics, economic loss, and time of occurrence.

Why I Chose This Dataset?
I selected this dataset because road safety is a global concern, and analyzing trends can provide actionable insights to help reduce accident rates. Additionally, the dataset offers diverse attributes, making it an excellent candidate for data transformation and visualization in Power BI.

Data Structure & Transformation

Flat Table Structure
For simplicity, I structured the dataset as a flat table since no complex relationships were required. All attributes (weather, driver details, economic impact, etc.) were contained within a single table, making aggregation and filtering more straightforward.

Data Cleaning in Power Query
Using Power Query in Power BI, I performed the following transformations:
✔ Removed unnecessary columns to focus on relevant attributes
✔ Filtered out missing or inconsistent data
✔ Standardized values for weather conditions and severity levels
This process ensured that the dataset was clean, structured, and optimized for analysis.

Contribution & Limitations of the Global Road Accident Dashboard

By analyzing this dataset, I aimed to:

- Identify high-risk locations — Which countries report the most accidents?
- Analyze weather impact — Which conditions increase accident likelihood?
- Examine trends in fatalities — Are fatalities rising or declining?
- Assess economic impact — How costly are road accidents globally?
- Evaluate gender distribution — Are there significant differences in accident involvement by gender?

These takeaways will help develop data-driven road safety policies, improve driving conditions, and raise awarenessabout key risk factors.

Limitations of the Study

While comprehensive, this study focuses only on eight countries and does not include all global accident data. Additionally:

- Seasonal variations in accidents were not analyzed due to dataset constraints.
- Economic loss estimates may differ across countries due to varying reporting standards.

Despite these limitations, the dataset provides meaningful insights into road safety trends and risk factors.

Key Questions Aimed to be Answered

The study was designed to answer the following questions using Power BI:

- Which country experiences the highest number of road accidents?
- Which weather conditions contribute to the highest number of accidents?
- What are the trends in fatality occurrences over time?
- What is the total economic impact of road accidents, and how significant are the financial losses?
- Is there a noticeable difference in accident involvement between male and female drivers?

By addressing these questions, the goal was to uncover patterns and risk factors that influence road accidents globally.

Global Road Accident Dashboard

After building the Global Road Accident Report in Power BI, I analyzed key factors influencing road accidents worldwide. This dashboard provides insights into where, when, and why accidents occur, along with the economic impact and severity levels.
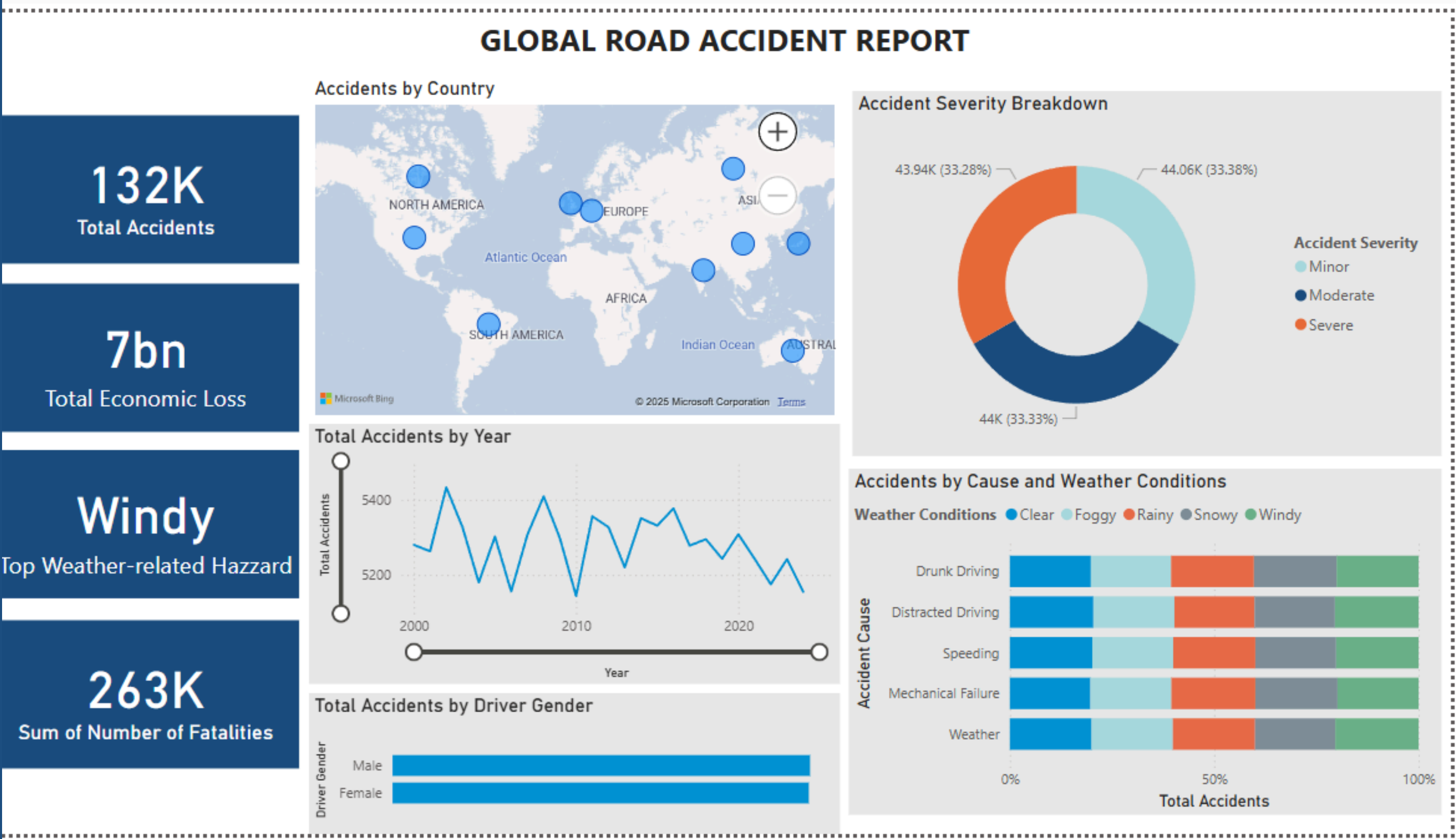
1. Where Do Most Accidents Occur? (Geographic Insights)

📌 Factor: Accident distribution by country

🔎 Key Finding:

- Canada has the highest number of recorded accidents (13,349 cases) compared to other countries.
- Possible reasons: harsh weather conditions, dense urban traffic, and road infrastructure challenges.

💡 Insight:

- Policy improvements in high-risk regions can significantly reduce accident counts.
- Better road maintenance and winter driving advisories can mitigate risks.

2. How Does Weather Impact Accidents?

📌 Factor: Weather-related accident trends

🔍 Key Finding:

- Windy conditions contribute to the highest number of accidents, followed by rainy and snowy weather.
- Mechanical failures and speeding accidents are more common in adverse weather conditions.

💡 Insight:

- Improved road signage and driver awareness campaigns in high-risk weather areas can help.
- Vehicle maintenance checks before peak seasons can reduce weather-related breakdowns.

3. What Are the Trends in Accident Fatalities Over Time?

📌 Factor: Changes in total fatalities (2000-2024)

🔍 Key Finding:

- Fatalities remained stable from 2000-2022, with a slight increase in 2023 but a sharp decline in 2024.
- This suggests that new safety policies, technological improvements, or enforcement changes have reduced fatalities.

💡 Insight:

- Continued investment in road safety measures and law enforcement could sustain the decline in fatalities.
- Further research into 2023's increase can reveal what caused the temporary spike.

4. What is the Economic Impact of Road Accidents?

📌 Factor: Financial burden of road accidents

🔍 Key Finding:
- The total economic loss due to accidents is estimated at $7 billion, covering medical costs, property damage, and lost productivity.

💡 Insight:
- Governments should allocate more funds to preventive measures rather than post-accident compensations.
- AI-driven traffic management and road safety technologies could reduce financial losses significantly.

5. Are There Differences in Accidents by Gender?

📌 Factor: Driver demographics

🔍 Key Finding:

- Males (66,098) and females (65,902) have nearly equal accident counts, showing no major gender-based disparity.

💡 Insight:

- Driver training programs should target all genders equally.
- Age and experience may be bigger risk factors than gender itself.

6. How Does Age Influence Accidents?

📌 Factor: Driver age group analysis

🔍 Key Finding:

- Accidents are evenly distributed across all age groups, with young and middle-aged drivers (18-40) slightly more involved.

💡 Insight:

- Younger drivers might benefit from defensive driving courses.
- Workplace driving safety programs could help reduce risks for middle-aged drivers.

Final Takeaways & Next Steps

Key Learnings from Power BI Analysis

✔️ Power BI enables fast, interactive, and dynamic data visualization.

✔️ Data cleaning and transformation are crucial for generating meaningful insights.

✔️ Visualization techniques (maps, line charts, KPI cards) simplify complex data storytelling.

✔️ Real-world data analysis can help improve policy-making and road safety regulations.

Future Enhancements

🚀 Analyze seasonal accident variations to determine peak-risk months.

🚀 Use machine learning to predict high-risk accident locations.

🚀 Incorporate real-time traffic data for more accurate insights.
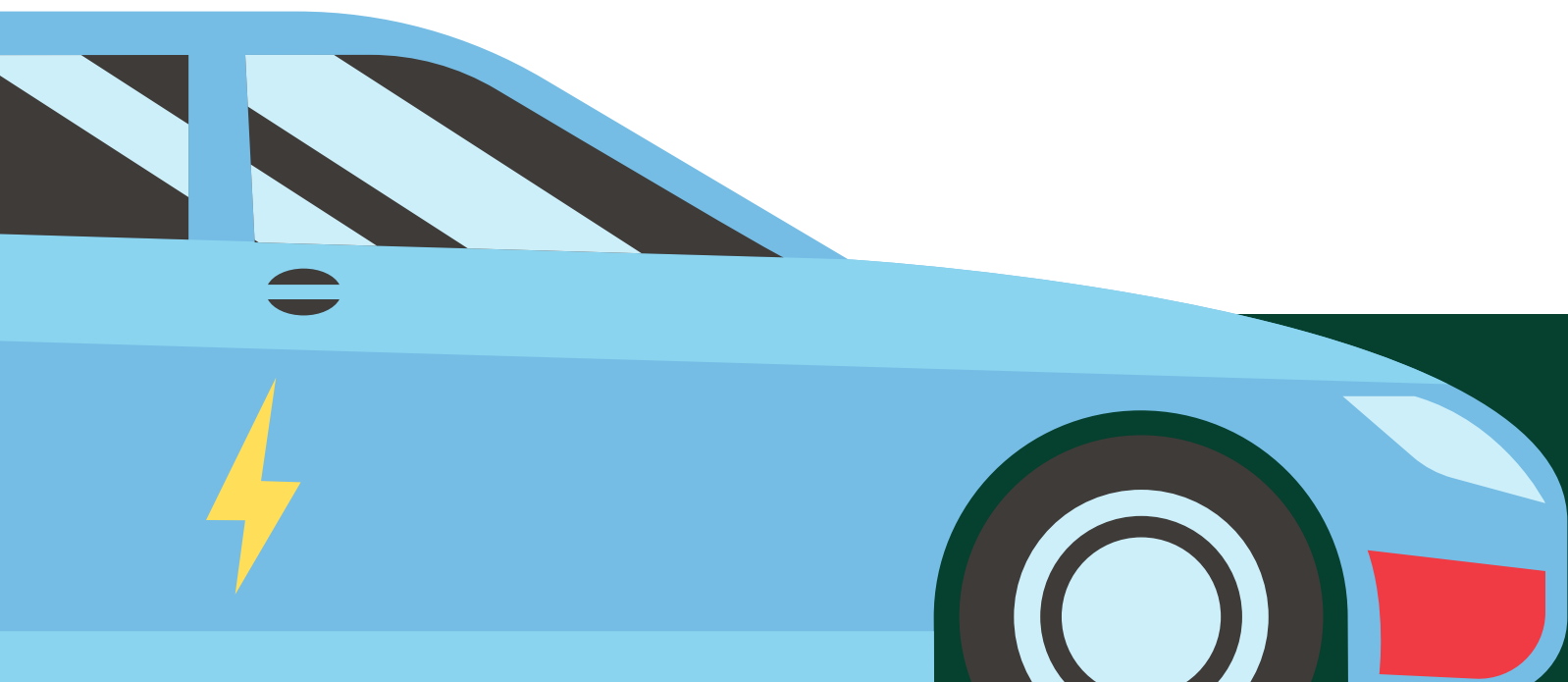
Conclusion

Through this project, I gained hands-on experience in data extraction, transformation, visualization, and interpretation using Power BI. The Global Road Accident Dashboard revealed critical trends in accident distribution, weather conditions, fatalities, and economic impact, offering actionable insights for road safety improvements worldwide. By leveraging data-driven solutions, governments and policymakers can reduce accident rates, minimize economic losses, and save lives. This study has solidified my understanding of Power BI's capabilities, and I look forward to applying these skills in future data science projects. 🚦📊🚗