Project Semester August–January 2025
DATA SCIENCE MINOR PROJECT REPORT

ON

TRAFFIC CRASH ANALYSIS DASHBOARD

<u>DATA ANALYTICS WITH POWER BI</u>

COURSE CODE: <u>INT374</u>

B. TECH COMPUTER SCIENCE AND ENGINEERING

LOVELY PROFESSIONAL UNIVERSITY

PHAGWARA, PUNJAB

PROJECT SUBMITTED BY:

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Roll No.: <u>03</u>

PROJECT SUBMITTED TO:

<u>Mr.Anchal Kaundal</u>

DECLARATION

I, **Bhoomika**, student of B.Tech – Computer Science and Engineering (Section K23CA) at Lovely Professional University, Punjab, hereby declare that all the information furnished in this project report titled:

"TRAFIC CRASH ANALYSIS DASHBOARD"

is based on my own intensive work and is genuine. The content of this report has not been submitted to any other university or institution for the award of any degree or diploma.

Date: 15-12-2025
Registration No.: 12313938
Name: Bhoomika

CERTIFICATE

This is to certify that **Ms. Bhoomika,** bearing Registration No. **12313938**, has successfully completed the **INT374** – Data Analytics With Power BI's project titled:

"TRAFIC CRASH ANALYSIS DASHBOARD"

under my guidance and supervision. To the best of my knowledge, the present work is the result of her original development, effort, and study. This project has been carried out as a part of the curriculum prescribed by Lovely Professional University, Phagwara for the Project Semester **August - January 2025.**

Name of the Supervisor
Mr. Anchal Kaundal

ACKNOWLEDGEMENT

I sincerely thank Mr.Anchal Kaundal, Assistant Professor, for his guidance and support throughout this project. I also thank the faculty of the CSE Department at Lovely Professional University for providing the necessary resources and assistance.

Bhoomika
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1. INTRODUCTION:

Road traffic accidents remain a major public safety concern, causing significant loss of life, injuries, and economic damage each year. To better understand the patterns and factors contributing to traffic crashes, this report presents insights derived from the **Traffic Crash Analysis Dashboard**. The dashboard provides a comprehensive overview of crash data across multiple years, enabling data-driven evaluation of trends, severity, and contributing conditions.

The analysis summarizes key metrics such as total crashes, total injuries, average injuries per crash, and the proportion of severe crashes. It further examines crashes by severity of injury, extent of vehicle damage, weather conditions, geographic distribution, and monthly trends over time. By visualizing these dimensions in an interactive and consolidated manner, the dashboard helps identify high-risk conditions, recurring patterns, and areas requiring targeted intervention.

Overall, this report aims to support informed decision-making for traffic authorities, urban planners, and safety stakeholders by transforming raw crash data into meaningful insights. The findings can be used to improve road safety policies, enhance preventive measures, and reduce the overall impact of traffic crashes.

2. SOURCE OF DATASET:

https://catalog.data.gov/dataset/traffic-crashes-crashes

3. DATA TRANSFORMATION & PREPARATION :

Before building the dashboard, the raw traffic crash dataset was processed and transformed using **Power BI Power Query** to ensure accuracy, consistency, and analytical readiness. The following transformation steps were applied:

The data was first imported from the source and the **first row was promoted as headers** to correctly assign column names. Appropriate **data types were defined and updated** for numerical, text, and date fields to avoid calculation errors during analysis.

Blank rows and unnecessary columns were **removed** to reduce noise and retain only relevant attributes required for analysis. Records containing errors were **identified and eliminated** to maintain data reliability.

To enhance time-based analysis, **Date and Time fields were derived**, and additional columns such as **Month Name and Year** were created. Columns were **reordered and renamed** to improve readability and logical structure.

Text-based columns were standardized by applying **text trimming, capitalization, and text cleaning** techniques to remove extra spaces, inconsistencies, and formatting issues. Specific values were **replaced** to ensure uniform categorization across the dataset.

Duplicate records were **removed** to prevent data inflation and ensure accurate crash counts. Finally, unnecessary intermediate columns were deleted, and the dataset was reorganized for optimal performance in visualizations and DAX calculations.

These transformations ensured that the dataset was clean, structured, and suitable for generating accurate insights through the Traffic Crash Analysis Dashboard.

4. OBJECTIVES OF THE STUDY:

The primary objective of this study is to analyze traffic crash data and identify key patterns, trends, and factors contributing to road accidents using an interactive dashboard. The study aims to provide meaningful insights that can support data-driven decision-making and improve road safety outcomes.

The specific objectives of the study are as follows:

- To examine the overall volume of traffic crashes and injuries across different years.
- To analyze the severity of crashes based on the most severe injury outcomes.
- To evaluate the extent of vehicle damage associated with traffic crashes.
- To assess the impact of weather conditions on the frequency of crashes.
- To study temporal trends in traffic crashes over time to identify seasonal or monthly patterns.
- To analyze the geographic distribution of crashes and identify high-risk locations.
- To summarize key performance indicators such as total crashes, total injuries, average injuries per crash, and severe crash percentage.

These objectives help transform raw crash data into actionable insights, enabling authorities and stakeholders to design effective safety measures and reduce the overall impact of traffic accidents.

5. KEY PERFORMANCE INDICATORS (KPIs):

Key Performance Indicators (KPIs) are used to measure and summarize the overall status and impact of traffic crashes. The following KPIs were derived and visualized in the Traffic Crash Analysis Dashboard to support effective analysis and decision-making:

Total Crashes: Represents the total number of traffic crashes recorded during the selected time period, providing an overall measure of accident frequency.

Total Injuries: Indicates the total number of injuries resulting from traffic crashes, reflecting the human impact of road accidents.

Average Injuries per Crash: Shows the average number of injuries per crash, helping assess the severity level of crashes on an aggregate basis.

Severe Crash Percentage: Represents the proportion of crashes that resulted in severe or fatal injuries, highlighting the seriousness of road safety conditions.
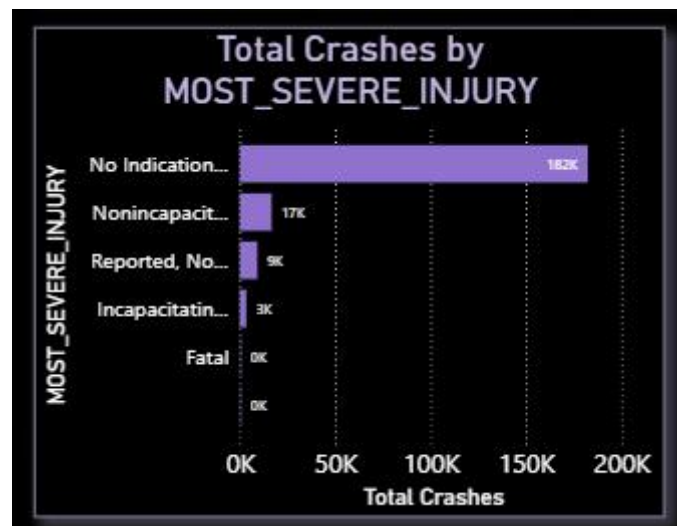

These KPIs offer a concise and high-level view of traffic crash performance and form the foundation for deeper analytical insights presented in subsequent sections of the report.
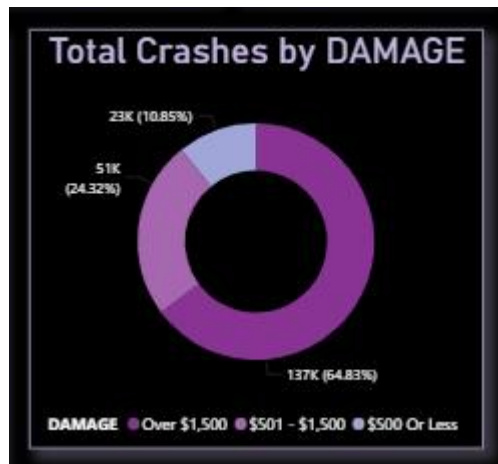
6. EXPLORATORY & VISUAL ANALYSIS:

Exploratory and visual analysis was conducted using interactive charts and maps in the Traffic Crash Analysis Dashboard to uncover patterns, trends, and relationships within the data. Visual representations enable quicker interpretation and support comparative analysis across multiple dimensions.
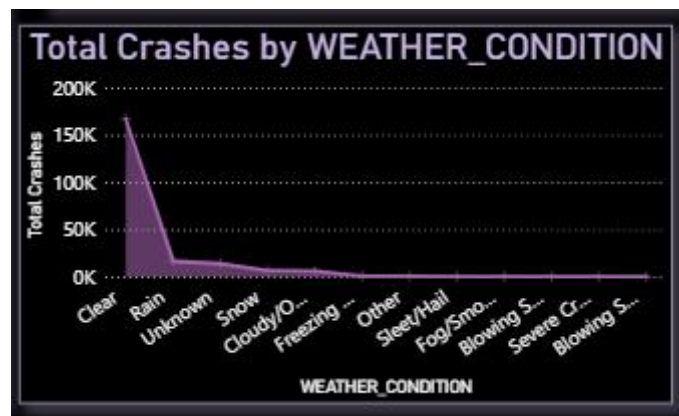
The analysis of **crashes by injury severity** shows that the majority of crashes result in non-incapacitating or reported injuries, while fatal and incapacitating injuries account for a smaller proportion but have a significantly higher impact. This highlights the need to focus on reducing crash severity in addition to crash frequency.

The **damage-based analysis** indicates that most crashes involve lower to moderate levels of vehicle damage, whereas a smaller share results in severe damage. These high-damage crashes often align with higher injury severity, suggesting a strong relationship between crash impact and economic loss.

Total Crashes by DAMAGE

23K (10.85%)
51K (24.32%)
137K (64.83%)

DAMAGE ● Over $1,500 ● $501 – $1,500 ● $500 Or Less

The **weather condition analysis** reveals that a large number of crashes occur during clear weather conditions, primarily due to higher traffic volume. However, adverse conditions such as rain, fog, snow, and poor visibility show an increased risk per occurrence, emphasizing the importance of weather-specific safety measures.

Total Crashes by WEATHER_CONDITION

Clear, Rain, Unknown, Snow, Cloudy/O..., Freezing ..., Other, Sleet/Hail, Fog/Smo..., Blowing S..., Severe Cr..., Blowing S...

WEATHER_CONDITION

The **temporal trend analysis** highlights variations in crash frequency across different months. Certain periods show higher crash counts, indicating possible seasonal patterns influenced by weather, travel behavior, or traffic density.

Crash Trend Over Time

January, December, May, June, October, March, November, July, September, February, August, April

CRASH_MONTH

The **geographic analysis** using map visualization identifies regions with higher concentrations of crashes. These hotspots indicate areas where targeted interventions, improved infrastructure, or stricter enforcement may help reduce accident rates.

Overall, the exploratory and visual analysis transforms complex crash data into clear insights, enabling stakeholders to identify high-risk conditions, understand underlying patterns, and prioritize road safety initiatives effectively.

7. KEY INSIGHTS AND OBSERVATIONS:

The analysis of the Traffic Crash Analysis Dashboard reveals several important insights related to crash patterns, severity, and contributing factors.

Most traffic crashes resulted in **non-fatal and non-incapacitating injuries**, while fatal and incapacitating crashes formed a smaller percentage. However, these severe crashes contribute disproportionately to total injuries, highlighting the critical need to focus on reducing crash severity, not just crash frequency.

A significant number of crashes occurred under **clear weather conditions**, indicating that high traffic volume plays a major role in accident occurrence. Although fewer crashes were recorded during adverse weather conditions such as rain, fog, or snow, these conditions showed a higher likelihood of severe outcomes, suggesting increased risk when visibility or road conditions are poor.
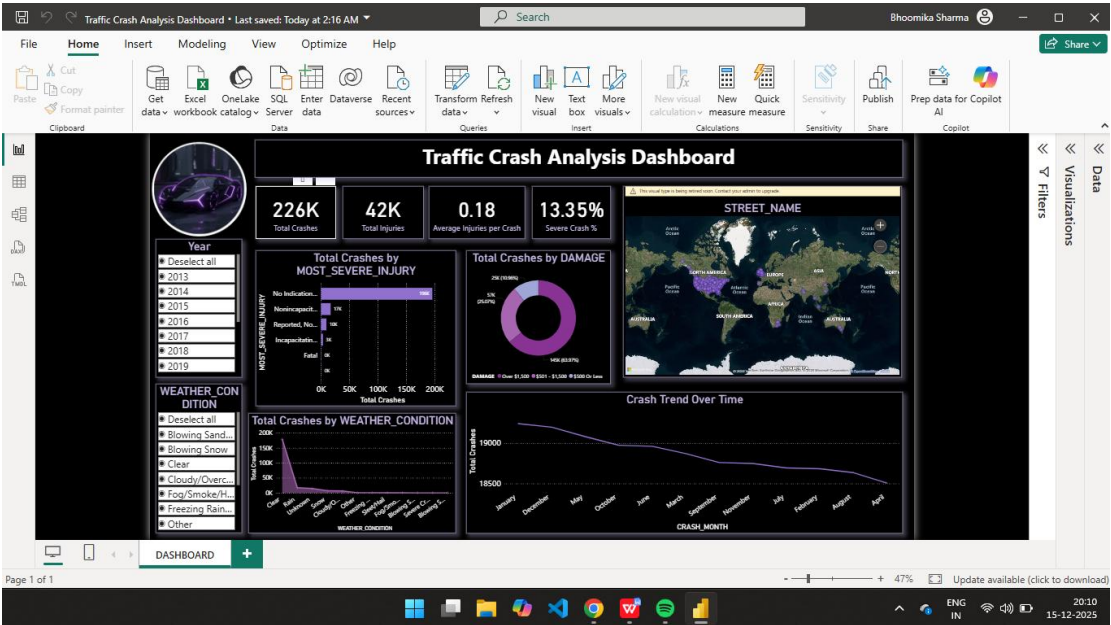
Analysis of **vehicle damage levels** showed that most crashes involved minor to moderate damage. Crashes with severe damage were less frequent but were strongly associated with higher injury severity and greater economic impact.

The **temporal analysis** indicated noticeable variation in crash frequency across different months. Certain periods experienced higher crash counts, suggesting seasonal patterns possibly influenced by travel behavior, weather changes, or traffic density.
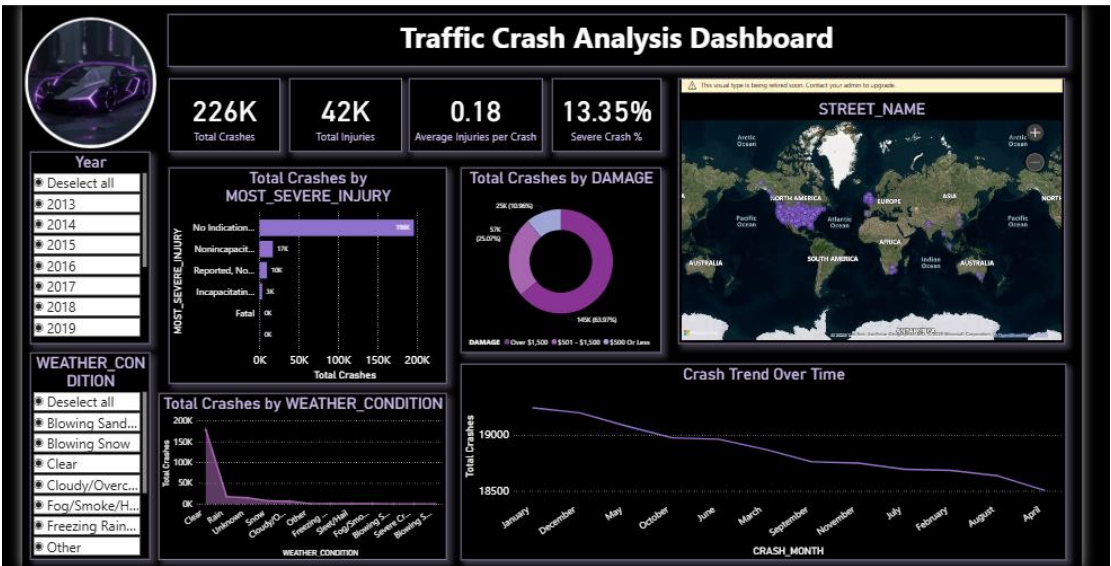
The **geographic distribution** of crashes revealed specific regions with consistently higher crash concentrations. These hotspots indicate areas where targeted safety

measures, infrastructure improvements, or stricter traffic enforcement could be most effective.

Overall, the dashboard demonstrates that traffic crashes are influenced by a combination of human behavior, environmental conditions, and location-based factors. These insights can support policymakers and traffic authorities in developing focused strategies to improve road safety and reduce accident-related impacts.

8. FINAL DASHBOARD

9. CONCLUSION

This project successfully demonstrates how traffic crash data can be transformed into meaningful insights through effective data preparation, analysis, and visualization. By

using Power BI, raw and complex crash data was cleaned, structured, and analyzed to highlight key patterns related to crash frequency, injury severity, vehicle damage, weather conditions, time trends, and geographic distribution.

The dashboard provides a clear and interactive overview of critical road safety indicators such as total crashes, total injuries, average injuries per crash, and the percentage of severe crashes. These insights help in understanding not only how often crashes occur, but also how serious their impact is.

The findings emphasize that while many crashes occur under normal conditions, severe outcomes are strongly influenced by factors such as adverse weather, high-impact collisions, and specific high-risk locations. Identifying these patterns can support targeted safety interventions, better traffic management, and informed policy decisions.

Overall, this analysis highlights the value of data analytics in addressing real-world problems. The Traffic Crash Analysis Dashboard serves as a useful tool for stakeholders to monitor trends, identify risk factors, and work towards improving road safety and reducing the overall impact of traffic accidents.

10. FUTURE SCOPE

The Traffic Crash Analysis Dashboard can be further enhanced and expanded in several ways to provide deeper insights and greater practical value. With additional data and advanced techniques, the analysis can support more proactive and predictive road safety measures.

Future improvements may include the integration of **real-time or near real-time crash data**, enabling continuous monitoring and quicker response to emerging risk patterns. Incorporating **traffic volume, vehicle type, driver behavior, and road condition data** could help in identifying more precise causes of crashes.

Advanced analytics such as **predictive modeling and machine learning** can be applied to forecast high-risk locations, time periods, or weather conditions, allowing authorities to take preventive actions in advance. The dashboard can also be enhanced with **severity prediction models** to estimate the likelihood of serious injuries or fatalities.

Expanding the **geographic analysis** to include detailed road-level or intersection-level data can help in identifying micro-level accident hotspots. Integration with **GIS tools** may further improve spatial analysis and planning.

Additionally, the dashboard can be customized for different stakeholders such as traffic police, urban planners, and policymakers, with role-specific views and alerts. Mobile-friendly access and automated reporting can also improve usability and reach.

Overall, the future scope of this project lies in evolving from descriptive analysis to predictive and prescriptive analytics, making it a powerful decision-support system for improving road safety and reducing traffic-related injuries and fatalities.

11. REFERENCES

Traffic Crash Dataset – Public Road Safety / Transportation Data Source

Power BI Power Query Documentation – Data Transformation and Cleaning

12. POST ON LINKEDIN:-

link