Targeting Traffic Trouble

Using Offence Pattern Visualization to Make Better Road Safety Decisions

TEAM 7

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1 Introduction

1.1 Background and Motivation

This project is designed to support local and state government agencies responsible for enforcing traffic regulations and delivering public safety services. As traffic violations and road accidents continue to increase—particularly during high-risk periods such as evenings, weekends, holidays, and major events—there is a growing need for a data-driven approach to road safety planning. Traditional methods often rely on generalised assumptions or outdated data, leading to inefficient allocation of deterrents and suboptimal public expenditure.

The primary objective of this project is to optimise government spending on road safety deterrents - such as speed cameras, police patrols, and traffic calming measures - by increasing their presence precisely when and where offences are most likely to occur. By harnessing the power of data visualisation, decision-makers will be able to identify patterns, recognise trends, and deploy resources more effectively, thereby improving road safety and reducing incident rates.

The intended users of this tool are policy analysts, public safety authorities, and traffic enforcement teams. They will interact with an interactive dashboard to:

- Understand trends in the number and type of offences by day, month, or event;
- Identify peak periods for traffic violations;
- Allocate investment strategically during critical times and in high-risk areas;
- Inform planning for future safety campaigns, aligned with policy board recommendations.

Visualisation is central to this initiative as it enables complex datasets to be translated into intuitive, actionable insights. This reduces reliance on assumptions and guesswork, supporting evidence-based, unbiased decision-making. Ultimately, the project aims to maximise the return on investment in road safety interventions while enhancing the safety and wellbeing of all road users.

1.2 Visualisation Purpose

Building on this foundation, the visualisation component of the project is designed to answer a key analytical question:

"Does the time of year, day of the week, or a public event influence the rate of traffic offences?"

By addressing this question, the visualisation aims to uncover patterns in offence data that can guide smarter deployment of resources. When offence rates are high, so too is the risk to public safety. Therefore, being able to identify when these spikes occur allows authorities to target high-risk periods with appropriate deterrents—ultimately making roads safer and public spending more efficient.

The dashboard allows users to:

- Explore and analyse offence data by time, date, and event to identify high-risk periods;
- Detect seasonal or event-driven trends in traffic violations;
- Inform and plan enforcement operations and public safety campaigns during peak offence periods.

Benefits of the Visualisation:

- **Evidence-based budgeting**: Supports data-driven decisions about when and where to allocate funding for traffic deterrents.
- **Improved road safety**: Enables pre-emptive planning by highlighting periods with increased risk, ensuring adequate deterrents are in place.
- **Community engagement**: Provides a transparent way to share traffic trends with the public, reinforcing trust and promoting safer driving behaviour.
- **Cost efficiency**: Prevents overspending on enforcement during periods with minimal risk, helping to allocate resources more responsibly.

This visualisation is more than just an analytical dashboard—it serves as a strategic decision-making tool that transforms complex traffic data into clear, actionable insights. By turning data into a compelling narrative, the project empowers government bodies to make informed choices that save lives, reduce costs, and foster safer communities.

2 Data

2.1 Data Source and Governance

- Identify the original data source(s) and provide links where applicable.
- Include a brief data summary table (e.g., number of records, key attributes, update frequency)
- Discuss data governance, including:
    - Data collection process
    - Data quality assessment
    - Security, privacy, and ethical considerations
- Demonstrate how the data supports answering the questions from Section 1.2

2.2 Data Processing and Analysis

- List key attributes and their data types (categorical, ordinal, interval, ratio/quantitative)
- Describe the data cleaning process, including:
    - Handling missing values
    - Removing duplicates
    - Normalisation, transformation, and derived variables
    - Data filtering and joining datasets
- Include a screenshot of the KNIME workflow and append the .knfw file to the submission

2.3 Data Exploration

- Conduct exploratory data analysis using KNIME or other tools.
- Provide summary statistics and data visualisations to understand patterns and outliers
- Discuss initial observations and any challenges encountered
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3 Visualisation Design

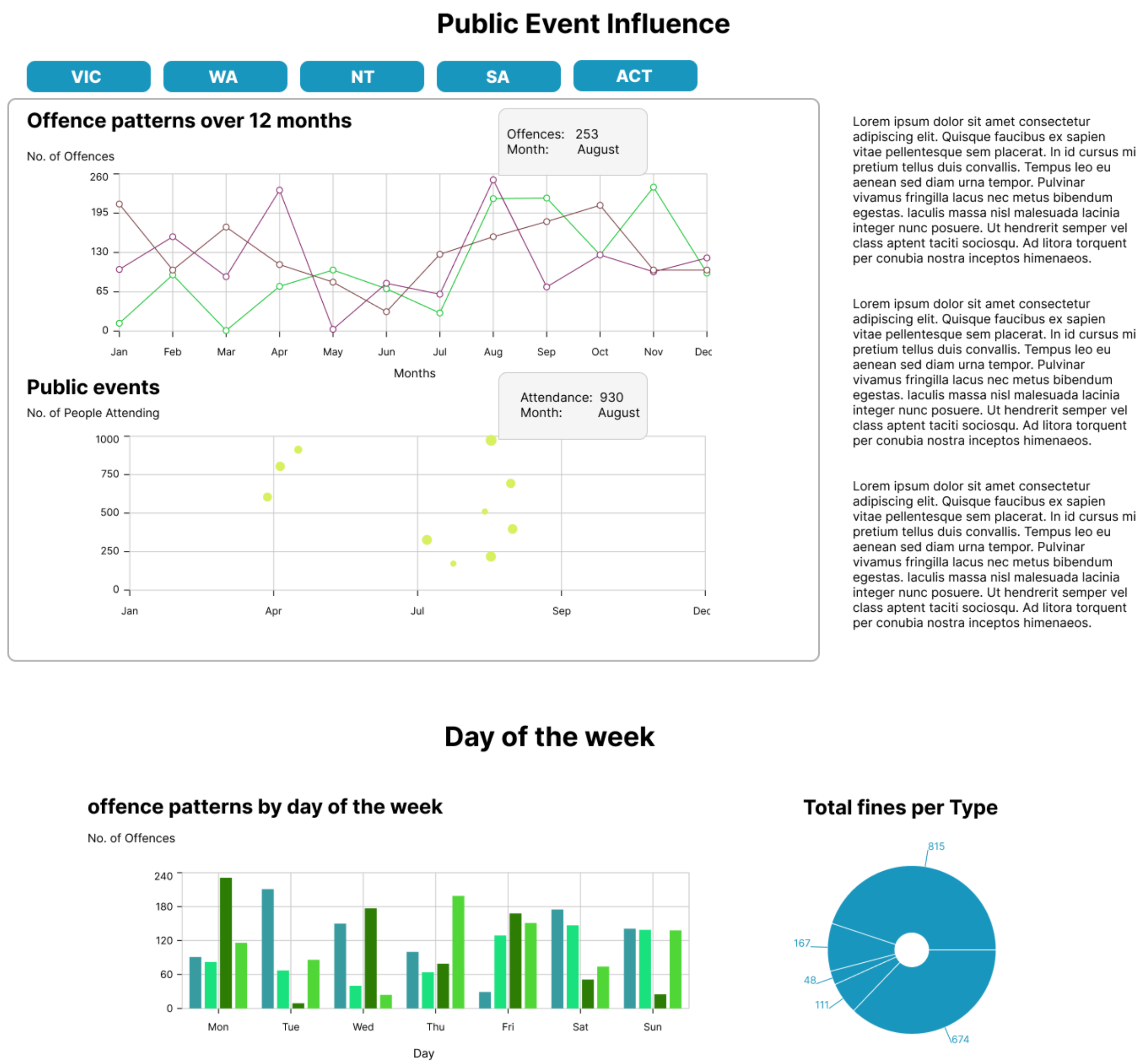

Figure 1: First Design Iteration Web Design Idea

This section should include:

3.1 Website Design

Create a wireframe of your webpage layout, showing:

- Navigation structure
- Placement of headings, text, and charts
- Provide a wireframe using tools like Figma, Miro, PowerPoint (or a hand-drawn sketch).

Create a storyboard showing how users will interact with your website and data visualisation to answer their question or achieve your purpose

3.2 Visualisation Design

- Explain the chart types chosen (e.g., bar, scatter, line, area, Sankey, parallel coordinates etc) and why they are appropriate.
- Discuss adherence to good design principles, including:
    - Graphical integrity (avoiding misleading charts)
    - Accessibility (colourblind and web-friendly palettes, font size)
    - Scalability (responsiveness across different screen sizes)
- Explain how graphical elements (colour, shape, size, annotations) are used to represent differences effectively.
- Justify colour choices, labelling, and layout decisions.
- Describe how you will use annotations and tooltips enhance user understanding.

3.3 Interaction Design

- Describe interactive features (e.g., zooming, filtering, tooltips, animations) and their role in improving user experience.
- Provide a table of interactions, explaining:
    - The interaction method (hover, click, drag, etc.)
    - The expected user behaviour and response

4 Iteration and Validation

4.1 Testing and Refinements

- Describe the iterative process of testing and improving the visualisation
- Include feedback received (from peers, users, or instructors) and how changes were made in response
- Provide before-and-after comparisons using screenshots/sketches
- Discuss any adjustments made to design due to programming issues
- Discuss accessibility features of design/programming

4.2 Usability Evaluation

- Conduct a usability evaluation

5 Conclusion and Future Improvements

The project was able to identify obvious patterns in the crime and traffic offence data related to days of the week, seasons, and public events. The interactive visualisations now allow the user to identify higher risk periods and plan more effectively to deter offending behaviour. Data led public policy decisions allow for the most efficient use of public resources and improve the safety of road users.

Future improvements to the project could include the input of real-time data on traffic offences, additional predictive analytics tools that forecast future hotspots for offending behaviours, and developing the dashboard to function on mobile devices. Continued user testing and design work that integrates stakeholder input will enhance user friendliness.

References

- Traffic Offence Data - Australian Government Open Data Portal Opening
- Tableau Design Guidelines
- D3.js Documentation - https://d3js.org
- KNIME Documentation - https://www.knime.com
- W3C Web Accessibility Guidelines

- Blog: [Medium] "Building Dashboards that Actually Work in Public Policy"
- Stack Overflow (for coding problems)

Appendices

Gen AI Declaration

Some help was provided by AI tools in the generation of ideas and language refinement. The student team completed the final decisions and validations.

Usability Evaluation Test Materials

- Task list used for user testing
- Feedback forms distributed during demo session

Notes/Data Collected in usability evaluation

- Users found filtering and tooltip helpful
- Suggested improvements included summary statistics and tooltip font size improvements