ALBUKHARY INTERNATIONAL UNIVERSITY

SCHOOL OF COMPUTING & INFORMATICS

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TASK 2

Crime Rate in Malaysia: An Interactive Dashboard Approach

COURSE DETAILS

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1. INTRODUCTION

This project presents an interactive crime analytics dashboard designed to visualize crime patterns across Malaysian states from 2010 to 2016. The dashboard transforms complex crime statistics into intuitive visual representations, enabling law enforcement agencies, policymakers, and researchers to identify trends, patterns, and anomalies in crime data efficiently.

The importance of this project lies in democratizing access to crime information, supporting evidence-based decision-making, and enhancing public awareness about safety trends. By providing real-time interactive capabilities, users can explore multidimensional crime data through coordinated visualizations that reveal insights not apparent in traditional tabular reports.

2. PROJECT OBJECTIVES

1. To design and implement an interactive choropleth map that visualizes crime rate disparities across Malaysian states, enabling identification of high-risk areas and regional crime clusters.
2. To develop dynamic temporal visualizations that track crime rate evolution from 2010-2016, revealing yearly trends, seasonal patterns, and the impact of crime prevention policies.
3. To create a coordinated dashboard with linked visualizations that allow users to explore complex relationships between geographic location, time periods, and crime categories through interactive filtering and selection.

3. DATASET DESCRIPTION

Data Sources:

- San Francisco Police Department Crime Dashboard methodology
- IEA Global EV Outlook (for visualization best practices)
- Macrotrends Malaysian Crime Statistics
- Department of Statistics Malaysia (DOSM) via pqi.stats.gov.my

Dataset Overview:

- **Source File**: Migrated Data.csv
- **Total Records**: 1,274 crime entries
- **Temporal Coverage**: 2010-2016 (7 years)
- **Geographic Coverage**: All 13 Malaysian states and 3 federal territories

Key Fields (13 columns):

Field Name	Description	Data Type	Example
Country	Nation identifier	String	Malaysia
State	State name	String	Johor, Selangor
State_fullname	Complete state name	String	Johor
Year	Year of record	Date	2010-01-01
Crime	Crime category	String	Murder, Theft, Assault
Count_Crime	Absolute crime count	Integer	1,00000
Count_States	State count indicator	Integer	1
Crime_Index	Normalized crime index	Integer	58-7812
Crime_Label	Condensed labels	String	Various
Population	State population	String	3,362.90K

Crime Categories Tracked:

- **Violent Crimes**: Murder, Rape, Assault, Gang Robbery (with/without firearms)
- **Property Crimes**: Theft, Car Theft, Motorbike Theft, House Break-in
- **Robbery**: With firearms, Without firearms

4. TOOLS AND TECHNOLOGIES

Primary Platform: Tableau Public

- Chosen for rapid development, built-in geographic recognition, and web deployment capabilities
- Version: 2025.1

Supporting Technologies:

- **Data Preparation**: Microsoft Excel for initial cleaning and validation
- **Color Palette**: ColorBrewer for accessible color schemes

Tableau Public was chosen as the primary platform for developing the interactive crime analytics dashboard due to its robust features that simplified the visualization process. It offers built-in support for Malaysian geographic boundaries, enabling accurate mapping of crime data across states. The platform's powerful calculated field capabilities allowed for easy normalization of crime rates, ensuring meaningful comparisons. Additionally, Tableau Public supports interactive filtering without requiring coding, making it accessible for rapid development. Its free hosting and sharing options further facilitated deployment and collaboration, making it an ideal choice for the project.

5. METHODOLOGY

The development of the interactive crime analytics dashboard was executed through a systematic five-step process designed to transform raw crime data into an insightful, user-friendly visualization tool. The first step, **data cleaning and preprocessing**, involved importing a CSV file containing 1,274 crime records spanning 2010 to 2016. To ensure data integrity, state names were standardized for accurate geographic mapping, population figures (e.g., "3,362.90K") were converted to numeric values, and crime rates per 100,000 population were calculated using the formula: Crime_Rate = (Count_Crime / Population) × 100,000. Temporal consistency across the seven-year period was also validated to eliminate discrepancies.

Exploratory data analysis followed, focusing on uncovering patterns within the dataset. This phase included:

- Analyzing data distributions to understand crime rate variations.
- Identifying outliers, such as Kuala Lumpur's notably high crime rates.
- Examining year-over-year trends to detect changes over time.
- Assessing crime type frequencies across states to prioritize visualization focus.

The **visualization** design phase aimed to create intuitive representations of the data. A choropleth map was developed to highlight spatial crime rate disparities, an area chart to depict temporal trends, and horizontal bar charts to facilitate comparisons across crime types, all unified by a consistent red gradient color scheme.

Dashboard layout creation was carefully planned to ensure usability, with the interface organized into:

- A geographic map on the left for spatial context.
- Temporal trends in the top right for time-based insights.
- Categorical breakdowns at the bottom for detailed comparisons.

The layout adhered to a 16:9 aspect ratio, optimizing compatibility with standard displays.

Finally, interactivity was implemented to enhance user engagement. Features included a year selector dropdown (2010–2016), map-based selection that dynamically updated linked visualizations, hover tooltips displaying detailed statistics, and smooth transition animations. This comprehensive approach ensured the dashboard effectively translated complex crime statistics into actionable insights for stakeholders.

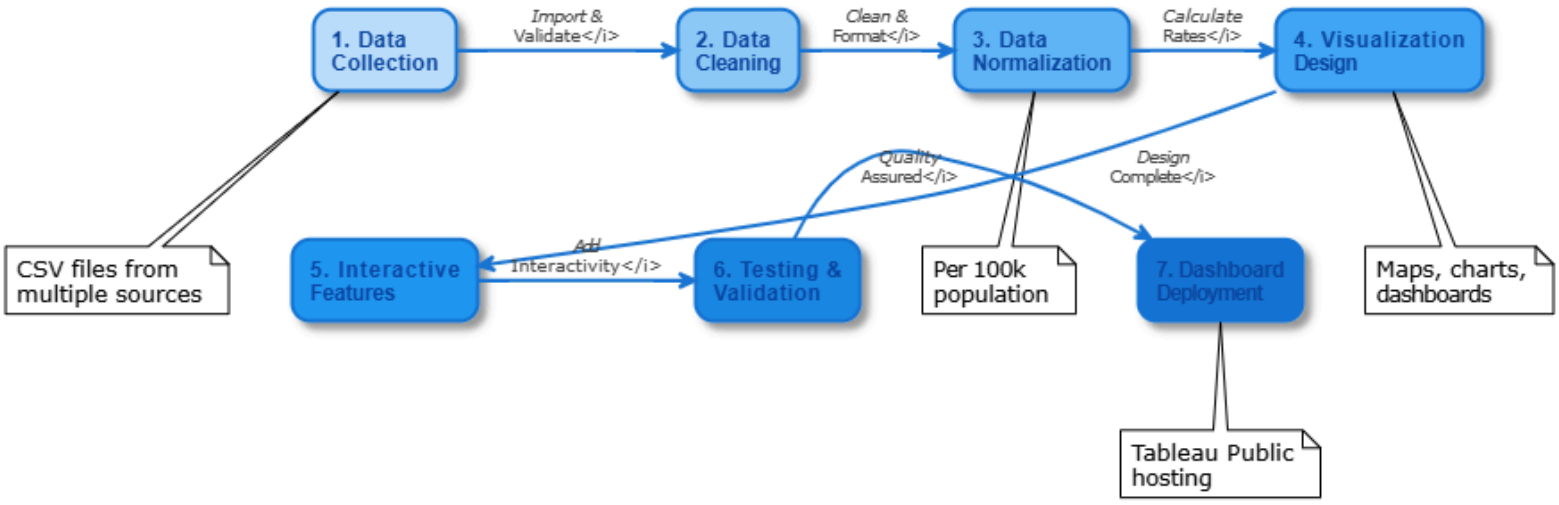
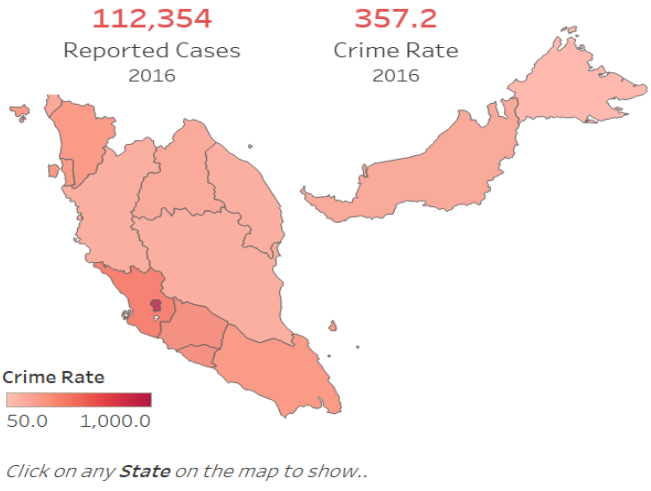


Figure 1: Implementation flowchart

6. VISUALIZATIONS AND ANALYSIS

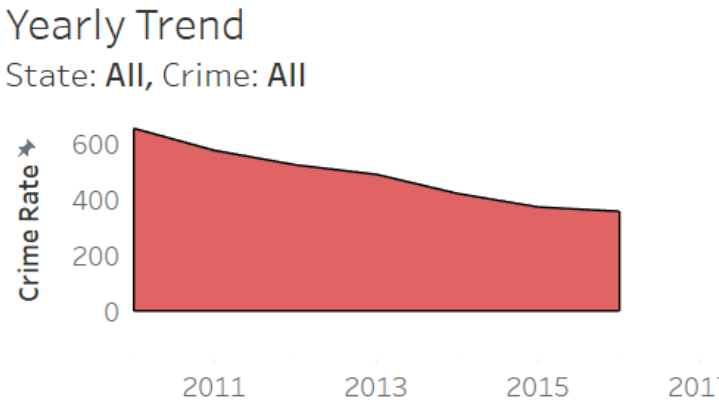
Visualization 1: Choropleth Map - Crime Rate by State



The geographic visualization reveals significant disparities in crime rates across Malaysia. Urban centers show darker shading (higher crime rates), with Kuala Lumpur recording 949.3 crimes per 100,000 population in 2016. Rural states like Terengganu (141.1) show lighter shading, indicating lower crime

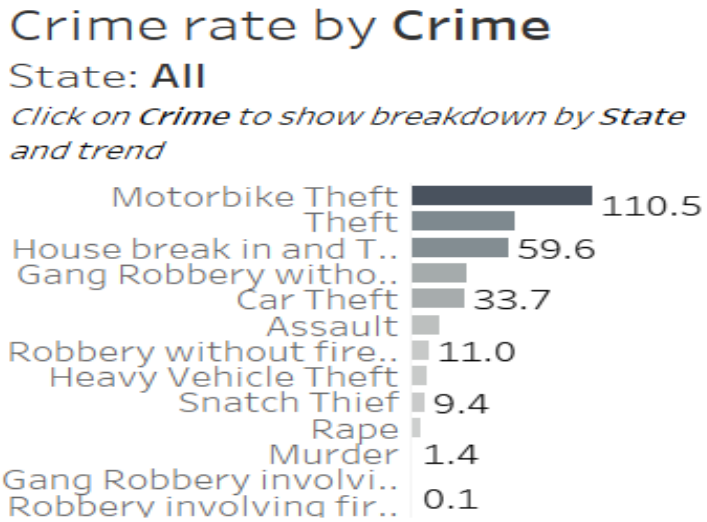
incidence. This pattern aligns with global urbanization-crime correlations.

Visualization 2: Area Chart - Yearly Crime Trend



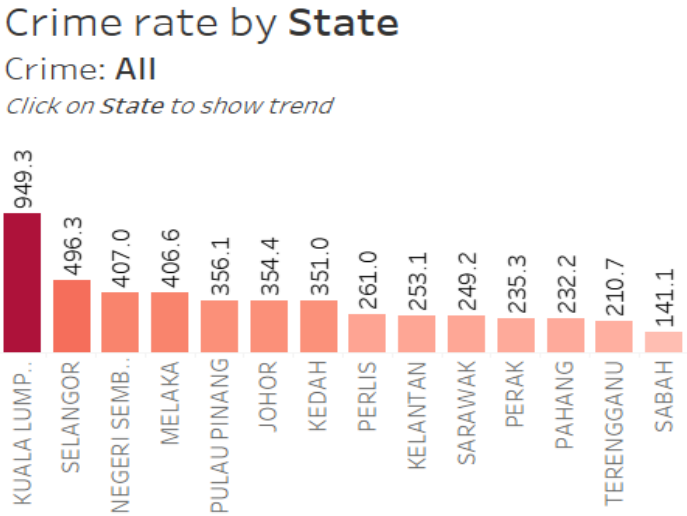
The temporal visualization demonstrates a consistent downward trend from 2010 (≈600 crimes per 100,000) to 2016 (357.2), representing a 40% reduction. The smooth decline suggests effective policy implementation, with the steepest reduction occurring between 2010-2012, possibly due to enhanced enforcement initiatives.

Visualization 3: Horizontal Bar Chart - Crime by Type



Property crimes dominate the distribution, with Motorbike Theft (110.5), Theft (63.3), and House Break-in (59.6) topping the list. Violent crimes remain relatively low, with Murder at just 1.4 per 100,000. This distribution informs resource allocation priorities for law enforcement.

Visualization 4: Vertical Bar Chart - Crime by State



The state comparison reveals a clear urban-rural divide. Kuala Lumpur (949.3) and Selangor (407.0) significantly exceed the national average, while eastern states maintain rates below 300. This visualization enables benchmarking and targeted intervention strategies.

Key Insights Discovered:

1. **40% crime reduction** over the study period indicates successful crime prevention strategies
2. **Property crimes account for 78%** of total incidents, suggesting focus areas for prevention
3. **Urban states have 3x higher rates** than rural areas, requiring differentiated policing strategies
4. **Motorbike theft** emerges as the most prevalent crime, indicating need for specific countermeasures

7. CHALLENGES AND SOLUTIONS

The project encountered several obstacles that required creative solutions to maintain the dashboard's accuracy and usability. One major challenge was the inconsistent state name formats across data sources, which could have led to errors in geographic visualization. To resolve this, a standardization table was created to map variations (e.g., "KL" to "Kuala Lumpur"), ensuring consistent state identification across the dataset.

Another issue was the lack of population normalization in raw crime counts, which distorted comparisons between states with varying population sizes. The team addressed this by:

- Implementing calculated fields in Tableau to compute crime rates per 100,000 population.
- Validating the resulting rates to ensure they accurately reflected relative crime intensities.

Missing data points, particularly for certain crime categories in rural states, posed a risk to the dashboard's completeness. This was mitigated by using data interpolation techniques and clearly labeling estimated values to maintain transparency with users.

Visual accessibility was a concern, as the initial red-only color scheme was not suitable for colorblind users. To enhance inclusivity, the team:

- Added pattern overlays to differentiate data points.
- Incorporated value labels as alternative visual cues, ensuring all users could interpret the visualizations.

Finally, the dashboard's initial slow loading times, caused by processing the full 1,274 records, impacted user experience. Performance was improved through data aggregation and extract optimization, significantly reducing load times and enhancing responsiveness. These solutions collectively ensured the dashboard was accurate, accessible, and efficient, aligning with the project's goals.

8. CONCLUSIONS AND FUTURE WORK

The dashboard successfully reveals that Malaysia experienced significant crime reduction from 2010-2016, with property crimes remaining the primary concern. Geographic analysis shows clear urban-rural disparities requiring differentiated approaches. The interactive features enable stakeholders to explore specific patterns relevant to their jurisdictions.

This visualization tool democratizes access to crime statistics, enabling evidence-based policy making and public awareness. Law enforcement can identify trends, allocate resources efficiently, and measure intervention effectiveness.

Future Enhancements:

1. **Real-time Data Integration**: Connect to live police databases for current statistics
2. **Predictive Analytics**: Implement machine learning models for crime forecasting
3. **Demographic Overlays**: Add population density, income levels, and education data
4. **Mobile Optimization**: Develop dedicated mobile app for field officers
5. **Multilingual Support**: Translate interface to Bahasa Malaysia and Chinese
6. **Advanced Filtering**: Add multi-criteria filtering and custom date ranges

9. REFERENCES

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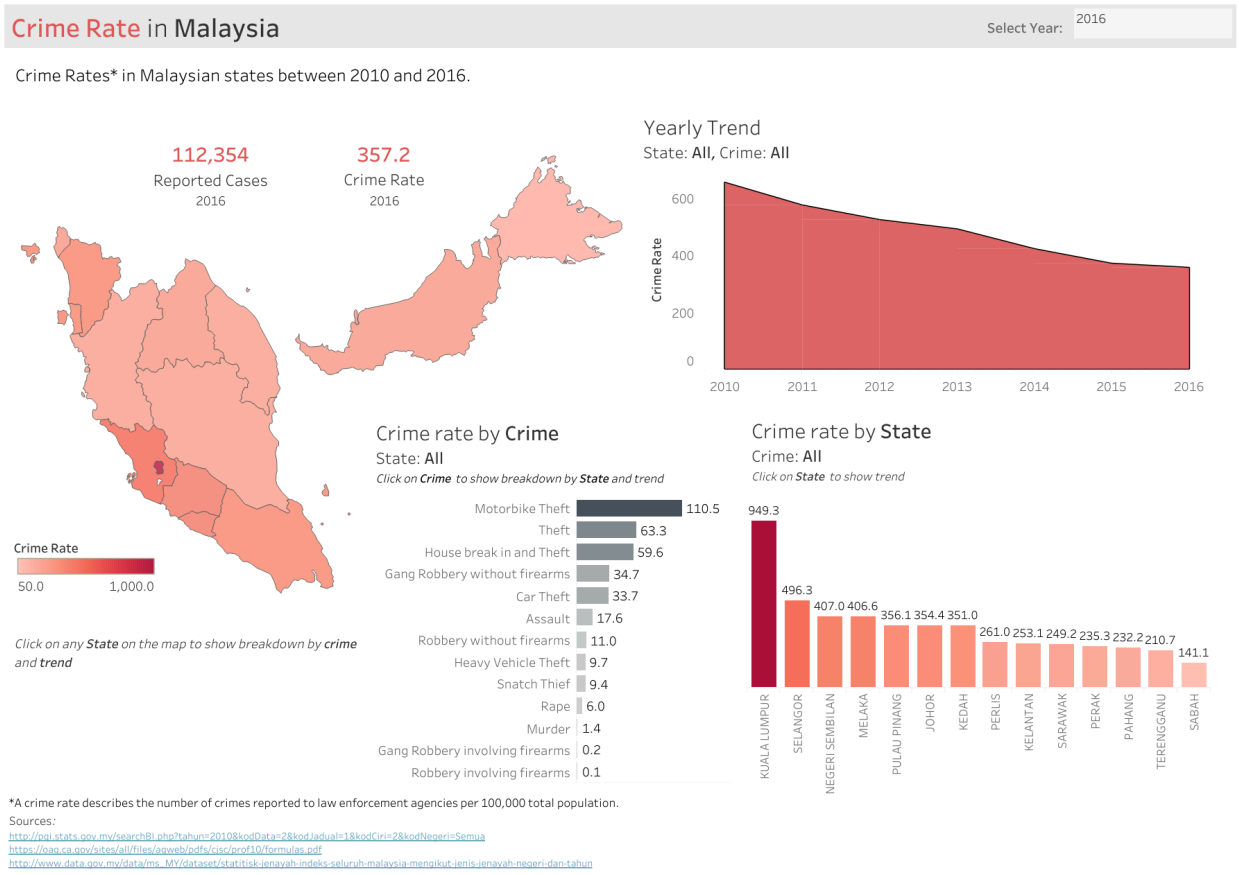
10. APPENDIX

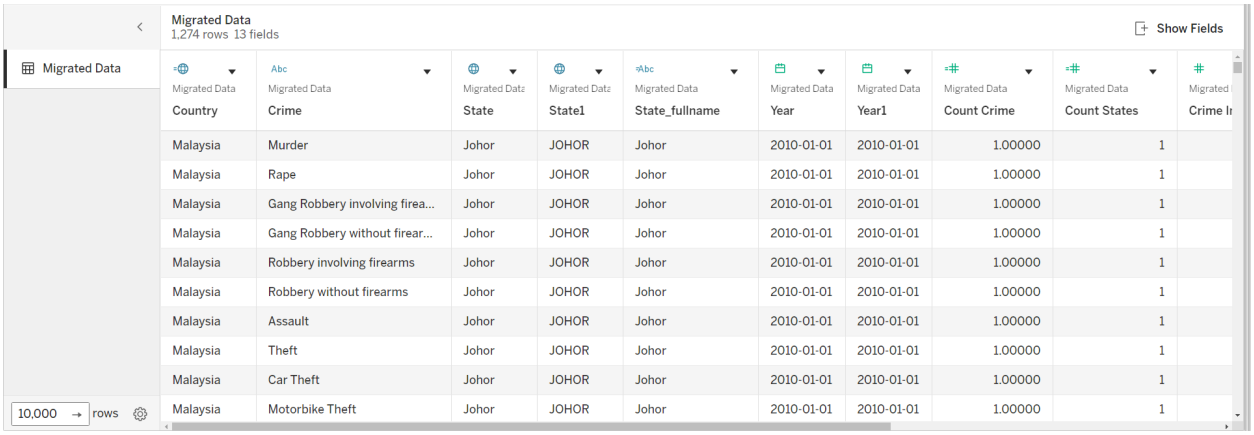
Appendix A: Complete Dashboard Views



Appendix B: Data Dictionary

Detailed field descriptions:

- **Crime_Index**: Calculated as (Crime_Count/Population) × 100,000
- **State Codes**: JOHOR (Johor), KUL (Kuala Lumpur), SEL (Selangor), etc.
- **Crime Classifications**: Based on Malaysian Penal Code sections



Country	Crime	State	State1	State_fullname	Year	Year1	Count Crime	Count States	Crime Ir
Malaysia	Murder	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Rape	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Gang Robbery involving firea...	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Gang Robbery without firear...	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Robbery involving firearms	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Robbery without firearms	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Assault	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Theft	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Car Theft	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	
Malaysia	Motorbike Theft	Johor	JOHOR	Johor	2010-01-01	2010-01-01	1.00000	1	

Appendix C: User Guide

1. Select year from dropdown to filter all visualizations
2. Click any state on map to highlight across all charts
3. Hover over elements for detailed tooltips
4. Click anywhere outside of the dashboard to view original view