Traffic flow analysis about the Malaysian city Johor Bahru

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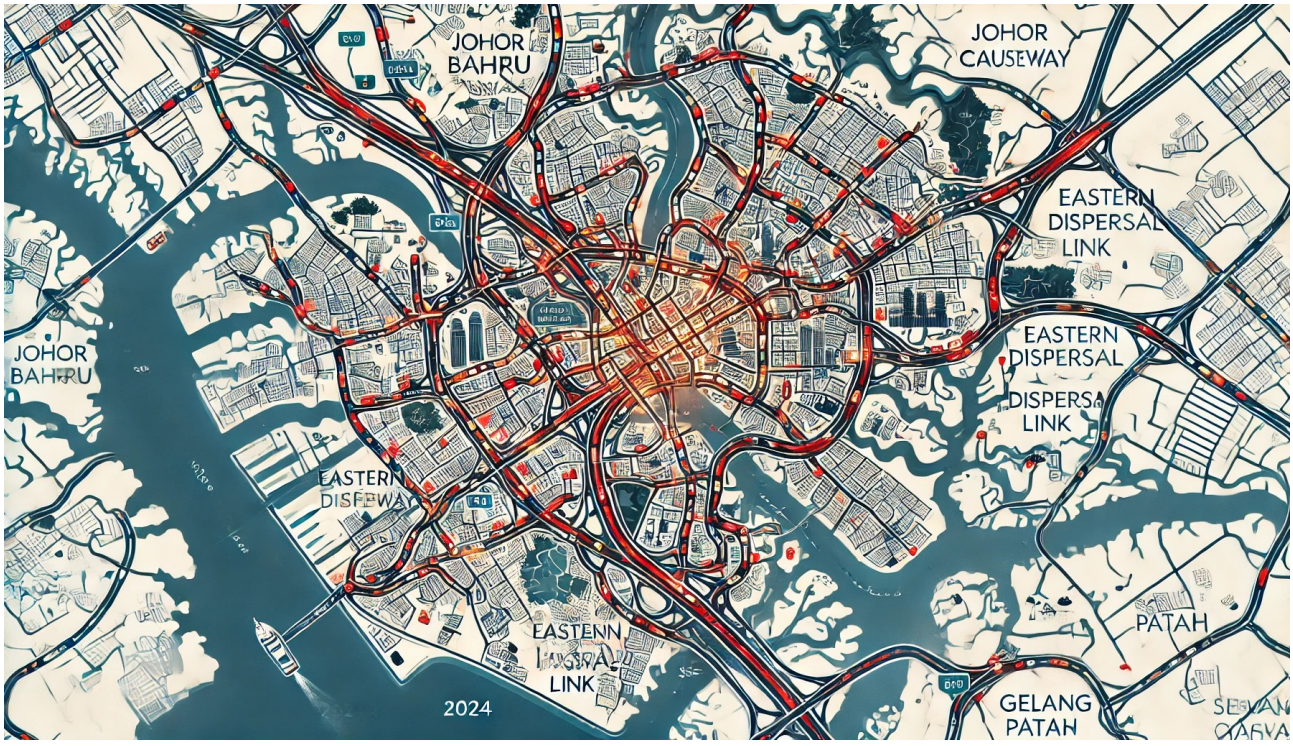
Chapter 2: Literature Review

2.1 Introduction

This chapter conducts a literature review of the traffic flow in Johor Bahru, Malaysia in recent years. By studying the flow of cars and pedestrians on the road, road use can be optimized, traffic congestion reduced and safety improved. This chapter will summarize and organize the direction of data–driven methods and future trends.



2.2 Visualization of road congestion in Johor Bahru

This is a visualization of traffic congestion on major roads in Johor Bahru in 2024. The red mark in the picture represents severe congestion, yellow represents moderate congestion, and green

represents basically smooth traffic. The figure also shows several key congestion locations, such as the Singapore–Johor Bahru Bridge and the Eastern Evacuation Link (EDL). The reason for the traffic congestion is that the Johor Bahru government is planning a number of road traffic upgrades and planned construction projects. The projects are divided into short, medium and long-term projects and cover the construction of a new road section from Gelang Patah CIQ interchange to Tanjung Pelepas four-junction, road expansion project from Bandar Seri Alam to Pasir Gudang, Senai–Desaru Expressway and from the east Evacuation Highway (EDL) viaduct project connecting the city center to Stulang Laut, etc. These projects are currently exacerbating the traffic pressure in Johor Bahru, which will be discussed in this chapter from two aspects.

2.3 Data-driven approach

In recent years, the advancement of data collection and processing technology has greatly promoted the development of road traffic flow analysis, which makes real-time observation possible.

- Big Data and Internet of Things (IoT)
- Machine learning model
- Regression model for traffic analysis
- Reinforcement learning for traffic signal control

2.3.1

The following are some key technologies and methods for combining the above technologies to analyze traffic flow

I. Data collection

IoT devices (sensors, radars, infrared cameras, GPS devices) collect traffic data in real time. ITS transmits data to headquarters via wireless networks.

Historical data collects traffic records, weather conditions, and time distribution to help analyze.

II. Data processing and storage

Big data platforms (Hadoop, Spark) process and store large amounts of traffic data.

Cloud computing High-speed and efficient data processing through the cloud.

III. Real-time monitoring

The traffic management platform integrates and processes the data collected by IoT devices and servers and exports them into visual traffic flow data, helping traffic management personnel to monitor in real time and handle emergencies in a timely manner.

IV.Data Visualization and Reporting

Visualization tools (3D models, dashboards, maps) display real-time traffic conditions.

Analysis reports provide managers with traffic flow reports and trend analysis reports.

2.4 Future Trends

Recently focused technologies can also provide support for traffic flow analysis

- Autonomous driving technology for vehicles
- Smart cities and traffic management systems
- AI-driven real-time traffic control systems
- Dynamic traffic assignment (DTA)

2.4.1 Vehicle Autonomous Driving Technology

Autonomous vehicles can provide accurate data by collecting and analyzing the speed, location and road conditions of vehicles in real time. Autonomous vehicles have built-in V2V and V2I systems that can communicate with each other, which can effectively improve the efficiency of traffic network coordination. Through these data, traffic flow can be accurately predicted and traffic congestion can be reduced.

2.4.2 Smart City and Traffic Management System

Smart cities collect traffic flow data, vehicle speed, road conditions and other data in real time by integrating sensors, cameras and IoT devices. Correspondingly, the traffic management system uses big data analysis and machine learning models to optimize traffic light control, route planning and emergency response based on the collected data. The two work together to effectively reduce congestion and improve road utilization.

2.4.3 AI-driven Real-time Traffic Control System

The AI-driven real-time traffic control system collects traffic data (such as vehicle speed, traffic accident information, road conditions) in real time and uses AI to perform in-depth calculations to organize and analyze traffic patterns. The system can adjust the duration of traffic lights based on real-time data to allocate lanes, thereby optimizing traffic flow and reducing congestion. AI can also predict potential traffic accident risks in advance through deep algorithms, improving overall traffic efficiency and safety.

2.4.4 Dynamic Traffic Assignment (DTA)

Dynamic traffic assignment uses real-time monitoring to flexibly allocate lanes and guide traffic signals to adapt to current traffic conditions.

2.5 References

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