2024-25 HIVE Summer Internship Project

Interactive Visualization of Perth's Public Transport Network for Urban Mobility Solutions

47SAE_EECMS_UrbanMobilityViz

Primary Academic Supervisor
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Project Background

As cities expand and populations grow, urban mobility becomes a central challenge for city planners and administrators. Perth, like many metropolitan areas, is experiencing increasing demand for efficient public transport systems that can alleviate traffic congestion, reduce carbon emissions, and provide seamless connectivity for its residents. Despite significant investments in public transport infrastructure, challenges such as traffic congestion, irregular public transport schedules, and gaps in service coverage still persist.

The current transport network provides static data on routes and schedules, but with the increasing availability of real-time data on traffic, vehicle locations, and public transport usage, there is a unique opportunity to develop an interactive platform that can visualize public transport flow in real time. This project aims to build a comprehensive interactive dashboard that brings together live public transport data, traffic data, and commuter insights to optimize Perth's urban mobility solutions.

This project aims to leverage Perth's public transport data to build an interactive 3D dashboard that provides real-time insights into the city's public transport network. By integrating data from multiple sources, including GTFS feeds for real-time bus and train locations, traffic data from Main Roads WA, and commuter patterns derived from SmartRider usage, this dashboard will serve as a powerful tool for both commuters and urban planners. For commuters, the tool will offer real-time route planning and traffic updates, while urban planners can use it to identify underutilized routes, optimize public transport schedules, and make data-driven decisions to improve overall mobility across the city.

Project Description, Expected Outputs, Possible Stretch Goals

The primary objective of this project is to develop an interactive visualization dashboard that combines real-time public transport data, traffic information, and demographic data to optimize urban mobility in Perth. The dashboard will display routes, schedules, traffic conditions, and real-time public transport vehicle locations. It will help commuters identify the best routes in real-time, while providing city planners with insights on transport demand patterns, underutilized routes, and congestion hotspots.

Expected Outputs:

1. Real-Time Transport Visualization: A dashboard showcasing live updates of Perth's public transport network, including buses, trains, and ferries, with their real-time locations.
2. Traffic Flow Analysis: Integrated data to visualize traffic congestion and its impact on public transport schedules and performance.
3. Commuter Patterns and Insights: A feature that allows city planners to analyse commuter behaviour, helping them identify high-demand areas and optimize public transport routes accordingly.
4. Interactive Route Planning Tool: A user-friendly route-planning tool that recommends the best routes for commuters based on real-time traffic and public transport conditions.

Possible Stretch Goals:

- Predictive Analytics for Transport Optimization: Integrate AI-driven predictive models to forecast transport demand and traffic congestion, providing insights for proactive route planning.
- AR/VR Visualization: Use augmented reality (AR) and virtual reality (VR) to provide an immersive experience for city planners, enabling them to explore and interact with Perth's transport network in 3D.
- Mobile App Integration: Development of a mobile-friendly interface or app that offers real-time updates and route planning for commuters on the go.

Links to background reading and any relevant recent work in the field

[1] Kuo, Y. H., Leung, J. M., & Yan, Y. (2023). Public transport for smart cities: Recent innovations and future challenges. European Journal of Operational Research, 306(3), 1001-1026.
[2] Papadakis, D. M., Savvides, A., Michael, A., & Michopoulos, A. (2024). Advancing Sustainable Urban Mobility: Insights from Best Practices and Case Studies. Fuel Communications, 100125.
[3] Liu, L., Porr, A., & Miller, H. J. (2023). Realizable accessibility: evaluating the reliability of public transit accessibility using high-resolution real-time data. Journal of Geographical Systems, 25(3), 429-451.

What type of visualisation will the student develop or produce?

The student will develop a 3D interactive dashboard that visualizes real-time public transport data across Perth, including vehicle locations, traffic congestion, and route schedules. The dashboard will integrate real-time traffic information and provide commuters with interactive tools for route planning.

How will the visualisation contribute to your research outcomes?

The visualization will provide valuable insights into public transport efficiency and traffic management, supporting the development of data-driven urban mobility strategies. By analysing real-time data, the research will contribute to smart city initiatives, improving overall urban planning and sustainable transport solutions for Perth.

If the project is successful, where would you consider publishing the results?

If the project is successful, the results could be published in various high-impact journals and conferences that focus on urban mobility, public transportation, and data-driven smart city solutions. Some possible venues include: IEEE Transactions on Intelligent Transportation Systems, International Conference on Urban Transport and the Environment, etc.

Draft Project Timeline:

Week 1

• Nov 11: Full-day HIVE induction, familiarizing the student with HIVE's visualization tools, workspace, and resources. • Nov 12: Area and project induction with the primary supervisor to outline project goals, methodology, and expected outcomes. • Develop a detailed project plan with input from the academic team and HIVE staff. • Conduct a comprehensive literature review on real-time public transport visualization, urban mobility, and relevant data technologies

Week 2

• Begin gathering and cleaning relevant datasets, including public transport data (GTFS feeds), real-time traffic data, and commuter behavior data (e.g., SmartRider usage). • Start basic exploratory data analysis to understand the structure and quality of

Week 3

• Start developing the basic framework of the 3D visualization dashboard, including data mapping for public transport routes and vehicle locations. • Implement basic user interface (UI) components to allow interaction with the transport data. • Begin integration of real-time traffic data into the dashboard.

Week 4

• Continue refining the dashboard visualization, focusing on optimizing the display of real-time vehicle locations, traffic congestion, and route schedules. • Implement initial interactive features such as route planning and time estimation tools for commuters. • Integrate GIS data to provide geospatial context for transport routes and areas of interest.

Week 5

• Conduct user testing with early-stage prototypes to gather feedback on the visualization's usability and performance. • Begin optimizing the system's ability to handle real-time data updates and improve visual clarity. • Integrate commuter behavior insi

Week 6

• Start incorporating predictive analytics to forecast transport demand, identify potential traffic congestion points, and optimize public transport routes. • Conduct further testing to ensure smooth interaction between real-time and predictive data.

Week 7

• Finalize integration of real-time traffic flow and predictive models into the dashboard. • Conduct user interface (UI) and user experience (UX) testing to ensure that the dashboard is intuitive and accessible. • Begin working on the final prototype base

Week 8

• Continue refining the visualization and addressing any technical issues. • Begin preparing final documentation detailing the data sources, system architecture, and key insights from the project. • Start planning the final presentation, focusing on key achievements and challenges.

Week 9

• Conduct final tests to ensure the dashboard operates smoothly with all real-time data sources. • Focus on report writing and preparing the final presentation. • Compile a visual summary of the dashboard's capabilities and findings.

Week 10

• Present the fully developed 3D public transport visualization dashboard at the HIVE Internship Showcase. • Submit the final report summarizing the development process, data analysis, system capabilities, and potential future enhancements.

Student Experience and Supervision:

How often will you meet with the student over the 10-week period?

Once per week

Your work desk location and the location of student desk

Possibly HIVE Staff Office: Building 201, Room 212

Student Attributes:

Please indicate any preference for student's academic discipline or field of study

Computer Science, Data Science

What competencies are required to start this project

Beginner - 2D image and/or video software (e.g. Adobe Suite, Sony Vegas)
Beginner - 3D modelling software (e.g. Blender, 3ds Max)
Beginner - Unity Programming (C# coding, animation syntax, debugging, problem-solving)
Beginner - Data structures, analytics, statistical modelling

Do you have any other student attributes you think are important to the project?

No