Bharatiya Antariksh Hackathon 2024
Problem Statement 1

Optimizing Urban Futures: Leveraging Digital Twins for Comprehensive Infrastructure Management

Focal Point/Mentor

Background

- In the modern urban landscape, effective management of traffic is crucial.

- Digital twin will enable us to create advanced simulation tools, predictive analytics, and interactive visualization for urban traffic management.

- This technology will also enable us to create various "what-if" scenarios. For instance, it will simulate the effects of traffic congestion at specific locations and predict which road networks would be impacted.


Develop a digital twin model that can simulate traffic scenarios

Objectives

- To create a highly detailed and dynamic digital twin of the urban area, that will simulate data on traffic flow.

- Use simulated data to predict the impact of traffic congestion at various points within the urban area.

- Simulate scenarios involving public service disruptions (e.g., emergency responses, utility failures) to understand their impact on traffic and overall urban mobility.

- Assess the resilience of the urban infrastructure under various stress scenarios, including peak traffic times and emergency situations.

- Create intuitive dashboards and visualization tools for easy access of simulation results and optimization recommendations.

Expected outcomes

- A highly detailed and accurate digital twin model that effectively simulates traffic congestion and public service scenarios based on the number of vehicles and other relevant data.

- Implementation of an AI model that utilizes simulated data to predict short-term and long-term traffic scenarios and forecast potential congestion points.

- Development of an intuitive and interactive user interface that allows to visualize various "what-if" scenarios.
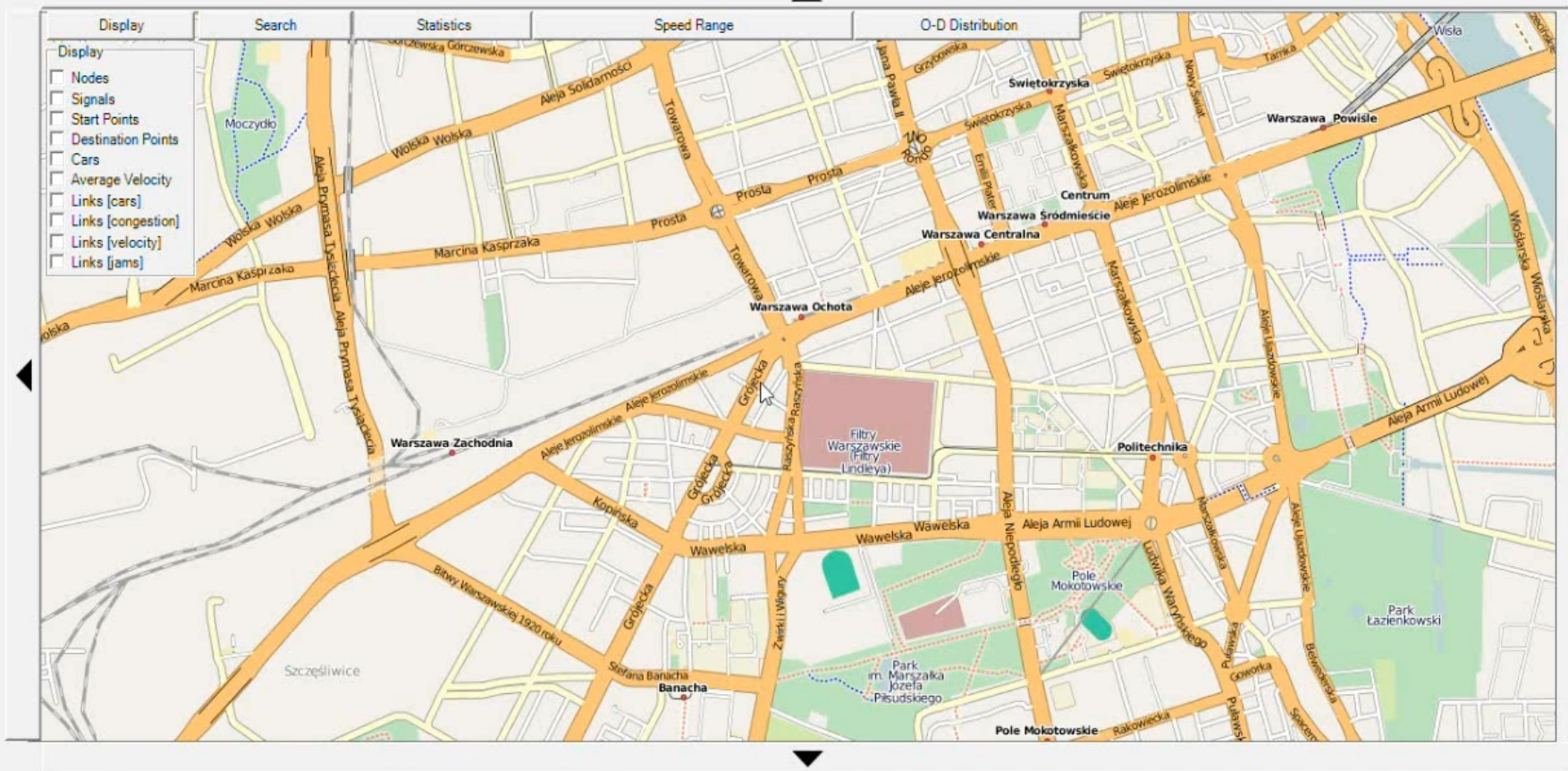
Simulate What-if scenarios
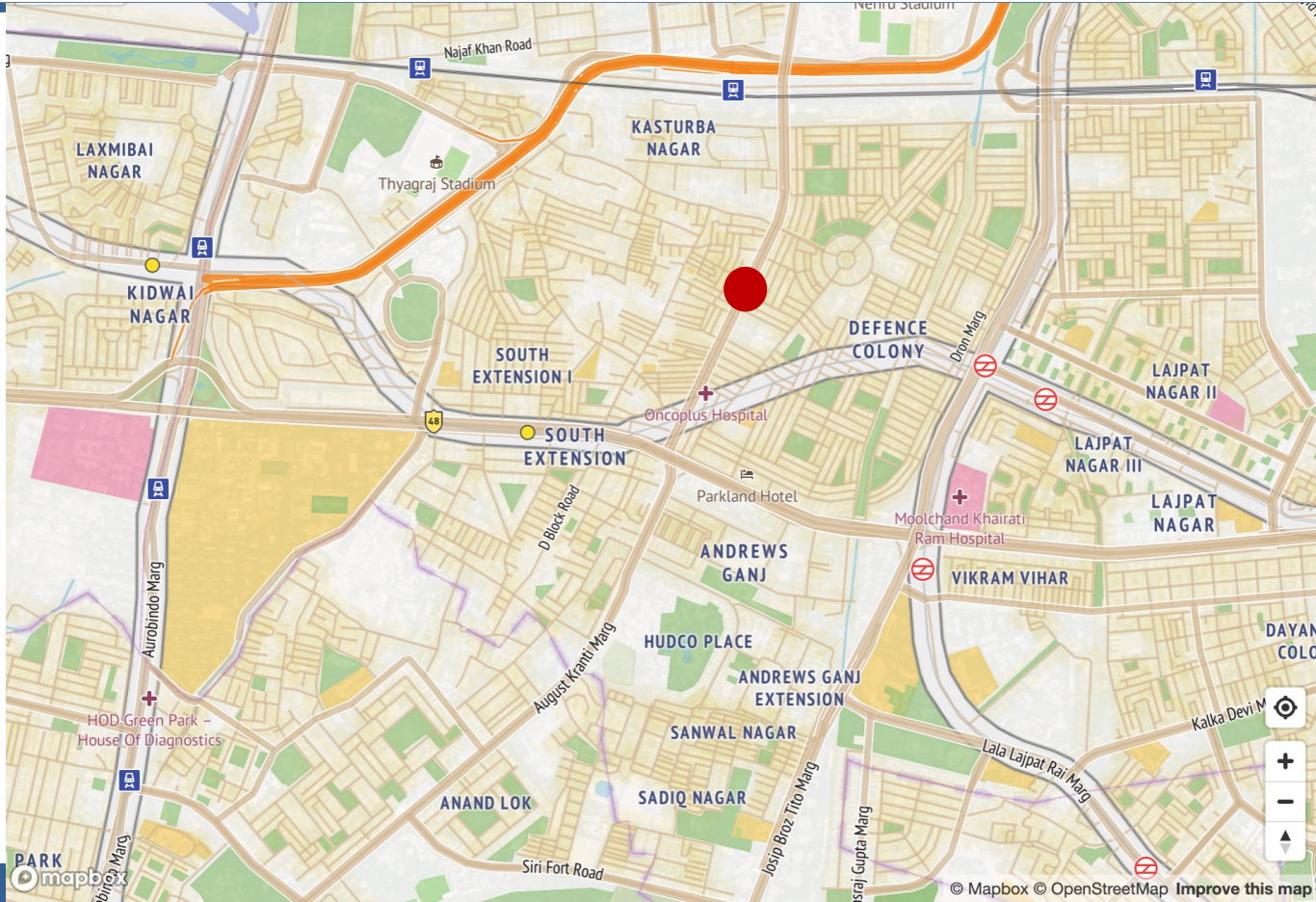
Dataset and technologies required

Dataset Required:

- Detailed road maps including all major and minor roads, intersections, roundabouts and location of traffic signals. **(OSM Data)**
- Simulated data on traffic flow (vehicle counts, speeds, and densities) for various road segments. **(Generated from objective 1)**
- GIS layers including land use, zoning, and urban features.

Suggested tools/technologies to be utilized:

- Python: For data processing, analysis, traffic simulation analysis and machine learning.
- JavaScript: For web development and creating interactive visualizations.
- Flask/Django: For building server-side APIs development.

Proposed workflow
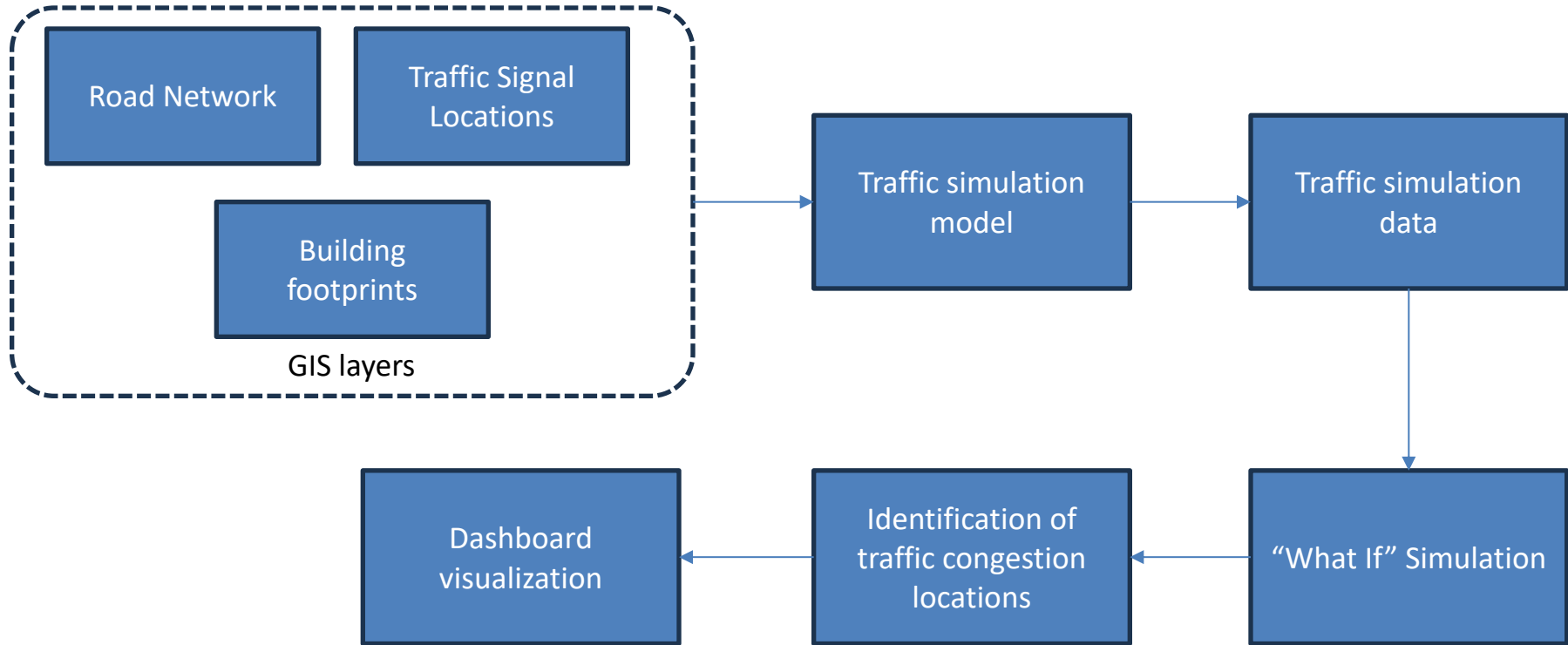
High level architecture of dashboard

❖ Participants can choose **open-source** tools and technologies.

❖ Challenge is in the processing layer where participants will have to build a robust model for simulation of traffic data

❖ The platform should work in OGC standards for interoperability.

Presentation Layer

Processing Layer

Data Layer

Evaluation Parameters

- The capability to the digital twin model analyze and visualize various "what-if" scenarios and their impacts on road networks and public services.

- Comparison of simulation and prediction results against historical traffic proxy data.

Thank you