

# CS201: Data Structures II Project Proposal

**Project Title:** Event Traffic Prediction and Optimization System

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## 1 Abstract

Traffic congestion near large events is a persistent issue that causes delays, increases fuel consumption and effects emergency response times. For example during match season in karachi when roads are purposely blocked and often times an invited polititian decides to block up a road causing a significant jam. Our system would provide a high alert signal whenever there is any sort of sudden congestion is detected to people using gps. Our project aims to develop an Event Traffic Prediction and Optimization System using interval data structures to efficeintly manage and predict traffic conditions. By analysing past and live/present data, the system will suggest optimal travel times and alternative routes, improving urban mobility and

## 2 Introduction

As large public events become more frequent, urban traffic management is efficiently becoming a major challenge for commuters. Traditional congestion estimation methods rely on fixed models that do not adapt to real time changes. This project aims to address this issue by using Interval Trees to store and query traffic congestion data efficiently and building an optimal algorithm so people could have high alert notifications when facing a traffic congestion. Unlike basic search methods, Interval Trees allow quick access to congestion data over time, making them ideal for handling continuous traffic variations throughout the day.

## 3 Objectives

The main Objectives of this project is to include:

- Implement an Interval Tree-based data structure to efficiently store and retrieve congestion data.
- Build an algorithm that predicts traffic conditions based on historical and real time data.
- Integrating the system with Google Maps API to provide real time traffic insights.
- Suggesting optimized routes for drivers to reduce travel time and congestion.
- Adding a high alert for sudden blockages

## 4 Methodology

The approach we will take to implement the project. Include:

- The primary data structure will be the **Interval Tree** to manage time-based congestion queries efficiently.

- We will implement interval based range queries to determine congestion levels within a given time frame. Additionally, we will use Dijkstra's algorithm for route optimization.
- The system will be implemented in C++. Some data processing task may require Python/NumPy/Pandas. The web API is still under consideration. Google Maps API will be integrated to fetch real time traffic data, allowing dynamic updates to congestion levels.
- Handling real-time traffic updates efficiently, integrating real time location or live GPS data and ensuring the scalability for large datasets. Although to validate our approach, we will initially focus on a smaller region to assess algorithm reliability before scaling up.

## 5 Expected Outcomes

- A fully functional event traffic prediction system that provides congestion forecasts based on real-time and historical data.
- Optimized routing recommendations to assist commuters in avoiding high-traffic areas.
- A performance comparison between Interval Trees and traditional traffic analysis methods.
- A user friendly API that integrates with navigation systems for real-time traffic monitoring.

## 6 References

Google Maps API Documentation: <https://developers.google.com/maps/documentation>