Group 16

QUISITIVE
SOLUTIONS

Project Deliverable 1 -

Requirements Analysis and Conceptual Database Design

(CMPG321)

Group Members:

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Submission date: 25/08/2023

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1. Background & Requirements Analysis

In response to the challenges of traffic congestion, road safety, and sustainability within North-West University (NWU) campuses, there's a pressing need for a data-driven approach to optimize traffic management. To address these challenges effectively, our project aims to develop a Smart Traffic Management Database System, integrating smart city technologies to enhance urban mobility, reduce congestion, and foster a more sustainable campus environment.

Objective: The primary objective is to design and implement a fully functional database system that empowers traffic management authorities with data-driven insights. By doing so, we intend to optimize transportation flow, enhance pedestrian and bicycle commuting options, and create a safer and more sustainable living environment within NWU campuses.

We acknowledge the challenges posed by traffic congestion, safety concerns, and the need for eco-friendly commuting options within NWU campuses. We propose a comprehensive Smart Traffic Management Database System to address these issues.

1. **Smart City Technologies Integration:**
    - **Traffic Signal Optimization:** Utilizing traffic lights, cameras, and sensors, we plan to implement an adaptive traffic signal system. Real-time data from these sources will enable dynamic adjustments to signal timings, aiming to optimize traffic flow and minimize congestion.
    - **Vehicle Attributes and Road Conditions:** Our system will consider vehicle speed, size, and road conditions such as potholes. This comprehensive data analysis will help us proactively address congestion sources.
2. **Parking Space Management:**
    - **Occupancy Tracking:** We will monitor parking space occupancy and predicted availability based on historical data across NWU campuses.
    - **Variable Message Signs:** Leveraging the occupancy data, we'll implement variable message signs to guide users to available parking spots, reducing traffic caused by parking searches.
3. **Entry/Exit Point Monitoring:**
    - **Congestion Analysis:** We will monitor traffic patterns at entry/exit points to identify congestion points and understand user behaviour during entry/exit – mainly campus gates.
    - **Alternate Gate Recommendations:** Real-time information will allow us to recommend less congested entry/exit gates, improving overall entry/exit efficiency.

4. **Environmental Impact and Sustainability:**
    - By reducing congestion and optimizing traffic flow, our system indirectly contributes to reduced fuel consumption and emissions, aligning with NWU's sustainability goals.
5. **Data Integration and Analysis:**
    - Data from various sources, including cameras, sensors, and user feedback, will be integrated, and analysed in real-time to make informed traffic management decisions.
6. **Usability and User Engagement:**
    - User-friendly interfaces, mobile apps, and web platforms will enable users to access real-time traffic information, receive alerts, and provide feedback, fostering community involvement.
7. **Predictive Analytics and Future Expansion:**
    - We aim to implement predictive analytics based on historical and real-time data to anticipate traffic patterns during events and peak hours.
    - The system's architecture will be designed with scalability in mind, enabling future expansion to include additional smart city features.
8. **Collaboration with Stakeholders:**
    - Regular communication with NWU stakeholders, including traffic management authorities, campus users, and IT teams, will ensure the system meets their needs.
9. **Security and Privacy Measures:**
    - We will prioritize data security and privacy, implementing robust measures to safeguard sensitive information and comply with data protection regulations.

2. Business Rules

Business rules:

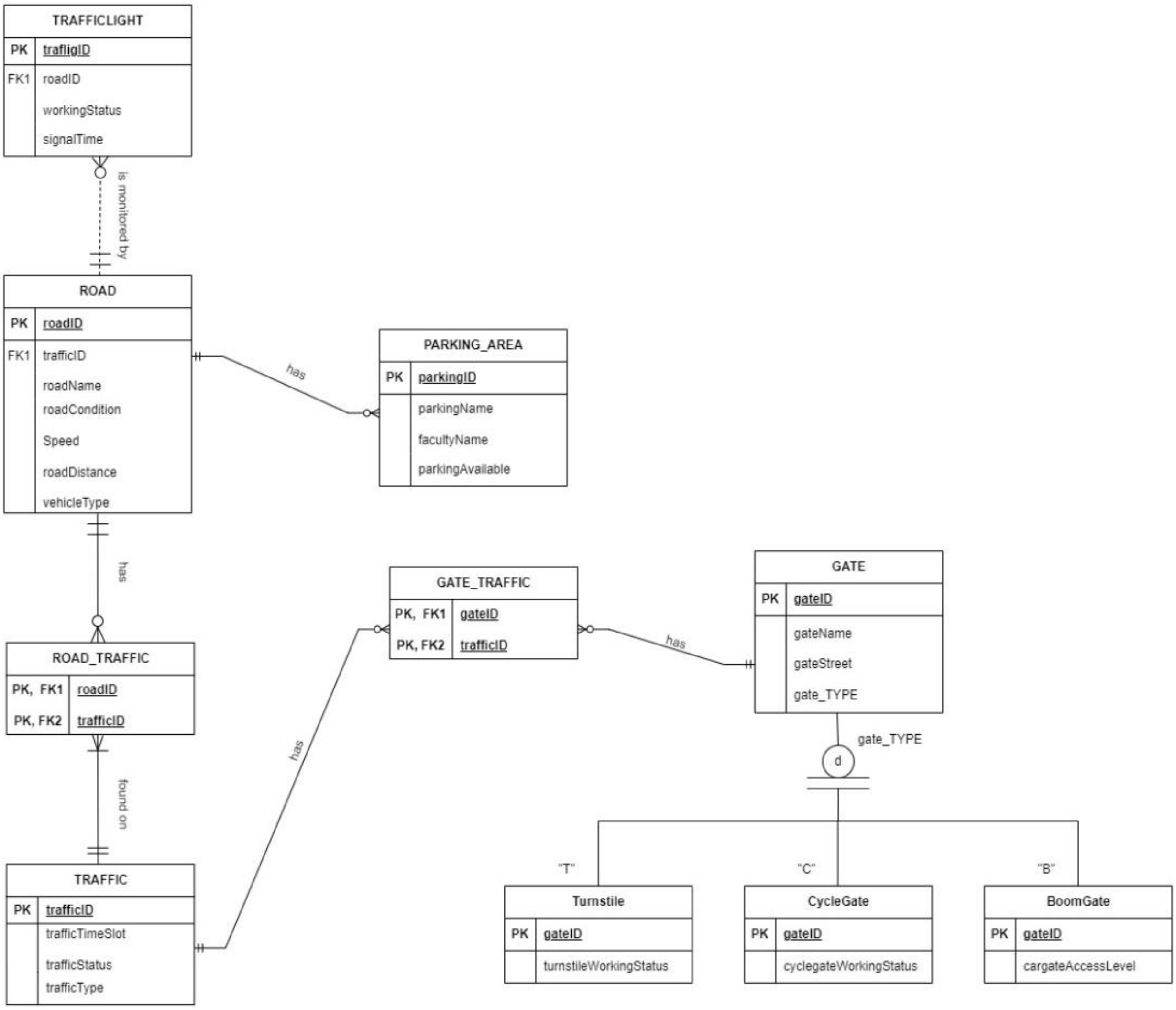
- A traffic light monitors one and only one road/street. A road/street is monitored by zero or more traffic light.
- A road can have zero or many vehicles (traffic). A vehicle (traffic) is found on one and only one road.
- A road has zero or more parking areas. Zero to many parking areas belong to one road.
- A gate has zero or more traffic. A traffic is associated with one or more gate.
- A gate has three types: boom gate, cyclist gate, or turnstile.

Assumptions:

- We assume that the North West University allows for traffic monitoring with already set up technologies.
- We assume that parking areas are accessed from a main entrance connecting to a single road.
- We also assume that cameras and/or other technologies are able to count the number of parking spaces that are available and drive number of parking spots left

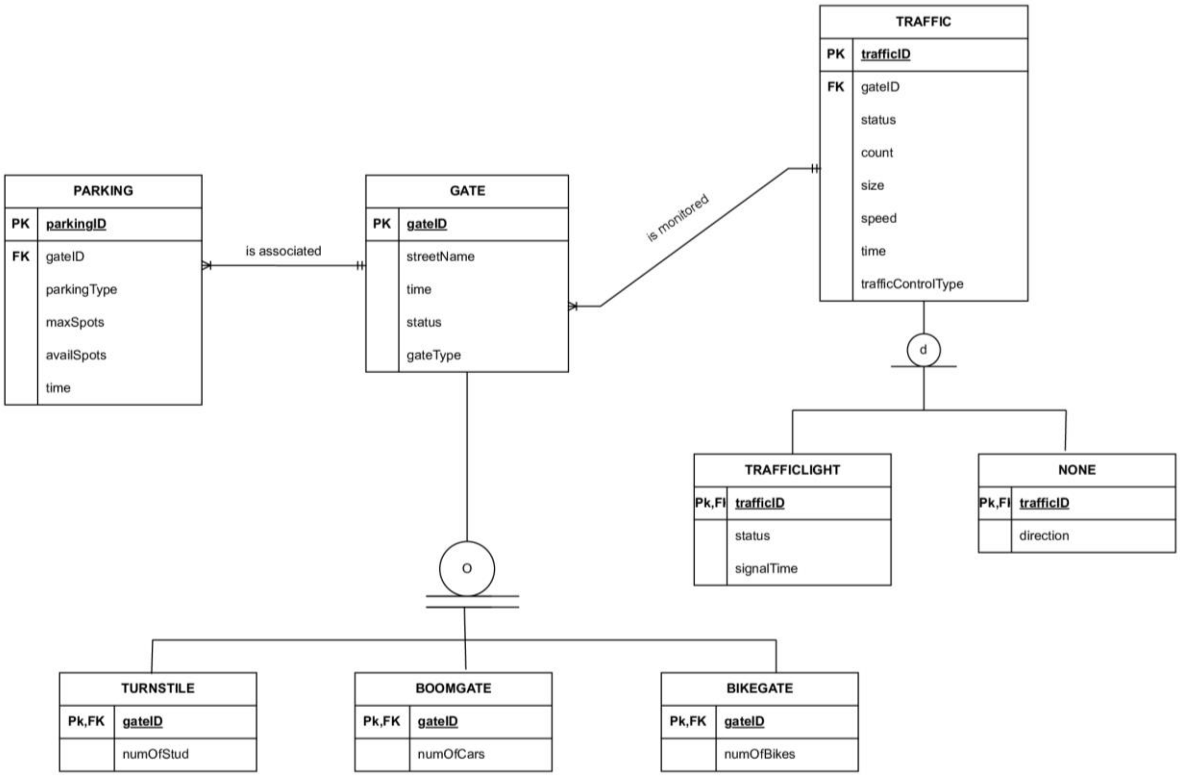
Our business rules are derived from Google Earth, Google Maps, and The internet, more specifically the TomTom website which also has a traffic management component (TomTom GPS Sat Nav - Traffic Alerts, Maps & Apps).

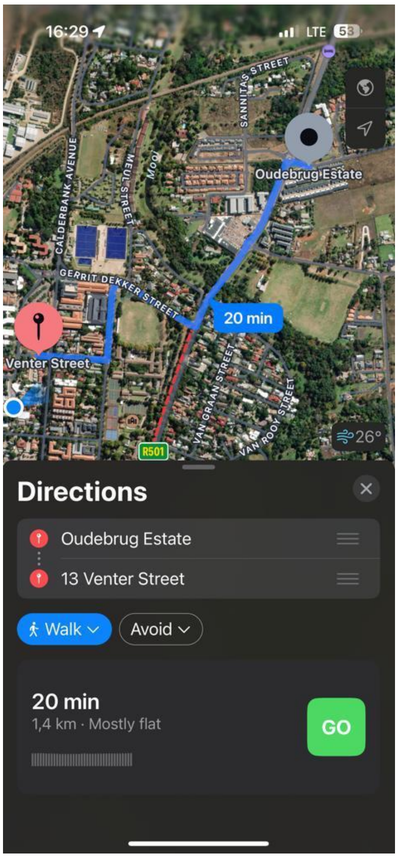
3. GROUP CONCEPTUAL DESIGN



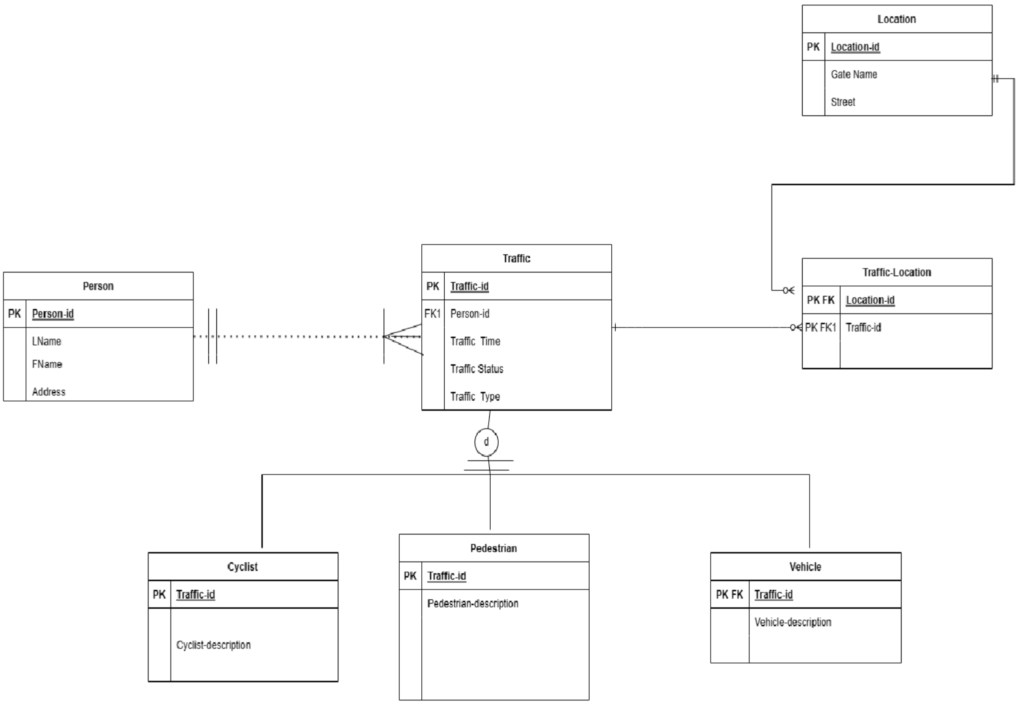
4. Members' Conceptual Designs

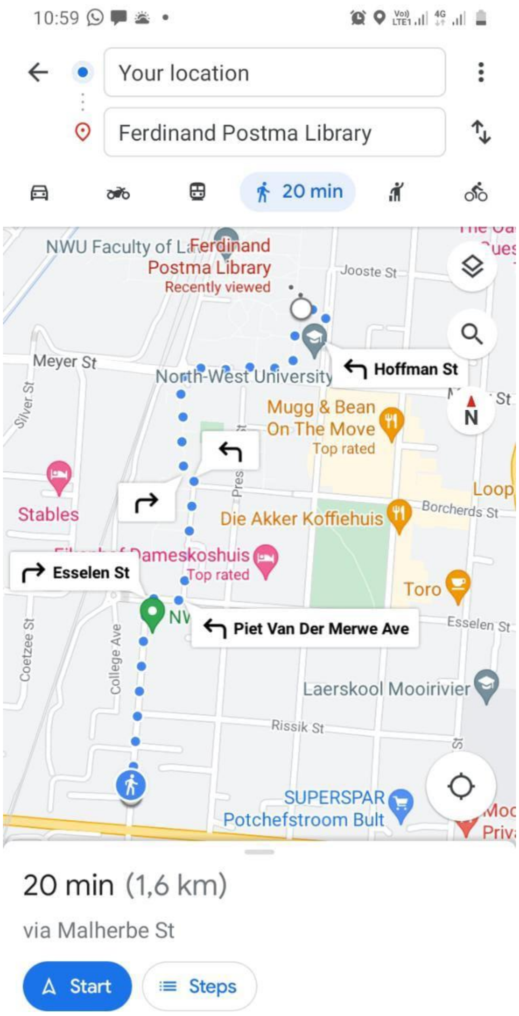
4.1 R Mmutlwane (36787426)



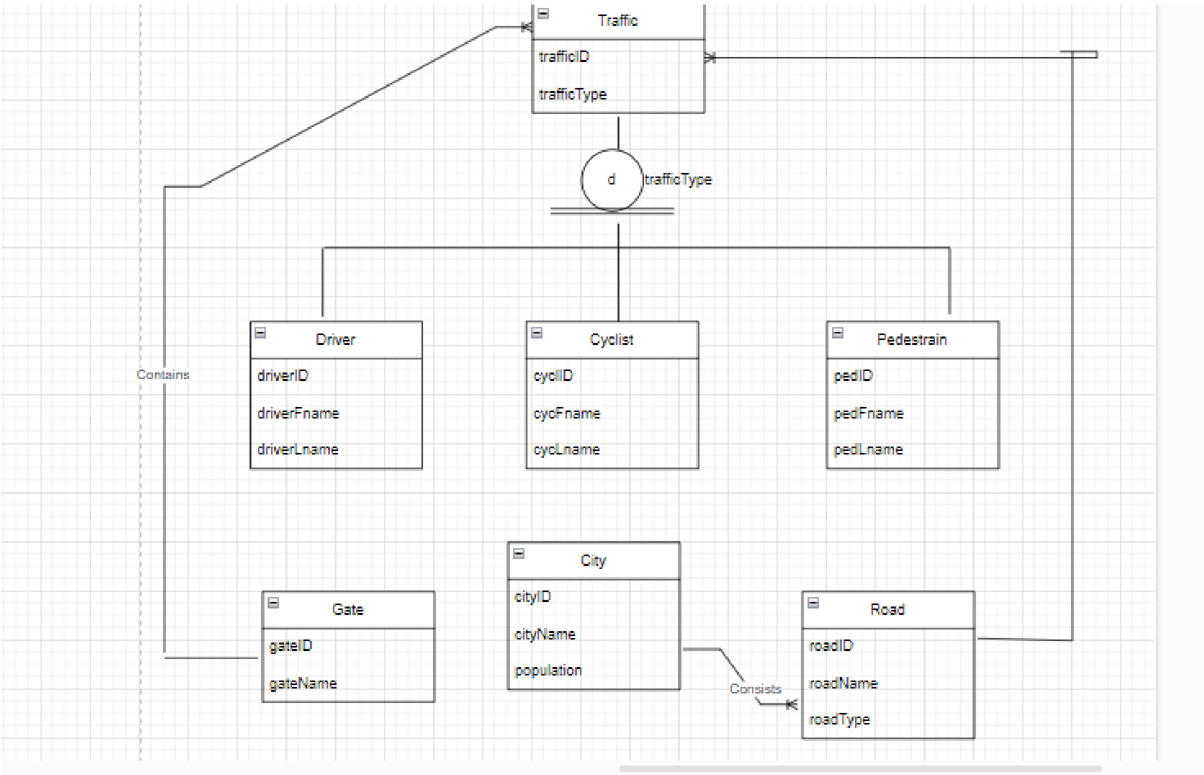


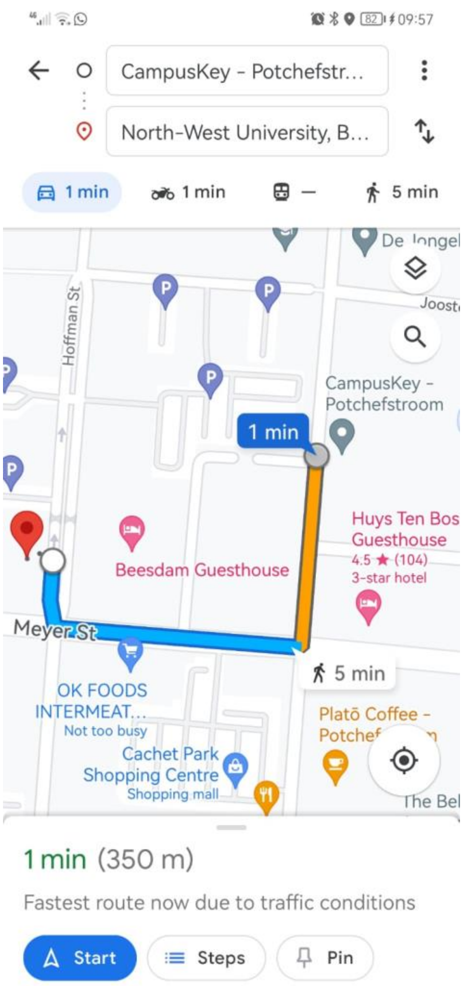
4.2 C.M NGOKANA (31846769)



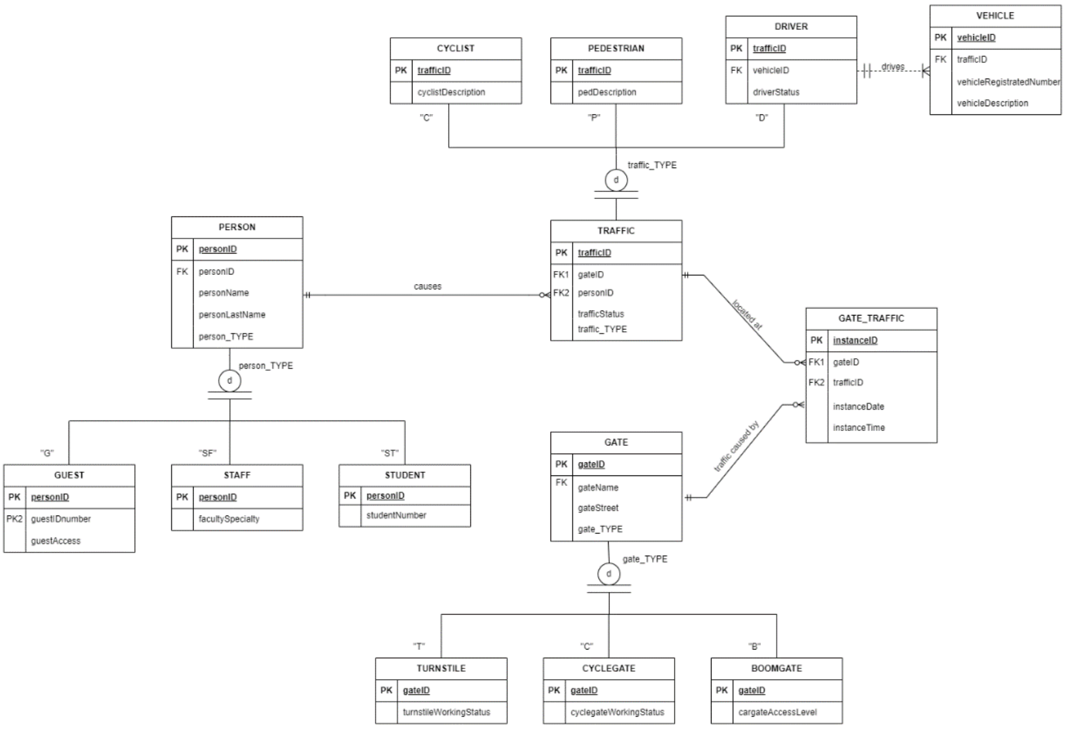


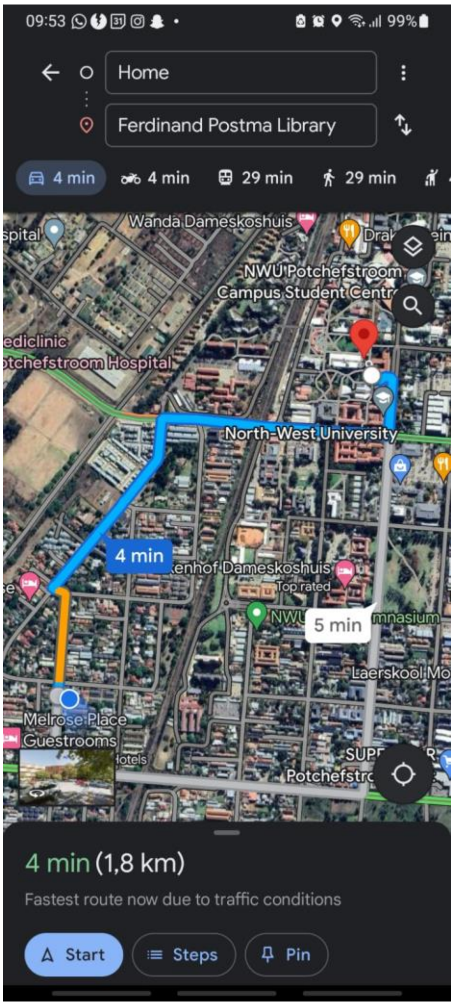
4.3 P.J THWALA (31889689)



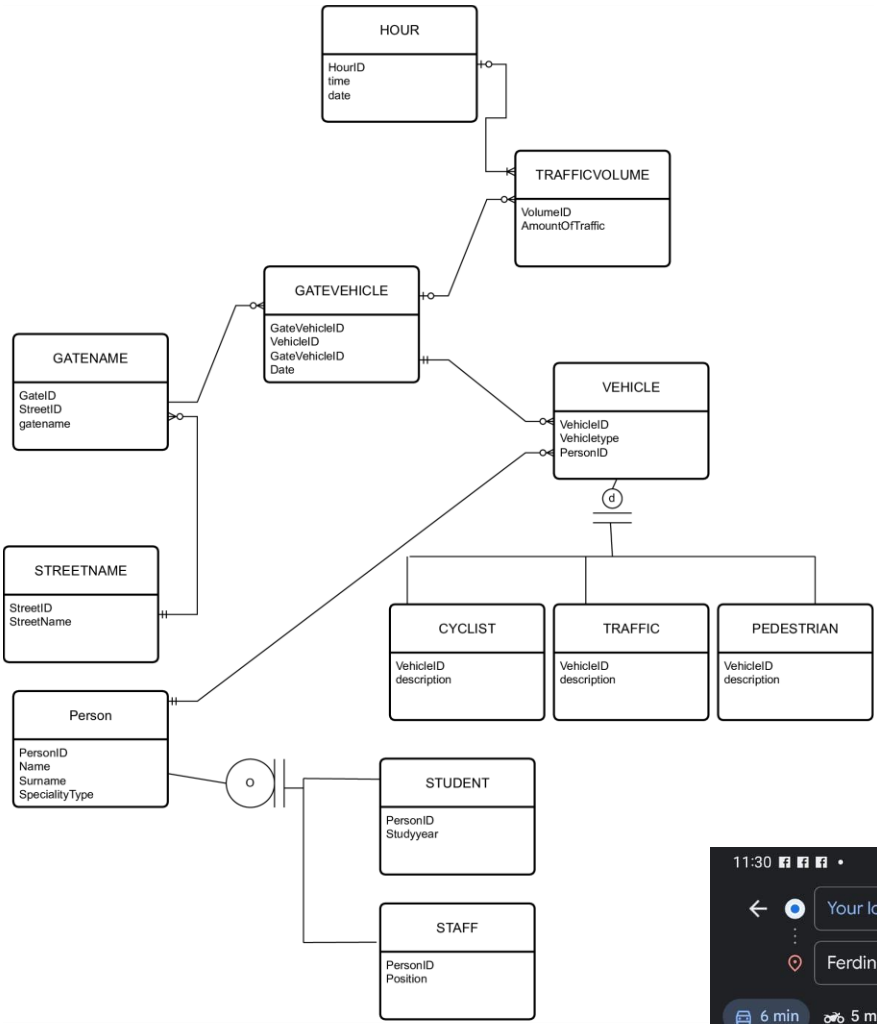


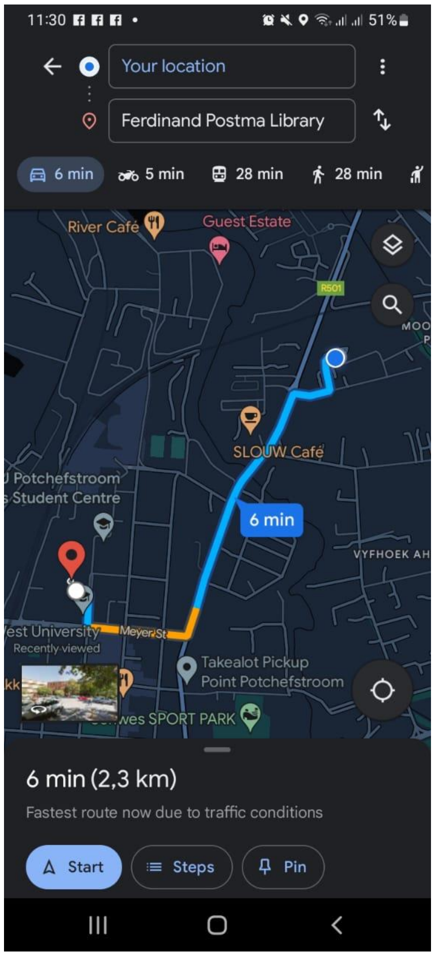
4.4 R van der Walt (30056136)





4.5 E SHURO (37324519)





4.6 JK NTLHANE (32021119)