Group PRL2: AI-driven Traffic Management Sprint One Report

Introduction

Effective traffic management is crucial in reducing urban congestion and improving transportation efficiency. This project aims to develop an AI-driven traffic management application that simulates various traffic scenarios at signalized intersections. By leveraging machine learning and optimization techniques, the application will dynamically adjust traffic light changes to reduce vehicle waiting times and overall congestion. This approach not only enhances traffic flow but also contributes to a more efficient and sustainable urban transport system.

To ensure an iterative and collaborative approach, we adopted the Agile process, specifically utilizing the Scrum framework. Through regular sprints and sprint retrospectives, we will be able to continuously refine the application's features, respond to challenges promptly, and incorporate stakeholder feedback throughout the development cycle. This methodology allows for flexibility and ensures the project remains aligned with its goals of optimizing traffic flow in various simulated scenarios.

Initial meeting

The group met with Brenden Taylor from Praelexis in Stellenbosch Techno Park. Various topics surrounding the application were discussed which are summarized below.

Goal: The primary goal of this project is to simulate and optimize traffic flow at traffic lights to reduce congestion. This involves creating a simulation of various traffic scenarios at signalized intersections and implementing strategies to optimize the traffic light changes.

Objectives:

- Develop a simulation model for traffic flow and intersections.

- Optimize traffic light timings to reduce vehicle waiting times
- Use AI to optimize traffic management.

Approach:

- **Real-Time Management Concept:** Develop a traffic simulator to test and optimize traffic lights without the need for real-time data collection.
- **Simulator development:**
  - **Sprint 1:** The first sprint will involve creating a basic simulator that models traffic flow at one intersection. The simulator will be a static setup.
  - **Sprint 2:** Implement basic optimization strategies based on simulation.
  - **Sprint 3:** Improve the simulator by adding different and more complex scenarios.

Technical considerations:

- **Communication tools:** Slack will be used for team communication.

Deliverables

- **Basic traffic simulator:** A functional simulator for traffic at intersections with static parameters.
- **Optimization strategies:** Test strategies to improve the flow of traffic.

Timeline:

- **Sprint 1:** Development of the basic simulator.
- **Sprint 2:** Implementation of optimization strategies.
- **Sprint 3:** Enhancement of the simulator with additional scenarios and features.

Roles

Product Owner(Brenden Taylor from Praelexis):

- The product owner was responsible for defining the features of the product. Some of the features that were communicated for the first sprint were a basic simulation with traffic light changes, one intersection and cars going through the intersection. The product owner set up a slack group for communication. The product owner highlighted the need to use tools to keep track of the development.

Scrum Master

- The scrum master was William Marais. He oversaw the management of the project. He provided the descriptions and execution of the functionality of the application for sprint one. He made sure that the team was kept on track.

Team

- The team was made up of various roles which are discussed below.
  - → Backend: William, Nicole and Brad were responsible for developing the backend of the application. William designed and coded all the logic for the simulation. Brad implemented the collision detection for the cars and Nicole coded the logic for the traffic lights. William was responsible for integrating all these features.
  - → Frontend: William and Nicholas were responsible for developing the frontend. Nic was tasked with developing a python frontend that will be used in future sprints. William designed and implemented the frontend. He also made sure that the back and frontend were integrated.
  - → Minutes and Report: William, Brad and Maggy were responsible for taking the minutes of the meetings and compiling the report.

Project Management

- The product backlog was created once all the features were realized. Gitlab boards were used to keep track of the product backlogs.
- For the sprint backlog some of the key features included was the intersection board, traffic lights, cars and a chart that plots the average wait time of the cars in real time.

Sprint one

For sprint one the team decided how to go about designing the simulation. Various ideas were brought forward. The decision was taken to have a Java backend with a python frontend. After the decision was made on how to proceed, two weeks later there was a change in what was planned. It was decided that Java would be used for both the frontend and the backend. In future, planning will be better handled as to avoid any major changes during sprints. Weekly group meetings were held to assess the progress of the group members. The frequency of the meetings should increase in future sprints.

Deliverables

The team achieved a basic traffic simulation for sprint one. The back and frontend were designed and built with Java and Swing. The frontend and the backend were well integrated to achieve a smooth simulation. All the features discussed with the product owner were implemented which included a 4-way intersection, changing traffic lights and cars present in all the lanes.

Conclusion

The AI-driven Traffic Management project will build a system to simulate and improve traffic flow at traffic lights. The goal is to create a working simulator and use smart optimization methods to reduce traffic jams and make driving more efficient.