Daniel Tweneboah ANYIMADU[1], Taofik Ahmed SULEIMAN[1]

Joint Master Student in Medical Imaging, and Applications
Université De Bourgogne, Universitat de Girona, and
Università degli studi di Cassino e del Lazio Meridionale
Software Engineering Report
Supervised by **Elvire HOUSSOU**

A CONCISE REPORT ON THE TRAFFIC INTERSECTION SIMULATION PROJECT

ABSTRACT: This study aims to simulate vehicle movement across a traffic intersection with traffic signals and timers for both vehicles and pedestrians. The intersection has four traffic lanes, each regulated by traffic signals with timers that show how much time the signal changes. The vehicles in the simulation include cars, bikes, buses, and trucks, and their movement is governed by the traffic signals as well as the other vehicles present on the road. The goal of the simulation is to accurately depict the flow of traffic at a real-life intersection and to allow users to observe and analyse the behaviour of vehicles under different traffic conditions including detecting violations by vehicles and pedestrians. The Pygame platform was utilized to simulate the project because it provides a visually appealing and interactive experience, allowing users to manipulate variables such as the duration of green signals or the frequency of vehicle generation. Through this simulation, we hope to provide a useful tool for understanding traffic patterns and potentially aiding in the optimization of traffic flow.

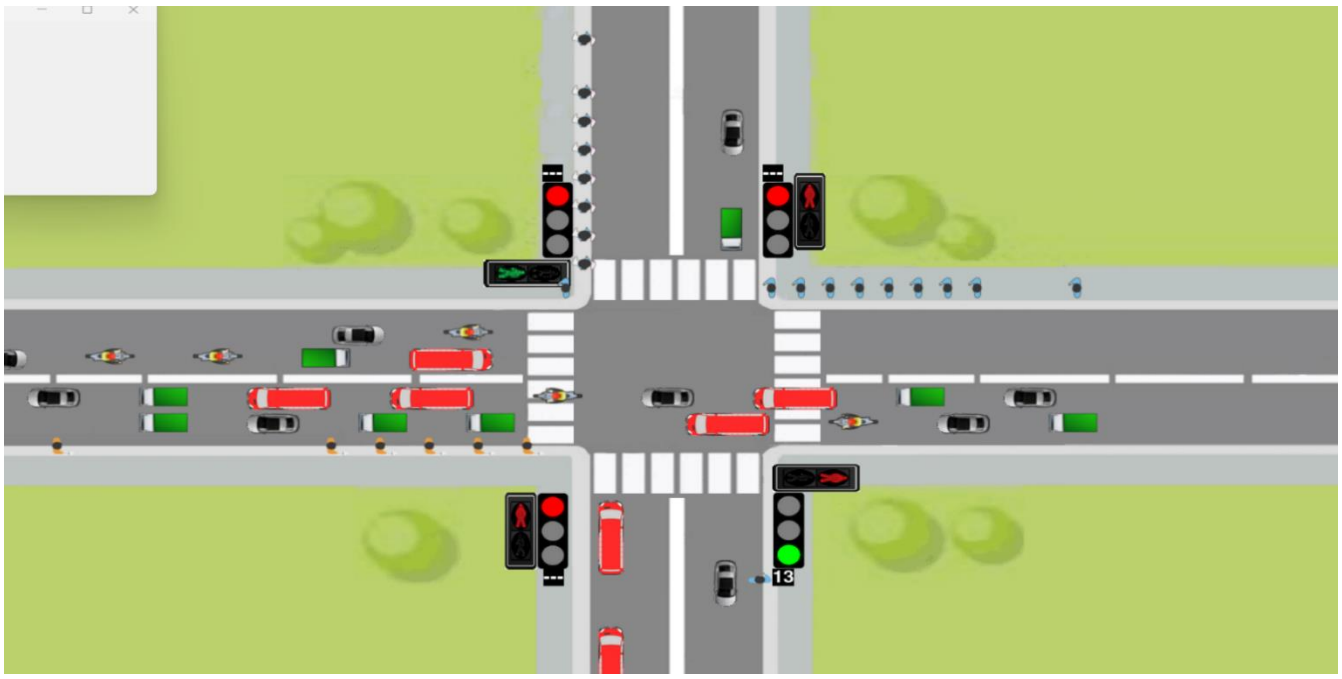

Figure 1: Image abstract of the project

Keywords: *Traffic Intersection Simulation; Pygame; Python*, Pedestrians, and Vehicles

1.0 INTRODUCTION

Traffic simulations have become increasingly important in recent years as cities around the world continue to grow and become more congested. By simulating different scenarios and traffic patterns, transportation planners and engineers can better understand how to optimize traffic flow and improve safety for all road users. Our traffic simulation, developed using Pygame, is designed to simulate the movement of vehicles across a 4-way traffic intersection with traffic signals controlling the flow of traffic in each direction. Each signal has a timer on top of it, which shows the time remaining for the signal to switch from green to yellow, yellow to red, or red to green. This allows us to accurately model the real-world behaviour of traffic signals and the way in which they regulate the flow of traffic.

In our simulation, a variety of different vehicles are generated, including cars, bikes, buses, and trucks. These vehicles are controlled according to the signals and the vehicles around them, with each vehicle having its own unique characteristics and behaviours. For example, a bike may be more agile and able to weave through traffic more easily than a truck, while a bus may have to wait longer to make a turn due to its larger size. One of the key features of our traffic simulation is the ability to adjust various parameters and settings to test different scenarios and see how they impact traffic flow. For example, we can change the timing of the traffic signals, the number, and types of vehicles on the road, or the size and layout of the intersection itself. This allows us to see how different variables can affect traffic patterns and identify any bottlenecks or areas of congestion.

Overall, our traffic simulation is a powerful tool for understanding and improving traffic flow in busy intersections. By accurately modelling the behaviour of vehicles and traffic signals, we can better understand how to optimize traffic flow and improve safety for all road users. Whether you are a transportation planner, an engineer, or simply someone who is interested in how traffic works, our simulation is sure to provide an engaging and educational experience.

2.0 METHODOLOGY

To develop a simulation using Pygame to simulate the movement of vehicles and pedestrians across traffic intersections with traffic lights and a timer, the following methodology was implemented:

2.1 Traffic intersection design:

The layout of the traffic intersection was designed, including the four roads that intersect at the traffic lights and the positions of the traffic lights in each direction using photoshop with dimensions of 1400x800px. A timer is also included on top of each traffic light, which shows the time remaining for the signal to switch. Figure 2: shows the design of the four-way intersection

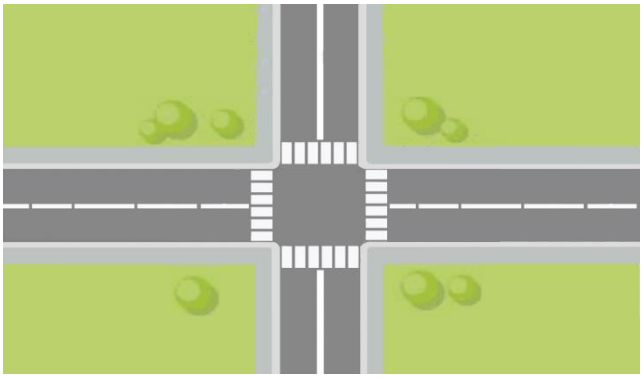

Figure 2: shows the design of the four-way intersection

2.2 Creation of vehicle objects:

Next, the vehicle objects that were used in the simulation were created. These included cars, bikes, buses, and trucks. We defined the attributes of each vehicle, such as its speed, and we also defined the movement patterns for each type of vehicle. Figure 3 shows the images used to generate the vehicles.

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2.3 Implementation of the traffic signals:

The traffic signals that control the flow of traffic at the intersection were then implemented. Each traffic light has a timer that counts down from green to yellow to red, and then back to green. We also defined the rules for how vehicles should behave when approaching a traffic light, such as stopping at red lights or proceeding with caution at yellow lights. Figure 4 shows the images used to generate the traffic signals.

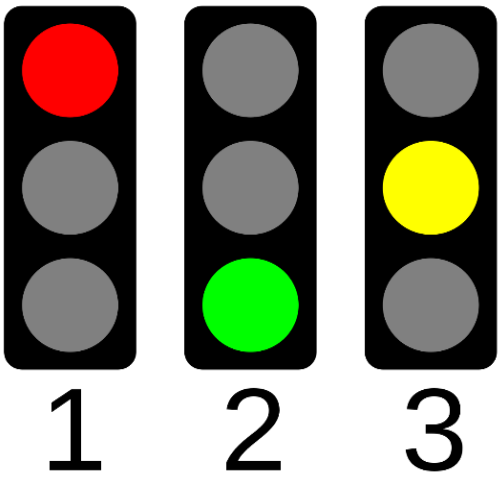

Figure 4 shows the images used to generate the traffic signals.

2.4 Creation of pedestrian objects:

Pedestrian objects used in the simulation were created as well. These include three different pedestrians who move in different directions. Figure 5 shows the images used to generate the pedestrians.

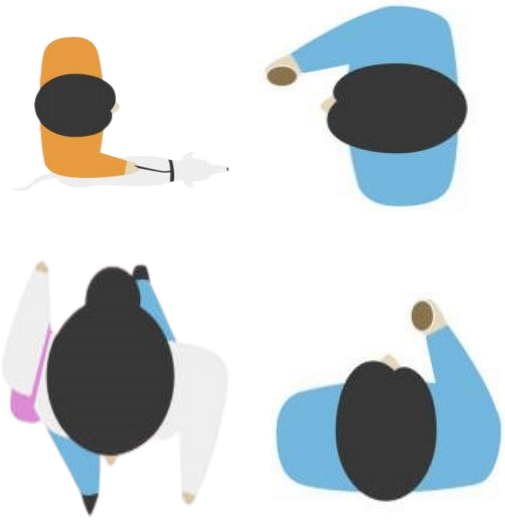

Figure 5 shows the images used to generate the pedestrians

2.5 Writing the simulation code:

Once we have designed the intersection and created the vehicle and traffic signal objects, we write the code that controls the simulation. This included creating a vehicle and pedestrian class with the move function that consist of a loop that updates the position of each vehicle on the screen and checks for violations, as well as updating the traffic signals and timers.

2.6 Testing the simulation:

The simulation was thoroughly tested to ensure that it is functioning as intended. This involved running the simulation with different combinations of vehicles and traffic signals to ensure that the vehicles are behaving correctly, and the traffic signals are switching at the appropriate times.

2.7 Debug and refine the simulation:

Any issues or bugs encountered during the testing, were debugged and all necessary adjustments were made to the code.

Overall, the above methodology allowed us to develop a comprehensive simulation of a traffic intersection using Pygame, complete with traffic lights and a timer to control the flow of traffic. By designing and testing the simulation carefully, we created a realistic and engaging experience that users can interact with.

3.0 RESULTS AND DISCUSSIONS

The simulation we developed using Pygame was able to successfully simulate the movement of vehicles, and pedestrians across a traffic intersection with traffic lights and timers. The intersection had four directions of traffic, and each direction had a traffic signal with a timer on top of it. The timers displayed the time remaining for the signal to switch from green to yellow, yellow to red, or red to green.

During the simulation, we generated various vehicles such as cars, bikes, buses, and trucks, and their movement was controlled according to the signals and the vehicles around them. We observed that the vehicles followed the traffic signals and slowed down or stopped when the signal turned red or yellow. They also avoided violations with other vehicles and took turns at the intersection according to the signal.

We also noticed that the timers on the traffic signals played a crucial role in controlling the flow of traffic at the intersection. The timers helped the drivers to anticipate the signal change and adjust their speed accordingly. This, in turn, helped to prevent accidents and improve the overall efficiency of the intersection.

Overall, the simulation was successful in simulating the movement of vehicles and pedestrians at a traffic intersection with traffic lights and timers. It was able to accurately depict the behaviour of vehicles according to the signals and the vehicles around them. The timers on the traffic signals played a crucial role in controlling the flow of traffic, and the simulation was able to demonstrate the importance of these timers in maintaining the safety and efficiency of the intersection.

However, there are a few limitations to our simulation when compared to real-life scenarios. For instance, it does not consider the effects of weather or road conditions on the movement of vehicles. This factor for example may have an impact on the flow of traffic in real life and is worthy of future consideration.

Despite these limitations, the simulation provides a useful tool for understanding the movement of vehicles at a traffic intersection with traffic lights and timers. It can be used by traffic engineers and planners to study the effects of various traffic control measures on the flow of traffic and to identify potential bottlenecks or areas for improvement. It can also be used by drivers to improve their understanding of traffic signals and to develop safe driving habits.

4.0 CONCLUSION

In conclusion, the simulation we developed using Pygame was able to successfully simulate the movement of vehicles, and pedestrians across a traffic intersection with traffic lights and timers. It demonstrated the importance of traffic signals and timers in controlling the flow of traffic and preventing accidents by detecting vehicle or pedestrian violations. The simulation provides a useful tool for understanding the movement of vehicles at a traffic intersection and can be used by traffic engineers, planners, and drivers to improve the safety and efficiency of traffic flow.