Part V: Calculus II Final Project

Team Members:

Mustafa Shafique Shadman - Major: Computer Science (Software Engineering Track), Minor in Mathematics

Miriam Shamsiev - Major: B.S./M.S. Computer Science (Software Engineering Track), Minor in Graphic Design

Amber Jiang - Major: Statistics and Interdisciplinary Study (Statistics, Economics, Sociology)

Rian Fernando - Major: Computer Science (Software Engineering Track)

Sharar Ashraf - Major: Computer Science (Graphics Programming Track)

Everything we learned in Parts 1 to 4 helped lead us to our project on traffic and urban mobility. We talked about the roots of Calculus II such as integration and rates of change in Part 1. The origins of Calculus II shaped the world as we know it today to better understand world problems such as figuring out traffic pattern behavior. Many mathematicians such as Newton, Leibniz and Riemann showed us that integrals measure how things add up over time which is interconnected with our project. Our project uses integration to show us that traffic flow and congestion on busy roads and highways. Part 2 connects our project to mathematical modelling. Part 2 taught us to pick important variables and make reasonable assumptions and to treat mathematics like an actual language rather than solving numerical problems on the board. Our team selected a busy and congested highway of the area, determined flow rate by the number of cars travelled per minute and using integrals to find out how much traffic builds up over time. Part 2 helped us better understand that our project is an algebraic and statistical model because we used real traffic data and integrals to estimate total congestion.

We emphasized social justice in Part 3 for which our project became much clearer. We talked about how mathematics is biased and models expose how systems distribute resources unfairly. It shows us that most data is hidden even if we look into it in detail. When we applied this idea into the project, we realized that our project isn't just based on numbers. Traffic comes from the decisions the city makes such as building of roads, making separate roads for public transport and which areas get money and support. By looking at how traffic congestion builds up in particular cities, our models highlight inequalities such as longer commute times and high exposure to pollution which affect overlooked communities. Part 4 discussed data collections and ethical usage of AI. Since traffic data comes from automated software, we need to be sure if the data is accurate. We also have to be mindful of not stereotyping certain areas and neighborhoods.

Keeping fair data and checking on it ensures fair urban planning rather than supporting policies which affect people.

Our project is strongly connected to environmental justice and economic inequality. Traffic congested roads are often placed in areas with little to no resources and zero political power. These areas deal with higher traffic time, air and noise pollution from the cars. Low income families, immigrants and poor neighborhoods end up being affected the most. Traffic also causes health issues such as asthma which is caused from poor air quality. Mostly older people and children are affected by this. This issue is important because transportation should help everyone to travel around safely and not make life harder for certain communities.

Mathematical modelling helps us reveal these inequalities where congestion mostly builds up and where traffic is the most occurring. Using data such as the number of vehicles passing per minute helps us compare traffic congestion of different areas and notice issues that we might have overlooked. We can see which neighborhoods are suffering the most just by adding up the total traffic or total time that the people are stuck. This will allow the city to make better decisions such as improving buses, fixing roads along with reducing pollution rates. In this way, math can help us plan fair and urban traffic planning.

This project helped us realize that mathematics is not just only about numbers but also it helps us understand real life situations that affect people. By using integrals and rates of change, we were able to see how unfair situations are built in particular areas. Some areas deal with more traffic, higher pollution and longer travel times and the calculations make them visible. Mathematics allows us to measure these issues and come up with better solutions. Overall, this project helped us see that mathematical modelling can support fair urban planning and improve daily lives for communities which are overlooked.