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ECE399

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**Final Project**

**Overview**

I worked on the Eco driving project this semester. Eco driving is a driving behavior that is created for a goal to reduce energy consumption. Eco driving is useful because it is beneficial for the environment (fuel saving, less emissions) and can even save some money with less fuel consumption. The problem with normal human driving behavior is that when humans drive vehicles in traffic light situations, they make unnecessary stops and goes which lower energy efficiency. What if we use automated driving and other technologies to prevent those unnecessary stops and increase energy efficiency? This was the question that we wanted to get out of the project.

**Experiment Procedure**

For the experiment, we had two traffic lights that were put apart from each other and made the vehicle pass them. We had two different traffic light timing plans: Synthetic and Peachtree. Synthetic plan had 3 scenarios in it. The scenarios differed from one another either by timing offset of two traffic lights, or different vehicle entry time. Peachtree plan was chosen from a real-life traffic light data and also had 3 scenarios. Unfortunately, we could only test 2 scenarios for Peachtree because of the weather. We drove through the traffic light situation with three different driving methods (HV, ACC, CAV) and collected log data. HV stands for human driven vehicle, and it was the default driving method where the human stops when red light and accelerate when green light. ACC is a human driven vehicle but with the assistance of adaptive cruise control. CAV stands for Connected and Automated Vehicles and was the driving method where automated driving controls the speed of the vehicle to minimize stops between traffic lights. We ran through all the timing plans and scenarios in them and collected log data **A screenshot of a computer

Description automatically generated**which collected three things: Mass Air Flow, SOC (Battery State of Charge), and Speed.

The log file looked like the picture shown at the right side and needed to be post processed to do data acquisition.

**Post Processing**

To do data acquisition, firstly I needed to do some filtering and format exchange. I decided to change this .trc file into csv file so I wrote a C code that will do exactly that. The code will be in the GitHub repository that will be linked at the end of this document for detail. Then, I thought of a way to combine battery energy consumption and engine fuel consumption. I did this by converting every energy consumption into Joules. There will be more description of the methodology in the code inside the GitHub repository.

**Insight**

I compared data for the Peachtree plan and the result were following:

ACC Scenario 1: Total Energy = 220660.3 kJ

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CAV Scenario 1: Total Energy = 208283.4 kJ

A graph showing a line

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HV Scenario 1: Total Energy = 275228.2 kJ

A graph with red lines

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ACC Scenario 3: Total Energy = 389015.9 kJ

A graph with orange lines

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CAV Scenario 3: Total Energy = 177669.8 kJ

A graph with a line going up

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HV Scenario 3: Total Energy = 296110 kJ

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As the result shows, for Scenario1, CAV were the most energy efficient followed by ACC and HV. For Scenario 3, CAV were the most energy efficient followed by HV and ACC.

This can conclude that in the Peachtree traffic plan, CAV is the most energy efficient while CAV and HV are less energy efficient. This result can tell us that CAV can be utilized in eco driving.

**Deliverable**

GitHub Repository: