Smart Traffic Light
Ronald Tudorache, Amr Ramadan, Aaron Christie, Dheepthi Sundararajan
{rjt135, aar179, asc179, ds1259}@scarletmail.rutgers.edu
Advisor: Prof. Caggiano

Goal

- Create a system that would dynamically change green light times based on the traffic density of cars waiting at a red light.
- Create sensors that would detect vehicles that are various distances from the head of the intersection (mainly inductive loops and IR sensors).
- Improve upon current vehicle detection methods that are currently used in traffic detection systems.

Motivations and Objectives

Motivations

- Reduce the number of cars waiting at an intersection with an emphasis moving the most amount as cars as possible.
- Many intersections detection systems focus on simple vehicle detection rather than traffic density.

Objectives

- Creating an IR sensor and inductive loop sensor that can detect vehicles waiting at a traffic light.
- Compare the functionality, effectiveness, and cost between the two different sensors.

Research Challenges

- Creating a customized inductor that is sensitive enough to detect a car as well as selective in order to detect a car in a small portion of the road.
- Deciding how to detect if an object is present in the loop (the traditional method is to detect a frequency change in the oscillations).
- Detecting our model cars for our small scale model since there is not enough metal to disrupt the magnetic field of the inductor.

Acknowledgements

We would like to thank our advisor Michael Caggiano as well as Kevin Wine for supplying us with all of the components needed.

Methodology

- Build an oscillator that has a frequency of

\[ f = \frac{1}{2\pi \sqrt{LC}} \]

- Instead of using the Arduino to measure a frequency change, we constructed a circuit that would detect an amplitude change, which follows as a result of a frequency change.

- Construct an IR sensor and loop detection circuit that send a Logic High when a car is sensed.

- Interface the sensors with the Arduino to change green light time to 5 seconds for normal traffic, 10 for medium, and 20 for extreme density.

Results

- Final coil design of 50 turns around an 8.7 cm around a cardboard core with a length of 7.6 cm and 1 mm wire. The resulting inductance 374 µH.

\[ L = \left( \mu_0 A \times 1.26 \times 10^{-6} \right) / l \]

- The IR sensors and inductive loop sense cars fairly well and sends digital signals to the Arduino, which makes coding much simpler than other methods.

- The Arduino recognizes the digital signals and changes the green light time according to the truth table above.

- IR sensors are cheap, detect vehicles easily, easier to implement, but are susceptible to damage, and can be hindered by weather.

- Inductive loops can be hidden in the road, less susceptible to damage, weather does not affect it, but is costlier, and slightly harder to implement.

- We have constructed a small scale 4-way intersection that has all of the sensors installed.

References