

The Simulation of Traffic Patterns and the Optimization of Traffic Lights

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Abstract

Traffic lights are essential to the daily traffic patterns on major roads and highways today. A single traffic light operation could delay or advance your progress by up to several minutes. However, many people feel that traffic lights aren't operated efficiently. My project is to find a useful algorithm for the operation of traffic lights to advance all drivers as quickly and efficiently as possible. This simulation or modeling program will take into account the number of cars on the road and the situation and number of cars waiting to advance in the opposite direction.

1 Introduction

1.1 Purpose

The purpose of this project is to model a simple two road traffic light. I used a program called NetLogo. Although I based the design and user interface off of an existing NetLogo model I created my own model from scratch and implemented some new features of my own. The model allows the user to manually switch the traffic lights or to have them switch automatically. Automatic switches come in to variations. The first is based just off of time and the light switches in equal intervals. The second automatic switch switches based on the conditions of the road. With three different methods of switching the lights, the user can find out which method is best for which conditions. Perhaps in balanced traffic going both east/west and north/south, a timed

switch is best. But in other situations, a manual or situational switch is better. The end result of the project should be able to model and graph actual results to display physically the outputting result of a certain method. The wanted outcome is one where the formula/method I come up with is efficient for all situations.

2 Research

Most of my research is based on prior knowlege. However there are a couple of websites that I visited and papers I read online in order to help create my own method of traffic optimization. These websites and papers are listed below.

2.1 Websites

2.1.1 Traffic light, Wikipedia the free encyclopedia

2.2 Online Papers

2.2.1 Traffic Competition

2.2.2 Probability and Traffic Signals

2.2.3 Designing Traffic Signals to Accommodate Pedestrian Travel

3 Methods of Conducting Traffic

3.1 Manual Method

To use the manual method with my simulation you must do the following things: Make sure that the auto switch option is off, press the East-West Switch button and the traffic lights for the cars moving east or west switch from red to green or vice versa and do the same for the North-South Switch button. Pressing these buttons switch the lights manually based on user input. The advantage of the manual method is that its good for situational traffic. Disadvantages is it could back up the entire system, possibility of human error, and of course its manual!

3.2 Timed Method

To use the timed method with my simulation you must do the following things: Make sure that the auto switch option is on, make sure that the formula option is on, and set the amount of time a switch stays green by adjusting the light timer slider (measured in units). Doing this will activated a timeed automatic switch between the traffic lights. It compares the amount of time a light has been green with the light timer option set. If the amount of time a light has been green is greater than or equal to the light timer option the lights switch. The advantage of the timed method is its not manual. The disadvantage is it doesnt account for busier roads. So if there's only one car one road. Its given the same amount of time to travel then if there were more cars on the opposite road.

3.3 Frequency Formula Method (My Method)

To use the Frequency Formula Method with my simulation you must do the following things: Make sure that the auto switch option is on, make sure that the formula option is on, and adjust the max wait slider (measured in different units). Doing this will activate my own created method. How it works is it compares flowing traffic frequency multiplied by a timer with the stopped traffic frequency multiplied by the quantity of the timer subtracted from maximum wait time. If the first quantity is greater than or equal to the second quantity the light switches. Advantages for my method is its good for situational traffic, takes into account heavily trafficated roads and it keeps traffic flowing. However if you were on a less populated road. The Frequency Formula Method may forget about you. Thus the max wait slider.

4 Writing the Program

I used NetLogo to write the program. NetLogo is great for model simulating because it already has key phrases and algorithms that you would already need to use. Also there were several traffic modeling programs that I could use as reference when I needed help. NetLogo only has one model of a car and a truck. I had to rotate and crop the models effectively to make them look like they were travelling the correct way on the correct roads. I also implemented a formula for randomizing the colors.