

TJHSST Senior Research Project

Simulation of Traffic Congestion on Route 1

2009-2010

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Abstract

Route 1 in Alexandria, VA is a constant nightmare for drivers trying to navigate it during rush hour. The road is not capable of holding the amount of traffic that travels on it on a daily basis. The purpose of this project is to create a realistic simulation of this congestion and then to define traffic management solutions that can ease the current congestion. Hopefully, this project will create a viable solution to increase traffic flow during peak hours that can save drivers both time and money.

Keywords: traffic simulation, congestion, traffic management solution

1 Introduction

1.1 Simulation of Current Situation

Currently, Route 1 has trouble with traffic congestion during rush hours, when many people use it to commute to their workplaces. I will create an accurate model of the traffic congestion on Route 1, based on traffic count data from the Virginia Department of Transportation. With this model in place I will find the cost to each driver on the current system using a variety of factors such as: average speed, cost of gas, and travel time.

1.2 Finding Viable Solutions to Congestion

Using the cost per driver on the current system as a control, I will then manipulate the traffic system in order to find ways that can ease both the congestion and the cost to the driver. Some solutions that could be viable to this process are: adding an additional lane, creating a bus-only lane, naked intersections, and round-a-bouts. The system will allow these solutions to be implemented together as well such as adding an additional lane and converting to naked intersections. The goal of this will be to find a viable solution to the congestion problem on Route 1.

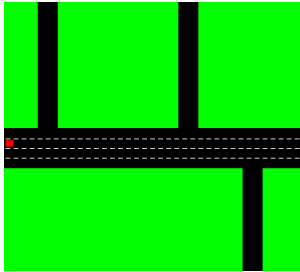
2 Background

I have done extensive research into how to simulate traffic as well as preliminary research into traffic management solutions. I reviewed the TJ senior research projects from 2008-2009 which dealt with the simulation of traffic including: Craig Haselers, Timmy Galvins, and Paul Woods. From their projects, as well as viewing some applets on the web, I decided that the best language to use in my project would be Java. I decided to then re-immers myself in Java and did some research into the Java language in the Java API, as well as looking at the graphics unit in the regular computer science curriculum, to get a feel again for how the code works. I then did some research on the ACM database, and found an article on traffic congestion and traffic management solutions. This article will help me in the more advanced aspect of simulating the decisions of drivers. In addition, the article had many factors with which to determine the cost to each driver of each traffic management decision. I hope to incorporate some of these factors into my calculations. I also did research online into the various ways congestion is alleviated around the world. In Europe a new idea is naked intersections or in other words, intersections with no traffic lights or stop signs. This method is based on the fact that drivers will slow down when they reach the intersection and will follow etiquette and allow people whose turn it is to go through the intersection to do so. Another idea that is very popular is to designate a lane for public transportation only. This allows the regular traffic lanes to be more free-flowing, because one lane does not suddenly stop when the bus stops to pick someone up. Finally there are the older solutions which are adding a lane or converting to the European favored round-a-bout. Both of

these methods have already been proven successful in other situations, but may not be in my simulation.

3 Procedure and Testing

The first piece of the project I am working on is the graphics part, because it will be the easiest part for me to finish and will be a good way to re-introduce myself to Java. This includes creating the road system to an accurate scale, creating the cars, and having them behave as actual cars. This part will be tested mostly through an eye test, in other words is the car acting like a normal car would, does the car move to the correct lane to turn off the road and does it turn off the road realistically.



The car driving on Route 1.

4 Results

Right now the road system is created to scale with mileage data found in the Virginia Department of Transportation paper. The car is able to drive forward and change speeds. The car can also change lanes both up and down in a realistic manner. The car is still having trouble turning realistically, but this should be fixed soon. The different classes and panels interact correctly and create an efficient system. The next step is to complete the turning method in the Car class, and then to begin to add additional cars to the system and having them interact with each other. The final step in this process would be to accurately create the traffic lights at intersections. This would include their timing with each other as well as how long each light is green.

References

- [1] VDOT, “Virginia Department of Transportation Daily Traffic Volume Estimates Including Vehicle Classification Estimates”, <http://virginiadot.org/info/2008trafficedata.asp>, 2008 (September 15 2009).
- [2] Atilla Elci and Ali Zambakoglu, “City Traffic Simulation and its Utilization”, <portal.acm.org/citation.cfm?id=1102537.1102538>, 1982 (September 22 2009).
- [3] Xu Jin, Mhamed Itmi, and Habib Abdulrab, “A Cooperative Multi-agent System Simulation Model for Urban Traffic Intelligent Control”, <portal.acm.org/citation.cfm?id=1357910.1358059>, 2007 (October 15 2009).
- [4] Timmy Galvin, “A Traffic Simulation Model Allowing for Wide-ranged Vehicle Communication”, Thomas Jefferson High School for Science and Technology, 2008.
- [5] Craig Haseler, “The Tragedy of the Commons as Applied to Traffic Simulation”, Thomas Jefferson High School for Science and Technology, 2008.
- [6] Paul Wood, “TJHSST Hallway Traffic Simulation”, Thomas Jefferson High School for Science and Technology, 2008.