

TJHSST Computer Systems Lab Senior
Research Project
JLSim: Visual Traffic Simulation with
Extensive User Interface
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Abstract

After seeing many traffic simulation web applets that work but have limited interaction on the part of the user, I wanted to create a traffic simulation that had an extensive user interface through which the user had high freedom and customizability options. A project in this field is called VISSIM, created by Tom Fotherby. This is an extensive project written in 11,000 lines of Java code to produce traffic simulation using a microscopic approach. The finished application should be able to at least somewhat realistically simulate real world behavior of traffic. Therefore, the primary goal of this project is to provide an accurate simulation of real world traffic behavior for multiple settings based on user-defined data.

Keywords: traffic modelling algorithms, microscopic traffic simulation approach.

1 Introduction

1.1 Scope of Study

This project will be more advanced than standard web applets, but it will not be a substitute for professional traffic simulations. The idea for the project is for it to be platform-independent, as long as the computer running the application has the JRE (Java Runtime Environment). This application will provide an extensive user interface that allows the user to change program variables such as number of cars and more. Therefore, this program will be useful for getting a general sense of what would happen in a hypothetical situation by setting the variables to reflect those in the real world.

Iterative development plan includes first developing a simple prototype or layout for the program. This involves simply creating the 800x600 application window, creating a JMenu bar at the top of the screen, and dividing the lower half into a JPanel and GUI functionality. The implementation will be done in steps to allow for testing simultaneous to development.

1.2 Expected results

By the end of the year, this application is expected to realistically simulate real-world traffic behavior for road networks defined by the user. The program should provide a default road network displayed at the left of the screen, but with GUI objects such as textboxes and checkboxes for which the user can modify the default road network to be similar to something found in the real world. While I do not expect this project to be as extensive as a professionally developed traffic simulation, it should be advanced enough to be of general use for modelling basic traffic situations in basic road networks.

I am desiring to learn further about the general subject of microscopic traffic simulation, using traffic algorithms that can emulate real world behavior. In addition, it will increase my proficiency in Java and using the swing API to generate effective GUI's. This project should let us see what would happen in basic road network situations including some more complicated situations such as merging. This project will also be able to examine factors such as how car speed and velocity affects traffic.

1.3 Type of research

Use-inspired basic research would best describe my project. My project seeks to research the effectiveness of microscopic traffic simulation through use and testing in basic road networks. I pursue fundamental understanding of microscopic traffic simulation and the accompanying traffic algorithms, but the main motivation is to see the application of the concepts in an actual simulation program, which is the aim of my program.

2 Background and review of current literature and research

- VISSIM: Visual Traffic Simulation VISSIM is a project developed by Tom Fotherby that visually simulates traffic using the microscopic traffic simulation approach. His project is very extensive, covering 11,000 lines of Java code and even including a "design" mode for the user to define their own road networks. While the project is now discontinued, the project is open-source and downloadable via the web. This project effectively emulates real-world situations on simple road networks without accounting for person by person characteristics such as slow and fast drivers, drivers who keep a lot of distance or drivers who tailgate.

3 Procedures and Methodology

Resources required: Netbeans Java IDE, JGrasp, Java SE, Java JRE. Programming language: Java The main procedure will include developing from a simple prototype, a 800x600 application window with the basic JMenu, JPanel and GUI options at the right. Functionality will be implemented step-by-step for the application. This allows for easy simultaneous testing of the program.

Eventually, input data may be user-defined data instead of the default data, for example 20 cars, cars moving at 20mph and so on. In addition, the program will output data such as a measure of how "bad" the traffic is, depending on the total situation.

Error analyses are both visually examining the program and comparing the data with those of real-world data or other established traffic simulation

programs such as VISSIM.

To verify the program, I will use specific structural and functional testing to verify each part of the application is working properly, from the JPanel that handles the visual traffic simulation to the user interface on the right. Eventually, dynamic testing may be used to test random inputs, but for now path and branch testing will be very effective in determining whether the application can successfully emulate real world behavior in a variety of situations.

-Basic requirements: 800x600, platform-independent, executable jar file
-Advanced requirements: Accurate simulation of real-world traffic behavior, runs at a smooth frame rate (not more than 100 and not less than 30), able to run user-defined data on road networks.

Traffic simulation algorithms with the microscopic traffic simulation approach: including algorithms to handle 1) Car speed, velocity, acceleration 2) Car breaking distance 3) Traffic light length, looping 4) Turning, switching lanes

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This project will essentially be open-source, allowing other researchers or next year's seniors to continue the project if they feel fit. This program can act as a example program or an application to test against if they also want to create their own traffic simulations.