CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
S1225

Project Title
Finding Efficiencies of 2 and 1-way Road Networks of Various City Block Sizes and Traffic Levels using Computer Modeling

Abstract

Objectives/Goals
This experiment will attempt to determine what kind of street configuration will best remedy traffic problems in dense cities by comparing one-way and two-way street systems.

Methods/Materials
Materials included a Compaq laptop and Macromedia Flash MX 2004. The simulation to test the hypothesis works by creating a grid network with either one or two-way streets spaced at a set distance (called the city block size). A set number of vehicles are created which use simplified path-finding algorithms to reach a random destination from a random starting point. When a vehicle reaches a destination, a counter is incremented and the vehicle is regenerated. Thus, there is always the same number of vehicles in a simulation as when the simulation began. The simulation will continue until the counter value is four times the number of vehicles in the simulation, meaning that, on average, every vehicle has reached its destination four times (generating hundreds of theoretically perfectly random numbers in the process).

Results
After conducting experiments in varying block sizes and vehicle volumes on the road network, the data was found to support the hypothesis. The raw quantitative data produced from the tests exhibited a strong quadratic relationship which made it possible to create regression models.

Conclusions/Discussion
After examining the movements of the vehicles in finding their destinations, an explanation was found that resembled the explanation behind the original hypothesis. Intersections in the two-way network allowed cars to turn in any direction, but time waiting for the lights to change was longer. The one-way system, where 50% of the traffic signal phases allowed a given car through, proved more efficient when vehicles encountered intersections more frequently. As the space between intersections grew, however, this advantage was overshadowed by the fact that vehicles would frequently find themselves needing to turn a certain direction at an intersection that would not allow it. This was not a problem for the two-way street system because all turns are allowed at a two-way street intersection. The regression models produced from the test results can be used to determine the optimum street configuration for real cities.

Summary Statement
A computer model simulates a simple grid road network to test how different types of street configurations (1or 2-way), different city block lengths, and different traffic volumes effect the efficiency of the network.

Help Received