The Tragedy of the Commons in Traffic Routing and Congestion

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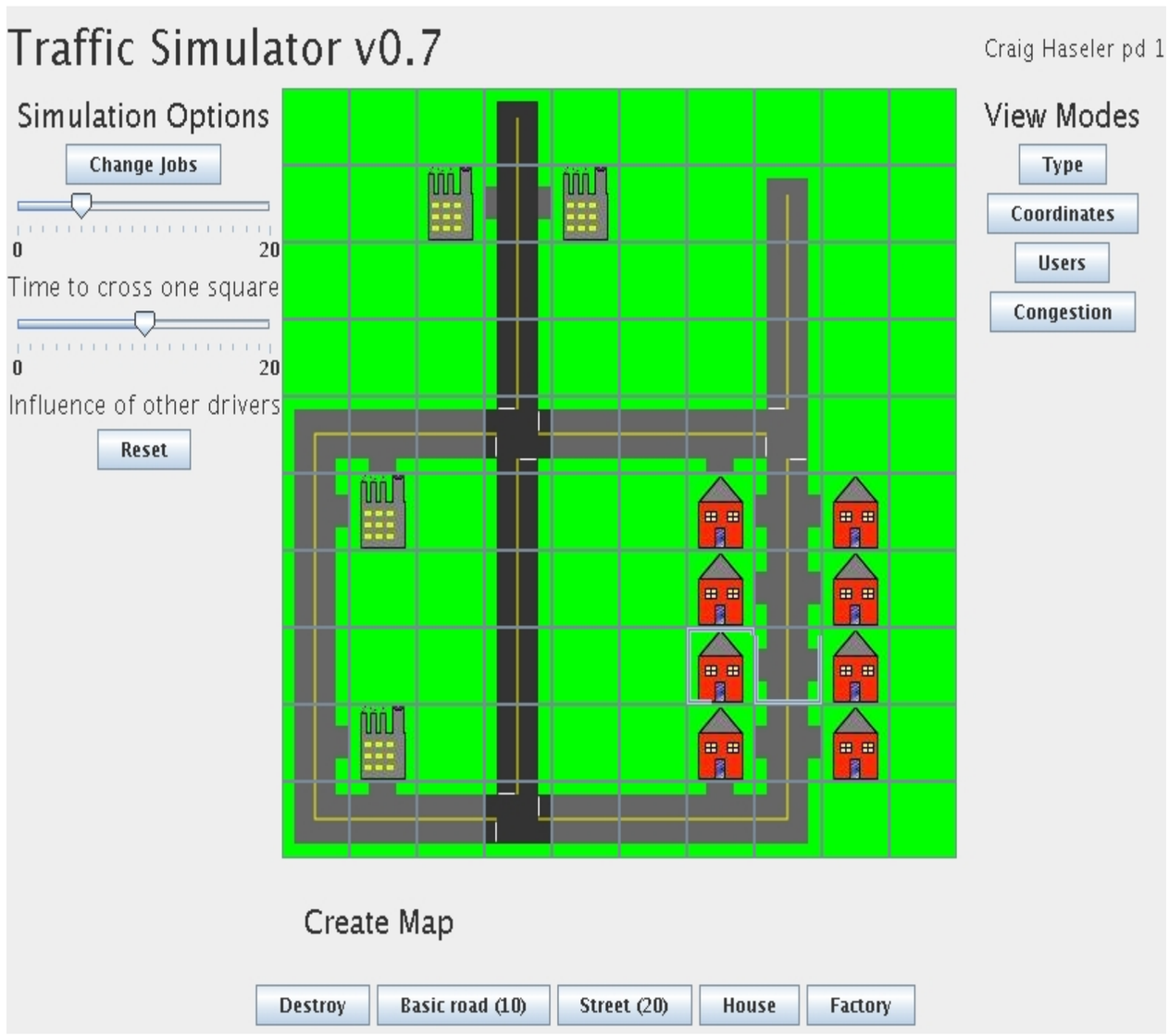
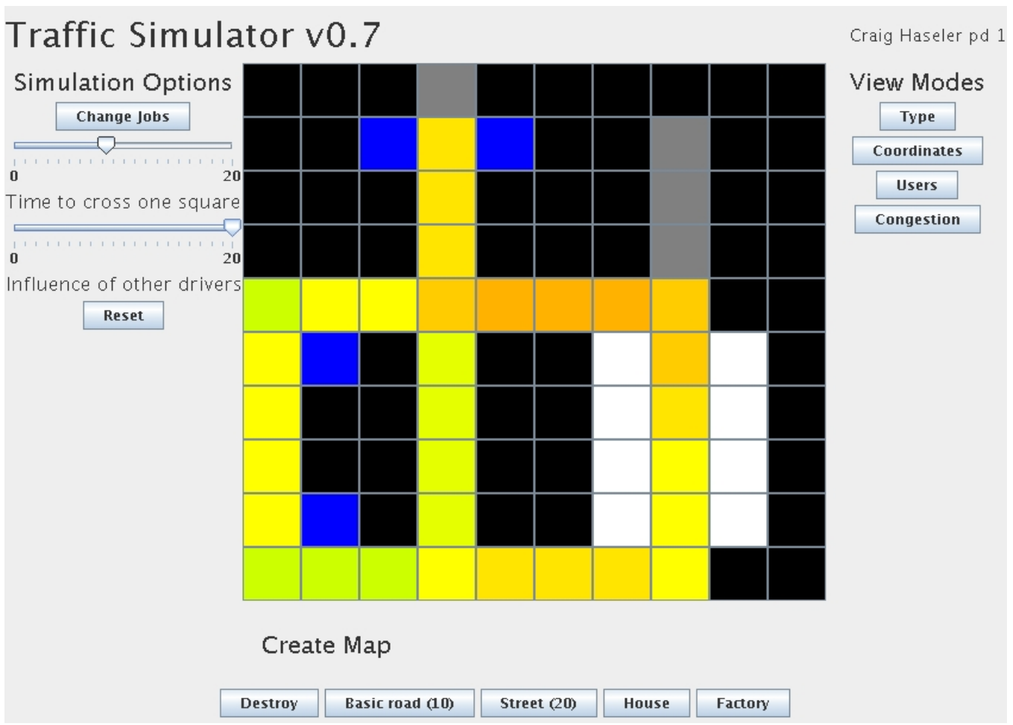
Abstract

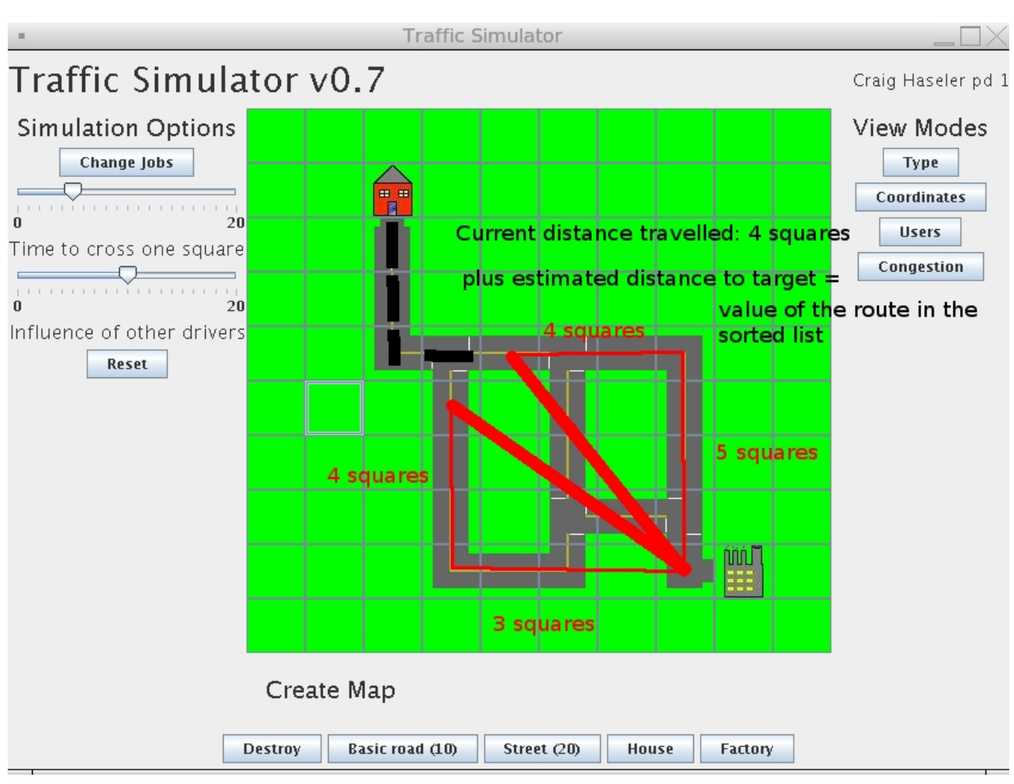
This project uses Java to create a functional traffic simulation, focusing on routing and congestion rather than individual car physics. We can then use the simulation to make several important conclusions about human behavior. The human tendency to always be self serving is considered an advantage in the economic system of today, but is this also true for other systems? This project could demonstrate the effectiveness of a traffic solution in which a central computer makes decisions rather than individual drivers. While that kind of system is not currently feasible, it will not be long before we will have the technology to implement it on highways at least. In most respects, it will be a simple matter of connecting the cruise control system of cars to a central highway computer bank. Of course, there would be the hurdles of justifying this much control to a computer (and of course the risks), but this project should demonstrate that turning over control to a computer can have significant benefits to society as a whole, even if it causes individuals to make a slight sacrifice.





Introduction

The purpose of this project was to give an example of a situation in which there in in fact an solution to the apparent paradox spelled out in theoretical situations such as the so-called Tragedy of the Commons. This paradox means that people acting purely out of self interest actually hurt the group as a whole, and so the society does not succeed. We see a similar effect in the world of traffic and congestion. People will always act in their own self interest, even if it slows down the system as a whole. My goal here is to demonstrate that the paradox can be solved by having a overall intelligence which makes these decisions for the people, acting in the interest of the system as a whole, rather than the interest of a specific individual.



Recent updates to the project include:

A more advanced Quicksort for the organization of the routes when a car is choosing the most efficient route.

This quicksort replaces a very basic “bubble sort” and means that the project runs much faster. Because of the structure of my code, it was relatively difficult to program, and took several weeks. However, it makes a significant difference to the performance of the program.

A more advance A* style search for the best route.

The old version used a breadth-first style sort of the data, meaning in this context it would spend far too long looking down routes that are irrelevant. By using an A* style search, I weight the search to prefer routes which travel in the right direction.

Creation of an algorithm to simulate a central computer. This produces noticeable improvements in quality over the old agent-based algorithm, but it is much less efficient.