A Traffic Simulation Model Allowing For Wide-ranged Vehicle Communication

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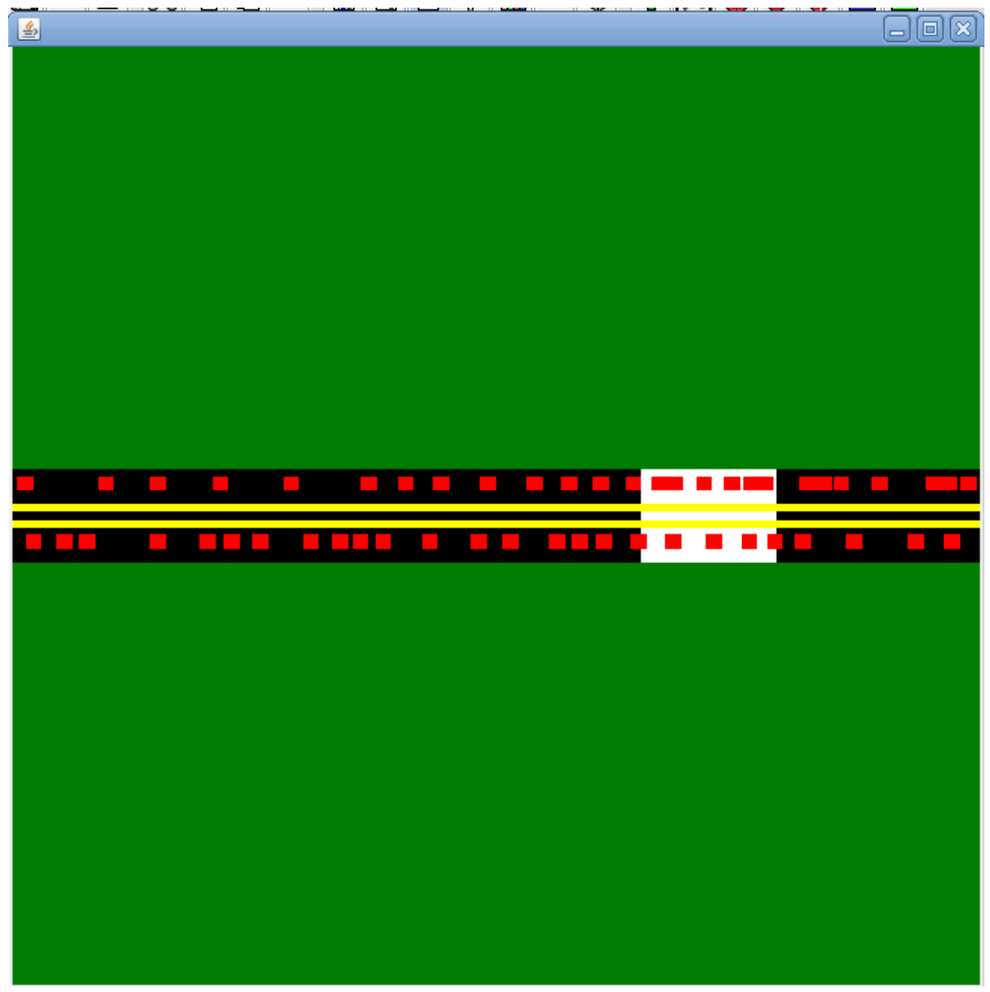
Abstract:

Traffic is an ever-growing problem as population around the world increases exponentially and with it, the number of drivers. Previously, fluid flow models have been used in an attempt to model traffic, but as has been recently discovered, only agent based models can accurately model a traffic scenario as small perturbations can have a butterfly effect and change the entire system.



Introduction:

I want to create an algorithm that responds to traffic backups by sending information across the system and altering traffic laws to help such situations. I will develop a method of calculation bad traffic jams and to what extent the speed limit on the roads leading up the jam need to be changed. For this to function well, I need to have an accurate model of driver behavior and an ability for my program to collect data and analyze the situation well. The model will be of varying road systems and the vehicles on the road will have their own properties such as location, speed, acceleration, speed limit, and aggressiveness, some of which will be user defined. While the simulation is made in an attempt to copy human behavior, like all other traffic models in use, it will be collision-free.

Developments Sections:

The World class that my environment is stored in holds an ArrayList of all the Vehicles so that it can access their information and location. Using these values it will be able to detect traffic jams and react to them by altering conditions. I have set up a basic simulation to do this, at the moment it is a two-lane system with traffic flowing in two directions moving at realistic velocity and acceleration and responding to a speed limit and vehicles around them. There is a variable in the program for traffic density that can easily be altered to change the number of cars. This program will be successful if it one, accurately depicts traffic flow by means of a traffic density versus flow graph, and two, if it can use information from the entire system to alter traffic laws.

Reaction Algorithm

This is a main component of my program as it determines the braking speed of the vehicles in relation to the vehicle in front of them. At first I used a linear model but found it be rather inaccurate, or rather, that with my micro model, I could use more complicated functions because of small set sizes and the ability to visually observe the results. Currently it is a combination of two parabolic functions that vary the speed of the car behind as a function of its current speed and the speed of the car in front of it. This will prevent the car behind from ever running up on the car ahead of it or overrunning it.

Results and Discussion

At the moment my program works in a two-lane traffic simulation. The only test of its validity that I have used is a visual comparison to known behavior. The behavior that it depicts is a traffic jam moving backwards in traffic. With the speed trap I built in, I was able to discover that it is better to have a speed trap earlier on rather than later, as traffic will build up on the road with the speed trap later on, making a slower lane. Hopefully, when my project is fully implemented I will yield results on how information sharing and system reaction will affect traffic flow, though I am not sure if it will be marginable enough to be reasoning behind buying many sensing systems for actual road systems.

I advise that my model be further developed and used as starting point. Current traffic simulation models are built upon micro models, a large compilation of them. If my code can be optimized and a computer network utilized, my program can be slightly altered to set up a large set of systems adjacent to one another to depict more than just a small road system, perhaps even a whole system.