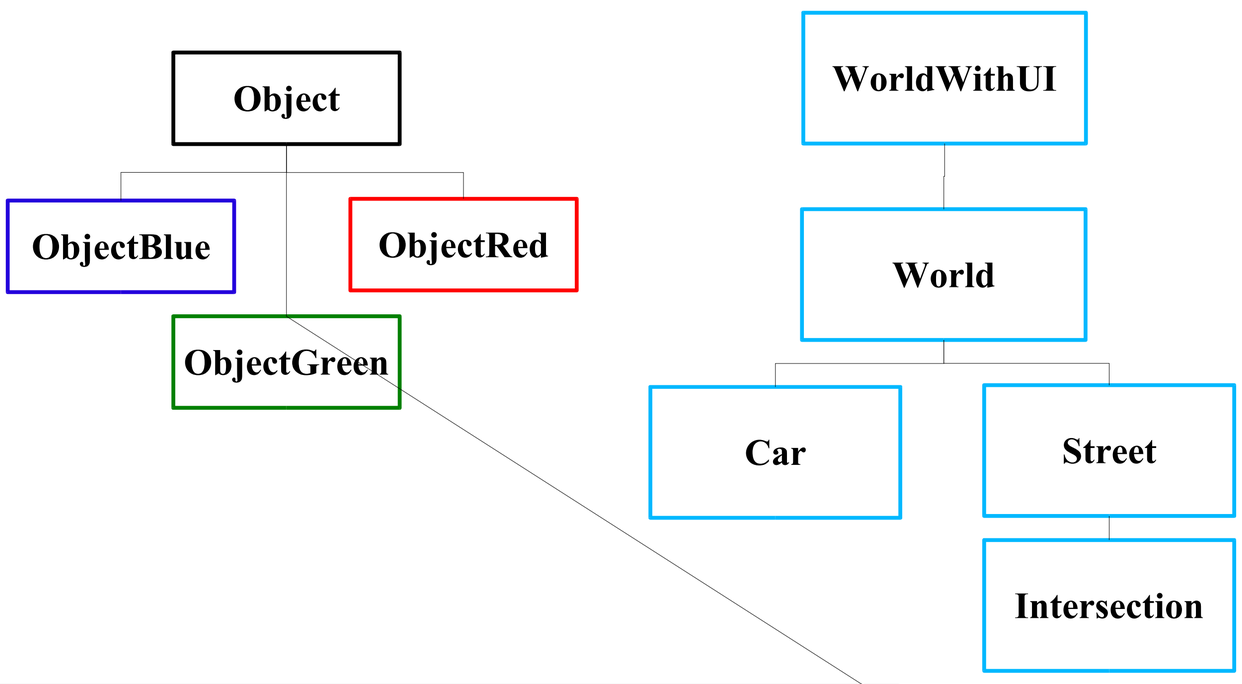
A Study in Creating Computational Models of Traffic

The goal of my project is to make an accurate simulation of traffic in a multi-lane intersection world that will be easily mutable. I will complete this goal by creating a logical organizational structure that will easily lend itself to creating situations in which to study traffic. My main concerns will be in the studies on the effects of construction work and accidents on traffic flow. I will then proceed to advance the accuracy of the traffic simulation as much as time will allow so the study will prove to be useful in its own right.

Traffic Simulations are used in a variety of ways. One of the most prominent and original uses was to use traffic simulations to evaluate alternate treatments. Since engineers were in control of all the variables, they could evaluate such things as signal control strategies, and speed limit management. Traffic simulations are often used to test new designs. Because roadwork is so expensive, traffic simulations can help quantify the improvement of traffic flow with different geometric arrangements. Traffic simulations are also used to test traffic center personal and can also be used to recreate a traffic accident and then design a safer environment in response to that accident.

Simulations describe a non-static environment in a statistical or pictorial way. They can be used whenever there is a system undergoing mathematical changes over a long period of time or there is a need to view an animation of the system to understand what is causing the final results. They are also approached when the mathematical equation can not accurately factor in all the agents of a system. Traffic simulations are used to support optimization models, and new theories in management. They are an efficient way to see understand calculated data particularly if the simulation creates an animation output.

Animation displays are one of the best ways to analyze whether or not the model is an accurate representation of a traffic simulation. The analysis has to be through, but can help identify cause-effect relationships and anomalous results. Particular cause-effect relationships to look out for are where congestion starts and is it where consistent traffic jams start or only so often.

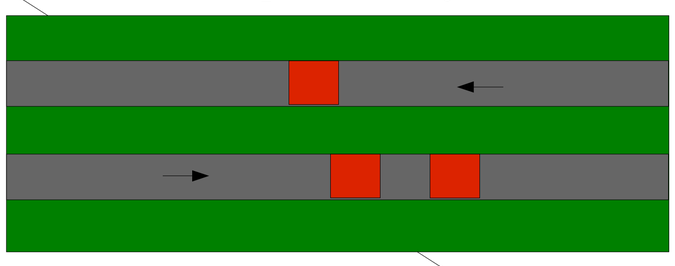


My project was made in MASON, a specific derivation of Java that is conducive to making simulations. It requires that I have not only a World.java file but a WorldWithUI file. In MASON, simulations can be run without any type of visual representation by just running the World.java file. The WorldWithUI file is like a wrapper for the World.java file and actually converts everything into an animation that can be seen and re-animated. I have chosen to work primarily in animation mode because it helps me see if the cars are actually doing anything. I have two other class files: Car and Street.

In the world there are two data members: land and world. The Land is the actual sparsegrid of the world where the streets are placed. The world is a doublegrid with a layout of how the streets are actually lined up together. This was done because one of my original problems was the streets had a length but that length could not be shown in the sparse grid. It is only a object which therefore can only take up one unit (like the cars). WorldWithUI uses the double grid to project the screen in the animation becuase world is full of 1 and 0's where 1's are areas of street and 0's are areas of grass.

The land contains two objects: the streets and the token objects for cars. Each street has a data member called myArea which is where the cars are actually located. Whenever a car moves, it finds its token object in World.land and moves it to the same spot. This is done again so that the streets can cycle the cars and since the cars cannot be in two spots at one time there are tokens for the cars in World.land. WorldWithUI uses the token objects to project the cars on the animation. Towards the end of the project I created three new objects for tokens so that the cars could have different colors: ObjectRed, ObjectBlue, and ObjectGreen.

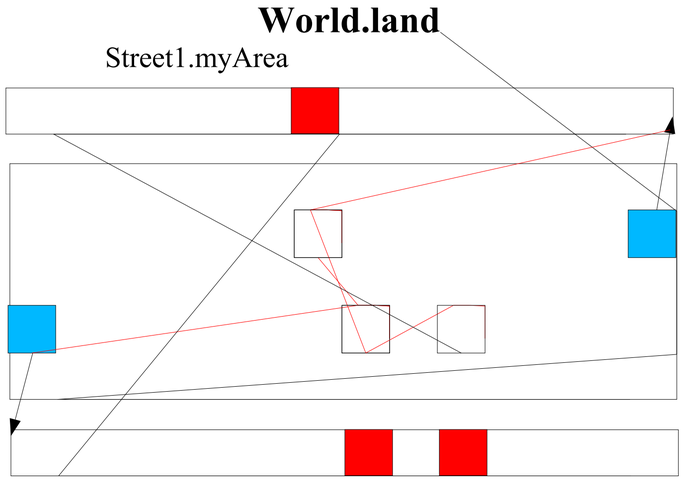
Graphic Portrayal



World.world

0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0

World.land



The Phases

One Dimensional Movement
Just as it sounds, the original step of making the cars move down a street at a constant speed to the end of the track and then off.

Speed Changes as Reactions to the Environment
The phase was based on the original creation of the cars abilities to orientate themselves to their environment and use that data to decide whether to speed up or slow down

Changing Lanes
Changing lanes seemed to be an easy task mainly because each street had a number of lanes set its height of its data member myArea.

Cars Stopping at the End of Roads
This method seemed out of place but it was the creation of an algorithm that would have the cars stop at the end of the road.

Continuous Flow of Traffic
This phase was perhaps one my first real triumphs which was creating a method that enabled the program for many turns and have cars continuously flow.

Flow Changing by Turns
This phase was based on the idea of having turns which were kept track of and during certain periods of time the volume of traffic would increase and decrease like normal days.

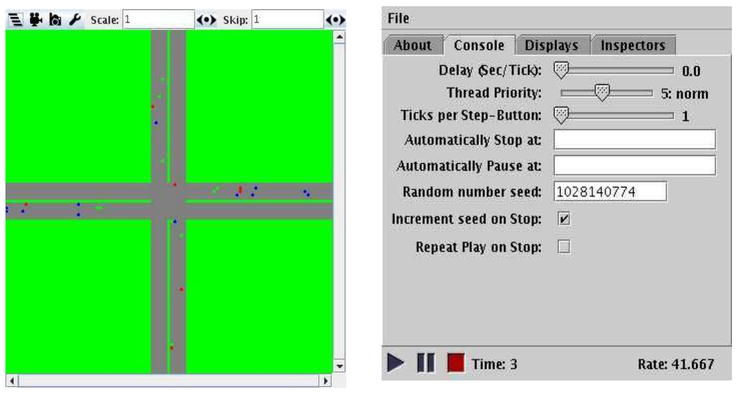
Two Directions of Traffic
This phase resulted in having traffic flow in both the east to west direction and the west to east direction.

Lane to Lane Interaction
This phase dealt with how to change cars to different streets while accounting for where the cars were and moving their tokens accordingly.

Creating Unique Tokens
This phase was more about making the animation easier to understand then making the program more exact. Thus I had to create three extensions of the Object class: ObjectRed, ObjectBlue, and ObjectGreen.

Creating the Intersection Class
I decided to create an intersection class that along with having to move cars across its area, it has to keep track of the lights of 8 different joining streets.

Four Way Traffic
This phase allowed the flow of traffic to go in the North to South direction as well as the South to North direction.



The main trial of this project was to create an organization where cars could move in a realistic fashion and be able to interact with the streets and the world with little issues. The organization did hold up to all of the phases my program was put through and in fact this served as a perfect testing platform for my project. One drawback has been the inability to create a more effective decision making agent however algorithms could easily be instigated in a brief amount of tim. Yet my program has proved itself to be an incredible tool and canvas for future programmers to expand on. I may not have solved any problems but I created a reliable tool in which problems can be solved with.

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