

Supercomputing Challenge

Emergency Evacuation Plan

Team 37

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EXECUTIVE SUMMARY

Espanola, New Mexico has no current emergency evacuation plan for its inhabitants. The Espanola population is growing 10 % each year, and with no Emergency Evacuation plan, in case of a fire accidents will occur. Espanola city officials have an old Emergency Evacuation plan that would not work today because the population has grown so much. Team 37 is focusing on the busiest and slowest intersection in Espanola: Espanola officials will use our project to create an Emergency Evacuation plan for the City of Espanola. By modeling an Emergency Evacuation plan we will help our community and families to successfully evacuate in case of an emergency.

Our project creates a computational simulation of an Emergency Evacuation plan for the city of Espanola. The traffic flow at the Fairview Lane and Riverside Drive intersection we created a simulation using Net Logo, a cross-platform multi agent programmable modeling environment. This simulation will demonstrate how this busy and slow intersection is affecting the traffic flow in Espanola.

INTRODUCTION

Our team met with the Mayor, Joseph Maestas. We discussed the number of problems that our community has been dealing with involving the city traffic. The population of Espanola is growing 10% each year, and traffic is getting worse. If there is no Emergency Evacuation Plan to address busiest and slowest intersection at Riverside Drive and Fairview Lane in case of an emergency the inhabitants would make wrong decisions.

With an Emergency Evacuation Plan concentrated on people in Espanola will be prepared to head in the right direction in case of an emergency. Working with Net Logo to model these two intersection we will have a solution for our Emergency Evacuation Plan to help our family and

friends and also our community to know how to evacuate in a fast and safe way from a potentially dangerous scene.

PROBLEM STATEMENT

Espanola does not have a current evacuation plan. Our project investigates a solution for the city of Espanola to have an Emergency Evacuation plan, with the two busiest and slowest roads which are Fairview Lane and Riverside Drive. The Fairview Lane and Riverside drive intersection causes a great problem with the traffic flow in Espanola. In an emergency situation, it is essential for people to have a safe evacuation route.

PROJECT GOAL

Our solution for this problem is to dedicate our time, to research a local evacuation route for the City of Espanola, and model the plans as to how the evacuation would go in the situation of an emergency. Also, the emergency evacuation plan would help residents and city officials evacuate based on the location of the disaster. We want to be able to have an evacuation plan that will work and that will get people out quickly and safely.

METHOD AND COMPUTATIONAL MODEL

The model we are developing is simulation movements of cars at the intersection of Riverside Drive and Fairview Lane. Each car follows a simple set of rules: it slows down (decelerates) if it sees a car close ahead and speeds up (accelerates) if it does not see a car ahead. The model demonstrates how traffic jams can develop without any accidents, broken bridges, or overturned trucks. No centralized cause is needed for traffic jams to form traffic jams can start from small "seeds." In our model, cars start with random positions and random speeds. If some cars are clustered together, they will move slowly, causing cars behind them to slow down, and a traffic jam forms. Our system uses agents, primitive (pre-defined) commands that control the

characteristics and behaviors of the turtles and commands that impact the patches. There are agents called turtles and there are agents called patches (the background). Procedures can be used to control both.

When you execute a command in Net Logo it always wants to know if the command should be executed by the Observer (you), the turtles (either some or all), or the patches (either some or all). It lets us students open simulations and "play" with them, exploring their behavior under various conditions. Also, it is an authoring environment that enables students, teachers and curriculum developers to create their own models. Net Logo is simple enough that students and teachers can easily run simulations or even build their own. It is advanced enough to serve as a powerful tool for researchers in many fields.

Project Goals:

- Develop numeric simulation and visualization tools for geodynamics with the involvement of middle school teachers and education experts.
- Train middle school teachers on the integration of such tools in the teaching of the existing curriculum topics.
- Stimulate middle school students' interest in science and technology and improve their knowledge and performance in these areas.
- Serve as role models for other schools contemplating the use of laptop computers in the Classroom.

ASSUMPTIONS AND EFFECTS ON NET LOGO

In this model the turtles are cars traveling through an intersection. The user has the ability to control the frequency of cars coming from each direction, the speed of the cars, and the timing of the light at the traffic intersection. Once the frequency and speed of cars is selected, the user

should run the simulation and adjust the timing of the traffic light which has two different colors; red and green will minimize the amount of waiting time of cars. Working through the intersection of Riverside Drive and Fairview Lane will help the residents evacuate faster In case of an Emergency.

RESULTS AND ANALYSIS

Traffic flow can be a serious problem in the city of Espanola without an Emergency Evacuation Plan. There are a huge number of vehicles traveling through these two major roads of Riverside Drive and Fairview Lane. In case of an emergency this would be a difficult area to control and to manage.

In comparing these two roads, we ensured the about sixty to ninety seconds cars need to wait for the light to turn green verified by analyzing and figuring out the outcomes of the cars going through. The current traffic systems that are being used to simulate the cars in traffic lanes have been a great help to our Emergency Evacuation Plan system. After running a computational model for this simulation numbers and percentages of vehicles our model showed us that the numbers of vehicles running through this intersection have grown a lot throughout the years.

CONCLUSION

In conclusion, our project was successful in achieving with great success the goals we had for our Project. The objectives that were used allowed us to draw valuable conclusions and learn more about the traffic in the Espanola Valley.

The simulation worked very well in finding out the north and south directions the traffic is and where their heading. In case of an emergency with the information received was great help, which concludes a basic and helpful Emergency Evacuation Plan.

ACHIEVEMENTS OF THE PROJECT

Our team group was able to achieve and study our major goals during the classroom sessions. The solution we found to be the problem of not having an Emergency Evacuation plan in Espanola to continue learning more about the traffic flow. In our group, we decided to calculate the amount of time of traffic jams take at the Intersection. This helped us through the process of Net Logo simulation. With the help of the tutors and our mentors, we where able to finish our Net Logo modeling with the demonstration of tools and objects that we really needed throughout this session.

ACKNOWLEDGEMENTS

The acknowledgements of this simulation we had the resources and mentors to help us finish our project. We received a lot of information from Chief Kitchen, which has worked with the Espanola Fire Department in for over thirty years. The city map of Espanola allowed us to see things in a different perspective which helped us with our project along with the help of Chief Kitchen. Having Riverside Drive and Fairview Lane with the most traffic, we decided to conclude an Emergency Evacuation Plan for the City of Espanola.

The help we received from our Mayor Joseph Maestas and Diego Ortiz were accurately modeled and discussed with in our group and key components and procedures were made. We are going to model a plan for the Intersection of Riverside Drive and Fairview Lane to model and stimulate the traffic with the time or speed was also calculated.

Net Logo Model Simulation

```
globals [ counter speed total_speed total]
```

```
to setup
```

```
ca
```

```
set counter river_side_time ; to setup the lights on the first cycle
```

```
set total_speed 0
```

```
set total 0
```

```
crt number_riverside + number_fairview ; create 'cars'
```

```
ask turtles
```

```
[
```

```
set color white
```

```
set shape "car"
```

```
ifelse who <= number_riverside ; half north-south, half east-west
```

```
[
```

```
setxy 0 who set heading 0
```

```
]
```

```
[
```

```
setxy who 0 set heading 90 ; using who to space out cars
```

```
]
```

```
]
```


end

to go

if total < 1000

[

light ; change lights

move ; move cars

]

end

to move

if not any? turtles-at 1 0 and not any? turtles-at 0 1 ; make sure no cars ahead either north

or south

[

if [pcolor] of patch-ahead 1 != red and [pcolor] of patch-here != red ; only move if no

red ahead or on

[

set speed (random 10) / 10

fd speed ; crazy drivers

set total_speed total_speed + speed

]

]

end

```

to light
if counter = river_side_time
[
ask patch -2 0 [ set pcolor red ] ask patch 0 -2 [ set pcolor green ] ;north_south_go

; river side drive

]
if counter = fairview_time + river_side_time
[
ask patch 0 -2 [ set pcolor red ] ask patch -2 0 [ set pcolor green ] ;east_west_go

; fair veiw lane

set counter 0

]
if who = 0 [set counter counter + 1 set total total + 1]

end

```