Emergency Egress in the Case of a Fire

New Mexico
Supercomputing Challenge
Final Report

Team 098

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Our project is basically about emergency management in a confined place. We decided that this place would be an airport like the Harstfield-Jackson Atlanta International Airport. What would happen in an emergency fire situation? Would everybody be able to get out? How could the emergency evacuation be quicker and more effective? These are the questions we tried to answer in our 2013 Supercomputing Challenge. In our project, the main goal was to make the ineffective evacuations in airports easier and more effective.

The first thing we did was research. We researched a lot about human behaviors in panic situations and the Atlanta airport. One of the things we learned was that the Atlanta airport had done an evacuation check some time ago. We tried to research more on this, but it was very difficult, and we decided that we would get results on our own.

The next thing we did to solve the problem was build a Netlogo model. In this computational model, we put the floor plan of Concourse E of the Atlanta Airport, and put all of our agents in that space. We then had the turtles do a random walk in this space and put a spreading fire somewhere around the model screen. Then we tried to imitate human

behavior. When the turtles spot the fire, they turn red and start to walk faster. If they have seen only the exit, they turn green, and if they haven't seen anything yet, they are white. All the turtles are white at the beginning of our model. The turtles then tell other turtles about the fire and exit. When a turtle has seen both the fire and the exit, it turns orange and runs straight to the exit. When it reaches the exit, it escapes.

The next thing we did was that we verified and validated our model. We got rid of some lags and glitches and then looked at the model from a bigger perspective. We asked ourselves if the way we were depicting human behavior was accurate, and we all came to a conclusion that is was vaguely accurate but good enough for this project.

After our model was done, we did a couple of experiments on it using Behavior Space. One of the first things we did was that we changed the exit in the floor plan to each of the four sides. We then had four different floor plans, and we measured the ticks it took the agents to escape in each picture. In our data, the numbers were completely different from each other, and we then concluded that the location of the exit didn't really matter.

The next change we made was that we increased the running speed of the red or orange turtles. In other words, we increased the speed of the turtles that have seen only the fire and the turtles that have seen both the exit and the fire. We did the same experiment again without changing the other variables and saw if this decreased the amount of ticks it took the agents to escape. To our surprise, this change had only a little effect on the results. The amount of ticks it took the agents to escape increased in 10 of the 20 trials and decreased in the other 10. We were surprised about the data because logically, one would think that if a person runs faster he or she would be able to escape faster in an emergency situation.

In our final experiment, we increased the size of the exits and saw if that affected our results and made evacuation faster. As we predicted, the amount of ticks it took for the agents to escape decreased, but not significantly. It was, however, less than our other results, which made us think that it was a solution that would make emergency evacuation more efficient and quicker.

In conclusion, from doing our three experiments, we learned that while the location of the exit and speed of the agents didn’t really help

the evacuation process, the size of the exit did help. So in order to make evacuation faster, you will have to make the exits bigger. However, we are sure that this is not the only solution, as it can be done with a lot of different ways.

We hope that our discoveries and conclusions from this project can be used in the future when investigating about human behavior in a panic situation or constructing buildings. In addition to this, we hope that our findings can help make evacuations easier and more effective. Also, we hope that our discoveries can be the spark for future inventions and creations. These innovations then can be used to think of other ideas and soon to have a completely new and fresh way of looking at emergency management in a fire situation.

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