Interim Report

Behavior Modeling in a Disaster Situation

Bailey McCarthy and Eric Swiler

Definition of the Problem:

Many lives are lost annually to fires and other emergency situations. Our problem is constructing a computational model of the actions of people in these situations to improve building design for maximum escape efficiency and efficacy.

Plan for solving the problem computationally:

Most buildings are designed with evacuation measures in mind. However, there is no way to truly test these measures except in a disaster situation itself. However, a model could be used to give an approximation of how people might behave in such a situation to give insight on how exactly a building should be designed. Our model will be created in Python by taking a 16 color bitmap as an input map file and parsing it to get an accurate representation of the floor layout. People and fire objects will be spawned in the locations given by the map file, and will behave according to certain postulates put forward on expected behavior. Normal crowd-flow modeling can be observed in a few ways, as outlined in two of our sources. One of these methods is minimizing the overall sum of time, discomfort, and distance, and the other is to have a specific person move in a straight line until they hit an obstacle. These have been incorporated into some of the postulates.
People Postulates
1. People will always attempt to take the shortest route.
2. (Corollary to 1): People will always try to move in straight lines.
3. (Corollary to 1): People will only change direction if they encounter an obstacle.
4. People will never intentionally endanger themselves.
5. People will never prioritize other people's safety over their own.
6. (Derived from 1, 4, and 5): A person will endanger another person if and only if it improves their own chance of survival.
7. People move more slowly through densely packed (people or hazards) space.
8. If an area is too densely packed (people or hazards), people will start to die.
9. People know the direction of the exit.
Fire Postulates
1. Fire can never travel through a wall
2. A fire will begin in exactly one place in the map
3. A fire will spread pseudo-randomly
Floor Postulates
1. Each tile is one meter wide
2. Each iteration models 0.5 seconds

In order to find a valid route to the exit, each person will have to take a route that avoids obstacles. Each person will scan a 5 by 5 tile square around them; if there is a hazard, such as a fire or another person in the region, they will move away from them while avoiding walls, and if there is no hazard

they will simply avoid walls. Since each person knows in which direction the exit lies, they will attempt to move toward it and only move in a different direction if an obstacle is encountered.

Progress:

- A framework for the program has been constructed. This includes that code that will take a 16-color bitmap as an argument and parse it to create a map object with walls, people, and exits as dictated by the input file.
- Work has begun on the parsing and routefinding aspects of the program. Little code has been written on how the people objects in the program will reach the exit, but methods of finding possible routes have been put forward.
- The basic postulates have been conjectured.

References

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