Project Proposal Final Version 1st Quarter 2008

Computer Systems Project Proposal - September 2008

1. **Title (or subject area) of the project and YOUR NAME and PERIOD**

    TJHSST Hallway Traffic Simulation
    Paul Woods
    Pd5

2. **Purpose and scope of the research project**
    *** goal and scope (extent)**

    -Accurately simulate the TJHSST hallway traffic
    -Create a visualization of the simulation
    -Analyze the results of the simulation and identify problems
    -Utilize the simulation to find ways to improve hallways

3. **Background and review of current literature/research in this area.**

Continuum Crowds by Adrian Trueille, Seth Cooper, Zoran Popovic—University of Washington, Electronic Arts

The project is designed to determine how to realistically model large crowd movement without collision detection. Collisions and movement were calculated together--as opposed to separately--because crowds tend to already know which areas are likely to be congested and adjust *before* reaching the congestion.

They created several simulations, including one with 24 people in a hallway, a 2000 person army retreating from a 8001 person army, and a 16 square city block. The researchers concluded that the crowds actually moved more smoothly and realistically when calculating the collisions and movement together, as opposed to separately. The researchers mentioned future areas for continued research which included tighter packed areas, areas where people do not have a common goal in movement, and what they described as "posse chasing," in which certain people are avoided and others are looked for.

Finding Multi-Constrained Feasible Paths By Using Depth-First Search by Zhenjiang L and J.J. Garcia-Luna-Aceves

The focus of the research was developing a depth first search algorithm that operated with an unusual number of restrictions. The algorithm was specifically designed for developing routing systems, which requires the consideration of several constraints (such as bandwidth, reliability, end-to-end delay, jitter, and cost).

The program was tested by implementing the proposed algorithm and recording the time required by the algorithm to find and select routing pathways. The results were that the algorithm can work very effectively, but works best with a smaller number of possible locations.

4. Procedure and Methodology.

The program is being made primarily in the C programming language, though it is possible other languages (such as C++ and Java) will be used later in the project to compensate for the weaknesses of the C programming language.

To test the program in its current state, I ran a simulation in which students would start positioned in a room and attempt to find their way to their destination: a different room. This preliminary simulation assumed the following:

1) Each room is located approximately three minutes apart from each other.
2) Students will attempt to take the quickest possible path to their destination.
3) Students will stay in their destination once they arrive.
4) Students move at the same speed, regardless of traffic conditions.
5) All students left their initial location at 10:05 and tried to make sure they arrived at their next location by 10:15.

The initial input into the program is as follows:

- Data containing the miniature school map, written directly into the program code* in the form of a hash.
- Randomly created student schedules

*At this point, there was no point in inputting data by reading a file because the map size manageable. The time and processing used to open and read an input file did not make such a method useful.

Example Output from the Simulation:

StudentName	Start	10:08	10:11	Finish
Student0	Area3	Area5	Area2	Area2
Student1	Area1	Area4	Area5	Area3
Student2	Area1	Area4	Area5	Area3
Student3	Area2	Area5	Area4	Area0
Student4	Area1	Area4	Area5	Area2
Student5	Area3	Area5	Area2	Area2

...

Figure 1:

Hall Traffic Given Time:

Hall
10:08
10:11
4
60%
10%
5
40%
60%

Table 1:

The results of the experiment were very positive. Every student was not only able to locate his or her destination, but he or she was able to arrive before there before the start of the next class (10:15).

However, there were some problems. Looking at the data, it was clear that the hallways were not utilized efficiently. For instance, at 10:11, the traffic through Hall5 hallway was 600% as congestion as the traffic through Hall4.

This may have been a result of the fact that students did not take into account traffic when selecting movement.

In the future, when the program is expanded to include the entire school, the program will likely be testing by collecting actual student movement data. There are several ways to do this, including counting the number of total students passing through certain hallways between classes, attaching tracking devices to willing participants, or asking a group of students to respond to survey questions about where they traveled and which areas they consider to be congested.

5. Expected Results & Applications, value to others

I expect the program to provide data regarding the concentration of traffic throughout the school at any given time during the school day. I plan to visualize these results, possibly by mapping student location data over a file containing the school building map. Once the program is completed, the data will likely identify several areas of intense congestion, such as the Junior Lounge and the main second floor hallway. As with the the first data, I expect to find that certain hallways are overused while others underutilized. I can then find possible ways to deal with this and test their results by using the simulation.