Modeling Virus Spread in a Modern Environment

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Abstract

This project explores the development and use of a real-time simulation to simulate the spread of a virus through the hallways and confined walking areas in a modern building environment, such as schools and other enclosed public places. In addition, the project explores the use and creation of various pathing algorithms used in real-time simulations.

Background and Introduction

Languages

This project is written Java with Java2D for the display and control.

Human Pathing

For this project, some systems have been deemed not applicable to this project and some seem possible. By itself, a potential field AI is not the best choice for a simulation of people in a building with narrow passageways. Potential field AIs work best in open spaces and not the tight hallways of a school or building. However, when used to get the general direction of movement and combined with another pathing system, it can be very useful. In this case of this project, I implemented the "probe point" system for pathing as the main pathing system, while the potential field will provide directional assistance. The probe points can be seen in Figure 1, where a group of virtual people are avoiding the walls.

The virus

The virus type used in this simulation is a basic airborne virus with an infection chance from a person to another person dependent on the distance from the infected person to the non-infected person. There is, however, a randomness to the infection of another person. Many aspects of the virus spread are controllable by the user of the simulation software, including variables such as maximum distance for infection, infection rate, and others.

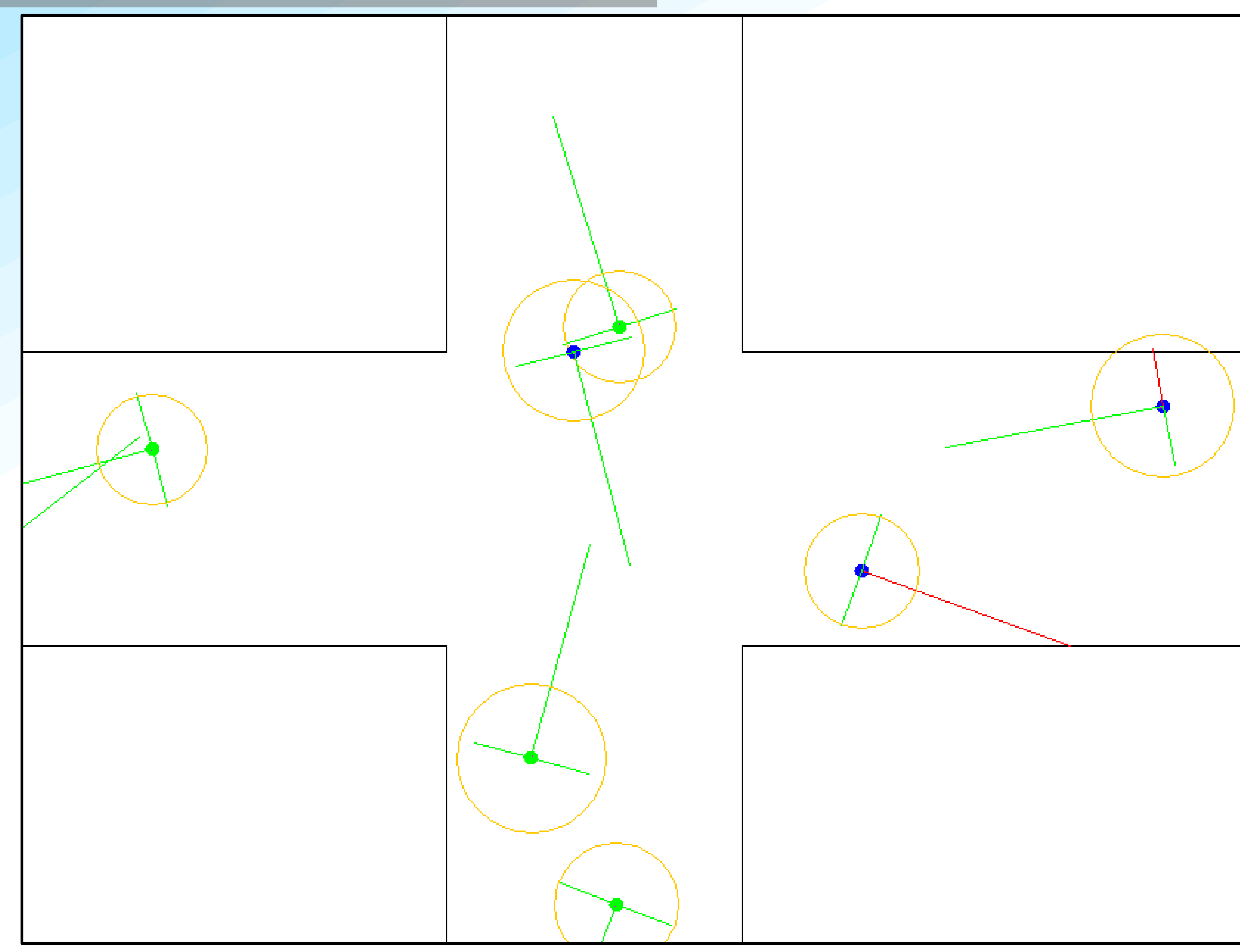

Fig. 1: The main simulation screen

Discussion

The project is a real-time simulation, where virtual people walk through the hallways in a building outline. The buildings are modeled after actual buildings such as the TJ building. As the people walk through the building, new people are randomly assigned a virus. This virus has the ability to spread to the other people in the building. The closer an uninfected person is to an infected person, the higher chance the uninfected person has of being infected by the virus. The simulation takes note of these infections and displays the concentration of infections along the hallways of the building. Some areas of the halls will have a higher concentration of infections than others.

Results and Conclusions

The results from this project show that there is indeed a correlation between hallway size and the rate of infection between people. The simulation itself is somewhat accurate at real human movement through hallways, but there are areas that could use some improvement, such as better wall avoidance, a better system to avoid other people, and a straighter movement down a straight hallway.