Modelling the spread of a virus

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Introduction

The aim of this project is to simulate how a virus is transmitted between groups of people in various environments. By simulating contact and airborne transmission, it should be possible to measure the efficacy of the different measures we take to keep ourselves safe from Covid-19, to see which techniques are working, and if any are a waste of time.

Viruses

Over the course of the Covid-19 pandemic the rules and guidelines were changing as often as every 3 weeks, from social distancing, and wearing masks in public, to limiting how many family members you can spend time with, many people became frustrated with the constant changes that came about as a trial-and-error approach to figuring out what works. If simulations could be run to figure out what works far quicker, then people would be far less frustrated, and more likely to follow the rules set in place.

Methods

For each of the simulated agents, they enter the map, with a set route in mind, for the store, they make a list of items to ‘pickup’, then leave the shop. Using NavMesh[1] to find the shortest route, and NavMesh ‘links to force one way motion up certain aisles. The addition of onscreen controls means that the user can change the virus’ parameters on the fly and customize the program to more accurately simulate a different virus and satisfy a different use case.

Featured Technologies

unity

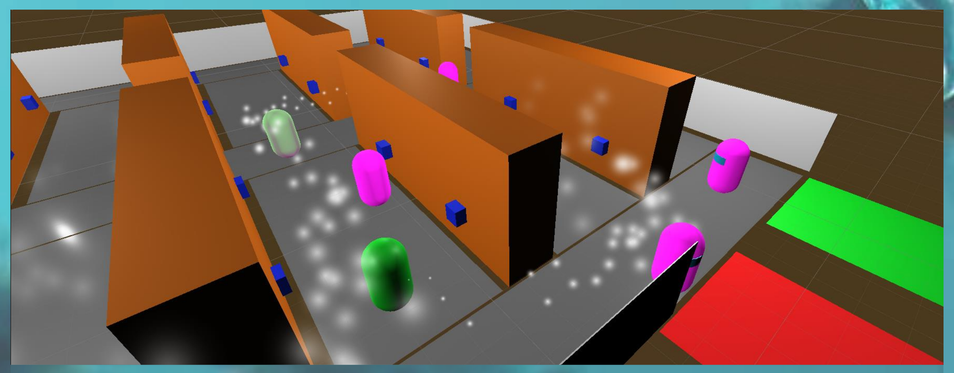
The simulations take place in Unity, traditionally a game engine, but has useful systems that makes it a perfect choice for a project like this such as NavMesh, which is used for guiding the AI agents, or the particle system, which is used to simulate airborne particles emitted though people’s breath.

Results

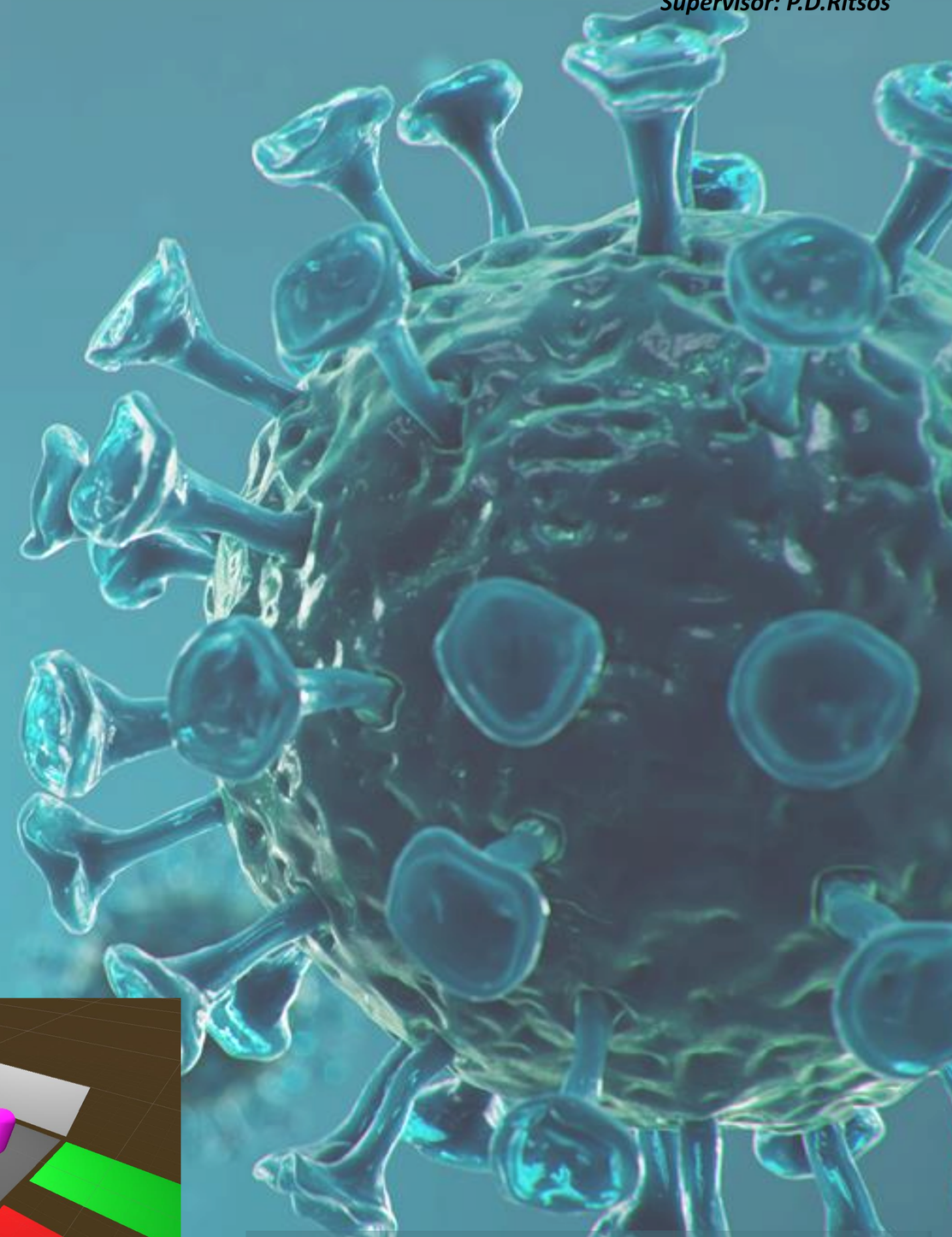
The end result is a convincing simulation of how viruses are spread, with interactive options to allow the user to customize the simulation for different viruses, or different scenarios, and to help figure out ways to mitigate the damage caused by the virus.

Future work

Currently, the simulation doesn’t use any real data, it merely functions as a proof of concept. If used in conjunction with simulations such as RIMPUFF[2], or with real data on how a specific virus spreads, this simulation could become far more robust.



A screenshot of the system with 6 simulated agents, pink are uninfected, transparent green are infected, and dark green are contagious. The white dots are the simulated virus particles



[1] *Zikky, Moh. "Review of A*(A star) navigation mesh pathfinding as the alternative of artificial intelligent for ghosts agent on the Pacman game." EMITTER International Journal of Engineering Technology 4, no. 1 (2016): 141-149.*

[2] *Thykier-Nielsen, S., S. Deme, and T. Mikkelsen. "Description of the atmospheric dispersion module RIMPUFF." Riso National Laboratory, PO Box 49 (1999).*