DOCUMENTATION

AMMi CAMiA

Problem:

The problem I had to solve was how to best present an ecosystem in a way that allows the user to evaluate and influence its balanced state, through a simulation.

Concept:

I decided to do a cell simulation, mostly inspired by the show Cells at Work. I used a basic predator-prey dynamic with a protector in between, which is *uniquely* called the protector cell. The enemy cells target both support and protector cells, protector cells target enemy cells, and support cells seek out protector cells to support.

For the design, I opted for a pixelated style because I felt that it would be easier to draw later in the process if I couldn't find any photos that matched. I chose contrasting colours so it would be easier to identify the different cells. As for environmental variables, I decided to make temperature the main variable that would affect all the cells. Additionally, I made the enemy and protector cells' reproduction rates adjustable for the user to allow for more experimentation.

Process:

The first thing I implemented was cell movement. This took the longest as I wanted the cells to mimic a natural behaviour. The cells move towards a target within their detection radius and move around idly when there's no target available, changing directions every few seconds. To prevent cells from stacking on top of each other, I implemented logic that pushes the cells apart if they get too close so that the cells crowd around their target instead. This was done by using a simple collision check, where the cells would apply a constant push which is the size of the cell, forming a barrier around the cell. The support mechanisms also relied on these checks. For example, damage and support would only apply when certain cells collide.

For the colours, I based it on simple colour theory: black for enemy cells to indicate threat, blue for protector cells to symbolize safety and protection, and green for the support cells to represent life and peace (as the support cells don't attack other cells). Cells also flash red when damaged, and protector cells turn gold when their immunity is triggered. The designs were created by me, on a pixel art app, with most of the inspiration coming from common cell designs that I saw online.

For user interaction, I used sliders from the ControlP5 library that would allow the user to adjust values like temperature and reproduction rates in real time. I also added custom buttons so the user can trigger the protector cells' immunity or reset the simulation any time.

Outcome:

I'd say I met the expectations of simulating an ecosystem; however, it might not be met in terms of balance. Since my ecosystem is volatile (fuelled mostly by the cells spawning at random locations), it's hard to predict whether it will end up balanced or not. Even the slightest drop in one of the cell's populations can change the course completely, making it difficult to balance the ecosystem naturally without user interaction. Despite this, I found that my ecosystem is balanced when each cell's population is within a certain range: 5-10 for enemy cells, 3-8 for protector cells, and over 15 for support cells. The average time it takes to reach equilibrium is around 14 seconds and it lasts an average of 8 seconds with the longest time being 13 seconds.

PROFILES

(Enemy Cell)

(Enemy Cell - Damaged)

TYPE: ENEMY

Characterized by its distinct spikes, the enemy cell is the predator in the ecosystem. Its main role is hunting both support and protector cells to destabilize the environment. Enemy cells reproduce through successful kills, which can cause them to grow rapidly if they're not taken care of.

(Protector Cell)

(Protector Cell - Damaged)

(Protector Cell - Immune)

TYPE: PROTECTOR

With it's bright blue and shield-like appearance, the focus of the protector cell is defending the ecosystem. Due to it's high detection radius, it can quickly detect and hunt enemy cells. Protector cells become stronger when they are supported by support cells, gaining the ability to take down enemy cells in just a few hits. They also have the ability to be immune temporarily, which can be triggered by the user.

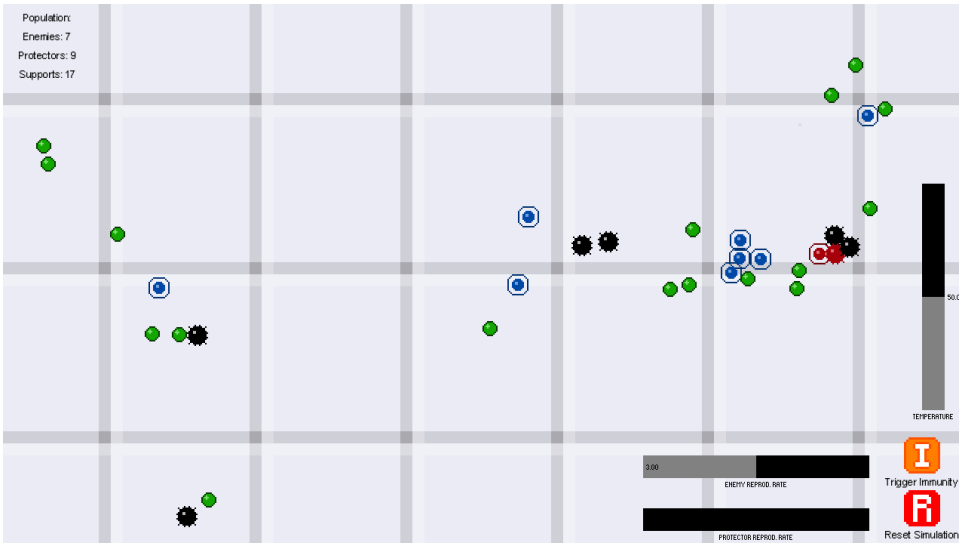
(Support Cell)

(Support Cell - Damaged)

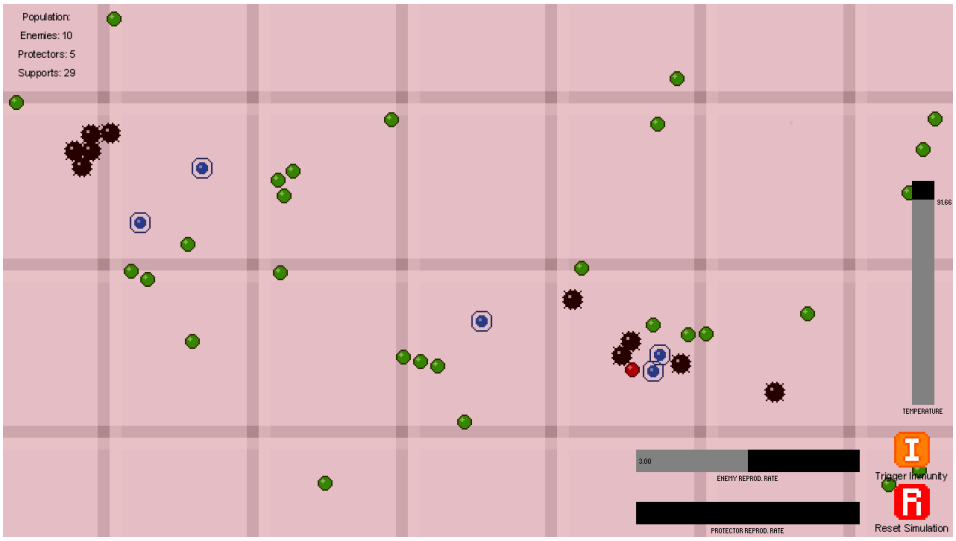
TYPE: SUPPORT

Distinguished by it's smaller size and significantly low health, the support cell is the primary prey of the system. Its main task is to seek out protector cells to support while also avoiding enemy cells. Support cells reproduce naturally and are easily affected by temperature changes, reproducing faster but moving slower in heat, and not reproducing at all in the cold.

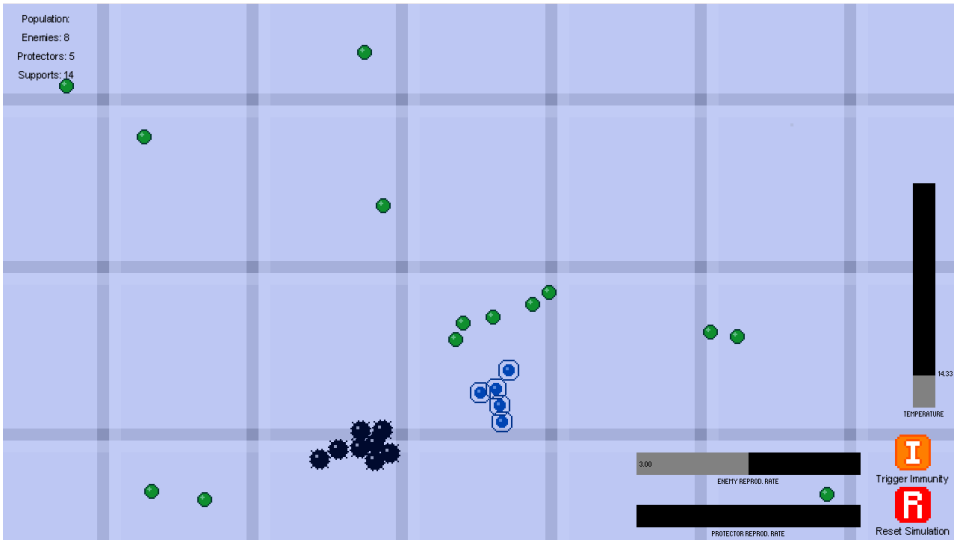
Ecosystem Screenshots



Simulation in normal state

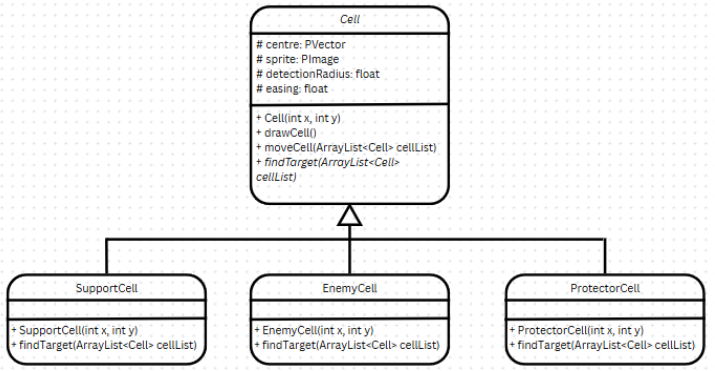


Simulation in hot temperature

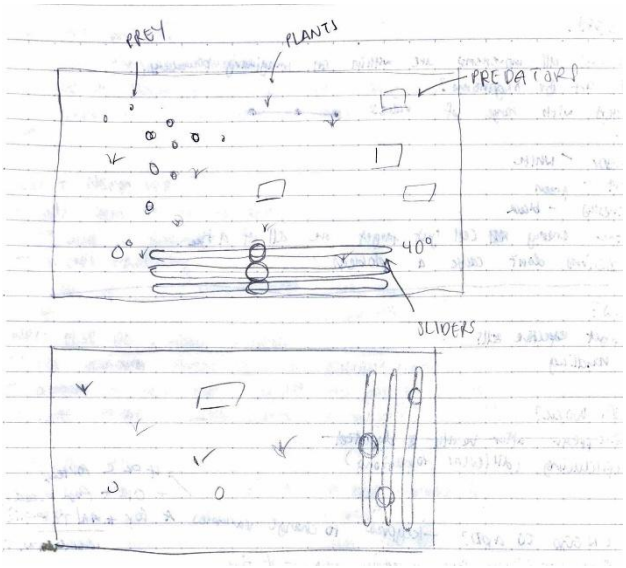


Simulation in cold temperature

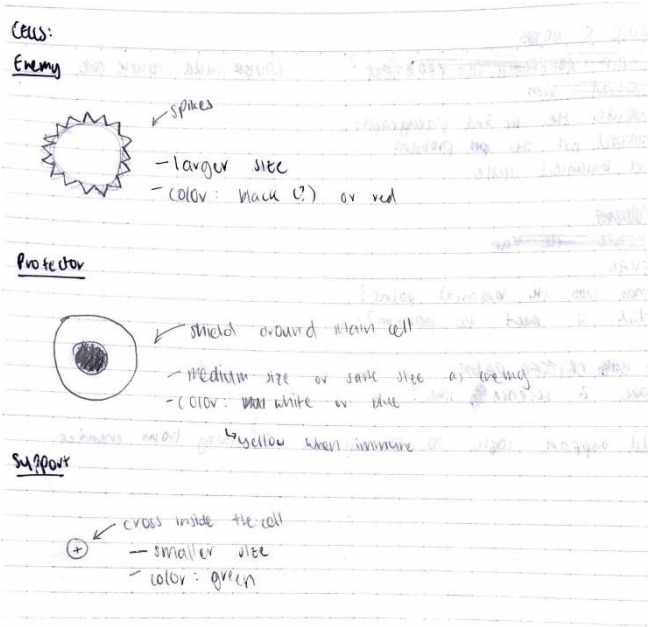
Design Sketches



Basic UML Diagram of my cell classes



Simulation design ideas



Cell design ideas

References

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