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Senior Design 1
Intermediate Planning Assignment

Updates:

- Our scope has changed in the way that our new scope involves simply getting an environment made with basic creatures that evolve over generations. This is the minimum project we will have done by April next semester. We have more ideas that we intend to add if we have ample time as our stretch goals. These involve adding functionality to how the creatures are created using a joint-based system. We would also like to add procedural world generation to give the creatures a larger space to utilize (more info below).
- Our goal has remained the same, but the focus is now based more on giving people a fun game to play. One of our stretch goals is to integrate visualization tools in order to see how our genetic AI algorithm is working. So with enough time, we could have that be a secondary focus as well. By focusing more on the visual aspect of this game, we can make this more possible. We have also changed the programming language we plan on using. We decided against Java since getting a working UI that looks good in Java would be harder. In lieu of this, we are planning to use the game engine GoDot to complete the project.
- Our plan/timeline has remained the same.

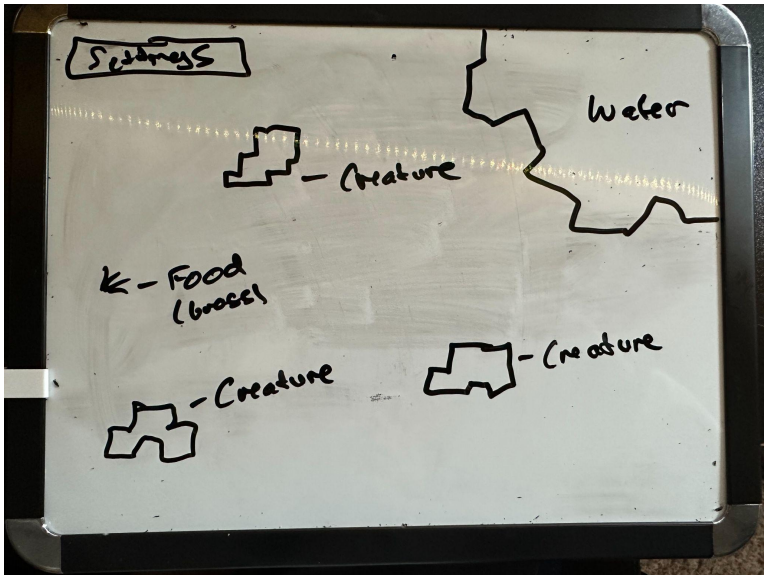
Minimum Scope (Details):

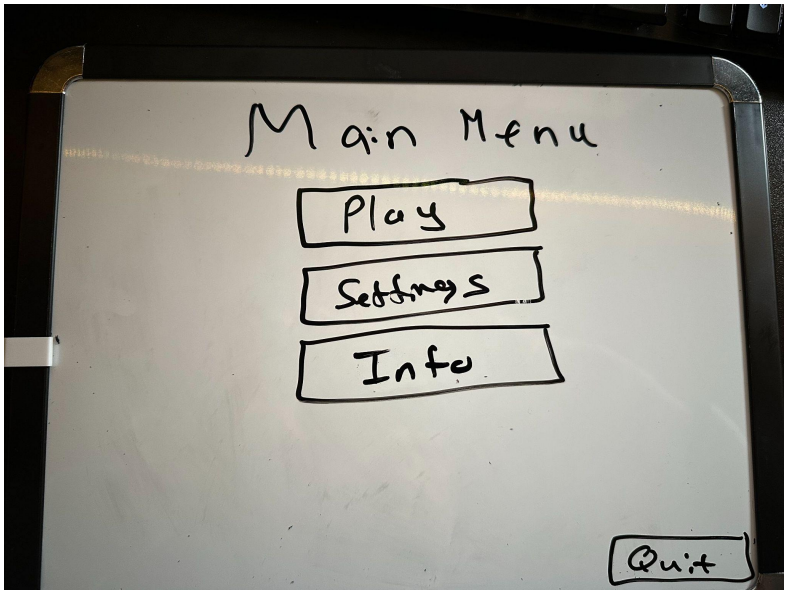
- Essentially what we hope to have at a minimum is an executable file that opens up to a menu screen. This menu screen has three options (we will add more if needed via stretch goals) in the form of basic buttons. The options consist of ‘Play’, ‘Settings’, and ‘Info’. The play option would take the user to a 2D world that has been pre-made by us. Essentially it would be a simple tilemap that looks similar to a landscape from a birds-eye point-of-view. On this landscape you can find ‘creatures/animals’ which would be represented as basic 2D shapes at a minimum. The color of the creatures would determine if they are friendly/aggressive along with other attributes (speed, endurance, vision, etc). Each creature would also have its own genes, which are represented in the form of a data structure. Each ‘gene’ would have a number associated with it that determines how good the creature's ability for that gene is. For instance, there may be a vision gene and as the value of this gene goes up, the creature’s vision improves. The user will be able to watch these creatures interact (attack, reproduce, etc.) in this environment and as they interact, the creature’s genes will mutate. We want to use a genetic AI algorithm to determine how these genes will mutate over time. Essentially the algorithm would be able to learn when to add or remove a specific value from the gene of the offspring of the creatures. For example, our algorithm should be able to determine that if the creatures are dying frequently because they can’t find food, it will increase the value of their vision gene so they can see food from farther away. The user will be able

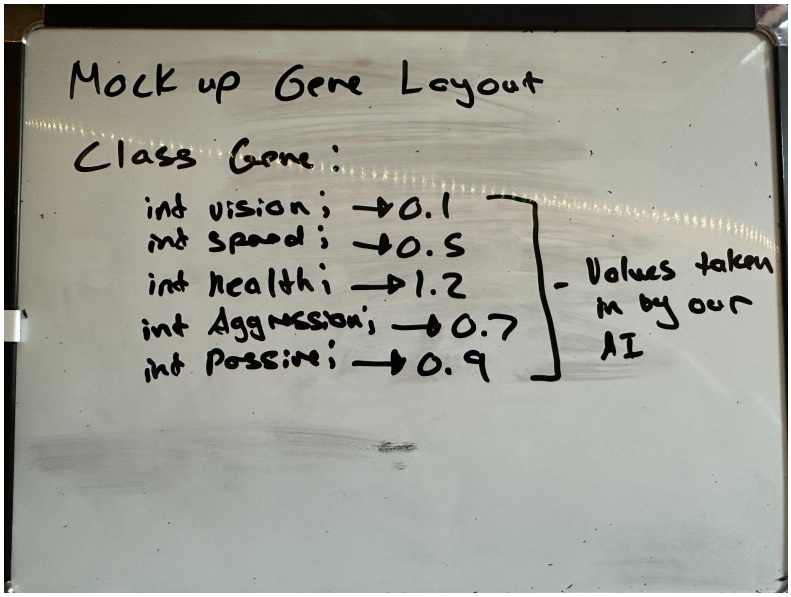
to click on individual creatures to see the values of each gene. The simulation will end when either all creatures die or when there's only one type of creature left in the environment. When the user clicks on 'Settings', they will be taken to a screen that allows them to adjust the starting gene values of each creature, and potentially the hyperparameters of the AI algorithm in order to change how the values of the genes change from generation to generation. One of our potential stretch goals is to also add an option in the settings that will display a graph at the end of the simulation that shows how well the creatures did over time. When the user clicks on the 'Info' button, it will bring them to a screen with instructions on how the game works.

What we will deliver:

- We can promise to deliver a working UI/game with a 2D environment that has creatures that reproduce and evolve over generations in order to better survive in their environment and with other creatures. This project will follow the layout issued above under our 'Minimum Scope' section. The features depicted in that are what we can promise for the project come April.
- Basic diagrams illustrating how the menu, game screen, and gene class will look are below. Our idea for the project is to make a UI/game with a visualization feature (stretch goal) that would display the evolution of species and how they interact with other species and the environment. We plan on using a genetic AI learning algorithm to compute the genes for the offspring of the species. One of our stretch goals is to potentially allow for the user to select a couple different genetic AI algorithms. We plan on synchronizing these Machine Learning processes with an interactive UI developed using a game engine. We plan on using GoDot for our game engine.
- Our original plan is as follows, Vihan will handle the visuals for our 2D display. Austin will work on the UI, Zakk and Vihan will work on creating and developing the classes for the genomes as well as working on the genetic learning algorithm(s). We will all work together to get these elements implemented into the game engine in.




Main Menu
Play
Settings
Info
Quit


Mock up Gene Layout
Class Gene:
int vision; → 0.1
int speed; → 0.5
int health; → 1.2
int Aggression; → 0.7
int Possive; → 0.9
- Values taken in by our AI