Criterion A: Planning stage

Defining the problem

My client for this project is Mr.Moran, a biology teacher at our school, and my supervisor will be Mr. Bach, my computer science teacher. Mr.Moran places emphasis on teaching through a variety of mediums, both visual and textual, to allow students to better contextualise the concepts they're learning about. However, he has recently had trouble finding suitable teaching material that is both intuitive and educational for teaching genetic evolution and natural selection. I scheduled a meeting with him to ask if it might be possible that I could provide a solution to his problem.

The teacher noted that since evolution is a process that occurs somewhat randomly over many generations, there isn't a reliable experiment or practical students can do related to this unit. He explained that currently, he resorts to letting the student watch informative videos and teaching with the textbook, which is "effective, but definitely not as interactive as it could be". Thus, I suggested building a genetic algorithm simulation that will allow students to visualise the process of natural selection. He was very intrigued by the potential solution I described to him, and specified some requests for the product.

In the interview, he showed me the presentation he has been using to teach this topic over the past few years. He mentioned that he has tried looking for evolution simulators online, but they are often too complicated for young students to use. He wanted a product that was more simple and customised to match his presentation. By considering his requests and referencing the presentation he showed me, I created the success criteria below.

Rationale for the proposed solution

Since the product is meant to serve as teaching material for young students, I wanted it to be easily accessible, intuitive to immediately start using, and have minimal hardware and technical skill requirements. This is why I have chosen to build the product on a website; the client will be able to use this product with ease as long as he has a web browser and internet connection. This is also ideal for me as a developer because I am very familiar with both JavaScript and html. Usually this might raise security concerns because JavaScript websites don't protect data very well, but since students are not required to login or enter any personal information to use this product, this is not a concern.

The programming languages I will be using are Python, JavaScript, and HTML. HTML and JavaScript will be used for the front end of the product (the website). JavaScript is a client-side scripting language, meaning the browser interprets the code instead of the web server. This means that the user's actions will result in an immediate response because they don't require a trip to the server. Fewer resources are used and needed on the web-server. This makes it highly suited for making web-based products, and it also gives me access to the p5.js library, allowing me to easily create interactive and pleasing visuals for the product. Python will be used for the back end of the product because it offers the Flask library, which allows me to create a virtual environment which my website will run on. This allows for ease of maintenance as well as efficient resource utilisation, since I can install and use only the libraries and dependencies that are required for my project.

Success criteria:

1. The product can run on a web browser
2. There are 3 elements to the simulation :
   - Rabbits
   - Grass
   - Hawks
3. Rabbits are able to eat grass
4. The rabbits have different colours
5. Hawks are able to eat rabbits
6. The rabbits are able to reproduce
7. The user is able to adjust the starting number of rabbits and mutation rate
8. The user will have the ability to perform the following operations by pressing buttons:
   - Pause
   - Unpause
   - Reset
   - Change season
9. A bar graph will showing the number of rabbits of each colour is visible on the right side
10. A line graph will showing the number of rabbits alive over time is visible on the right side
11. Each rabbit has a DNA that decides the following variables:
    - Colour
    - Size

- Energy gain

- Intelligence

- Speed

12. Any offspring's DNA is a combination of its parents' DNAs,

13. DNA can randomly mutate

14. Each rabbit's probability of getting targeted by a hawk is dependent on:

- The colour of the rabbit

- The current season