TEB1113/TFB2023: ALGORITHM & DATA STRUCTURE

Performance Report on Drone Swarm Simulation

Homework 5

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1.0 Application Domain

Device Specification

1. **Model:** Victus 15
2. **RAM:** 16GB
3. **Storage:** 500GB
4. **Processor:** AMD Ryzen 5 7535 HS
5. **GPU:** Radeon Graphics
6. **Operating System:** Windows 11

2.0 Introduction

This project creates a group of drones that fly together like a swarm. They are designed to protect a specific area. The drones move around an area, changing color when they get close to the edge. If a drone goes too far, it destroys itself to prevent accidents. The drones also work together to stay in formation and avoid obstacles. This technology could be used for security purposes, as it allows for coordinated movement and control of a group of drones. This report is a continuation from report four but with some additional UI button and function.

3.0 New Functionalities

3.1 Drone Network Communication

The Drone Network Communication class represents how drones within a group communicate with each other, it's like a network where each drone is connected to every other drone in the same group. This is important for how messages are sent and received between drones.

3.2 User Interface (UI) Implementation

The UI is designed to provide an interactive and user-friendly interface for simulation control and monitoring.

3.1.1 Design Features

- **Search Functionality:**
  (1) **Search by Battery Level:** User can know all drones battery levels by entering its ID number. This feature is useful for identifying low-battery drones that may need recharging or return to the base.
- **Search by Speed:** This feature enables users to locate drones basLed on their current speed.

- **Drone Control**:
  (1) **Button to change speed**: User can select a drone and set a new speed for it. Thhis feature enables dynamic control, allowing adjustments to individual drones based on environmental or operational requirements.
  (2) **Return to Base button:** Drone with battery levels below specified threshold are commanded to return to the base. This feature helps maintain operational continuity and ensure drones do not deplete their power completely in the field.
- **Network and Performance:**
  (1) **Distance Calculator Button**: User can select two drones ~~i~~in the n~~network~~etwork and ~~the~~the system calculates and displays the distance between them.

4.0 Additional Functionalities

There are several functions being added to the application. A search function to identify a particular drone status and location was added. Apart from that a return to base function was also added. This function works as a restart which means when it is click, all the drones will return to the starting position. A battery search was added, it is a function where drones with certain battery level be identified. It will show its position. The function to calculate the distance between two drones was also being added. The speed of a particular drones can also be known by using the new added features which is the display speed function. The speed of the drone can also be change by using the change speed function. This was also newly added. Lastly the new function added was the path from one drone to another can be shown.

5.0 Performance Analysis

6.0 Framerate and Performance Measurement

The framerate is being calculated by the “Time.DeltaTime” function. By having an FPS counter, it gives us the information on how smooth the animation. As the final update and addition is finished, the FPS rate varies between 40 up until 205. 205 was the highest framerate achieved. This shows that this application is more efficient compared to earlier versions even when more functions were added. The average time for one function to operate is 0.003 m/s plus minus. This is a huge improvement from the previous version. With a highspeed execution time further proves that this application is not facing any lagging issues.

7.0 Impact on Performance Analysis

- CPU: A mid-range processor like the Ryzen 5 should handle the computational load for a moderate-size drone swarm effectively, but as the simulation size grows, performance may be affected. Complex behaviors and large numbers of drones could slow down computation.
- Memory: With 16GB of RAM, the system should perform well under most conditions, but very large swarms or complex data structures (like the binary tree) may strain memory usage, especially if drones' data grows more detailed.
- Storage: As long as disk writing is minimized or handled efficiently, storage capacity and speed won’t be a major concern for real-time operations. If persistent storage or logging is involved, an SSD would be preferred to reduce potential lag.
- GPU: If your simulation includes rendering visual data (like in a Unity-based environment), the GPU will enhance performance. However, for purely algorithmic tasks, the GPU will not be significantly involved.

8.0 Screenshots and Visuals

These are new the buttons and assets added:

Figure 1:

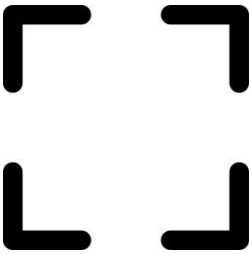

Figure 2: Target Icon

Figure 3: Drones

Figure 4:Buttons Design

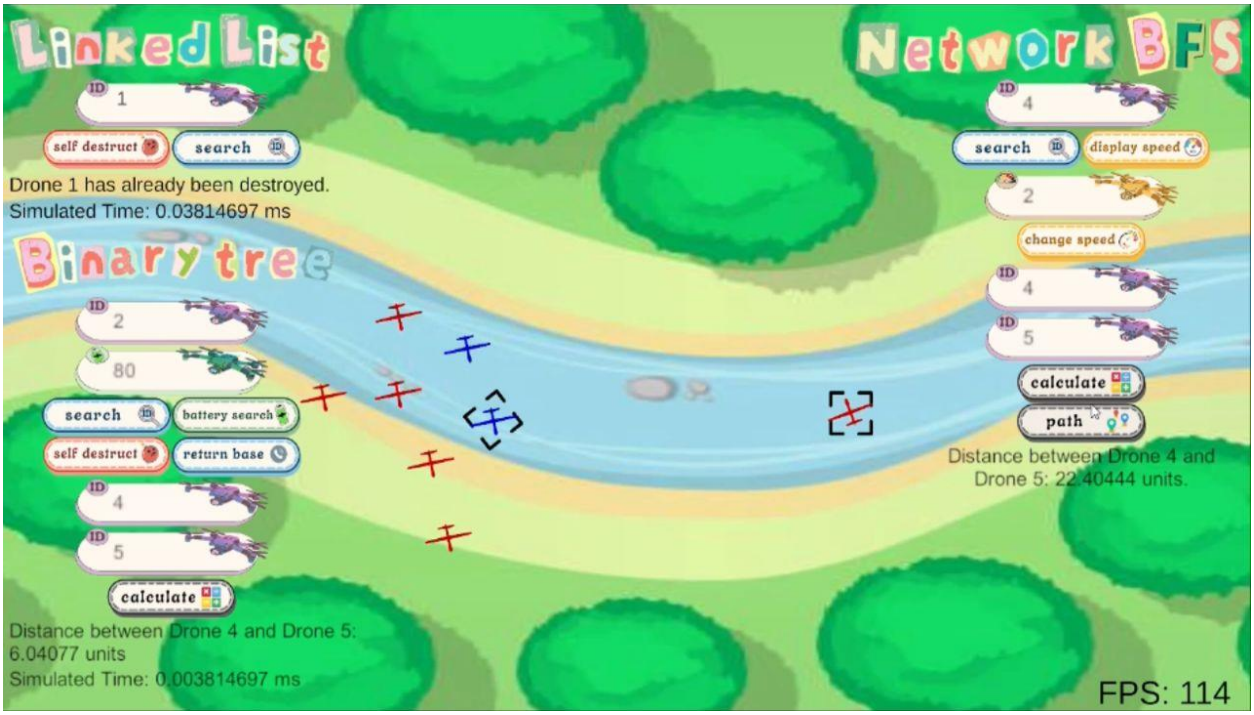

Figure 5: Complete Project with Buttons