Team Number: Group 32

Project Title: Multiple Drones Coordination System

Report Date: 02/17/2025

Part one:

All team members have detailed tasks listed on Team's Planner: YES or NO; if NO, explain.

Yes.

Please answer the following questions:

1.   Have you met as a team this past week? If yes, give date/time, and the members attended the meeting. If no, explain.

        Not all together at once. Our group has had some members who have been or are currently sick, as well as jobs and time zones, getting in the way of being able to find a good time for a group meet up. Instead, we are trying to meet with whoever is available at the moment.

2.   Have you met with the sponsor as a team? If yes, give date/time, and the member attended the meeting. If no, explain.

        Not yet, we haven't had a meeting scheduled from the sponsor this semester yet.

3.   Describe verbally the tasks completed the past week and the challenges faced.

Tutku Gizem Guder (Target Detection Subsystem)

- Tested the environment and the algorithm for more complex scenarios.
- Started using Unity to produce outcomes

Brenden M. (Simulation Management Subsystem)

- Properly implemented weather obscurations that occlude vision.

4.   Describe the tasks to be completed the coming week.

Brenden M. (Simulation Management Subsystem)

- **Detailed Collision Mapping:** Properly fitting the collision maps over the terrain and buildings.

Matthew P.(User Interface)

- **UI Refinement**:Improving layout, ensured consistent styling, and improved navigation.
- **Integration Planning**: Outlined steps for integrating UI with AirSim and database system.
- **Database Connectivity Research**: Researched methods for connecting UI to backend.
- **Testing and Feedback**: Conducted user testing and gathered feedback for improvements.

Tutku Gizem G. (Target Detection Subsystem)

- Improving the speed of data processing
- Tracking only the targeted objects

Matthew Wyatt (Data Management and Communications Subsystems)

- Continue to sync data with AirSim and work to bring communications between other subsystems.

Student Name	# Tasks completed past week	# Tasks not completed	# Tasks for next week
Brenden Martins	1	1	1

Matthew Paternoster	1	3	2
Matthew Wyatt	1	1	2
Tarek Kayali	N/A	N/A	N/A
Tutku Gizem	2	1	2

Name of the Member: Brenden Martins

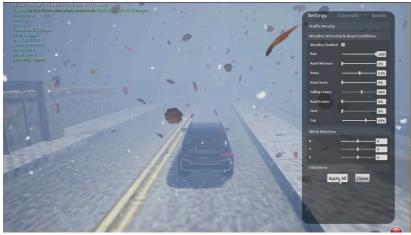**Report Date: 02/17/2025**

List the following:

1. All tasks completed the past week (in this example template, tasks between 1/20 and 1/26) (completion date in parenthesis) Highlight these tasks headers in green.

Finished Dynamic Weather Console (2/16/2025)

- Description:

    - Console that allows control of different types of weather ranging from rain to snow.
    - Included different types of obscurations such as fog and dust storms.

- Outcome:
    - Allows the simulated 3D environment to have a deeper semblance of real life weather conditions.

2.   Tasks you attempted but did not get to complete due to time constraints or other factors in the week (in this example template, tasks between 1/20 and 1/26).

Detailed Collision Mapping (02/23/25)

- Description: Creating collision barriers and opening areas that should be accessible to the drones, such as broken buildings or windows.

    - Able to have the ground's collision, including changes in elevation due to sidewalks and other various inclines.
    - Still working on the collision being properly mapped without costing too much CPU resources.
    - Looking into GPU acceleration as an idea to help with resource management.

- Outcome:

    - Having a deeper understanding of the auto convex collision, which automatically creates a basic mesh of the environment to allow for collisions to be properly rendered.
    - Convex decomposition can be detailed at a higher rate but at the cost of more computational resources.

Name of the Member: Matthew Paternoster

Report Date: 02/17/2025

Implementation:

- **Integration Planning**: Outlined steps for integrating UI with AirSim and database system. Most likely will integrate a live cam feed instead of the live map for drone tracking for smoother integration and simplicity.
- **Database Connectivity Research**: Researched methods for connecting UI to backend.

- **Testing and Feedback**: Conducted user testing and gathered feedback for improvements.
- **UI-AirSim Integration**: Begin integrating the user interface with AirSim to pull live simulation data.
- **Feature Enhancements**: Refine interactive features based on feedback.
- **Testing Integrated System**: Perform end-to-end testing to ensure seamless integration between the UI, AirSim, and the database.

Next Steps:

We have been planning and researching how to integrate everything seamlessly with AirSim. Next big step that still has to be done is getting live updates. Contemplating on integrating a live camera feed instead of the drone tracking on the map.

Name of the Member: Tutku Gizem Guder

Report Date: 2/17/2025

1. All tasks completed the past week (tasks between 2/9 and 2/16)

- Conducted testing across different environments on several objects with different numbers, confirming that the system effectively identifies and switches targets.
- Switched to Unity due to slow rendering and performance issues of Unreal Engine. Previously, Unreal Engine did not work well in my computer, and was too slow in rendering which was delaying (and hindering my process). As both of these platforms are developed in languages in C-family, I think the transition back to Unreal Engine, if absolutely necessary, would be easier.

2. Tasks I have completed so far (until 2/16)

After a long search, I finalized the algorithm development process, and have had results for tracking a targeted object, then upon pressing space bar, leaving that object to track the next available object
(https://drive.google.com/file/d/1lPHb7aF-WqwdC-NJ4UVeGBb4E0AqptWe/view?usp=s

[haring](#)). However, in this scenario; I still needed to test different scenarios to make sure the subsystem would answer to more complex real-life-like scenarios. I have managed to test some other scenarios and it seems to be working so far. The next goal was to ensure that the tracking was only applicable to desired and targeted objects, which is still ongoing as I only had time to work on the complex scenarios.

3. Tasks you attempted but did not get to complete due to time constraints or other factors in the week (tasks between 2/9 and 2/16).

- Ensuring that the desired object is always the tracked object and not an incorrect object remains an issue, particularly in single-object tracking configurations.
- Continued efforts to get Unreal Engine functioning properly, but not yet managed to iron out performance problems.

Name of the Member: Matthew Wyatt

Report Date: 2/17/2025

List the following:

1.   All tasks completed the week before the past week (completion date in parenthesis). This is copied from the last report, and if this report is the first one, skip.

   a. (2/9/2025) API Enhancement and Testing Before Sync

      Description: Enhanced the existing API to include additional endpoints and improved error handling. Conducted thorough testing to ensure the API's reliability and performance

      Outcome: The API now has additional endpoints for better functionality and improved error handling, ensuring robust and reliable communication between the UI and MySQL database. The API has been tested and is ready for integration with the AirSim environment.

2.   All tasks completed the past week (completion date in parenthesis)

    a. (2/16/2025) <mark style="background-color:#00ff00">Data Syncing</mark>

    Description: Ensure that the data between the MySQL database and AirSim remains synchronized.
    Desired outcome: Maintain data consistency between the database and the simulation environment.

3.   All tasks you are currently working on or planned for this coming week (completion date in parenthesis)

    a. (2/23/2025) <mark style="background-color:#ff0000">Subsystem Data Integration (multiple weeks)</mark>

    Description: Integrate the MySQL database with AirSim using identified APIs as well as meet up with the other subsystem components (UI, AirSim, etc.) to coordinate and advance the integration efforts.
    Desired outcome: Enable the simulation to use real-world data and ensure all subsystems are aligned and integrated smoothly to progress the project effectively.

    b. (2/23/2025) <mark style="background-color:#ff0000">Performance Optimization</mark>

    Description: Optimize the performance of the integrated system. Identify and address any bottlenecks in data retrieval, processing, and syncing between MySQL and AirSim.
    Desired outcome: Ensure that the subsystems are able to perform tasks smoothly, securely, and quickly.

Name of the Member: Tarek Kayali

Report Date: 2/17/2025

1. All tasks completed the past week

- **Basic Control Algorithm Setup (2/9/2025)**
  - Implemented an initial control algorithm to stabilize drone movement in AirSim.
  - Focused on basic altitude and directional control for smooth maneuvering.
- **Preliminary Research on Multi-Drone Coordination (2/9/2025)**
  - Researched existing methods for coordinating multiple drones in a shared airspace.

- ○ Explored leader-follower and decentralized control approaches.

2. Tasks you attempted but did not get to complete due to time constraints or other factors in the week

- ● **PID Controller Implementation for Stability Control**
  - ○ Began designing a **Proportional-Integral-Derivative (PID)** control algorithm for drone stability.
  - ○ Encountered challenges with tuning parameters for different flight conditions.
  - ○ Next steps: Fine-tune control parameters for smoother maneuverability.
- ● **Drone Movement Coordination**
  - ○ Started research on multi-drone formation control methods.
  - ○ Found limitations in direct communication latency between drones.
  - ○ Next steps: Implement a leader-follower approach for better coordination.

3. All tasks planned for the coming week (completion date in parenthesis)

- ● **Flight Control System Refinement (2/23/2025)**
  - ○ Integrate the PID control system with AirSim for real-time drone stability testing.
- ● **Collision Avoidance Implementation (2/23/2025)**
  - ○ Develop and test obstacle avoidance algorithms using sensor feedback.
  - ○ Ensure drones adjust their paths dynamically without compromising formation.
- ● **Communication Between Subsystems (2/23/2025)**
  - ○ Work with the **Data Management and Communications team** to sync drone commands and responses with the database.
  - ○ Test how the **Control Subsystem** interacts with **Target Detection and UI** for real-time feedback and response.