Team Number: **Group 32**

Project Title: **Multiple Drones Coordination System**

Report Date: **02/24/2025**

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.

Yes, we met as a group on Wednesday. However, some members could not partake due to personal reasons that have been shared with our sponsor.

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

Yes, we met with the Sponsor on Thursday. However, some members could not partake due to personal reasons that have been shared with our sponsor.

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

Tutku Gizem Guder (Target Detection Subsystem)

- Learning about ways to integrate my algorithm into the 3d environment
- Increased the speed of re-tracking
- Testing different ways to utilize what the algorithm does in our environment.

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**: Began integrating UI with AirSim and setup a python server for the drone feed.
- **Testing and Feedback**: Conducted user testing and gathered feedback for improvements.

Tutku Gizem G. (Target Detection Subsystem)

- Integrate the target detection algorithm into the environment
- Test its functionality

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	0	1	1
Matthew Paternoster	2	1	1
Matthew Wyatt	1	2	2
Tarek Kayali	N/A	N/A	N/A
Tutku Gizem	1	1	2

Name of the Member: Brenden Martins

Report Date: 02/24/2025

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 N/A (2/24/25)

This week I had two exams and was not able to finish any tasks.

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 (02/24/25)

- 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: 02/24/2025

Implementation (2/26):

- **Integration**: Setup a python server to communicate to AirSim for the live drone feed. Replaced map function with the drone feed.
- **Testing and Feedback**: Conducted user testing and gathered feedback for improvements.
- **Testing Integrated System**: Perform end-to-end testing to ensure seamless integration between the UI, AirSim.

Next Steps:

Test the Python server with the UI with AirSim to see if communication works for the live drone feed and metrics, and continue troubleshooting from there if need be.

Name of the Member: Tutku Gizem Guder

Report Date: 2/24/2025

1. All tasks completed the past week (tasks between 2/16 and 2/24)

- Focused on improving the speed of target tracking and re-tracking, I am satisfied with it. Majority of the lags seem to be gone.
- I'm looking for integration methods to combine the algorithm I developed with the 3d environment the team has created. I am especially looking to integrate the algorithm without doing much reprogramming.
- Although I could not join the meetings, there has been two meetings (one with the group and another with the sponsor), and I am working on progressing based on what has been discussed in those meetings.

2. Tasks I have completed so far (until 2/24)

[Already mentioned] 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=sharing). 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.[end of already mentioned parts]

This week I could fix some issues with target tracking, especially focusing on speed of tracking, leaving a tracked object to track another object. Apart from this, I have spent most of my energy learning ways to integrate my algorithm into the environment, and to make sure it is functioning. The latter part, currently is what I hope to accomplish during the winter break and the week after that.

3. Tasks you attempted but did not get to complete due to time constraints or other factors in the week (tasks between 2/16 and 2/24).

- Integrating the algorithm and the other parts of our design.

Name of the Member: Matthew Wyatt

Report Date: 2/24/2025

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. (2/16/2025) Data Syncing

      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.

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

   a. (2/23/2025) Performance Optimization

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

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

   a. (3/2/2025) Subsystem Data Integration (Drone Control Subsystem)

      Description: Integrate the MySQL database with the Drone Control Subsystem using identified APIs. Coordinate with other subsystem components to ensure seamless integration.

      Desired outcome: Enable the Drone Control Subsystem to utilize real-world data effectively and ensure smooth alignment with other subsystems.

   b. (3/2/2025) Subsystem Data Integration (Target Detection Subsystem)

      Description: Integrate the MySQL database with the Target Detection Subsystem using identified APIs. Meet up with other subsystem components to coordinate and advance integration efforts.

      Desired outcome: Enable the Target Detection Subsystem to process real-world data accurately and ensure smooth integration with other subsystems.

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.