Team Number: Group 32

Project Title: Multiple Drones Coordination System

Report Date: 02/09/2025

Part one:

All team members have detailed tasks listed on Teams 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 in 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.

   This past week, we were focused on completing and submitting the project report draft as it was due on Valentine's day which made it a bit of a challenge since we had the demo to work and present, 4 days prior.

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

Brenden M. (Simulation Management Subsystem)

- **Dynamic Weather System:** Polishing the weather system and making it properly fit the realistic 3D simulated environment.
- **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)

- Refining the Target Detection Subsystem

  Improving the accuracy and speed of the machine learning model for real-time data processing.

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	2	2
Matthew Paternoster	4	4	4

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: 02/02/2025

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) <mark>Highlight these tasks headers in green.</mark>

<mark>**Finished Working on Project Report (2/14/2025)**</mark>

- Description:

    - The large majority of this week was spent working on a progress report on 2/14.
    - Collaborated on a google doc for the project report.

- Outcome:
    - Created/submitted the project report.

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).

<mark>**Polishing of Dynamic Weather System (02/02/25)**</mark>

- Description:

    - Able to implement a rudimentary weather system, but not polish it up.

-
  - Did not complete fully due to time spent working on getting the project report.

  - Attempted to polish AirSim's built-in weather system to work with our 3D simulated environment.

- Outcome:

  - Identified the core issue related to UE4's volumetric fog rendering affecting visibility calculations in AirSim.

  - Next steps involve adjusting lighting settings and testing weather interpolation effects for smooth transitions.

Name of the Member: Matthew Paternoster

Report Date: 02/09/2025

Implementation:

- **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.
- **UI-AirSim Integration**: Begin integrating the user interface with AirSim to pull live simulation data.
- **Database Integration**: Implement API calls in the UI to connect with the backend database.
- **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.

Name of the Member: **Tutku Gizem Guder**

Report Date: **2/9/2025**

1. All tasks completed the past week (in this example template, tasks between 2/2 and 2/9) (completion date in parenthesis)

I developed an algorithm for detecting a target, this is something that helps with the previous concerns I had regarding tracking only aimed targets and not random targets in the environment.

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 2/2 and 2/9).

Developing Complex Scenarios and Testing:

I still need to fine-tune the model and add complex real-life scenarios for testing before deploying it in real-life.This task has been getting partially done by each step I'm adding, but it is not complete as of now. I want to also test the ability to track without colliding

with other targets. Now, although there is a single target algorithm set; I still need to make sure that it will not collide.

Lastly, drone-to-drone communication is something I am expecting to fix as I go.

Name of the Member: Matthew Wyatt

Report Date: 2/9/2025

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. (1/26/2025) <mark style="background-color:#00FF00">Requirement Analysis</mark>

        Description: Analyzed the project requirements based on the proposal. This involved understanding the scope, objectives, and deliverables of the project.
Outcome: Established a clear understanding of the project requirements, which will guide the subsequent phases of the project.

    b. (1/26/2025) <mark style="background-color:#00FF00">Database Review Part I</mark>

        Description: Reviewed the MySQL database that was already created to ensure it meets the project requirements. This involved checking the schema, data integrity, and relevance of the data.
Outcome: Confirmed that the MySQL database itself is suitable for the project, ensuring that we have access to the necessary data. However, we may need to migrate the location of the server.

    c. (2/2/2025) <mark style="background-color:#00FF00">Database Review Part II</mark>

        Description: Continued evaluation and optimization of the MySQL database to ensure data quality and performance.
Outcome: Optimized the MySQL database for better performance and confirmed its readiness for integration with AirSim.

    d. (2/2/2025) <mark style="background-color:#00FF00">API Review</mark>

        Description: Reviewed the existing API created to sync data between the UI and MySQL.
Outcome: Confirmed that the API is suitable for syncing data between the UI and MySQL, ensuring seamless data flow and integration.

e. (2/9/2025) <mark>MySQL Server Migration</mark>

Description: Migrated the MySQL server from lamp.cse.fau.edu to Freesqldatabase.com to work outside of the internal network. This will allow for easier collaboration and demonstration for the final project.

Outcome: The MySQL server is now accessible from outside the internal network, facilitating collaboration and demonstration.
Sample Code:

```js
JS index.js > ...
26
27    // Create a new record via direct link with URL parameters
28    app.get('/records/create/:name/:latitude/:longitude', (req, res) => {
29        const record = {
30            name: req.params.name,
31            description: `Location: Latitude ${req.params.latitude}, Longitude ${req.params.longitude}`
32        };
33        connection.query('INSERT INTO records SET ?', record, (err, results) => {
34            if (err) {
35                console.error('Error inserting record:', err);
36                res.status(500).json({ error: 'Error inserting record', details: err });
37                return;
38            }
39            console.log('Record inserted via link');
40            res.status(201).json({ message: 'Record inserted via link', id: results.insertId });
41        });
42    });
43
44    // Create a new record
45    app.post('/records', (req, res) => {
46        const record = req.body;
47        connection.query('INSERT INTO records SET ?', record, (err, results) => {
48            if (err) {
49                console.error('Error inserting record:', err);
50                res.status(500).json({ error: 'Error inserting record', details: err });
51                return;
52            }
53            console.log('Record inserted');
54            res.status(201).json({ message: 'Record inserted', id: results.insertId });
55        });
56    });
57
```

Sample API Output:

localhost:3000/records/create/Drone1/34.0522/-118.2437

Pretty-print ☐

{"message":"Record inserted via link","id":3}

localhost:3000/records

Pretty-print ☐

[{"id":1,"name":"AirSim Sample 1","description":"Sample data for AirSim 1","created_at":"2025-02-10T08:00:06.000Z"},{"id":2,"name":"AirSim Sample 2","description":"Sample data for AirSim 2","created_at":"2025-02-10T08:00:06.000Z"},{"id":3,"name":"Drone1","description":"Location: Latitude 34.0522, Longitude -118.2437","created_at":"2025-02-10T10:26:41.000Z"},{"id":4,"name":"Drone2","description":"Location: Latitude 37.7749, Longitude -122.4194","created_at":"2025-02-10T10:27:35.000Z"},{"id":5,"name":"Drone3","description":"Location: Latitude 40.7128, Longitude -74.0060","created_at":"2025-02-10T10:27:40.000Z"}]

Sample Database:

	id	name	description
☐ 🖉 Edit 🖿 Copy ⊖ Delete	1	AirSim Sample 1	Sample data for AirSim 1
☐ 🖉 Edit 🖿 Copy ⊖ Delete	2	AirSim Sample 2	Sample data for AirSim 2
☐ 🖉 Edit 🖿 Copy ⊖ Delete	3	Drone1	Location: Latitude 34.0522, Longitude -118.2437
☐ 🖉 Edit 🖿 Copy ⊖ Delete	4	Drone2	Location: Latitude 37.7749, Longitude -122.4194
☐ 🖉 Edit 🖿 Copy ⊖ Delete	5	Drone3	Location: Latitude 40.7128, Longitude -74.0060

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

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.

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

a. (2/9/2025) Subsystem Data Integration (multiple weeks)

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. (2/9/2025) 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.

Name of the Member: Tarek Kayali

Report Date: 2/16/2025

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.