# Modelling Unmanned Aerial Swarms Using Unreal Game Engine and AirSim Simulator

Presented By: Naimah-Joy Chapman, Elijah Keck, Dillion Mead, and John Mueller

# Table of Contents


I. Introduction

II. Project Vision

III. Design Considerations

IV. System Architecture

V. Sub-System Design

VI. Demo Videos

VII. Lessons Learned

VIII. Project Road Map

# Introduction

The aerial swarm will be autonomous with a unified, cohesive behavior that will be able to collect data from a three dimensional environment. For this project our product owner is Professor Akbas.

Benefits:

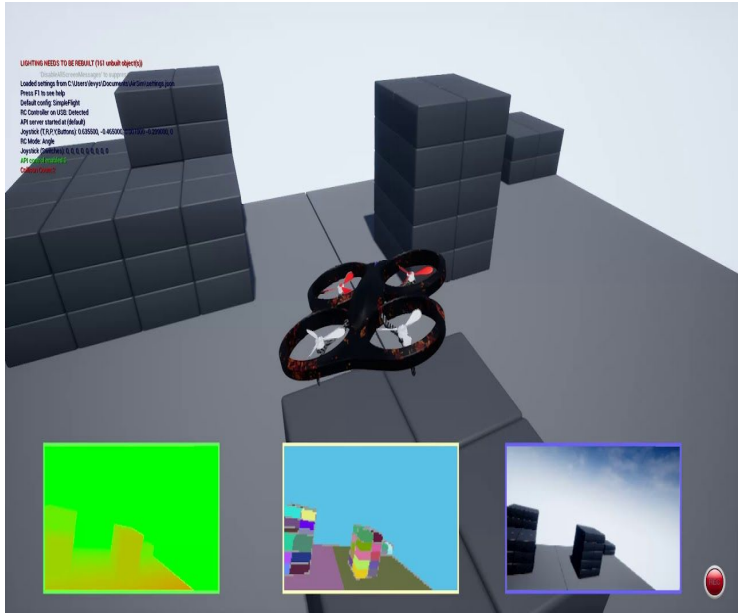
- Safer for use in dangerous situations
- Easier for use in time constrained missions
- Faster to deploy

# Project Vision

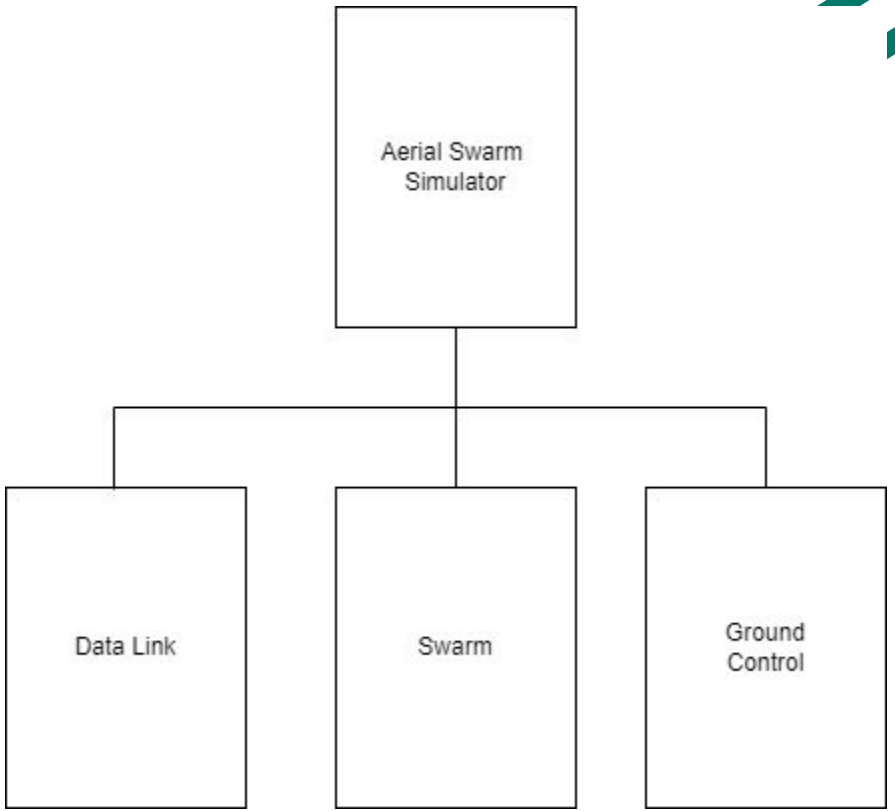
- Simulation of UAV
- UAVs communicate between each other
  - Position
  - Activity status
- Moves within a three dimensional environment
- Collects data to calculate volume
  - Irregular objects (plume of smoke)
  - Regular objects (cube)
- Reports to ground station

# Design Considerations

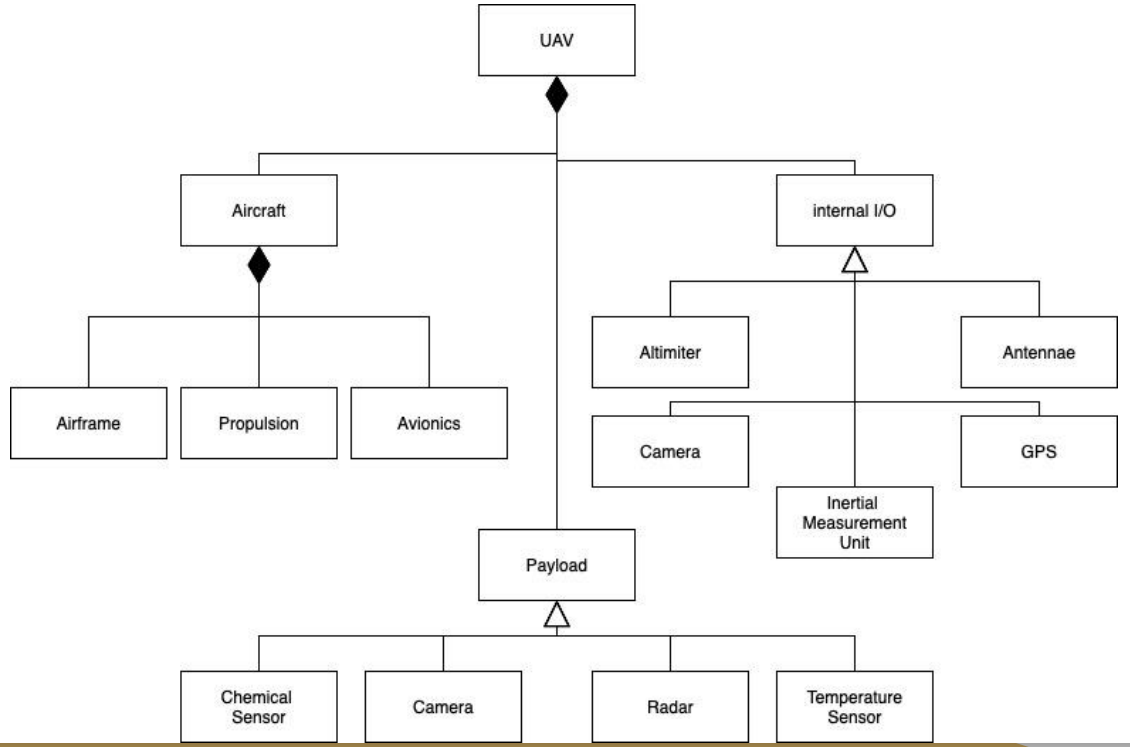
- Assumptions
  - Minimum of 3 drones in swarm to measure an object
  - Measured objects are solid and uniform
  - No objects in swarm path
  - No collision in object measurement
- Dependencies
  - Microsoft’s AirSim Simulator
  - Unreal Engine 4
  - Visual Studio 2019
  - Python based instead of C++
- Design Constraints
  - Limited to Unreal Engine 4 environment
  - Collisions/object constrained



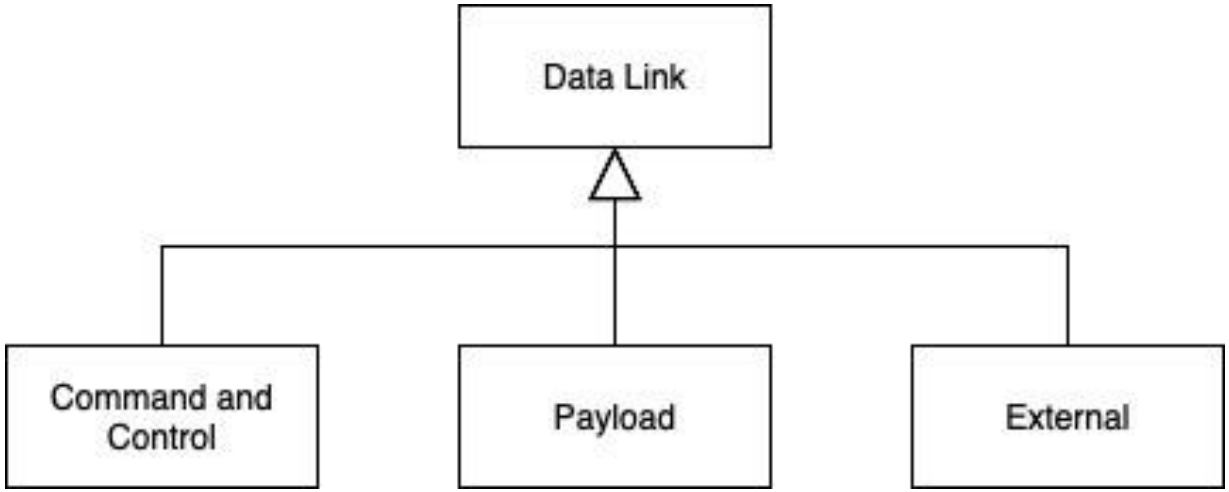
# System Architecture (High to Low)



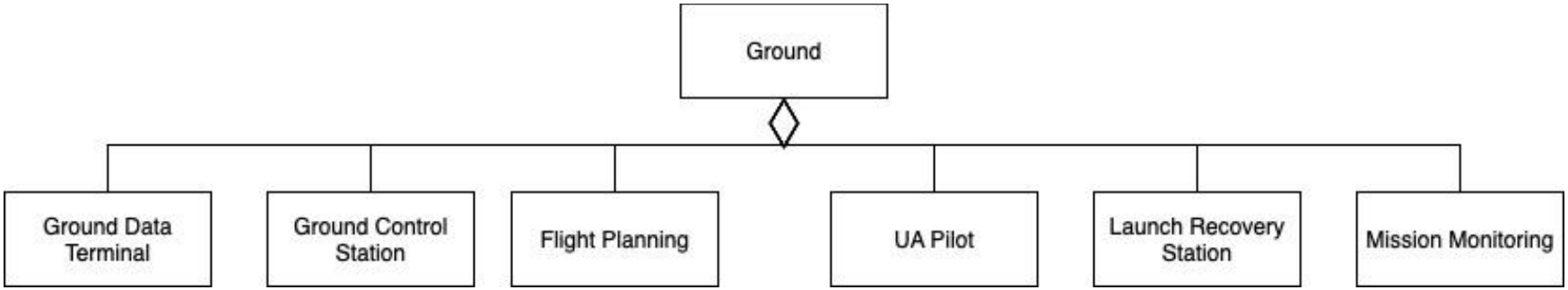
# Sub-System Design - Swarm



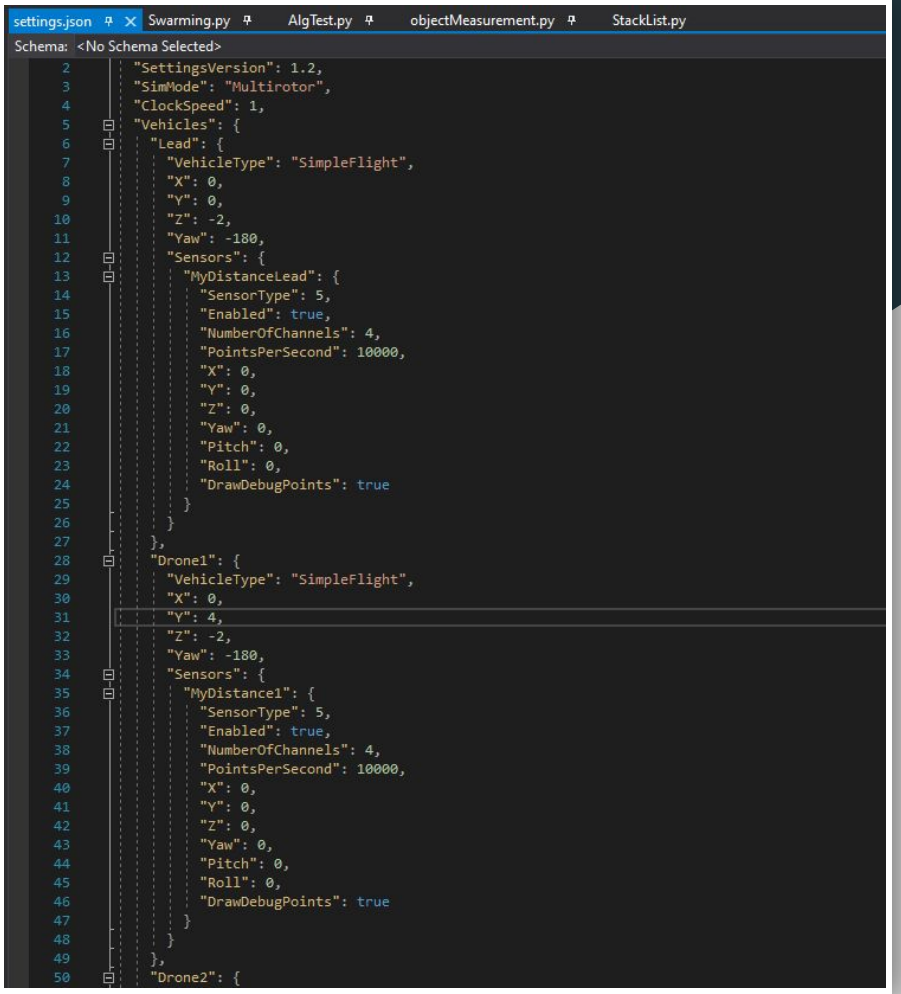
# Sub-System Design - Data Link



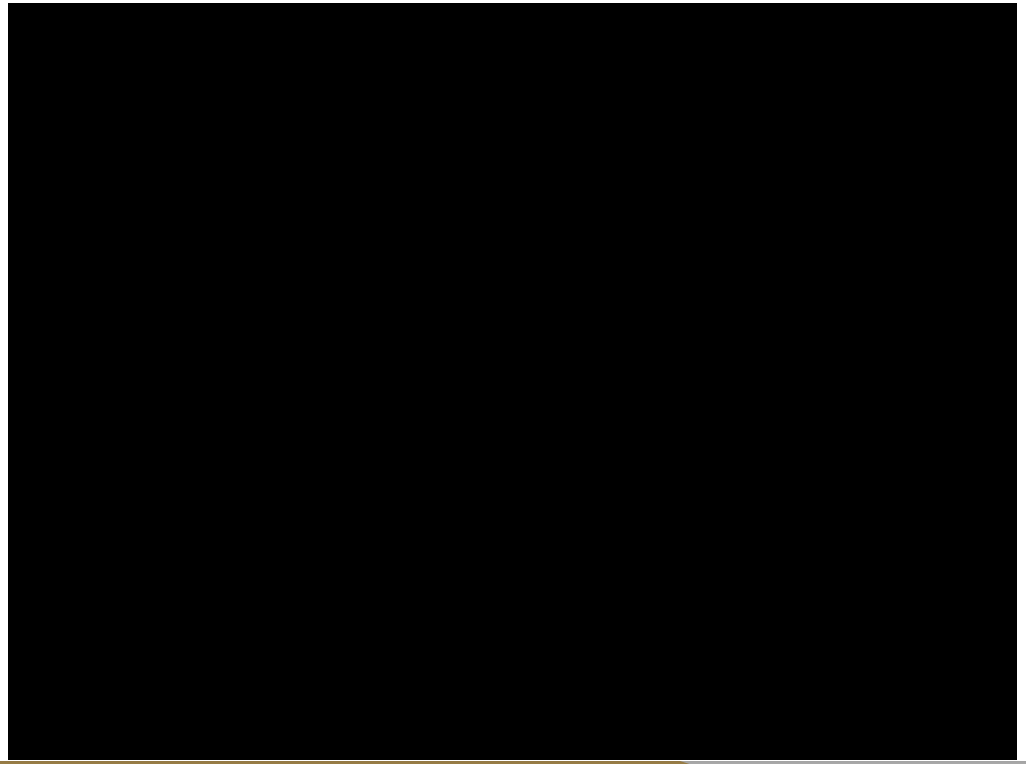
# Sub-System Design - Ground Control



# Settings File



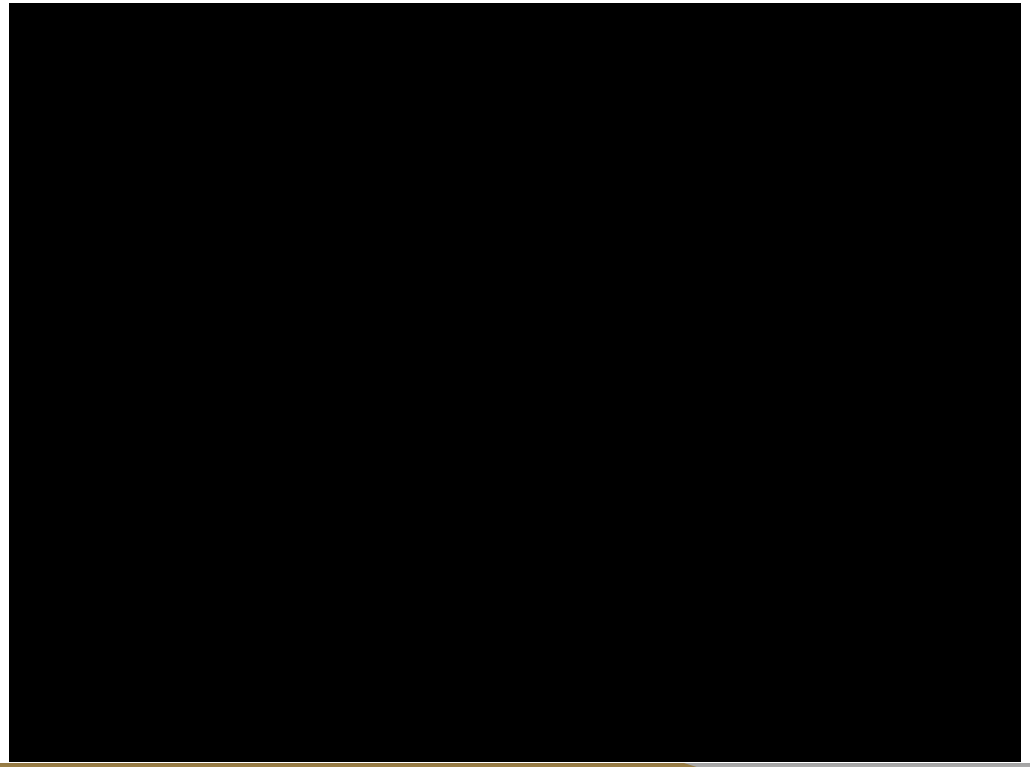
# Swarming Formation



# Swarm Unified Flight

# Drone Loss Contingency

# Object Measurement



# Challenges Faced and Lessons Learned

- Collaboration
  - Increase in productive in-person meetings
- Communication
  - Communication hub (I.E Discord)
- Meeting Deadlines
  - Set mini-deadlines to help meet end-goal
- Steep “economy of scale”
  - Utilize online resources (I.E videos and papers)
- Design versus implementation
  - Temper our design
- Reinventing the wheel
  - Utilize available tools in Airsim

# Project Road Map

- Must Have
  - Object Detection – **Sprint 4**
    - Collision avoidance
    - Dimension id (volume measurement)
  - Swarm Autonomy – **Sprint 5**
    - Pathing on mission
    - Task completion
  - Ground Control Station – **Sprint 4**
    - Swarm data display
  - Object Measurement – **Sprint 4**
    - Complex objects
- Want to Have
  - Agent Based Aerial Swarm – **Sprint 5**
    - Individual agent jobs and behaviors
  - Ground Control Station
    - Dynamic mission tasking – **Sprint 5**
    - Saving data – **Sprint 6**
- Nice to Have
  - Environment Measurement – **Sprint 6**
    - Additional sensors

# Thank You

Questions?