CERIAS
The Center for Education and Research in Information Assurance and Security

SiDG-ATRID: Simulator for Data Generation for Automatic Target Recognition, Identification and Detection

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Motivation

- Building **autonomous target recognition** systems capable of detecting, identifying, and classifying adversarial agents with machine learning models requires extensive **data for training**
- Simulation software allows developers to assess autonomous system performance and **collect data** across various environments
- Generated synthetic data should reflect environmental factors, such as lighting and weather, affecting **sensor performance**

System Architecture

- API bridge for processing data and simulation configuration
- Utilization of AirSim API for robust flight control scripting
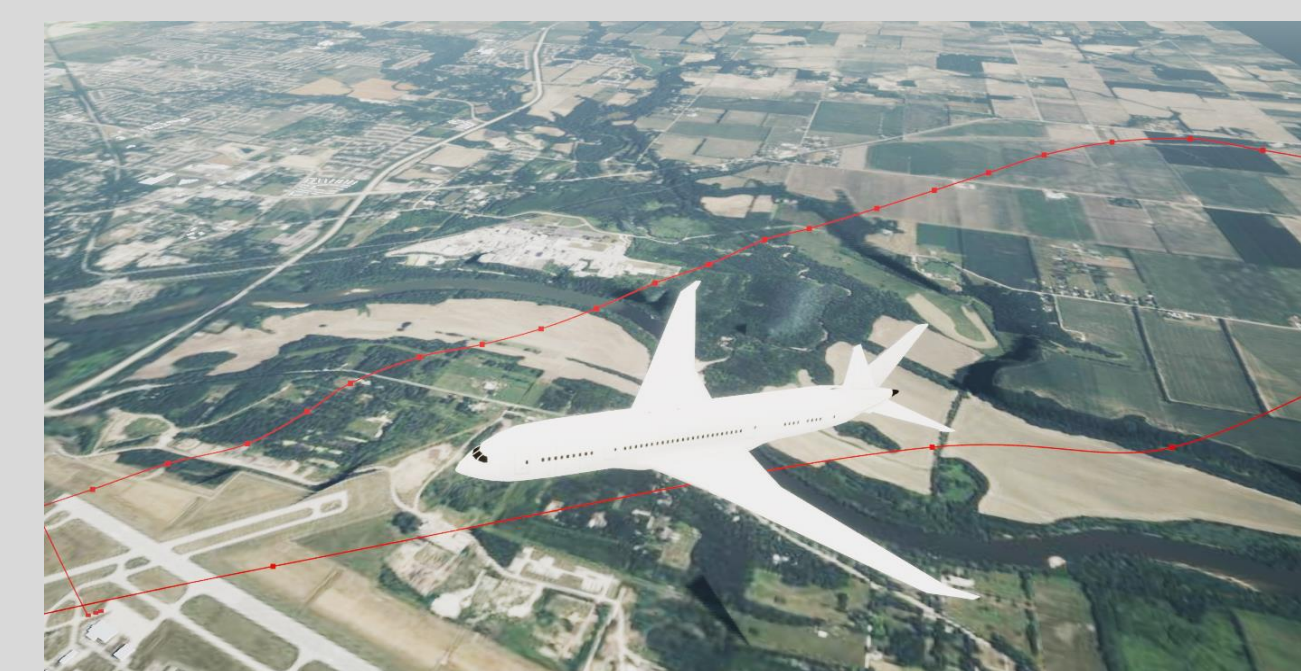- Integration of Unreal Engine 5 for high-fidelity graphics rendering
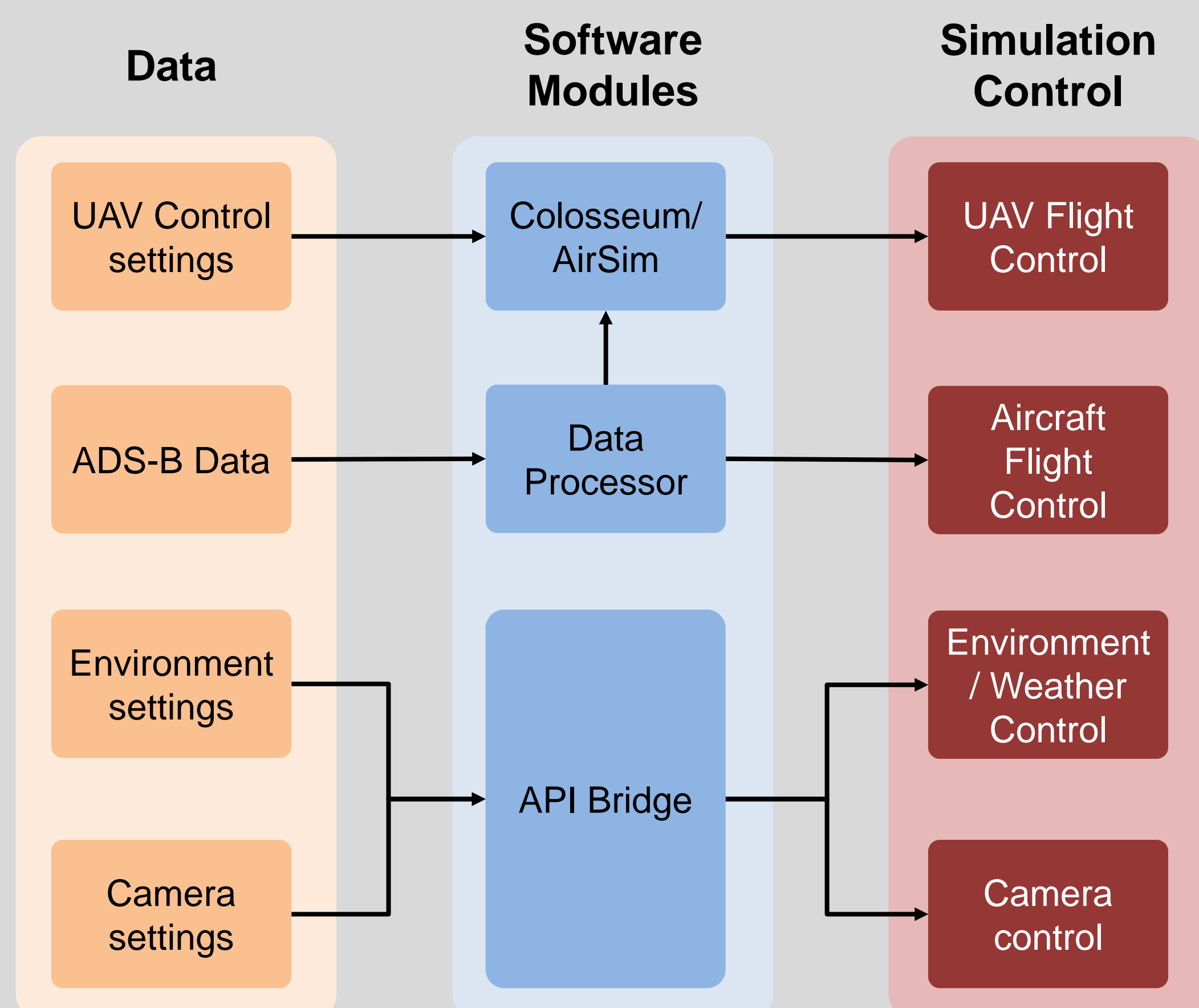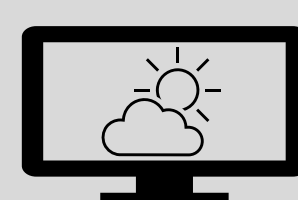

Simulator Capabilities

1 Multi-agent Simulation Controls

UAV control through AirSim API library and PX4 Software-In-the-loop (SITL)

Realistic Commercial Aircraft Traffic Simulation Using ADS-B Data

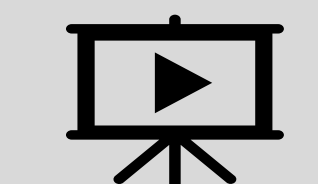### 2 Real-World Environment and Weather configuration

Geo-spatial map environment with Cesium Ion framework

Weather and lighting conditions (Rain, snow, fog, time of day, etc.)

3 High-Fidelity Imagery Data Collection

Configure camera parameters (Location, FOV, number of cameras)

Save imagery data at specified resolution and frame rate

How It Works

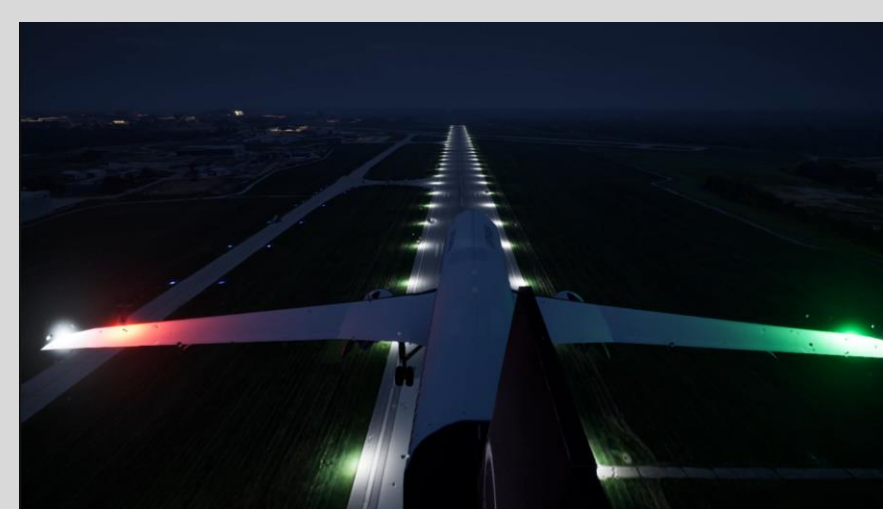| Configuration	• Configure settings parameters in JSON format
Simulation	• Scenario monitoring with real-time function execution
Data Output	• Ground truth data (camera and agent position) • Image/Video data

Data Collection

Figure a) Airport environment at low light condition

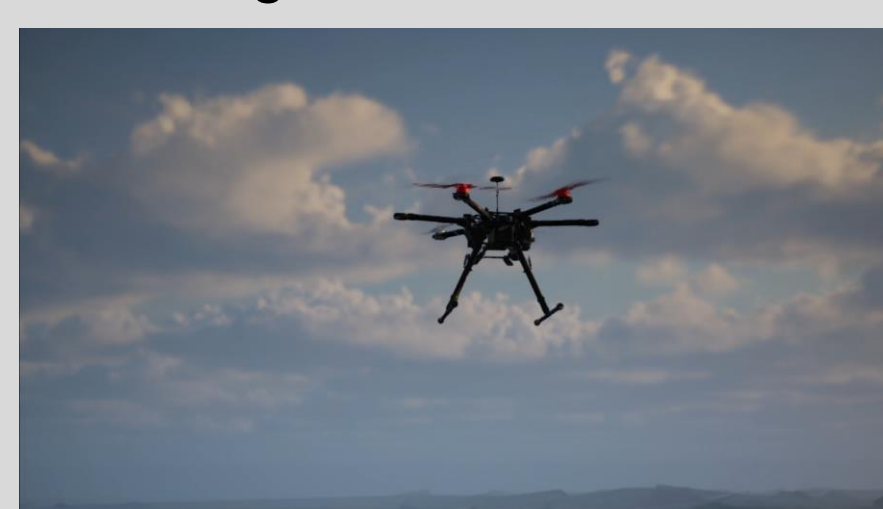**Figure b)** Open sea environment with snow effect

Figure c) Image capture from multiple camera perspectives

Future Work

- Expand API Capabilities
- SITL Ground Control support
- Test detection performance with synthetic data

Acknowledgements

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