

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

Joshua Younggil Chang, Alec Andrulis, Isabel Hoppe, Prof. Shreyas Sundaram
chang529@purdue.edu

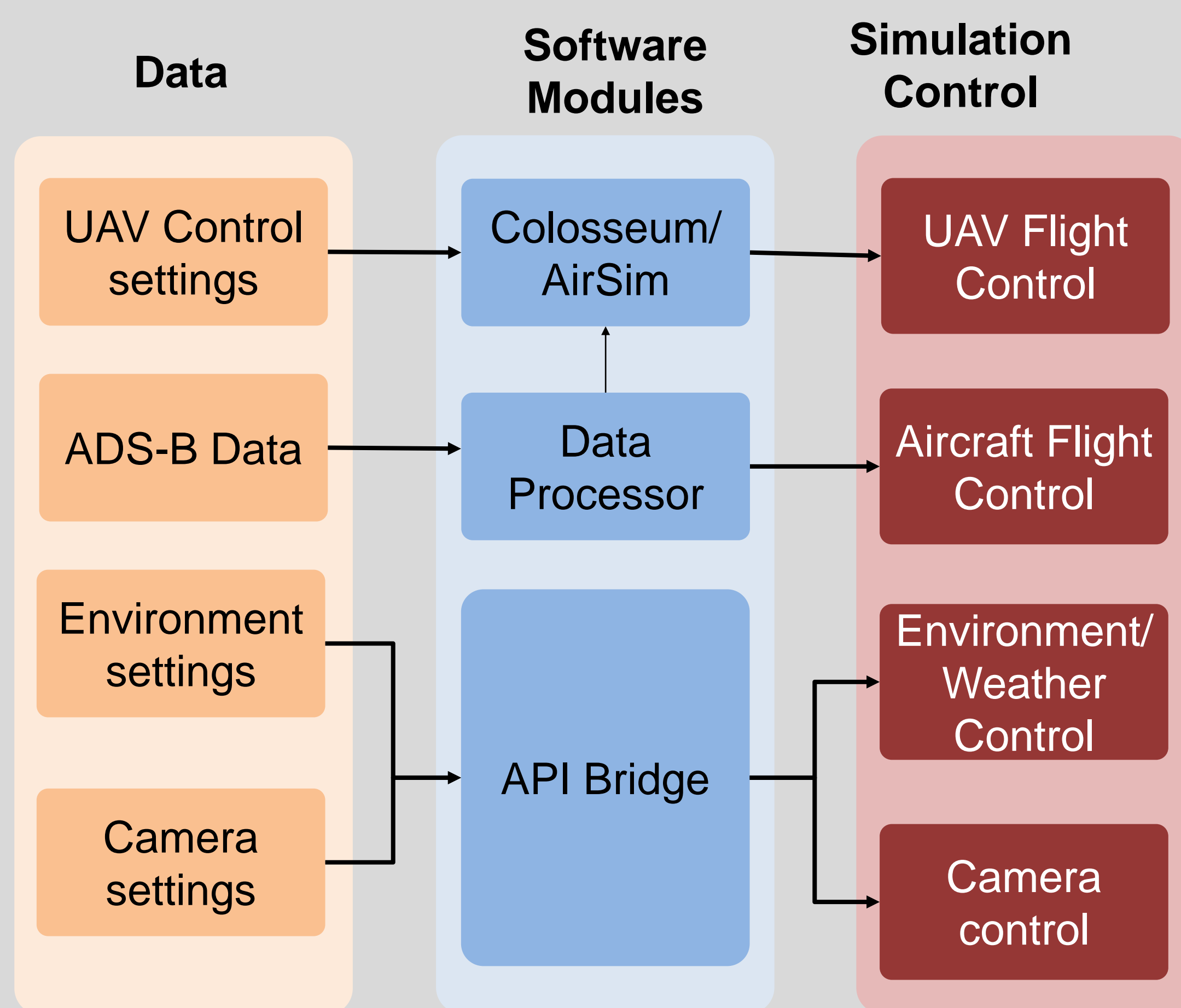
Purdue University – Elmore Family School of Electrical and Computer Engineering

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**

Methodology

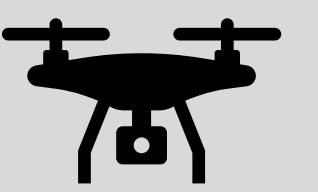
- API bridge for processing data and simulation configuration
- Utilization of AirSim API for robust flight control scripting
- Integration of Unreal Engine 5 for high-fidelity graphics rendering



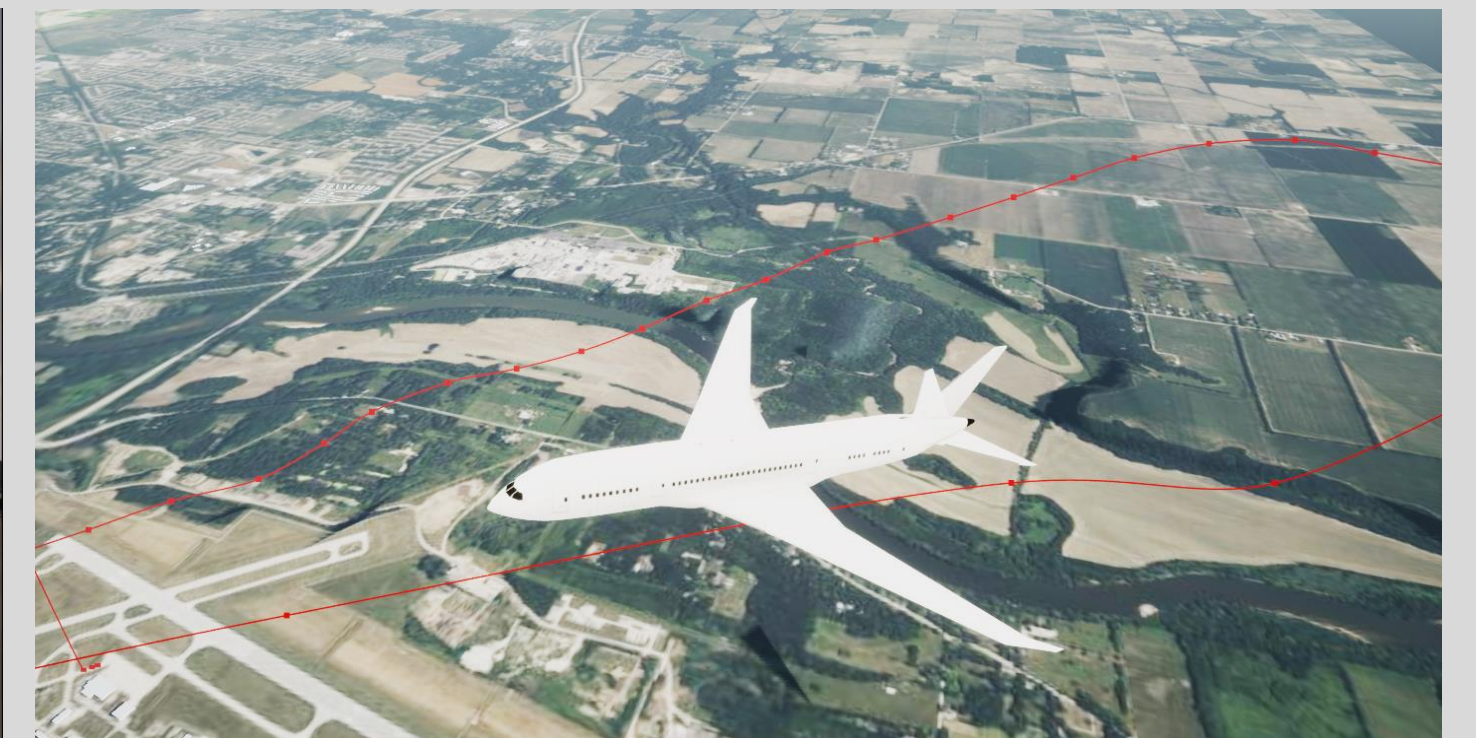
Simulator Capabilities

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



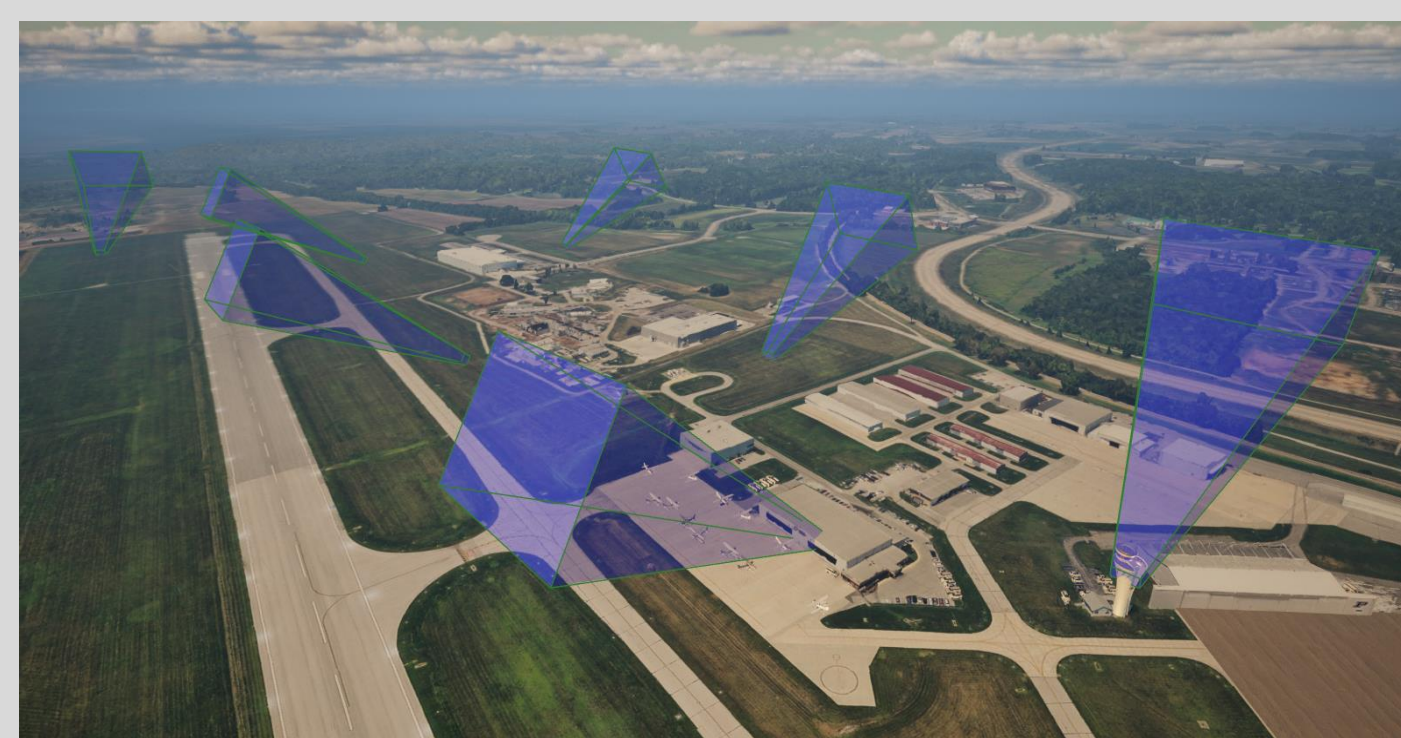
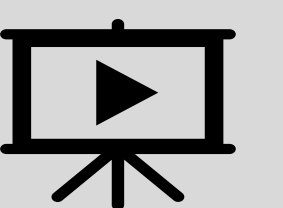
Geo-spatial map environment with Cesium Ion framework



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

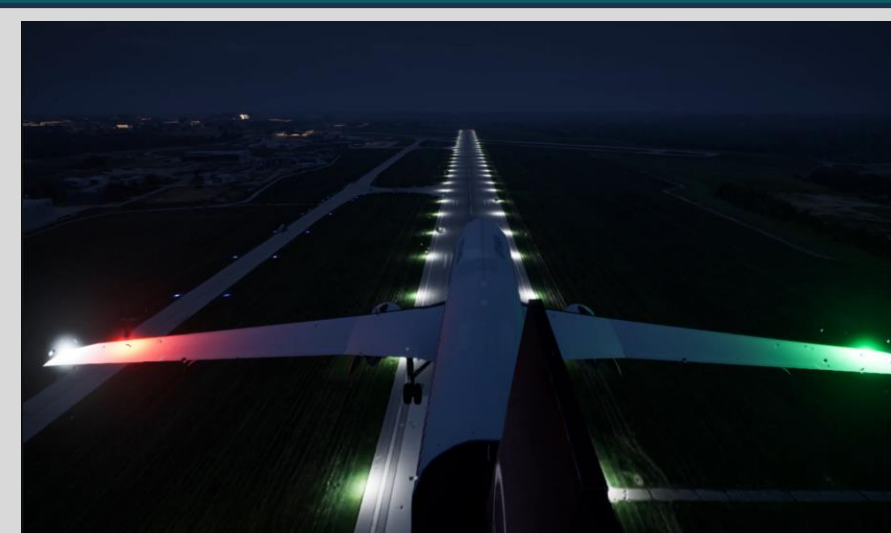


Figure a) Airport environment at low light condition



Figure b) Open sea environment with snow effect



Figure c) Urban environment with auto labeling



Figure d) Model object detection

Future Work

Expand API Capabilities

SITL Control support

Test object detection performance

Acknowledgements

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