

The background of the slide is a dark space scene with a view of the Earth's horizon on the left side, showing the blue oceans and brown landmasses. A faint blue orbital line is visible around the Earth.

Multi-Drone AI Surveillance System

Kyriakos Aristidou, Charalambos Chrysostomou, Diofantos Hadjimitsis,

Michalis Mavrovouniotis

ERATOSTHENES Centre of Excellence

The Traditional Security Challenge



Static Cameras

Limited by fixed fields-of-view, which creates predictable blind spots and gaps in coverage.



Human Patrols

Resource-expensive, difficult to scale, and can expose security personnel to possible risk.



Large Perimeters

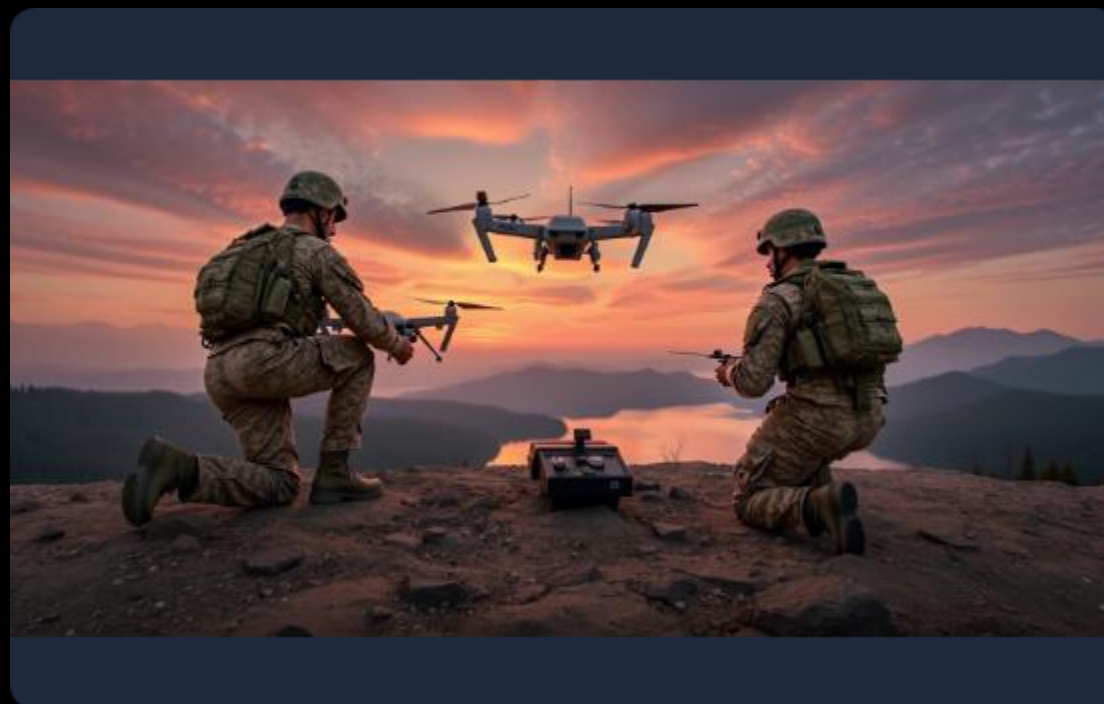
Securing expansive areas like borders or facilities is a persistent challenge for conventional infrastructure.

Our Solution: An Overview

A Dynamic Surveillance Tool

This project introduces an advanced, multi-drone surveillance system designed for real-time threat detection.

Our primary objective is to help security operators with a scalable and dynamic tool to enhance situational awareness over large perimeters.



System Architecture

Swarm Logic: A single operator can efficiently manage a fleet of up to four unmanned aerial vehicles (UAVs).

Coordinated Paths: Enables optimized, pre-planned flight paths that ensure inclusive area coverage while minimizing surveillance gaps.

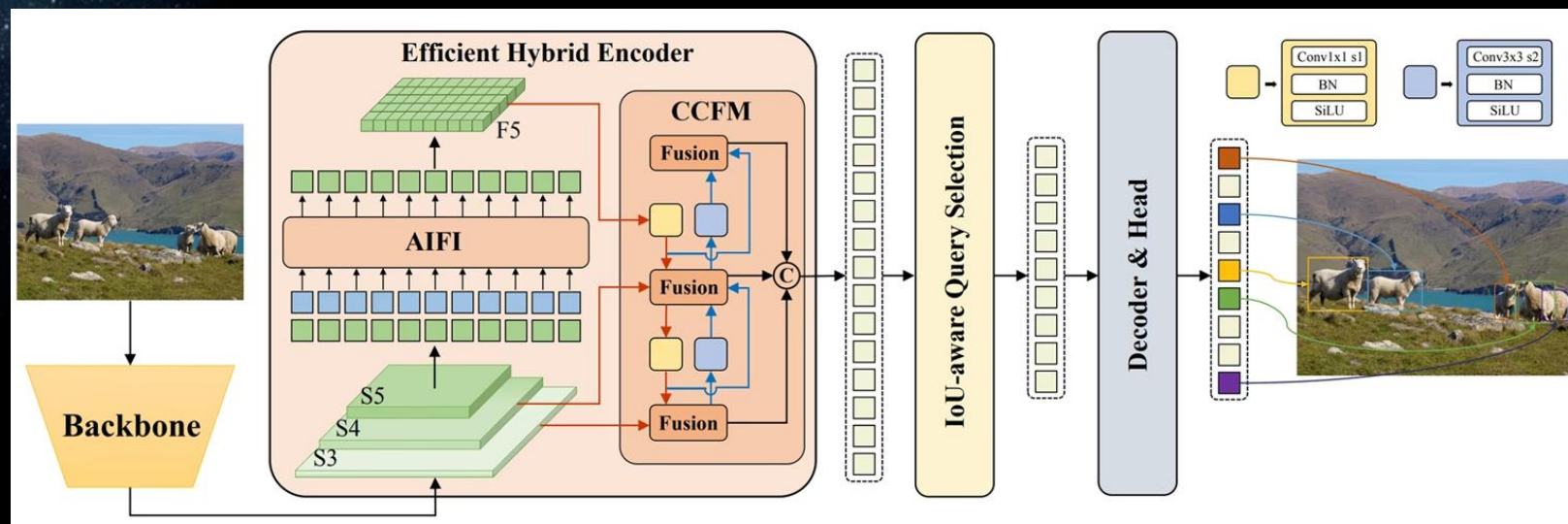
High-Res Data Stream: Each drone is equipped with a high-resolution RGB camera, providing clear, live video feeds.

Centralized Console: All video feeds are channeled into a unified, user-friendly Graphical User Interface (GUI) for command and control.

Real-Time Detection Transformer

The core of our detection capability lies in the **RT-DETR** model.

This state-of-the-art, transformer-based architecture provides an exceptional balance of speed and accuracy for live video analysis, ranking as one of the best real-time detectors available.



Live Detection Capabilities



Persons

Reliably identifies individuals, crucial for monitoring unauthorized access or unusual activity.



Vehicles

Detects a wide spectrum of vehicles, tracking movement in and around the secured perimeter.



Boats

Capable of monitoring water boundaries by identifying boats and other marine vessels.

Custom Dataset

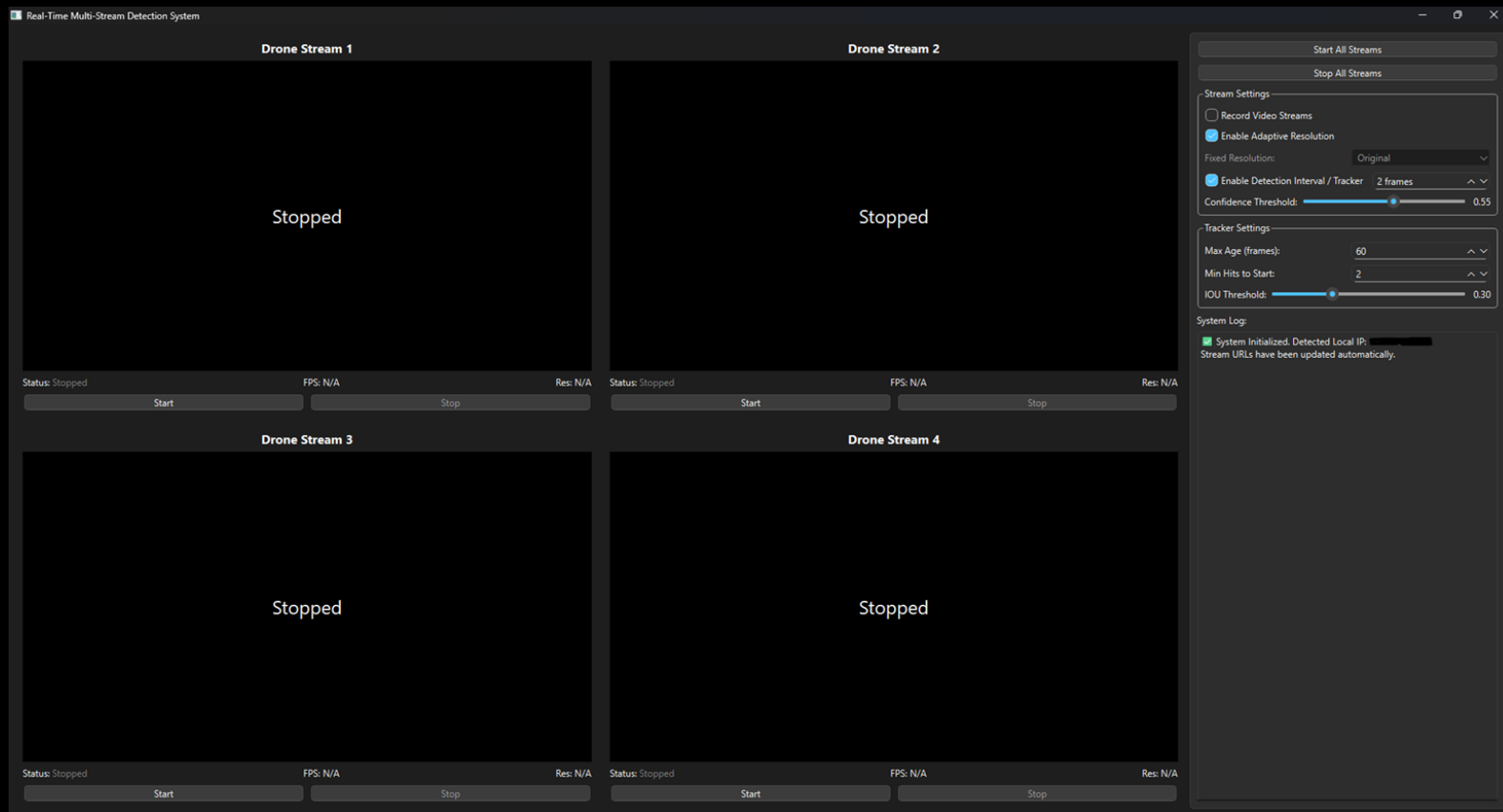
The model can be trained on a custom dataset.

Command & Control GUI

Centralized Awareness

A user-friendly command-control dashboard presents all four real-time streams simultaneously.

Detected objects are automatically highlighted, minimizing operator cognitive load and allowing for immediate attention to potential threats.



A partial view of the Earth from space, showing the horizon and a portion of the African continent, set against a dark starry background.

53.1%

mAP on COCO (RT-DETR-R50)

Performance Validation

State-of-the-Art Accuracy

Performance validation confirms the model's reliability with a Mean Average Precision (mAP) of over 53% on the COCO Dataset.

This result ranks it as one of the best real-time detectors, confirming its exceptional balance of speed and accuracy for live analysis.







Key System Benefits



Dynamic & Scalable

Easily deploy and manage a fleet of up to four drones to cover vast and complex perimeters.



Enhanced Awareness

Coordinated flight paths provide inclusive coverage, minimizing the blind spots and gaps left by static cameras.



Operator Efficiency

The centralized console with AI-driven threat highlighting significantly reduces operator cognitive load.

“

By combining coordinated mobility, powerful AI analytics, and a centralized console, our system offers a robust and adaptable solution for modern security surveillance.

”



ERATOSTHENES Centre of Excellence

A leading research center in Cyprus specializing in Earth Observation, Geoinformatics, and Big Earth Data Analytics.

This project aligns with our 'Resilient Society' and 'Big Earth Data Analytics' departments, driving innovation in security and monitoring technologies.

About Our Centre



A large, detailed image of the Earth from space occupies the left side of the slide. The Earth is shown in a curved, semi-circular shape, with the blue oceans and brown landmasses clearly visible. The background is a dark, starry space.

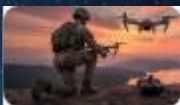
Thank You

Questions?

Kyriakos Aristidou - Assistant Researcher A

ERATOSTHENES Centre of Excellence

Image Sources



https://www.hling.com/images/flapone-crm/assets//images/upload-image/Military-drones-cover_1742292572.png

Source: www.flapone.com



<https://github.com/ultralytics/docs/releases/download/0/baidu-rtddetr-model-overview.avif>

Source: <https://docs.ultralytics.com/models/rtddetr/>



<https://eratosthenes.org.cy/wp-content/uploads/2023/11/ERATOSTHENES-CoE-franklinou-rousvelt-A.png>

Source: <https://eratosthenes.org.cy/about-us/our-premises/>