

PROBLEM

! PROBLEM STATEMENT

No existing counter-UAS system combines **autonomy and portability** with **continuous 3D airspace patrol, real-time coverage adaptation**, and **low-latency, high-accuracy hostile drone detection** — all on **affordable hardware**.

⚡ THREAT SCALE — RUSSIA-UKRAINE CONFLICT

7M in 2026

Russia plans to produce 7 million FPV drones in 2026. ^[1]

CURRENT COUNTER-UAS PRODUCTS



CURRENT LIMITATIONS

STATIC SYSTEMS

Fixed radar & jamming — cannot adapt to mobile threats

NOT PORTABLE

Extensive setup — unusable at events or temp zones

HIGH COST

Defense systems cost millions

GROUND-BASED

No aerial view — blind spots exploited by hostile UAVs

✓ OUR SOLUTION

A **portable aerial swarm** that autonomously **patrols, detects, and localizes hostile drones** in real time — using affordable hardware.

CORE SYSTEM CAPABILITIES

CUSTOM GCS & EFFICIENT ROUTING

Controlling the swarm using custom Ground Control Station (GCS) that supports key features, like Shared Probability Grid Map to achieve optimal area coverage rates.

HOSTILE DETECTION

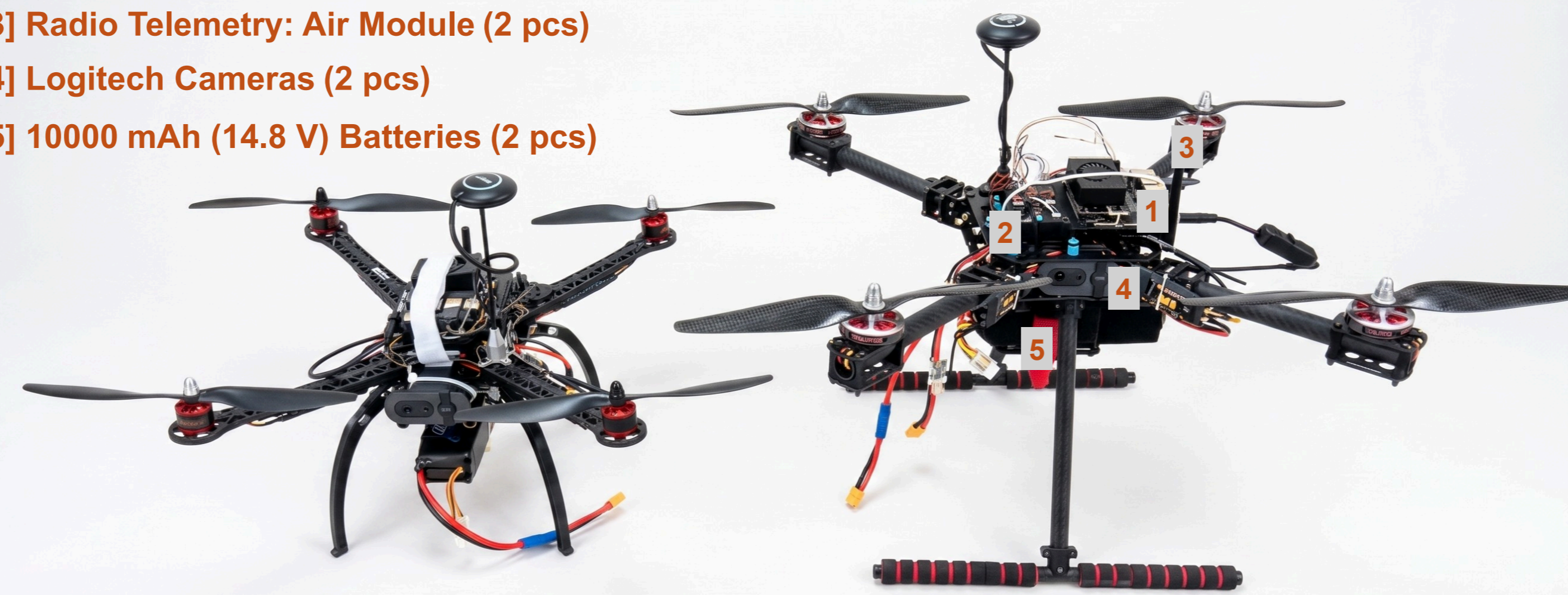
Identifying unauthorized drones in the protected airspace.

HOSTILE LOCALIZATION

Finding the spatial coordinates of the detected threat.

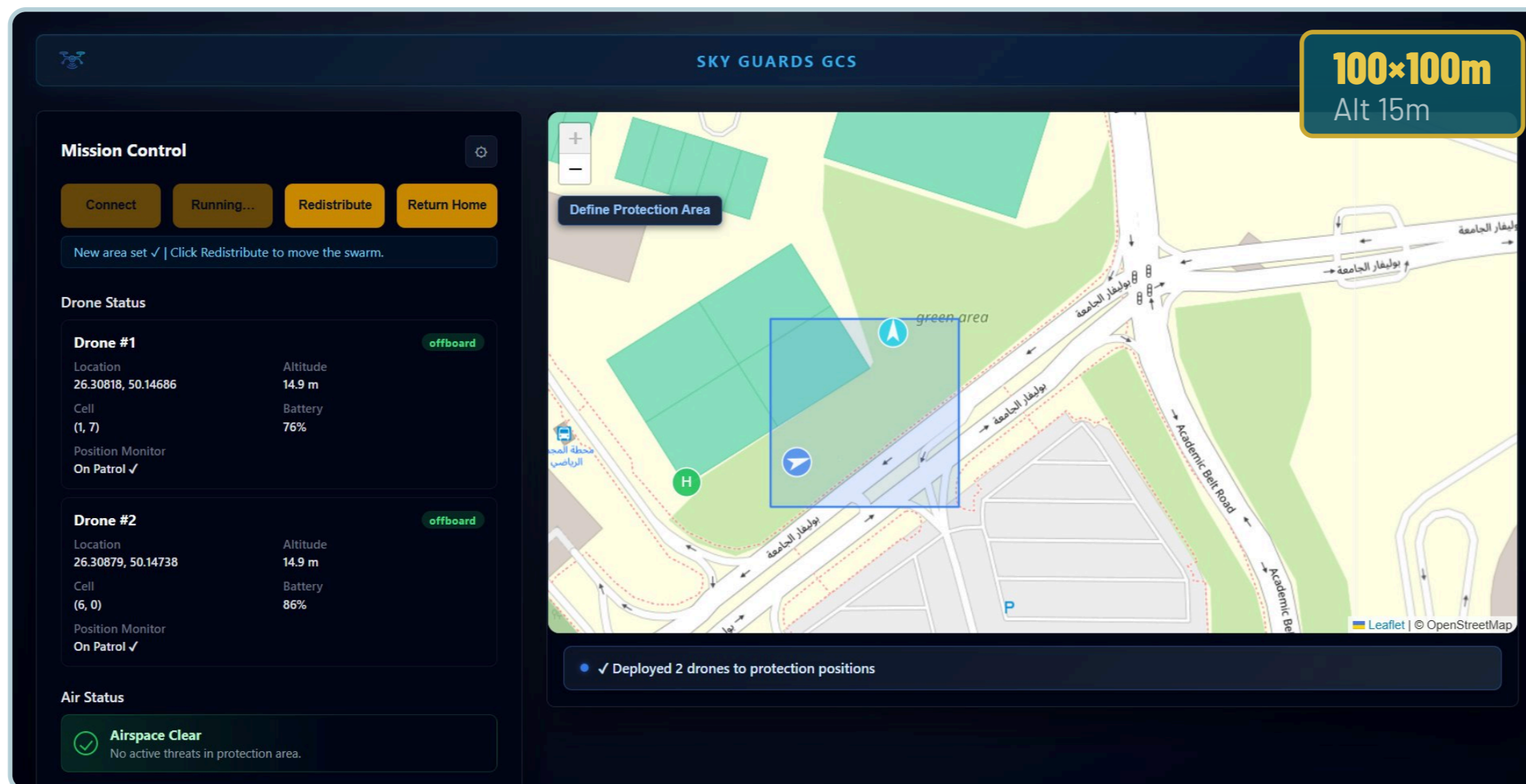
PROTOTYPE

- [1] Jetson Nano Orin (2 pcs)
- [2] Flight Controller (FC) — Pixhawk 2.4.8 (2 pcs)
- [3] Radio Telemetry: Air Module (2 pcs)
- [4] Logitech Cameras (2 pcs)
- [5] 10000 mAh (14.8 V) Batteries (2 pcs)



Costs: 8500 SAR
Deployed in 5 Minutes
Available for 24 Minutes

GROUND CONTROL STATION (GCS)



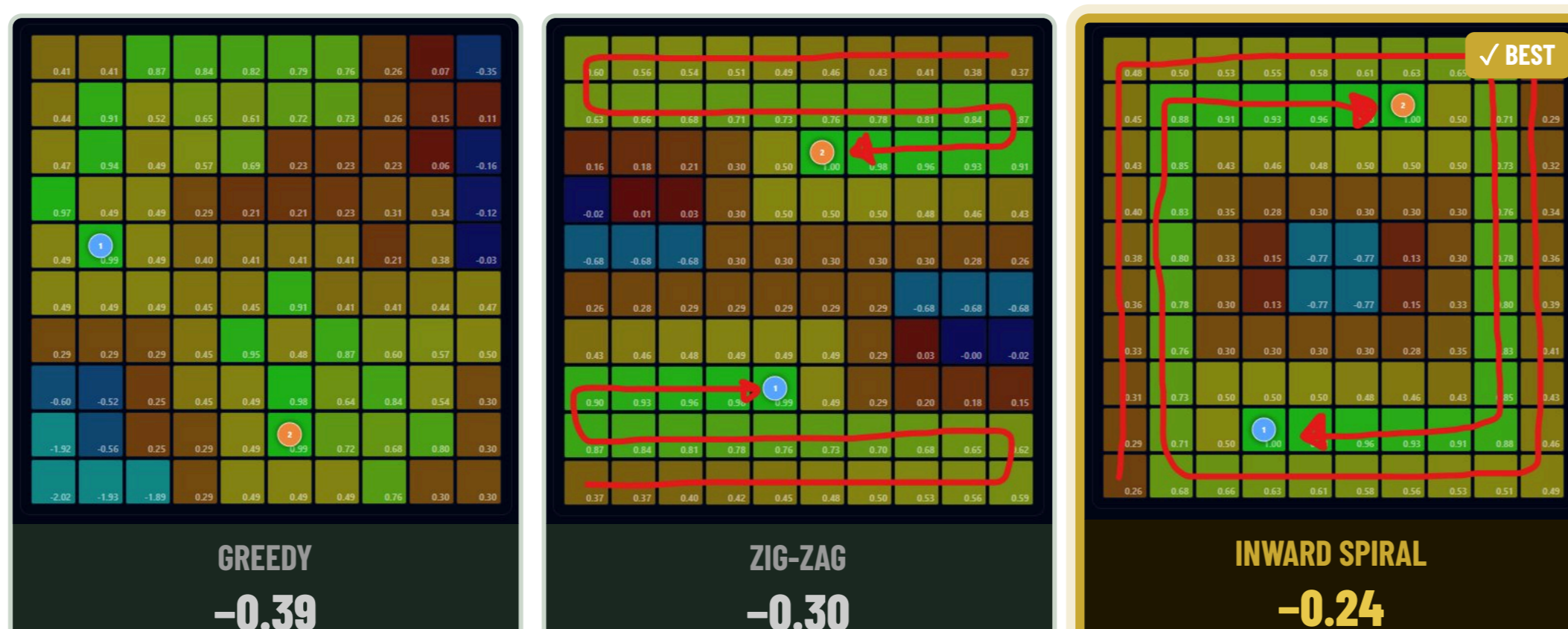
GCS FEATURES

Define Protection Area	100×100×15m
Redistribution	<10s
Return to Home (RTH) Battery	<15%
Shared Probability Grid	

ROUTING ALGORITHMS COMPARISON

Metric - Mean Minimum Coverage:

Averages each cell's *worst* coverage. Higher = no blind spots anywhere on the grid.



DRONE DETECTION



DATASET & MODEL TRAINING

Model	YOLO26s
Dataset	7K Images
Distance	Up to 100 m
Inference	< 50 ms
Classes	Drone / Birds
Modality	RGB & Thermal

VALIDATION RESULTS

Validation Results
Precision : 0.9505
Recall : 0.9476
F1 : 0.9491
mAP@0.50 : 0.9682
mAP@0.5:95 : 0.5875
Latency : 12.18 ms/frame (pre 1.09 + infer 10.86 + post 0.23)

DRONE LOCALIZATION

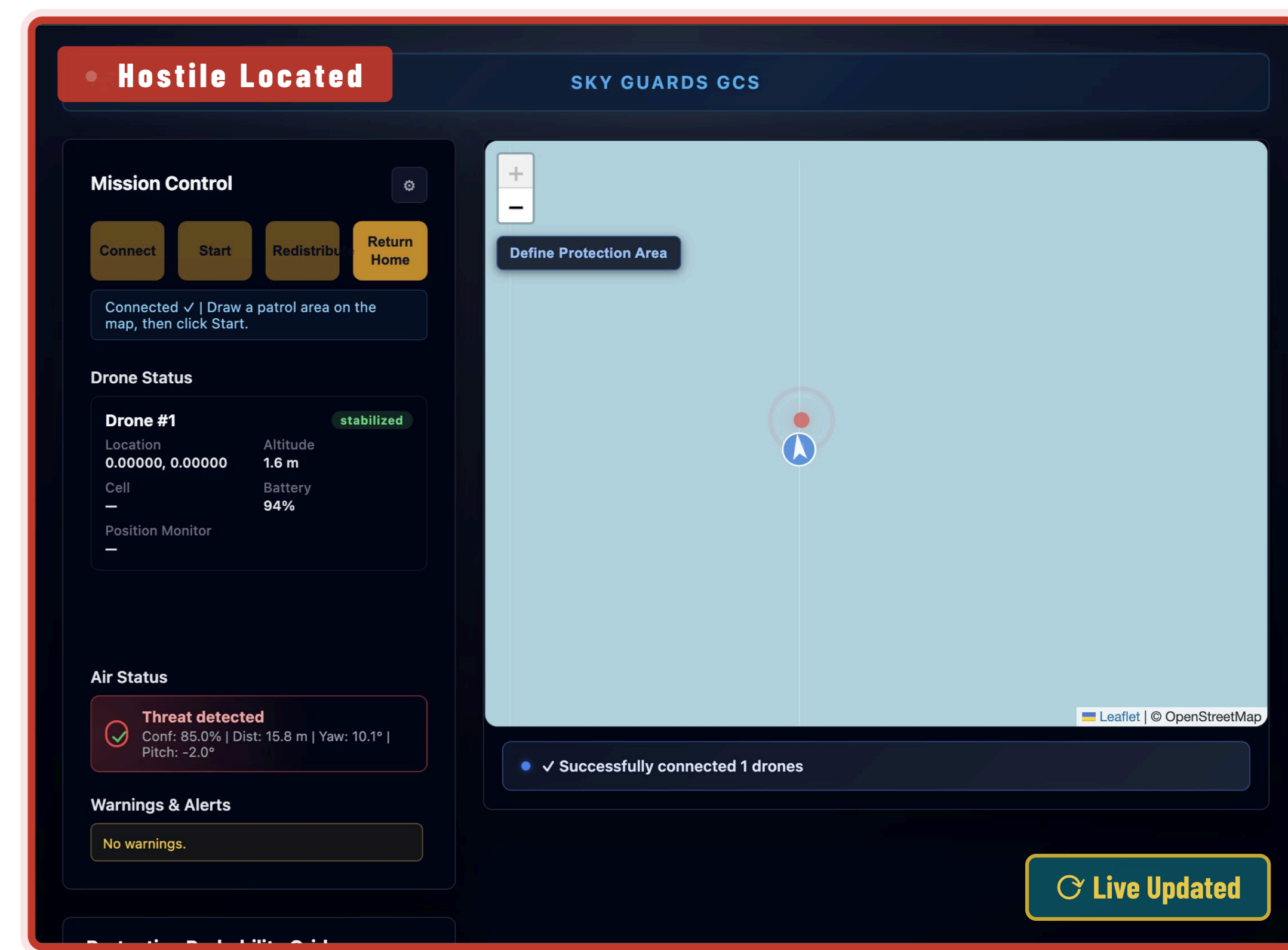
THE THREAT
Hostile Drone
Enters airspace unannounced Unknown Loc.

STEP 1 - CAPTURE
Camera
Live video to Jetson Video

STEP 2 - INFERENCE
Jetson + YOLO26s
Detects the hostile and finds (Depth, Yaw & Pitch) Depth
Yaw
Pitch

STEP 3 - BRIDGE
Pixhawk FC
Bridges the message from Jetson to GCS Message

STEP 4 - COMPUTE
GCS Server
Compute the hostile location using the message coming from flight controller and the drone's current location. Lat/Lon



CONCLUSION & FUTURE WORK

KINETIC INTERCEPTOR INTEGRATION

Integrating Sky Guards with Interception system — delivering real-time localization coordinates for automated threat neutralization.

SWARM SCALABILITY FOR WIDE-AREA COVERAGE

Adopting more drones in the system to cover wider protection areas

EXTENDED OPERATIONAL ENDURANCE

Integrating lightweight solar panels into the drones for in-flight energy harvesting, significantly increasing system availability.