

ARIES: Autonomous Reconnaissance, Inspection and Exploration System for Hybrid Single and Multi-UAV Building Inspection Approach after Disaster

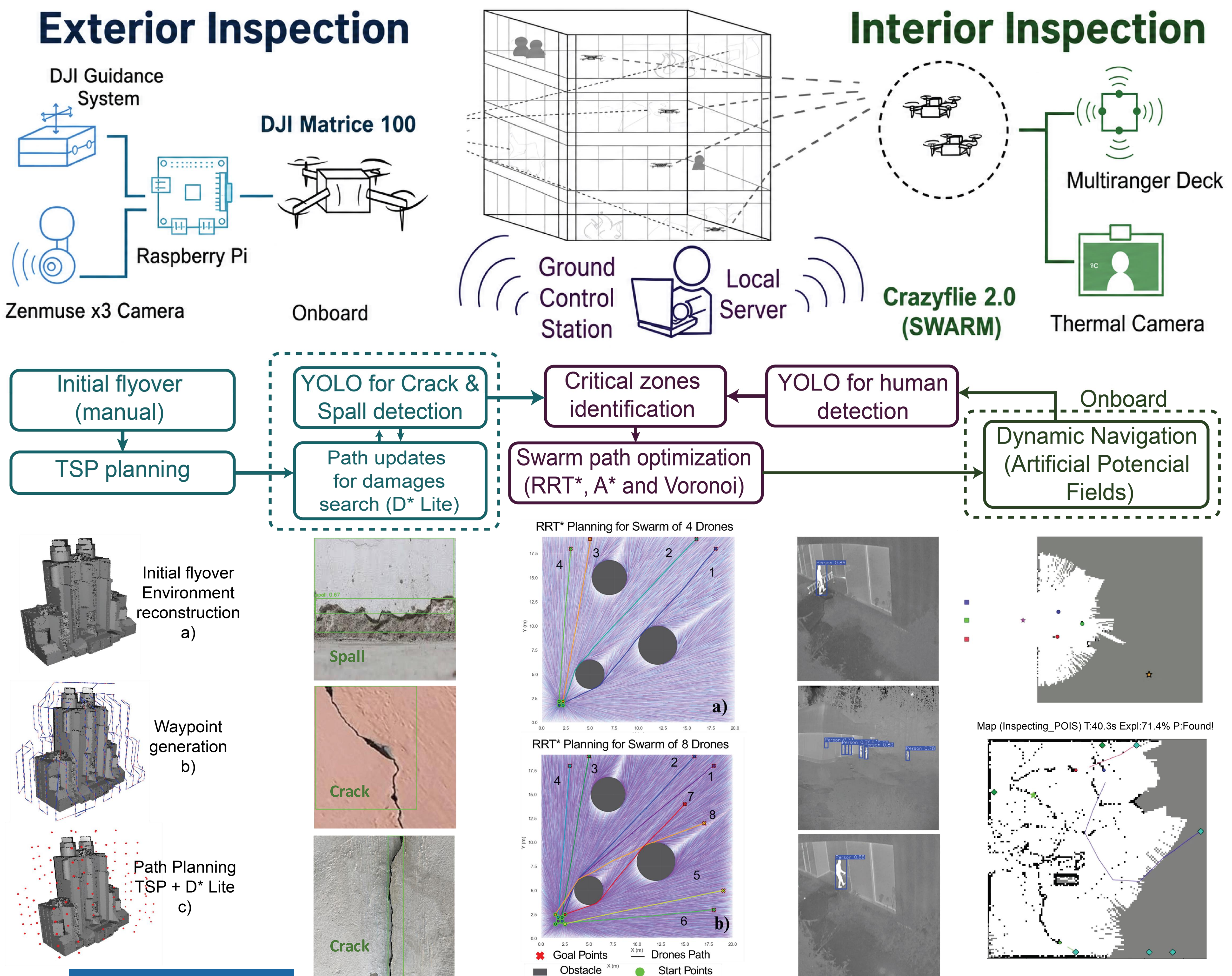
PROBLEM

Autonomous building inspections during search and rescue (SAR) face severe time limits and compute constraints on edge devices. Low-light indoor conditions hamper optical victim detection, and a gap exists in analyzing processing offloading trade-offs across drone system devices.

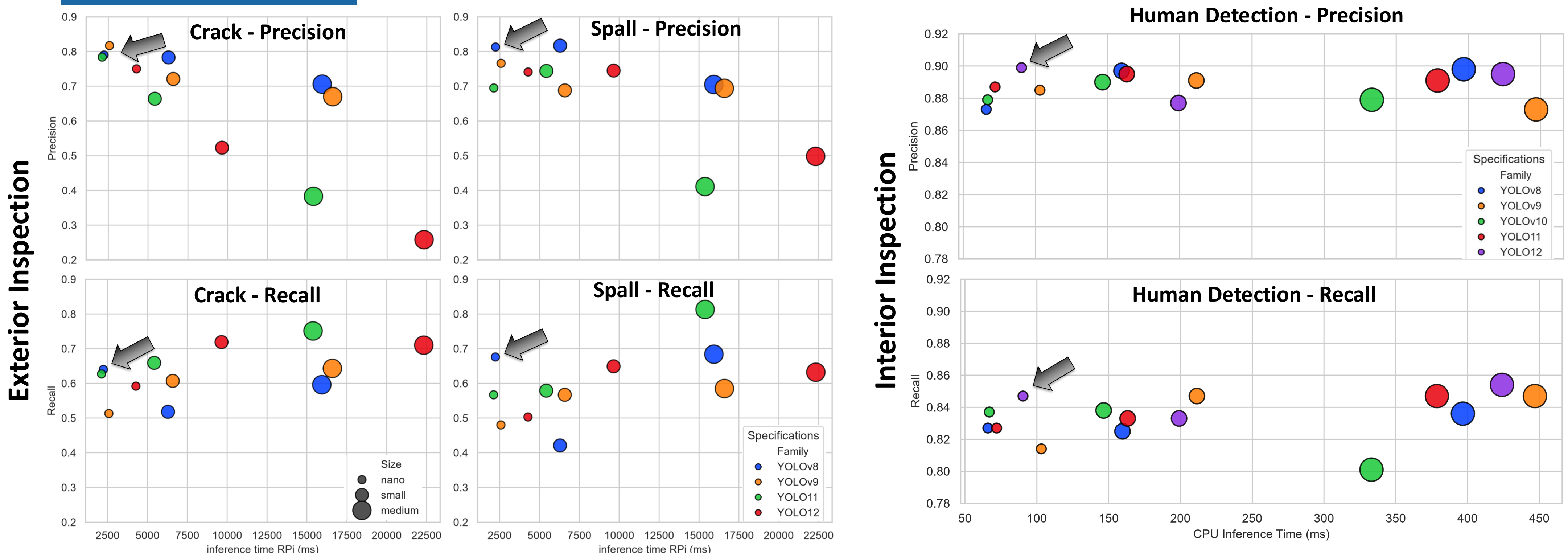
GENERAL OBJECTIVE

Develop a hybrid, multi-agent system combining a single exterior UAV and an interior UAV swarm to optimize autonomous navigation and real-time detection of structural damage and victims through strategic computational offloading.

METHODOLOGY



RESULTS



CONCLUSIONS

- Prioritizing interior exploration based on real-time exterior damage mapping successfully optimizes search efficiency in high-collapse risk zones.
- The hybrid design efficiently routes time-critical tasks (flight control, collision avoidance) to the edge, while heavy optimization routines are successfully offloaded to the GCS server.
- YOLOv8-nano (INT8) and YOLO12-nano offer the best overall trade-offs to balance precision, recall, and processing speed for real-time embedded robotic systems.

Higher is better, Faster is better