

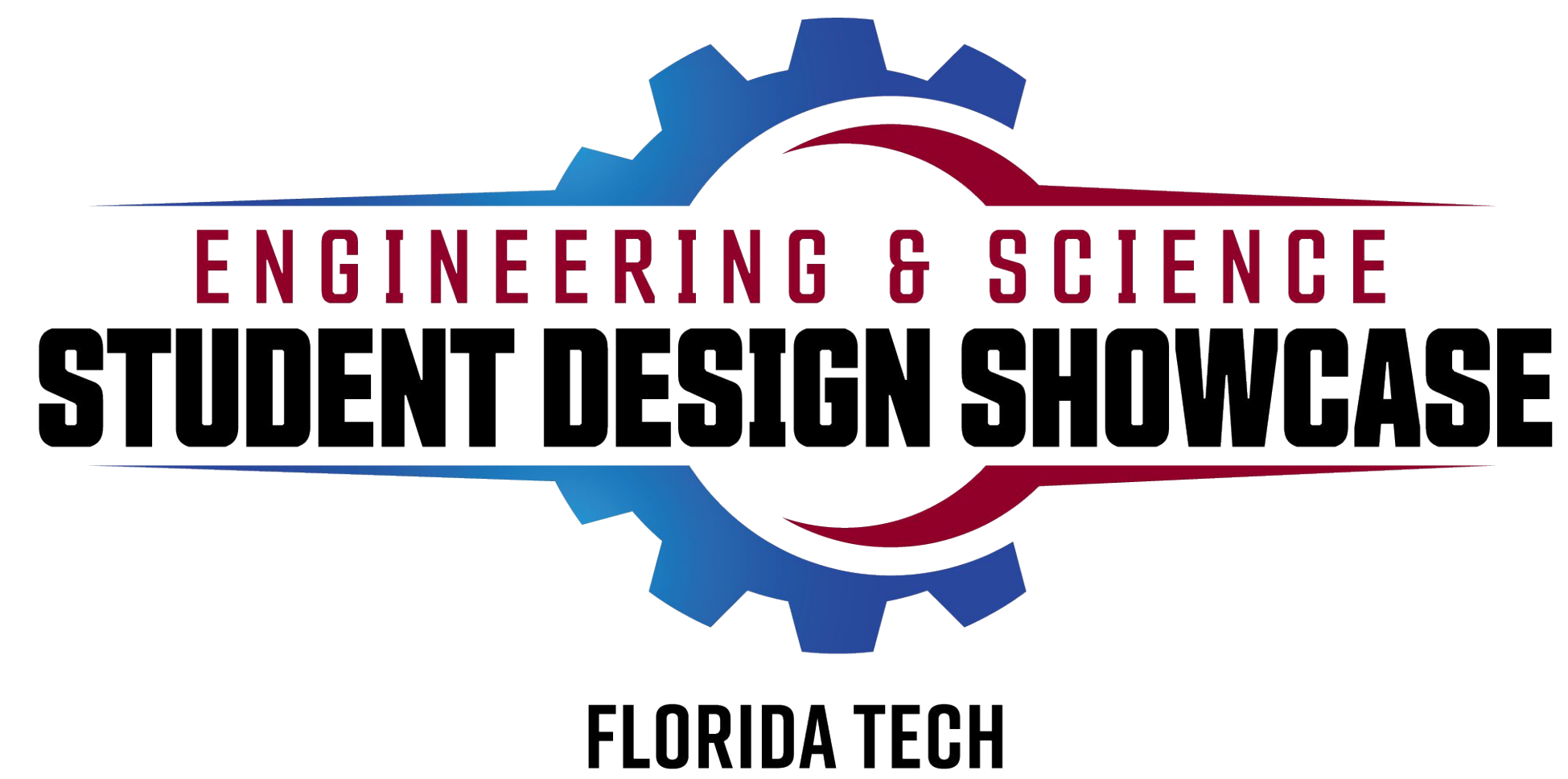
SRCIS: Human-Robot Collaboration in Urban Search and Rescue Operations

A unified multi-robot system that improves speed and coordination in urban search and rescue missions.

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INTRODUCTION

Search and Rescue Coordinated Intelligence System (SRCIS) is a human-agent system designed to:

- Improve the effectiveness of real-time search and rescue operations.
- Integrate human judgement with robotic autonomy and capabilities
- Enable coordinated action and adaptive response in dynamic environments.

NOVELTY

FEMA Urban Search and Rescue (US&R) Task Forces are composed of approximately 70 personnel, demanding significant resources and coordination to conduct effective operations.¹ SRCIS is intended to augment, not replace, these teams by extending human reasoning through autonomous agents. By leveraging strengths and capabilities from both humans and robots, the system improves the efficiency and effectiveness of US&R operations.

ACCOMPLISHMENTS

Agentic Control Layer

- Enabling autonomous **agents** to **collaborate** with **human** decision-makers
- Establishing a team dynamic and distributing responsibility across the team

High-Level Abstraction Layer

- Allowing **interoperability** across platforms



FEATURES

Abstraction Layer

- Provides a *common interface* for task execution *across robotic platforms*
- Transforms high-level commands into platform-specific instructions

Heirarchical Communication Approach

- *Low level*: Control signals from direct input
- *High level*: GUI with controls for Mission Operator interaction

Continuous Compositional Control

- Grants precedence to human operator directives
- Supports *adaptive* human-robot collaboration

Shared Situational Map

- *Real-time shared global map* integrating positions of team and detected targets
- *Reduces redundant search coverage*

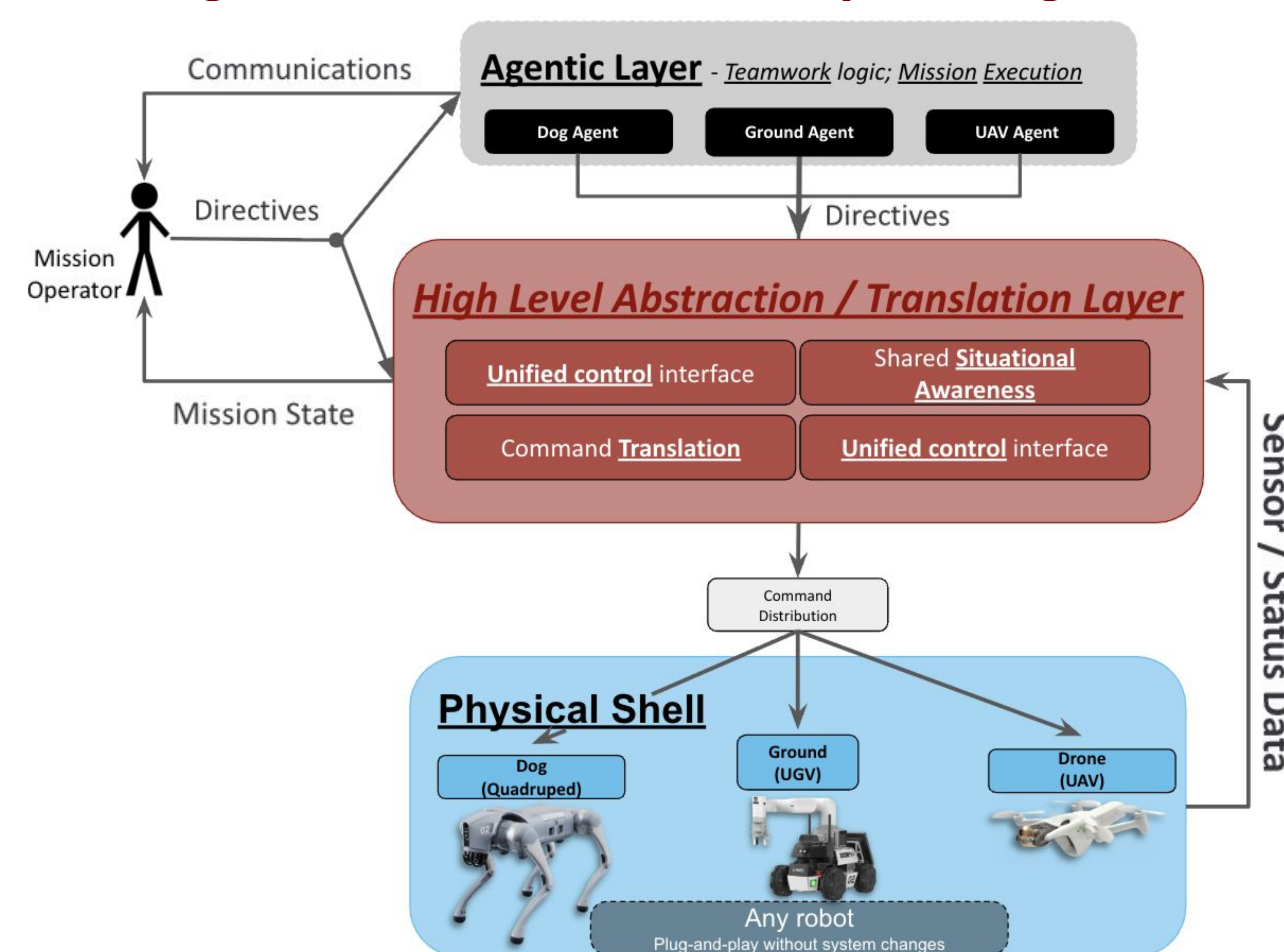
Cooperative Target Engagement

- Multi-agent *path coordination* for target interception and containment



ARTIFACTS

High Level Abstraction Layer Diagram



Lab Map

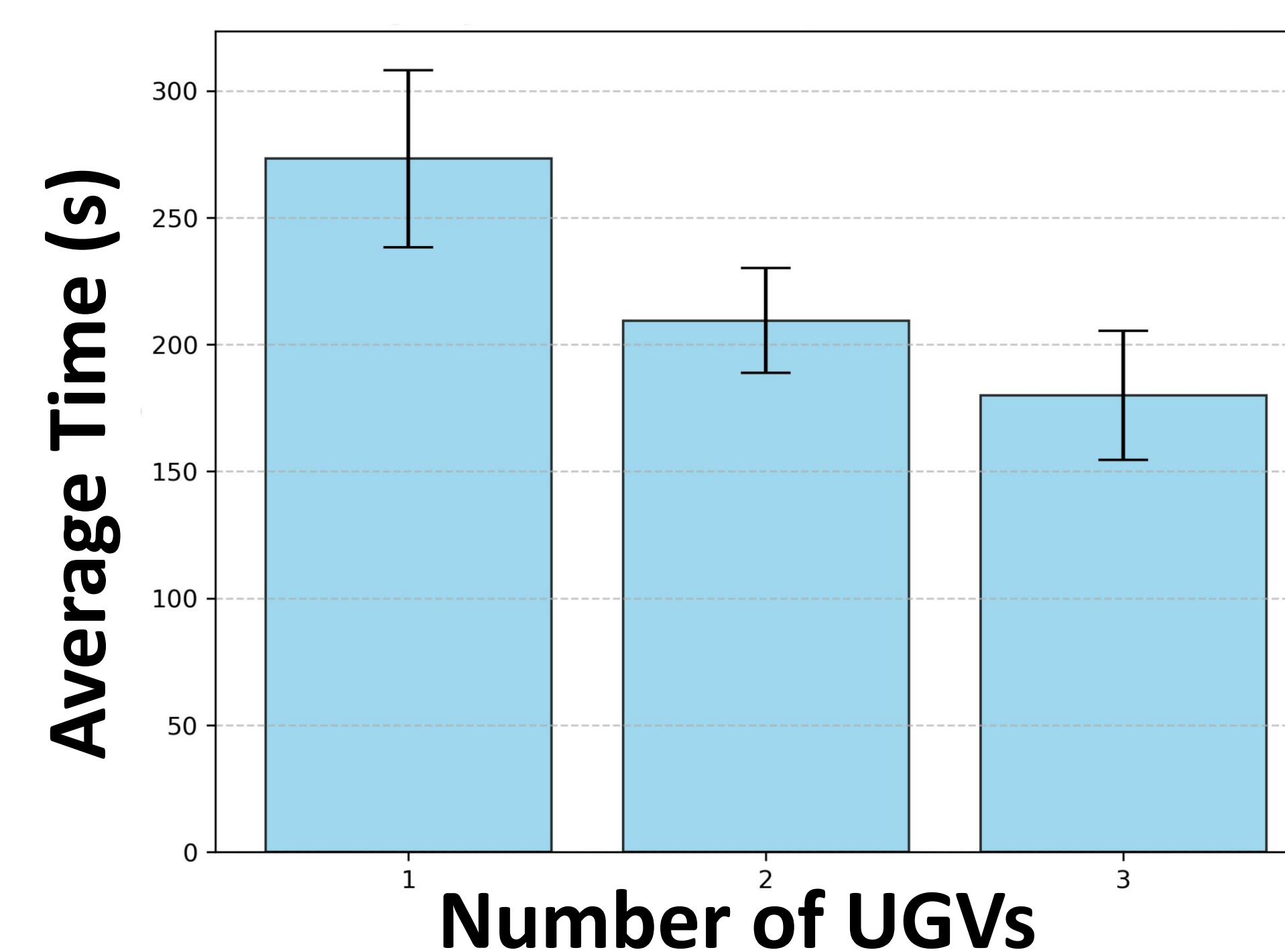


★: Potential Hiding Spots

Lab Map Photograph (From Top to Bottom)



Average Time to Scan the Map by Number of UGVs (5 trials each w/ Std. Dev)



Increasing the number of UGVs resulted in a reduced average task completion time