# Multiagent Physical Cognition and Control Synthesis Against Cyber Attacks

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https://sites.bu.edu/securingmas/

## Main challenge

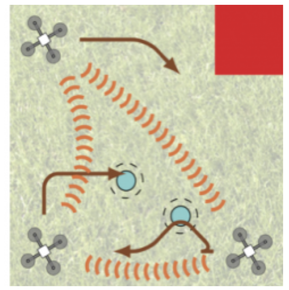
- Increasing adoption of autonomous mobile, networked robots with increased needs for communication and sensor fusion
- Large-scale hacking events are becoming more common.

***Risk:*** new cyber-physical attack surfaces, with potential losses in production and increases in human injuries

***Opportunity:*** Jointly consider planning, sensing, communication and execution to enhance security

## Scientific impact

A new security layer that is tailored to CPS by using physical measurements for security



***Our work:***

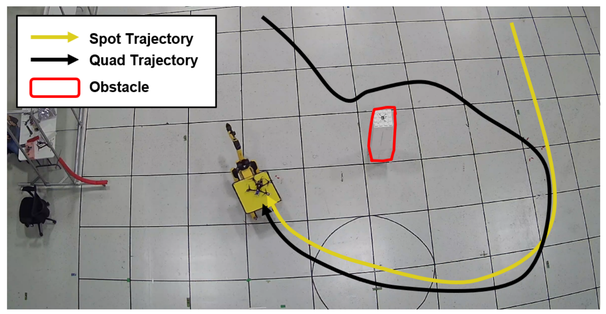
- Co-observations as introspection: use the robots' own sensors to collaboratively verify that robot do not falsify information/enter forbidden regions
- Control movement of the robots and information (where and when) as an effective way to deter attacks

## Focus: Decentralized Control of Connected and Automated Vehicles

**Thrust 1:** Guarantee vehicle safety and performance while providing resilience against Sybil and bounded state perturbation attacks
**Method:** A novel framework of trust-aware robust event-triggered control barrier functions, and a resilient coordination scheme that re-sequences traffic at runtime.

[Ahmad et al. VehicleSec 2023 + VehicleSec 2024]

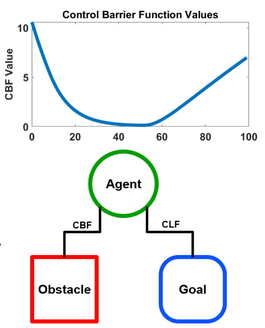
**Thrust 2:** Track secured high-level trajectories via distributed control
**Method:** Algorithms and code for to track co-observation multi-agent plans with: *1)* joint assignment and tracking of planned trajectories, and *2)* CBF-based safety and co-observation guarantees.




[Schoer et al. NFM 2024, Ziqi et. al, IEEE TAC, submit.]

## Broader impacts

- Make operation of robot swarms safer for nearby humans and property
- **Calculus project:** Provided a 3 hours workshop to students of color and economically disadvantaged students
- One BU undergraduate worked as part of a **UROP internship**
- Open-source release of **Python CBF Toolbox** *https://github.com/mit-ll-trusted-autonomy/cbfToolbox*

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