NRI: FND: Robust and Scalable Planning for Agile and Collaborative Robot Teammates in Complex Environments

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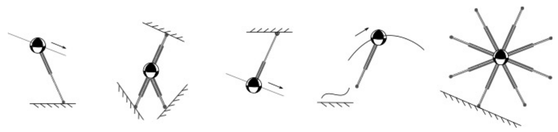
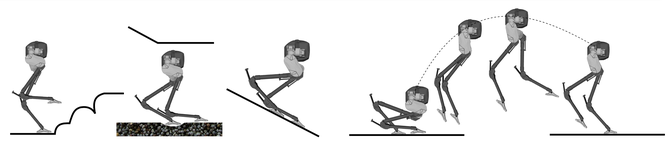
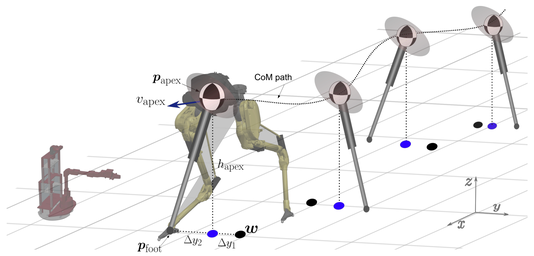
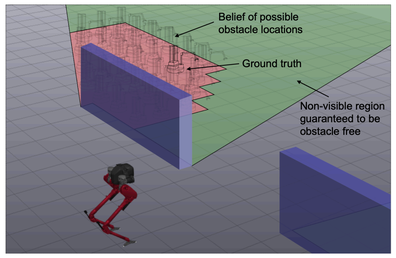
http://lab-idar.gatech.edu/planning-collaborative-robots/

Project goal: “Whole-System Decision and Planning” of heterogeneous and ubiquitous co-robots with robustness and safety guarantees

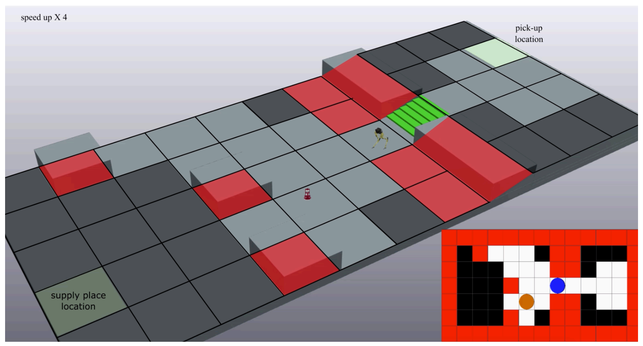




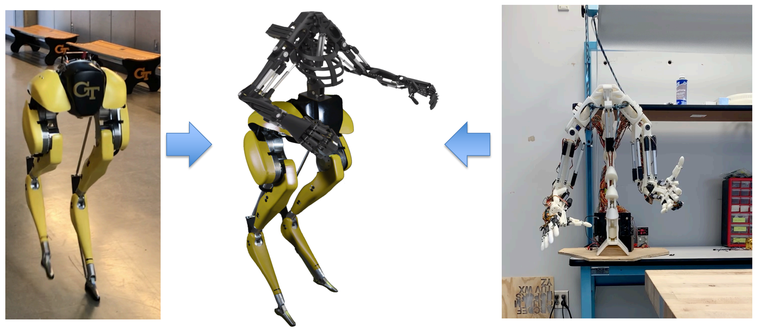




Thrust 1: Safe locomotion in partially observable environments with dynamic obstacles

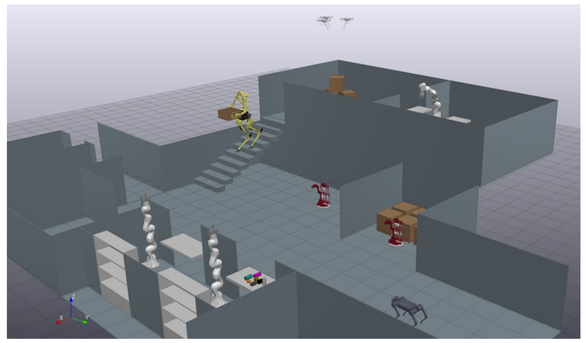


- Two-stage environment abstraction: fine and coarse level
- Belief tracking of dynamic obstacles [CDC 2020]
- Sequential composition of template models via game-based reactive synthesis [IJRR 2021, under review]

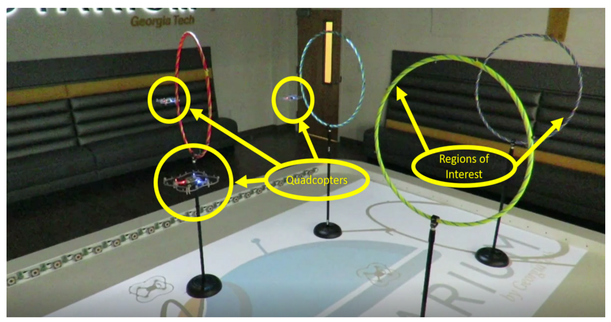


- Agile locomotion and manipulation

Thrust 2: Scalable and safe mission and task planning of heterogeneous robot teaming

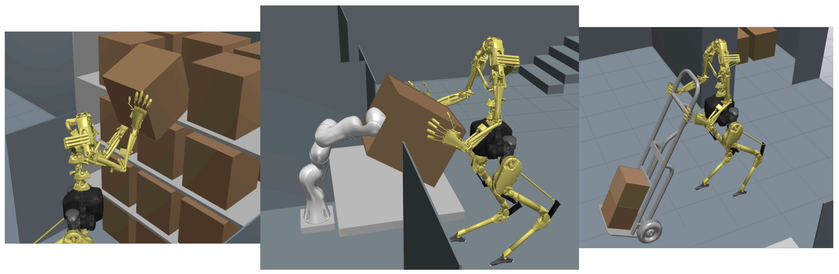


- Collision avoidance + contact-rich tasks
- Multi-robot decision-making with formal guarantees
- Simultaneous balancing and navigation safety



- Multi-agent task allocation via temporal logic optimization (experiments of firefighting quadcopters, ICRA 2020)

Thrust 3: Optimal task allocation and planning of multi-contact locomotion and manipulation



- Multi-modal planning: object-centric contact planning
- Signal temporal logic for collaborative loco-manipulation tasks
- Mixed integer programming for robust multi-contact planning

Scientific and Broader Impact

- Generalizable to other robotic systems, including wheeled robots, manipulator, and underwater vehicles.
- Initiate a Vertically Integrated Project (VIP) team at Georgia Tech to encourage undergraduate involvement.

2021 NRI & FRR Principal Investigators' Meeting
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