

Onboard Mission Management for a Decentralized Multi-UAV System using Behavior Trees
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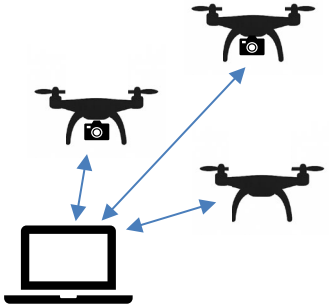


Problem – Decentralized Multi-UAV coordination

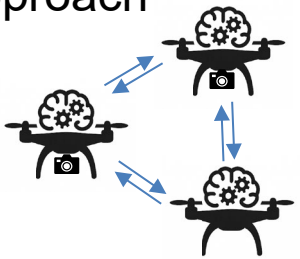


https://www.dlr.de/de/fl/forschung-transfer/projekte/swarming

Centralized approach



Decentralized approach



Problem: Decentralized coordination of a multi-UAV System in dynamic environments

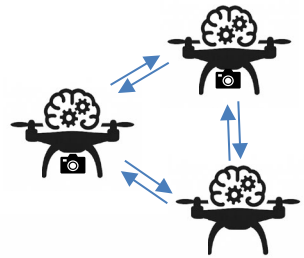


Approach

Approach

- Integrate Task Assignment into onboard mission management
- Behavior Trees: Modularity & Reactivity
- Decentralized Task Assignment Algorithm
  - Consensus-Based Bundle Algorithm [1]
    - Drones bid on tasks until consensus

Behavior Tree used:





Enables drones to make decisions onboard without a central planning module



[1] Choi, Han-Lim, Luc Brunet, and Jonathan P. How. "Consensus-based decentralized auctions for robust task allocation." *IEEE transactions on robotics* 25.4 (2009): 912-926.

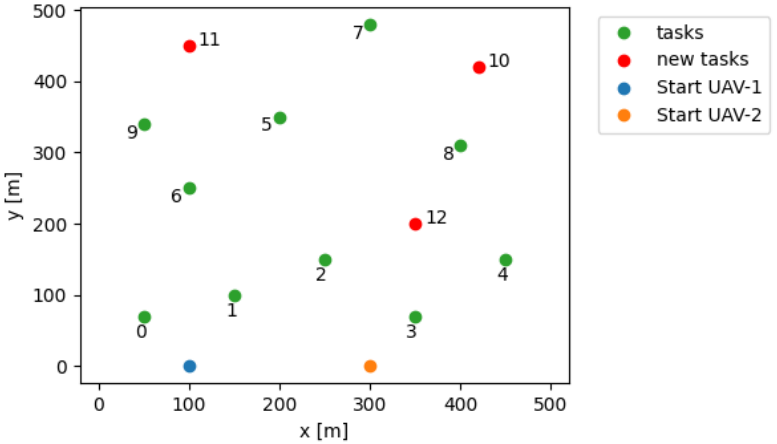
Approach: Simulation Setup

Simulation Setup

- PX4 based SITL with Gazebo
- Behavior-tree based Mission Management
- Enables evaluation close to real flight setup



Static Mission and Dynamic Mission

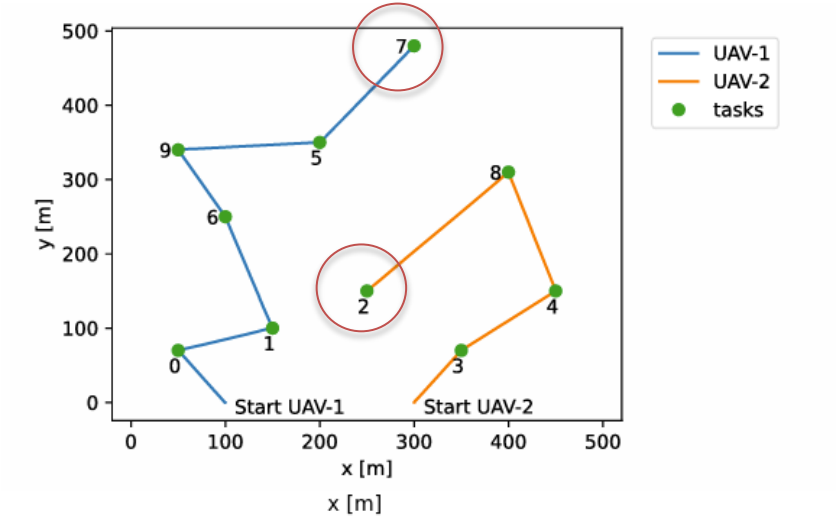




Findings

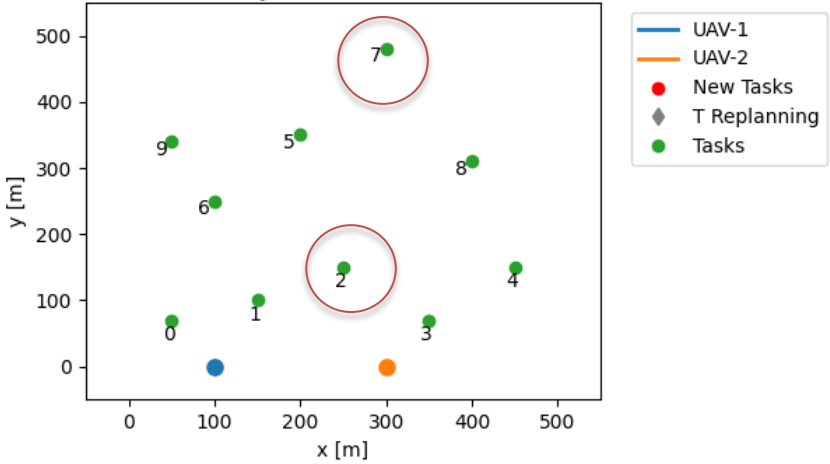
Static Scenario

2 UAVS
10 tasks



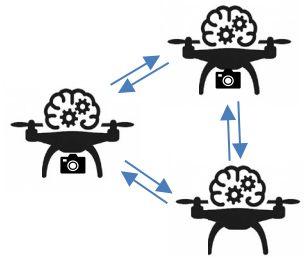
Dynamic Mission

2 UAVS
10 initial tasks
3 dynamic tasks

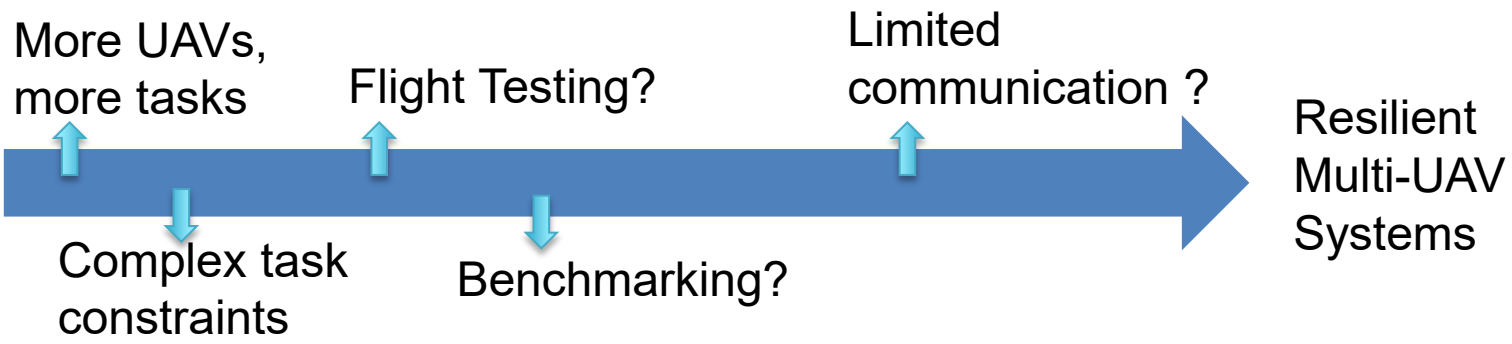




Impact and Next Steps

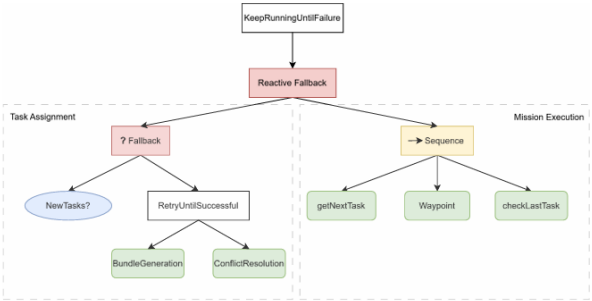


- Autonomous, Resilient and Scalable Multi-UAV Systems
  - UAVs coordination through decentralized decision-making
  - Reactive and adaptive behavior
- What happens next?

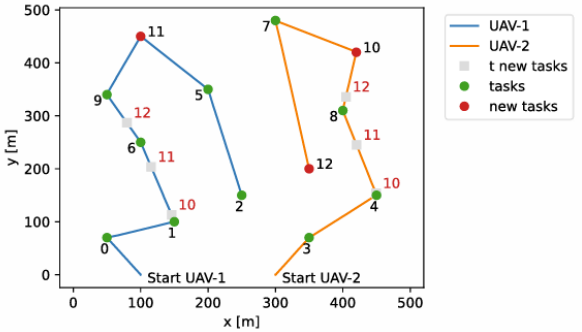




Takeaway



SITL



Decentralized task assignment in Behavior-Tree based mission management

React to new tasks in dynamic missions

Foundation for future work on resilient multi-UAV coordination



Questions?

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