Collaborative Research: CPS: Medium: Wildland Fire Observation, Management, and Evacuation using Intelligent Collaborative Flying and Ground Systems

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https://www.cefns.nau.edu/~fa334/

Challenge:

- Current wildfire detection techniques using sensor networks or satellite images are slow and inaccurate.

- Current fire management techniques involve the presence of first responders in fire zone that endanger their lives.
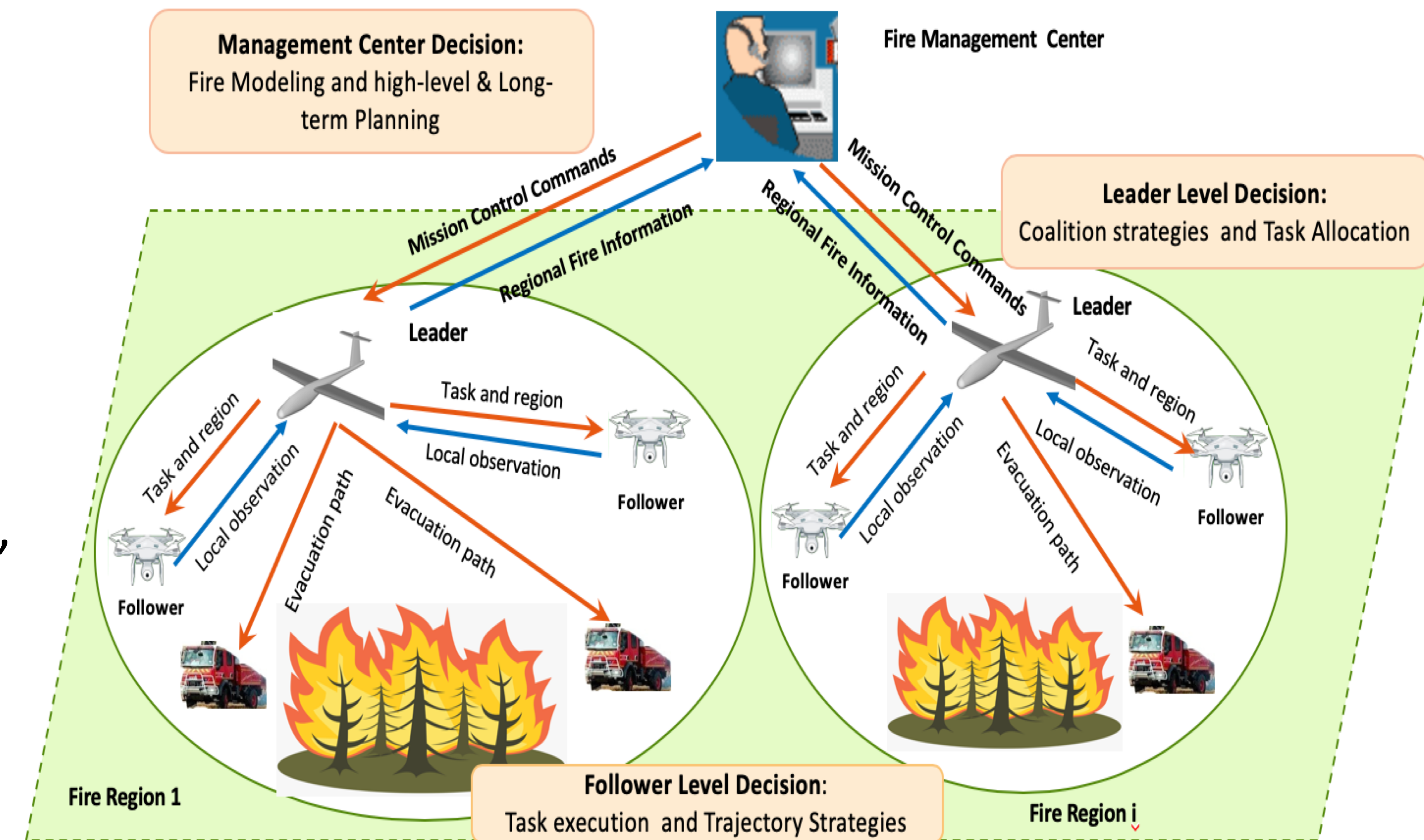
Solutions:

- real-time reinforcement learning for control, trajectory optimization, and motion-planning during disaster management missions

- developing tools for fire data analytics, visualization, and prediction to forecast fire expansion futures

- developing autonomy approaches by applying game theory inspired methodology to address diverse and unforeseen scenarios

Broader Impacts:

- Practical solutions for utilizing a network of small and autonomous UAVs in wildfire management

- Collaboration with US Forest Services and Arizona Department of Forestry and Fire Management to test and evaluate the developed solutions during prescribed fires

Education and Outreach:

- Involving several Hispanic and Indian American undergraduate students through collaboration with NAU's LSAMP program

- Training for first-responders and firefighters to use UAS for fire monitoring

Management Center Decision: Fire Modeling and high-level & Long-term Planning — Fire Management Center — Leader Level Decision: Coalition strategies and Task Allocation — Follower Level Decision: Task execution and Trajectory Strategies — Fire Region 1 — Fire Region i

Outcomes:

1- "UAV-assisted Communication in Remote Disaster Areas using Imitation Learning", IEEE Open Journal of the Communication Society,, 2021.

2. "Aerial Imagery Pile burn detection using Deep Learning: the FLAME dataset", Computer Networks, 2021.

3. Public Data Set- FLAME DATESET: AERIAL IMAGERY PILE BURN DETECTION USING DRONES

https://ieee-dataport.org/open-access/flame-dataset-aerial-imagery-pile-burn-detection-using-drones-uavs

4- "An Exhaustive Study of Using Commercial LTE Network for UAV Communication in Rural Areas", ICC Workshop 2021.