NRI: INT: Balancing Collaboration and Autonomy for Multi-Robot Multi-Human Search and Rescue

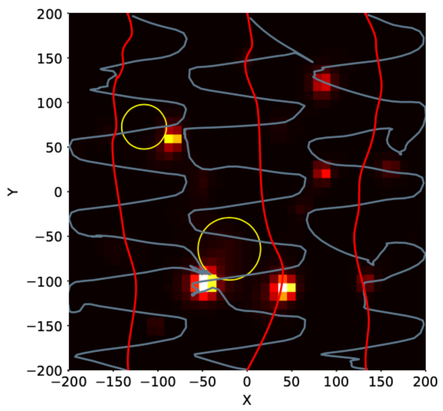
Ryan K. Williams (rywilli1@vt.edu), Nicole Abaid (nabaid@vt.edu), Nathan Lau (nkclau@vt.edu), and James McClure (mcclurej@vt.edu)
Virginia Polytechnic Institute and State University
http://caslab.ece.vt.edu/research

Challenge

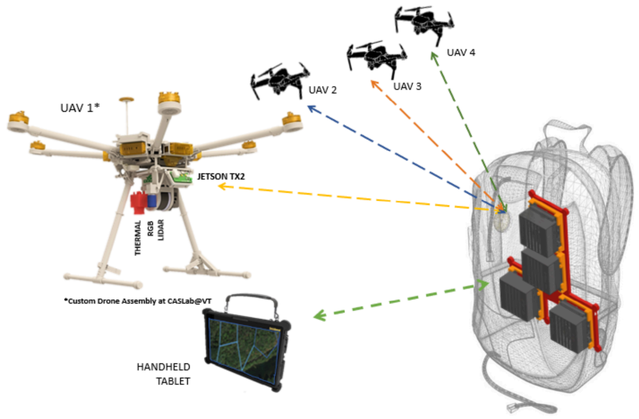
- Enabling teams of human searchers and unmanned aerial vehicles to collaborate towards improving search outcomes and reducing human effort.
- Selecting and assigning search tasks that ensure long-term human-robot collaboration, while complementing human searchers in real-time.

Key Results (Year 1)

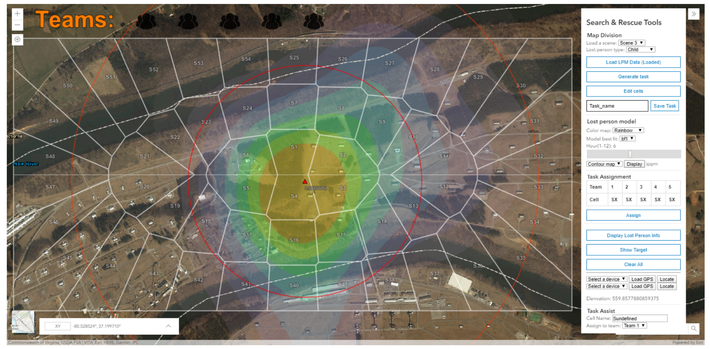
- Risk-aware UAV search planner incorporating a lost person predictive model and predicted searcher motion.
- Agent-based model of lost person behavior based on pedestrian dynamics and the International Search & Rescue Incident Database (ISRID).
- Custom computing unit housed inside a backpack to be carried by a human rescuer for UAV support.
- Web-based application integrating path planning, mobile computing, and behavioral modeling for practitioners.



Lost person modeling and human-robot search planner.



In-field computational backpack.



Search and rescue interface.

Education and Outreach

- K-12 academic experiences for students with Virginia Tech's Center for Enhancement of Engineering Diversity.
- Advisory board oversight and mock search participation from leaders in the Virginia search and rescue community.
- Cross-training undergraduate and graduate students in computational methods and engineering.

Scientific Impact

- Planning and control systems that can autonomously gather information in a distributed way while adapting to uncertain human plans.
- Interfaces that allow humans to collaborate effectively with robots and appropriately guide exploration vs. exploitation.
- Scalable computation that supports the analysis, storage, and sharing of data subject to field constraints.

Broader Impact

- Volunteerism is in dramatic decline nationally and across Virginia, and thus UAVs could eventually supplement the lack of trained volunteers.
- UAV teams will also create an ad-hoc network over which human searchers may communicate.
- Portable, low-cost, low-power computational infrastructure suitable for a wide range of applications.

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