Demonstrating Performance Benefits of Human-Swarm Teaming

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Motivation

- Consider a high-stakes scenario such as disaster relief.
- Large collective of autonomous systems over a dispersed area
- The cognitive burden on human operators to control the system is unmanageable.
- A single human operator is unable to:
  - effectively control individual agents,
  - designate tasks, and
  - achieve overall mission objectives in a timely and precise manner.
- Fully autonomous systems are lacking in ability to handle a diverse range of real-world scenarios reliably
- Performance is not assured, nor deemed trustworthy, for safety-critical systems.

Human-swarm teaming

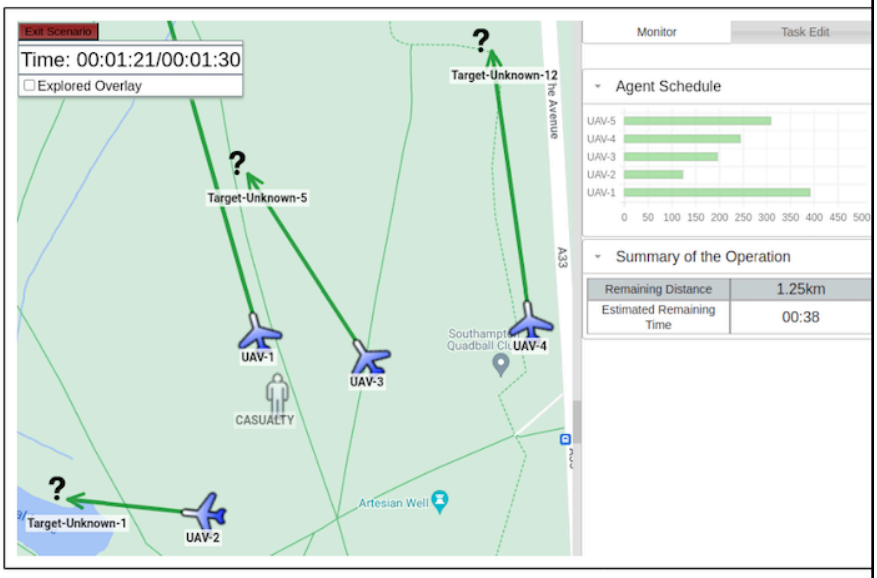
- It is hypothesized that the optimal solution lies at the intersection between these two approaches.
- An efficient human-swarm system requires a highly usable interface for the human operator(s) of the swarm to:
  - define tasks with priorities,
  - allocate groups of agents to a task set,
  - monitor the behavior of the swarm,
  - analyze the decisions of the system and
  - intervene when needed

Use Case

- Employing human-swarm teams in response to a real-world search and rescue scenario.
- Identify a number of unknown casualties in an area using a fixed number of UAVs.
- The swarm autonomously performs dynamic allocation
- Swarm optimizes for the total energy cost of an allocation.

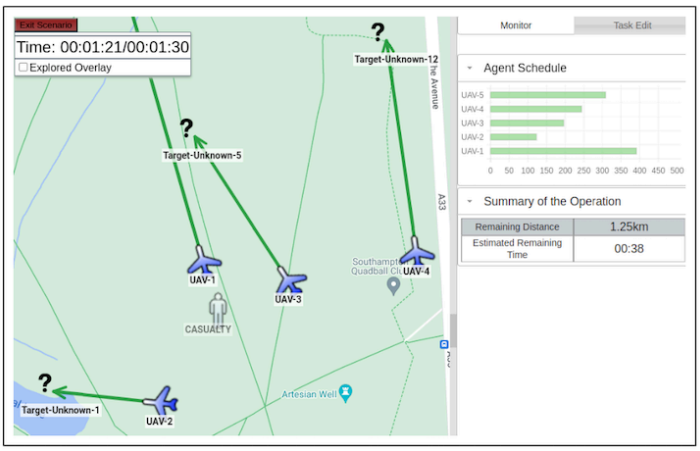
Use Case

- Four UAVs are autonomously assigned to unknown targets on a map.
- The targets represent areas with potential casualties.



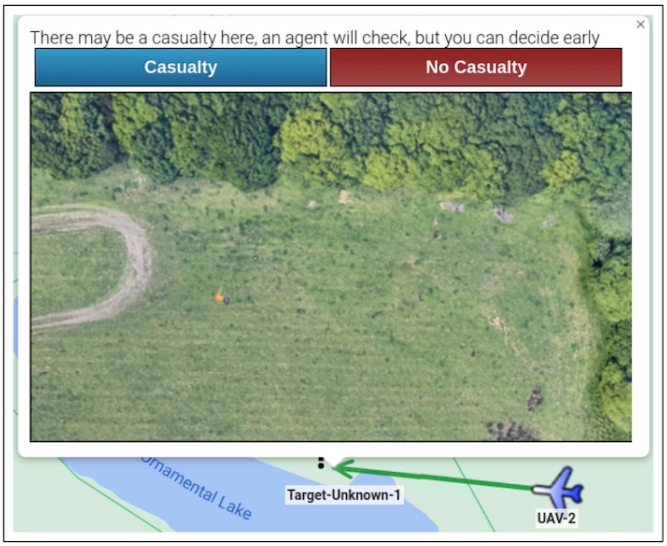
Use Case

- Agents move towards their targets
- Assess whether or not they are actual casualties.
- Operator monitors the views of the agents and their planned schedule on the right-hand panel.
- They can also manually reassign them using the task view.



Use Case

- Users are shown an image of the target which gets clearer as the agent gets closer to the target.
- The user can classify the target early, saving time.



Use Case

- Classification a target allows a human to augment the swarm with their superior reasoning skills.
- Empowers the existing strategy by reducing the number of wasted journeys.