Initial Investigation into Impact of Faulted Drones on Swarm Search and Rescue

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Overview

- Gap: Identifying, tracking and simulating the elements that impact Search and Rescue scenarios involving a swarm of drones
- Why it matters: Improving the efficiency and success rate of SAR with drones increases the speed and effectiveness of life-saving missions
- Research Question: How can we apply the use of simulations to increase the efficiency of Search and Rescue using drone swarms

The simulation currently has a swarm of drones searching for a stationary target using one of several search options. The drones' paths are also drawn for analysis. The drones have a probabilistic radius in which as they get closer to the target, the chance of successfully finding the target increases.

Model Features

- Includes drones searching for a target
- Scenario size is scalable
- Changeable parameters like drone speed, # of drones, drone search radius
- Probabilistic individual drone search radius

Future features include implantation of consensus algorithms, in order to test their effectiveness against faulted drones' adverse effects.

Other Features

- Multiple runs per launch allow for data gathering
- Statistical output of tracked data like time to find, false positives, false negatives, etc.

The simulation can be run in singular mode or multiple run mode, and statistical output to CSV or Excel files can be enabled.

The Model

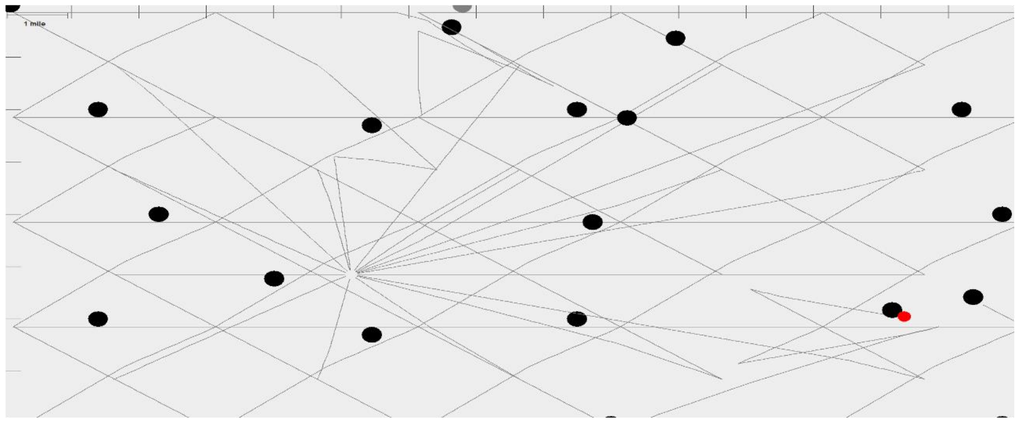

Figure 1: This simulation run shows a 120 square mile "forest" area where a search and rescue operation is occurring using drones to search in a grid pattern for a target

Time to Find vs % Faulted Agents – Grid Search

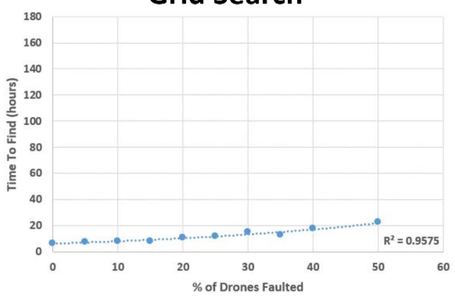

Figure 2: Relationship of # of Drones vs TTF; shows faulted agent's impact on search & rescue efficiency. (64 drones over a 120mi² area, grid search)

Time to Find vs % Faulted Agents – Random Search

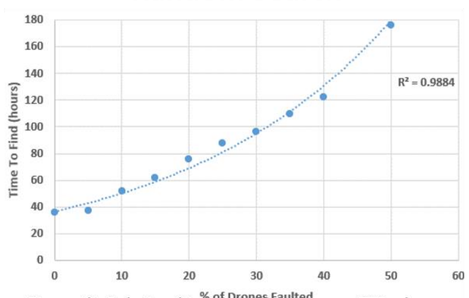

Figure 3: Relationship of # of Drones vs TTF; shows faulted agent's impact on search & rescue efficiency. (64 drones over a 120mi² area, random search)

Research timeline

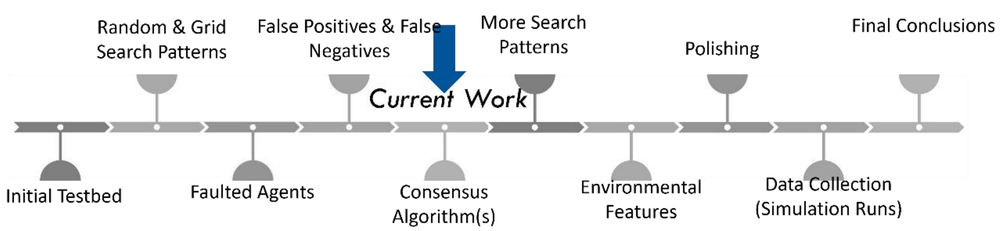

Figure 4: Timeline of research (past, current and future)

Multi Agent Systems

- Multi Agent Systems (MAS) are any system of devices working together
- Drone Fleets are the prime example of a MAS
- MASs can be distributed or centrally controlled
- Consensus algorithms play a large part in distributed MASs

Multi-Agent System research has multiple real-world applications, such as: drone fleets, communications systems, autonomous vehicles and more.

Drones in Search & Rescue

- Drones are the future of Search and Rescue Operations
- Quicker search times and aerial views are more efficient than human searches
- Drones are autonomous, cutting down on human error

The advantages of drones in SAR are more efficiency, higher success rate and less human error possibilities. Disadvantages include large infrastructure requirements, cost, and potential faulted agents.

Future Work

- Current Work includes the implementation of consensus algorithms to test their viability.
- Future features are improvements such as environment with landscape features like trees and different search patterns.
- The long-term goal is to decrease the Time to Find the target by changing parameters, adding new search patterns, and countering faulted drone impact.

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