

SHARKS Obstacle Avoidance

UAV Drone Swarm Decentralized Behavior Algorithms

Summer
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Team Members



Ally Hays

- Junior
- COSC Major



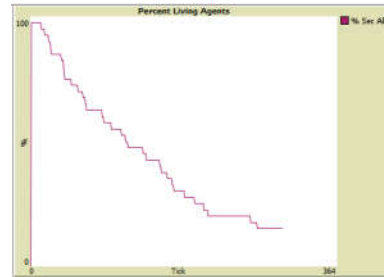
Jarek Brown

- Junior
- COSC Major

Problem Statement

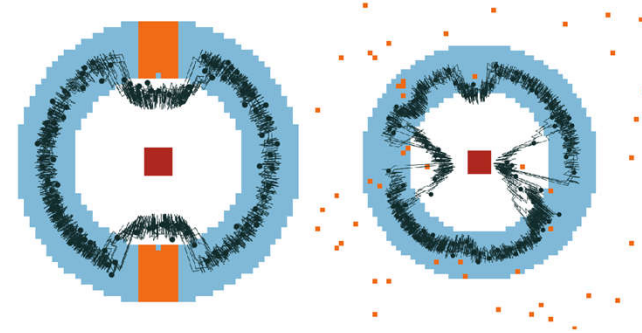
The presence of obstacles can cause loss of agents which diminishes or even negates their ability to form a perimeter around the target. This research developed methods for detecting and avoiding stationary obstacles. These methods:

- Had a minimal impact on the stability of the circling behavior
- Maintained the population of the distributed swarm



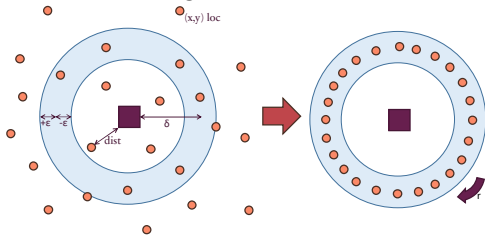
Results

- 100% agent survival rate regardless of obstacle type
- Stability levels slightly impacted



Background

The SHARKS protocol enables a fully decentralized swarm to perform a circling maneuver around a target. By only sensing their immediate neighbors' positions, agents in the swarm can perform simple, lightweight calculations for movement that results in the circular swarming behavior.



Methods

Obstacle avoidance was constructed where:

1. The agents follow the SHARKS protocol until an obstacle is detected nearby.
2. The agent stops and checks a cone in front of it for obstacles.
3. If obstacles are detected, it rotates and checks again.
4. If no obstacles are detected, the agent moves forward.

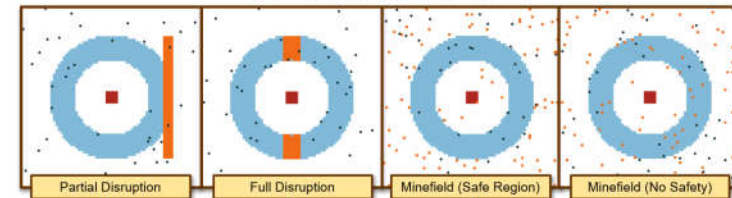
This cycle continues until no obstacles are detected nearby, at which point the agent reverts to following SHARKS protocol.

Challenges & Future Work

Two main challenges:

1. Scalability of avoidance techniques and ensuring a method that works for four agents also works for 400 agents.
2. Accounting for many types of obstacles

SHARKS: Obstacle Avoidance



Advisor: Dr. Mike Borowczak (mike.borowczak@uwyo.edu)

Grad Mentors:

- Rafer Cooley (rcooley2@uwyo.edu)
- Shaya Wolf (swolf4@uwyo.edu)

Group Members:

- Ally Hayes (ahays8@uwyo.edu)
- Jarek Brown (jbrow12@uwyo.edu)