Secure, Heterogeneous, Autonomous, and Rotational Knowledge for Swarms (SHARKS)
## Embedded Implementation

Abstract

The Secure, Heterogeneous, Autonomous, and Rotational Knowledge for Swarms (SHARKS) protocol investigates distributed algorithms for swarm movement patterns. Swarm agents, such as drones and other lightweight devices, rely on substantially restrained computing and memory resources. Therefore, algorithm development relies heavily on efficient emergent behaviors.
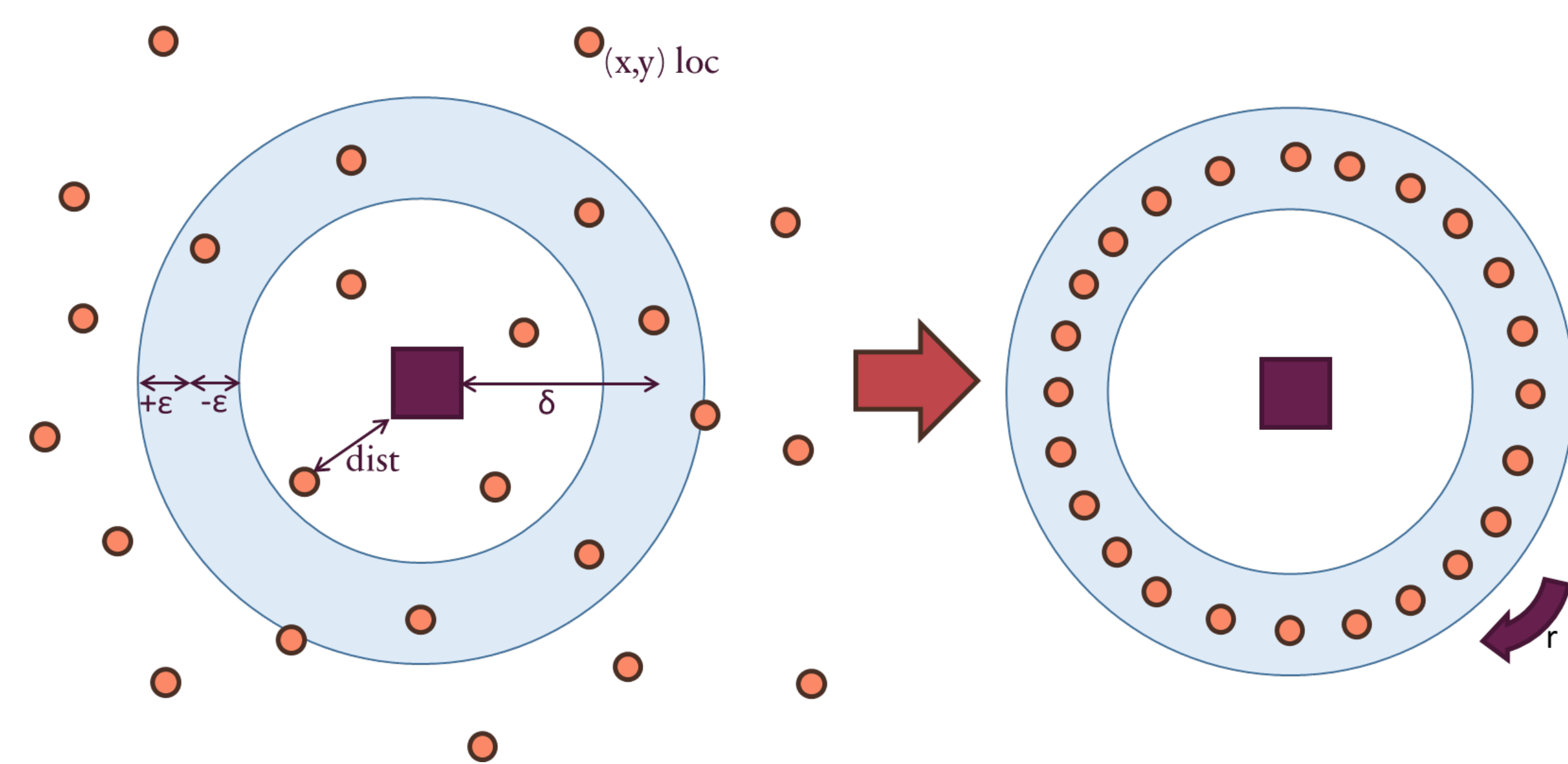
- In addition to positioning behaviors, this project investigates safety protocols to protect the swarm from adversarial swarms and environmental obstacles.
- Current researchers aim to implement the SHARKS protocol in physical hardware, beginning with two wheeled drones operating in circles across two dimensional fields, then extending to aerial drones working in spheres throughout a three-dimensional area.

## Background & Preliminary Results

The protocol, and its subsequent improvements, has been published several times over the last few years.

The protocol is based on two basic rules:
- Center rule, to maintain optimal distance from the target
- Dispersion rule, to maintain distance between drones
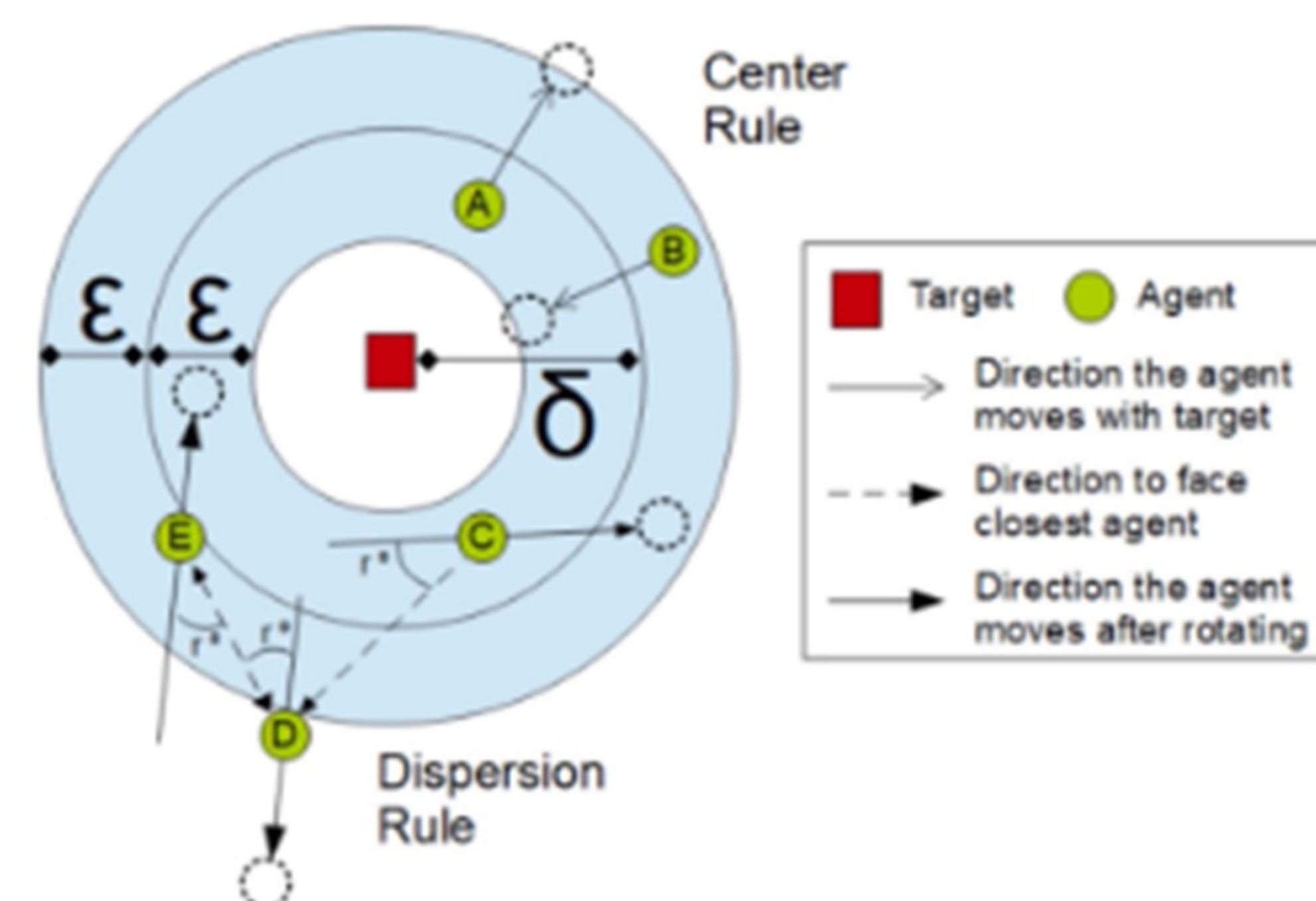
The ATmega328P microcontroller shows promise for experiment use in our implementation.

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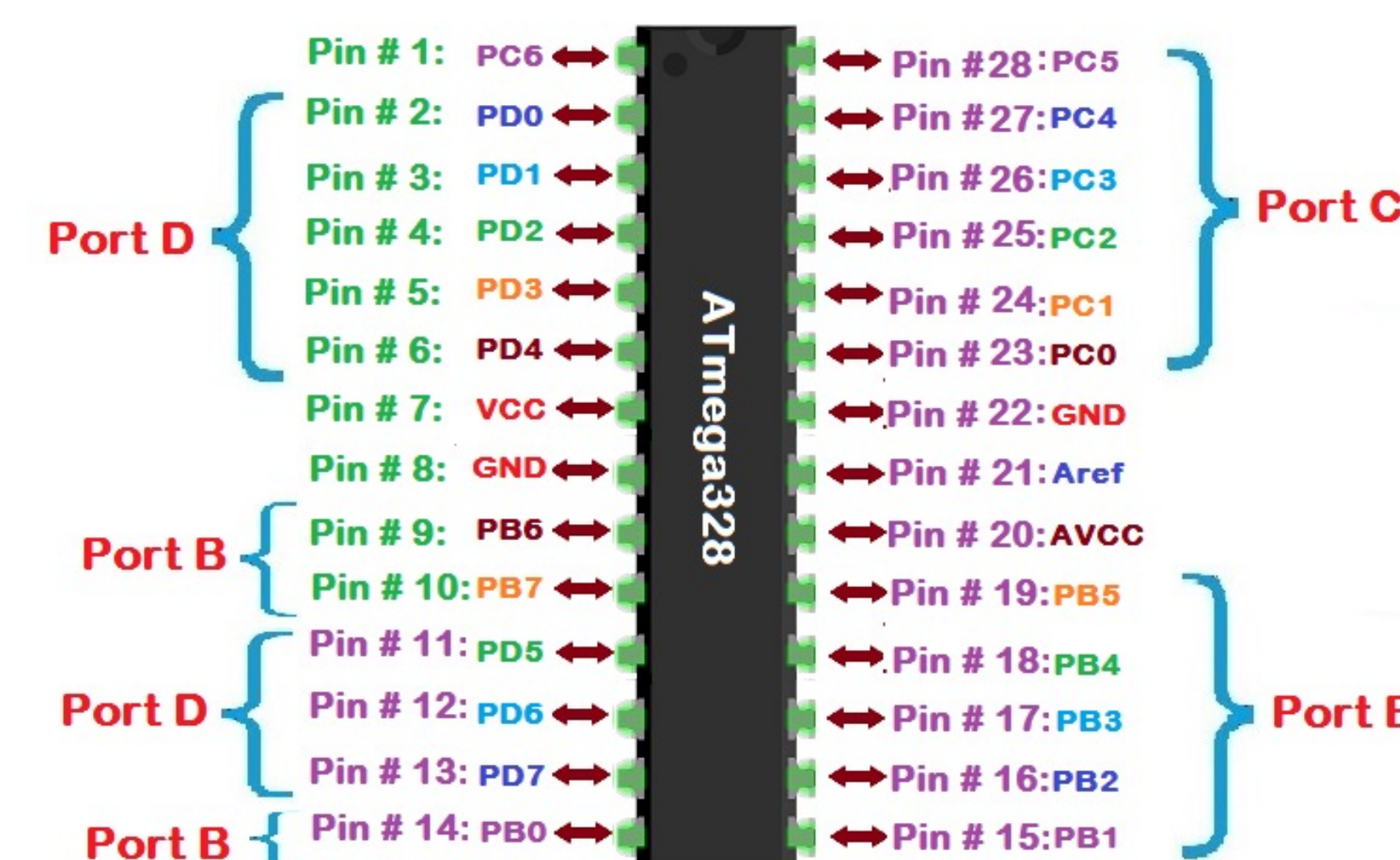
Methods

- The protocol will first be implemented in two-wheel drones operating in two dimensions. Once a successful version is built, the next goal is to have similar success using aerial drones.
- Sensors are to be chosen by testing the accuracy and usability of each, with emphasis given to scalable options.
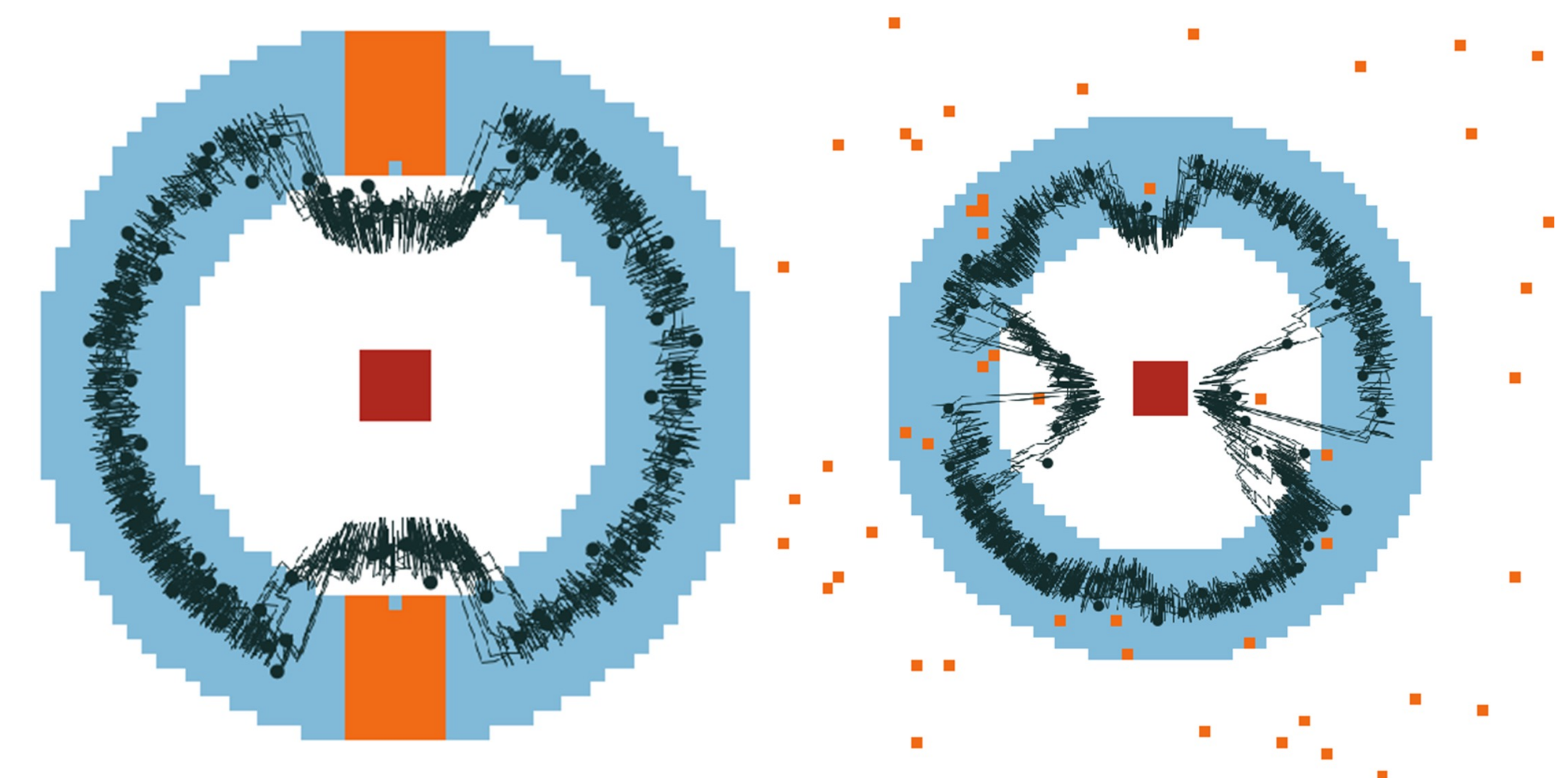
Challenges & Future Work

- The initial attempt was aimed at implementing the SHARKS protocol in C. After obstacles being found in this route, the project is regrouping towards an implementation in Rust.
- It would be preferrable to build custom microcontroller board. This would allow for a minimal interface for our drones, reducing physical size and power consumption.

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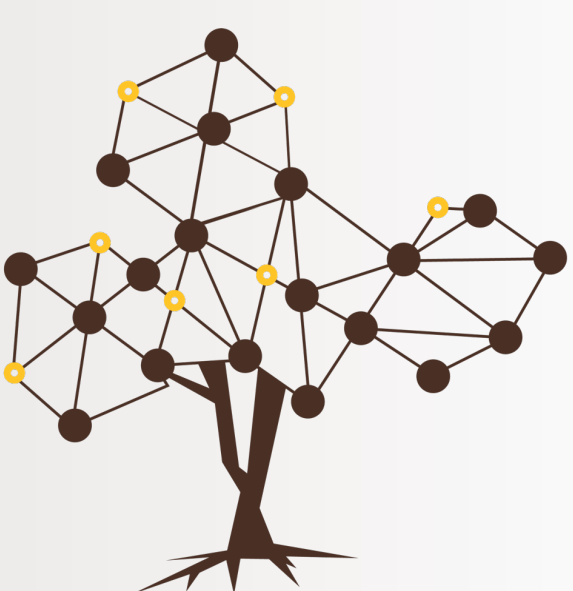
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