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Decentralized Control of Communicating Agents

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Project Goals

- Create algorithms for the control and coordination of micro-sized robots
- Determine bare minimum requirements for coordinated movement
 - Sensing capabilities
 - Communication bandwidth
 - Computation power
- Incorporate research from other groups determining “realistic” parameters (i.e. noise amplitude)
- Create a working simulation environment to test in



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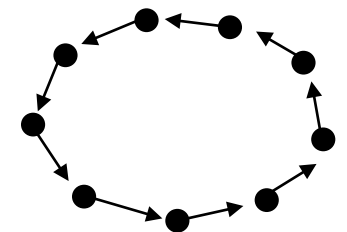
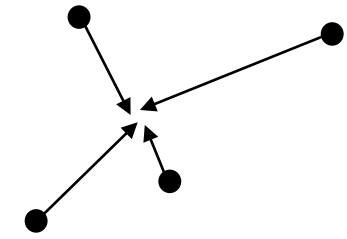
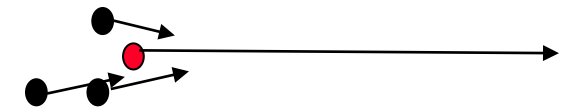
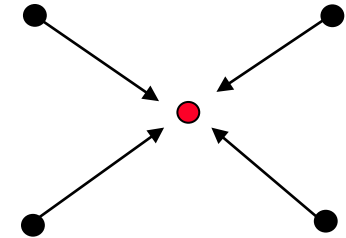
The Simulation Environment

- Focus on modular programming
 - Models of each aspect of the robots can be easily modified/swapped
- Realistic Sensing Capabilities
 - Robots only know distances not directions
- Realistic Movement Capabilities
 - Movement modeled off of bristle bots



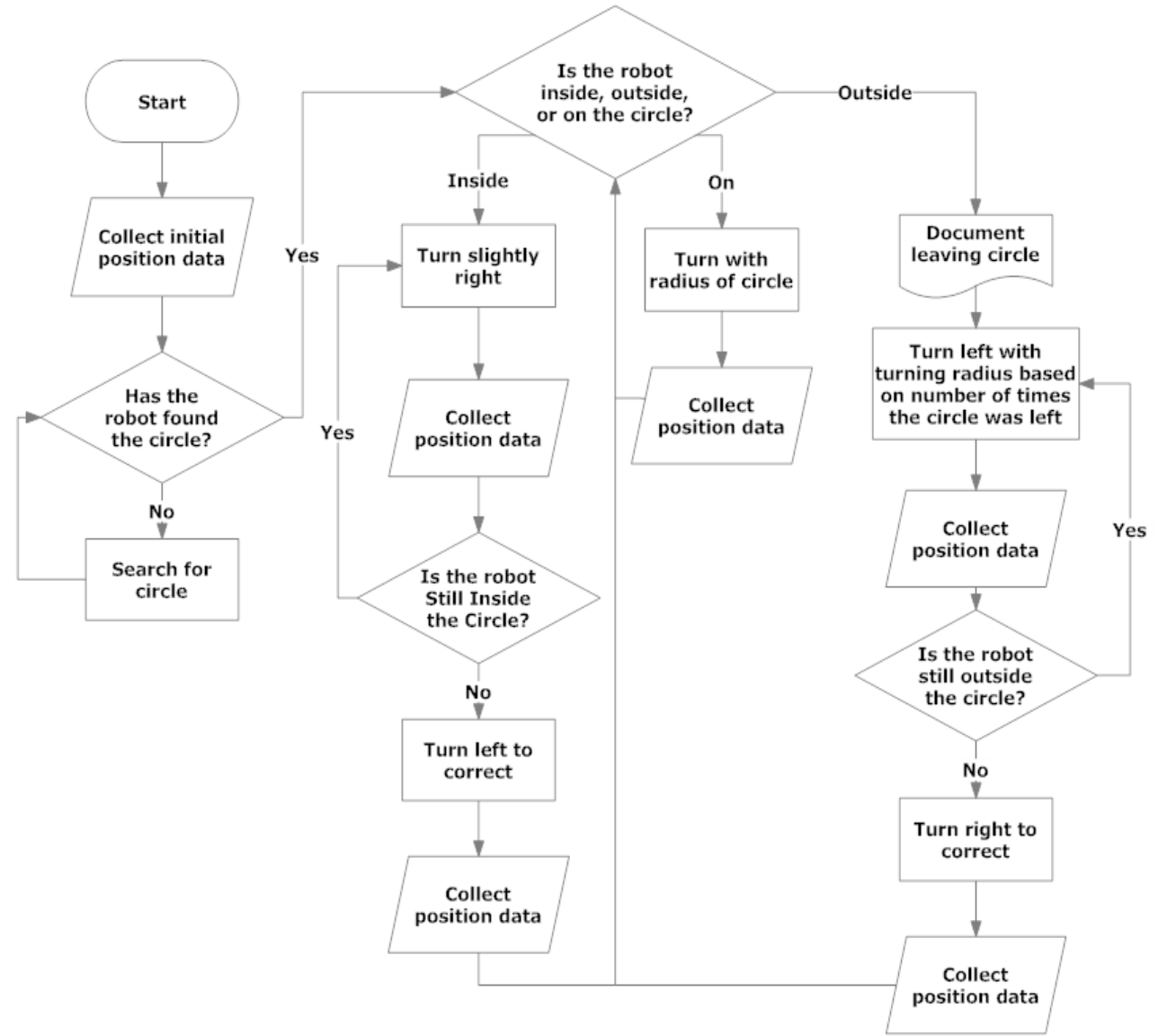
Overview of Algorithms

- Rendezvous with leader
 - Robots rally around a stationary leader
- Follow the leader
 - Robots follow the a leader, that travels in a predetermined path
- Center of mass rendezvous
 - Robots rendezvous near center of group
- Equidistant circular travel
 - Robots travel counterclockwise around a circle, equally spaced



Circular Travel

- **Algorithm Goal**
 - All robots travel around a circle in the counter clockwise direction
- **Control Summary**
 - Each robot will turn right while inside the circle and left while outside the circle





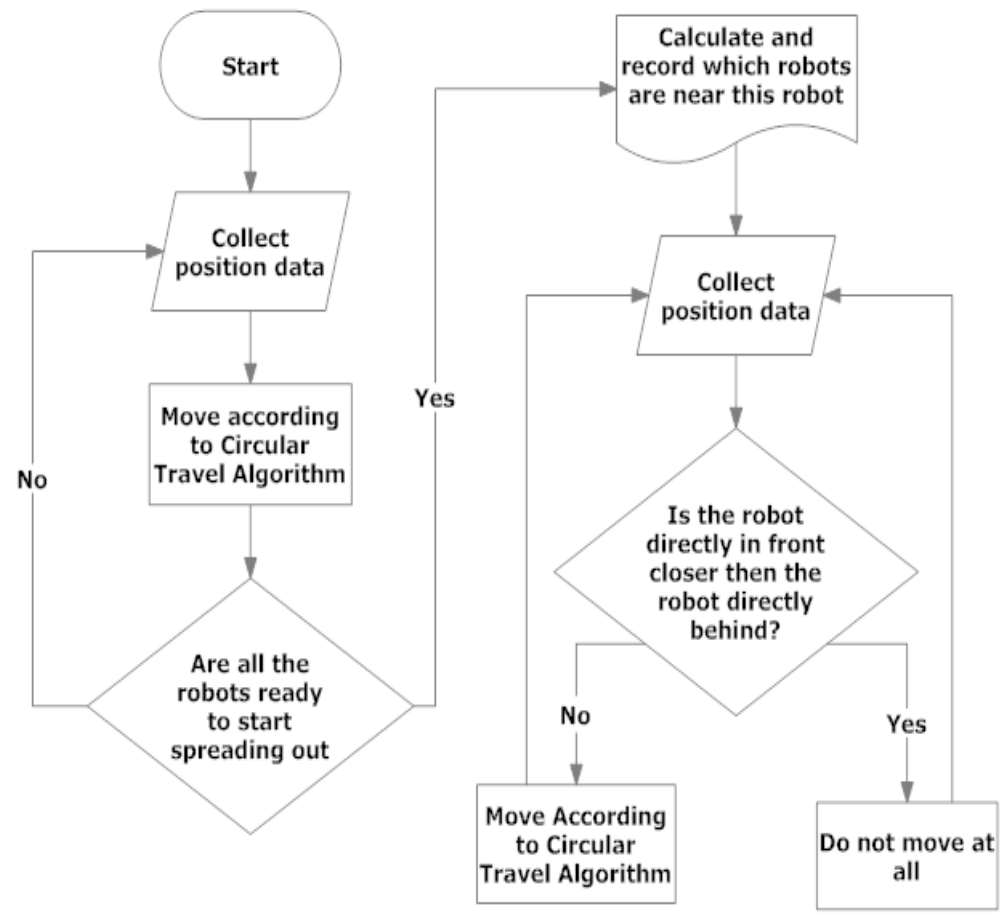
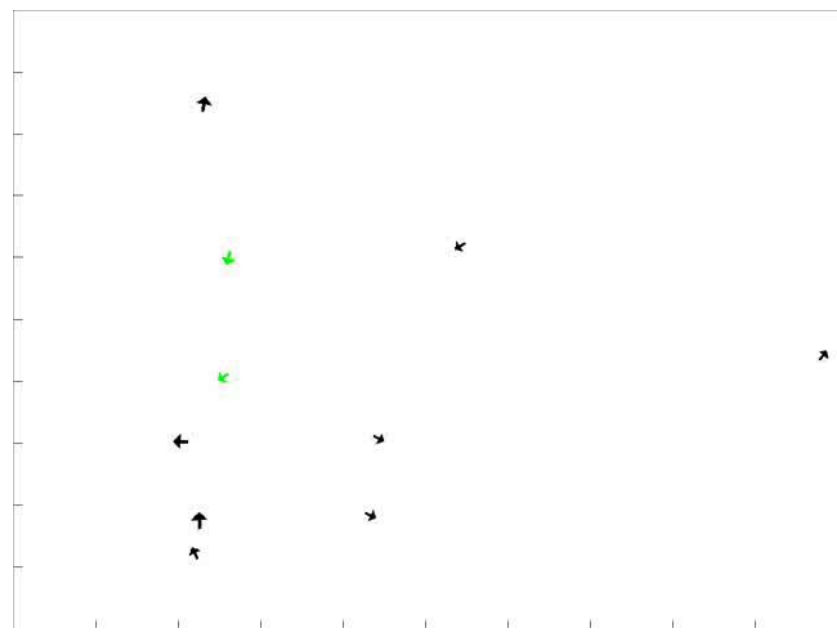
Equidistant Circular Travel Example

Robot searching for circle

Robot correctly position on circle

Robot determining neighbors

Robot aware of neighbors





Suggested Future Work

- Fine Tuning
 - Refine algorithms to work better with noise
 - Create commands to help robots avoid collisions
- Additional Algorithms
 - Spreading out
 - Leaderless flocking
- Implementation
 - Run algorithms on demo robots



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