

Project Title: Networking Swarm

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Project Goal

This project will coordinate a swarm of moving robots to send exploration data while navigating an unknown territory without losing connection to the host machine.

Project Approach

This project will model the connection between bots as a graph, and the algorithm continuously trying to expand the graph without breaking the swarm's connectedness. The outcome would be a network protocol that would ensure maximum throughput of exploration data back to the host machine in the shortest possible time frame without losing any member of the swarm.

Resources

This project will be sponsored by the Biomimetic Millisystems Lab, which will provide us both hardware and algorithmic support. We will have at least 3 Zumo bots. Each bot comes with an ODROID-U3 embedded development module running Ubuntu, connected to an [mbed LPC1768](#) embedded controller for connecting to the motor drivers, and a Nordic Instrument board which implements the networking protocol. Our networking protocol will either XBee or Bluetooth. To measure signal strength, we intend to attach a Atheros AR9271 Chip USB Wifi Wireless Adapter, and extract its RSSI readings. We will have the readily-setup Optitrak which uses TrackingTools to track 3D location of bots to analyze and test our deployment. For simulation, our plan is to test the algorithmic and mathematical aspects of our algorithm on MatLab, the state-machine aspects on LabView, and the cooperation between bots on V-REP.

Analysis

For each Roomba bot, we plan to realize a state machine that will communicate with other bots and be able to backtrack to its latest connected position. And to realize a state-machine which expands its exploration territory while maintaining the connectivity of the swarm from a swarm system point of view.

Schedule

- October 28: Setup of Simulation in MatLab and Research about Mesh Network Algorithms
Finished Configuration of Networking Hardware
- November 4: Running algorithm in MatLab. Statechart Simulation for FSM of 1 bot.
Implement polling protocol and connectivity testing on 1 ODROID board.
- November 11: Optimization of algorithm in MatLab. Statechart Simulation for cooperation between bots.
Implement polling protocol and connectivity testing on all boards.
- November 18: Optimization of algorithm in simulation.
Implementation of polling collision avoidance algorithm.
- November 25: Deployment and Testing of the optimized algorithm on the bot.
- December 2-9: (Flexible Week)
- December 17: Final presentation and demo.
- December 19: Project report and video turned in

Risk and Feasibility

There might be external signal that interferes with the connectivity testing of the bots. Configuration of hardware and networking interface can be a lot more difficult than we expect that we may need to consult additional resources. We may encounter hardware failure and waste time and resource.