Assignment 4: Robot Resource Collection

CS 491/591: Programming Swarm Robots
Assigned November 13th, 2017
Due: December 13th, 6:00pm Mountain Time
Version: 1.1
Last modified: November 22, 2017

1 Change Log

- Fixed a typo. "tanking" → "ranking"
- Reformatted the assignment. Moved requirements into sections from bulleted list.
- Added requirement to discuss the reality gap.
- Added requirement to cite Luc Steels paper in related work.
- Further encouraged the use of Gazebo to present the algorithm developed by teams in the paper.

2 Description

This project is based on the NASA-UNM Swarmathon Competition. The competition challenges students to program robots to search for targets, pick up and return those targets to a central collection zone.

You will work with your assigned partners to extend the provided base code at SwarmBaseCode-ROS to collect as many targets as possible in 15 minutes using 3 robots. You will be judged on the innovation and performance of your approach as presented in your paper, and your codes' performance in real robots.

I expect you to make significant use of Gazebo in presenting your solution in the paper. You will be able to show the maps generated by your code and perform a few experiments in Gazebo that would be harder to do in real hardware. When moving from simulation to the real robots recall our discussion of the "reality gap".

Format your 5 page paper as described in the syllabus. Use the peer review rubric to guide your writing and figure creation.

2.1 Introduction

Describe the context of the problem you are trying to solve: swarm *in situ* resource utilization.

2.2 Related Work

Describe any related papers and how your work builds on, implements or differs from other work. You should begin by citing the Luc Steels paper we read in class.

2.3 Methods

Each method may be described in a separate sub-section. Describe algorithms and approaches that you developed using, e.g., psuedocode, equations, flow charts, figures or descriptions.

2.4 Results

Describe the physical and virtual experimental setup that you used and how you analysed your experiments. The report can contain figures, photos, screenshots and/or links to videos demonstrating physical and/or virtual robots. You are encouraged to use the Gazebo simulator to generate figures describing your approach.

2.5 Discussion

Summarize your most important findings.

2.6 Competition

On Friday December 8th we will have a competition among the 6 teams. 30% of the final score for your project depends on the performance of your algorithm in this competition. The performance in the competition will replace the normally required peer review. No peer review will be required for Project 4. Competition points will be allocated as follows:
1st place: 100 points
2nd place: 90 points
3rd place: 80 points
4th place: 70 points
5st place: 60 points
6th place: 50 points

Ties will be resolved by having both teams receive the lower rank. For example, if there are 3 teams with scores 4, 2, 2 the ranking is 1, 3, 3. The 3rd ranked teams receive 80 points each. 80 points in the competition and perfect scores on the paper and code result in a 94% project grade. A 6th place score and perfect paper and code scores results in an 85% project score.

References

Place references to the sources of information you used in this assignment. Make sure you reference all code you used to implement your swarm, scientific papers, and books. You may cite websites. You will be graded on the quality and reliability of your sources. Stackexchange is much less reliable than a published book for example.

Author contributions

Include a contributions statement before the introduction section. The contributions may fall into three categories: analysis, code, and writing. For example your author contribution statement might look like this:

\section*{Author contributions}
J. C. wrote the code that generated Figs. 1, 3, and 5. V. W. wrote the code that generated Fig. 4. Both authors wrote the code that generated Figs. 6 and 7. J.C. wrote sections 1 though subsection 2.3, and section 3.6 of the paper. V. W. wrote subsection 2.4 through 3.5. The authors wrote sections 4 and 5 together. J. C. performed stability analysis for the map and V.W. identified the fixed points for the flow.

3 Notes

Format your paper as described in the project section of the web syllabus. Use the ACM paper template provided. Organise the paper into the following sections:

1. Abstract
2. Introduction
3. Related Work
4. Methods
5. Results
6. Conclusions
7. References

The paper may not exceed 5 single spaced pages including references.