Stigmergy for Multi-Robot Coverage

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Chapter 1

Requirements

1.1   Project Description

The project is being completed for Professor Karl Tuyls in the department of Computer Science, University of Liverpool, as the primary supervisor. The Project is also applicable for anyone wishing to build an area in which to conduct simulations that utilise the E-Puck platform[1]

Project Aims include building the testing grounds for the robotic simulations as well as showing a demonstration of the arena through the use of the e-Puck hardware platform. With the completion of this project, researchers have the capability of producing a testing ground for their experiments with the e-Puck hardware platform. The demonstrative section aims to show that the arena is capable and performs it's required task.

The initial solution for the project involves using standalone posts, rope and two large pieces of cloth. By using the ropes in a similar manner to a boxing ring, the solution provides flexibility in terms of arena size yet still contains the e-puck robots. Once properly erected, the posts will hold up the large pieces of cloth — one of a darker colour which will be the internal ceiling of the arena, and a piece of fabric which is lighter in colour to serve as the theoretical 'roof' of the structure. The lighter colour will help to reflect most of the external light which would otherwise cover the sectioned area, and the darker colour to absorb light within the structure, as well as absorbing light which manages to pass through the lighter fabric.

This solution allows practitioners to modify the size of the area as there is no permanent link between the posts, thanks to the rope. The dual-layered cover over the area prevents most light from entering the area and should any openings be made within the lower layer of fabric, it would allow visual monitoring with little compromise.

There are multiple research papers on decentralised robots — for patrolling, there is the Edge Ant Walk (EAW) algorithm, which V. Yanovski has worked on [4]. Due to memory limitations, the demonstration will be similar to StiCo[3] as well as the work on HybaCo [2].

1.2 Statement of Deliverables

1.3 Conduct of Project and Plan

1.4 Everything else

Bibliography

[1] Michael Bonani and Francesco Mondada. E-Puck Education Robot. URL: http://www.e-puck.org/.

[2] Bastian Broecker et al. "Hybrid Insect-Inspired Multi-Robot Coverage in Complex Environments". English. In: Towards Autonomous Robotic Systems. Ed. by Clare Dixon and Karl Tuyls. Vol. 9287. Lecture Notes in Computer Science. Springer International Publishing, 2015, pp. 56–68. ISBN: 978-3-319-22415-2. DOI: 10.1007/978-3-319-22416-9_8.

[3] Bijan Ranjbar-Sahraei, Gerhard Weiss, and Ali Nakisaee. "A Multi-robot Coverage Approach Based on Stigmergic Communication". English. In: Multiagent System Techn. Ed. by IngoJ. Timm and Christian Guttmann. Vol. 7598. Lecture Notes in Computer Science. Springer Berlin Heidelberg, 2012, pp. 126–138. ISBN: 978-3-642-33689-8. DOI: 10.1007/978-3-642-33690-4_13.

[4] Vladimir Yanovski, Israel A. Wagner, and Alfred M. Bruckstein. "A Distributed Ant Algorithm forEfficiently Patrolling a Network". English. In: Algorithmica 37.3 (2003), pp. 165–186. ISSN: 0178-4617. DOI: 10.1007/s00453-003-1030-9.