Engineering Tripos Part IIB, 4I15: Mobile Robot Systems, 2020-21

Leader

Dr A Prorok [1]

Lecturer

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Lecturer

Dr F Iida [2]

Lecturer

Dr F Forni [3]

Timing and Structure

Lent term. Lectures and coursework. Assessment: 100% coursework.

Prerequisites

4M20 useful; 3F2 useful; 3F3 useful

Aims

The aims of the course are to:

- This course teaches the foundations of autonomous mobile robots, covering topics such as perception, motion control, and planning.
- It also teaches algorithmic strategies that enable the coordination of multi-robot systems and robot swarms.
- The course will feature several practical sessions with hands-on robot programming. The students will undertake mini-projects, which will be formally evaluated through a report and presentation.

Objectives

As specific objectives, by the end of the course students should be able to:

- understand how to control a mobile robot;
- understand how a robot perceives its environment;
- understand how a robot plans actions (navigation paths);
- know paradigms of coordination in systems of multiple robots;
- know classical multi-robot problems and their solution methods;
- Know how to use ROS (Robot Operating System, http://www.ros.org).

Content

- [redacted]
- *Multi-robot systems IV. Multi-robot path planning.*

Further notes

Requirements:

Students are expected to have laptops running Linux, with installations of ROS Kinetic and Gazebo. An installation guide will be provided.

Coursework

Students will be expected to hand in two reports and attend an individual questioning session.

Coursework	Format	Due date & marks
[Coursework activity #1 : Assignments] Learning objectives: The assignments will consist of two elements: (1) experimental work using a robot simulator and real robots, and (2) theory / understanding. The exercises will require data collection and analysis. The balance between practice and theory will depend on the exercise topic. Each student will submit a written report. Each assignment will be marked on a scale of 0-100, and will compose 30% of the mark.	Individual Report anonymously marked	February 202 60% (30% ea assignment
[Coursework activity #2 :] Learning objectives: A set of proposals will be announced at the start of term. Students will form groups of 2-3 and select a project proposal. Each proposal will include a core and a set of extensions; Engineering students will be expected to complete the extensions. The project will compose 40% of the mark and will be evaluated on a scale of 0-100. It will be handed in as group-work in groups of 2-3, and the report will clearly state what each group member contributed. The overall project mark will be composed by a report score (60%) and a presentation score (40%). Project marks will reflect the contribution of each team member. Every team member is expected to make a similar, significant contribution to the project, and where this happens all team members will receive the same mark. The report requirements will differ for students. Engineering students will hand in 6-page double-column report (conference-formatted)	Individual Report anonymously marked	April 2021 40%

Booklists

Siegwart, R., Nourbakhsh, I.R. & Scaramuzza, D. (2004). *Autonomous mobile robots*. MIT Press.

Thrun, S., Wolfram B. & Dieter F. (2005). *Probabilistic robotics*. MIT Press.

Mondada, F. & Mordechai B. (2018) *Elements of Robotics*. Springer

Siciliano, B. & Khatib, O. (2016) *Springer handbook of robotics*. Springer.

Mesbahi, M. & Egerstedt, M. (2010) *Graph theoretic methods in multiagent networks*. Princeton University Press.

Examination Guidelines

Please refer to Form & conduct of the examinations [4].

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