Universitat de les Illes Balears

Academic year	2017-18
Subject	11554 - Robotics
Group	Group 1, 1S
Syllabus	C
Language	English

Syllabus

Subject

Name 11554 - Robotics
Credits 0.72 in-class (18 hours) 2.28 distance (57 hours) 3 total (75 hours).
Group Group 1, 1S (Campus Extens)
Period First semester
Language English

Lecturers

Lecturers	Office hours for students					
	Starting time	Finishing time	Day	Start date	End date	Office
José Guerrero Sastre jose.guerrero@uib.es	09:30	10:30	Tuesday	13/09/2017	11/02/2018	127. Anselm turmeda
	09:30	10:30	Thursday	12/02/2018	06/07/2018	127. Anselm turmeda

Context

Robotics is a compulsory subject of the Vision and Robotics Module that is taught in the first semester of of the Computer Science Master. The aim of this course is to provide an overview of the basic concepts on design, control and programming of mobile autonomous vehicles (mobile robots). All these topics will be required for advanced robotics courses, such as Mobile Robotics.

Requirements

Recommended

It is highly recommended that the students have basic knowledge of programming with C/C++. Experience with handling matrix calculations and trigonometry is also required.

Skills

Specific

* CE10 - Understand and apply advanced knowledge of high-performance computing and numerical or computational methods to engineering problems..

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* CE12 - Apply mathematical, statistical and artificial-intelligence methods to model, design and develop applications, services, intelligent systems and knowledge-based systems..

Generic

* CG8 - Integrate and apply the knowledge acquired and solve problems in new or little-known situations within broader (or multidisciplinary) contexts..
* CG1 - Propose, calculate and design products, processes and installations in all areas of computer engineering..

Basic

* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

Theme content

Lecture 1. Introduction (10%)

Lecture 2. Mobile Robot Kinematics (20%)
Kinematic and mechanical structure of a robot.

Lecture 3. Sensors and Perception (30%)
Optical enconders, IMU, compass, GPS, laser, sonar, …. and vision. Localization problems

Lecture 4. Control and Navigation. (30%)
Obstacle avoidance, maps (metric and topological maps), path planning with graphs (A*, D*, wavefront, …)

Lecture 5. Advanced Topics (10%)

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Theoretical lectures	Large group (G)	Exposition of theoretical concepts by the lecturer. Solution by the professor of a selected group of problems and examples previously proposed.	11
Seminars and workshops	Seminars and resolution of problems	Medium group (M)	The lecturer will propose several exercises and problems to be solved in class by the students.	4
Practical classes	Projects and Laboratory Sessions	Medium group 2 (X)	By the method of problem-based learning , students must solve a set of practical problems of increasing difficulty. The aim of these workshops is to facilitate the understanding of theoretical concepts seen in class as well as provide a deeper knowledge on practical issues. In groups , students will	3

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Modality	Name	Typ. Grp.	Description	Hours
			perform different practices proposed by the teacher related to programming and control of an autonomous vehicle.	

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Self-study	Each student will spend some personal time to assimilate the theory presented in class and to solve the proposed exercises/problems	24
Group self-study	Programming a Mobile Robot	After conducting several workshops, a project will be proposed to each group of students based on programming a real mobile robot (pioneer 3DX) with C/C++ in order to evaluate the robot's behavior under different algorithms. This study will be completed with several simulations using the Robotics Toolbox Matlab.	20
Group self-study	Research work & Oral Presentation	Presentation of a work about some topic related with the subject and previously proposed by the lecturer.	13

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

Students will obtain a numerical score between 0 and 10 for each activity. The table, that can be seen in this section describes for each one of them, the evaluation technique to be applied, the type (recoverable , non-recoverable), the qualification criteria, and the weight in the final mark. In order to pass the subject, the student must obtain,at least, a final mark greater or equal to 5.

Only if the student has presented less than 33% of the total assigned evaluation course tasks, will the grade be NP (absent) (see article 19 of the Academic Regulations)

Article 33 in the Academic Regulations will be applied in cases of fraudulent practices in the process of assessment.

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Seminars and resolution of problems

Modality	Seminars and workshops
Technique	Extended-response, discursive examinations **(retrievable)**
Description	The lecturer will propose several exercises and problems to be solved in class by the students.
Assessment criteria	Student will do a final exam at the end of the semester in which the theoretical and practical contents of the subject will be evaluated. The following skills will be assessed in this exam: CE10, CE12, CG8

Final grade percentage: 50%

Programming a Mobile Robot

Modality	Group self-study
Technique	Papers and projects **(retrievable)**
Description	After conducting several workshops, a project will be proposed to each group of students based on programming a real mobile robot (pioneer 3DX) with C/C++ in order to evaluate the robot's behavior under different algorithms. This study will be completed with several simulations using the Robotics Toolbox Matlab.
Assessment criteria	Each group must deliver the source-code of programs with their reports to assess their correctness. The quality of the programs execution will be assesed. The skills related with this activity are: CG1, CE12, CE10.

Final grade percentage: 30%

Research work & Oral Presentation

Modality	Group self-study
Technique	Papers and projects **(retrievable)**
Description	Presentation of a work about some topic related with the subject and previously proposed by the lecturer.
Assessment criteria	The quality of written report and clarity on its exposition will be assessed (skills: CG1 and CE12)

Final grade percentage: 20%

Resources, bibliography and additional documentation

Basic bibliography

"Introduction to Autonomous Mobile Robots", 2nd Edition. R. Siegwart, I. Nourbakhsh, D. Scaramuzza. 2011, MIT Press

Complementary bibliography

"Fundamentos de Robótica" segunda edición. A. Barrientos, L. Peñín, C. Balaguer, R. Araceli, 2007, McG

Other resources

Lecturer's notes and other resources are available to students through Campus Extens