UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Escola Superior d'Enginyeries Industrial, Aeroespacial i Audiovisual de Terrassa

General description

Name of the course: Autonomous Vehicle Pogramming

Department: ENG. SISTEMES, AUTOMÀTICA I INFORMÀTICA INDUSTRIAL

ECTS: **3 ECTS**

Degree: **all degree**

Level:

Language: English

Code:

Type: **Elective**

Lecturers

Main teacher: Morcego Seix, Bernardo

Others: -

General learning objectives of the course

The main objective of the course is to acquire a hands-on, panoramic view of the problems and (programmed) solutions in the control system of an autonomous vehicle.

Some aspects of this overview are treated in depth. Consequently, there are sub-objectives derived from the main one, which are: to create a functional ROS module in a complex software project, to distinguish and classify the problems in autonomous vehicle guidance and to deal with an introductory problem from other knowledge areas, such as computer vision, artificial intelligence or computer control.

Competencies

Specific competencies	any
Generic competencies	any

Credits: total hours of student work

		Dedication	
		Hours	%
Directed learning	Large Group (G)	30	40%
Autonomous learning		45	60%

Modules

Module 1: Introduction to AV	Dedication: 2 hours	Large group: 2 hours Autonomous learning: 0 hours
Description	Autonomous vehicles (definition, autonomy levels, examples, controversies) General description of the AV Control Architecture Sensors and actuators	
Related activities (*)	1	

Module 2: Programming environment	Dedication: 16 hours	Large group: 1 hours Autonomous learning: 15 hours
Description	Linux OS ROS	
Related activities (*)	2	

Module 3: AV Problems and solution approaches	Dedication: 57 hours	Large group: 27 hours Autonomous learning: 30 hours
Description	Guidance problems Navigation problems Control problems	
Related activities (*)	1, 2, 3	

Activities Description

1. Theory lectures	Dedication: 6 hours	Large group: 6 hours Autonomous learning: 0 hours
Description	Exposition of the subject theory contents.	
Objectives	Knowledge transfer, creation of a conceptual reference frame, solving questions and generating interest about the subject.	
Resources	Slide compilations and handouts at Atenea General bibliography of the subject	
Evidences	This activity is evaluated together with activity 2 and 3.	

2. Lab project	Dedication: 55 hours	Large group: 20 hours Autonomous learning: 35 hours
Description	Students, in groups, follow the instructions to program one of the blocks that make up the control system of an autonomous vehicle. These sessions take place at the lab. A complete, functional program architecture of the autonomous vehicle is given and the objective is to add a new module to this architecture each group.	
Objectives	Proper application and programming of problem identification and solving.	
Resources	Project instructions at Atenea Simulation software (ROS) Lab experimental platforms Course handouts and notes	
Evidences	Programs, working simulations and working experiments.	

3. Final demonstration	Dedication: 14 hours	Large group: 4 hours Autonomous learning: 10 hours
Description	Each group explains its project and carries out an experimental demonstration of the behavior of its programmed block.	

Objectives	Assess the knowledge acquisition of activities 1, 2. Refine student assessment within group from the evaluation in activity 2.
Resources	Lab experimental platforms Presentation assets
Evidences	Proper working of the programmed block. Answers to the questions posed during the presentation.

Grading system (assessment)

Project assessment – planning: 25%
Project assessment – code development: 25%
Project assessment – presentation: 25%
Project assessment – demo: 25%

Teaching methodology

The theoretical part of the course is developed through lectures including theoretical sessions imparted with the aid of presentations. The applied part is developed with a project-based approach but adapted to the specific traits of the course.

References

Basic	YURTSEVER, Ekim, et al. A survey of autonomous driving: Common practices and emerging technologies. *IEEE Access*, 2020, 8: 58443-58469. (*https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9046805)* BADUE, Claudine, et al. Self-driving cars: A survey. *Expert Systems with Applications*, 2020, 113816. (https://arxiv.org/pdf/1901.04407)
Complementary	