Universitat Autònoma de Barcelona

Platforms for the Integration of Navigation and Positioning Systems

2016/2017

Code: 42841
ECTS Credits: 6

Degree	Type	Year	Semester
4313797 Telecommunications Engineering	OT	2	1

Contact

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Use of languages

Principal working language: english (eng)

Prerequisites

It is recommended kwoledegements in programming, VHDL and embedded systems.

Objectives and Contextualisation

Basics on the development of platforms for the integration of navigation systems and positioning, mainly focused to robotics.
To get the design HW based platform methodology for digital processing of algorithms that integrates different inertial data source measurements.
Application to mapping, localization and planning algorithms especially, but not closed, to terrestrial applications.

Skills

- Be capable of using programmable logic as well as designing advanced electronic systems, both analogue and digital.
- Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
- Capacity for developing electronic instrumentation as well as transducers, actuators and sensors.
- Capacity for working in interdisciplinary teams
- Knowledge of the hardware description languages for highly complex circuits
- Maintain proactive and dynamic activity for continual improvement
- Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously

Learning outcomes

1. Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
2. Capacity for working in interdisciplinary teams
3. Design integrated circuits using hardware description languages through ASICs and/or FPGAs
4. Integration of inertial sensors and programmable platforms for advanced digital processing
5. Maintain proactive and dynamic activity for continual improvement

6. Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
7. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
8. Use programmable digital logic devices for advanced digital processing

Content

1. Introduction.

2. Recursive estimation and filtering in navigation.

3. Movement kinematics in robotics.

4. Sensoring, perception and measurement in inertial systems.

5. Positioning and localization.

6. Mapping.

7. Planning and path control.

8. Integration to hardware systems.

9. Navigation software tools.

Methodology

Lectures

Exhibitions on the board of the theoretical part of the syllabus of the subject. Give basic knowledge of the subject and indications on lectures.

Seminar problems

Work on scientific and technical papers. Exercises are solved and discussed on case studies, promoting the capacity for analysis, synthesis and critical reasoning. Exercises to be delivered.

Lab practices

The main tools used in software and hardware for processing in navigation systems are presented.
Students work in groups of two.
Students will develop group work habits.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Master class	28	1.12	3, 4, 8
Type: Supervised			
Problems, lab sessions	12	0.48	2, 6, 7

Type: Autonomous			
Own study and work	90	3.6	1, 2, 5

Evaluation

The evaluation of the course is performed the following items:

1. Evidence of continuous assessment. The total weight of the subject is 45%. A minimum grade of four is necessary to make average.
2. Laboratory activities. The total weight of the subject is 35%. It must be approved to pass the course. No lab recovery mechanism is established.
3. Seminar work. The total weight of the subject is 20%. It corresponds to the student work done during the course.

4. It is considered absent when the there is any evaluation of the subject.
5. In the case of not reaching the minimum required in any of the evaluation activities, the maximum qualification will be 4.5.
6. The continuous assessment tests will be conducted on the stablished date without any exception. There is a final assessment test to recover the continuous assessment not approved.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Laboratory	35	5	0.2	1, 2, 5
Problems	20	5	0.2	6, 7
Theory	45	10	0.4	3, 4, 8

Bibliography

S.Thrun, W. Burgard, D. Fox. PROBABILISTIC ROBOTICS. MIT Press. 2005.

A.Kelly. MOBILE ROBOTICS: MATHEMATICS, MODELS AND METHODS. Cambridge University Press, 2013

R.Siegwart, I.R.Nourbakhsh, D.Scaramuzza.INTRODUCTION TO AUTONOMOUS MOBILE ROBOTS. Intelligent Robotics & Autonomous Agents Series. MIT Press. 2011

A.Martinez, E.Fernández. LEARNING ROS FOR ROBOTICS PROGRAMMING. PACKT Publishing. Birmingham. 2013.

Complementaris:

J.V.Guttag. INTRODUCTION TO COMPUTATION AND PROGRAMMING USING PYTHON. MIT Press. 2013.

C.Hallinan. EMBEDDED LINUX PRIMER. Prentice Hall. 2012.