Course guides
230105 - SAM - Sensors, Actuators and Microcontrollers in Mobile Robots

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR’S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR’S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).
BACHELOR’S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).
BACHELOR’S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Optional subject).
BACHELOR’S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018). (Optional subject).

Academic year: 2021 ECTS Credits: 6.0 Languages: Catalan, Spanish, English

LECTURER
Coordinating lecturer: Sergio Bermejo Sánchez

Others:

PRIOR SKILLS
Analogue and digital electronics concepts. Microprocessors.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT
The subject gives an introduction to the mobile autonomous robotics wherein microcontrollers are a part of the strategies of control of the electronic system. The basic concepts of different types of sensors and actuadores of habitual use in robotics as well as the basic strategies of control are analysed including his achievement, with special emphasis on the adaptive and action-reaction strategies of control. In the laboratory, a prototype of an autonomous robot will be mounted.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Self study</td>
<td>98,0</td>
<td>65.33</td>
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<tr>
<td>Hours large group</td>
<td>26,0</td>
<td>17.33</td>
</tr>
<tr>
<td>Hours small group</td>
<td>26,0</td>
<td>17.33</td>
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Total learning time: 150 h
CONTENTS

1. Introduction to mobile autonomous robotics (2 hours)

1.1. Basic concepts

1.2. Design considerations

1.3. Parts of a robot

1.4. Robot control

2. Sensors (6 hours)

2.1. Concepts. Introduction


2.3. Signal conditioning. Basic circuits

2.4. Use of A/D and D/A converters

3. Actuators (4 hours)

3.1. DC Motors

3.2. Gears

3.3. Pulse Width Modulation (PWM)
3.4. Stepper motors

3.5. Servomotors

4. Microcontrolador architecture (8 hours)

4.1. Introduction

4.2. Blocks diagram

4.3. Memory

4.4. Input/output ports

4.5. Timers/counters

4.6. A/D conversion

4.7. Interrupts

4.8. Instruction set and addressing modes

5. Communications between systems (2 hours)

5.1. Serial line

5.2. Infrared and wireless connections

6. Control systems. Algorithms (4 hours)
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
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<tbody>
<tr>
<td>6.1</td>
<td>Control basis and principles</td>
</tr>
<tr>
<td>6.2</td>
<td>Control systems and their stability</td>
</tr>
<tr>
<td>6.3</td>
<td>PID controllers</td>
</tr>
<tr>
<td>6.4</td>
<td>Introduction to adaptive control</td>
</tr>
<tr>
<td>6.5</td>
<td>Active learning based algorithms</td>
</tr>
<tr>
<td>6.6</td>
<td>Inductive learning in automatas</td>
</tr>
<tr>
<td>6.7</td>
<td>Reinforcement learning algorithms</td>
</tr>
<tr>
<td>7</td>
<td>Autonomous navigation (4 hours)</td>
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<tr>
<td>7.1</td>
<td>Basic requirements</td>
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<tr>
<td>7.2</td>
<td>Environment maps construction</td>
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<tr>
<td>7.3</td>
<td>Environment maps abstraction</td>
</tr>
<tr>
<td>7.4</td>
<td>Several architectures examples (neural nets, fuzzy logic, biological based...)</td>
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</tbody>
</table>

**GRADING SYSTEM**

The evaluation of the subject is obtained as a 100% of a robotics project realised within the laboratory divided into diverse phases in a work continued along the course and his later presentation in public.
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources: