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.

Prior skills

Analogue and digital electronics concepts. Microprocessors.

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>Total learning time: 150h</th>
<th>Hours large group: 26h</th>
<th>17.33%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group: 26h</td>
<td>17.33%</td>
</tr>
<tr>
<td></td>
<td>Self study: 98h</td>
<td>65.33%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to mobile autonomous robotics (2 hours)</td>
<td>Degree competences to which the content contributes:</td>
</tr>
<tr>
<td>1.1. Basic concepts</td>
<td></td>
</tr>
<tr>
<td>1.2. Design considerations</td>
<td>Degree competences to which the content contributes:</td>
</tr>
<tr>
<td>1.3. Parts of a robot</td>
<td>Degree competences to which the content contributes:</td>
</tr>
<tr>
<td>1.4. Robot control</td>
<td>Degree competences to which the content contributes:</td>
</tr>
<tr>
<td>2. Sensors (6 hours)</td>
<td>Degree competences to which the content contributes:</td>
</tr>
<tr>
<td>2.1. Concepts. Introduction</td>
<td>Degree competences to which the content contributes:</td>
</tr>
<tr>
<td>2.2. Types of sensors: Pressure/ contact. Resistive position. Infrared. Light. Ultrasound. Magnetic</td>
<td>Degree competences to which the content contributes:</td>
</tr>
<tr>
<td>2.3. Signal conditioning. Basic circuits</td>
<td>Degree competences to which the content contributes:</td>
</tr>
</tbody>
</table>
2.4. Use of A/D and D/A converters

Degree competences to which the content contributes:

3. Actuators (4 hours)

Degree competences to which the content contributes:

3.1. DC Motors

Degree competences to which the content contributes:

3.2. Gears

Degree competences to which the content contributes:

3.3. Pulse Width Modulation (PWM)

Degree competences to which the content contributes:

3.4. Stepper motors

Degree competences to which the content contributes:

3.5. Servomotors

Degree competences to which the content contributes:

4. Microcontrolador architecture (8 hours)

Degree competences to which the content contributes:

4.1. Introduction

Degree competences to which the content contributes:
### 4.2. Blocks diagram

Degree competences to which the content contributes:

### 4.3. Memory

Degree competences to which the content contributes:

### 4.4. Input/output ports

Degree competences to which the content contributes:

### 4.5. Timers/counters

Degree competences to which the content contributes:

### 4.6. A/D conversion

Degree competences to which the content contributes:

### 4.7. Interrupts

Degree competences to which the content contributes:

### 4.8. Instruction set and addressing modes

Degree competences to which the content contributes:

### 5. Communications between systems (2 hours)

Degree competences to which the content contributes:

### 5.1. Serial line

Degree competences to which the content contributes:
### 5.2. Infrared and wireless connections

Degree competences to which the content contributes:

### 6. Control systems. Algorithms (4 hours)

Degree competences to which the content contributes:

#### 6.1. Control basis and principles

Degree competences to which the content contributes:

#### 6.2. Control systems and their stability

Degree competences to which the content contributes:

#### 6.3. PID controllers

Degree competences to which the content contributes:

#### 6.4. Introduction to adaptive control

Degree competences to which the content contributes:

#### 6.5. Active learning based algorithms

Degree competences to which the content contributes:

#### 6.6. Inductive learning in automatas

Degree competences to which the content contributes:

#### 6.7. Reinforcement learning algorithms

Degree competences to which the content contributes:
7. Autonomous navigation (4 hours)

Degree competences to which the content contributes:

<table>
<thead>
<tr>
<th>7.1. Basic requirements</th>
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<tbody>
<tr>
<td>Degree competences to which the content contributes:</td>
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<table>
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<tr>
<th>7.2. Environment maps construction</th>
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<tr>
<td>Degree competences to which the content contributes:</td>
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<table>
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<tr>
<th>7.3. Environment maps abstraction</th>
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<tbody>
<tr>
<td>Degree competences to which the content contributes:</td>
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</tbody>
</table>

<table>
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<tr>
<th>7.4. Several architectures examples (neural nets, fuzzy logic, biological based...)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree competences to which the content contributes:</td>
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</table>

**Qualification 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:


Others resources: