Course guide
340242 - SDIN-K7P07 - Distributed Industrial Systems

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2022   ECTS Credits: 6.0   Languages: Catalan

LECTURER

Coordinating lecturer: Francesc Xavier Parra Llanas
Others: Francesc Xavier Parra Llanas

PRIOR SKILLS

It is recommended that students took Industrial Informatics lectures.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE28. Applied knowledge of industrial and communication computing.

TEACHING METHODOLOGY

The teaching methodologies include classes, problem solving, lab sessions, autonomous learning and supervised activities.

LEARNING OBJECTIVES OF THE SUBJECT

Objectives
1. Characteristics of the industrial distributed systems
2. Analysis of the computation and communication systems in industrial distributed systems
3. Design and implement device-level communications under different environments: CAN, ETHERNET and OPC

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
## Introduction to distributed industrial systems

**Description:**
1. Process control: centralized vs. distributed system
2. Field bus
3. OSI model
4. Buses and industrial networks, middlewares for industrial applications

**Full-or-part-time:** 13h  
Theory classes: 1h  
Guided activities: 3h  
Self study: 9h

## SPI and I2C Communications

**Description:**
1. Typology of communications: analog vs. digital
2. Analog Communications
3. Digital Communications
4. Electronic Interfaces
5. SPI Communication
6. I2C Communication

**Related activities:**
- I2C Communication - Triaxial accelerometer
  * MPU-6050
  * Wire Library

**Full-or-part-time:** 8h  
Guided activities: 8h

## CAN Bus - Controller Area Network

**Description:**
1. Introduction
2. Physical layer
2.1. Typology
2.2. Line coding
2.3. Bus access
2.4. Transmitter-receiver synchronization
3. Data Link Layer
3.1. Medium access control
3.2. Logical link control

**Related activities:**
1. CAN Bus with Arduino
   * CAN Shield
   * MCP_CAN Library
2. CAN Game: rock, paper, scissors

**Full-or-part-time:** 16h  
Guided activities: 16h
Ethernet

Description:
1. Introduction
2. Physical layer
   2.1. Cables
   2.2. Hub
3. Data Link Layer
   3.1. Addressing
   3.2. Frames
   3.3. Bridge and Switch
4. Network Layer
   4.1. Addressing
   4.2. Router
   4.3. IP frame
5. Transport layer
   5.1. TCP protocol
   5.2. UDP Protocol

Related activities:
- Ethernet shield
- ESP32
- Sockets
- Ethernet Library
- WiFi Library

Full-or-part-time: 12h
Guided activities: 12h

OPC: OLE for Process Control

Description:
1. Introduction
2. OPC Server-client
3. Classic OPC
4. OPC Unified Architecture

Related activities:
1. OPC + Simulink
   * OPC Library
   * OPC Toolbox
   * Arduino and Simulink connection
2. OPC + PLC Omron
   * CX-Programmer
   * KEPServerEX

Full-or-part-time: 12h
Guided activities: 12h

GRADING SYSTEM
BIBLIOGRAPHY

Basic: