Course guide
340242 - SDIN-K7P07 - Distributed Industrial Systems

Last modified: 17/05/2023

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: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Francesc Xavier Parra Llanas

Others: Francesc Xavier Parra Llanas

PRIOR SKILLS

It is recomended that students took Industrial Informatics lectures

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE28. Applied knowledge of industrial and communication computing.
2. CE21. Knowledge of basics and application of digital electronics and microprocessors.

TEACHING METHODOLOGY

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

LEARNING OBJECTIVES OF THE SUBJECT

Objectives
1. Charactetistics 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

Type	Hours	Percentage
Hours large group	30,0	20.00
Hours small group	30,0	20.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

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
23. 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
* 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:
- Castro Gil, Manuel-Alonso; Fuertes, J. M. Comunicaciones industriales: sistemas distribuidos y aplicaciones. Madrid: UNED, 2007. ISBN 9788436254679.
- Kurose, James F; Ross, Keith W. Computer networking : a top-down approach [on line]. 8th ed. Harlow, United Kingdom: Pearson Education Limited, 2022 [Consultation: 10/11/2022]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5187270. ISBN 9781292405469.
- Tanenbaum, Andrew S. Computer networks [on line]. 8th ed. Harlow: Pearson, 2021 [Consultation: 27/02/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6432022. ISBN 9781292374062.
- Etschberger, Konrad. Controller area network: basics, protocols, chips and applications. 2001. Weingarten: IXXAT Automation GmbH, 2001. ISBN 3000073760.