Embedded Digital Systems for IoT

Academic Year: (2021 / 2022) **Review date: 04-06-2021**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: ENTRENA ARRONTES, LUIS ALFONSO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

For this subject, some basic knowledge of Digital Electronics, Software Programming and Microprocessors, such as those achieved in the degrees associated to Telecommunication Eng., Industrial Eng. and Computer Science, is required.
It is strongly advisable to take the course of Digital Systems and Applications, which is offered within the Master´s program.

OBJECTIVES

- Knowledge of the different types of embedded systems and their role in IoT, including those based on reconfigurable devices (FPGAs) and MPSoC.
- Knowledge of the architecture of an embedded system, its components, the hardware configuration mechanisms and its interfaces.
- Capability to design an electronic system based on microprocessors that are embedded in a MPSoC, including FPGAs, and are able to process the information provided by different types of sensors.
- To know the advantages and disadvantages of developing an embedded system with and without an operating system.
- Knowledge of the development tools for embedded systems.
- Capability to use a specific development tool to design and program a digital system based on a microcontroller embedded in a configurable device.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to embedded systems
- Definition and main features of embedded systems
- Types of embedded systems
- Design challenges
2. The hardware component of an embedded system
- System architecture
- Inputs and outputs. Peripherals
- Communication: Buses and interfaces
- Processing units. Memories
3. The software component of an embedded system
- Tools and development environments
- Bare metal applications
- Operating systems
4. Application: Embedded systems implemented in MPSoC
- Embedded microprocessor in MPSoC
- Desing tools for MPSoC
- Use of operating systems
- Debugging and validation
5. Evaluation and optimization of resources for IoT
- Critical parameters
- Evaluation and optimization techniques
- HW/SW co-design

LEARNING ACTIVITIES AND METHODOLOGY

TRAINING ACTIVITIES
AF1 Lectures
AF4 Laboratory sessions
AF6 Group work

AF7 Individual work
AF8 Exams

METHODOLOGIES
MD1 Classroom lectures with support of IT and audiovisual means to develop the main concepts that can be extended by the students with appropriate bibliography.
MD3 Practical case studies, exercises, etc. posed by the professor to be solved individually or in group.
MD5 Works and reports developed individually or in small groups

ASSESSMENT SYSTEM

The evaluation system is based on the following parts:
1.- Student work, individually or in group, to develop an IoT solution. Weight: 60%.
3.- Final exam. Weight: 40%. A minimum achievement of 3 points over 10 is required
In the extraordinary examination, the final term exam can be 100% of the final grade.

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- Marilyn Wolf Computer as Components Principles of Embedded Computing System Design, Morgan Kaufmann, 2012
- Peter Marwedel Embedded System Design, Embedded Systems Foundations of Cyber-Physical Systems, Springer, 2011

ADDITIONAL BIBLIOGRAPHY

- J. K. Peckol Embedded Systems: A Contemporary Design Tool, Wiley, 2008
- K.C. Wang Embedded and Real-Time Operating Systems, Springer, 2017
- L. H. Crockett et al. The Zynq Book. Embedded Processing with the ARM® Cortex®-A9 on the Xilinx® Zynq®-7000 All Programmable SoC, Strathclyde Academic Media, 2014