Academic Year/course: 2021/22

60976 - Electronic sensor networks

Syllabus Information

Academic Year: 2021/22
Subject: 60976 - Redes de sensores electrónicos
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 623 - Master's Degree in Telecommunications Engineering
ECTS: 6.0
Year: 2
Semester: First semester
Subject Type: Optional
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

- Lectures, where the theoretical basis of sensor networks in Internet of Things applications will be presented.
- Laboratory sessions, in which small groups of students will solve representative problems, designs and practical assemblies with sensor networks.
- A project where the student will be responsible for developing the work and the teacher will supervise it.
- The teacher will define different areas of research for students to carry out their research essay and their presentations.

Students are expected to participate actively in the class throughout the semester.

4.2. Learning tasks

The course includes the following learning tasks:

A01 and A02 Lectures and problem solving (25 hours). The fundamental contents of the course will be presented and a set of representative problems will be made. This activity will take place in the classroom. The materials will be available on the virtual platform.

A03 Laboratory sessions (25 hours). Lab sessions are structured in 9 tasks. The detail of the tasks will be available on the virtual platform.

A06 Project (40 hours). Activity related to the lab sessions and it will be done in pairs.

A07 Study (56 hours). This activity includes personal study aimed at monitoring the learning process, preparing lab sessions, research essay preparation and tutorials.

A08 Assessment tests (4 hours). It includes the work and research essay presentation.

4.3. Syllabus

Theoretical program:
- Presentation of the subject and evaluation
- Introduction to IoT
  - Applications and implications
  - IoT architecture and components
- How to make a critical state of the art
- Introduction to sensor networks
  - ISO-OSI layers. Physical layer. MAC layer
  - Network topology. Synchronization. Routing Security
  - Standard protocols in sensor networks. PAN (BLE) -LAN (ZigBee, WIFI, 6LowPAN) -LPWAN (Lora, SigFox, NBIOT)
  - Data management. Coding-Interoperability.
- Electronic design of an intelligent sensor node
  - Storage and energy management.
  - Hardware architecture and component selection.
  - Firmware architecture. Real-time operating systems.
- Intelligence design of a smart sensor node
  - Firmware architecture. Layers of data processing in embedded system.
  - Intelligence design methodology. Design of the experimentation, data collection and development of the algorithm.
  - Implementation and evaluation of the algorithm.

Practical program:
- Communication, management and representation of sensor data with Python.
- ESP32 as a platform for rapid prototyping of sensors. TIMER. I / Os. UART. ADC. Interruptions. Serial buses (I2C and SPI). Sensor data reading
- WIFI communications from microcontroller. IP stack and data upload to the cloud.
- BLE and Bluetooth communications.
- Lora and LoraWAN Communications.
- ZigBee Communications.

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

The detailed calendar of the various activities to be developed will be established once the University and the Center have approved the academic calendar (which can be consulted on the website of the center):

- Period of classes: first semester (autumn).
- Classes of theory and problems-cases: each week there are scheduled theory classes and / or problem-cases in the classroom.
- Practical laboratory sessions: the student will perform practical laboratory sessions and deliver work associated with them.
- Presentation of works and research essay: will be informed in class of the dates and conditions of delivery.

4.5. Bibliography and recommended resources

They will be available at http://moodle2.unizar.es:

? Slides of the subject

? Complementary teaching materials: set of useful materials for the subject: manufacturers' catalogs, component characteristics sheets, laboratory instrumentation manuals, etc.

? Scientific publications related to sensor networks