IE.2307 / IE.2407 – Electronics for IoT

Module title: Electronics for IoT
Module code: IE.2307 / IE.2407
Person in charge: Xun Zhang
ECTS: 4 credits
Workload: 100 hours including 46h face-to-face
Teamwork: yes
Keywords: sensors, microcontrolers, periphérics, communications I2C SPI, Radio rotocols, energy.

Presentation

The IOT market is growing exponentially, with increasingly innovative needs and services. These connected objects, which are increasingly invading our daily lives, are made up of a number of essential hardware components, such as sensors for collecting data, microcontrollers for managing the data collected, batteries and radio frequency transmission modules.

This module provides the engineering student with all the bases for the electronic design of a communicating object, from the sensor to the RF module.

Academic objectives

The aim of this module is to raise students' awareness of several key issues in the design of communicating objects. In particular:

- Choosing sensors, their manufacture, the specific features linked to *specialized* applications (biomedical, telemedicine, smart home, smart city, energy, automotive, etc.), conditioning the raw signal from the physical sensor, digital communication interfaces for standard sensors, etc.
- Mastering power supply and energy management
- Use the on-board mini-c*alculato*r
- Use the various wired and wireless communication protocols for transmitting data between sensors and server.
- Design technological objects based on microcontrollers, sensors and conditioning electronics.
- Model the design problems of this type of object.
- Communicate, read and write documents in English in a culturally diverse environment.
- Assimilate technical terms to understand documentation related to IoT systems.
- Act as a good communicator, listen and lead a dialogue, argue, convince, present and defend their solution.

Content/program

- Introduction to digital and analogue sensors, the parameters measured (physical, chemical or biological...)
- Sensors and sensor networks and their applications
- Sensor-electronics interface
- Energy optimization (sensor level, network level, system level)
- I²C and SPI communication buses
- Communications protocols
- Load sharing between objects and servers
- Design and optimization of a communicating measurement and control node

- Optimization and control of energy as a function of the various criteria for managing sensors, the application, the means of communication, etc.

Prerequisites

- Basic knowledge in electronics and programming

Tools

- Microcontroller board, electronic components, sensors, radio modules (LORA, BLUETOOTH…)

Academic methodss

Learning methods

The module is taught in form of :

- A lecture/tutorial that presents the main concepts involved in designing communicating objects for applications in the following fields: telemedicine, transport, smart home and smart city. It places particular emphasis on current and future developments, and on the issues still open in these communicating modules. Practical work is used to develop and implement the various concepts.
- A mini project in the workshop enables students to apply the concepts studied in class and design a communicating object.

Assessment

Assessment will take the form of continuous assessment during practical work, mini-projects and workshops, and a written exam to evaluate the skills acquired through the various issues addressed.

Cross-disciplinary skills will be assessed during the teamwork, as well as by the quality of the final work presented.

Language l

Module delivered entirely in English, student productions in English