IE.2301 Electronics, signal and telecommunication project

General information

Title : Electronics/Signal project (APP)
Code : IE2301
Supervisors : Maria Trocan and Frédéric Amiel
ECTS : 8
Average amount of work per student: approx. 120h including around 2/3 in autonomy.
Teamwork : yes
Keywords: Analog electronics, microcontroller programming, digital signal processing, sensors, Bluetooth communication.

Presentation

The project is a first introduction to IoT and connected objects that includes the implementation of an actual prototype. It focusses on the design, test, and production of an electronic prototype for a user-based application. The module consists in the analog and digital interface of several sensors with a microcontroller, and a communication module the student will use.
The course is divided into sessions of 4 hours. The students work in teams of 4 to 6 students maximum. Students implement a communication module with actual components on a prototype. The electronics part interfaces diverse sensors (Carbonate dioxide detector, Humidity…) with a microcontroller in order to perform a basic signal processing and obtain some information that is useful for the case under study.

Objectives

Specialized competences

- Understanding of basic microcontroller usage
- Real-time signal processing
- Analog interface of sensors (amplifiers, filters, biasing, etc)
- Project mode

General comptences

- Work in teams
- Communicate in a scientific environment in an international team with different cultures and habits
- Be professionnal

At the end of the course, the students will be able to :

- Design and implement a IoT-prototype
    - Specify the functionnal needs
    - Analyze them and divide them into subproblems to be solved
    - Propose some architectures
- Simulate an electronic circuit
    - Build an electronic simulation
    - Analyze its results compared to real experiments

Content

- **Electronics**
    - Microcontroller – programming, use of I/O peripherals
    - Signal conditionning
    - Low level communication protocols

- **Basics of electricity / electronics**
    - Voltage / current measurement
    - Power consumption

- **Signal processing and telecommunication**
    - Fourrier analysis
    - Sampling
    - Coding

Tools under use

- Matlab/Simulink
- Electronic prototype board with discrete electronic components
- Electronic measurement benches (sources, oscilocopes, etc.)
- IDE (Energia – code composer studio)

Pedagogy

Organization

This course is divided into 2 four-hour sessions per week, one being in autonomy. The students work on an application-oriented project as a group. Approximately half of the sessions take place with a teacher who supervise the teams in the classroom.

The sessions are divided into electronics on the one hand, and signal processing on the other.

Evaluation

The students are evaluated continuously during the whole semester. Some presentations and reports are regularly to be submitted. Evaluation covers both individual and collective work.

Language

English