

# IE.2301 Electronics, signal and telecommunication project

## General information

Title : Electronics/Signal project (APP) Code : IE2301 Supervisors : Yahia Medjahdi and Alexis Brenes ECTS : 8 Average amount of work per student: approx. 120h including around 2/3 in autonomy. Teamwork : yes Keywords: Analog electronics, microcontroller programming, filtering, sensors, IR communication, modulation.
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## 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, as well as a communication module that the students will build.

The course is divided into sessions of 4 hours. The students work in teams of 4 to 6 students maximum. After an introduction to modulation and communication in simulations, the students implement a communication module with actual components on a prototype. The electronics part then interfaces sensors such as sound or acceleration sensors with a microcontroller in order to perform some basic signal processing and obtain some information that is useful for the case under study.

## Objectives

### Specialized competences

- Understanding of basic modulation schemes and coding
- Real-time signal processing
- Analog interface of sensors (amplifiers, filters, biasing, etc)
- Agir en mode projet

### General competences

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

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

- Design and implement a IoT-prototype
  - Specify the fonctionnal 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 and use of I/O peripherals
  - Signal conditioning
  - Low level communication protocols
- **Signal processing and telecommunication**
  - Fourier analysis
  - Sampling
  - Baseband communication
  - FSK modulation
  - Coding

## Tools under use

- Matlab/Simulink
- Electronic prototype board with discrete electronic components
- Electronic measurement benches (sources, oscilloscopes, 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 supervises the teams in the classroom.

The sessions are divided into electronics on the one hand, and telecommunication (including some 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