

# Autonomous embedded systems design

 ECTS  
5 credits

 Component  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 Number of  
hours  
71h

## Presentation

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## Description

Programme (detailed contents):

Due to embedded system constraints linked to the application, two applications are detailed:

- complete design an autonomous mobile robot able to move and communicate with other robots.
- design of an automotive application (body control) with sensors, microcontrollers, smart power actuators, communication bus, LCD display, system basis chip, in partnership with NXP.

The themes are:

- Management / Storage / energy recharging.
- Automotive electronics modern power boards, computers communication bus, LCD display, system basis chip
- Architectures and protocols of the various buses (wired and wireless)

- Architectures multi-source voltage (interface and translation of logic levels)
- Motor control
- Instrumentation and reconfigurable architectures for sensor signal conditioning
- components to ensure safety and robustness

Organization:

Mixed between lectures and Project based learning

Lectures are made by different industry stakeholders, each with a special skill and working in order to give students the latest advances in automotive electronics.

Projects allow students to work in a very close conditions that they will find in the industry.

For the design part of a mobile robot, it is ensured by leading researchers in the field of embedded electronics.

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## Objectives

At the end of this module, the student will have understood and be able to explain (main concepts) main subsystems as follow:

- Energy Management:

- \* architectures converters (DC-DC, LDO, Band-Gap ...)
- \* Storage and charging architectures (Lipo, Li-ion ...)

\* Management of low-power modes of a microcontroller

- Interfacing:

- \* between logic levels (strong currents, voltage levels, EMC, thermal protection, ...)
- \* between the microcontroller and peripherals based on the waveform of the current • with power actuators (smart MOS)

-Communication:

- \* protocols: I2C, SPI, CAN, OneWire
- \* RF protocols: XBee, 868MHz, 433MHz RFID

- On board intelligence:

- \* Reconfigurable digital and analog architectures (3 bit microcontroller, FPAA)

- Display:

- \* Automotive Dashboard
- \* Screens / touchscreens

- Safety and robustness:

- \* analysis of safety
- \* System basis chip, power supply supervision
- \* Watchdogs, error and fault diagnosis
- \* EMC requirements

The student will be able to devise from specifications all the subsystems architectures and choose components to assume a design complies with the specifications (battery and electronics management, connection of selected cards and constraints for microcontrollers programming).

Note that analog design will be provided on

FPAA.

## Useful info

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### Place

➤ Toulouse