INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

5th YEAR THEME INNOVATIVE SMART SYSTEM

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Smart Devices

ECTS
5 crédits

Hourly volume

Introducing

Description

Objectives

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

SMART SENSORS AND ACQUISITION CHAIN:
- The criteria for the design and use of a "smart device" and an acquisition chain
It will be capable of handling:
- The physical principles of sensors operation
- The concepts used in metrology
- Procedures implemented,
- electrical "conditioners"
- The design of an acquisition chain and a "smart device".
MICROCONTROLERS AND OPEN SOURCE HARDWARE: the elements necessary for the design and implementation of concrete applications in Open Source Hardware,

DESIGN OF A CIRCUIT IN ANALOG ELECTRONICS:
It will be able to design and simulate an amplification stage dedicated to the measurement of the sensor realized

DESIGN OF AN ELECTRONIC BOARD OF THE SENSOR:
He will be able to design and build an electronic board containing the sensor, its conditioning electronics and the communication elements necessary to send the data on a low speed network such as LoRa.

NANO-SENSOR:
- The approach of making nano devices and micro-electronic methods by integrating low-cost nano-objects prepared in solution;
- The operation of a nano-sensor.

The student will have understood and be able to explain:
- Experimental concepts and practices to synthesis nano-objects in liquid phase; Stabilization of colloidal solutions;
- Experimental concepts and practices of deposits of these nano-objects as 2D and 3D networks;
- The physical principles of sensors based on nanoparticles (gas sensors, stress ...)
The student will be able to:
- Experimentally produce a nanoparticle-based sensor that will be synthesized and assembled between two electrodes;
- Measure the properties of the sensor and describe its operation;
- Discuss experimental results and suggest improvements

Necessary prerequisites

General physic and electronic lectures. C et C++ programming

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Practical info

Location(s)

Toulouse

Communication

ECTS
5 crédits

Hourly volume

Introducing

Description

Objectives

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

-the communication architectures and protocols for wireless sensors networks and Internet of Things (IoT)
-the quality of services for adaptative networks (routing layer, MAC layer, beamforming algorithms)
- the functioning of adaptative networks and adaptative communication services
-the Software Defined Radio (SDR) and cognitive radio principles (reconfigurability in mobile networks)
-the functioning and the services of 4G and 5G networks
-the overall architecture of an energy management system, capturing or not ambient energy.
-the difficulties to assure the integrity, the availability and the confidentiality of the deployed equipment on a large scale, in different environments using heterogeneous communication interfaces

The student will be able to:

-design, dimensioning and deploying a wireless sensor networks depending on the applications
- having strong knowledges about quality of service on the MAC layer and beamforming algorithms
-having strong knowledges on 4G and 5G networks and adaptative networks
-identify the information to protect in IoT with respect to the security properties
-analyse the communication interferences to characterise the weakness of the system
-propose or modify the communication architectures to take into account the security problems
-design the energy management of a connected object

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Practical info

Location(s)

Toulouse

Middleware and services

ECTS
5 crédits

Hourly volume
62h

Introducing

Description

Objectives

This training consists of 3 parts, the following concepts will be discussed:
- Service oriented architectures
- Middlewares
- The Middleware for the Internet of Things through standards and the deployment of an architecture of sensors networks.
- The concept of Cloud and especially Infrastructure As A Service.
- Dynamic management through the principles of autonomic computing

The student will be able to:
- Design and develop a service oriented architecture
- Implement Web services SOAP and Rest
- Develop a service composition (orchestration) via BPEL
- Know the main standards of the Internet of Things
- Deploy an architecture according to a standard and implement a sensor network system services
- Understand the concept of cloud
- Use a cloud infrastructure in Infrastructure as a Service
- Recognise the different architecture types (type 1 and type 2) of cloud hypervisors
- Provision service-based (develop, deploy, manage) in cloud environment using Docker containers
- Deploy and adapt an Internet of things platform on cloud and manage it with autonomic concept

Necessary prerequisites

Java programming, Object Oriented design, base notion on network, XML and XML schema, NodeJS

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Practical info

Location(s)

Toulouse

Non-contractual information

Analysis and data processing, business applications

ECTS
4 crédits

Hourly volume
37h

Introducing

Description

Objectives

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

Data management:
Exploratory/confirmatory data analysis. Algorithmic Complexity vs. development costs, parallelism, software engineering notions (life cycle of a data analysis pipeline).
Data visualisation techniques.

Semantic manipulation:
- What an ontology is
- What are the main constituting elements of an ontology
- What are the perks of enriched data compared to raw data

Software engineering:
- Software project lifecycle
- The challenges of software development
- Project management methods, including agile method

The student will be able to:
- Explore a dataset, leverage it to answer specific questions, and present the results of this analysis -incl. Its limits- in a synthetic written report.
- Design an ontology to capture domain knowledge
- Discover and reuse knowledge sources (ontologies, knowledge bases) online
- Enrich a dataset with semantic metadata
- Control the conduct of a software development project with a team by following the agile method
- Perform requirement analysis: expression, analysis and transformation into technical requirements

Necessary prerequisites

- Algorithms and programming
- Statistics (notions)
- Java programming
- Web technologies background knowledge

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Practical info

Location(s)

Toulouse

Non-contractual information

Innovative project

ECTS
5 crédits

Hourly volume
76h

Introducing

Description

Objectives

The student will be able to:
(English course)
- present their scientific research in a clear, logical, and organized manner, both orally and in a written report
- adapt their register to their audience and follow standard scientific publication standards with respect to format and appropriate style
- quote scientific sources according to international citation standards
- use specific technical vocabulary and terms relevant to their field of study

Regarding the innovative project, students will be able to carry out an innovative project using the skills learnt during this semester. The project will cover the specification, design, implementation and a presentation to a jury of academia and industry.

Necessary prerequisites

(English) Students must master general English and follow strict standard scientific guidelines for both oral presentations and written abstracts and reports.

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Practical info

Location(s)

Toulouse

Non-contractual information

Innovation and humanity

ECTS
6 crédits

Hourly volume
76h

Introducing

Description

Objectives

Aims
The student will learn how to:
¿ Analyze group situations using social psychology concepts
¿ Identify the ethical dimensions of these situations and take a stance
¿ Identify and understand HR-related information
¿ Analyze a team management situation in a theoretical context
¿ Formulate and justify managerial decisions
¿ Operate in a natural environment: analysis, decision, action, safety implementation, use of specific equipment, site exploration
¿ Respect and adapt to an environment that is different from their own
¿ Consistently commit to the activity project
¿ Take an active role within the group
¿ Fulfill their career objectives, build a strategic plan and acquire job searching skills.

Necessary prerequisites

Prerequisites
None

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Practical info

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Non-contractual information