Internet of Things

ECTS credits
8 credits

Presentation

Prerequisites

This course is offered without pre-requisites given the knowledge acquired in 1A & 2A. It is more particularly recommended in time 3, to students who have followed time 1&2 with a Machine Learning or Web Development focus, in order to offer them added value by opening up possibilities for optimising ecosystems through the combined use of Machine Learning, IoT and Web Services. Indeed, the combination of connected objects and artificial intelligence mechanisms will allow the emergence in the next few years of truly advanced solutions for decision support or action suggestion, as is already the case with predictive maintenance in production units.

Learning objectives

The Internet of Things (IoT) refers to the rapidly expanding network of devices that are connected to the internet and enable the collection, processing and exchange of data for the optimised use of our physical environment.

This "web" transforms the conventional approach to automation, which links the consideration of the parameters of our environment to the actions that can be exerted on it, with objectives on resilience, performance and reliability.

It concerns in a non-exhaustive way :

Our environment: the domestic environment (building automation), air quality control, etc.
Transport in the broadest sense: energy transport and distribution, signalling, parking management, autonomous driving, etc.
Increased productivity and process automation, robotisation in the fields of industrial manufacturing, connected agriculture and personal assistance.

The objective of this option is to highlight the "ecosystem" that enables the development of IoT solutions by highlighting what can be an obstacle to its deployment: security.

The approach chosen is a project-based approach that allows for a better overview of the fields of competence to be acquired in order to develop and implement IoT solutions.

Description of the programme

This option is composed of several modules:

Introduction to IoT (12h):

Definition, history, issues, ecosystem, architecture, radio protocols and application interfaces, use cases, implementation.

Introduction to Real Time (2h):

Processes & inter-process communications, use of semaphores.

Embedded Code (8h) :

Microarchitecture, Impact of microarchitecture on software performance and security, Embedded software architecture.

Attacks/Auxiliary Channels & Fault Injection (8h):

Auxiliary channel attacks, Fault injection.

Networks and network protocols for the IoT (9h) :

Data transmission, OSI and TCP/IP models, IPv4 addressing, ARP, IP, ICMP, TCP, UDP, DHCP, DNS, HTTP, SSL/TLS, POP/IMAP/SMTP, SNMP, Attacks and defenses of web applications, Network architectures and components

Security (7h) :

Methodologies used to model the security aspects of a system, RGPD regulation, use of cryptography to design secure protocols, security of popular IoT protocols (TLS, BLE, LoRa), security/performance/functionality trade-off: on two STM32 /STSAFE product families.

Practical work/projects (48h) :

Illustrations through the implementation of the ecosystem by studying its different components.

Use cases (6h) :

Illustrations in the form of supplier/customer conferences.

Generic central skills and knowledge targeted in the discipline

This teaching completes the application of the "system" approach in the training, which is essential in :

The development of technical and scientific innovations

The resolution of complex and transdisciplinary problems.

It allows the development of the student's ability to propose connected solutions for a system, and to exploit them to supervise or control this system

Items of the Centralien reference system :

Scientific & Technical Innovation

Control of complexity & systems

Program management

Management of people

Strategic vision

How knowledge is tested

Continuous assessment: The mark will be a weighted average (small tests, practical work, mini projects, etc.)

Bibliography

The Technical Foundations of *IoT*, *Raspberry Pi IoT Projects*, *IoT*: Technical Challenges and Solutions

Teaching team

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Total des heures **0h**

Useful info