

Internet of Things

Responsible of the course: Lina MROUEH

Prerequisites: APP Info & Telecom

Course activities: 12 lectures of 3h de courses/conferences - 2 TPs and 1 Project.

Evaluation: Exam, Project and TP

ECTS: 5 credits

Context

With more than 100 billion of connected objects estimated in 2020, the Internet of Things is considered now as a key element of the numerical evolution. The technology connecting the smart objects of the IoT is extremely varied: some objects are connected through a local access point using WiFi, Zigbee or Bluetooth and rely on the connectivity of the access point to access a wider network; others rely on a communication infrastructure to convey the information and are often referred as Low Power Wide Area (LPWA) networking technologies. These LPWAN technologies define a new air interface that gives a low power connectivity alternative to cellular systems and are either exploited under unlicensed band (such as Sigfox, LoRa) or licensed band (such as LTE-Cat M and NarrowBand IoT). This course introduces the general architecture of the IoT network of as well as the radio technologies that connect these objects.

Keywords: 6LowPAN, CoAP, MQTT, WiFi, Bluetooth, Bluetooth Low Energy, Body Area Network, Zigbee IEEE 802.15.4, RFID, NFC, Low Power Wide Area Network (LPWAN), Sigfox, LoRa, LTE-CatM , NB-IoT, Internet of Things, M2M / smart devices, miniaturization.

Objectives

In terms of acquired skills, this course aims to

- Understand the general architecture of the network of connected objects and its interface with the classical internet network (gateway, IPv6 Low power Wireless Personal Area Networks 6LOWPAN, protocols CoAP, MQTT, etc)
- Acquire the fundamental basics of the conception and the realization of the existing and future IoT network
- Understand the mechanism of coexistence of unlicensed technologies;

- Acquire a vision on the low range and unlicensed radio technologies (WiFi, Bluetooth, Bluetooth Low Energy, Zigbee IEEE 802.15.4, RFID, NFC, Body Area Network);
- Acquire a vision on the unlicensed and licensed with long range and low power consumption: Low Power Wide Area Network (LPWAN), Sigfox, LoRa, LTE-CatM , NB-IoT;
- Acquire a vision on the miniaturization techniques of the antennas.

Knowledge

- **Concepts**
 - The constraints imposed by the different network of connected objects in terms of power, interference, identification, security, routing and the different communication networks;
 - Low range and long range communications technologies with low power conception
 - Multiple access protocols
- **Savoir-faire**
 - Establishment of the choice criteria between different types of network,
 - Dimensioning and deployment of the ambient networks,
 - Application of the ambient networks in the industry, the medical domain, the vehicular networks, the domestic networks. Etc
 - Implementation of the exchange between a sensor, a server and an actuator.

Pedagogical approach

The basics on the IoT technologies are taught as lecture courses associated with conferences given by industrial experts from IBM, Thales Communications, etc

A tender call about the furniture, the installation and the maintenance of a network of connected objects to apply the concepts taught in this course.