Internet of Things

Academic Year: (2024 / 2025) **Review date: 17-01-2025**

Department assigned to the subject: Telematic Engineering Department

Coordinating teacher: BARNOLAS VILADES, GUILLEM

Type: Electives ECTS Credits : 3.0

Year : Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Communications networks and services

LEARNING OUTCOMES

CB1: Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study
CB2: Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CG3: Knowledge of basic and technological subject areas which enable acquisition of new methods and technologies, as well as endowing the technical engineer with the versatility necessary to adapt to any new situation.
ECRT1: Ability to learn and acquire autonomously the requisite new knowledge for the design, development and utilization of telecommunication systems and services.
ECRT12: Knowledge and use of the concepts of network architecture, protocols and communications interfaces.
ECRT13: Ability to differentiate the concepts of network access and transport, circuit switching and packet switching networks, fixed and mobile networks as well as systems and applications of distributed networks, voice services, audio, data, video and interactive services and multimedia.
ETEGITT4: Ability to construct, develop and manage telecommunication networks, services, processes and applications, such as capture, transport, representation, processing, storage, and multimedia information presentation and management systems, from the point of view of telematics services.
ETEGITT5: Capacity to apply techniques on which telematics networks, services and applications are based. These include systems for management, signaling and switching, routing, security (cryptographic protocols, tunneling, firewalls, payment authentication mechanisms, and content protection),traffic engineering(graph theory, queuing theory and tele-traffic), tarification and service reliability and quality, in fixed, mobile, personal, local or long distance environments, with different bandwidths, including by telephone and data.
RA1: Knowledge and understanding of the general fundamentals of engineering, scientific and mathematical principles, as well as those of their branch or specialty, including some knowledge at the forefront of their field.
RA5: Applications. Graduates will have the ability to apply their knowledge and understanding to solve problems, conduct research, and design engineering devices or processes. These skills include knowledge, use and limitations of materials, computer models, process engineering, equipment, practical work, technical literature and information sources. They must be aware of all the implications of engineering practice: ethical, environmental, commercial and industrial.
RA6: Generic competences. Graduates will have the generic skills necessary for engineering practice, and which are widely applicable. First, to work effectively, both individually and as a team, as well as to communicate effectively. In addition, demonstrate awareness of the responsibility of engineering practice, social and environmental impact, and commitment to professional ethics, responsibility and standards of engineering practice. They must also have knowledge of business and project management practices, as well as risk management and control, and understand their limitations. Finally, have the capacity for continuous learning.

OBJECTIVES

This course introduces the basic principles of the Internet of Things (IoT) and the main standardised IoT architectures, then it focuses on IoT-specific communication networks and services, illustrating their application to different use cases.
The aim of the course is to analyse both the architectural principles and the different alternative technologies that can be used for the deployment of an IoT system. In order to achieve this objective, the student must acquire a series of knowledge and skills.

In terms of knowledge, at the end of the course the student will be able to:
- Understand the concept of IoT and its basic principles.
- Know the main standardised IoT architectures.
- Know the main IoT connectivity technologies applicable to different use cases.
- Understand the modifications necessary to adapt the IP protocol to the IoT environment.
- Learn about the main IoT application protocols.
- Learn about different IoT use cases.

In terms of specific skills, at the end of the course the student will be able to:
- Know and understand the main reference architectural models for IoT.
- Know and identify different connectivity technologies, both short- and long-range, applicable to the IoT field.
- Ability to design network, transport and application level solutions for IoT.
- Be able to design a sensor/actuator network and its connection to the Internet according to the requirements of different use cases.

DESCRIPTION OF CONTENTS: PROGRAMME

1.- Introduction to IoT and basic concepts
2.- Standardized IoT architectures: OneM2M, IoTWF
3.- Sensors and actuators: smart objects
4.- Connectivity in IoT: NB-IoT, LTE-M, LoRaWAN, IEEE 802.15.4
5.- IP for IoT: 6LowPan and RPL
6.- Application protocols: COAP, MQTT
7.- Use Cases

LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology based on active learning will include:

1.- Lectures. The course has a basic reference book (see bibliography). The course will also propose complementary bibliography to allow students to complete and detail particular chapters.

2.- Practical classes applied to IoT networks and applications.

3.- Resolution of case studies in group work, which will enable them to consolidate the skills acquired.

4.- Group discussion of case studies that will allow to develop the skill of analysing and communicating the relevant information so as to solve problems.

ASSESSMENT SYSTEM

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

Evaluation:

100% of continous assessment

The extraordinary evaluation will be by means of an exam (100% of the mark).

BASIC BIBLIOGRAPHY

- Rob Barton; David Hanes; Gonzalo Salgueiro IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 2017

ADDITIONAL BIBLIOGRAPHY

- Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle. From machine-to-machine to the Internet of things: introduction to a new age of intelligence., Kidlington Oxford: Academic Press., 2014

- Jean-Philippe Vasseur;Adam Dunkels. Interconnecting Smart Objects with IP: The Next Internet., Morgan Kaufmann Publishers Inc., 2010

- Perry Lea. Internet of things for architects: architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security., Packt Publishing., 2018