School of Technology and Management
Course Unit Syllabus

Level of qualification:
Second Cycle (EQF level 7) - Master
Study cycle:
The Internet of Things

Course Unit: **2016006 - Infrastructures and Communications for the IoT**

Year 1	**Semester 2**	**ISCED Code: 0714**	**ECTS: 7,5**

Type of Course Unit: Compulsory **Delivery Mode:** Face-to-face / Distance Learning **Language of Instruction:** Portuguese

COURSE COORDINATOR: Luis Miguel Tavares

HOURS OF WORK

TOTAL HOURS	Contact Hours								Hours in autonomous work
	Theory	Theory and practice	Practical and laboratory work	Field work	Seminar	Internship	Tutorial guidance	Other	
187,5		**45**							**142,5**

Prerequisites (if applicable): n.a.

LEARNING OUTCOMES (knowledge, skills and competence)

On successful completion of this course unit, the student should be able to:

1. Discuss concepts of architectures, standards, protocols and technologies for the IoT.
2. Characterize the communication needs of an IoT system, including privacy and security aspects.
3. Know the various wireless technologies as well as their technical characteristics.
4. Know the current navigation and location systems.
5. Design and implement sensor networks, taking into account its geographical scope, energy requirements and bit rate.
6. Use and develop applications for the IoT using specific IoT operating systems and simulators.
7. Build a sensor network for the IoT.
8. Summarize, in a report format, the work carried out to implement a network for the IoT.

CONTENTS

1. Framework of infrastructure and communications characteristics in the implementation of IoT systems.
2. Geospatial characterization, energy and data rate necessary for the development of specific applications for the IoT.
3. Wireless technologies: WiFi, Bluetooth, BLE, Zigbee, NFC, Mobile Networks (2g, 3g, 4g - WiMax and LTE) Sigfox, LoraWAN.
4. IEEE 802.15.4 and 802.11 standards.
5. Protocols for the IoT: MQTT and CoAP.
6. Security in communication systems for the IoT.
7. Navigation and Location Networks GPS, Glonass and Galileo.
8. Sensor networks: architecture, access control, routing.
9. Open Operating systems for the IoT: Contiki and Cooja simulator.

DEMONSTRATION OF THE CONTENTS COHERENCE WITH THE COURSE UNIT'S LEARNING OUTCOMES

We specify the relevant contents for each learning outcome:

1. Discuss concepts of architectures, standards, protocols and technologies for the IoT (all contents).

2. Characterize the communication needs of an IoT system, including privacy and security aspects (1 and 2).

3. Know the various wireless technologies as well as their technical characteristics (3,4,5,6, and 7).

4. Know the current navigation and location systems (7).

5. Design and implement sensor networks, taking into account its geographical scope, energy requirements and bit rate (2,3,4,5,6, and 7).

6. Use and develop applications for the IoT using specific IoT operating systems and simulators (8,9).

7. Build a sensor network for the IoT (3,4,5,6,8, and 9).

8. Summarize, in a report format, the work carried out to implement a network for the IoT (all contents).

TEACHING METHODOLOGIES

The teaching of each subject will begin with the presentation and discussion in class of the content planned for the course.

After the introduction of each topics addressed in contents 1 to 4, laboratory work will be carried out, using actual computing systems, with specific communication modules.

The characteristics of the system to be developed will be incremental, in order to obtain a complete and complex system. In the end, students will have designed and built a communication system for the IoT, using the operating system Contiki and Cooja simulator.

DEMONSTRATION OF THE COHERENCE BETWEEN THE TEACHING METHODOLOGIES AND THE LEARNING OUTCOMES

It is the course objective that students know the main concepts of architectures, standards, protocols and technologies of the IoT.

In the analysis and design of communication system for the IoT, students should make general requirements analysis, such as geographic coverage, energy constraints and transmission rate required for specific applications.

It is intended that students know operating systems and simulators oriented for IoT applications, and to design and build complete communication systems.

In order to ensure contact with this variety of concepts and tools, the lecture periods in the classroom will be interspersed with interrogative methods and followed by practical application in laboratory.

In this practical component students will have to implement applications with increasingly complexity, culminating in a final project which aims to develop a complete communication system with application for the IoT.

EVALUATION METHODS

The evaluation will have three components:

1. Laboratory work assignments (20%);

2. Individual written test (20%);

3. Design and development of a system for the IoT, with presentation and discussion of the project report (60%).

MAIN BIBLIOGRAPHY

- Arshdeep Bahga and Vijay Madisetti. 2014. Internet of Things (A Hands-on-Approach).

- Adrian McEwen and Hakim Cassimally. 2014. Designing the Internet of Things. John Wiley & sons.

- Peter Waher. 2015. Learning Internet of Things. Packt Publishing.

- Contiki: The Open Source OS for the Internet of Things, disponível em http://www.contiki-os.org/ (acedido em Set/2016)