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: **2014007** – **Systems Integration**

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: José Jasnau Caeiro

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. Describe the systems integration paradigm importance in IoT.

2. Identify the different hardware subsystems and software in a IoT systems.

3. Know the main computing platforms used in IoT.

4. Build a system for IoT based on the integration of several hardware and software subsystems.

5. Use different software packages (operating system, web-frameworks, programming tools) to developing a solution for IoT with the client-server paradigm.

6. Apply the most common signal processing operations for signal, image processing, video and audio.

7. Design a system for IoT with the client-server paradigm, with remote client modules and M2M communications through systems integration.

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. Understand the importance of systems integration paradigm in IoT. (1)

2. Identify the different hardware and software subsystems in a IoT systems. (1, 2, and 4)

3. Know the main low-cost computing platforms used in IoT. (1)

4. Build a system for IoT based on the integration of several hardware and software subsystems. (1, 2, 3, 4, and 5)

5. Use the different software packages (operating system, web-frameworks, programming tools) to developing a solution for IoT with the client-server paradigm. (1, 4, 5, and 6)

6. Apply the most common signal processing operations for signal, image processing, video and audio. (1, 4, and 7)

7. Design a system for IoT with the client-server paradigm, with remote client modules and M2M communications through systems integration. (1-8)

TEACHING METHODOLOGIES

The syllabus will be presented using practical examples and analysis of current computational platforms and systems used in the IoT.Students are asked to make a critical analysis of an existing system, either based on a concrete real systems or on a system described in the literature, analyzing both their hardware and software. Afterwards, the the students will be introduced to the most common software development systems and programming tools to support systems in production for IoT.The most common signal processing techniques will also be implemented and applied by students for processing data collected by remote modules, and for audio and image processing.At the end, the students will design and develop a system for IoT from the integration of several systems.

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

It is intended that the student knows the main computer systems used in the development of embedded systems for IoT, which can be used both as client and server. Several real computational platforms will be studied, namely the BeagleBone and Raspberry Pi platforms. Students are expected to know these systems, both its hardware and software, and be able to develop applications using its hardware interfaces. The students will also implement in software the most common signal processing operations, and more specifically, processing of audio and video. It is understood that learning is more effective when practical cases are used with the development and implementation of applications in real situations. Thus, the practical component of the course is particularly important so that, in the end, students can apply the systems in solving a particular problem in IoT.

EVALUATION METHODS

The students assessment is composed by two components:

1. Practical laboratories (40%);

3. Design and development of an IoT system using the system integration paradigm, with project demonstration and report discussion (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/ (accessed on Set/2016)

Year of implementation: 2017/2018 | Date of approval by the Technical-Scientific Board: 2016-09-28