Universitat de les Illes Balears

Academic year	2017-18
Subject	11560 - Internet of Things
Group	Group 1, 2S
Syllabus	C
Language	English

Syllabus

Subject

Name 11560 - Internet of Things
Credits 0.72 in-class (18 hours) 2.28 distance (57 hours) 3 total (75 hours).
Group Group 1, 2S (Campus Extens)
Period Second semester
Language English

Lecturers

Lecturers	Office hours for students					
	Starting time	Finishing time	Day	Start date	End date	Office
Manuel Alejandro Barranco González manuel.barranco@uib.es	17:30	18:30	Monday	14/09/2017	05/02/2018	D115 (Anselm Turmeda)
Isaac Lera Castro isaac.lera@uib.es	12:00	13:00	Wednesday	18/10/2017	27/06/2018	132

Context

This subject is included within the itinerary called "Distributed and Embedded Computing", which is one of the possible choices for the "Information Technology" module. Therefore the subject is compulsory for any student who opts for this itinerary.

The subject purports to initiate the students in the basics of the "Internet Of Things (IOT)", in such a way that they could acquire some minimum knowledge, that could later on be expanded to allow its use both in industrial and academic activities, including the research in this area.

The learning goals of the subject are:

1 Understanding the concept of IOT, the context within which it is being developed, the factors that do influence in its success, and the role of each IOT-related actor.

2 Knowing and understanding the IOT architecture, as well as what are the most relevant IOT's services and applications.

3 Knowing what are the main information technologies that constitute the backbone of the IOT; including the most relevant hardware and communication platforms (devices, networks and protocols), as well as the main software platforms (operating systems, middlewares, cloud computing technologies, etc.)

4 Being aware of the social impact of the IOT, specially from the point of view of the security and privacy, and the information technologies related to these issues.

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5 Being able to propose and sketch projects that exploit the potential of IOT for providing services that are of benefit to the society.

Requirements

Essential requirements

Basic knowledge about computer networks and the Open System Interconnection (OSI) reference model

Skills

There are basic skills that correspond to all subjects of the master's programs taught at UIB. The list of these skills can be found by clicking on the following link:

http://estudis.uib.es/en/master/comp_basiques/

Next, both the specific and generic skills that will be partially acquired in this subject are indicated.

Specific

* CE4 - Model, design, and define architectures, implement, manage, operate and maintain computer applications, networks, systems, services and content..
* CE5 - Understand and apply the operation and organization of internet, new-generation network technologies and protocols, models of components, intermediary software and services..
* CE9 - Design and evaluate operating systems and servers, as well as applications and systems based on distributed computing..
* CE11 - Design and develop computer systems, applications and services in embedded and ubiquitous systems..

Generic

* CG1 - Propose, calculate and design products, processes and installations in all areas of computer engineering..
* CG3 - Lead, plan and supervise multidisciplinary teams..
* CG8 - Integrate and apply the knowledge acquired and solve problems in new or little-known situations within broader (or multidisciplinary) contexts..
* CG9 - Understand and apply ethical responsibility, legislation and codes of practice to professional activity in computer engineering..

Basic

* You may consult the basic competencies students will have to achieve by the end of the Master’s degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

Theme content

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1. Introduction to IoT
    * Definition and objectives
    * The Web of Things (WoT), the web 3.0
    * IoT key applications: barriers, development forecast, vertical and horizontal markets
2. The 4 IoT paradigms
    * RFID: the Internet of objects
    * M2M: the Internet of devices
    * WSN: the Internet of transducers
    * SCADA: the Internet of controller
3. IoT networks and protocols
    * IoT pervasive networks
    * Next Generation Network (NGN)
    * Convergence, interoperability and standardization of networks
    * Protocols and standards for communication and data management in IoT/WoT
4. IoT Middleware Platforms
    * Middleware: basic concepts and taxonomy
    * IoT vision of middleware platforms
    * Horizontal middleware platforms for the IoT
5. Data in IoT
    * Data: representation and flow
    * Big Data: huge volumes of data
    * Intelligent data processing: filtering, storing, retrieving and computing
6. Services of an IoT ecosystem
    * Services architecture: accessability
    * Security and privacy
    * Risks, ethic and legal issues

Teaching methodology

Next they are described the activities that require the presence of the student, as well as the ones that the student has to carry out autonomously.

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	1. Master classes	Large group (G)	The lecturer will describe the theoretical and practical fundamentals of the different topics covered in the course. In addition, for each topic the lecturer will provide information on the recommended working method and materials that students should use to autonomously study the subject. These master classes will be distributed throughout the semester. Each session will last either 2 or 3 hours, during	10

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Modality	Name	Typ. Grp.	Description	Hours
			which the theoretical descriptions and the resolution of exercises and problems will alternate.	
Seminars and workshops	2. Oral presentation and report of technologies and uses cases of IoT	Medium group (M)	Some (seminar) sessions will be devoted for each student to present, in a pedagogic and oral manner, a revision of some technologies and use cases related to the design and/or implementation of IoT architectures and/or services. Each student will have to deliver a short but detailed written report of the revision she/he carries out. Both the oral presentation and the written report will be scored. The objective of this activity is to help the student in achieving the following abilities. - Interpret, autonomously understand and explain to an audience aspects related to the IoT technologies and IoT uses cases. - Briefly describe those technologies and use cases by means of the concepts studied during the theory classes. - Analyze from a critical point of view technologies, designs and projects for IoT, taking into account technological aspects related to the software, hardware and communication protocols, as well as to ethic and legal issues. - Present clearly and in a pedagogic manner technologies and use cases of IoT.	3.75
Seminars and workshops	3. Problems-based learning by means of laboratory sessions	Medium group (M)	Some laboratory sessions will be devoted for each student to solve by means of simple programs (mainly executing on micro controllers) a set of practical problems of increasing complexity. The objective of these laboratory sessions is to help the student in the comprehension of fundamental theoretical and practical concepts related to the acquisition, representation, storage and use of data in IoT, e.g. architecture of embedded devices, data streaming, data bases, and cloud computing. The solution to the last one of these problems will have to be delivered for the lecturer to score it. Moreover, the student will also have to make an oral presentation to explain this solution, which will be scored as well.	3.75
ECTS tutorials	4. Tutorships for clarifying doubts about the different evaluation activities.	Medium group (M)	Some time will be devoted to clarify doubts related to the tasks to be carried out in the activities “2. Oral presentation and report of technologies and uses cases of IoT” and “3. Problems-based learning by means of laboratory sessions”.	0.5

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

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Modality	Name	Description	Hours
Individual self-study	1. Study to assimilate the theory described in the sessions.	Each student will have to devote some time to individually assimilate the theoretical contents that were presented by the lecturer in the sessions.	20
Group or individual self-study	2. Revision of technologies and uses cases of the IoT	Each student will have to devote some time to complete the oral presentation and the written report proposed in the activity "2. Oral presentation and report of technologies and uses cases of IoT" The specific aspects to describe by the student would have been previously agreed between the student and the lecturer. In particular, the student will prepare some slides to assist in the oral presentation. The goal of the presentation is to demonstrate that the student is competent to autonomously assimilate and describe to his or her pairs descriptions of IoT technologies and use cases, by using the concepts presented in the theory classes. Therefore the student will have to devote some time to the preparation of the presentation to be performed for all the other students of the subject.	24.5
Group or individual self-study	3. Completion of the practical exercises started in the laboratory	Each student will have to devote some extra time (besides the time established in the course schedule) to complete the resolution of the problems proposed in the laboratory sessions. As already said, the solution to the last one of these problems will have to be delivered for the lecturer to score it. Moreover, the student will have to devote some additional time to prepare the oral presentation describing this solution.	12.5

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

The skills that have to be acquired in this course will be evaluated by means of a series of assessment procedures associated to each evaluative activity.

The table in this section describes, for each evaluative activity, the evaluation technique that will be used, the type of evaluation (recoverable or non-recoverable), the scoring criteria and the weight of the mark in the final mark of the subject (depending on the specific evaluative itinerary).

This subject considers a single evaluative itinerary (labelled "A") which is suitable both for students who can attend to all the sessions and for those who cannot. The students commit themselves to perform all the activities included in the "A" itinerary.

The student will get a numeric mark comprised between 0 and 10 for each evaluative activity. This mark will be used (with the corresponding weight) to compute the final mark of the subject. In order to pass the student must get a minimum of 5 points in each evaluative activity.

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Any student that delivers any of the two written reports will be considered as evaluated and will get a final mark.

2. Oral presentation and report of technologies and uses cases of IoT

Modality	Seminars and workshops
Technique	Other methods **(retrievable)**
Description	Some (seminar) sessions will be devoted for each student to present, in a pedagogic and oral manner, a revision of some technologies and use cases related to the design and/or implementation of IoT architectures and/or services. Each student will have to deliver a short but detailed written report of the revision she/he carries out. Both the oral presentation and the written report will be scored. The objective of this activity is to help the student in achieving the following abilities. - Interpret, autonomously understand and explain to an audience aspects related to the IoT technologies and IoT uses cases. - Briefly describe those technologies and use cases by means of the concepts studied during the theory classes. - Analyze from a critical point of view technologies, designs and projects for IoT, taking into account technological aspects related to the software, hardware and communication protocols, as well as to ethic and legal issues. - Present clearly and in a pedagogic manner technologies and use cases of IoT.
Assessment criteria	The skills that will be assessed by means of the oral presentation and the written report are the following ones: CE5 - Understand and apply the operation and organization of internet, new-generation network technologies and protocols, models of components, intermediary software and services. CE9 - Design and evaluate operating systems and servers, as well as applications and systems based on distributed computing. CG1 - Propose, calculate and design products, processes and installations in all areas of computer engineering. CG8 - Integrate and apply the knowledge acquired and solve problems in new or little-known situations within broader (or multidisciplinary) contexts. CG9 - Understand and apply ethical responsibility, legislation and codes of practice to professional activity in computer engineering. The assessment criteria to assess these skills are the following ones: - Accuracy and depth with which the IoT technologies and/or uses cases are described. - Clear identification and description of the relations between the IoT technologies and uses cases that are reviewed and the IoT technologies and uses cases addressed in the master classes (or other IoT technologies and/or use cases). - Clear identification of the degree in which the IoT technologies and uses cases that are reviewed encompass the different levels of the IoT, taking into account aspects related to the software, hardware and communication protocols. - Clear identification of the different disciplines involved in the reviewed technologies and/or uses cases. - Critic analysis of the novelty of the reviewed technologies and/or uses cases. - Clear identification and description of the potential benefits and limitations of the reviewed technologies and/or uses cases from a technical point of view. - Clear identification and description of the potential benefits and limitations of the reviewed technologies and/or uses cases from a social point of view. - Clear identification of the social implications of the reviewed technologies and/or uses cases from the point of view of the security, privacy and legality. - Exhaustiveness, clarity and order in which the ideas are described in the oral presentation and in the written report.

- Orthographic correctness of the slides and the written report.

Final grade percentage: 40% with minimum grade 5

3. Problems-based learning by means of laboratory sessions

Modality	Seminars and workshops
Technique	Other methods **(retrievable)**
Description	Some laboratory sessions will be devoted for each student to solve by means of simple programs (mainly executing on micro controllers) a set of practical problems of increasing complexity. The objective of these laboratory sessions is to help the student in the comprehension of fundamental theoretical and practical concepts related to the acquisition, representation, storage and use of data in IoT, e.g. architecture of embedded devices, data streaming, data bases, and cloud computing. The solution to the last one of these problems will have to be delivered for the lecturer to score it. Moreover, the student will also have to make an oral presentation to explain this solution, which will be scored as well.
Assessment criteria	The skills that will be assessed by means of the oral presentation and the written report are the following ones: CE4 - Model, design, and define architectures, implement, manage, operate and maintain computer applications, networks, systems, services and content. CE11 - Design and develop computer systems, applications and services in embedded and ubiquitous systems. CG3 - Lead, plan and supervise multidisciplinary teams.

Final grade percentage: 60% with minimum grade 5

Resources, bibliography and additional documentation

Basic bibliography

"Rethinking the Internet of Things. A Scalable Approach to Connecting Everything". Francis DaCosta. Apress Open.
"The Internet of Things in the Cloud. A middleware Perspective". Honbo Zhou. CRC Press, Taylor & Francis Group, Boca Ratón, 2013
"Designing the Internet of Things". Adrian McEven and Hakinm Cassimally. John Wiley and Sons

Complementary bibliography

Hangouts and slides prepared by the lecturers.

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