GENERAL INFORMATION

Course information	
Name	Communications for Smart Systems
Code	DEA-OPT-629
Degree	MII, MIT
Year	2
Semester	Spring
ECTS credits	3 ECTS
Type	Elective
Department	Electronics, Control Engineering and Communications
Area	
Coordinator	Juan José Hierro

Lecturer	
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Lecturer	
Name	
Department	
Area	
Room	
e-mail	
Tutorial timetable	

DETAILED INFORMATION

Contextualization of the course

Contribution to the professional profile of the degree

The purpose of this course is to provide students with a fundamental understanding and an extensive practical experience of how to design and develop IoT-enabled Smart solutions.

By the end of the course, students will:

- Understand the Reference Architecture of IoT-enabled Smart Solutions
- Understand how such Reference Architecture can be materialized using an open standard platform such as FIWARE
- Have practical experience integrating IoT devices and developing smart solutions that exploit data gathered through those devices.
- Have well-formed criteria about what IoT protocols and backend relevant modules of a smart platform must be used depending on the target solution being addressed.

Prerequisites

Students willing to take this course should be familiar with undergraduate-level programming. Previous experience with C++ or JAVA desired although not strictly required.

CONTENTS

Contents: Theory
PART I: Core principles of IoT-enabled Smart Systems
• Introduction to IoT-enabled Smart Systems • Context Information Management in IoT-enabled Smart Systems: the basics • Connection of context sources (IoT networks, third systems) to Smart Systems • Overview of IoT protocol standards: part I • Overview of IoT protocol standards: part II • Context Information Management: advanced features • Lab review: testing a first IoT-enabled Smart System
PART II: Advanced functionalities of IoT-enabled Smart Systems
• Role of Smart platforms in application domains: Smart Cities, Smart Industry, Smart Agrifood • BigData analysis in IoT-enabled Smart Systems: overview • BigData analysis in IoT-enabled Smart Systems: case example • Publication of context information through dashboards • Publication of context information as Open Data • Lab review: analysis, monitoring and publication of information in IoT-enabled Smart Systems • Market analysis, Recent trends and future prospects
Contents: Laboratory
PART I - PRAC. 1: context information management
• Definition of a simple data model. • Connection of context sources to a smart platform based on FIWARE: third systems. • Connection of context sources to a smart platform based on FIWARE: IoT devices. • Advanced context information management
PART II - PRAC. 2: BigData analysis of context information
• Case example of BigData analysis in an IoT-enabled Smart System
PART II - PRAC. 3: Publication of context information
• How to build operational dashboards • How to publish context information as open data

COMPETENCES AND LEARNING OUTCOMES

Competences and Learning Outcomes

Competences

General Competences

CG3. The capability of adapting to new theories, methods and changing engineering situations based on a sound technical training.

CG4. The capability of solving problems with personal initiative, efficient decision making, critical reasoning and transmitting technical information in the engineering world.

CG5. The capability of conducting measurements, calculations, assessments, studies, reports, planning, etc.

CG10. The ability to work in a multilingual and multidisciplinary environment.

Basic Competences

Specific Competences

Learning outcomes

RA1. Understanding of architecture patterns associated to smart solutions in multiple domains

RA2. How to connect information sources, including IoT devices, to a smart platform.

RA3. How to exploit gathered context information to implement the intelligent behavior in smart solutions.

RA4. Visualization of context information using dashboards and open data publication platforms

RA5. Understanding of standards integrated into the FIWARE open source platform

TEACHING METHODOLOGY

General methodological aspects
Theory and practice will be combined along the course. The teacher will explain the basics of the subject and will go in depth in the more important issues with illustrative examples. The students will be grouped in pairs in order to put in practice the proposed methods and techniques in a collaborative way.
In-class activities
Lectures and problem-solving sessions (13 hours): The lecturer will introduce the fundamental concepts of each chapter, along with some practical recommendations, and will go through worked examples to support the explanation. Active participation will be encouraged by raising open questions to foster discussion and by proposing short application exercises to be solved in class either on paper or using a software package. **Lab sessions (13 hours):** Under the instructor's supervision, students, divided in small groups, will apply the concepts and techniques covered in the lectures to real problems and will become familiar with technologies used in development of smart solutions, particularly how to connect IoT devices and other sources of information to gather context information which can be then further processed, analyzed and visualized. **Assessment (4 hours)**
Off-class activities
Personal study of the course material and resolution of the proposed exercises (30 hours) **Lab session** preparation, programming and reporting (30 hours)

ASSESSMENT AND GRADING CRITERIA

Assessment activities	Grading criteria	Share
Mid-term exam	• Understanding of the theoretical concepts. • Application of these concepts to problem-solving.	15%
Final exam	• Understanding of the theoretical concepts. • Application of these concepts to problem-solving.	25%
Lab sessions and reports	• Application of theoretical concepts to real problem-solving. • Ability to program. • Attitude and effort: Initiative and proactive work will be encouraged. • Written communication skills. There will be an intra-group evaluation method to differentiate among team members. There will be an interim assessment at Week 7	60%

GRADING AND COURSE RULES

Grading

Regular assessment

- **Theory** will account for 40%, of which:
  - Mid-term: 15%
  - Final exam: 25%

- **Lab** will account for the remaining 60%

In order to pass the course, the mark of the final exam must be greater or equal to 4 out of 10 points.

Retakes

Lab practice marks will be preserved.

In addition, all students will take a final exam. The resulting grade will be computed as follows:

- Final exam: 40%
- Lab practices: 60%

As in the regular assessment period, in order to pass the course, the mark of the final exam must be greater or equal to 4 out of 10 points. Otherwise, the final grade will be the lower of the two marks.

Course rules

- Class attendance is mandatory according to Article 93 of the General Regulations (Reglamento General) of Comillas Pontifical University and Article 6 of the Academic Rules (Normas Académicas) of the ICAI School of Engineering. Not complying with this requirement may have the following consequences:

  - Students who fail to attend more than 15% of the lectures may be denied the right to take the final exam during the regular assessment period.

  - Regarding laboratory, absence to more than 15% of the sessions can result in losing the right to take the final exam of the regular assessment period and the retake. Missed sessions must be made up for credit.

- Students who commit an irregularity in any graded activity will receive a mark of zero in the activity and disciplinary procedure will follow (cf. Article 168 of the General Regulations (Reglamento General) of Comillas Pontifical University).

WORK PLAN AND SCHEDULE[1]

In and out-of-class activities	Date/Periodicity	Deadline
• Mid-term exam	Week 7	-
• Final exam	Last week	-
• Lectures + Lab sessions	Weekly	-
• Lab reviews	Intermediary assessment in Week 7, Final assessment in Week 13	Last week of each part

STUDENT WORK TIME SUMMARY			
IN-CLASS HOURS			
Lectures	**Lab sessions**	**Assessment**	
13	13	4	
OFF-CLASS HOURS			
Self-study	**Lab preparation and reporting**		
30	30		
		ECTS CREDITS:	3 (90 hours)

BIBLIOGRAPHY

Basic
• Presentations prepared by the lecturer (available in Moodle).
Complementary

[1] A detailed work plan of the subject can be found in the course summary sheet (see following page). Nevertheless, this schedule is tentative and may vary to accommodate the rhythm of the class.

	SESSIONS													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Theory Program														
PART I: Core principles of IoT-enabled Smart Systems														
PART II: Advanced functionalities of IoT-enabled Smart Systems														
Lab practices														
PART I - PRAC.1: Context Information Management														
PART II - PRAC.2: BigData analysis of context information														
PART II - PRAC.3: Publication of Context Information														