Integration of Wireless Sensor Networks: Hardware Solutions   2015/2016

Code: 43355
ECTS Credits: 6

Degree	Type	Year	Semester
4314660 Computer Engineering	OT	2	1

Contact

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Teachers

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Use of languages

Principal working language: english (eng)

Prerequisites

None, though it is recommended to have made the subject of first course.

Objectives and Contextualisation

The aim of this module is to provide knowledge for the development of sensor network nodes that allow both the implementation of the communication protocols of the network of sensors, such as sensors and actuators connected to the node. From the Internet-of-Things applications and design methodologies, the hardware platforms development aspects are reinforced.

Skills

- Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
- Communicate orally and in writing in English.
- Define and communicate results, guaranteeing high levels of performance and quality.
- Design and develop computer systems, applications and services in embedded and ubiquitous systems.
- Integrate and apply the knowledge acquired and solve problems in new or little-known situations within broader (or multidisciplinary) contexts.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Launch, lead and manage manufacturing processes for computer hardware, safeguarding persons and goods and overseeing product quality and certification
- Responsibly manage information and knowledge when leading multidisciplinary groups and/or projects.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Understand and apply ethical responsibility, legislation and codes of practice to professional activity in computer engineering.

Learning outcomes

1. Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
2. Communicate orally and in writing in English.
3. Define and communicate results, guaranteeing high levels of performance and quality.
4. Design integrated circuits on the basis of hardware description languages implemented by application-specific integrated circuits (ASICs) and/or FPGAs.
5. Develop hardware platforms for the construction of sensor-network nodes.
6. Implement operating systems in real time and application and control software for sensor nodes.
7. Integrate and apply the knowledge acquired and solve problems in new or little-known situations within broader (or multidisciplinary) contexts.
8. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
9. Integrate sensors and actuators together with programmable circuits for advanced digital processing.
10. Launch, lead and manage manufacturing processes for computer hardware, safeguarding persons and goods and overseeing product quality and certification
11. Responsibly manage information and knowledge when leading multidisciplinary groups and/or projects.
12. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
13. Understand and apply ethical responsibility, legislation and codes of practice to professional activity in computer engineering.
14. Use digital programmable logic devices in communications applications.

Content

1. Introduction to IoT

Internet of things (IoT), IoT characteristics, IoT layered architecture, Applications and Scenarios of Relevance, Application Areas, Smart Applications.
2. Electromobility
ICE, HEV and EV. Battery Management Systems, Wireless communications, Electronic Control Units.
3. Smart Industry
Smart Factory, Industrial Robots, Autonomous Mobile Robots, Hw platforms for control autonous systems.
4. Smart buildings
ICS & OT. Building Management Systems. Cyber Physical Systems.
5. Security for WSN
SW and HW architecture, Secure Features for WSNs, Authentification and Key Management by FPGA.

Methodology

Theory lectures:
Exhibitions on the board of the theoretical part of the syllabus for the course. Give basic knowledge of course and instructions on how to complete and deepen the content.

Seminars problems:
It works exhibited scientific and technical knowledge in lectures. They solve problems and discuss case studies. Problems with promoting the capacity for analysis and synthesis, critical reasoning, and trains students in problem solving.

The methodology problems is: deliver complete exercises to be solved. In class A review of the doubts that have arisen are resolved and those students have conflicts. In some problems working session group for solving synthetic material.

Practices:
Practices are held during the year and serve to deepen the practical knowledgematter. Students will work in groups of two. In practice, students will develop habits of thought from the course and work group.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Theory lectures	26	1.04	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14
Type: Supervised			
Practices	12	0.48	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Seminars	12	0.48	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Type: Autonomous			
Study	76	3.04	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14

Evaluation

The evaluation of the course is broken down into the following items:

1. Evidence of continuous assessment (theory and seminar lectures). The total weight of this subject is 50%. You must get at least 4 points in each partial test for the absence to recover. A 4.5 points the average of the continuous assessment tests to pass the course by the middle notes of items 2 and 3.

2. Laboratory activities. The total weight of the subject is 35%. It is essential to aprove them to pass the course. No recovery mechanism established practice.

3. Student works. The total weight of the subject is 15%. Corresponds to the student works done during the course.

There is a final exam to recover part of the continuous assessment or suspended for up note. In the latter case, the final grade will be that obtained in this last race.

Any modification that has been produced in this forecast assessment due to unforeseen circumstances, will be communicated to students.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Practices	35%	10	0.4	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14
Problems/seminars	15%	10	0.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
Theory	50%	4	0.16	1, 2, 4, 5, 6, 8, 9, 10, 11, 13, 14

Bibliography

Ovidiu Vermesan, Peter Friess: Internet of Things: From Resaerch and Innovation to Market Deployment. River Publishers, 2014.

Bernard Candaele, Dimitrios Soudris, Iraklis Anagnostopoulos: Trusted Computing for Enbedded Systems. Springer, 2014.