Universitat Autònoma de Barcelona

2018/2019

Internet of Things (IoT)

Code: 44019
ECTS Credits: 6

Degree	Type	Year	Semester
4316624 Internet of Things for e-Health	OB	0	1

Contact

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Use of languages

Principal working language: english (eng)

Teachers

Jose Lopez Vicario

Quang Vinh Ngo

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Marc Codina Barbera

Prerequisites

None

Objectives and Contextualisation

This module introduces the essential concepts, metrics, technologies and platforms of the value chain of the Internet of Things ranging from the enormous amount of connected devices that operate autonomously (mostly independent of the users) collecting information (and acting when needed) in an energy-efficient way until its cloud storage and processing passing through embedded and/or mobile platforms connected via interfaces and communications wireless or wired protocols. These skills are integrated into IoT projects that are introduced as use cases based on real problems. These use cases will be used in other modules.

Skills

- Apply the local, autonomic, national and international regulations in the area of IoT in health.
- Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
- Continue the learning process, to a large extent autonomously.
- Plan, develop, evaluate and manage solution for projects in the different areas of IoT taking into account aspects of multidisciplinary co-design, user privacy and data security.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Solves problems of health and health services which require elements of the value chain of the IoT using specific concepts and technologies.
- Understand, analyse and evaluate theories, results and developments in the language of reference (English) as well as the mother tongue (Catalan, Spanish) in the area of IoT in health.
- Use ICT applied to IoT in health.

Learning outcomes

1. Apply the local, autonomic, national and international regulations in the area of IoT in health.
2. Based on cost-performance criteria, select the optimal solution for implementing integrated & flexible systems and embedded and mobile platforms, whether real or virtual, for both computing and communication.
3. Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
4. Continue the learning process, to a large extent autonomously.
5. Evaluate the requirements of IoT systems (especially portable ones) in terms of energy efficiency and develop solutions that meet such requirements.
6. Identify health problems that can be solved through distinct IoT technologies and be familiar with the devices and tools developed in the module and their suitability to health problems.
7. Participate in research and development projects through methodologies developed in use cases, and in scientific or technological collaborations within their thematic scope, in an autonomous way, in interdisciplinary contexts, and, where appropriate, with knowledge transfer.
8. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
9. Understand, analyse and evaluate theories, results and developments in the language of reference (English) as well as the mother tongue (Catalan, Spanish) in the area of IoT in health.
10. Use ICT applied to IoT in health.

Content

- Global View of the Internet of Things
  - System Functionality & Architecture
  - Use Cases
  - Energy Efficiency and Energy Sources
  - HW Components
  - SW programming
  - Integrated & Flexible Systems
- Introduction to Wireless Communications
  - Fundalemtal concepts
  - Communication standardization
  - Wireless Body Access Networks (WBAN) and Wireless Personal Area Networks (PAN)
  - Wireless Local Area Networks (WLAN)
  - Low Power Wide Area Networks (LPWAN) and Wide Area Networks (WAN)
  - 5G
  - IoT to the Cloud
  - Applications review and case discussion
- Embedded platform and mobile
  - Definition
  - Embedded platforms: Industrial examples
  - Mobile platforms
- Computation Virtualization
  - Virtual platforms for embedded systems
  - Virtual platforms for cloud systems
    - IaaS, PaaS, SaaS
- Communications Virtualization
  - Network simulators: NS-3
  - SDN
  - NaaS

Labs: Implementation of a Fall Detection Algorithm in Different Platforms

L0. Fundamentals on C programming. 2h

L1. Introduction to programming on a MCU. 2h

L2. Fall Detection Algorithm on Accelerometre + MCU + Bluetooth. 2h

L3. Android Programming I: Bluetooth Low energy Data Acquisition. 2h

L4. Android Programming II: Compute and JSON application to a server. 2h

L5. Cloud application: Acquisition & Computation. 2h

Methodology

The learing methodology will combine: master classes, activities in tutored session. problem based-learning and use cases; debates and other collaborative activities and laboratory sessions.

Attendance will be mandatory for all face-to-face activities.

This course will employ UAB's virtual campus at https://cv.uab.cat.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Lessons and Seminars	30	1.2	1, 4, 5, 6, 8, 10
Type: Supervised			
Laboratories & Exercices	28	1.12	2, 3, 4, 5, 6, 7, 8, 9, 10
Type: Autonomous			
Study & Homework	90	3.6	2, 4, 5, 6, 7, 8, 9, 10

Evaluation

The final mark for the course, is calculated in the following way:
A - 10% from the mark obtained by the student for class attendance and active participation in class discussions.
B - 45% from the mark obtained by the student for a practical project developed through problem-based learning (TFM).
C - 45% from the mark obtained by the student for an oral defense

A final weighted average mark not lower than 50% is sufficient to pass the course, provided that a score over one third of the range is attained in everyone of the 3 marks.

Plagiarism will not be tolerated. All students involved in a plagiarism activity will be failed automatically. A final mark no higher than 30% will be assigned.

An student not having achieved a sufficient final weighted average mark, may opt to apply for remedial activities the subject under the following conditions:
- the student must have participated in the problem-based learning activities, and
- the student must have participated in the oral defense, and
- the student must have a final weighted average higher than 35%, and
- the student must not have failed any activity due to plagiarism.

Students not having participated in any evaluation activity will receive a final mark of "No evaluable".

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Activities & Reports from supervised sessions (labs)	30%	0	0	2, 3, 5, 6, 8, 10
Attendance and active participation in class	10%	0	0	3, 4, 5, 6, 9
Report(s) evalution	30%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Synthesis examination	30%	2	0.08	1, 2, 3, 5, 6, 7, 9, 10

Bibliography

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A. Bassi, M. Bauer, M. Fiedler, T. Kramp, R. van Kranenburg, S. Lange, S. Meissner. (Eds) Enabling Things to Talk - Designing IoT solutions with the IoT Architectural Reference Model. Springer.

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Y. Noergaard, "Embedded Systems Architecture" 2nd Edition, 2012, Elsevier
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