Universitat Autònoma de Barcelona

**2018/2019**

## Security and Compression in IoT

Code: 44028
ECTS Credits: 6

| Degree | Type | Year | Semester |
|---|---|---|---|
| 4316624 Internet of Things for e-Health | OT | 0 | 2 |

## Contact

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## Use of languages

Principal working language: english (eng)

## Prerequisites

There is no official prerequisite.

Students may have difficulties passing this subject if they have not passed the four formation complements (Laboratorio de Programación, Sistemas Empotrados, Tecnologías de Desarrollo para Internet y Web, Sistemas Distribuidos) and they have not had equivalent formation in their respective undergraduate degrees.

## Objectives and Contextualisation

This subject aims to provide an introduction to information security and data compression for Internet of things devices in relation to e-health. The two principal objectives are:

- Study innovative and recent proposals in relationwith data privacy and data integrity (security).
- Study innovative and recent proposals in relation with efficient data storage and distribution (compression).

## Skills

- Apply basic research tools in the area of IoT in health.
- Design, develop, manage and evaluation mechanisms of certification, compression and security guarantees in the processing of and access to information in a local or distributed processing system.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Use ICT applied to IoT in health.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

## Learning outcomes

1. Apply basic research tools in the area of IoT in health.
2. Based on cost-performance criteria and energy efficiency, select the compression solution for IoT sensors.
3. Evaluate the suitability of network-protocol compression and security based on components used, signal characteristics and transmission channel.
4. Implement adequate compression techniques for distinct data types.
5. Implement security technologies based on devices and components used and on transmission channel.

6. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
7. Use ICT applied to IoT in health.
8. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

## Content

**Part 1: Information security**

- Software and Hardware vulnerabilities

- Networks and application security

- Security in IoT devices and in relation to e-health

**Part 2: Data compression**

- Wavelet compression of electrocardiograms

- Lempel Ziv Welch (LZW) for IoT Smart E-Health

- Compression of mixed bio-signals for portable brain-heart monitoring systems

- Adaptive compression of sensor data in IoT systems

- Compression without loss of low complexity for wearable ECG sensors

- Hybrid Compression for Energy Reduction in IoT Wireless Sensors

## Methodology

**General Methodology**

The methodology applied to the student work will combine the attended lectures, the problem-based learning activities, the independent work of the student, the presentation of working papers throughout the course, and the oral and public dissertation about a specific subject previously approved.

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

**Communication**

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

## Activities

| Title | Hours | ECTS | Learning outcomes |
|---|---|---|---|
| **Type: Directed** | | | |
| Classes | 28 | 1.12 | 1, 2, 3, 7, 8 |
| **Type: Supervised** | | | |
| Problem-based learning | 30 | 1.2 | 1, 2, 3, 4, 5, 6, 7, 8 |
| **Type: Autonomous** | | | |

| | | | |
|---|---|---|---|
| Homework assignments | 90 | 3.6 | 1, 2, 3, 6, 7, 8 |

## Evaluation

### Evaluation method

The final mark for the course, that includes the assessment of the acquisition of knowledge and skills, 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 an oral defense

C - 45% from the mark obtained by the student for a practical project developed through problem-based learning.

A final weighted average mark not lower than 50% is sufficient to pass the course, provided that a score over 0% is attained in all individual marks.

I.e.,

$$A * 0.1 + B * 0.45 + C * 0.45 >= 5,$$

and

$$A > 0 \text{ and } B > 0 \text{ and } C > 0.$$

Students meeting the first condition but not the second one will receive a mark no higher than 45%.

### Plagiarism

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.

### Remedial activities

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.

Remedial activities will be available to improve parts A and B, but not part C.

### Additional considerations

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

Students with a final mark not under 90% will be given a mark of "cum laude". In case it is not possibleto assign a "cum laude" mark to all students meeting this condition, assignments will be in order of descending final mark.

## Evaluation activities

| Title | Weighting | Hours | ECTS | Learning outcomes |
|---|---|---|---|---|
| Class attendance and participation | 10% | 0 | 0 | 1, 6, 8 |
| Oral defense | 45% | 2 | 0.08 | 1, 2, 3, 6, 7, 8 |
| Problem-based learning | 45% | 0 | 0 | 1, 2, 3, 4, 5, 6, 7, 8 |

## Bibliography

Belesioti, Maria, Ioannis P. Chochliouros, Stefan Vanya, Viktor Oravec, Natalia Theologou, Maria Koutli, Athanasios Tryferidis, and Dimitrios Tzovaras. "e-Health Services in the Context of IoT: The Case of the VICINITY Project." In *IFIP International Conference on Artificial Intelligence Applications and Innovations*, pp. 62-69. Springer, Cham, 2018.

Jayabharathi, J., R. Saminathan, and G. Ramachandran. "A Comprehensive Survey on Internet of Things."

Andreu-Perez, Javier, Carmen CY Poon, Robert D. Merrifield, Stephen TC Wong, and Guang-Zhong Yang. "Big data for health." *IEEE J Biomed Health Inform* 19, no. 4 (2015): 1193-1208.

Poon, Carmen CY, Benny PL Lo, Mehmet Rasit Yuce, Akram Alomainy, and Yang Hao. "Body sensor networks: In the era of big data and beyond." *IEEE reviews in biomedical engineering* 8 (2015): 4-16.

Rahmani, Amir M., Tuan Nguyen Gia, Behailu Negash, Arman Anzanpour, Iman Azimi, Mingzhe Jiang, and Pasi Liljeberg. "Exploiting smart e-Health gateways at the edge of healthcare Internet-of-Things: A fog computing approach." *Future Generation Computer Systems* 78 (2018): 641-658.

Farahani, Bahar, Farshad Firouzi, Victor Chang, Mustafa Badaroglu, Nicholas Constant, and Kunal Mankodiya. "Towards fog-driven IoT eHealth: Promises and challenges of IoT in medicine and healthcare." *Future Generation Computer Systems* 78 (2018): 659-676.

Deepu, Chacko John, Chun-Huat Heng, and Yong Lian. "A hybrid data compression scheme for power reduction in wireless sensors for IoT." *IEEE transactions on biomedical circuits and systems* 11, no. 2 (2017): 245-254.

Yuan, Yazhou, Yu Zhang, Zhixin Liu, and Xinping Guan. "Lossless coding scheme for data acquisition under limited communication bandwidth." *Digital Signal Processing* 69 (2017): 204-211.

Sethi, Pallavi, and Smruti R. Sarangi. "Internet of things: architectures, protocols, and applications." *Journal of Electrical and Computer Engineering* 2017 (2017).

Park, KeeHyun, Joonsuu Park, and JongWhi Lee. "An IoT system for remote monitoring of patients at home." *Applied Sciences* 7, no. 3 (2017): 260.

*The actual bibliography may changed due to the fast-paced nature of the subject.*