Universitat Autònoma de Barcelona

2019/2020

Seguridad y Compresión en IoT

Código: 44028
Créditos ECTS: 6

Titulación	Tipo	Curso	Semestre
4316624 Internet de las Cosas para Salud Digital / Internet of Things for e-Health	OT	0	2

Contacto

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Uso de idiomas

Lengua vehicular mayoritaria: inglés (eng)

Equipo docente

Carlos Borrego Iglesias

Prerequisitos

There areno formalprerequisites.

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 have not had equivalent formation in their respective undergraduate degrees.

Objetivos y contextualización

The goal of this course is to provide an introduction to relevant topics in security and compression in the context of Internet of Things (IoT). The two main areas of focus are:

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

Successful students will learn about the most important types of attacks to which IoT systems can be vulnerable, and best security practices in the context of IoT for e-Health. Students will also aquire in-depth knowledge about specific data compression techniques and their application in real-life scenarios. As a part of the course, students will need to provide written and oral justification of security- and compression-related design decision in IoT systems. These decisions shall rely on autonomous and rigorous literature research, and further analysis thereof to identify and analyze existing options. It will also be critical to develop oral and written skills to report, present and defend the results of that analysis.

As a result of the course, successful students will be able to make informed choices and justified designs for IoT systems for e-Health in different types of professional environments.

Competencias

- Aplicar las herramientas básicas de investigación en el ámbito del Internet de los Objetos en Salud.

- Diseñar, desarrollar, gestionar y evaluar mecanismos de certificación, compresión y garantía de seguridad en el tratamiento y acceso a la información en un sistema de procesamiento local o distribuido
- Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
- Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios.
- Utilizar las tecnologías de la información y la comunicación aplicadas al Internet de los Objetos en Salud.

Resultados de aprendizaje

1. Aplicar las herramientas básicas de investigación en el ámbito del Internet de los Objetos en Salud.
2. Evaluar la idoneidad de la compresión y la seguridad de los protocolos de redes en base a los componentes utilizados, características de la señal y del canal de transmisión.
3. Implementar tecnologías de seguridad en base a los dispositivos y componentes utilizados y del canal de transmisión.
4. Implementar técnicas de compresión adecuadas para diferentes tipos de datos.
5. Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
6. Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios.
7. Seleccionar en base a criterios de coste-prestaciones y eficiencia energética la solución de compresión para sensores IoT.
8. Utilizar las tecnologías de la información y la comunicación aplicadas al Internet de los Objetos en Salud.

Contenido

Information security

1. Software and Hardware vulnerabilities
2. Networks and application security
3. Security in IoT devices and in relation to e-health

Data compression

1. Wavelet compression of electrocardiograms
2. Lempel Ziv Welch (LZW) for IoT Smart E-Health
3. Compression of mixed bio-signals for portable brain-heart monitoring systems
4. Adaptive compression of sensor data in IoT systems
5. Compression without loss of low complexity for wearable ECG sensors
6. Hybrid Compression for Energy Reduction in IoT Wireless Sensors

Metodología

The methodology of this course is designed to expose the students to some of the most important concepts in the area of IoT-eH.

Different learning formats will be used in the presential lectures, including:

- Analysis of the literature
- Discussion of practical cases
- Presentation and defense of decissions and implementations related to security and compression in IoT

Autonomous student work will be required before each session, including independent literature research and preparation of written submissions and oral presentations. Active participation in class will be required for all formats to enhance learning outcomes for all course participants. Positive interactions and contributions in class will be rewarded in the final course grades

Actividades

Título	Horas	ECTS	Resultados de aprendizaje
Tipo: Dirigidas			
Presential sessions	30	1,2	1, 2, 3, 4, 6, 7, 5, 8
Tipo: Supervisadas			
Presential supervised sessions	15	0,6	1, 2, 3, 4, 6, 7, 5, 8
Tipo: Autónomas			
Homework: resolution of exercises, reading of journal papers or technical reports, preparation of sessions	35	1,4	1, 2, 6, 7, 5, 8
Preparation of oral assignments	25	1	1, 2, 3, 4, 6, 7, 5, 8
Preparation of written assignments	25	1	1, 2, 3, 4, 6, 7, 5, 8
Study for synthesis test	15	0,6	1, 2, 3, 4, 6, 7, 5, 8

Evaluación

Final course marks will be based on each student portfolio, and computed as follows:

- Active preparation and participation in sessions: 2 points.

  Students must be able to provide evidence of participation in presential lectures, e.g., by sharing aquired knowledge and participating in group discussions. Failure to provide such evidence (e.g., by not engaging in lecture activities) will result in a 0% score in this part and automatic failure of the course. A minimum of 50% in this part will be required to pass the course.

- Assignments: 6 points.

  Students will be given written and oral assignments that must be submitted/delivered before specific deadlines that will be made public in class. Scoring of this partwill be as follows:

- Written documents: 3 points
- Oral presentations: 3 points.

  Failure to submit/deliver them will result in a 0% score in this part and automatic failure of the course. A minimum of 2 points is required for the written and for the oral parts separately. Correct usage of the English language is mandatory for both parts.

- Synthesis written test: 2 points.

  A final synthesis test will be given based on the contents discussed during the course sessions. A minimum score of 50% in this part is required to pass the course.

The minimum score for each part must be met in order to pass the course. Otherwise, a final score of 3 out of 10 will be assigned.

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the academic regulations in force, assessment activities will receive a zero whenever a student commits academic irregularities that may alter such assessment.Assessment activities graded in this way and by this procedure will not be re-assessable. If passing the assessment activity or activities in question is required to pass the subject, the awarding of a zero for disciplinary measures will also entail a direct fail for the subject, with no opportunity to re-assess this in the same academic year. Irregularities contemplated in this procedure include, among others:

- the total or partial copying of a practical exercise, report, or any other evaluation activity;
- allowing others to copy;
- presenting group work that has not been done entirely by the members of the group, if applicable
- presenting any materials prepared by a third party as one's own work, even if these materials are translations or adaptations, including work that is not original or exclusively that of the student;
- having communication devices (such as mobile phones, smart watches, etc.) accessible during theoretical-practical assessment tests (individual exams), when prohibited

An overall grade of 5 or higher is required to pass the subject. A "non-assessable" grade cannot be assigned to students who have participated in any of the individual partial tests or the final exam. No special treatment will be given to students who have completed the course in previous academic years. The grade in the Transcript of Records (ToR) will be the lowest value between 3.0 and the weighted average grade, in the event of irregularities having been committed for any assessment activity (and therefore re-assessment will not be possible).

Actividades de evaluación

Título	Peso	Horas	ECTS	Resultados de aprendizaje
Oral presentations	30%	1	0,04	1, 2, 3, 4, 6, 7, 5, 8
Participation in class: preparation, contributions and discussion	20%	2	0,08	1, 2, 3, 4, 6, 7, 5, 8
Synthesis test	20%	1	0,04	1, 2, 3, 4, 6, 7, 5, 8
Writen deliverables	30%	1	0,04	1, 2, 3, 4, 6, 7, 5, 8

Bibliografía

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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.

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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.