Last update: 13-05-2015

230150 - XSF - Wireless Networks

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 744 - ENTEL - Department of Network Engineering

Academic year: 2015

Degree: BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: Catalan

Teaching staff

Coordinator: ANNA CALVERAS

Others: Calveras Auge, Ana M.
Paradells Aspas, Jose
Casademont Serra, Jordi

Prior skills

C programming and linux knowledge

Requirements

Enginyeria Telemàtica o Ciències and Tecnologies de Telecomunicació o Enginyeria de Sistemes de Telecomunicació.

Teaching methodology

- Lectures.
- Classes of application.
- Laboratory classes.
- Group work (learning).
- Individual (learning).
- Oral presentations.
- Exercises.
- Short answer tests.
- Testing long answer.

Learning objectives of the subject

- Introduce a new vision of communication networks based on ubiquitous networks and low power consumption. An example: sensor networks.
- Introduce what is known as the Internet of Things, and Internet of Things (IOT), presenting the protocols used.
- Offering a new vision of communication networks where simplicity is the key to reducing power consumption and price.
- To complement the theoretical concepts with practical concepts.
- Allow different degree of participation in the course.

Last update: 13-05-2015

230150 - XSF - Wireless Networks

Study load

Total learning time: 150h	Hours large group:	26h	17.33%
	Hours small group:	26h	17.33%
	Self study:	98h	65.33%

Last update: 13-05-2015

230150 - XSF - Wireless Networks

Content

1. Organization course. Motivation. focus

Learning time: 2h
Self study : 2h

Description:
Organization, motivation and focus of the course.

2. Apps

Learning time: 4h
Theory classes: 2h
Self study : 2h

Description:
Key applications of wireless networks such as wireless: home automation and building, agriculture, infrastructure monitoring, "smart cities", logistics,

3. Plataforms

Learning time: 16h
Theory classes: 4h
Laboratory classes: 4h
Self study : 8h

Description:
- Architecture of a wireless sensor node: Microcontroller, memory, actuator and transducer, transceiver, antennas, power (batteries, hardvesting).
- Operating systems (Contiki presentation). Trading platforms: Elements; SoC SIP modules and platforms. Presentation Platform Zolertia (Z1).
- Lab 1: Configuring and "Hello World". Configuration programming environment based on a virtualized Debian system that can run on Windows or Mac in September. Compilation and execution of the example "Hello World."
- Lab 2: Ports, LEDs, timers and buttons. use buttons, LEDs and timers in the system Contiki.

4. Systems

Learning time: 4h
Theory classes: 2h
Self study : 2h

Description:
Description of existing commercial systems such as Z-Wave, EnOcean, Insteon, ZigBee and IETF proposal (6LoWPAN/IPv6/UDP/CoAP).

230150 - XSF - Wireless Networks

5. Sensors and Actuators

Learning time: 8h

Theory classes: 2h
Laboratory classes: 2h
Self study : 4h

Description:
- Review of different devices that can be connected to convert physical quantities to electrical and vice versa. existing interfaces
- Lab 3: Sensors and actuators. Visualization of sensor data in digital format. Control actuators. Construction of a simple logic control based on the same node.

6. Interface radio and implications

Learning time: 8h

Theory classes: 4h
Self study : 4h

Description:
Presentation of the radio interface and their implications. Frequency bands. Current consumption of the node met. Periods of activity.
MAC level topology control, organization of nodes. Types of access control mechanisms to the environment. Support periods "idle."

7. IEEE802.15.4

Learning time: 8h

Theory classes: 2h
Laboratory classes: 2h
Self study : 4h

Description:
- Description of the radio interface and MAC protocol most used currently in wireless sensor networks. Types of nodes. Frame formats, frame rates, access mechanisms. Use "beacons." Services. Improvements: IEEE802.15.4e, IEEE802.15.4a.
- Lab 4: Transmission radio. Radio transmission, multicast and unicast. Viewing frames with protocol analyzer ("sniffer"). Measures RSSI and LQI.

8. Mid term exam

Learning time: 8h

Practical classes: 2h
Self study : 6h

Description:
Mid term exam

230150 - XSF - Wireless Networks

9. IPv6

Learning time: 12h

Theory classes: 6h
Self study : 6h

Description:
- Addressing and packet format.
- ICMPv6 and Neighbor Discovery.
- 6LoWPAN: adaptation layer between IEEE802.15.4 and IPv6. Header compression, fragmentation and reassembling.

10. Routing Protocols

Learning time: 12h

Theory classes: 4h
Laboratory classes: 2h
Self study : 6h

Description:
- Basic Ideas routing in WSN. Proactive. Reactive Diffusion Geographic.
- Example: ROLL.
- Lab 5: Routing. Creating the network and routing.

11. Transport Protocols

Learning time: 8h

Theory classes: 2h
Laboratory classes: 2h
Self study : 4h

Description:
- TCP, UDP. Reliability. Basics of TCP. Congestion control.
- Lab 6: End-to-end connectivity. TCP and UDP communication in a multi-hop network.

12. REST based solutions

Learning time: 6h

Theory classes: 2h
Laboratory classes: 1h
Self study : 3h

Description:
- HTTP COAP. Using proxies and gateways. Other alternatives.
- Lab 7: Access to information COAP sensor.

230150 - XSF - Wireless Networks

13. Project	Learning time: 47h Self study : 47h

Description:
Construction of a complex system combining parts that were seen throughout the course: sensors and actuators, wireless communication, use of the Internet protocols (IPv6, UDP / TCP, HTTP / COAP). Groups of 3 or 4 people using at least two sensors data, an actuator and a server connected to the Internet. Must demonstrate sensing data, communication, processing, Internet connectivity and performance as a result of a specific process.

14. Presentation of selected projects	Learning time: 7h Theory classes: 5h Self study : 2h

Description:
Presentation of selected projects

Planning of activities

PRACTICAL SESSIONS	Hours: 14h Theory classes: 14h

Description:
7 laboratory sessions spread over the course detailed in the syllabus.

ORAL PRESENTATIONS	Hours: 2h Theory classes: 2h

Description:
Oral presentation of the project developed during the course.

(ENG) CONTROLS DE RESPOSTA CURTA

EXAM	Hours: 1h 30m Theory classes: 1h 30m

Description:
Evaluation Intermediate / Final.

230150 - XSF - Wireless Networks

Qualification system

Final exam: 40%
Partial examination and controls: 15%
Exercises and monitoring of classes: 15%
group project: 15%
laboratory practice: 15%

Bibliography

Basic:

Gomez, C.; Paradells, J.; Cavallero, J.E. Sensors everywhere: wireless network technologies and solutions. Fundacion Vodafone, 2010. ISBN 9788493474058.

Others resources: