Course guides
230150 - XSF - Wireless Networks

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering.
Degree: BACHELOR’S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR’S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).
BACHELOR’S DEGREE IN TELECOMMUNICATIONS TECHNOlogIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2015 ECTS Credits: 6.0 Languages: Catalan

LECTURER
Coordinating lecturer: ANNA CALVERAS
Others: Calveras Auge, Ana M.Paradells Aspas, JoseCasademont 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

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.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours small group</td>
<td>26</td>
<td>17.33</td>
</tr>
<tr>
<td>Self study</td>
<td>98</td>
<td>65.33</td>
</tr>
<tr>
<td>Hours large group</td>
<td>26</td>
<td>17.33</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
## CONTENTS

1. **Organization course. Motivation. focus**  
   **Description:**  
   Organization, motivation and focus of the course.

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

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

5. **Sensors and Actuators**  
   **Description:**  
   - Review of different devices that can be connected to convert physical quantities to electrical and vice versa. existing interfaces -  

6. **Interface radio and implications**  
   **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**  
   **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.  
8. Mid term exam

Description:
Mid term exam

9. IPv6

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

Description:

11. Transport Protocols

Description:

12. REST based solutions

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

13. Project

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

Description:
Presentation of selected projects
ACTIVITIES

PRACTICAL SESSIONS

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

Full-or-part-time: 14 h
Theory classes: 14h

ORAL PRESENTATIONS

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

Full-or-part-time: 2 h
Theory classes: 2h

(ENG) CONTROLS DE RESPOSTA CURTA

EXAM

Description:
Evaluation Intermediate / Final.

Full-or-part-time: 1 h
Theory classes: 1h 30m

GRADING SYSTEM

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

BIBLIOGRAPHY

Basic: