Course guide
300429 - AIGI-OA - Smart Airport and Facility Management

Last modified: 12/06/2023

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering.

Degree: BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:**

LECTURER

Coordinating lecturer: Definit a la infoweb de l'assignatura.

Others: Definit a la infoweb de l'assignatura.

PRIOR SKILLS

· Knowledge of communications networks fundamentals.
· Knowledge of basic signal transmission principles and characteristics in wired and wireless links.
· Knowledge of the main characteristics of wired and wireless local area networks.
· Knowledge of the main characteristics of communications infrastructure, in the context of the airport.
· Knowledge of the TCP/IP stack.

REQUIREMENTS

None.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE 23 AEROP. Conocimiento aplicado de: edificación; electricidad; electrotecnia; electrónica; mecánica del vuelo; hidráulica; instalaciones aeroportuarias; ciencia y tecnología de los materiales; teoría de estructuras; mantenimiento y explotación de aeropuertos; transporte aéreo, cartografía, topografía, geotecnia y meteorología. (CIN/308/2009, BOE 18.2.2009)

Generical:
6. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 2: Use the correct instruments, equipment and laboratory software for specific or specialized knowledge of their benefits. A critical analysis of the experiments and results. Correctly interpret manuals and catalogs. Working independently, individually or in groups, in the laboratory.

Transversal:
3. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
5. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
2. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
4. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
7. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

TEACHING METHODOLOGY

Theory classes comprehend explanations from the teacher by using slides and the blackboard. The teacher will encourage students' participation by making questions and asking for comments. Slides will be available in ATENEA, earlier than they are used in class. For these classes, it is recommended to the students to bring them (e.g. printed or in a laptop) to the class to make it possible to take notes.

On the other hand, reading and discussion (per group) of documents relative to the topics to be developed will also be carried out.

Regarding the use of a third language (English), some documents to be used by the students (e.g. papers, standards, etc.) and a subset of the slides will be in English.

A subset of the students' activities will be carried out in groups. The rest will evaluate individual progress of the student.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the subject, the student has to be able to:
·Know the main wired and wireless access networks used in the context of an airport, and the main aspects that have impact on their performance.
·Design basic aspects of a sensor network in the scope of an airport.
·Choose and configure the sensor network communications protocols in the scope of an airport.
·Identify and understand the security threats and the mechanisms and services to overcome them in airport networks.
·Identify the elements that compose management systems of airport networks (including access networks and sensor networks).
·Know the possibilities of intelligent applications for both airport users and airport management.

STUDY LOAD

Type	Hours	Percentage
Self study	84,0	56.00
Hours large group	66,0	44.00

Total learning time: 150 h

CONTENTS

INTRODUCTION

Description:
Smart airport definition.
Vision of the system and its components.
Applications, experiences and use cases.

Full-or-part-time: 4h 33m
Theory classes: 2h
Self study : 2h 33m

PERFORMANCE AND CONFIGURATION OF ETHERNET NETWORKS

Description:
Interconnection equipment: performance, configuration and powering.
Spanning Tree Protocol (STP).

Full-or-part-time: 18h 11m
Theory classes: 8h
Self study : 10h 11m

WIRELESS ACCESS NETWORKS

Description:
Wireless Wide Area Networks (WWANs)
· Cellular networks.
· Technologies: 2G, 2.5G, 3G, 3.5G, 4G
Wireless Local Area Networks (WLANs)
Wireless Personal Area Networks (WPANs)
Other technologies of interest within the scope of the airport (e.g. WiMax).

Full-or-part-time: 11h 22m
Theory classes: 5h
Self study : 6h 22m

SENSOR NETWORKS

Description:
Introduction to sensor networks.
IEEE 802.15.4
IP-based protocol architecture for sensor networks
· IPv6 and interoperability
· 6LoWPAN
· RPL
· CoAP
ZigBee architecture
Bluetooth Low Energy

Related activities:
Activity 1: smart airport sensor network project.

Full-or-part-time: 47h 44m
Theory classes: 21h
Self study : 26h 44m

SENSOR NETWORKS MANAGEMENT

Description:
Introduction to network management
Management architectures
SNMP, MIB
The concept of management in WSNs: functionality, challenges and differences with traditional environments and techniques.
SCADA.

Related activities:
Activity 2: management and security sensor network project.

Full-or-part-time: 11h 22m
Theory classes: 5h
Self study : 6h 22m

SECURITY IN AIRPORT NETWORKS

Description:
Introduction to network security: basic concepts
Firewalls and intrusion
Hotspots
Sensor network security

Related activities:
Activity 2: management and security sensor network project.

Full-or-part-time: 34h 05m
Theory classes: 15h
Self study : 19h 05m

INTELLIGENT APPLICATIONS IN AIRPORTS

Description:
Introduction to different intelligent applications in the scope of the airport: tracking systems, location systems, HVAC, etc.

Full-or-part-time: 22h 43m
Theory classes: 10h
Self study : 12h 43m

ACTIVITIES

SMART AIRPORT SENSOR NETWORK PROJECT

Description:
Preparation of a written document which provides a sensor network solution within the scope of the smart city.

Specific objectives:
1) Consolidation of the knowledge regarding sensor networks and the corresponding communication protocols in the scope of the intelligent airport. 2) Development of a solution to a problem that has an open solution, applying the acquired knowledge. 3) Preparation of documentation and oral presentation of work carried out by teams of students.

Material:
Class slides, notes and recommended bibliography.

Delivery:
Written document. Oral presentation with the support of slides. The mark of this activity represents the 20% of the final mark of the subject.

Full-or-part-time: 4h
Theory classes: 4h

SMART AIRPORT NETWORK MANAGEMENT AND SECURITY PROJECT

Description:
Preparation of a written document which provides a sensor network solution within the scope of the smart city.

Specific objectives:
1) Consolidation of the knowledge regarding sensor networks and the corresponding communication protocols in the scope of the intelligent airport. 2) Development of a solution to a problem that has an open solution, applying the acquired knowledge. 3) Preparation of documentation and oral presentation of work carried out by teams of students.

Material:
Class slides, notes and recommended bibliography.

Delivery:
Written document. Oral presentation with the support of slides. The mark of this activity represents the 20% of the final mark of the subject.

Full-or-part-time: 4h
Theory classes: 4h

GRADING SYSTEM

The final mark of the subject will be calculated as follows:

· Two partial exams (25% each exam)
· Smart airport sensor network project (20%)
· Management and security project (20%)
· Subjective mark (10%)
o By default, the subjective mark will be equal to the average of the rest of the marks

EXAMINATION RULES.

All the proposed activities are mandatory. In consequence, the mark of any activity not carried out by the student will be equal to zero.
All activities include individual and group evaluation components.

BIBLIOGRAPHY

Basic:
- Schiller, Jochen H. Mobile communications. 2nd ed. London: Ed. Addison-Wesley, 2003. ISBN 0321123816.
- Seifert, Rich; Edwards, J. The All-new switch book: the complete guide to LAN switching technology [on line]. 2nd ed. Indianapolis, IN: Ed. Wiley, 2008 [Consultation: 05/10/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=353371. ISBN 9780470287156.
- Gómez, C.; Paradells Aspas, J.; Caballero Herrero, J.E. Sensors everywhere: wireless network technologies and solutions. Ed. Fundación Vodafone España, 2010. ISBN 9788493474058.

Complementary:
- Gast, Matthew S. 802.11 wireless networks [Recurs electrònic]: the definitive guide [on line]. 2nd ed. Beijing: Ed. O'Reilly, 2005Available on: http://proquest.safaribooksonline.com/0596100523?uicode=politicat. ISBN 9780596100520.