

Course guide

240278 - 240AU135 - ICT Technologies and New Mobility Services

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2019). (Optional subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Lluís JOFRE ROCA
Elisa SAYROL CLOLS

Others:

REQUIREMENTS

The course starts from a basic knowledge of electronics and communication systems already seen previously and delves into specific systems for the automotive sector and mobility.

TEACHING METHODOLOGY

Lecture classes
Application classes
Individual work (not face-to-face)
Short answer tests (control & Test)
Quick Response Test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

The objective of the subject is to provide attendees with the most significant knowledge of the different urban infrastructures and vehicle platforms for communications, positioning and sensorization necessary for a progressively autonomous mobility of people and goods. On the basis of these digital technologies, new mobility services are presented that combine multimodal systems, integrated data management and a combination of individual and collective solutions managed by an integrated intelligent transport system. For this, lectures are combined where the most theoretical concepts are presented with practical workshops where practical solutions are addressed to specific situations on ICT technologies and new mobility services.

CONTENTS

Part I. principles of new technologies and services (27h)

Description:

1. Introduction to the new mobility (2h)

New technologies and services

The international technological and industrial context

2. Communication systems for vehicular mobility (2h)

Evolution of the type of mobility. ITS systems. Autonomous vehicles

XG systems for V2X. V2I, V2V systems

Ad-hoc (G5) and cellular (5G) architectures

Electromagnetic characterization on the V2X channel and on the vehicle

Antenna system in infrastructures and vehicles

3. Vehicle sensor systems (2h)

Vehicle sensing. Perception technologies.

Infrastructures for sensorization systems.

Sensor systems in the vehicle

4. Positioning systems (2h)

Satellite systems (GNSS)

Systems based on local infrastructure

Vehicle interaction and proximity systems

The fusion of positioning systems

5. Mapping the streets and geofencing (2h)

High definition, 3D and resolution maps for automatic driving

Maps as single sensor, static objects and dynamics a priori

Layer mapping system

Geofencing, concepts and applications to mobility

6. Imaging systems. Processing and augmented reality (2h)

Application of artificial vision to vehicles

Application of artificial vision to mobility infrastructures

3D vision for augmented reality. Real driving simulation and environment

7. Databases, Big Data, urban traffic management and information (2h)

Static and dynamic data

Useful databases in urban mobility

Intelligent transportation systems

Improved prediction for traffic management and driving

8. Adaptation of city infrastructures for mobility (2h)

Holistic vision of communication, sensorisation and data infrastructures

Road markings, beacons and virtual walls, smart traffic lights. pedestrian sensing

Parking areas, gas stations, waiting areas, intersections

9. New technologies for urban logistics of merchandise mobility (2h)

Figures for freight mobility

New technologies. From drones to autonomous vehicles

New integrated solutions

10. Additional services for mobility (2h)

Autonomous vehicle entertainment: audiovisual entertainment, advertising, video games, education

Health monitoring and safe driving: sensors for vital signs and other warning signs

Other additional services

11. Solutions to mobility (Maas) (2h)

Multimodal solutions
Public transport & private transport
Integration of mobility data systems
New collaborative systems and services to users.

12. Conclusions on the new mobility (2h)
The key elements of the new mobility.
The social dimension of the new mobility
The temporal evolution scenarios

Full-or-part-time: 27h
Theory classes: 27h

Part II. Seminars-laboratorios of analysis and modeling of the urban mobility (13.5h)

Description:

- Cooperative mobility and traffic management simulator: SUMO
- Simulation of georeferencing systems. Google Collab, Python Bookstore
- Modeling of new Mobility Services & Business Plan

Full-or-part-time: 13h 30m
Laboratory classes: 13h 30m

GRADING SYSTEM

- This subject has an evaluation of theory (60%) and seminar-laboratories (40%).
 - Both the theory part and the laboratory-seminar have continuous evaluation, consisting of short questionnaires (50% of the weight) at the end of the sessions and a controls for each part (50% of the weight). The course can be passed directly through continuous assessment.
 - In case of not passing the theory part with continuous assessment, a final theory exam must be taken.
 - Laboratory class attendance must be 100% in order to pass the subject, except in cases justified in writing.
- Addenda: In case the health situation during the COVID-19 course requires it, the method and the evaluation tests will be conveniently modified so that they can be carried out in a remote manner.

BIBLIOGRAPHY

Basic:

- Coppola, Pierluigi ; D. Esztergar-Kiss. Autonomous vehicles and future mobility [on line]. Amsterdam: Elsevier, 2019 [Consultation: 17/11/2022]. Available on : <https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780128176962/autonomous-vehicles-and-future-mobility>. ISBN 9780128176962.
- Perallos Asier [et al.]. Intelligent Transport Systems : Technologies and Applications [on line]. Chichester, UK: Wiley, 2016 [Consultation: 21/04/2023]. Available on : <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781118894774>. ISBN 9781118894774.