Course guide
340605 - INAM-R2O07 - Environmental Intelligence

Last modified: 17/05/2023

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish, English

LECTURER

Coordinating lecturer: Catala Mallofre, Andreu

Others: Catala Mallofre, Andreu

PRIOR SKILLS

There are no prerequisites for this course although the knowledge acquired in the degree on control theory, mechanical and electronic systems is very convenient. It is also very convenient to know some programming environment like MATLAB, C or JAVA.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
cb8. CB8 - Students will be able to integrate knowledge and handle complexity and formulate judgments from a incomplete or limited information, including reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments
cb9. CB9 - Students can communicate their conclusions, knowledge and rationale underpinning these, to skilled and unskilled public in a clear and unambiguous way
cc01. CC01 - Ability to research, design, develop and characterize advanced control systems that enable the dynamic system behave according to the operational performance requirements.
cg01. (ENG) CG01 - Ability to research, design, develop and characterize the dynamics of complex systems that must be controlled to meet certain demanding operational performance at the operational level and security level, noticing some restrictions components and the possibility of failures in the control system

CB7. CB7 - Students can apply their knowledge and their ability to solve problems in new or
unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
CEV12. CEV12 - A Learn to design interactive systems in multidisciplinary teams applying the methodology and techniques of Design Centered in User (DCU).
CEV11. CEV11 - Structure and integrate artificial intelligence techniques and Automatic Learning.
CEV10. CEV10 -Identify solutions in smart environments through design and implementation of sensor networks and services environment.
CEV02. CEV02 - Analyze and evaluate programming techniques of mobile devices.

Transversal:
ct4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

ct3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT1a. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.

TEACHING METHODOLOGY

The subject will be conducted with the principles of Project Based Learning. An introductory lecture of each area will be presented by the professor. The students will work with their projects during the whole semester and they should defense their evolution in four different stages with public presentations. A final report should be delivered at the end of the course.

LEARNING OBJECTIVES OF THE SUBJECT

1. To learn the terminology and basic techniquesof Artificial Intelligence and its implementation in Environmental Intelligence scenarios .
2. To design systems able to capture and extract meaningful information from human behaviors in various environments (indoor, outdoor)
3. To understand the concept of ubiquitous computing as a new paradigm in the field of information technology.
4. To know the possibilities of Environmental Intelligence applications for health and care tecnologies and environmental control

STUDY LOAD

Type	Hours	Percentage
Hours large group	15,0	12.00
Hours small group	30,0	24.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

Introduction to Ambient Intelligence

Description:
Ambient Intelligence and HCI
General interaction framework. Norman's model of interaction
Rules and principles of HCI Design
Sensation and perception

Full-or-part-time: 18h
Theory classes: 2h
Practical classes: 7h
Self study : 9h

Data Processing

Description:
Clustering
Dimensionality reduction
Feature Extraction

Full-or-part-time: 18h
Theory classes: 2h
Practical classes: 7h
Self study : 9h

Neural Networks and Support Vector Machines

Description:
Structure and learning
Multilayer Perceptrons and Radial Base Functions
Kernels and SVM
Deep learning

Full-or-part-time: 18h
Theory classes: 2h
Practical classes: 7h
Self study : 9h

Pervasive Computing

Description:
Pervasive Computing concepts
Current technology and related fields
Users view: security, privacy, management

Full-or-part-time: 18h
Theory classes: 2h
Practical classes: 7h
Self study : 9h

Ambient intelligence applications

Description:
Ambient intelligence services
Ambient Assisted Living (AAL): requirements and solutions.
Ethics in AmI: privacy, autonomy, integrity, reliability, e-inclusion.

Full-or-part-time: 18h
Theory classes: 2h
Practical classes: 7h
Self study : 9h

GRADING SYSTEM

The assessment of this course will be mainly through an original project, preferably in groups of 2 students. On the evaluation of the project will be considered:
-The adequacy of the project in the context of the subject.
-The monitoring of the project in all its phases: problem statement, analysis of existing solutions, information gathering, solution design proposed, selection of physical devices and computing strategies, simulated or functional prototypes and finally, analysis of the impact of the system.
-Report writing and oral presentation of the project.
Each student will make a total of 4 presentations agreeing the different project phases.
The evaluation will be based on the quality of the different presentations and the final report
Additionally an examination of the core content of the course will also be performed.
Final Mark = 0,3 Project evolution mark + 0,3 Final report mark + 0,4 Exam

BIBLIOGRAPHY

Basic:

- Torres, Jordi. Python deep learning : introducción práctica con Keras y TensorFlow 2 [on line]. Barcelona: Marcombo, 2020 [Consultation: 11/11/2022]. Available on: https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=2749560&site=ehost-live. ISBN 9788426728289.
- Bishop, Christopher M. Pattern recognition and machine learning. New York: Springer, 2006. ISBN 9780387310732.
- Weber, Werner; Rabaey, Jan M; Aarts, Emile Aarts. Ambient Intelligence [Recurs electrònic] [on line]. Berlin, Heidelberg: Springer Berlin Heidelberg, 2005 [Consultation: 22/02/2022]. Available on: https://renoir.upc.edu/login/tipus.php?url=http%3A%2F%2Flink.springer.com%2F10.1007%2Fb138670&logup=false. ISBN 9783540271390.
- MacKenzie, I. Scott. Human-Computer interaction : an empirical research perspective [on line]. Waltham, Mass: Morgan Kaufmann, 2013 [Consultation: 13/02/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=1110719. ISBN 9780124058651.