Robotics in the Smart City

Code: 104553
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500001 Management of Smart and Sustainable Cities	OT	3

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

The subject does not formally require any pre-requisite.

Objectives and Contextualisation

The objectives of this subject are framed in the application of Robotics in the field of smart city. In particular, it is intended:

- Provide the student with an overview of the basic concepts of robotics, artificial intelligence and internet of thinks.
- Ask the student to reflect on the ethical, social and economic implications of the application of robots in the city and intelligent industry.
- Apply robotic solutions to various current problems in the city.

Competences

- Carry out projects related to the management, equality and sustainability of cities applying elements of technological innovation such as ICT.
- Critically analyse work carried out and demonstrate a desire to improve.

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- Demonstrate creativity, initiative and sensitivity in the different social and environmental topic areas.
- Design platforms of management, integration of public and government services applying technologies and systems of sensorization, acquisition, processing and communication of data.
- Generate innovative and competitive proposals in professional activity.
- Identify and interpret social, economic, technological and sustainability challenges in different areas such as: town planning, infrastructures, mobility, urban economies, services and equipment, cultural diversity and social inequality, energy and natural resources, waste, etc.
- Integrate cyberphysical systems based on the interrelationship between information technology and physical processes in urban environments.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Work cooperatively in complex and uncertain environments and with limited resources in a multidisciplinary context, assuming and respecting the role of the different members of the group.

Learning Outcomes

1. Critically analyse work carried out and demonstrate a desire to improve.
2. Define sustainable projects based on socially sustainable and equitable robotic contributions.
3. Demonstrate creativity, initiative and sensitivity in the different social and environmental topic areas.
4. Describe essential robotic systems in the smart city and apply these to new services for citizens.
5. Develop the ability to integrate robotic-system solutions in urban and industrial environments.
6. Generate innovative and competitive proposals in professional activity.
7. Identify and analyse the ethical issues and socio-economic repercussions associated with the presence of robots in the context of the smart city.
8. Identify and analyse the paradigm shift in industry, mobility and assistance deriving from autonomous systems.
9. Identify the challenges of social transformation resulting from the escalation of robotics in the smart city.
10. Identify the integration processes associated with the transformation of the urban environment following the impact of robotics in logistics, mobility, service development, etc.
11. Identify the unresolved problems generated by industrial transformation through the ubiquitous appearance of robots.
12. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
13. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
14. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
15. Work cooperatively in complex and uncertain environments and with limited resources in a multidisciplinary context, assuming and respecting the role of the different members of the group.

Content

The contents of the subject are divided into the following blocks:

Block 1. Theoretical and technical fundamentals:

Classic views of robotics.
Automation and control systems.
Fundamentals of Artificial Intelligence and desitions making.
Robotics and the Internet of things.

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Block 2. Ethical, social and economic implications:

Ethical issues that arise from the proliferation of robots in the industrial and urban environment.
Industrial Shift: employability in the context of ubiquous robotics and sustainability models.
Impact of artificial intelligence on urban mobility.

Block 3. Applications of robotics.

Case study 3. Industry 4.0 and robotics. Challenges for the insertion of the robot in industrial fields, systems of interaction and collaboration with interconnected, interactive and collaborative robots. Challenges for the insertion of the robot in urban environments.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Case study seminars	12	0.48	
Laboratory sessions	12	0.48	
Theory sessions	26	1.04	
Type: Supervised			
Tutories	5	0.2	
Type: Autonomous			
Preparation of oral presentations	35	1.4	
Preparation of reports in writing	60	2.4	

The teaching methodology to be followed is oriented to the student's learning of the subject on an ongoing basis. This process is based on the realization of three types of activities that will be developed throughout the course: theory lectures, case studies and laboratory practicum.

- Theory lectures: the teacher will provide information on the knowledge of the subject and on strategies to acquire, expand and organize this knowledge. The active participation of the students during these sessions will be encouraged, for example by raising discussions in those points that have a higher conceptual load.
- Case studies: students will have to actively participate to consolidate the knowledge acquired by solving, presenting and discussing problems and case studies. The transversal competences T01, T03 and T05 will be evaluated in the papers presented in the case studies by carrying out a critical analysis of the work done by each member of the team and the total work presented. This part will have a 5% to the grade of each of the case studies.
- Laboratory practicum. Students will work as a group in the development of laboratory practicum related to the use of computer and robotic tools.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Laboratory reports	30%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Oral Presentations	50%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Reports from case studies	20%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

The evaluation of the subject will be done progressively and continuously throughout the semester for each block.

a) Blocks evaluation process.

For each of the three blocks that make the subject, the teacher will propose a series of activities (case studies and practices with a computer). The student, conducted by the teacher, will have to work on the development of the activities. Likewise, they must present them in the form and on the date indicated by the teacher and make an oral defense.

The final mark will be calculated as follows:

FinalMark = 40% * MarkBlock1 + 40% * MarkBlock2 + 20% * MarkBlock3

To pass the course, you must obtain a minimum grade of 5 as a result of the calculation of final grade (FinalMark). To apply the FinalMark formula it will be necessary to obtain a minimum grade of 3.5 in all grades of the blocks, i.e. each of the grades MarkBlock1, MarkBlock2 and MarkBlock3 must be greater than or equal to 3.5. Therefore, if a MarkBlock is graded with a grade lower than the one indicated above, the subject cannot be passed.

If a student does not reach the minimum grade of 3.5 in any of the MarkBlock and for this reason does not pass the course, the final grade will be a maximum of 4.5, i.e. it will be equal to the value of the weighted average if FinalMark is less than 4.5 or 4.5 if it is higher.

b) Programming evaluation activities

The scheduling of the evaluation activities will be given on the first day of the subject and will be made public through the Virtual Campus (Moodle) and on the website of the Engineering School, in the exams section.

c) Make-up process

This course is continuously assessed by means of the presentation of the works that correspond to the study cases and to the practices of laboratory. Papers must be submitted on a date and form according to the instructions provided by the teacher, who may request a resubmission as a form of make up. Since one MarkBlock can be offset with another, there are no recovery processes at the end of the semester.

d) Procedure for review of qualifications

For each evaluation activity, a place, date and time of revision in which the student can review the activity with the teacher will be indicated. In this context, claims may be made on the activity grade, which will be evaluated by the faculty responsible for the subject. If the student does not show up for this revision, this activity will not be reviewed later.

e) Qualifications

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The final grade of the subject will be calculated according to the percentages mentioned in section a)of this point. Keep in mind that:

- Honor plates. Granting a grade of honor registration is only the decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be granted to students who have obtained a final grade equal to or greater than 9.00.
- Not evaluable. A student who has not submitted to any Activity will be considered "non-evaluable". In any other case, the evaluation criteria detailed above are followed.

f) Irregularities by the student, copy and plagiarism

Without prejudice to other disciplinary measures deemed appropriate, the irregularities committed by the student that may lead to a variation of the grade of an evaluation act will be scored with a zero. Therefore, copying, plagiarism, cheating, letting copy, etc. in any of the evaluation activities will involve suspending it with a zero. If it is necessary to pass any of these evaluation activities to pass the subject, this subject will be suspended directly, without the opportunity to recover it in the same course.

g) Evaluation of repeating students

No mark is saved from one course for the next. Repeating students follow the same evaluation standards asany other student.

Bibliography

Platform used for communication with students: Moodle.

Basic bibliography:

- A. Barrientos. Foundations of Robotics, McGraw-Hill, 2007.
- J. R. Mercader Uguina. The future of work in the era of digitization and robotics, Tirant Lo Blanch, 2017.
- International Journal of Social Robotics, Springer-Verlag, online magazine.
- Concha Bielza, A. Mateos and S. Ríos, Fundamentals of Decision Aid Systems, Ed. Ra-Ma, 2002.
- VV.AA. Artificial intelligence A Modern Approach, Prentice-Hall, 1996.
- T.S. Kuhn. The structure of Scientific Revolutions: 50th Aniversary Edition. The University of Chicago Press. 2012

Software

In Block 1 (Theoretical and technical fundamentals): Node-Red and Arduino

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	611	Catalan	second semester	afternoon
(PLAB) Practical laboratories	611	Catalan	second semester	afternoon
(PLAB) Practical laboratories	612	Catalan	second semester	afternoon
(TE) Theory	61	Catalan	second semester	afternoon

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