Universidad Zaragoza

Academic Year/course: 2021/22

68958 - Multi-Agent systems and Robotics in Health

Syllabus Information

Academic Year: 2021/22
Subject: 68958 - Multi-Agent systems and Robotics in Health
Faculty / School: 326 - Escuela Universitaria Politécnica de Teruel
Degree: 614 - Master's in Innovation and Entrepreneurship in Health and Wellbeing Technologies
ECTS: 3.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

This course provides the foundation for those who wish to use the agent paradigm for small developments applied to the health context. It will also lay the foundation for applying robotics, perception, and control techniques in this context. Thus, as the main objectives of the course, it is sought that those who take it reach the adequate level of competences in aspects of design and implementation of multi-agent systems and robotic systems.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDG, of the 2030 Agenda (https://www.un.org/sustainabledevelopment/es/) and certain specific goals, in such a way that the acquisition of the Learning outcomes of the subject provides training and competence to the student to contribute to a certain extent to their achievement:

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? Goal 3: Ensure healthy lives and promote well-being for all at all ages.

> Target 3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.
>
> Target 3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

? Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

> Target 4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

? Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

> Target 8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training.

? Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

> Target 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.

1.2. Context and importance of this course in the degree

The course goes deeper into the area of multi-agent systems and robotics, providing solutions within the context of health.

In the part of the multiagent systems, the main architectures, platforms, and tools for the development, implementation, and deployment of multiagent systems will be presented. In addition, agreement technologies (e.g. negotiation and argumentation) and agent-based simulation will be introduced. In the robotics part, the main tools that allow the development of simple applications in the health context will be introduced. The focus of the course will be practical and it is intended to raise small developments oriented to the health field using the tools seen in the different aspects highlighted.

1.3. Recommendations to take this course

To take this course, it is advisable to have basic notions of programming. Therefore, it is recommended to have passed the Complementary Training in Information and Communications Technology.

2. Learning goals

2.1. Competences

After passing the course, the student will be more competent for...

- Acquiring the knowledge, skills, and abilities necessary to carry out innovative work in the field of technologies for health and well-being.

- Writing technical documents or reports describing a novel application in the field of technology for health and well-being, as well as knowing how to protect or distribute it.

- Searching, managing, understanding and critically analyzing scientific publications, bibliography, and documentation in the field of Health and Wellness Technologies.

- Understanding knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.

- Applying their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

- Communicating their findings and rationale behind them to specialist and non-specialist audiences in a clear and unambiguous manner.

- Continuing to study in a largely self-directed or autonomous manner.

- Analyzing biomedical data and extracting relevant information from it for problem-solving in the field of Health and Welfare Technologies

- Conducting technological modeling of a real element or scenario in the field of Health and Welfare Technologies being able to connect it with models from other disciplines.

2.2. Learning goals

The student will have to show the following skills in order to pass the course?

He/she knows the fundamentals, principles and applications of robotic systems

He/she knows the problems of multi-agent control systems and network control: communication delays, sensor noise, data loss, etc.

He/she develops simple practical applications of intelligent cooperative robotics in the field of health and well-being.

He/she specifies and designs a multiagent system for a given problem.

He/she implements multi-agent systems in the field of health and wellness.

2.3. Importance of learning goals

Multi-agent systems and robotics have important applications today in the field of health and well-being. In this course, students will be provided with the necessary foundations to use the associated paradigms (multi-agent systems and robotics). It also has a markedly practical character, since students will carry out small developments, applied to the context of health.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student will have to prove that he/she has achieved the learning goals by means of the following tasks.

The marks of both calls of the course (January/February and September) will be calculated in the following way:

Multi-agent Systems. 50% of the final mark:

- Theoretical and practical tests (30% of the mark of the part of the multi-agent systems). It is a theoretical-practical exam that includes questions and problems about the whole course. The student will need to obtain a mark of 4 to pass the course. If the mark is lower than 4, then the final mark of the course will be the minimum between the weighted average of the two parts and the mark of the exam.

- Assignments (70% of the final mark). During the course, some assignments will have to be carried out by the students. If they do not fulfill all of them, or their average mark is lower than 5, then the student will have to carry out a practical exam to pass this part of the course.

Robotics. 50% of the final mark:

- Theoretical and practical tests. 30% of the mark of the Robotics part. These are tests on theoretical and practical content and exercises related to the subject matter.

- Evaluation of the practical work. 70% of the mark of the Robotics part. The objective of this test is to evaluate the knowledge and skills acquired during the development of a case study that requires putting into play all the learning results. It

will be carried out in each official call.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process that has been designed for this subject is based on the following:

- The study and work continued from the first day of class.

- The learning and application of concepts and methodologies, through the theory and problem classes. In these classes, students will play an active role in discussion and resolution.

- The work developing projects proposed by the teachers, whose result is reflected in the delivery of the results properly documented, and that will serve for evaluation in the terms indicated in the corresponding section.

4.2. Learning tasks

The program offered to the student to help him/her achieve the expected results includes the following activities:

- In the theory and problem classes, the subject's agenda will be developed and problems of application of the concepts and techniques presented in the subject's program will be solved.

- In the assignments, the students will apply the acquired competences and they will reflect it in a document or presentation directed to the teachers of the subject.

- Virtual tutorials will consist of tutorials proposed by the teacher in a telematic way to clarify possible doubts that may arise during the study.

- All the activities (except the exam) will take place at a distance, using the means provided by the University of Zaragoza for this purpose, and taking advantage of what the University of Zaragoza dictates in terms of blended learning.

4.3. Syllabus

- Multi-agent systems
    - Intelligent agents
    - Multi-agent systems
    - Agreement Technologies
    - Agent architectures
    - Communication and coordination
    - Agent platforms

- Robotics
    - Introduction to Perception, Robotics, and Control
    - Conceptual framework and classic models
    - Fundamentals and applications
    - Case studies (related to topics that include: Computer vision, Perception systems, Multi-robot systems, Robot manipulators, Service robotics)
    - Examples of recent results

4.4. Course planning and calendar

Student's work
The student's dedication to achieving the learning outcomes in this subject is estimated at 75 hours distributed as follows:

- 8 hours of problems and cases,
- 8 hours of practice,
- 18 hours of work,
- 38 hours of study,
- 3 evaluation

Calendar of face-to-face sessions and presentation of papers

The teaching organization of the subject is as follows:
Theory and problem classes (20 hours). As mentioned above, these classes will not be face-to-face, being recorded, and available on the virtual platform and/or synchronous classes.

Presentation of work to be evaluated:
The problems and works that are proposed will be informed of their delivery date when they are proposed.
The schedule of exams and the dates for submission of papers will be announced in advance.

4.5. Bibliography and recommended resources

The bibliography recommended by the teaching staff will be available in the library of the University of Zaragoza
http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=68958