Cooperative Robotics

Credits: 4 Semester 3 UJI Compulsory: No

Format	Lectures 20 h	Examples 10 h	Private study 85 h

Lectures: G. Recatalá

The distribution of devices, sensors and actuators, among several mobile robots increases flexibility and robustness, and reduces the overall cost compared to monolithic solutions based on a single gifted robot. However, for efficient cooperation among a team of robots, it is necessary to address and solve challenges to efficiently manage devices and communications between them. They also represent a test for the allocation and planning of real tasks. Its applications range from exploration and / or efficient surveillance environments, to the work of rescue assistance.

Contents:

The following subjects will be treated:

- Introduction to cooperative robotics. In this issue the latest robotic technology network will be studied according to the IEEE Technical Committee on "Network Robotics".
- Literature review. This section provides a literature review of some significant articles were made in the field of cooperative robotics.
- Technology for cooperative robotics. In this section, network technologies, both hardware (Zigbee, Wifi, etc..) And software (TCP Reno, Las Vegas, etc..), That help you make the most of an application study of cooperative robotics.
- Architectures and software platforms for cooperative robotics. In this section the design of platforms for cooperative applications are discussed. Examples of these platforms can be Jade, Player / Stage, or ROS.

Objectives: After completing this course the students will be able to:

- Efficiently manage a team of robots.
- Schedule and distribute tasks.
- Exploiting Multiplicity to increase the capacities of perception and learning.

Assessment: 20% continuous assessment, 80% from end of semester examination.
Practical Work: laboratory: multi-agent systems

Recommended texts:

- Tucker Balch, Lynne Parker, Robot Teams: From Diversity to Polymorphism, AK Peters, Ltd., 2002.
- Jiming Liu, Jianbing Wu, Multiagent Robotic Systems, CRC Press, 2001.
- Alan C. Schultz, Lynne E. Parker, Multi-Robot Systems: From Swarms to Intelligent Automata, Kluwer, 2002.
- Peter Stone. Layered Learning in Multiagent Systems: Approach to Robotic Soccer AWinning, MIT Press, 2000.

Further readings:

will be provided by the lecturer

Cognitive Processes

Credits: 4 Semester 3 (UJI) Compulsory: No

Format	Lectures 30 h	Examples 15 h	Private study 80 h

Lectures: Ll. Museros (UJI)

Objectives:

The development of robotics has been directed toward the development of skills in robots, similar to those of human beings, regardless of the cognitive processes underlying human intelligent behavior. Probably the poor implementation of natural cognitive processes to robotics and artificial intelligence is because neuroscience, the discipline that should nurture knowledge on natural cognitive processes, has not been able so far to provide a generic explanation of behavior of our brain, which could be used for artificial intelligence and robotics. This course will approach the study of the latest discoveries in neuroscience of human brain function, and then move to the implementation of artificial cognitive processes.

Contents:

- Use of cognitive processes modeling world
- Cognitive computer vision, and sensory integration
- Construction of cognitive maps
- Cognitive processes of action
- Case study: autonomous navigation of robots
- Cognitive processes of interaction
- Modeling of artificial emotional intelligence
- Cognitive learning

Abilities: After completing this course the students will be able to:

- Know the natural cognitive processes that neuroscience has discovered. Define natural cognitive processes can be implemented in artificial cognitive processes and how.
- Know a few artificial cognitive processes for automated world modeling. Know the limits of science at this point. Be able to formulate and solve new ways to build models of the world.
- Know how to approach and solve new cognitive navigation algorithms that incorporate new cognitive skills in robots.
- Know how to approach and solve new cognitive processes of action.

Assessment: 20% continuous assessment, 80% from end of semester examination.

Practical Work:

Exercises will be set, which will involve preparing and presenting a paper in scientific format.

Recommended texts:

- Thagard, Paul (2nd, 2005). Mind : Introduction to Cognitive Science. Cambridge, MA: The MIT Press.

Further readings:

will be provided by the lecturer

Ambient Intelligence

Credits: 5 Semester 3 (UJI) Compulsory: No

Format	Lectures 30 h	Tutorials 5 h, Lab.10h	Private study 80 h

Lectures: R. Marin (UJI)

Objectives: The goal of the course is to enable students to understand the Ambient Intelligence computing paradigm, which envisions a world where people (and possibly robots) are surrounded by intelligent sensors/actuators and interfaces embedded in the everyday objects around them.

Contents:

The following subjects will be discussed:

Middleware Infrastructures for Ambient Intelligence.
Networks of sensors and actuators.
Robots within Smart Environments.
User/Situation Modelling and Context Awareness.
Human-centred adaptive interfaces, Augmented Reality and wearable computing.
Applications: from Smart Dust to Smart Cities.

Abilities: After completing this course the students will be able to

1. Understand and discuss the most relevant articles in related areas: smart environments, smart networked objects, augmented + mixed realities, ubiquitous computing & communication, sensor and actuator networks, pervasive computing, tangible computing, intelligent interfaces and wearable computing.
2. Come up with new ideas, start innovative projects in this area.
3. Address the socio-cultural impact (to a lesser extent).

Assessment: 20% continuous assessment, 80% from end of semester examination.

Practical Work: Laboratory exercises with the KnowHouse simulator.

Recommended texts:

Handbook of Ambient Intelligence and Smart Environments (AISE), Ed. by H. Nakashima, H. Aghajan and J.C. Augusto (Eds.), Springer, to be printed in 2009.

Ambient Intelligence, Ed. by G. Riva, F. Vatalaro, F. Davide and, M. Alcañiz, Vol. 6., IOS Press Emerging Communication series, January 2005, 316 pp.

Further readings:

will be provided during the course

Telerobotics

Credits: 4 Semester 3 (UJI) Compulsory: No

Format	Lectures 30 h	Tutorials 5 h, Lab.10h	Private study 80 h

Lectures: R. Marin (UJI)

Objectives: The overall goal of this course is to study the processes and tools to design systems of remote control for electromechanical devices.
The evolution of information technologies and communications research opens new possibilities with interesting applications in improving the methods and industrial and civil processes. Device control through communication networks, and more specifically the Internet public network, is currently an emerging and very productive line of research, which also has a great interest in the industry. Still there are very few via Web robotic systems that allow remote control of electro - mechanical devices in industrial scopes and / or research. As an illustrative example, the first Internet robot (The Mercury Project) was designed and implemented in late 1995 at the University of Berkeley. Since then, the interest of the international scientific community in these systems has grown exponentially thanks in part to the very rapid evolution of features that are experiencing telecommunication and also the benefits of these remote control systems in terms of the possibility of the operator to be located anywhere in the terrestrial globe.

Contents:
The following subjects will be discussed:

- Networked Robots.
- Telerobotics.
- Tools for remote control.
- Multi-Device Network Architectures.
- User Interfaces for remote control.
- The communication network and its influence on the remote control.
- Applications of remote control in the social and industrial domains.

Abilities: After completing this course the students will be able to

- Learn the concept of Networked Robot and its characteristics.
- Know the facilities provided by the telerobotic systems applied in the history.
- To introduce the latest software and tools for the design of remote control systems.
- Study the network architectures, both hardware and software, to facilitate the design of the remote control.
- Know how the user interface can help to improve interaction with a remote device.
- Study the impact of bandwidth and latency own a public communications network (ie
- Internet) in the reliable control of remote systems.
- Study examples of remote control applications and how they have solved the network effects of communication and user control.

Assessment: 20% continuous assessment, 80% from end of semester examination.

Practical Work: Laboratory exercises with the KnowHouse simulator.

Recommended texts:

T. Sherindan, *Telerobotics, Automation, and Human Supervisory Control*. Cambridge: MIT Press, 1992.
K. Goldberg, Roland Siegward, *Beyond Web Cams: An introduction to Online Robots*, MIT Press, Massachusetts, 2001.

Further readings:

will be provided during the course