

## 340621 - ROVI-R2P07 - Robotics and Vision

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering  
 Teaching unit: 707 - ESAII - Department of Automatic Control  
 Academic year: 2016  
 Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012).  
 (Teaching unit Optional)  
 ECTS credits: 5 Teaching languages: Catalan, Spanish

### Teaching staff

Coordinator: LUIS MIGUEL MUÑOZ MORGADO  
 Others: LUIS MIGUEL MUÑOZ MORGADO

### Prior skills

Previous knowledge on programming, control theory and automation

### Degree competences to which the subject contributes

Transversal:

1. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
2. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

### Teaching methodology

Master classes, and participative Active Learning, Learning and Projects based problems, and case study.

### Learning objectives of the subject

Understand the fundamentals of mathematical models of the robots  
 Understand the fundamentals of machine vision systems  
 Learning to program applications of computer vision  
 Learning to program robots and teleoperation tasks with robot manipulators  
 Learn the techniques associated with mobile robots and its applications

### Study load

Total learning time: 150h	Hours large group:	45h	30.00%
	Hours medium group:	0h	0.00%
	Hours small group:	15h	10.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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### Content

(ENG) -Mathematics of vision and robotics	Learning time: 1h Theory classes: 1h
<p>Description: (ENG) Spatial Transformations Quaternions Kinematics models</p> <p>Related activities: (ENG) MP1, MP2</p> <p>Specific objectives: (ENG) Knowing the mathematical tools necessary for the disciplines of robotics and vision.</p>	
(ENG) -Visió per ordinador	Learning time: 2h Theory classes: 2h
<p>Description: (ENG) Introducció a la visió per computador Adquisició i processament d'imatges Segmentació i reconeixement Visió estereoscòpica</p> <p>Related activities: (ENG) MP1, MP2</p> <p>Specific objectives: (ENG) Aprendre els fonaments dels sistemes de visió per computador i les tècniques aplicades a la robòtica.</p>	
(ENG) -Interaction and Teleoperation	Learning time: 1h Theory classes: 1h
<p>Description: (ENG) Man-Machine interaction Interface devices Teleoperation Visual and augmented reality</p> <p>Related activities: (ENG) MP1, MP2</p> <p>Specific objectives: (ENG) Aprendre els fonaments dels sistemes d'interacció persona-màquina i la Teleoperació</p>	

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(ENG) -Autonomous Robots	Learning time: 1h Theory classes: 1h
<p>Description: (ENG) Wheeled mobile robots Walking robots Planning Social robots</p> <p>Related activities: (ENG) MP1</p> <p>Specific objectives: (ENG) Learn the basics of mobile robots and autonomous planning techniques.</p>	
(ENG) -MP1 Miniproject: Autonomous navigation of a telepresence robot	Learning time: 20h Guided activities: 20h
<p>Description: (ENG) Developing an application under Matlab and National Instruments programming tools in order to make a mobile robot navigate autonomously in an unknown environment, using its own sensors and actuators in order to perform a predefined task.</p>	
(ENG) -MP2 Miniproject: Vision guided robotic manipulation	Learning time: 20h Theory classes: 20h
<p>Description: (ENG) Developing an application under Matlab and National Instruments programming tools to make an industrial robot performing a handling task autonomously assisted with computer vision.</p>	

### Qualification system

The final qualification is:

$$NF = 0,3X_{Ex} + 0,7X_{Team\ Group}$$

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### Bibliography

#### Basic:

K.S. Fu, K.S.; Gonzalez, R.C.; Lee, C.S.G. Robótica: control, detección, visión e inteligencia. Madrid: McGraw-Hill, 1988. ISBN 8476152140.

Springer handbook of robotics [Recurs electrònic] [on line]. Berlin: Springer, 2008 [Consultation: 04/03/2016]. Available on: <<http://dx.doi.org/10.1007/978-3-540-30301-5>>. ISBN 9783540239574.

Craig, John J. Introduction to robotics: mechanics and control. 3rd ed. Essex: Pearson Education, 2014. ISBN 978-1292040042.

Gómez de Gabriel, Jesús Manuel [et al.]. Teleoperación y telerrobótica. Madrid [etc.]: Pearson Education, 2006. ISBN 9788483222966.

Ollero Baturone, Aníbal. Robótica: manipuladores y robots móviles. Barcelona: Marcombo Boixareu, 2005. ISBN 8426713130.

Escalera Hueso, Arturo de la. Visión por computador: fundamentos y métodos. Madrid [etc.]: Prentice Hall, 2001.

#### Complementary:

Davies, E. R. Computer & machine vision : theory, algorithms, practicalities. 4th ed. Oxford: Elsevier, 2012. ISBN 9780123869081.