ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000392 - Intelligent virtual environments: technologies, architectures and applications

DEGREE PROGRAMME

10AK - Master Universitario en Software y Sistemas

ACADEMIC YEAR & SEMESTER

2017/18 - Semester 1

Index

Learning guide

1. Description

1.1. Subjet details

Name of the subject	103000392 - Intelligent virtual environments: technologies, architectures and applications
No of credits	4 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AK - Master Universitario en Software y Sistemas
Centre	Escuela Tecnica Superior de Ingenieros Informaticos
Academic year	2017-18

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Angelica De Antonio Jimenez (Subject coordinator)	D-3354	angelica.deantonio@upm.es	Tu - 11:00 - 13:00 F - 10:00 - 14:00

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Skills and learning outcomes *

3.1. Skills to be learned

CEM1 - Identificar, a partir del estado de la cuestión, la presencia de problemas de investigación relacionados con la concepción, la construcción, el uso y la evaluación de sistemas sociotécnicos complejos que hagan un uso intensivo de software

CEM9 - Evaluar las tecnologías más innovadoras para la interacción persona-ordenador y juzgar de manera crítica las aportaciones a los problemas de investigación relacionados

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente.

CG2 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios.

CG4 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CG7 - Especificación y realización de tareas informáticas complejas, poco definidas o no familiares

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas

CGI20 - Adquirir conocimientos científicos avanzados del campo de la informática que le permitan generar nuevas ideas dentro de una línea de investigación.

CGI23 - Capacidad de leer y comprender publicaciones dentro de su ámbito de estudio/investigación, así como su catalogación y valor científico

3.2. Learning outcomes

RA72 - Capacidad de plantear y llevar a la práctica el diseño de una investigación en el ámbito de la interacción persona?ordenador en el contexto de un entorno virtual inteligente

RA74 - Capacidad de plantear y llevar a la práctica el diseño de una investigación en el ámbito de las tecnologías y arquitecturas para entornos virtuales inteligentes

RA73 - Capacidad de plantear y llevar a la práctica el diseño de una investigación en el ámbito de las capacidades de los agentes virtuales inteligentes

RA71 - Capacidad de plantear un proyecto de construcción de un entorno virtual inteligente, estableciendo el proceso a seguir, las tecnologías a utilizar, las posibilidades de interacción a ofrecer, y el rol a desempeñar por los agentes virtuales inteligentes, y seleccionar las tecnologías, arquitecturas y herramientas más apropiadas para llevarlo a cabo

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

This subject allows deepening into Intelligent Virtual Environments as a specific kind of computer systems:

- with very peculiar characteristics regarding human computer interaction (three dimensional environments in which the user is immersed and interacts with the objects, other users and autonomous agents)
- with specific technologies that support their construction and use (Virtual Reality and Augmented Reality devices)
- with very important and promising applications that demand more research and development efforts (such as educational or design applications)
- and still with many open challenges and research opportunities for the future

The main research and development trends in the area of Intelligent Virtual Environments will be presented, with a special focus on the peculiarities of 3D interaction, the challenges associated with the design of intelligent virtual

agents, and educational applications.

4.2. Syllabus

1. Virtual Reality and Augmented Reality Technologies
   1.1. Basic Concepts in Virtual and Augmented Reality
   1.2. Devices and Technologies for Virtual and Augmented Reality
   1.3. Specific Challenges in Augmented Reality
2. Virtual Environment Development
   2.1. Tasks and Tools for the Development of a Virtual Environment
   2.2. 3D Interaction Tasks and Techniques
3. Virtual Humans
   3.1. Architecture and Components of a Virtual Human
   3.2. Perception in a Virtual Human
   3.3. The Mind of a Virtual Human
   3.4. Actuation Capabilities in a Virtual Human
4. Virtual Reality and Augmented Reality Applications
   4.1. Educational Applications: Virtual Tutors
   4.2. Industrial Applications: Design and Verification
   4.3. Applications in Culture and Entertainment

5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	**Subject Presentation** Duration: 02:00 Lecture			
2	**Chapter 1 - VR and AR Concepts** Duration: 02:00 Lecture			
3	**Chapter 1 - VR and AR Technologies** Duration: 02:00 Lecture			**Reading test in Moodle** Online test Continuous assessment and final examination Duration: 03:00
4	**Chapter 1 - Specific Challenges in AR** Duration: 02:00 Lecture			**Definition of Research Work** Individual work Continuous assessment and final examination Duration: 01:00
5	**Chapter 2 - Tasks for VE development** Duration: 02:00 Lecture			**Reading Test in Moodle** Online test Final examination Duration: 03:00 **Reading test in Moodle** Online test Continuous assessment and final examination Duration: 00:00
6	**Chapter 2 - 3D Interaction Tasks and Techniques** Duration: 02:00 Lecture			
7	**Chapter 2 - VE Development Tasks and Tools** Duration: 02:00 Lecture			**Preparation of Advance Presentation for Research Work** Individual presentation Continuous assessment Duration: 02:00
8				**Advance Presentation for Research Work** Individual presentation Continuous assessment Duration: 02:00
9	**Chapter 3 - Archiitectura and Components of a Virtual Human** Duration: 02:00 Lecture			

10	**Chapter 3 - Perception in a VH** Duration: 02:00 Lecture			**Review of the Advance Presentation of another student** Individual work Continuous assessment Duration: 02:00
11	**Chapter 3 - The Mind of a VH** Duration: 02:00 Lecture			
12	**Chapter 3 - Actuation capabilities in a VH** Duration: 02:00 Lecture			**Reading Test in Moodle** Online test Continuous assessment Duration: 03:00
13	**Chapter 4 - Educational Applications of IVEs** Duration: 02:00 Lecture			
14	**Chapter 4 - Other Applications of IVEs** Duration: 02:00 Lecture			**Preparation of Final Presentation for Research Work** Individual presentation Continuous assessment Duration: 06:00
15	**Final Presentations of Research Work** Duration: 02:00 Cooperative activities			**Final Presentation of Research Work** Individual presentation Continuous assessment and final examination Duration: 02:00
16	**Final Presentations of Research Work** Duration: 02:00 Cooperative activities			**Final Presentation of Research Work** Individual presentation Continuous assessment and final examination Duration: 02:00 **Delivery of Commented Bibliography** Individual work Continuous assessment and final examination Duration: 04:00 **Delivery of Final Report of the Research Work** Individual work Continuous assessment and final examination Duration: 42:00 **Participation in the classroom** Other assessment Continuous assessment Duration: 02:00
17				**Review of the Research Work of another student (presentation and report)** Individual work Continuous assessment Duration: 04:00 **Only Final Evaluation Exam** Written test Final examination Duration: 01:30

The independent study hours are training activities during which students should spend time on individual study or

individual assignments.

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The subject schedule is based on a previous theorical planning of the subject plan and might go to through experience some unexpected changes along throughout the academic year.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Reading test in Moodle	Online test	No Presential	03:00	5%	/ 10	CG4 CGI23
4	Definition of Research Work	Individual work	No Presential	01:00	%	/ 10	
5	Reading test in Moodle	Online test	No Presential	00:00	5%	/ 10	CG4 CGI23
7	Preparation of Advance Presentation for Research Work	Individual presentation	No Presential	02:00	%	/ 10	
8	Advance Presentation for Research Work	Individual presentation	Face-to-face	02:00	10%	/ 10	
10	Review of the Advance Presentation of another student	Individual work	No Presential	02:00	10%	/ 10	CG2 CG13 CG12 CGI23
12	Reading Test in Moodle	Online test	No Presential	03:00	5%	/ 10	CG4 CGI23
14	Preparation of Final Presentation for Research Work	Individual presentation	No Presential	06:00	%	/ 10	
15	Final Presentation of Research Work	Individual presentation	Face-to-face	02:00	7.5%	5 / 10	
16	Final Presentation of Research Work	Individual presentation	Face-to-face	02:00	7.5%	5 / 10	
16	Delivery of Commented Bibliography	Individual work	No Presential	04:00	5%	/ 10	
16	Delivery of Final Report of the Research Work	Individual work	No Presential	42:00	30%	5 / 10	CG9 CEM1 CG2 CG4 CG8 CG7 CG12 CG13 CGI20 CGI23 CEM9

16	Participation in the classroom	Other assessment	Face-to-face	02:00	5%	/ 10	
17	Review of the Research Work of another student (presentation and report)	Individual work	Face-to-face	04:00	10%	/ 10	CG2 CG12 CG13 CGI23

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Reading test in Moodle	Online test	No Presential	03:00	5%	/ 10	CG4 CGI23
4	Definition of Research Work	Individual work	No Presential	01:00	%	/ 10	
5	Reading Test in Moodle	Online test	No Presential	03:00	5%	/ 10	CG4 CGI23
5	Reading test in Moodle	Online test	No Presential	00:00	5%	/ 10	CG4 CGI23
15	Final Presentation of Research Work	Individual presentation	Face-to-face	02:00	7.5%	5 / 10	
16	Final Presentation of Research Work	Individual presentation	Face-to-face	02:00	7.5%	5 / 10	
16	Delivery of Commented Bibliography	Individual work	No Presential	04:00	5%	/ 10	
16	Delivery of Final Report of the Research Work	Individual work	No Presential	42:00	30%	5 / 10	CG9 CEM1 CG2 CG4 CG8 CG7 CG12 CG13 CGI20 CGI23 CEM9
17	Only Final Evaluation Exam	Written test	Face-to-face	01:30	35%	5 / 10	CG8 CG2 CG12 CG13 CEM9

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

The course has a theoretical and a practical side.

The theoretical part will be dealt with through lectures and the established mandatory readings. This part will be evaluated via Moodle tests.

The practical part will be evaluated via an individual work that consists on an initiation to research. Each pupil will deepen into one of the following topics:

- Virtual Reality and Augmented Reality technologies

- Interaction in Virtual Environments

- Virtual Humans and their capabilities

- Virtual Learning Environments. Virtual Tutors

- Virtual Environment Applications

Each pupil will produce a report as a result of the research work. This report should have a minimum length of 15 pages, not counting references. The report should offer a historical perspective (what has been done, and when) as well as a technical perspective (description of the main results in the area, viewpoints, contributions...). A critical approach and the identification of research opportunities will be positively valued.

The work can also consist on the design of an experimental work. In this case, an application area will be chosen, one or more interesting hypotheses should be posed, and a procedure to test the hypotheses should be designed.

For each document or paper that has been read in the preparation of the report (even if finally it was not relevant and cited in the report) a brief summary paragraph should be written. The report should include an appendix with all these summaries.

In the classroom, each pupil should perform an intermediate advance presentation of their work, aimed to describe the approach selected, the degree of advance, and the plan for the future work.

Also, at the end of the semester, each pupil should perform a final presentation of the work and the results

obtained.

On the other hand, each pupil will act as a reviewer for another pupil, being responsible for the evaluation of the written report and both oral presentations. The review work performed will also be evaluated by the instructor.

The weights for the assessment of the different activities are as follows (evaluated competences are indicated in parentheses):

- Moodle Tests: 15% (CG4, CGI23)
- Research Work: 60% (CEM1, CEM9, CG2, CG4, CG7, CG8, CG9, CG12, CG13 CGI20, CGI23), que se descompone en:
    - Intermediate advance presentation: 10%
    - Final report: 30%
    - Final Presentation: 15%
    - Bibliographic Analysis: 5%
- Reviewer Work: 20% (CG2, CG12, CG13, CGI23)
- Participation in the classroom: 5%

For students in Final Exam mode, the evaluation criteria are as follows:

Moodle Tests: 15% (CG4, CGI23)
Research Work: 50%, que se descompone en:

- Final report: 30%
- Final Presentation: 15%
- Bibliographic Analysis: 5%

Final Exam: 35% (CEM9, CG2, CG8, CG12, CG13)

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Understanding Virtual Reality: Interface, Application, and Design, William R. Sherman, Alan Craig, Morgan Kaufmann, 2003	Bibliography	
3D User Interfaces: Theory and Practice, Doug A. Bowman, Ernst Kruijff, Joseph J. LaViola, Ivan Poupyrev, Addison-Wesley Professional, 2004	Bibliography	
Cassell, J. (2001) Embodied conversational agents: representation and intelligence in user interfaces, AI Magazine, Volume 22, Issue 4, pp. 67 - 83	Bibliography	
Designing Virtual Worlds, Richard Bartle, New Riders Games, 2003	Bibliography	
Animated agents for procedural training in virtual reality: Perception, cognition and motor control. Rickel, J., Johnson, W. L. Applied Artificial Intelligence 13, 343-382, 1999	Bibliography	
Dehn, D., van Mulken, S. (2000) The impact of animated interface agents: a review of empirical research, Int. J. Human-Computer Studies, 52, 1-22	Bibliography	
Gratch, J.; Rickel, J. et al ?Creating Interactive Virtual Humans: some assembly required? IEEE Intelligent systems july/august 2002, pp.2-11.	Bibliography	

Greenhalgh, C., Benford, S. and Reynard, G., A QoS Architecture for Collaborative Virtual Environments, ACM Multimedia (MM'99), Orlando, Florida, November, 1999, ACM Press	Bibliography	
M.R. Macedonia, and M. J. Zyda: ?A Taxonomy for Networked Virtual Environments?, IEEE Multimedia, Jan-Mar, 1997, pp. 48-56.	Bibliography	
D.A. Bowman, L.F. Hodges (1997). An Evaluation of Techniques for Grabbing and Manipulating Remote Objects in Immersive Virtual Environments. Proceedings of the ACM Symposium on Interactive 3D Graphics, pp. 35-38.	Bibliography	
Sitio Moodle de la asignatura (http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2580)	Web resource	
http://electronics.howstuffworks.com/gadgets/other-gadgets/virtual-reality.htm	Web resource	
http://computer.howstuffworks.com/augmented-reality.htm	Web resource	
Ronald T. Azuma. A survey of augmented reality. Presence: Teleoperators and Virtual Environments, 6(4):355? 385, August 1997	Bibliography	
"A Taxonomy of Mixed Reality Visual Displays." IEICE Transactions on Information Systems E77-D (12): 1321-1329	Bibliography	