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804244 - RAVJ - Augmented Reality

Coordinating unit: 804 - CITM - Image Processing and Multimedia Technology Centre

Teaching unit: 804 - CITM - Image Processing and Multimedia Technology Centre

Academic year: 2019

Degree: BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: Díaz García, Jesús

Degree competences to which the subject contributes

Specific:

CEVJ 5. (ENG) Utilizar lenguajes de programación, patrones algorítmicos, estructuras de datos, herramientas visuales de programación, motores de juego y librerías para el desarrollo y prototipado de videojuegos, de cualquier género y para cualquier plataforma y dispositivo móvil.

CEVJ 6. (ENG) Analitzar, decidir i aplicar tècniques de programació gràfica, física, intel · ligència artificial, interacció, realitat augmentada i xarxes a un projecte de videojoc.

Transversal:

04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

Teaching methodology

The main topics and technologies to use are explained by the lecturer in order to allow the students to understand the state of the art of the different fields related to the subject, and to develop the practical projects proposed during the course. These projects will be developed in groups of two people during class, with the assistance of the lecturer, and autonomously by the students. Three projects are developed during the course and the obtained results must be presented at class. Sessions are expected to be as participative as possible, where students share the problems found during the resolution of activities and propose solutions/alternatives related to the topics and technologies used.

Learning objectives of the subject

- Accquire the knowledge on the state of the art and the possibilities that offer computer vision, computer graphics and virtual/augmented reality.
- Learn the different techniques to design and develop augmented reality applications.
- Learn the applications of augmented reality in the field of designing and developing video games.
- Be able to effectively combine the knowledge accquired throughout the course to develop augmented reality video games.

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Study load

Total learning time: 150h	Hours large group:	18h	12.00%
	Hours medium group:	30h	20.00%
	Hours small group:	0h	0.00%
	Guided activities:	12h	8.00%
	Self study:	90h	60.00%

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Content

Introduction

Learning time: 10h

Practical classes: 10h

Description:
Definition, evolution, applications and state of the art:
1. Computer Vision
2. Computer Graphics
3. Virtual/Augmented Reality

Computer vision: accquiring the real world

Learning time: 46h

Practical classes: 8h
Guided activities: 8h
Self study : 30h

Description:
1. Basic knowledge on computer vision
2. Image accquisition
3. Image processing
4. Introduction to the hardware/software to use

Related activities:
Project 1: image accquisition and processing

Computer graphics: creation of the virtual world

Learning time: 46h

Practical classes: 8h
Guided activities: 8h
Self study : 30h

Description:
1. Basic knowledge on computer graphics
2. Rendering of virtual elements
3. Introduction to the software to use (WebGL - Shaders)

Related activities:
Project 2: Rendering of virtual elements

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Augmented Reality: interaction of virtual elements with the real world	Learning time: 48h Practical classes: 8h Guided activities: 10h Self study : 30h

Description:
1. Development of an AR video game
2. Introduction of the software to use (Unity3D - Vuforia)

Related activities:
Project 3: augmented reality video game

Planning of activities

Project 1: image accquisition and processing	Hours: 30h Guided activities: 30h

Description:
The goal of this project is being able to accquire information from the real world and extract the features of interest for our application/video game, by using image processing algorithms.

Project 2: rendering of virtual elements	Hours: 30h Self study: 30h

Description:
The goal of this project is being able to render virtual elements by using graphic libraries and shaders.

Project 3: augmented reality videogame	Hours: 30h Self study: 30h

Description:
The goal of this project is developing an augmented reality videogame where virtual and real objects interact.

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Qualification system

3 projects:
Project 1st topic: 15% of the final mark.
Project 2nd topic: 15% of the final mark.
Project 3rd topic: 15% of the final mark.

2 exams:
Midterm exam: 15% of the final mark.
Final exam: 30% of the final mark.

Participation and learning attitude: 10% of the mark of the subject.
This part will be evaluated according to the participation of the student at class (solving exercises, proposing solutions/alternatives), the interest shown in learning the different topics and developing the projects, etc.

To pass the course, is mandatory to present in time all the projects stated before.
The students who do not pass the course, will have the possibility to do a reevaluation exam (just the 45% corresponding to the exams is evaluated and 5 will be the maximum mark of the subject).

Regulations for carrying out activities

Part of the activities will be developed at class with the assistance of the lecturer. Students should also work autonomously to finish the activities proposed during the course.

Projects will be submitted via Campus Virtual following the guidelines provided by the instructions document of each one (name of the files, etc.). Projects submitted after midnight of the specified date will be considered as NP. Any issues that do not allow the student to submitt a project in time should have a reasonable cause and must be communicated with enough anticipation to the lecturer. The evaluation of the projects does not consist just on submitting the code, but also on oral presentations when required.

Projects have to be executed at CITM, so be sure that you work with the same Unity3D version as the one provided at the center and that your projects can be executed there without errors.

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Bibliography

Basic:

Szeliski, R. Computer vision: algorithms and applications [on line]. London [etc.]: Springer, 2011 [Consultation: 19/12/2016]. Available on: <http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10421311>. ISBN 9781848829343.

Hughes, J.F. [et al.]. Computer graphics: principles and practice. 3rd ed. Addison-Wesley Longman, 2013. ISBN 9780321399526.

Schmalstieg, D.; Hollerer, T. Augmented reality: principles and practice. Addison-Wesley Longman, 2016. ISBN 9780321883575.

Akenine-Möller, T.; Haines, E.; Hoffman, N. Real-time rendering. 3rd ed. Wellesley: A K Peters, 2008. ISBN 13 9781568814247.

Complementary:

Solomon, J. Numerical algorithms: methods for computer vision, machine learning and graphics. A K Peters/CRC Press, 2015. ISBN 9781482251883.

Others resources:

Hyperlink

ACM Siggraph
http://www.siggraph.org/

VR Developers Conference
http://www.vrdconf.com/

IEEE Virtual Reality
http://ieeevr.org

Unity3D
https://unity3d.com/es

Vuforia Developer Portal
https://developer.vuforia.com/