Course guide
804244 - RAVJ - Augmented Reality

Last modified: 09/02/2025

Unit in charge: Image Processing and Multimedia Technology Centre
Teaching unit: 804 - CITM - Image Processing and Multimedia Technology Centre.

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

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, English

LECTURER

Coordinating lecturer: Fernández, Marta

Others: Fernández, Marta
Omedas, Pedro
Galvez, Marc

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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

Explanation by the teacher of the theoretical and practical concepts, which must allow the student to understand the current state and the possibilities offered by the different fields introduced in the subject, as well as carrying out the practices proposed throughout the course.

Some practices will be done individually, while the final work of the subject will be done in groups (3 to 4 people). The development of contents and some part of the practices will be carried out in class with the assistance of the teacher, while other activities will have to be carried out independently outside of class time.

The results of the final work must be presented orally. Both in the explanation of contents and in the realization of practices, it is about doing a participatory class where the student actively intervenes, asking questions and proposing solutions / alternatives in relation to the concepts and technologies used.

LEARNING OBJECTIVES OF THE SUBJECT

- Be able to design video games for interfaces based on augmented reality (AR) and immersive virtual reality (VR).
- Understand the principles of user-centered design for AR and VR, as well as the challenges and applications generated by these technologies.
- Show knowledge and be able to use libraries for the creation of video games and applications on mobile devices and/or other devices.
- To be able to design and build models that represent the necessary information for the creation and visualization of interactive images using virtual and augmented reality.
- Understand the current status and the different possibilities offered by computer graphics, computer vision systems and virtual and augmented reality.
- Understand the cognitive principles and perceptual illusions generated by AR and VR technologies.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	30,0	20.00
Guided activities	12,0	8.00
Self study	90,0	60.00
Hours large group	18,0	12.00

Total learning time: 150 h

CONTENTS

Theme 1. Introduction to AR and VR

Description:
Definition, evolution, current status and applications of augmented reality and virtual reality.

Full-or-part-time: 14h
Theory classes: 7h
Guided activities: 2h
Self study : 5h

Theme 2. Concepts, properties and effects of AR and VR

Description:
- Immersion.
- Presence.
- Embodiment.
- Agency.
- Plausibility.
- Spatiality.
- VR / AR hardware and software.

Full-or-part-time: 18h
Theory classes: 7h
Guided activities: 2h
Self study : 9h

Theme 3. Augmented Reality Video Games and Environments: Interaction Design, Mechanics, Storytelling.

Description:
- 3D User Interface (interaction techniques, selection, navigation).
- User Centered Design Principles applied to AR.
- Challenges (social interaction, relation with the physical environment, ethics).
- Mechanics.
- Storytelling.
- Genres and Typologies.

Full-or-part-time: 18h
Theory classes: 7h
Guided activities: 2h
Self study : 9h

Theme 4. Virtual Reality Video Games and Environments: Interaction Design, Mechanics, Storytelling.

Description:
- 3D User Interface (interaction, selection, manipulation and navigation techniques).
- User-Centered Design principles applied to VR.
- Challenges (level of graphic realism, simulator sickness, social interaction, multisensory feedback, ethics).
- Mechanics.
- Storytelling.
- Genres / Typologies.

Full-or-part-time: 18h
Theory classes: 7h
Guided activities: 2h
Self study : 9h

Theme 5. Prototyping and Testing

Description:
- Conceptualization and creation of a video game prototype based on VR, MR, or AR, applying all the contents explained in class.
- Application testing.

Full-or-part-time: 22h
Theory classes: 7h
Self study : 15h

ACTIVITIES

Practice 1 - Prototype Mobile AR

Description:
Development of a prototype game or application for mobile augmented reality. The delivery will be accompanied by a design/conceptualisation document. The prototype will also be presented in class.

Full-or-part-time: 25h
Self study: 25h

Practice 2 - Final Project (MR, VR, AR Prototype)

Description:
Conceptualization and prototyping of a video game based on MR, VR or AR, collecting aspects of game design and all the concepts seen throughout the course. The supervision of the project will be carried out by milestones:

- Conceptualization and planning
- Presentation and review of the provisional prototype
- Presentation of the prototype

Full-or-part-time: 44h
Guided activities: 4h
Self study: 40h

GRADING SYSTEM

- Assignment 1 (Prototype Mobile Augmented Reality): 30%

- Midterm Exam: 20%

- Assignment 2 (Prototype Video Game AR / MR/ VR): 40%. Three milestones:
- Milestone 1: Conceptualization and design, 10%
- Milestone 2: Submission and technical review of the provisional prototype, 10%
- Milestone 3: Submission and presentation of the final prototype, 20%

- Participation and attitude towards learning: 10%

Students' participation and learning attitude will be evaluated by monitoring their interventions in class and the interest shown during the course. This evaluation equals 10% of the final grade.

Students who do not pass the course during the continuous assessment may take the re-assessment (only the 20% corresponding to the midterm exam will be assessed, being 5 the maximum mark that can be obtained in the course).

Irregular actions that may lead to a significant variation of the grade of one or more students constitute a fraudulent performance of an evaluation act. This action entails the descriptive grade of failure and a numerical grade of 0 for the ordinary global evaluation of the course, without the right to re-evaluation.

If the lecturers have indications of the use of AI tools not allowed in the evaluation tests, they may summon the students concerned to an oral test or a meeting to verify the authorship.

EXAMINATION RULES.

- The activities, once completed, must be delivered to the Virtual Campus in the corresponding delivery and on the corresponding date.

- The evaluation of the activities does not only imply the resolution of the same, but also the presentation of the results (when the student or the group is required to do so during the classes).

- The documents must be completed following the instructions given therein, especially with regard to the file names and the content structure. The correct management of the documentation provided is an aspect related to the skills to be acquired and is, therefore, subject to evaluation.

BIBLIOGRAPHY

Basic:
- Geroimenko, Vladimir . Augmented Reality Games II: The Gamification of Education, Medicine and Art. Cham: Springer, 2019. ISBN 978-3-030-15619-0.
- Jerald, Jason. The VR book : human-centered design for virtual reality . [s.l.] : ACM Books , 2016. ISBN 978-1-97000-112-9.
- Murray, Janet Horowitz. Hamlet en la holocubierta : el futuro de la narrativa en el ciberespacio . Barcelona [etc.] : Paidós, cop. 1999. ISBN 8449307651.
- Bolter, David; Engber, Maria. Reality media: augmented and virtual reality. The MIT Press, 2021.
- Fisher, Joshua. Augmented and mixed reality for communities. CRC Press, 2021.

RESOURCES

Hyperlink:
- ACM Siggraph. http://www.siggraph.org/- IEEE Virtual Reality. http://ieeevr.org- Unity3D. https://unity3d.com/es- Vuforia Developer Portal. https://developer.vuforia.com/

Other resources:
Scientific Papers:

Azmandian, M., Hancock, M., Benko, H., Ofek, E., & Wilson, A. D. (2016). Haptic retargeting: Dynamic repurposing of passive haptics for enhanced virtual reality experiences. Conference on Human Factors in Computing Systems - Proceedings, 1968–1979.

Azuma, R. (2015). Location-based mixed and augmented reality storytelling. Fundamentals of Wearable Computers and Augmented Reality, CRC Press, 259-276.

Dube, T. J., & Arif, A. S. (2019). Text Entry in Virtual Reality: A Comprehensive Review of the Literature. Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 11567 LNCS, 419–437.

DuÅ¼maÅ□ska, N., Strojny, P., & Strojny, A. (2018). Can Simulator Sickness Be Avoided? A Review on Temporal Aspects of Simulator Sickness. Frontiers in Psychology, 9(NOV), 2132.

Fernández, M; Ruiz-Torres, D. y Puente, H. (2023). Environmental Visualization and Exploration in Mobile Augmented Reality Games: Redefining the Spatial Affordances. Interaction Design & Architecture, 56, pp. 69 – 88. DOI: 10.55612/s-5002-056-004

Kilteni, K., Bergstrom, I., & Slater, M. (2013). Drumming in immersive virtual reality: The body shapes the way we play. IEEE Transactions on Visualization and Computer Graphics, 19(4), 597–605.

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Kim, M. (2013). A framework for context immersion in mobile augmented reality. Automation in construction, 33, 79-85.

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Kruijff, E., Swan, E., Feiner, S. (2010). Perceptual issues in augmented reality revisited. 2010 IEEE International Symposium on Mixed and Augmented Reality.

Manovich, L. (2005). The poetics of augmented space.

Rakkolainen, I., Farooq, A., Kangas, J., Hakulinen, J., Rantala, J., Turunen, M. y Raisamo, R. (2021). Technologies for Multimodal Interaction in Extended Reality—A Scoping Review. Multimodal Technologies and Interaction, 5 (81).

Seinfeld, S., Feuchtner, T., Maselli, A., & Müller, J. (2020). User Representations in Human-Computer Interaction. Human-Computer

Interaction.

Seinfeld, S., & Müller, J. (2020). Impact of visuomotor feedback on the embodiment of virtual hands detached from the body. Scientific Reports, 10(1), 1–15.

Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1535), 3549–3557.

Slater, M., Gonzalez-Liencres, C., Haggard, P., Vinkers, C., Gregory-Clarke, R., Jelley, S., Watson, Z., Breen, G., Schwarz, R., Steptoe, W., Szostak, D., Halan, S., Fox, D., & Silver, J. (2020). The Ethics of Realism in Virtual and Augmented Reality. Frontiers in Virtual Reality, 1, 1.

Slater, M., & Sanchez-Vives, M. V. (2016). Enhancing our lives with immersive virtual reality. In Frontiers Robotics AI (Vol. 3, Issue DEC, p. 74). Frontiers Media S.A.

Skarbez, R., Neyret, S., Brooks, F. P., Slater, M., & Whitton, M. C. (2017). A psychophysical experiment regarding components of the plausibility illusion. IEEE transactions on visualization and computer graphics, 23(4), 1369-1378.

Wetzel, R., McCall, R., Braun, A. K., & Broll, W. (2008). Guidelines for designing augmented reality games. ACM Future Play 2008 International Academic Conference on the Future of Game Design and Technology, Future Play: Research, Play, Share, 173–180.

Zollmann, S., Langlotz, T., Grasset, R., Hong Lo, W., Mori, S. & Regenbrech, H. (2021). Visualization Techniques in Augmented Reality: A Taxonomy, Methods and Patterns. IEEE Transactions on Visualization and Computer Graphics, Vol 27 (9), 3808 - 3825.