GUÍAS DOCENTES

Universidad de Jaén

School of Engineering of Linares

Virtual reality

2024-2025

Máster Universitario en Industria Conectada

Acceso Mayores 40
Guías docentes UJA
Horarios de tutorías
Llamamientos PAU
Movilidad (Coordinador)
P.O.D.
Solicitud bilingüismo

Syllabus 2024-25 - 78412005 - Virtual Reality (Realidad virtual)

Caption
- Level 1: Tutorial support sessions, materials and exams in this language
- Level 2: Tutorial support sessions, materials, exams and seminars in this language
- Level 3: Tutorial support sessions, materials, exams, seminars and regular lectures in this language

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DEGREE: Máster Univ. en Industria conectada
FACULTY: SCHOOL OF ENGINEERING OF LINARES
ACADEMIC YEAR: 2024-25
COURSE: Virtual Reality

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Virtual Reality
CODE: 78412005 ACADEMIC YEAR: 2024-25
LANGUAGE: English LEVEL: 2
ECTS CREDITS: 4.0 YEAR: 1 SEMESTER: PC

2. LECTURER BASIC INFORMATION

NAME: VICIANA ABAD, RAQUEL
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FIELD OF STUDY: 560 - INGENIERÍA TELEMÁTICA
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LANGUAGE: - LEVEL: 2

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DEPARTMENT: -
FIELD OF STUDY: -
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WEBSITE: -
LANGUAGE: English LEVEL: 1

3. CONTENT DESCRIPTION

The course is based on the analysis of the main technologies that allow the development of virtual environments in the field of industry. Knowing the scope of their use, both in relation to the development of training simulators and emulators of industry procedures. Familiarization with the bi-directional multimodal flow typical of applications based on virtual and augmented reality. Creation of visual, auditory and/or haptic models to enrich the system's output flow. Analyze and know the possible inputs to an advanced virtual reality system through the study of different peripherals, which allow the location of a person, the detection of gestures made or force applied, etc. To analyse the different applications in which advanced virtual reality technologies can be integrated in the field of industry. In addition, activities will be incorporated such as the viewing of descriptive videos, web pages of developer companies, and research results that train the student to existing proposals and technological innovations in science and technology.

This content is developed through theoretical topics and practical activities described below:

Theory block

1. Introduction to Augmented Reality and Virtual Reality technologies

1.1 Types and evolution of technologies.

1.2 Use in different fields.

2. Graphic environments and tools.

2.1 Basic concepts. Rendering, views, textures, materials, lighting.

2.2 Representation based on node hierarchies.

2.3 Construction of geometries. Basic operations.

2.4 Basic properties: color, material, textures and lighting.

2.5 Interaction mechanisms. Development of a GUI with basic interaction (keyboard, mouse). Collision detection.

2.6 Special aspects. Import of 3D models, animation, LOD.

2.7 Virtualization and Augmented Reality.

2.8 Development tools.

3. Output information modeling.

3.1 Visual interaction. Stereoscopy and synchronization between real and virtual worlds in augmented reality.

3.2 Audio programming for interactive applications. Basic concepts of audio and physiology of the ear. Spatial audio and sound in Unity. Effects tools and sound engines (FMOD).

3.3 Haptic modeling. Basic concepts of proprioceptive and tactile stimulation. Haptic rendering, texture simulation, deformation simulation.

4. Advanced input/output devices.

4.1 Visualization devices.

4.2 Position sensors. From magnetic to infrared trackers (Kinect, LeapMotion).

4.3 Haptic devices. From mice with piezoelectric stimulators to Phantoms and/or robotic arms.

5. **Virtual reality applications in the industry.**

5.1 Training simulators.

5.2 Other applications (emulators)

Practical block

P1 (Associated with Unit 2). Basic creation and rendering of a 3D object. Developing a basic 3D object or importing a model (blender or 3Dstudio) into Ogre or Unity.

P2 (Associated to Unit 3). Incorporating interaction to the model created in P2. Simulate the pulsation or displacement of an object and incorporate sound and/or visual feedback.

P3 (Associated to Unit 4). Incorporate realism to the model created in P2. Add haptic information regarding texture and/or deformations of an object and or piece. Incorporate visual information (shadows, light and stereoscopic parameters) to make a piece or object more realistic.

P4 (Associated to Unit 4). Incorporate binaural auditory information to give auditory realism to the interaction with objects or sound environments.

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

Throughout all the activities of the course, attention will be paid to two fundamental aspects in relation to inclusion and equity (SDG-4), which will also be part of the participation aspect evaluation:

- Promoting the use of inclusive language in both large and small group lectures, both written and oral, and attending to activities of various kinds (lectures and seminars where the student can be the instructor, practice with hardware and software, reports and tests with multiple choice questions) focused on being equitable with the different learning abilities of the student.
- Attendance, as well as active, respectful and responsible participation, either to raise doubts or to respond to the teacher's requests or questions, will be evaluated positively in its corresponding factor.

This course also encourages innovation in various areas of industry through the use of technologies associated with simulation and interaction supported by the use of virtual reality. This activity seeks to respond to the objective of 'Building resilient infrastructures, promoting sustainable industrialisation and fostering innovation' (SDG9).

Lectures in large groups:

Students must follow the lecturer's presentation with the material provided for this purpose through the PLATEA platform, whether notes or slides, which must be completed with their own notes and with the subsequent review of the basic and/or recommended bibliography. The activity consists of:

- Introductory activities, lectures on theoretical content and practical aspects (CB6, CG1MIC, CG3MIC, CG4MIC, E11MIC).

- Analysis of case studies related to the theory syllabus, as well as seminars on relevant contents for the practical sessions (CB10, CT3, E11MIC).

During these sessions, students will be able to analyse new technologies and their application to current professional contexts. In addition, debate and reflection on the implications of the use of virtual reality technologies in industry will be encouraged, taking into account the needs of both the employer and the end user (CB9, CG1MIC, CCG4MIC, CT5, E12MIC).

Classes in practical groups:

Small group classes will be instrumented through working sessions in the laboratory, in which mainly Unity 3D software will be used and some of the available virtual reality devices will be described and used.

The activities to be carried out are focused on the development of a project in Unity, in whose initial phases (practices P1, P2, P3, P4) a supervised guideline will be followed. Afterwards, a project-based learning phase will be follow in which students must select between different options for the development and simulation of a virtual environment (CB6, CB7, CB8, CB9, CT4, CT5, E11MIC, E12MIC).

Students will be encouraged to acquire the ability to adapt to the technological changes that occur, which in the field of Virtual Reality concerns both the existence of new devices and the evolution of development tools (P1 and P4, software installations and use/testing of devices) (CG1MIC, E12MIC).

With regard to the autonomous work, in addition to the previous work, this will focus on the preparation of the documentation to be handed in for each practical, as well as on completing the work started in the laboratory and which could not be finished in the corresponding session. Special emphasis will be placed on the need for continuous training and to undertake this activity independently throughout their professional life, as well as on the ability to keep up to date with new developments in the field of Virtual Reality, taking a more technical approach.

Group/individual tutorials

In addition to resolving specific doubts, tutorials will be used to actively monitor and validate the delivery of the practices and the final project, in addition to talks, conferences, workshops and/or seminars, designated by the lecturer, with the aim of completing and updating training and obtaining general, transversal and/or specific competences defined for this activity, such as the value of continuous training, entrepreneurship or the review of technological innovations in the field.

Students with special educational needs should contact the Student Attention Service (Servicio de Atención y Ayudas al Estudiante) in order to receive the appropriate academic support

5. ASSESSMENT METHODOLOGY

The course will follow a format of continuous evaluation, although at the end of the course, on the date set by the centre, a written test will be taken on part of the theoretical and practical contents of the course.

The competences contemplated in the subject (CB10, CB6, CB7, CB8, CB9, CG1M1C, CG3MIC, CT3, CT4, E11MIC, E12MIC) will be assessed according to the following outcomes.

The aspects considered in the evaluation system are:

- **Attendance to face-to-face and/or virtual activities (S1-10 %):**
  - Attendance sheets in theory and practice (RB8): 5 %.
  - Participation (RB8, RBG9, RGEMIC, RT3 and GDS-4): 5 %. Notes on active participation.
- **Examination on the theoretical and practical concepts of the subject (S2-30 %):**
  - Evaluation with multiple-choice tests at the end of each unit (RB8, RE14MIC, RG4MIC): 10 %.
  - Evaluation with a final exam of theoretical and practical contents (RB8, RE14MIC, RG4MIC): 20%.
- **Performance of works, cases or practical exercises (S3-30 %)**
  - Development and delivery of guided practices (RB7, RE15MIC, RG1MIC, RT4): 10%
  - Development and delivery of proposed activities (RB7, RE15MIC, RG1MIC, RG3MIC, RT3, RT4): 20 %
- **Participation in face-to-face and/or virtual activities (S4- 30 %)**
  - Delivery of documentation associated with the implementation of projects (RB10, RB6, RB7b, RB7c, RG1MIC): 20 %
  - Presentation of proposals and results (RB10, RB6,RB7b, Rb7c, RB9, RG3MIC, RT3, RT4, RT5): 10%

More than a 4.0 must be obtained in each of the aspects assessed in order to be included on the average. The course will be considered passed when a 5.0 average mark is reached among all the activities.

6. BOOKLIST (Access the bibliography in the Library catalog)

MAIN BOOKLIST:

- Augmented reality for developers : build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia Jonathan Linowes, Krystian Babilinski.. Edition: -. Author: Linowes, Jonathan, author.. Publisher: Packt.
  - **Notes**: Unit 3

(Library)

- Learning virtual reality : developing immersive experiences and applications for desktop, web, and mobile Tony Parisi.. Edition: First edition.. Author: Parisi, Tony, author.. Publisher: O'Reilly (Library)

7. SUSTAINABLE DEVELOPMENT GOALS

Educación de calidad

Industria, innovación e infraestructura

DETAILED INFORMATION

Goal 4. Quality education

Throughout all the activities of the course, fundamental aspects in relation to inclusion and equity will be addressed, which will also be part of the evaluation of the participation aspects. Thus, it will be promoted, both in large group expository classes, as well as in small groups, to use inclusive language both at the written and oral level and to attend to activities of various kinds focused on being equitable with the different learning capacities of the student.

Furthermore, on the one hand, in large group classes the ability to collect and interpret data and handle complex concepts in the field of Virtual Reality will be developed and enhanced, to make judgments that involve reflection on ethical and social issues. On the other hand, in small group classes special emphasis will be placed on the need for continuous training and undertaking this activity independently throughout one's professional life, as well as the ability to stay up to date with new developments. in the field of incorporating VR in the Industry, taking a more technical approach.

Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation

Through the activities of this subject in large and small group classes, special emphasis is placed on the fact that Information Technology systems and services must be developed, implemented and maintained in a way that achieves resilient and robust industrialization, as well as as sustainable.

Furthermore, both with the training of content, abilities, skills and abilities, and with the development of the activities proposed to the students, personal initiative and the ability to solve problems autonomously are promoted in order to encourage innovation as a driving force for industrial development, especially in the field of new technologies usage in the industry, as well as a wealth-generating element of a society.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

Teaching methodology and learning activities

Learning activities	Format	Teaching methodology Description
A53. Theoretical Activities: - M1 - Master classes - M345 - Presentation of theory and general examples - M789 - Introductory activities	100% in the classroom	Participatory master class sessions, lasting two hours each, held in the classroom.
A54 -Practical activities: debates and seminars - M101 - Discussions, seminars, etc	100% in the classroom	Development of practical sessions, lasting two hours each, in laboratories.

Schedule

The schedule can vary mainly due to the change from multi-modal scenario to the online one.

Evaluation system

There are no changes in the evaluation format (weights of each section) or in what is specified in the detailed evaluation.

Since the evaluation of the course is continuous, there will only be one exam on the more theoretical contents S2:

Ordinary exam

Evaluation	Format	Description	Percentage
Final exam evaluation	Classroom	Multiple-choice and/or short-question exam to be taken on the date set by the centre.	S2: 20%

Extraordinary exam

Evaluation	Format	Description	Percentage
Final exam evaluation	Classroom	Multiple-choice and/or short-question exam to be taken on the date set by the centre.	S2: 20%

Resources

Given that the attendance in the large group lectures and in the classes in practice groups is 100%, no exceptional resources are foreseen for them.

9. VIRTUAL TEACHING SCENARIO

Teaching methodology and learning activities

Learning activities	Format	Teaching methodology Description
A53. Theoretical Activities: - M1 - Master classes - M345 - Presentation of theory and general examples - M789 - Introductory activities	100% online	Participatory master class sessions, lasting two hours each, held in the classroom.
A54 -Practical activities: debates and seminars - M101 - Discussions, seminars, etc	100% online	Development of practical sessions, lasting two hours each, in laboratories.

Schedule

The schedule can vary mainly due to the change from multi-modal scenario to the online one.

Evaluation system

There are no changes in the evaluation format (weights of each section) or in what is specified in the detailed evaluation.

Since the evaluation of the course is continuous, there will only be one exam on the more theoretical contents S2:

Ordinary exam

Evaluation	Format	Description	Percentage
Final exam evaluation	Online	Multiple-choice and/or short-question exam to be taken on the date set by the centre.	S2: 20%

Extraordinary exam

Evaluation	Format	Description	Percentage
Final exam evaluation	Online	Multiple-choice and/or short-question exam to be taken on the date set by the centre.	S2: 20%

Resources

Since all the teaching, either in the exposition classes in large groups or in the classes in practice groups, be taught online, the following resources will need to be used:

Common informatic resources (lecturers and students):

- PC equipment or similar.
- Videoconference system or virtual classroom, such as Google Meet or BigBlueButton.
- Use of interactive tools: screen sharing to use comments as a virtual whiteboard in PDF presentations.
- Use of the teaching platform of the University of Jaén: messaging, forums, tasks, activities and means of evaluation.

DATA PROTECTION CLAUSE (on line exams)

Institution in charge of data processing: Universidad de Jaén, Campus Las Lagunillas, s/n, 23071 Jaén

Data Protection Delegate: dpo@ujaen.es

Purpose: In accordance with the Universities Law and other national and regional regulations in force, carrying out exams and assessment tests corresponding to the courses students are registered in. In order to avoid frauds while sitting the exam, the exam will be answered using a videoconference system, being able the academic staff of the University of Jaén to compare and contrast the image of the person who is answering the exam with the student's photographic files. Likewise, in order to provide the exam with evidential content for revisions or claims, in accordance with current regulation frameworks, the exam will be recorded and stored.

Legitimacy: compliance with legal obligations (Universities Law) and other national and regional regulations currently in force.

Addressees: service providers who are the owners of the platforms where the exams are carried out and with whom the University of Jaén has signed the corresponding data access contracts.

Storage periods: those established in current in force regulations. In the specific case of exam videoconference recordings, not before the examination records and transcripts are closed or the exam can still be reviewed or challenged.

Rights: you can exercise your right of access, amendment, cancellation, opposition, suppression, limitation and portability by sending a letter to the postal or electronic address indicated above. In the event that you consider that your rights have been violated, you may submit a complaint to the Andalusian Council for Transparency and Data Protection www.ctpdandalucia.es

CLASS RECORDING CLAUSE PERSONAL DATA PROTECTION

Person in charge: Universidad de Jaén, Paraje Las Lagunillas, s/n; Tel.953 212121; www.ujaen.es

Data protection delegate (DPO): TELEFÓNICA, S.A.U. ; Email: dpo@ujaen.es

Procedure aim: To manage proper recordings of teaching sessions with the aim of facilitating learning process under a multimodal and/or online teaching

Period for record storage: Images will be kept during legal term according to regulations in force

Legitimacy: Data will be managed according to legal regulations (Organic Law 6/2001, December 21, on Universities) and given consent provided by selecting corresponding box in legal admission documents

Data recipients (transfers or assignments): Any person allowed to get access to every teaching modality

Rights: You may exercise your rights of access, rectification, cancellation, portability, limitation of processing, deletion or, where appropriate, opposition. To exercise these rights, you must submit a written request to the Information, Registration and Electronic Administration Service of the University of Jaen at the address above, or by e-mail to the address above. You must specify which of these rights you are requesting to be satisfied and, at the same time, you must attach a photocopy of your ID card or equivalent identification document. In case you act through a representative, legal or voluntary, you must also provide a document that proves this representation and identification. Likewise, if you consider that your right to personal data protection has been violated, you may file a complaint with the Andalusian Data Protection and Transparency Council www.ctpdandalucia.es