WELCOME

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Virtual and Augmented Reality

RVA - 2025/2026

The Team

universidade de aveiro | deti departamento de electrónica, telecomunicações e informática | ieeta

- Professors from DETI
- Researchers at IEETA
- Enthusiasts of Virtual, Augmented, Mixed & eXtended Reality (VR/AR/MR/XR)

- Bernardo Marques - bernardo.marques@ua.pt
- Beatriz Sousa Santos - bss@ua.pt
- Paulo Dias - paulo.dias@ua.pt

Some History

2013
1st Edition

2016
Introduction
of Unity

2020
Pandemic

2022
VAR Lab
Research Group

2023
10th Edition

2025
Best Paper Award
Ordem dos Engenheiros

Let's create
new memories

Topics

- Introduction to Extended Reality (XR): Virtual Reality (VR) Augmented (AR) and Mixed Reality (MR)
- Definition, historical perspective, evolution, and applications
- Frameworks for XR
- Input and output devices, tracking
- 3D user interfaces and interaction techniques
- Human-Centered Design for XR
- Human factors in XR
- Evaluation of XR applications
- Traditional and emerging applications

Main Bibliography

- Jerald, J., The VR Book: Human-Centered Design for Virtual Reality, ACM and Morgan & Claypool, 2016
- LaValle, S., Virtual Reality - Virtual Reality. Cambridge University Press, 2023
- LaViola, J., Kruijff, E., McMaha, R., Bowman, D, Poupyrev, I. J., 3D User Interfaces: Theory and Practice, 2nd ed., Addison Wesley, 2017
- Schmalstieg, D., Hollerer, T., Augmented Reality: Principles and Practice (Usability). Addison-Wesley Professional, 2016
- Miguel Melo, Maximino Bessa, José Vasconcelos-Raposo, Introdução à Realidade Virtual - Conceitos e Aplicações. FCA, 2024

Lectures and Practical Classes

- Theoretical Lecture:
  - Invited talk
  - Paper presentation and discussion
- Practical sessions
- 3 sessions devoted to presentation and demo of the mini-projects (follow up and final presentations)
- All materials will appear in Elearning > RVA

Lectures and Practical Classes - Tentative Schedule

1	(Sep/16)	Introduction to the course, syllabus, assessment, bibliography, paper presentation guideline Homework: Install and star exploring Unity | Creation of student groups - Decide on a paper to present
2	(Sep/23)	T - Introduction to XR (VR, AR and MR) P - Works from previous years; Presentation of mini-projects list Homework: Decide on a mini-project
3	(Sep/30)	Research work at VAR Lab and visit to the laboratory with demos
4	(Oct/ 7)	T - Human Centered Design for XR P - Mini-project selection; Familiarization with Unity Homework: Start designing mini-project
5	(Oct/14)	T - Input devices and trackers / Paper presentation P - Designing and conceptualization of mini-project
6	(Oct/21)	T - Input devices and trackers P - Mid-term presentation (Submit slides)
7	(Oct/28)	T - Interaction in XR / Paper presentation P - Mini-project Development

Lectures and Practical Classes - Tentative Schedule

8 (Nov/ 4)	T - Invited Talk (To be defined) / Paper presentation P - Mini-project Development
9 (Nov/11)	T - Human Factors for XR / Paper presentations P - Mini-project Development
10 (Nov/18)	T - Human Factors for XR / Paper presentation P - Mini-project follow-up
11 (Nov/25)	T - Output devices / Paper presentation P - Mini-project Development
12 (Dec/ 2)	T - Evaluation in XR / Paper presentation P - Mini-project Development
13 (Dec/10)	T - Invited Talk (To be defined) / Paper presentation P - Mini-project Development
14 (Dec/16)	T - Paper presentation P - Mini-project follow-up

Assessment

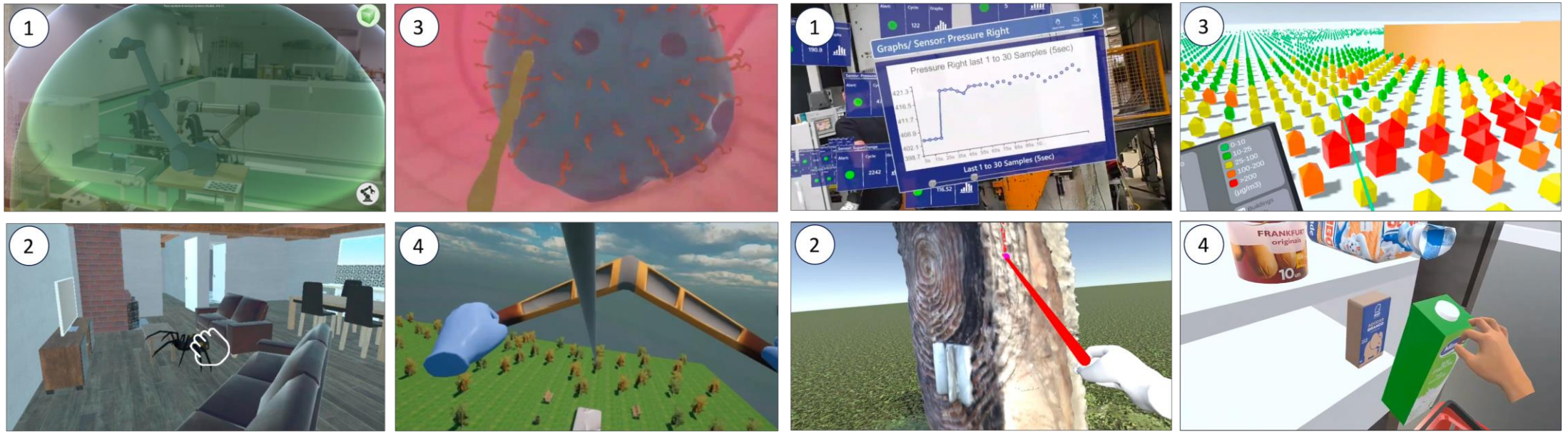
- Exam – 30%
- Mini-project – 60% (20% + 40%)
  - Project Based Learning (PBL)
  - (Final presentation on the day of the Exam)
- Paper presentation and discussion – 10%
- Working students must contact us until October 3 about the assessment!

Assessment – Practical component

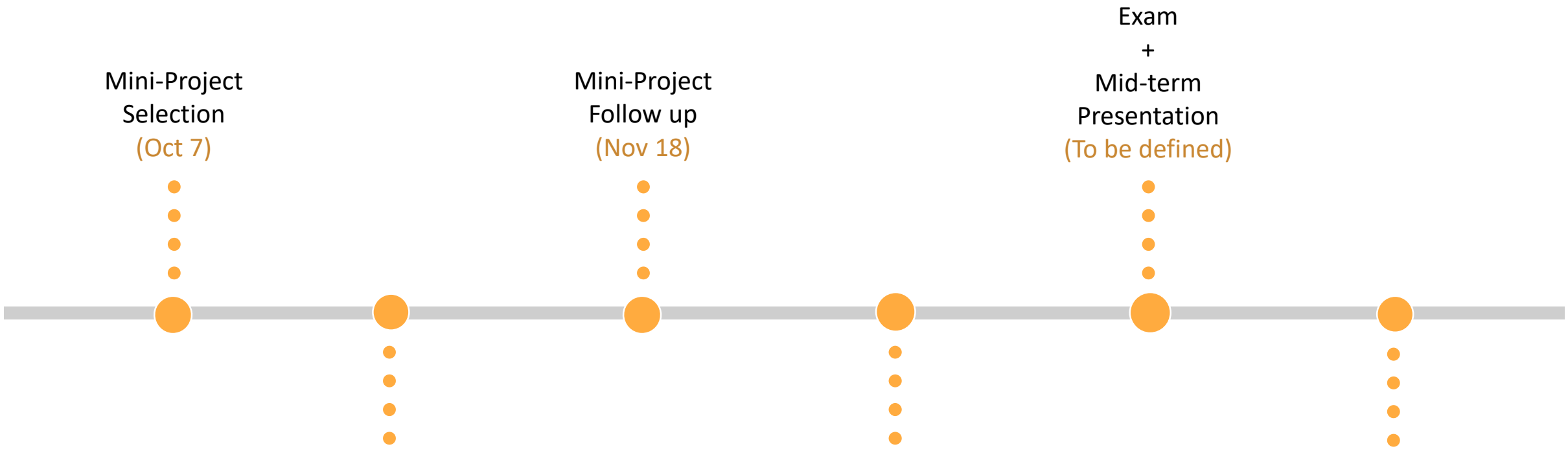
- Groups of two students
- Development of a simple XR application using a Human-Centered Design approach
- Mini-project Selection:
  - Chosen from a list of project we will provide
  - Proposed by the group based on MSc Diss topic or personal interests
- Hardware will be provided accordingly

Assessment – Practical component

- We will show you some examples of past works in the next classes…



Assessment – Practical component – Overview



There will be a lunch for everyone!

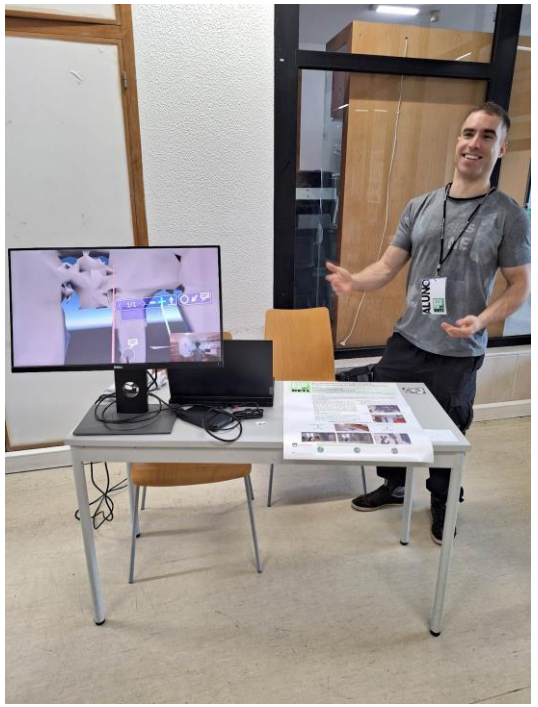
Some Hardware Available

Suggested Development Tool

Unity

During classes, you may also be invited to…

- Participate in testing of XR applications currently being developed by other students/researchers …



Paper/Framework Presentation

Analyze and present a conference/journal paper or an XR framework

Bring your preferences to propose until September 23

- Group of 2 students - Make a 20min presentation
- Paper Selection:
  - A list of interesting papers will be made available at Moodle
  - Groups may choose their own paper according to their personal interests
- Alternative: You may select an XR framework to present!
- Guidelines for the presentation will be available at Moodle
- Send slides to bernardo.marques@ua.pt and bss@ua.pt

Paper Presentation

- Conferences:
  - IEEE VR; ISMAR; UIST; SUI; MUM; VRST; Eurographics; ISS; IMX; ICAT-EGVE; CSCW; CHI; Mobile HCI; among others.
- Journals:
  - IEEE Transactions on Visualization and Computer Graphics; Virtual Reality; Computer and Graphics; Multimedia Tools and Applications; IEEE Computer Graphics and Applications; International Journal of Human Computer Interaction; International Journal of Advanced Manufacturing Technology; Computers in Industry; among others (Avoid articles from MDPI).
- Tools you may use to search: Google Scholar; Scopus, Scimago (journals only), etc.
- Contact us if you have questions regarding the suitability of a paper

Alternative presentations

- Auditory perception in XR
- Haptics or smell interfaces in XR
- Human-Robot Collaboration
- Applications of AI in XR use-cases
- Ethics, privacy and security in XR

- Advanced features of Unity
- An emerging XR equipment

- Or other relevant topics…

Presentation discussion

- After each talk:
  - You must be prepared to discuss the topic with the class
  - Engagement/questions by students are encouraged
  - All students will vote on each other presentations – link will be at Moodle

In 2 weeks

- Visit the VAR Lab installations – Who are we and what we do? + Demonstrations of XR applications

- You should appear at the beginning of next class in Building 24 – IEETA

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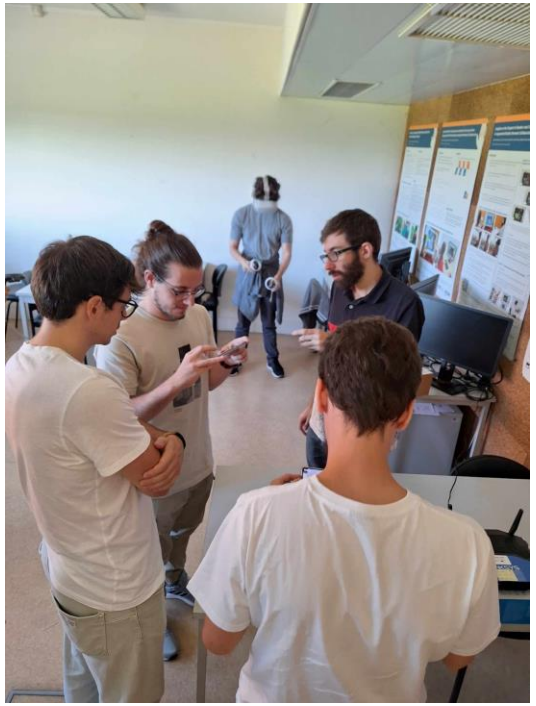

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Before we finish

- Questions?
- Let’s talk about You – Why this class?
- Who want to present and discuss a paper on **October 14th**?

THE END

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