

An Overview of Teaching a Virtual and Augmented Reality Course at Postgraduate Level for Ten Years

Bernardo Marques,
Beatriz Sousa Santos,
Paulo Dias

VARLab
IEETA, DETI, LASI,
University of Aveiro
Portugal



universidade
de aveiro

deti

departamento de electrónica,
telecomunicações e informática



ieeta



- Virtual and Augmented Reality (VR/AR) is **becoming more affordable and applicable**;
- Developing such applications **demands specific skills**;
- **Often missing** from CSE programs.

- **Course goals:**
 - Introduce fundamental principles, methods, and tools of VR/AR;
 - Provide necessary knowledge to comprehend, design, implement, and assess applications ...

- **10 Editions** – ~200 students - different backgrounds/programming skills;
- Lectured to multiple Master programs, including Erasmus Students;
- Has become a popular elective course at our department;
- Homogenization needed concerning graphics libraries, interaction;
- Invited speakers (practitioners/researchers).



- 15 three-hour weekly classes:
 - lectures + paper presentations/discussions + Lab (mini-project);
- Assessment: mini-project + test + paper presentation;
- Groups of 2 students – Topics selected by students:
 - Mini-project & paper presentation.

Syllabus has been evolving...

- Introduction to VR, AR (and other realities) and applications
- Human-Centered Design
- Input / Output Devices
- Human Factors
- Interaction
- Evaluation
- Guidelines

for VR/AR

2013 → 2023

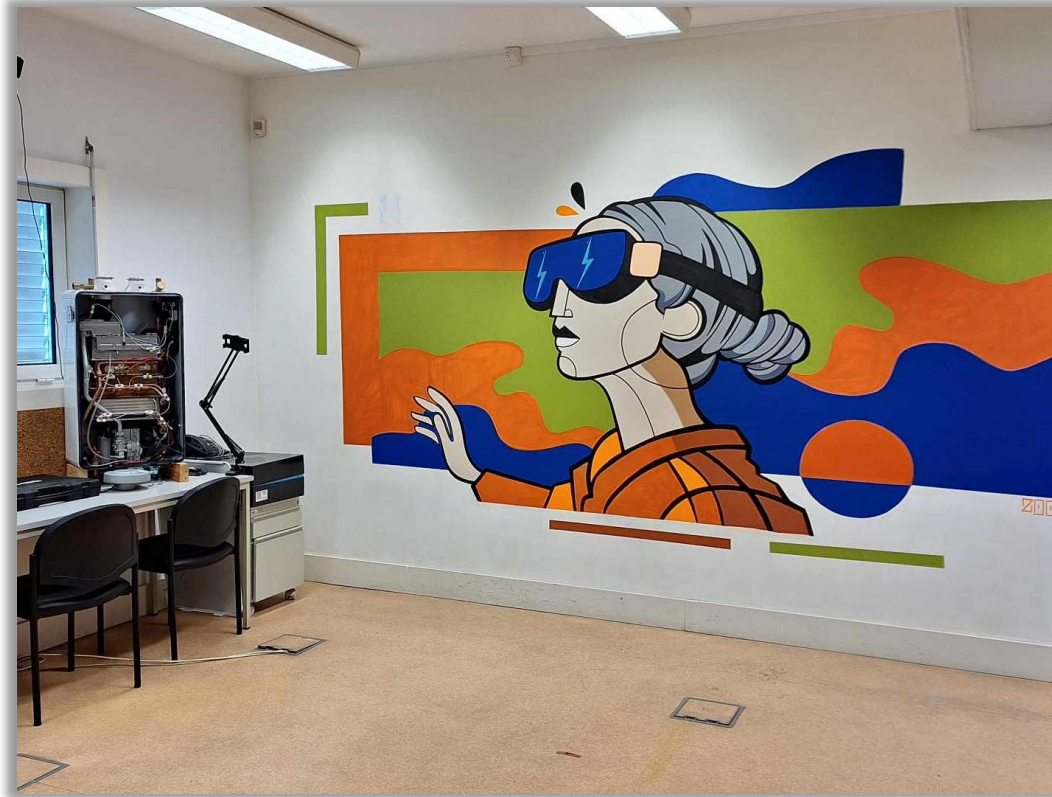
❖ Graphics -> HCD system/app design

- Selected from **recent conferences/journals**
(ECVE, IEEE VR, ISMAR, VRST, CGF, C&G, VR,TVCG, etc.)
- Provide access to **cutting-edge research**;
- Aligned with:
Dissertation, practical projects,
or personal preferences



- Students work on their projects;
 - Present/discuss their ideas and get help to overcome difficulties.
- **Mini-project: Develop a VR/AR application using a HCD approach;**
- **1st part** - propose/select a project and **conceptualize**:
 - Mid-term-presentation: Vision and requirement analysis
(personas, scenarios, storyboards, H/W, possible constraints)

- **2nd part** - develop the application,
find/create 3D models,
build Virtual Environment,
include animations, sound...
- Navigation/manipulation;
- Integrate all SDKs and libraries;
- Test;
Using Unity or other game engine.



Free access,

Take home if possible:

Oculus Quest 2, HTC VIVE,

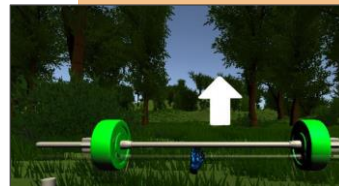
Microsoft HoloLens 2,

Mobile devices, Cameras ...





First Prototypes



Introducing Unity

First prototypes:

Focused on modelling the VE

Simple interaction

HMD + simple interaction devices

Time consuming ...

Introducing Unity:

More sophisticated VE and interaction

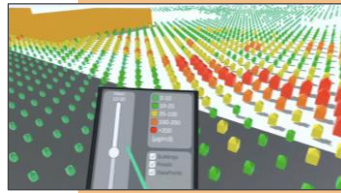
Improved immersive experiences

External collaborations

...



During the Pandemic



Recent years

During the pandemic:

Real challenge!

Remote classes

Students' own / borrowed devices

Remote tests & hygiene issues

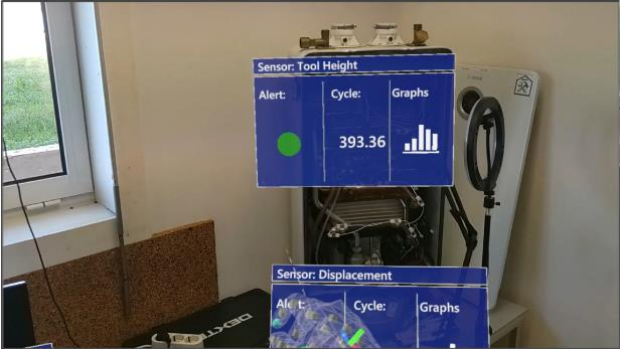
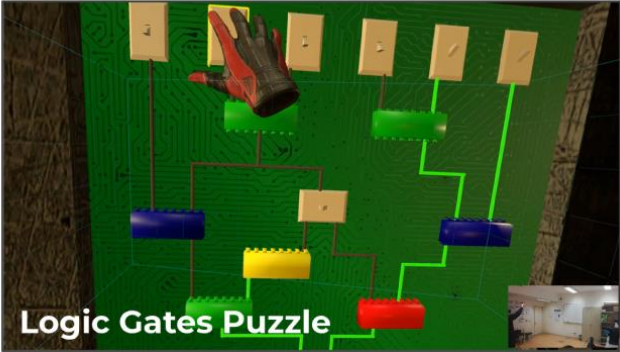
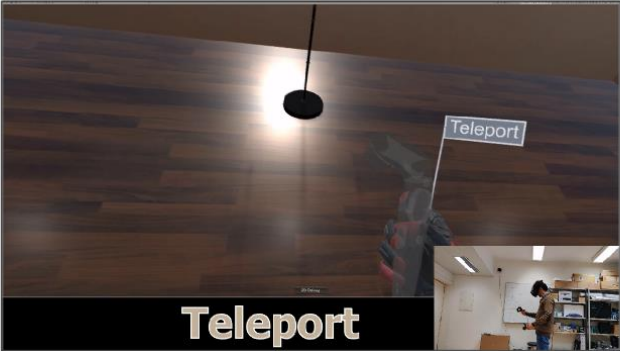
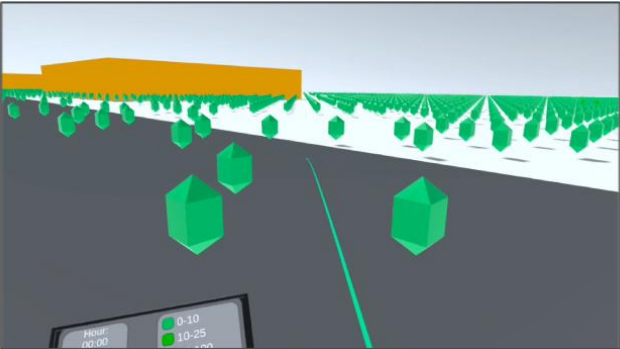
Remote exams ...

All's well that ends well !!

Recent years:

More external collaborations ...

Immersive experiences ...



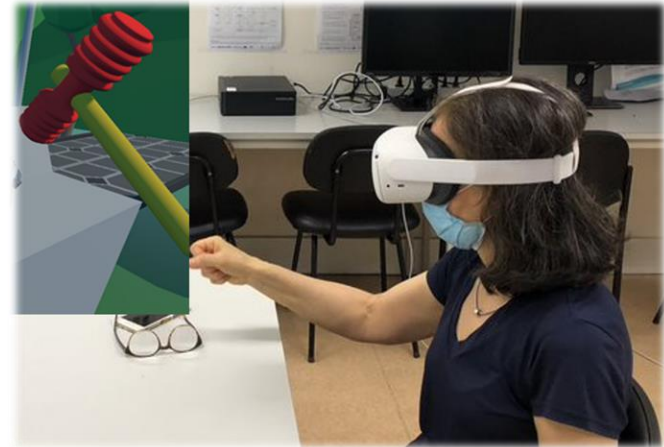
External collaborations ...

- **Strategies:**
- Understanding the diverse audience;
- Using a Human-Centered Design (HCD) approach;
- Keeping topics updated;
- Motivating a research-oriented approach;
- Fostering external collaboration;
- Encourage work dissemination.

- **Open challenges:**
 - Fast evolution & rapid obsolescence;
 - Students' diverse backgrounds;
 - Evaluating all different mini-projects;
 - Managing ...

Next steps:

- More user evaluation;
- Multimodal interaction;
- Ethics, privacy and security;
- Artificial intelligence;
- ...



Epilogue



The journey is the reward!



Acknowledgements:
Thanks to the 200+
students, colleagues
& everyone else!

An Overview of Teaching a Virtual and Augmented Reality Course at Postgraduate Level for Ten Years

Bernardo Marques,
Beatriz Sousa Santos,
Paulo Dias

IEETA, DETI, LASI,
University of Aveiro
Portugal

