VR and AR based Tool for Supporting Teaching in Mechanical Engineering

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VR and AR

According to the widely adopted definition, **Virtual Reality (VR)** represents a high-end human-computer interface that involves real-time simulation and interactions through multiple sensorial channels.

[*Burdea & Coifett 2003*]

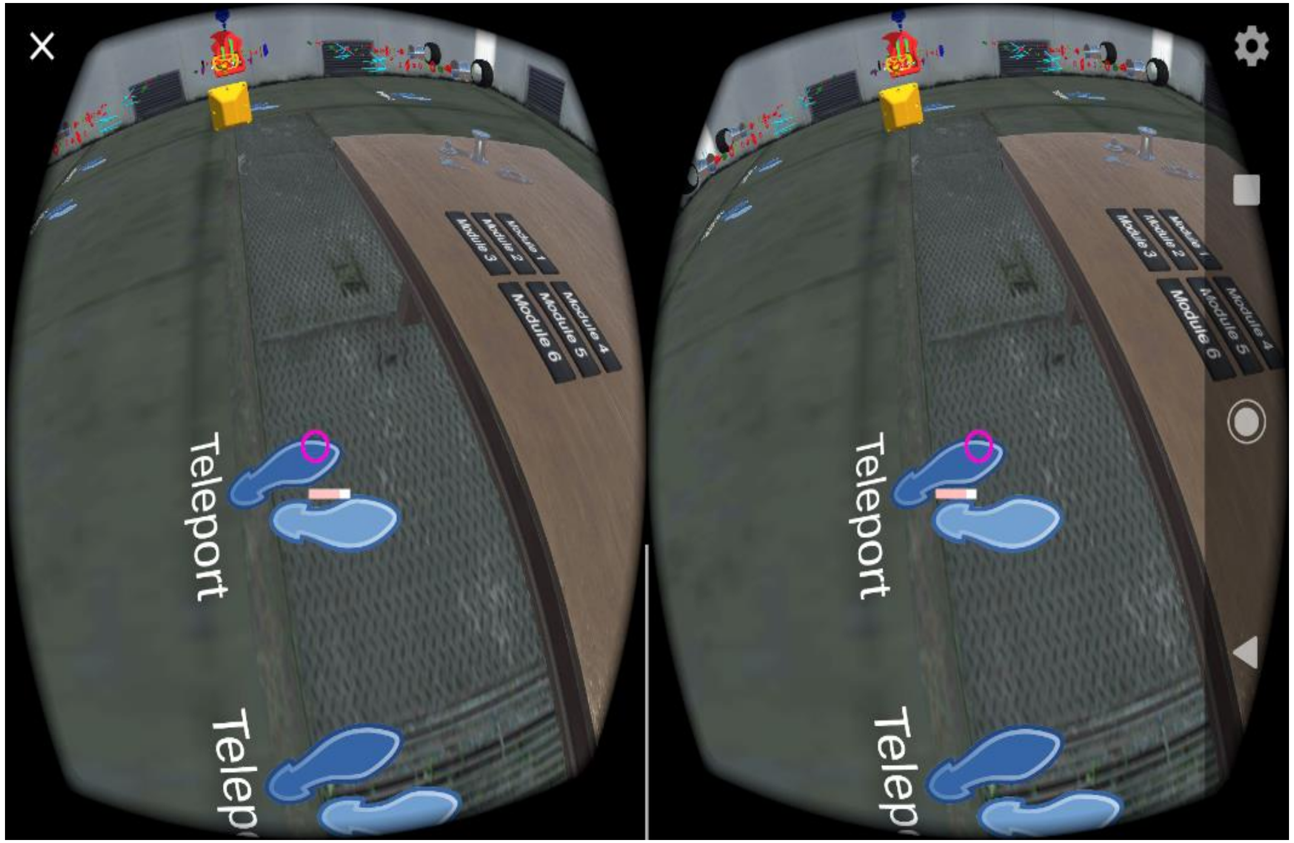
Key Advantages

- The user is able to see a seamless **360° panorama** of a virtual space built of **3D objects** in **1:1 scale**
- **VR experience** is multisensory augmented by audio and video content
- The user is able **to interact in real time** with the virtual space at basic level
- The experience is **less passive and user-directed rather then guided**

Content

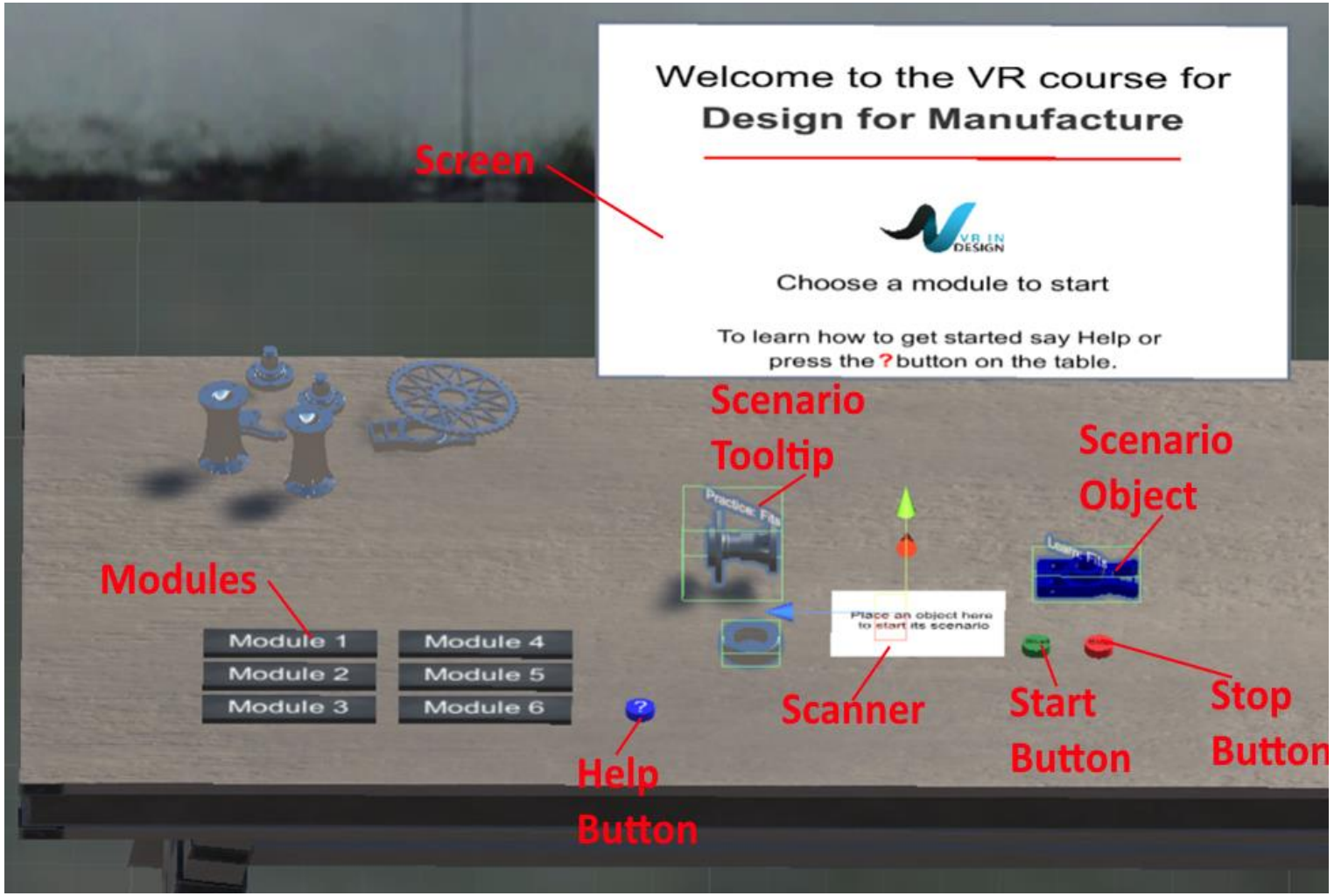
- Dimensioning and Tolerances
- Sectioning, Projections and Perspectives
- Dimensional Tolerances, Edge Tolerances, Shaft and Hole Tolerances
- Geometric Dimensioning and Tolerancing
- Surface Roughness
- Manufacturing and Assembly Drawings

Implementation for VR (low level)


Module 1
Module 2
Module 3
Module 4
Module 5
Module 6
Teleport

Implementation for VR (high level)

Component	Recommended system requirements	Minimum system requirements
Processor	Intel Core i5-4590/AMD FX 8350 equivalent or better	Intel Core i5-4590/AMD FX 8350 equivalent or better
GPU	NVIDIA GeForce GTX 1060, AMD Radeon RX 480 equivalent or better	NVIDIA GeForce GTX 970, AMD Radeon R9 290 equivalent or better
Memory	4 GB RAM or more	4 GB RAM or more
Video output	HDMI 1.4, DisplayPort 1.2 or newer	HDMI 1.4, DisplayPort 1.2 or newer
USB port	1x USB 2.0 or newer	1x USB 2.0 or newer
Operating system	Windows 7 SP1, Windows 8.1 or later, Windows 10	Windows 7 SP1, Windows 8.1 or later, Windows 10


Welcome to the VR course for
Design for Manufacture
Choose a module to start
To learn how to get started say Help or
press the ? button on the table.
Screen
Scenario
Tooltip
Scenario
Object
Modules
Module 1
Module 2
Module 3
Module 4
Module 5
Module 6
Place an object here
to start its scenario
Scanner
Start
Button
Stop
Button
Help
Button


Welcome to the VR course for
Design for Manufacture
VR IN DESIGN
Choose a module to start
To learn how to get started say Help or
press the ? button on the table.
Place an object here
to start its scenario
Start
Stop
Module 1
Module 4
Module 5

Testing in a Focus Groups

Testing in a Focus Group

- Interviewed persons: **41**
- 3 groups:

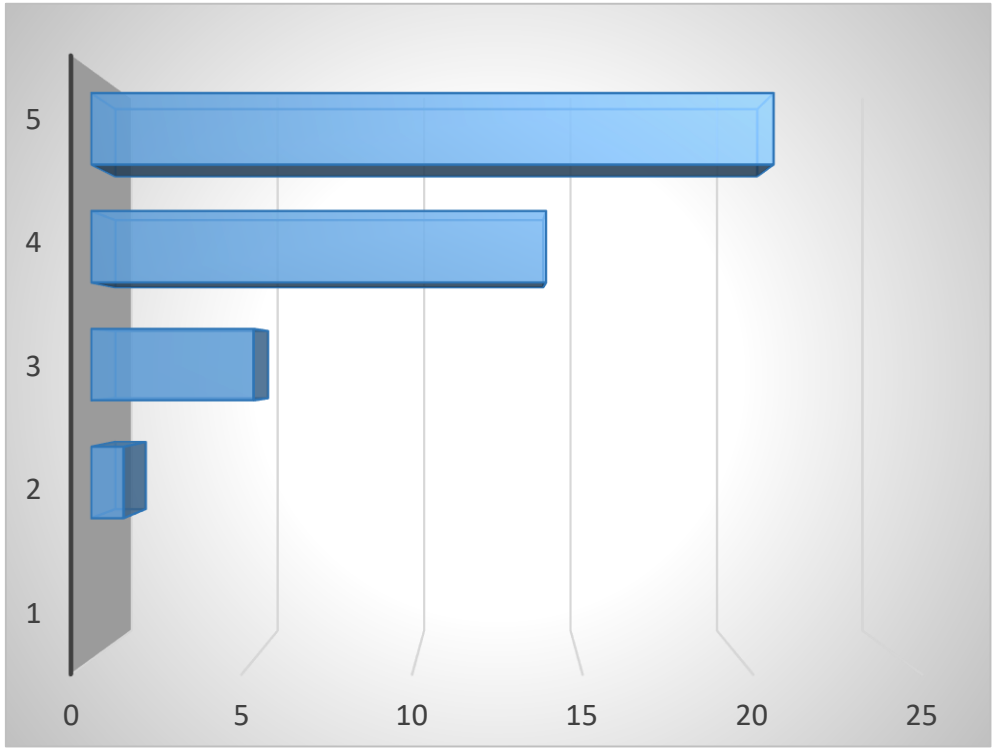
  Faculty for Industrial Engineering@TUS, Industrial Engineering, 4. year: 21 persons
  Faculty for German Engineering@TUS, Mechatronic systems, 2. year: 12 persons
  Faculty for German Engineering @TUS, Virtual Engineering, 2. year: 8 persons

- Test procedure:

  Using a HMD
  Instructions from the examiner
  20 minutes self-experiencing the VR tool
  Filling in a test questionnaire

Overall Estimation

- Stimulates brain by visual implementation
- Increases the focus
- Brings a better understanding without need of physical objects
- Enables the active part involvement
- Make things more interesting
- Allows exploration of diverse scenarios
- Improves learning
- Presents things in more interactive way



Conclusions

- Use of **VR** related technologies for supporting training of engineering students increases the level of comprehension and persistent knowledge
- The training period is shortened
- The students can learn in their own pace and retain the focus on the content
- **VR versions of different immersion levels** can be observed as complementary providing different levels of immersion and mobility
- There some technical limitations concerning hardware
- The presentation of specific topics requires new user interaction paradigm

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Thank You!!