Technology
Arts Sciences
TH Köln

Course
VER - Virtual and Augmented Reality

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General information

Long name	Virtual and Augmented Reality
Approving CModule	VER_MaMT, VER_MaTIN
Responsible	Prof. Dr.-Ing. Arnulph Fuhrmann Professor Fakultät IME
Level	Master
Semester in the year	winter semester
Duration	Semester
Hours in self-study	60
ECTS	5
Professors	Prof. Dr.-Ing. Arnulph Fuhrmann Professor Fakultät IME Prof. Dr. Stefan Grünvogel Professor Fakultät IME
Requirements	Computer Graphics Computer Animation
Language	German, English if necessary
Separate final exam	Yes

Final exam

Details

In an oral examination, students demonstrate the following competences:
- mastering the concepts of VR/AR (proven by answering questions on these concepts)
- Applying the mathematical basis of VR/AR (proven by computational tasks)
- Evaluation of VR/AR solutions (proven by answering questions on current solutions)

Minimum standard

At least 50% of the questions are answered correctly.

Exam Type

In an oral examination, students demonstrate the following competences:
- mastering the concepts of VR/AR (proven by answering questions on these concepts)
- Applying the mathematical basis of VR/AR (proven by computational tasks)
- Evaluation of VR/AR solutions (proven by answering questions on current solutions)

Lecture

Learning goals

Knowledge

Explain terms from the field of virtual and augmented reality
Explain and compare data structures and algorithms for VR/AR applications
3D data formats
Spatial data structures
Describing Multimodal User Interfaces
Selection of 3D objects
Manipulation of 3D objects
Navigation in virtual scenes
system control
Describe input and output devices and specific virtual and augmented reality hardware
display technologies
Stereo Displays
Autostereoscopic Displays
projection solutions
Wearable Displays
Head Mounted Displays
Handheld Displays
See-through Displays
Workbench
Cave
Tiled Displays
3D-Audio
Force Feedback Devices
Haptic feedback
input devices
controller
data gloves
locomotion devices
Explain algorithmic and mathematical basics
stereoscopy
tracking
capture of position and orientation: Degrees of freedom
tracking technologies
Mechanical
Optical

Electromagnetic
ultrasound
interial
eye tracking
head tracking
object tracking
Markerless Tracking
Marker-Based Tracking
rendering
management of large 3D scenes
haptic rendering
stereo rendering
real-time rendering
collision detection
intersections between primitives
Discrete and continuous collision detection
acceleration data structures
collision response

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Tutorial (voluntary)	0

Separate exam

none

Practical training

Learning goals

Skills

- Design, build and evaluate virtual environments and augmented reality applications
- Creating Interaction and Navigation Procedures
- Further develop fundamental technologies of virtual and augmented reality
- Use tools and methods to implement VR/AR applications
- Apply algorithmic and mathematical principles of VR/AR
- understand and grasp textual tasks
- Testing and debugging your own application

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	2
Tutorial (voluntary)	0

Separate exam

Exam Type

working on practical scenarion (e.g. in a lab)

Details

Development of different VR/AR applications with tasks to the topics of the lecture. During the laboratory the students work on the tasks with the help of the lecturer. Afterwards the independent completion takes place in self-study.

Minimum standard

More than 80% of all exercises submitted. A task is deemed to have been completed if it has been solved predominantly and independently.

Seminar

Learning goals

Skills

Apply Algorithmic and Mathematical fundamentals
Check interaction and navigation procedures
Independently obtaining and summarizing scientific literature
Present and discuss new concepts of virtual and augmented reality

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Seminar	1
Tutorial (voluntary)	0

Separate exam

none