

Course Manual VER

Virtual and Augmented Reality

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– General information

Long name Virtual and Augmented Reality

Approving CModule [VER_MaMI](#), [VER_MaTIN](#)

Responsible Prof. Dr.-Ing. Arnulph Fuhrmann
Professor Fakultät IME

Valid from winter semester
2020/21

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

Literature

R. Dörner et al., Virtual und Augmented Reality (VR/AR): Grundlagen und Methoden der Virtuellen und Augmentierten Realität, Springer Vieweg, 2019

Schmalstieg und Höllerer, Augmented Reality – Principles and Practice, Addison Wesley, 2016

T. Akenine-Möller, et al., Real-Time Rendering Fourth Edition, Taylor & Francis Ltd., 2018

J. Jerald, The VR Book: Human-Centered Design for Virtual Reality, Acm Books, 2015

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

EN mündliche Prüfung,
strukturierte Befragung

– Lecture / Exercises

Learning goals

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

Special requirements

none

Accompanying material	electronic lecture slides
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Separate exam	No
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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

– Practical training

Learning goals

Goal type	Description
Skills	<ul style="list-style-type: none"> - 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

Special requirements

none

Accompanying material	electronic task collection electronic development tools for the development of virtual and augmented reality applications
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Separate exam	Yes
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Separate exam

Exam Type	EN praxisnahes Szenario bearbeiten (z.B. im Praktikum)
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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.
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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.
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– Lecture / Exercises

Learning goals

Goal type	Description
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

Special requirements

none

Accompanying material	undefined
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Separate exam	No
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Expenditure classroom teaching

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