MIXED REALITY (EMaCS-02-02)				
DEGREE PROGRAM:		Master in Computer Science for the Human-Centric and Sustainable Industry		
SEMESTER: Second	**TYPE:** Elective	**CREDITS:** 5 ECTS	**WORKLOAD:** 125 hours	**MENTORING:** 1 hours/week
LANGUAGE: English				

OBJECTIVES	
General	The general objective of this module is to equip students with the theoretical knowledge and practical skills to design and develop applications in the mixed reality spectrum, encompassing virtual reality (VR) and augmented reality (AR) technologies, and effectively interact with human users in these environments.
Specific	• Human perceptual system: Colour vision, Stereoscopic vision, Multisensory perception • Fundamentals of visualization: Colours, Shapes, Information visualization • Fundamentals of computer graphics: Surface models, Materials, Lighting, Runtime optimization • Virtual reality: Mixed reality spectrum, Immersion, VR displays and sensors, Latency • Augmented reality: Tracking, Registration, Ambient light estimation, AR displays and sensors • Interaction: Selection, Manipulation, Navigation, Sketching, Gestures • Additional topics based on current relevance.

SUSTAINABILITY

The Mixed Reality course substantially contributes to sustainability by providing students with the knowledge and skills to design and develop applications in the mixed reality spectrum, including virtual reality (VR) and augmented reality (AR) technologies. By focusing on the human perceptual system, colour vision, and multisensory perception, the course encourages the creation of immersive and engaging experiences that align with sustainable practices. Students learn to leverage fundamentals of visualization and computer graphics to present information effectively, enhancing user experiences in mixed reality applications. The emphasis on protecting health and well-being further underscores the importance of creating sustainable and user-friendly applications that prioritize the welfare of users. This course equips students to contribute to the development of mixed reality applications that align with ethical considerations and social responsibility, promoting sustainable and responsible technology use.

RESILIENCE AND HUMAN-CENTRIC DEVELOPMENT

The Mixed Reality course plays a pivotal role in fostering resilience and human-centric development by focusing on interaction design principles and practical skills needed to create applications within the mixed reality spectrum. Through topics like interaction, selection, manipulation, navigation, sketching, and gestures, students develop skills that enhance user engagement and satisfaction. The course's emphasis on the human perceptual system and immersive technologies contributes to the creation of resilient applications that cater to the needs and preferences of users. Additionally, the focus on identifying needs and technological responses ensures that students are well-prepared to address real-world challenges in the development and deployment of mixed reality applications. By adopting a proactive and problem-solving attitude, students are equipped to contribute to the advancement of mixed reality technologies with a human-centric approach, fostering innovation and positive user experiences.

SUBJECT MATTER

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COMPETENCES

C5. PROGRAMMING
C6. USING MACHINE LEARNING AND A.I. TECHNIQUES
C8. PROTECTING HEALTH AND WELL-BEING

C11. PROBLEM FRAMING C12. IDENTIFYING NEEDS AND TECHNOLOGICAL RESPONSES C13. CREATIVELY USING DIGITAL TECHNOLOGIES C17. COMMUNICATING EFFECTIVELY	
LEARNING OUTCOMES	
Knowledge	• Know about the human perceptual system, including colour vision, stereoscopic vision, and multisensory perception, as it applies to mixed reality applications. • Know about the fundamental principles of visualization, including colour theory, shapes, and information visualization, to effectively present information to target audiences. • Know about the basics of computer graphics, including surface modelling, materials, lighting, and runtime optimization, for realistic virtual scene creation.
Skills	• Develop the practical skills to design and implement applications within the mixed reality spectrum, utilizing virtual reality (VR) and augmented reality (AR) technologies. • Gain proficiency in using VR displays and sensors, managing latency, and ensuring a high level of immersion in virtual environments. • Acquire skills in AR, including tracking, registration, and estimating ambient light, to seamlessly blend virtual elements with the real world.
Attitudes/values	• Develop a sense of appreciation for the significance of mixed reality technologies in various domains, fostering an innovative and forward-thinking mindset. • Cultivate an understanding of the ethical considerations and social implications related to the use of mixed reality applications. • Adopt a proactive and problem-solving attitude when addressing challenges in the development and interaction design of mixed reality applications.
TEACHING METHODS	
• Seminar-style teaching methods: Work in small groups, board work, multimedia presentations, voluntary exercise tasks, academic work with publications, application-oriented work using online materials and current tools. • Practical work: Task processing in small groups with a concluding acceptance discussion, presentations, and written assignments.	
EVALUATION	
• Regular examination format: Graded written exam. • Alternative examination formats: Graded oral examination or graded presentation. In cases where multiple examination formats are possible for the module, the responsible lecturer will announce the required format at the beginning of the course.	
PRECONDITIONS	
None	
DEPARTMENT	Computer Science
LECTURERS	Marina Tropmann-Frick Jan Sudeikat: https://www.researchgate.net/profile/Jan-Sudeikat
LITERATURE	• T. Akenine-Möller, E. Haines, N. Hoffman und A. Pesce, M. Iwanicki, S. Hillaire: Real-Time Rendering, CRC Press • D. Schmalstieg, T. Hollerer: Augmented Reality: Principles and Practice, Addison Wesley