Technical University of Munich| School of Computation, Information and Technology
Chair of Computer Aided Medical Procedures and Augmented Reality

Lab Course / “Praktikum”:
Medical Augmented Reality [IN0012] [IN2106]

Preliminary Meeting – SS2025

Prof. Nassir Navab, Dr. Ulrich Eck,
Sasan Matinfar, Laura Schütz, Tianyu Song, Michael Sommersperger, Alexander Winkler, Kevin Yu

Technische Universität München

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Johns Hopkins Whiting School of Engineering

Design and implement
novel augmented reality user interfaces
for medical use cases.

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Johns Hopkins
Whiting School of Engineering

Group Projects

- Groups of 3 to 4 students, with 1 to 2 mentors who will actively support them
- Students will be matched taking their preferences into account
- Project direction can be steered by the ideas of the group
- Project proposals will be discussed in introduction session
- Projects either on real world problems OR open research questions

Application

- **2 stage process:**
  - Register in TUM matching system (14.02. - 19.02.25)
    https://https://matching.in.tum.de
  - ↬ Submit motivational letter
    medar-ss25@camp.cit.tum.de
- ➢ Matching Results: 28.02.2025
- ~ 20 Master / 10 Bachelor students will be selected (usually 100+ applications)
- Info on Course Website
  https://www.cs.cit.tum.de/camp/teaching/practical-courses/practical-course-medical-augmented-reality-ss-2025/

Course Structure

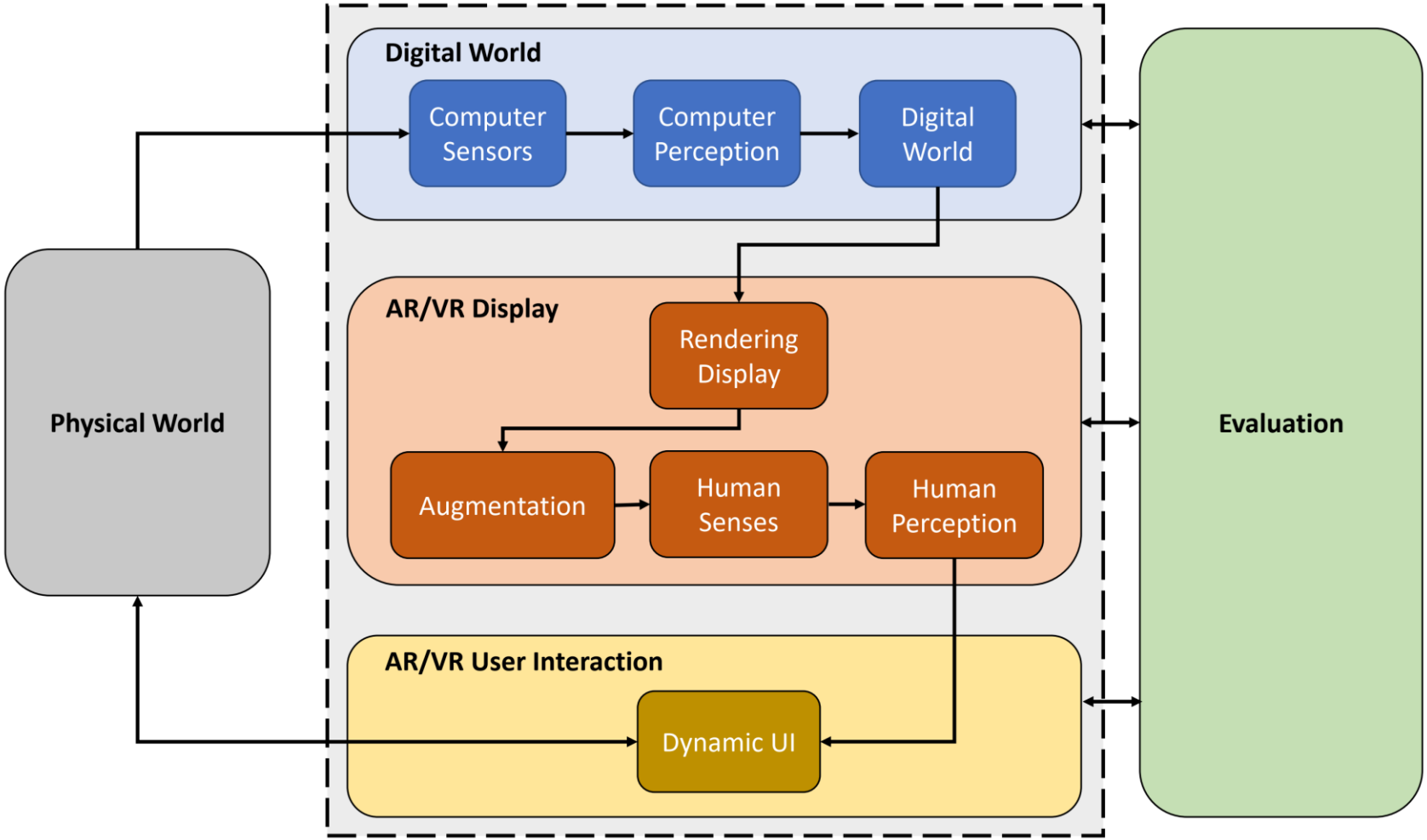
- **4 lectures** by course tutors **(required to attend, Tuesdays 10:00-11:30)**
  - Introduction (Administrative, Requirements, Grading) – **Mandatory**
  - Unity, MaLibU, Network Communication
  - MRTK, HMD Specific Development/Deployment
  - User Experience

- **2 presentations** by students **(Mandatory)**
  - Project Kickoff (7 minutes)
  - Final (incl. demo) (10 minutes)

- Minimum **10 hours per week** of project work during the semester

Project Objectives

- Develop an augmented reality (AR) app/solution for the project, which uses at least 2 or 3 features (depends on hardware and group size) listed below:
  - Marker detection and/or tracking (e.g. STTAR, Vuforia etc.)
  - Physical environment interaction (e.g. Classical SLAM, HoloLens' spatial mapping etc.)
  - Sensor data (e.g. RGB, Depth, Infra-red, IMU etc.)
  - Multi-devices / cross-platform communication (e.g. TCP/IP, IPC etc.)
  - Integration with other input/output control (e.g. Phone/tablet, Smart Watch, Myo Armband etc.)
  - Gesture and/or gaze control (e.g. Gesture recognition, Gaze tracking etc.)
  - Sounds augmentation – not ambient sound (e.g. Spatial sound, use of head-related transfer function)
  - Voice control user interface (e.g. Voice recognition, voice generation)
  - Medical Data / Perceptual Visualization (Segmentations / Volume Rendering / Focus Context)
- A project idea will be assigned based on your preferences
- Kick-off for presenting your project plan (Graded)
- Final Presentation and Demonstration of your AR app/solution (Graded)
- Individual Project Report (2 Pages, Graded)


Digital World
Computer Sensors
Computer Perception
Digital World
AR/VR Display
Rendering Display
Augmentation
Human Senses
Human Perception
AR/VR User Interaction
Dynamic UI
Physical World
Evaluation

Available Hardware

- Hardware and Software Support

- We provide access to:
  - 2-3 Windows machines
  - Several HoloLens v1 and v2
  - (Magic Leap 1)
  - HTC Vive HMDs with Controllers
  - Meta Quest 2, Meta Quest 3
  - Windows Mixed Reality Headsets

- More equipment if necessary
  - 3D printer
  - Tracking system
  - Depth cameras
  - X-Ray
  - ...







Project Showcase from Previous Years

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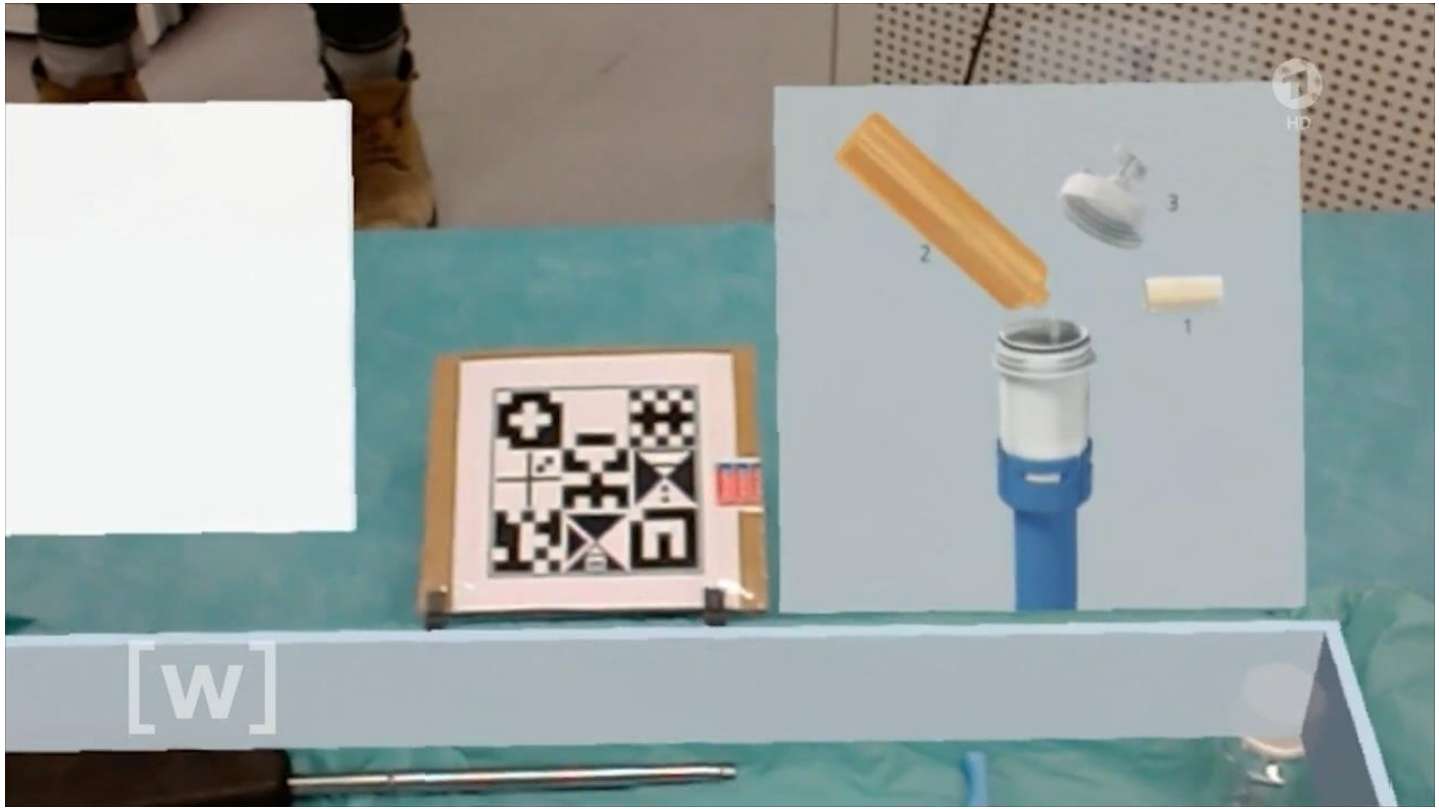
JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

12 February 2025

Medical AR Project Featured in ARD documentary

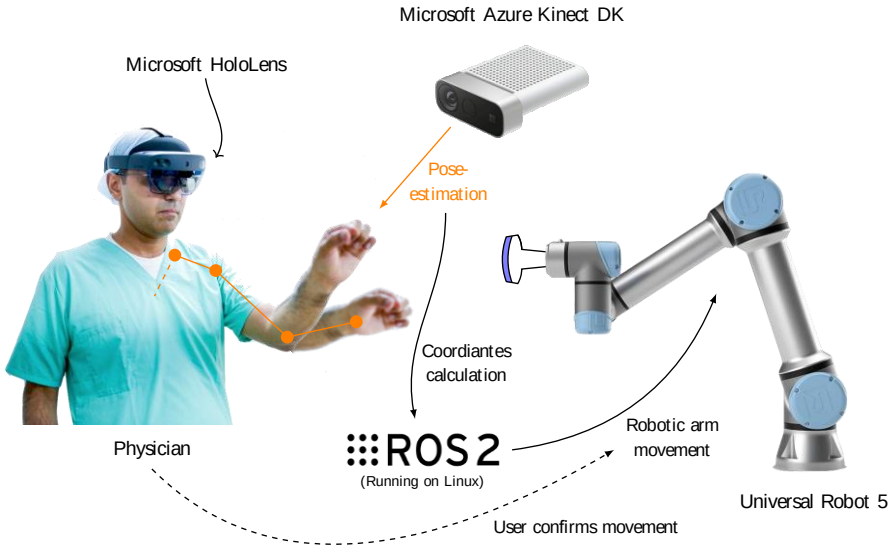


ORganizAR: AR Guidance for Operating Room Setup (SS24)

Marc Fischer, Haoyang Sun, Zhenghao Zhang

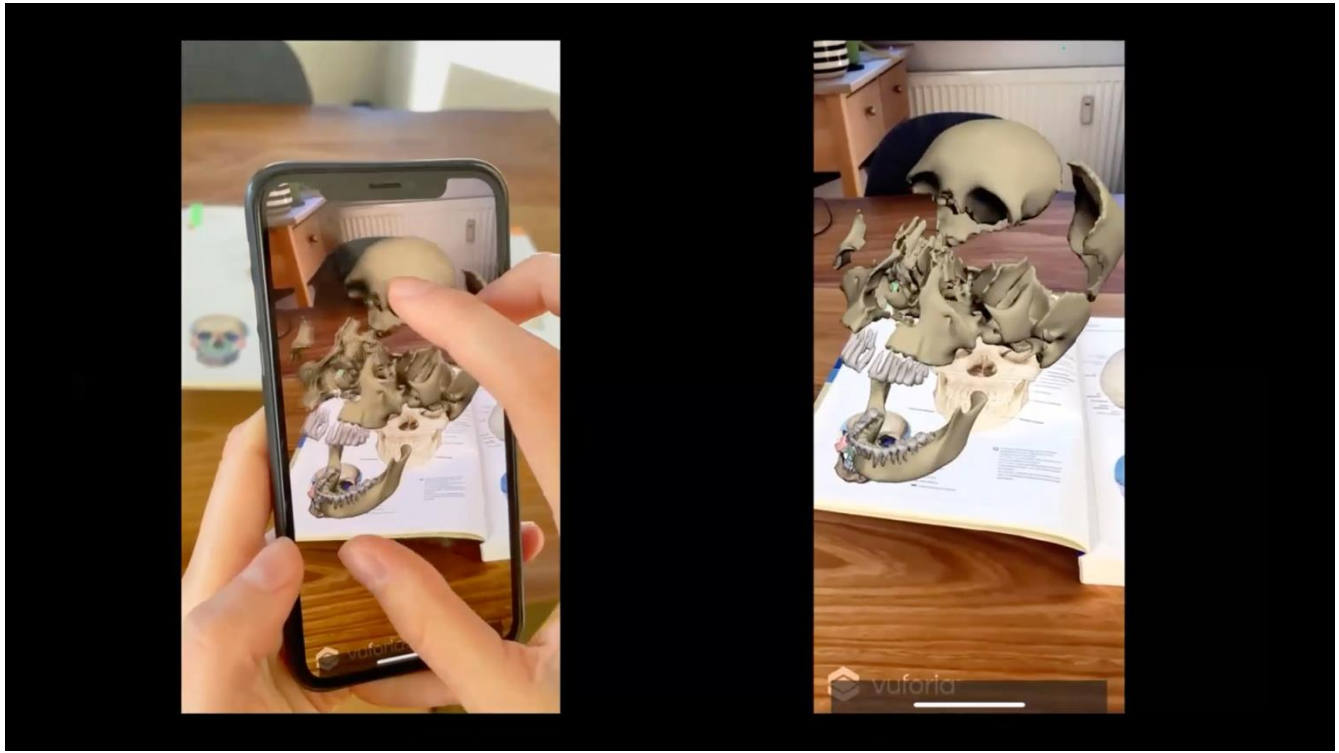
Human Pose Tracking for Teleoperated Robotic Arm Control

Felix Pabst, Jorge Padilla, Victor Kawai



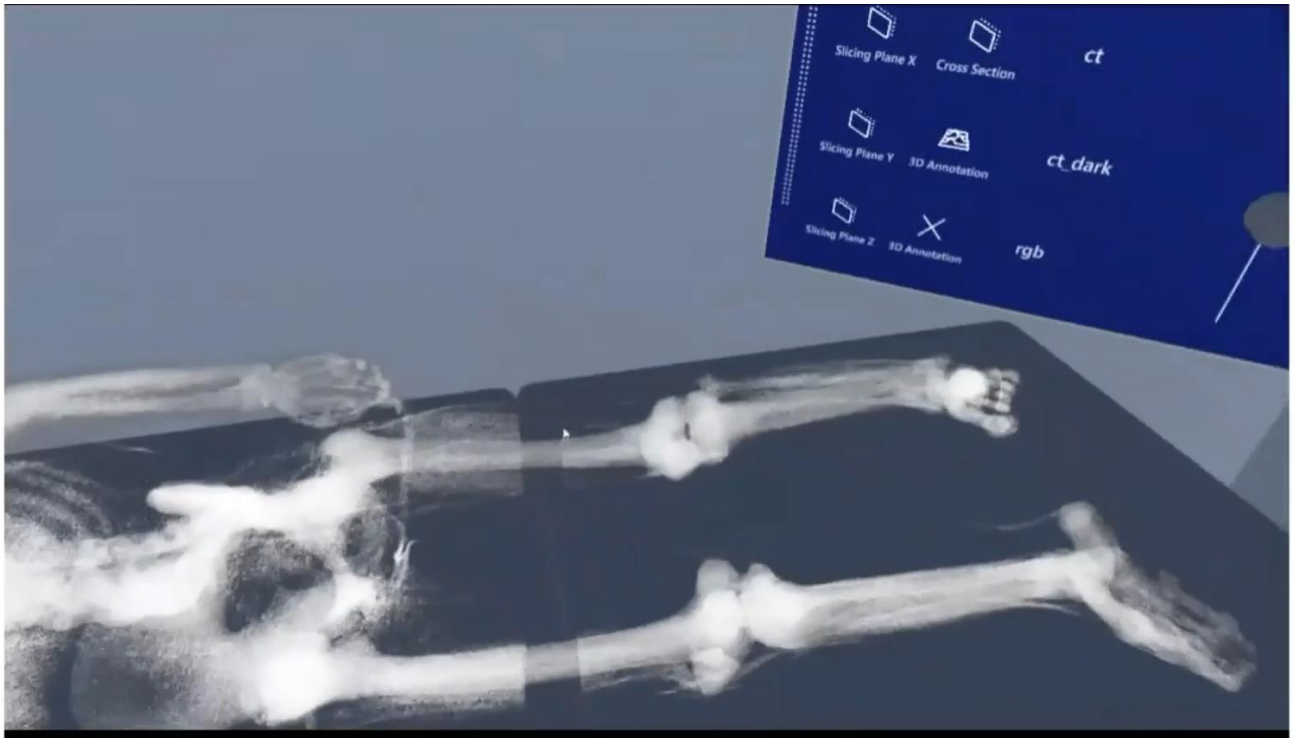
AR Textbook for Anatomy Learning

Fabian Nadegger, Mona Ziegler



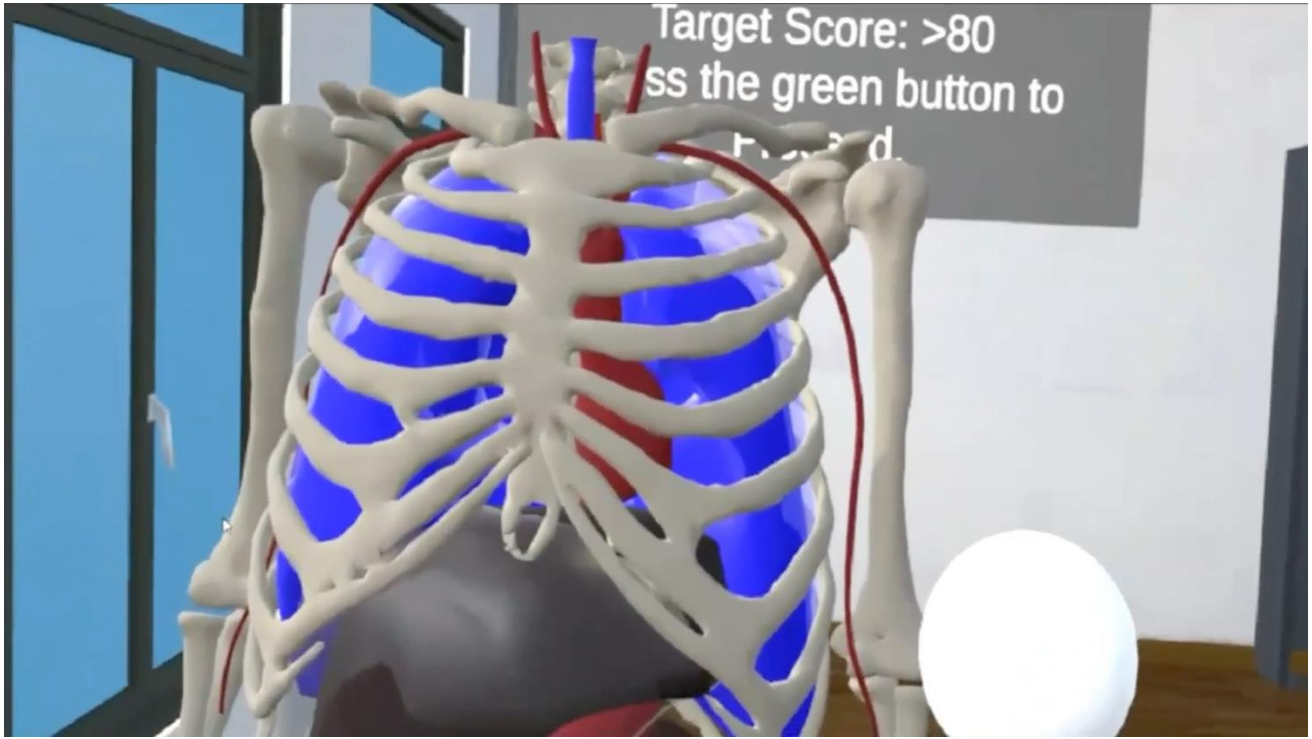
3D User Interaction Design for VR Volume Exploration

Kathiresan Chandrasekaran, Korbinian Linus Träuble, Kristina Diery, Umesh Rajesh Ramchandani



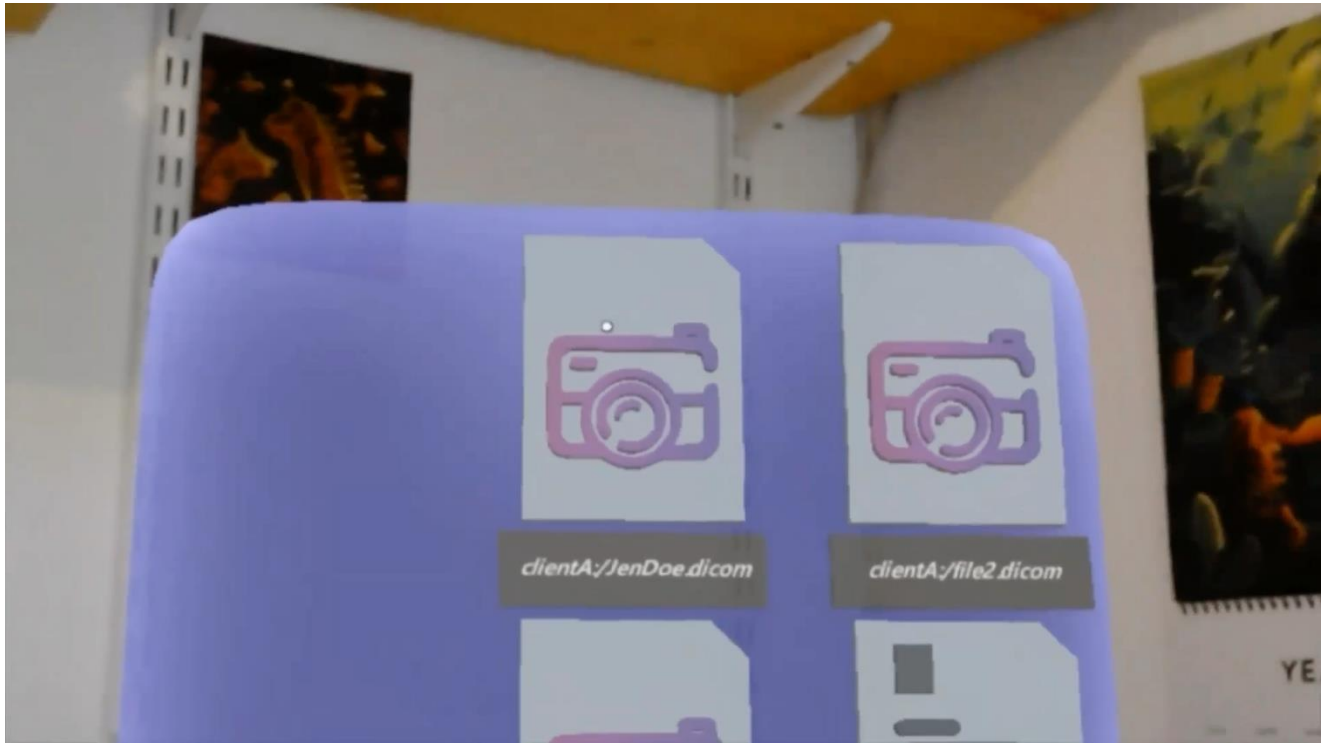
A Serious Anatomy Education Game

Tarek Elsherif, Gabrielle Shay Artiawan



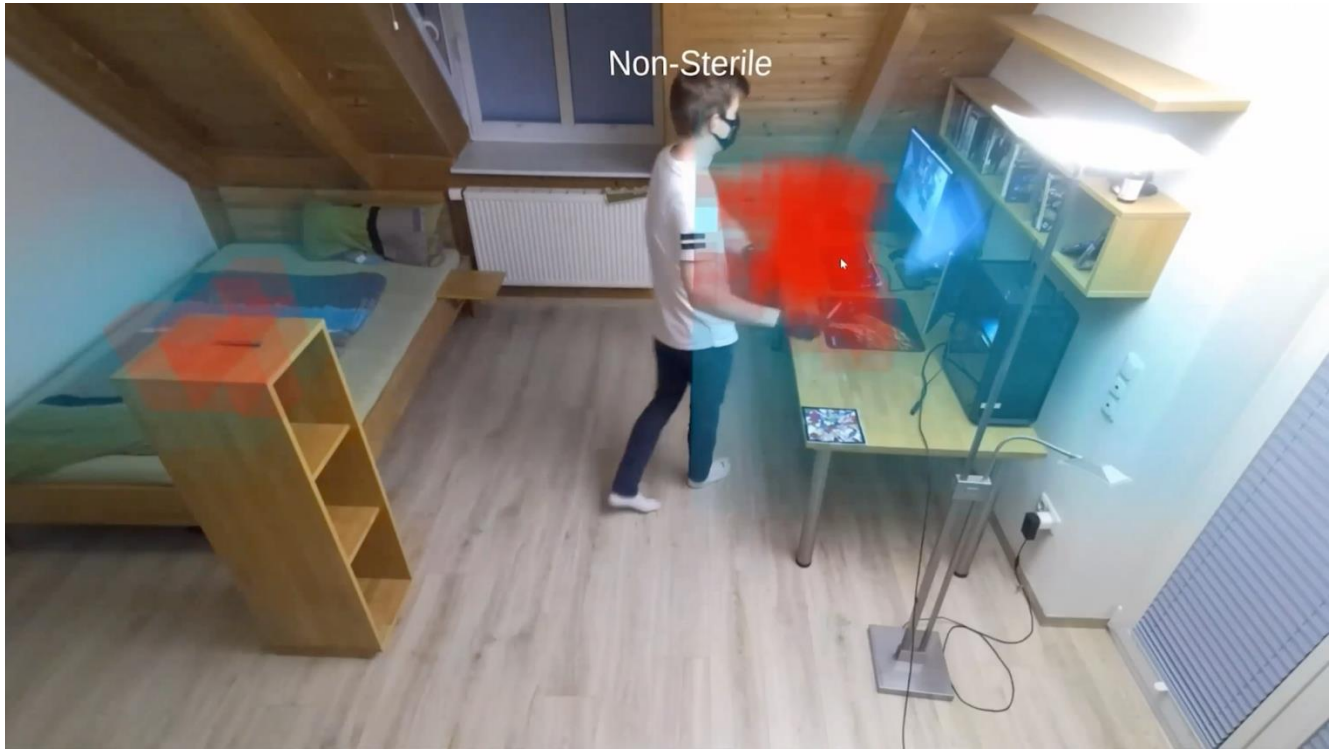
Cross-Device 3D Interaction and Data Sharing

Amir Nourinia, Florian Albrecht



Asepsis Training (Visualization of Sterility)

Andreas Keller, Dalia Yaghmaee, Mariia Shyn

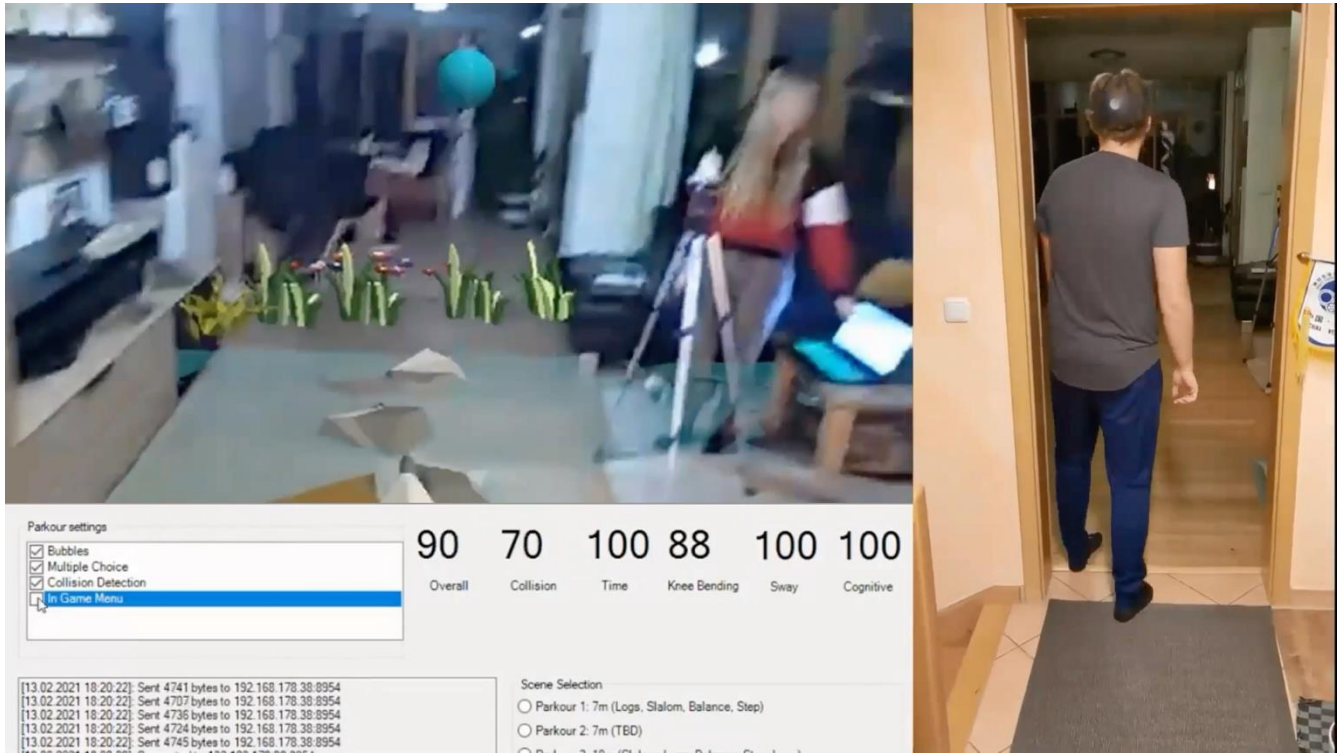


X-Ray Device Positioning with AR Visual Feedback

Kartikay Tehlan, Matteo Nardini -> Resulted in IEEE VR Poster

Mixed Reality Parkour for Physical Rehabilitation

Florian Bogner, Li Xin, Janis Reinelt



Questions

- Email:
  - medar-ss25@camp.cit.tum.de
- Web:
  - https://www.cs.cit.tum.de/camp/teaching/practical-courses/practical-course-medical-augmented-reality-ss-2025/
- Course tutors:
  - Dr. Ulrich Eck, Sasan Matinfar, Laura Schütz, Tianyu Song, Michael Sommersperger, Alexander Winkler, Kevin Yu