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Piano nazionale per gli investimenti
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Ministero dell'Università e della Ricerca



FIT4
MED
ROB
Fit for Medical Robotics

Exergames and Serious Games Development: Theory and Practice

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Foundations of XR for Healthcare (2h) - Monday 14th Sept. 10-12

Objective: situate exergames/serious games in the XR landscape and understand how different visualization techniques and perceptual aspects affect user experience (and implications for patients and caregivers)

- Course intro, motivation, and the role of serious games & exergames in cognitive/physical rehabilitation
- The Reality–Virtuality Continuum (Milgram & Kishino): AR, AV, MR, VR, XR
- Immersive vs non-immersive systems: HMDs, CAVE, projection, screen-based setups: trade-offs for clinical use
- How HMDs work: optics, displays, FoV, refresh rate, DoF tracking
- Perceptual & cognitive factors: presence, cybersickness, vergence–accommodation conflict

Exergames, Requirements & Interaction (2h) - Tuesday 15th Sept. 10-12

Objective: understand what makes exergames distinct and how to formalize requirements that balance therapy with engagement, analysis of standard and personalized interaction techniques

- Specificity of exergames vs entertainment games: flow, difficulty adaptation, motivation
- Defining and formalizing requirements: functional/non-functional, clinical constraints, target populations
- Interaction modalities: controllers, hand/gesture tracking, voice, haptics, wearables for interaction and sensing (IMUs, EMG, sensorized devices)
- Integration with robotics
- Short design exercise / discussion /examples

User Tracking and Representation (Avatars) (2h) - Wednesday 16th Sept. 10-12

Objective: capture human movement and represent the user's body in the virtual scene.

- Overview of human-subject tracking approaches: camera-based and markerless tracking, RGB-D, 2D/3D pose estimation, wearable/inertial mocap and marker-based systems
- Inverse kinematics: reconstructing full-body pose from sparse inputs
- Avatars: embodiment, realism, and the uncanny valley
- Rigging, skinning, animation, and retargeting; avatar pipelines/SDKs
- Examples

Game Engines and Application Architecture (2h) - Thursday 17th Sept. 10-12

Objective: understand the engine ecosystem and how a data-logging exergame is structured.

- XR hardware/software ecosystem; real-time engines (Unity, Unreal, Godot, WebXR/PlayCanvas)
- Anatomy of a game: game loop, scene graph, entity–component model, assets
- Scripting & event handling; state machines
- Data logging for rehabilitation: metrics, telemetry, session data, outcome measures, privacy
- Bridge to the practical: PlayCanvas project setup

Hands-on: Building an Exergame Prototype in PlayCanvas (2h) - Friday 18th Sept. 10-12

Objective: build a functional prototype end-to-end.

- Editor tour: entities, components, assets, hierarchy
- Building the scene: environment and interactive/target objects
- Scripting interaction: input, movement, collision, scoring
- Adding an exergame mechanic (e.g., a reach/aim task) with difficulty adaptation
- Logging performance data and exporting results