

Title

Design and Validation of an Adaptive Virtual Reality Simulator for Medical Motor Skill Training

Keywords : Human–Computer Interaction, Virtual Reality Training, Adaptive Learning, Physiological Sensing, Stress Modulation, Cognitive Load, Microsoft Psi, Data Synchronization

Host Structure and Laboratory

Université d'Évry–Paris Saclay (UEVE) | IBISC Laboratory – IRA2 Team

Funding: ~3500 € for the 6-month period

(Scholarship by Genopole, <https://genopole.agorize.com/fr/challenges/master-2-2024>)

Internship Supervisor

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Internship Period

Starting date: 01/12/2025 (possibility to work remotely during the first month).

Duration: 6 months.

This internship may serve as a preliminary step toward the preparation of a **PhD project**, with potential opportunities for applying to thesis funding

How to Apply

Applications are open to **Master 2 students (or equivalent level)** in Computer Science, Software Engineering, or related fields.

Interested candidates should send the following documents by email to aylen.riccacambon@univ-evry.fr:

- An **extended CV** (including relevant technical skills and project experience)
- **Academic transcripts/marks** from their Master's program
- A **portfolio** and/or links to **GitLab/GitHub repositories** (if available)

Selected candidates will be invited to schedule a **first online meeting** to discuss the internship project.

Context and Motivation

Adaptive training in Virtual Reality (VR) is an emerging research direction for enhancing motor skill learning in domains such as medicine and industry. Traditional VR training systems offer immersive practice but typically rely on fixed scenarios or correlations between physiological states and performance. The challenge is to design truly adaptive systems capable of adjusting training difficulty, pacing, and feedback **in real time** based on the learner's physiological and performance data.

This internship is part of the **AMoLeVR project**, aiming to design and validate an adaptive training simulator that personalizes motor learning by dynamically adjusting tasks according to the user's physiological signals (e.g., heart rate, EEG signals, stress indicators) and performance outcomes.

Objectives of the Internship

The intern will participate to these activities:

1. Literature Review & Functional Analysis

- Study adaptive mechanisms for motor skill training in VR.
- Identify functions relevant for adapting difficulty, rhythm, sensory feedback, and pedagogical strategies.

2. Platform Development (Core Technical Work)

- Design and implement a software architecture for **synchronous multimodal data acquisition** using **Microsoft Psi (Platform for Situated Intelligence)**.
- Integrate physiological sensors (e.g., heart rate, galvanic skin response, EEG) and performance tracking within the VR application.
- Ensure synchronization and recording of data streams (physiology, VR events, motion capture).
- Develop real-time adaptation modules that adjust VR training scenarios according to incoming data.

3. Experimental Validation

- Design user studies comparing adaptive vs. non-adaptive training conditions.
 - Analyze results statistically to assess learning efficiency, stress modulation, and cognitive load.
 - Provide recommendations for improving adaptive training mechanisms.
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Resources

The student will benefit from the **Evr@ VR platform**, which includes:

- VR and Mixed Reality headsets (Varjo, Meta Quest, etc.)
- Motion tracking systems (optical cameras, gloves, positional trackers)
- Haptic and force-feedback devices
- Physiological sensors (heart rate monitors, GSR, EEG)
- Software stack including **Microsoft Psi, ROS2, Unity3D/Unreal Engine, and existing VR simulators**

Expected Technical Contributions

- Development of a **modular data recording and synchronization platform** based on Microsoft Psi.
 - Implementation of adaptive training logic using performance and physiological metrics.
 - Integration with a VR application for motor skill learning (medical training focus).
 - Experimental validation and documentation of the simulator.
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Candidate Profile

- **Required:**
 - Master's student in **Computer Science, Software Engineering, or related fields**
 - Strong background in **software architecture and development**
 - Solid knowledge of **Object-Oriented Programming (Java, C#, or C++)**
- **Other skills:**
 - **VR** development skills (Unity3D, Unreal Engine)
 - Familiarity with **ROS2** or middleware for sensor/robot integration
 - Experience with **statistical** data analysis (**R, SPSS**)

The candidate must have a good communication level in English, both written and spoken, as part of the work and reporting will be conducted in English.