UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Designing Safer VR Locomotion Through Stability Analysis

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Description

Motivation and application domain

VR locomotion often disrupts balance due to mismatches between visual and vestibular cues. This leads to altered gait patterns, increased postural sway, and higher cybersickness risk. Identifying biomechanical markers of instability is essential for designing safer locomotion methods in VR applications such as rehabilitation, training, and immersive simulation.

General objectives and main activities

The objective of this thesis is to identify and quantify biomechanical indicators of instability during VR locomotion under controlled experimental conditions. Participants will perform walking tasks using different locomotion techniques within a Unity-based VR environment. Gait and balance metrics such as center-of-pressure sway, step variability, trunk motion, and temporal-spatial gait parameters will be recorded using trackers (Vive trackers or markerless tracking). The analysis will determine which locomotion methods induce the greatest deviations from baseline stability. Relationships between objective instability markers and cybersickness scores will be modeled to better understand the link between biomechanical alterations and perceptual experience. Based on these findings, design guidelines or visual feedback cues aimed at reducing instability will be proposed and experimentally evaluated.

Training Objectives (technical/analytical tools, experimental methodologies)

The application will be developed using Unity 3D (scripting in C#). Optimization of the application will be performed in a loop of development and assessment. Participation in the definition of an experimental protocol. Participation in experimental sessions. Analysis of experimental data.
human balance testing, locomotion protocol design

Place(s) where the thesis work will be carried out: DIBRIS Valletta Puggia (Perception&Interaction Lab)

Additional information

Pre-requisite abilities/skills: Programming in C++ or C#, Basic knowledge of Unity3D

Maximum number of students: 2