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

Thesis Project Form

Title (tentative): An immersive virtual reality application for the assessment and rehabilitation of vestibular disorders

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Description

Motivation and application domain

The goal of this thesis is to develop an application for the assessment and the rehabilitation of patients with peripheral and central vestibular disorders, by exploiting immersive virtual reality.

General objectives and main activities

The perception and control of the orientation of the head and of the body in space, relative to the gravitational stimulus, is fundamental for maintaining balance. The otolith organs provide sensory input necessary for the perception of verticality and horizontality. An otolithic deficiency can transiently cause counter-rotation of the eyes, with a lateral shift of one's vision. A healthy subject can align a vertical bar with an error of no more than 2 degrees. In peripheral vestibular disorders in the acute phase, patients tilt the bar by more than 2 degrees towards the damaged side.

The aim of this thesis is to develop a virtual reality application to evaluate subjective visual vertical in static and dynamic conditions. The patient wearing an immersive virtual reality headset observes a bar with different inclinations either on a uniform and dark background or on a moving background: the task is to bring the bar back to a vertical position. Furthermore, feedback (e.g. tactile, acoustic) may be provided to monitor and correct the actions performed. Specific tasks will be developed in close collaboration with the doctors of the Audiologic unit of San Martino hospital. The hardware platform will be mainly immersive virtual reality, e.g. Oculus Quest 2. A group of healthy volunteers will be recruited to assess the application; afterward, patients might be involved. The experimental outcomes will be analyzed.

Training Objectives (technical/analytical tools, experimental methodologies)

The virtual reality 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.

Place(s) where the thesis work will be carried out: DIBRIS Valletta Puggia (Perception&Interaction Lab) and San Martino hospital (U.O.S Audiologia).

Additional information

Pre-requisite abilities/skills: DIBRIS Valletta Puggia (Perception&Interaction Lab) and San Martino hospital (U.O.S Audiologia).

Maximum number of students: 2