Project ID: 12

Project Title

Enhancing Spatial Fidelity In Virtual Reality: Adaptive Viewpoint And Scene Scaling For Improved User Comfort

Client Name

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Group Capacity

3 groups

Project Background

Head-mounted display (HMD) virtual reality (VR) has become an increasingly popular medium for immersive experiences, spanning entertainment, education, training, and rehabilitation. However, a significant proportion of users still experience discomfort that inhibits prolonged or repeated VR use. While much research has been dedicated to improving visual resolution and aligning visual simulations with postural positioning, an often-overlooked factor is the spatial alignment of virtual environments with real-world sizes and positions.

In interactive VR applications, spatial fidelity is crucial for haptic feedback and proprioceptive alignment. The perceived and actual positions of a user's body, limbs, and hands within the virtual environment must be accurately mapped to ensure a natural interaction. Unlike 2D environments, where size perception is predominantly influenced by visual cues, 3D environments require a careful calibration of both viewpoint projection and object scaling to match real-world user experiences. Misalignment can lead to discomfort, disorientation, and diminished presence, negatively impacting the overall VR experience.

Project Scope

- Develop a Unity VR application that enables real-time manipulation of object scaling and positioning within a scene.
- Implement a customizable viewpoint projection centre that aligns with users' natural eye positions and field of view.
- Conduct user testing to evaluate the effectiveness of these manipulations
- Provide an interface for users to fine-tune spatial settings accordingly

Project Requirements

- Dynamic Spatial Manipulation: Enable real-time scaling and positioning adjustments of objects within the VR scene.
- Viewpoint Projection Centre Control: Implement adjustable viewpoint settings to match the user's natural visual perspective.
- User Calibration Interface: Develop an intuitive UI for users to fine-tune spatial

settings based on their physiology.

- User Data Logging & Analysis: Implement a system for collecting user feedback and interaction data to refine spatial alignment settings.

Required Skills

- Unity Development: Proficiency in C# and Unity3D for creating interactive VR applications.
- Graphics Programming: Experience with shaders, rendering pipelines, and performance optimization techniques.
- Cross-Platform VR Development: Knowledge of different VR SDKs (OpenXR, Oculus SDK, SteamVR) for compatibility across multiple devices.

Expected Outcomes

- A fully-recompilable Unity VR project and necessary assets that allow dynamic spatial manipulation of objects and viewpoint adjustments.
- Recommendations for integrating spatial customization features into commercial VR applications.

Disciplines

System/game Development;Human Computer Interaction (HCI);

Other Resources

None