

Camera-Based Hand Tracking Device for Smartphone Virtual Reality Headsets: A Prototype

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Problem

While VR interaction often demands costly equipment, smartphone VR-headsets offer a budget-friendly alternative. However, their limited capacity for immersive interaction makes them less engaging, especially without additional controllers or sensors.

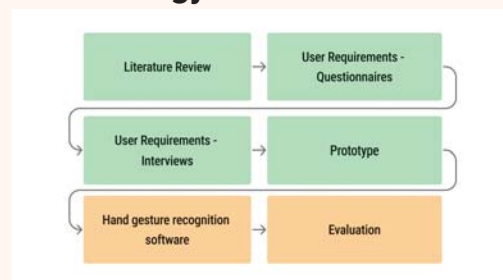
Observation

Gesture-based interaction provides an affordable and convenient method to interact with VR environments, eliminating the need for extra controllers or time-consuming setup processes.

Aim

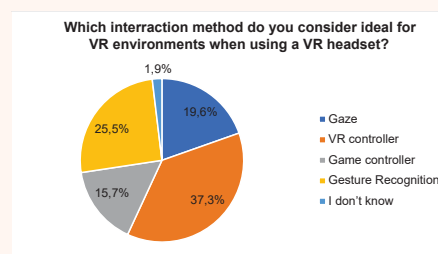
To develop a novel low-cost smartphone VR headset compatible device that allows the use of gesture-based interaction when using VR applications.

Methodology



1. User Requirements - Questionnaires

A questionnaire was developed to determine the preferred interaction method among VR users, and it was successfully completed by 51 individuals. Even though people were initially unfamiliar with gesture recognition, it emerged as the second most preferred interaction method for VR headsets.



2. User Requirements - Interviews

Five individuals who expressed interest in contributing further to the research were carefully chosen to participate in an interview. During the interview process, they were provided with the opportunity to experience and evaluate various interaction methods, sharing their valuable insights and feedback.



Image from interview

3. Prototype

Having in mind the previous results, a versatile 3D model was specifically designed to accommodate various mobile phone-operated VR headsets and accommodate different phone cameras. The adjustable nature of the model allows for optimal positioning, enabling a clearer view of the user's hands to facilitate accurate gesture recognition. To bring the design to life, it was 3D printed and enhanced with a strategically placed mirror to enhance the camera view. Additionally, an elastic band was attached to provide stability, ensuring a secure fit during usage.



Primitive 3D model

3D model



3D print



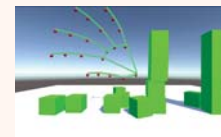
Primitive product

4. Hand gesture recognition software

We are currently developing an Android app that tracks gestures and communicates them to the game engine of a VR application. This enables gesture-based interaction in VR applications running on smartphone VR headsets.



Gesture Recognition app



Gesture Recognition game

5. Evaluation

A comprehensive explanatory video was created to provide a clear understanding of the device's functionality and its features. Following that, five individuals were invited to evaluate the device by participating in a questionnaire-based assessment.



Explanatory video

Final product



Conclusions / Future work

A low-cost prototype for hand-based gesture recognition in VR applications on smartphone VR headsets has developed. It does not need expensive or specialized equipment to work. It enhances user experience and accessibility.

In the future it will be compatible with all VR headsets and it will be integrated with game engines planned for complete hand-gesture interaction. Future comprehensive user evaluation is also planned.

