A Study of Haptic Devices in Virtual Reality Meditation

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Introduction: This study discusses the potential of Virtual Reality (VR) technology to enhance the meditation experience, particularly addressing the challenges that beginners face in maintaining focus and practicing effectively. We designed a VR meditation application that combines an immersive environment with interactive hand and finger gestures to facilitate deeper engagement in meditation practice. The application utilizes an interactive device called eteeController to capture hand and finger movements, enabling nuanced interactions, such as performing Mudras and adjusting the VR meditation in real-time to enhance the meditative state (Kosunen et al., 2016).

Materials and Methods: Static gestures are like signatures and dynamic hand gestures are composed of the shape and motion of the hand (Osman Hashi et al., 2024). The system includes a Head-mounted Display (HMD) and eteeController. The HMD provides a 3D immersive environment, transporting users to tranquil settings like forests, oceans, lakes, or mountains, complemented by realistic spatial audio, such as birdsong, ocean waves, or a babbling brook, to enhance immersion (Grieve, 2010). The eteeController features full-finger tracking, enabling precise capture of each finger's movement, allowing for natural interaction with the virtual environment and accurate execution of Mudras. Mudras are symbolic hand gestures used in ancient Yoga and meditation practices, believed to guide energy flow, and enhance concentration (Zuesse, 2002). In the application, users can interact with the virtual environment by performing different Mudras, triggering visual and audio effects as shown in Figure 1. Additionally, a virtual mentor, such as Buddha, is incorporated into the application to guide users through meditation practices.

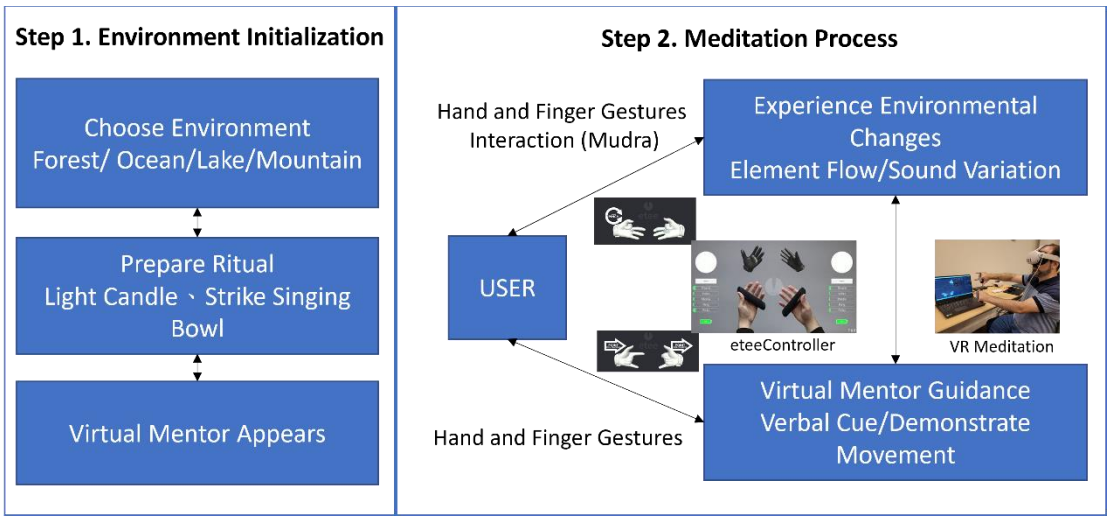

Figure 1. System Process Flowchart

The virtual mentor provides voice guidance, demonstrates Mudra gestures, and offers real-time feedback on the user's posture and movements, acting as a mentor to provide personalized guidance and create a sense of ritual, guiding users into a meditative state (Grieve, 2010; Zuesse, 2002). Furthermore, the system integrates machine learning to analyze user data over time by allowing the virtual mentor to provide personalized feedback based on a user's meditation history and progress.

Discussion and Future Works: This study investigates the potential of VR technology to enhance meditation practice, which is designed to relieve stress and reduce anxiety (Reshma et al., 2024). We are planning to conduct further experiments with other specialized interfaces for interactive hand and finger motion tracking and gesture recognition (Kanev et al., 2024). We will build upon our earlier works with the high-fidelity Yamaha Datagloves (Mimura et al., 2024) and Haptic Datagloves (Hung et al., 2023) and conduct comparative studies to identify the factors that bring to higher user satisfaction. We will also conduct longitudinal studies to assess the VR application's impact on mental health over extended periods by evaluating its potential for sustained reductions in stress, anxiety, and symptoms of depression.

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