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Design and Development of a VR Based Relaxation Environment for Mental Wellness

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ABSTRACT: Rising levels of stress and anxiety among students and working professionals have intensified the demand for accessible, cost-effective, and technology-driven mental wellness solutions. Virtual Reality (VR) has emerged as a promising tool for relaxation and stress management due to its ability to provide immersive and distraction-free environments. This paper presents the design and development of a mobile-based VR relaxation environment aimed at promoting mental wellness through immersive natural scenes and guided relaxation techniques. The proposed system integrates 3D nature-inspired virtual environments, spatial ambient soundscapes, and guided breathing exercises within a smartphone-enabled VR framework using low-cost head-mounted displays.

Emphasis is placed on affordability, personalization, and real-world usability to overcome limitations of existing VR systems that rely on expensive hardware or controlled clinical settings. Users can select preferred relaxation environments and session durations, enabling a customizable and user-centred experience. The system architecture, environment design principles, implementation methodology, and evaluation approach are discussed in detail. A preliminary evaluation involving volunteer participants assessed perceived stress levels, usability, comfort, and immersion.

Experimental results indicate a notable reduction in self-reported stress levels after short VR relaxation sessions, along with high user satisfaction in terms of visual comfort, audio quality, and overall immersion. The findings demonstrate that mobile-based VR relaxation systems are feasible, scalable, and effective for everyday mental wellness support. The proposed solution highlights the potential of immersive VR technology as a practical digital intervention for stress management in educational, occupational, and healthcare settings.

KEYWORDS: Virtual Reality, Mental Wellness, Stress Reduction, Immersive Environment, Guided Breathing, Mobile VR.

I. INTRODUCTION

Mental stress and anxiety have become increasingly prevalent among students and working professionals due to academic pressure, occupational demands, and rapid lifestyle changes. Prolonged exposure to stress can negatively impact cognitive performance, emotional stability, and overall physical health. Although traditional relaxation approaches such as meditation, counseling, and pharmacological interventions are effective, they are often limited by accessibility, time constraints, and reduced user engagement. As a result, there is a growing need for innovative, technology-driven solutions that can support mental wellness in an engaging and easily deployable manner.

Virtual Reality (VR) has emerged as a promising technology for mental health and wellness applications due to its ability to provide immersive, interactive, and distraction-free environments. By simulating calming natural scenes and controlling sensory experiences, VR enables users to temporarily disengage from real-world stressors and focus on relaxation. Recent research has demonstrated the effectiveness of VR-based interventions for stress reduction, anxiety management, and mindfulness training. However, many existing VR relaxation systems rely on high-end hardware, are restricted to clinical settings, or offer limited personalization, which reduces their practicality for everyday use.

To address these limitations, this paper presents the design and development of a mobile-based VR relaxation environment focused on accessibility, affordability, and user-centered design. The proposed system integrates immersive 3D natural environments, spatial ambient audio, and guided breathing exercises within a smartphone-enabled VR platform.

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By allowing users to select preferred environments and session durations, the system enhances engagement and relaxation effectiveness. This work aims to demonstrate the feasibility of deploying scalable VR-based relaxation solutions for everyday mental wellness support in educational, occupational, and healthcare contexts.

II. LITERATURE REVIEW

Recent studies have demonstrated the effectiveness of Virtual Reality (VR) in stress reduction and mental wellness applications. Virtual Reality Relaxation for People with Mental Health Conditions by Riches et al. (2022) reported that immersive VR environments, particularly nature-based scenes, significantly reduce stress and anxiety levels. The key innovation of this work is the validation of VR as a scalable and low-intensity intervention suitable for both clinical and non-clinical users.

Similarly, Virtual Reality Relaxation for Patients with a Psychiatric Disorder: A Randomized Controlled Trial by Veling et al. (2021) introduced the "V-Relax" system, which allows users to interact with calming virtual environments. The innovation lies in developing a self-guided VR relaxation system, enabling users to independently manage stress without continuous clinical supervision. Another study, Immersive Virtual Reality: An Effective Strategy for Reducing Stress in Young Adults by Chirico et al. (2023), demonstrated that VR can effectively reduce stress even in healthy individuals. This work highlights VR as a preventive tool for everyday stress management, expanding its application beyond medical treatment. In addition, Virtual Reality-Based Mindfulness Interventions for Mental Health by Seabrook et al. (2022) explored the integration of mindfulness techniques within VR. The key contribution is the combination of guided meditation and immersive environments, which enhances user engagement and relaxation effectiveness.

Furthermore, VR Calm Plus: Coupling Tangible Interaction with Virtual Reality for Stress Regulation by Yildirim et al. (2020) introduced a system incorporating physical interaction through tangible controls. This study's innovation is the use of haptic interaction to improve emotional engagement in VR relaxation. Despite these advancements, many existing systems depend on expensive hardware and controlled environments, limiting accessibility. Therefore, there is a clear need for affordable, mobile-based VR solutions, which the proposed work aims to address by providing a scalable and user-friendly relaxation system.

III. RESEARCH METHODOLOGY

The proposed VR-based relaxation system follows a structured workflow to deliver a personalized and effective mental wellness experience. The methodology is divided into the following stages:

1. User Authentication (Login Stage): The workflow begins with the user authentication stage, where users access the system through a mobile-based interface by entering basic credentials such as email and password. This step ensures secure access and enables the system to maintain user-specific session data. It also supports personalization by storing user preferences and session history for future interactions.

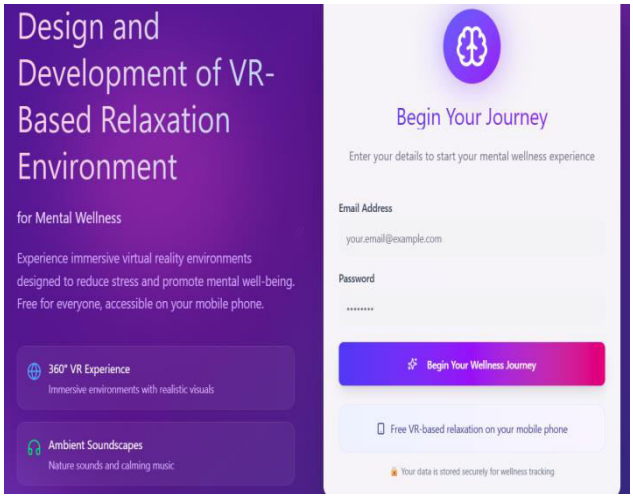

Figure1. Login page

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2. Initial Stress Assessment: After successful login, the system conducts an initial stress assessment to determine the user's current mental state. Users rate their stress level on a numerical scale, typically ranging from low to high. This baseline measurement is essential for personalizing the relaxation session and serves as a reference for evaluating the effectiveness of the VR intervention.

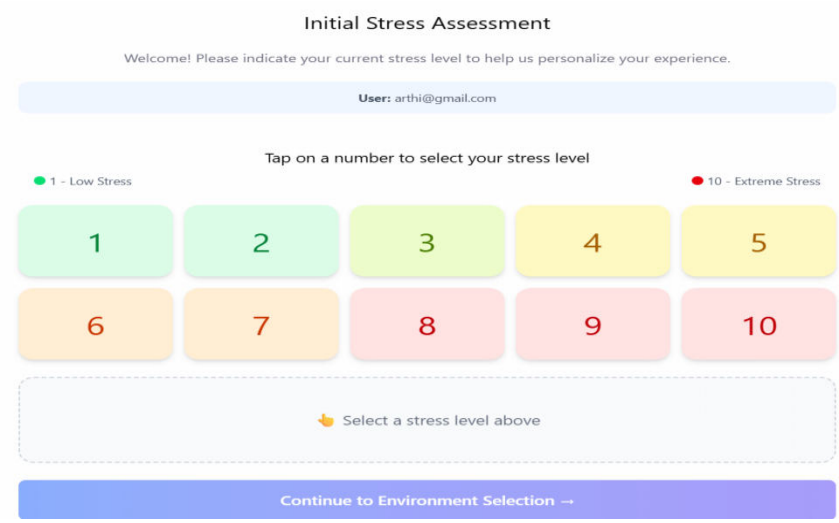

Figure2. Initial Stress assessment

3. Environment Selection and Configuration: In this stage, users select their preferred virtual environment from available options such as forests, beaches, or mountains. Along with environmental selection, users can configure session parameters, including duration and audio settings. This customization ensures that the relaxation experience aligns with individual preferences, thereby improving engagement and effectiveness.

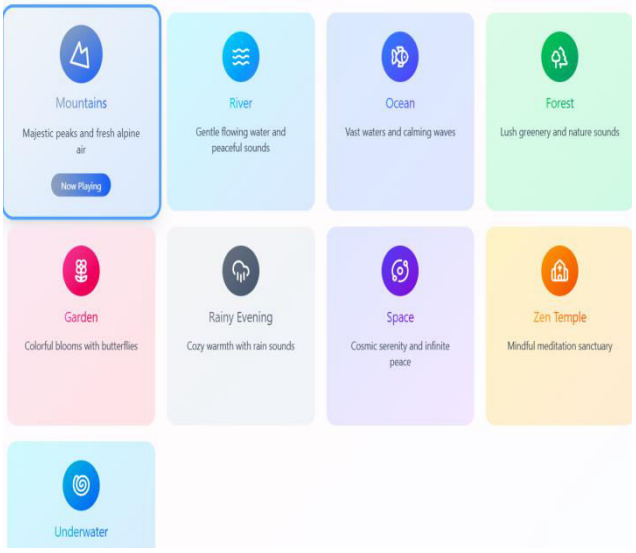

Figure3. Environment Selection

4. Immersive VR Experience: The selected environment is then rendered in real time using Unity, forming the core stage of the system. Users experience immersive 3D natural scenes through a smartphone-based VR setup integrated with Google Cardboard. Spatial audio enhances realism by delivering synchronized ambient sounds that respond to head movements. Additionally, a guided breathing module provides visual and auditory cues to regulate breathing patterns, helping users achieve relaxation and improved focus during the session.

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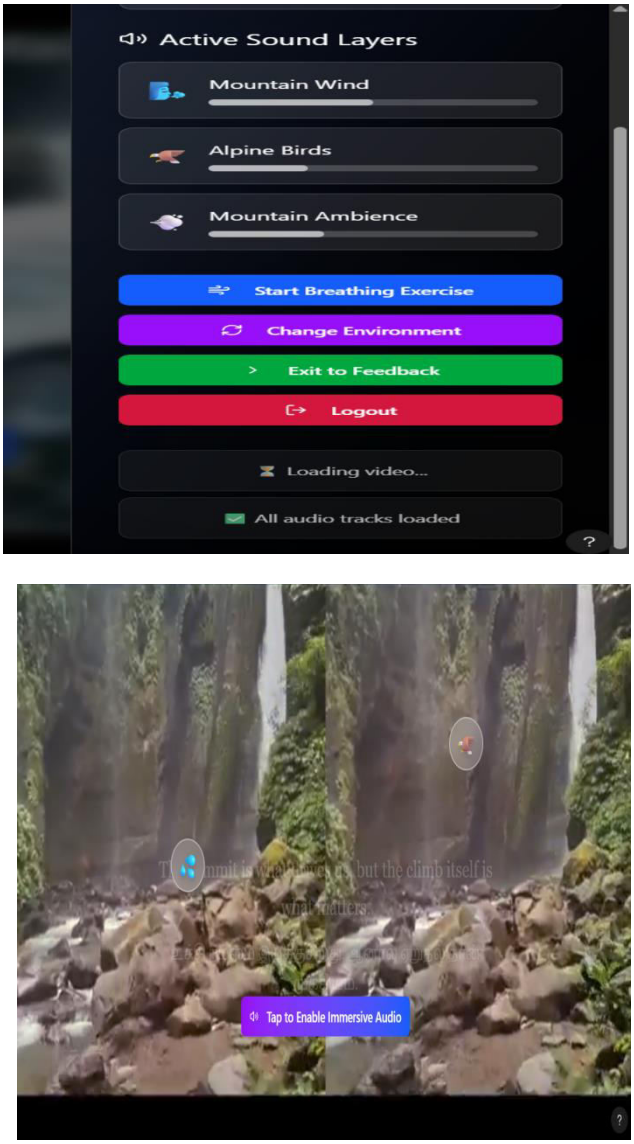

Figure4. Users experience the environment

5. User Feedback Collection: Upon completion of the VR session, users are prompted to provide feedback regarding their experience. This includes aspects such as usability, comfort, immersion, visual clarity, and audio quality. The feedback collected at this stage is important for evaluating user satisfaction and identifying areas for system improvement**.**

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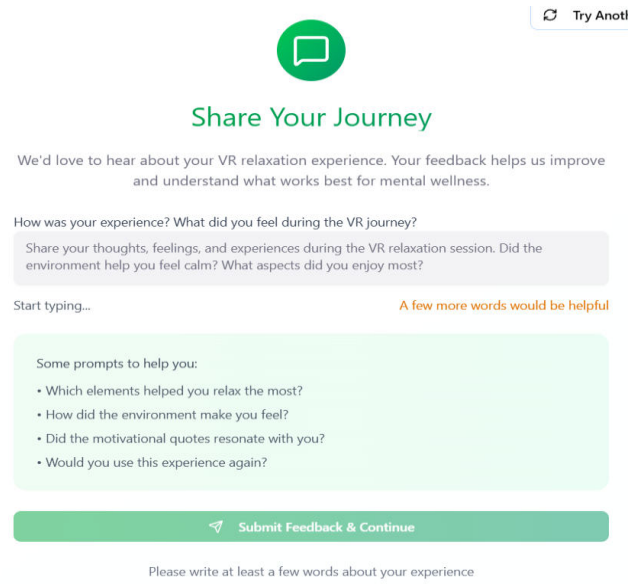

Figure5. Feedback page

6. Post-Session Stress Assessment: Following feedback collection, a post-session stress assessment is conducted using the same numerical scale as the initial assessment. This step enables direct comparison of stress levels before and after the VR experience, allowing measurement of the system's effectiveness in reducing stress.

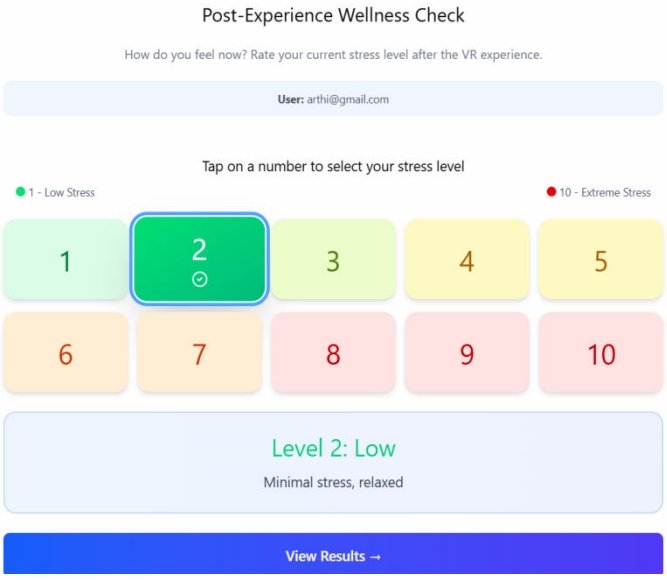

Figure6. Post stress assessment

7. Result Analysis and Evaluation: In the final stage, the system analyzes the collected data using descriptive statistical methods. The comparison between pre- and post-session stress scores provides quantitative evidence of stress reduction, while user feedback offers qualitative insights into system performance. This combined evaluation ensures a comprehensive assessment of the VR-based relaxation system.

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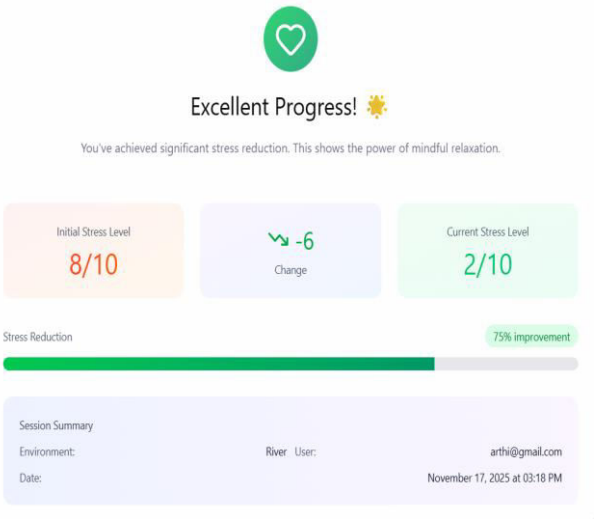

Figure7. Result

IV. RESULTS AND DISCUSSION

The performance of the proposed VR-based relaxation system was evaluated using both quantitative stress assessment and qualitative user feedback. A comparison of pre-session and post-session stress scores shows a consistent and meaningful reduction in perceived stress levels after a 5–10-minute VR session. Most participants initially reported moderate to high stress levels, typically ranging from 6 to 8 on the rating scale, which decreased to lower levels between 2 and 4 after the session. This corresponds to an average stress reduction of approximately 40–60%, indicating that short-duration immersive VR exposure can effectively provide immediate relaxation.

In addition to stress reduction, user experience analysis revealed high levels of usability and engagement. Participants found the system interface simple and intuitive, enabling smooth navigation without cognitive burden. The immersive nature-based environments, combined with spatial ambient audio, created a strong sense of presence and emotional calmness. The guided breathing module further enhanced relaxation by promoting controlled breathing patterns and improved focus throughout the session.

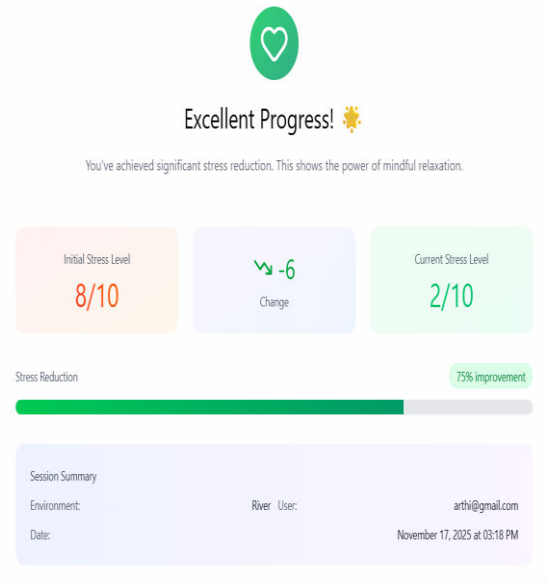

Figure9. Final Result

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Comfort evaluation indicated that the system provided a stable and safe user experience. Most participants reported minimal visual discomfort and no significant motion sickness, while a few experienced only mild dizziness. This can be attributed to optimized rendering, stable frame rates, and accurate head tracking. Overall, users expressed high satisfaction and willingness to use the system regularly for stress management. These results confirm that the proposed mobile-based VR relaxation system is effective, user-friendly, and technically reliable.

V. CONCLUSION

This paper presented the design and development of a mobile-based VR relaxation system aimed at improving mental wellness through immersive and accessible technology. The system integrates natural 3D environments, spatial audio, and guided breathing techniques within a smartphone-enabled VR platform, ensuring affordability, portability, and ease of use. The evaluation results demonstrate that the system effectively reduces perceived stress levels and provides a comfortable and engaging relaxation experience.

A key contribution of this work is its focus on accessibility and user-centred design, addressing the limitations of existing VR systems that rely on expensive hardware or controlled environments. By leveraging widely available mobile technology, the proposed system enables scalable deployment for everyday stress management in educational, occupational, and healthcare settings. The immersive experience allows users to temporarily disengage from real-world stressors and achieve improved emotional balance and mental clarity.

However, the study is limited by a relatively small sample size and short evaluation duration. Future work will focus on large-scale validation, long-term effectiveness analysis, and integration of physiological measurements such as heart rate variability for objective assessment. Additionally, incorporating adaptive and personalized features using intelligent algorithms can further enhance system performance and user experience.

In conclusion, the proposed VR-based relaxation system demonstrates strong potential as a cost-effective, scalable, and practical solution for mental wellness, highlighting the growing role of immersive technologies in modern healthcare and stress management applications.

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