VR Exposure Therapy and Artificial Intelligence for Accessible Mental Health

Kapil Kumar Singh , Piyush Mishra, Nayan Pathak, Kapil Chauhdhary, Shreela Pareek,

Department of Computer Science, KIET Group of Institutions, Ghaziabad (Uttar Pradesh), India

Abstract. There is increasing concern for the mental health of youth in general and adolescents with phobia and anxiety in particular, is reported to increase in recent years. Efforts to integrate traditional treatments face barriers to access, participation, and effectiveness. In this paper, after presenting the initial design of a platform for potential mental health and the influence that automated treatment will have in an immersive VR exposure therapy driven by AI, we have described. That system has VR-based therapy, AI-based emotional sensing and peer-support chat rooms, to take a people-first approach. The software is designed to let users start taking on levels of fear and anxiety from the comfort of home in small doses, they can then continue to take on higher levels as they build a tolerance. The integration of chatbots and peer chatting along with personalized recommendations enhance the interaction with the service and also give instant help. This paper presents technology, methods, and benefits of the proposed method.

Keywords: Virtual Reality (VR), Mental Health, Artificial Intelligence (AI), VR Exposure Therapy (VRET), Natural Language Processing (NLP), Chatbots, Large Language Models (LLMs), Phobia, Anxiety.

1. Introduction

In a world where we are all time-poor, people want to find new ways to enhance their emotionally focused therapies, that includes stuff like AR and VR. Thanks to VR and a shooter can simply be placed in an emotionally stable environment that can help the user deal with his issues.

This article considers how new technologies such as Artificial Intelligence (AI) and Virtual Reality (VR) can be integrated for mental health aid and assistance. Whereas AI-driven chatbots and NLP models such as GPT-4o help in the diagnosis process for instant analysis and personalized assessment, VR brings an immersive and monitored treatment space. VR exposure therapy enables patients to face their fears and phobias in a safe, controlled way, which the makes treatment more effective. With AI powered diagnosis tools and VR therapy sessions, this solution offers a complete, inclusive and adaptive solution to mental well-being.

2. Literature Review

2.1. Traditional Diagnosis Of Mental Health Disorders

The SCL-90-R is a questionnaire measure of psychological distress that has been widely used to assess mental health problems. It is a 90-question survey that assigns scores to 90 different prompts using a scale from 0-4 (e.g., 0 for least frequent symptoms and 4 for most frequent symptoms).[1] The SCL-90-R is able to diagnose all 10 types of mental disorders and it has been of interest to researchers. It is the most commonly used instrument for diagnosing mental health issues, as well. But the using of SCL-90-R is too much long time taking process [2]. As a result, various statistical methods have been employed to reduce the number of questions to save time and improve the ease of diagnosis [3]. One such technique was proposed by Prinz et al., creating SCL-14 to diagnose somatization, phobic anxiety and depression [4]. However, due to limited number of questions, this tool is not able to diagnose all 10 mental health disorders that SCL-90-R can detect.

There are also several limitations of SCL-90-R. For instance, there are several questionnaires in SCL-90-R and each questionnaire is dedicated to diagnose a particular disease. This means that each question pool adds linearly to the discrimination of a given mental disorder. Another issue is its length. It is very time-consuming and laborious to answer every question, so the response rate is low [2].

2.2. Artificial Intelligence for Diagnosis and Treatment of Mental Health Disorders

In light of limitations of traditional assessments reviewed in the earlier section, one would expect the literature to include a number of recent recommendations concerning the shortening of the SCL-90-R as soon as possible without sacrificing a reasonable level of diagnostic coverage. This can be achieved by the application of AI for diagnosis of mental diseases [5].

One of the most striking weaknesses of SCL-90-R instrument is that it is based on self-reporting, so it is susceptible to bias and misinformation. COVID-19~Diagnosis and treatment can now presumably also be facilitated even more on demand at both ends (communicate with the patient real time) via chatbots and LLMs with AI capabilities [6]. Unlike the monotonous questionnaires, these bots enable getting user responses considering the user mental state through a real-time psychometric test, by considering real-time aspects like the user tone, language usage, sentiments etc [6].

The data from the conversations with chatbots can also be used to build AI models for personalized treatment interventions. Having analysed a patient's history/mood and behaviour cycles, AI can suggest cognitive behavioural therapy (CBT), guided meditation, or exposure therapy (using virtual reality) as more personalized approaches.

Current assessment tools are not designed to provide immediate feedback to mental health professionals. Patients' answers can now be studied using AI driven models and the treatment strategies can be made better. For example, technology that uses AI to analyse chatbot conversations can enable the detection of emerging specific mental health issues early to enhance their therapeutic timing.

2.3. Virtual Reality and Mental Health

Virtual Reality (VR) is being heralded as the NEXT BIG THING in the field of mental health treatment, because it can do something which has been believed to be impossible -- it can enable such treatments to have an effect. As a mainstream technology for gaming and entertainment "Virtual Reality" have made great progress not just to "make world magic" and let people "experience the magic world", but rather to stimulate all the inanimate environment and object or contacting people with them for therapeutic applications. Looking specifically at mental disorders, it can be said that patients are exposed to artificial exposure of actual stimuli that are meant to induce anxiety in a secure manner [7] [8].

The point that is worth mentioning is that the key feature of any VR simulation is the ability to engage the user and facilitate certain emotions that otherwise are impossible to recreate.

This amazing characteristic is useful primarily in concerning various mental conditions such as phobias where the patients should be forced to face cases such as places with a high altitude [11], addressing an audience or face to face with a group of people that evoke anxiety [9]. In such situations, VR offers people the opportunity to face these triggers, one by one, in a setting that's relatively less daunting, and least harmful. This technique Virtual Reality Exposure Therapy or VRET has further been established to be successfully used in helping patients overcome fears and reduce the b symptoms for sometime. The efficacy of VRET has also been demonstrated in studies showing it can achieve the results classical exposure techniques are capable of but in an effortless, faster and less intrusive manner. These studies show that exposure results in a similar outcome to traditional exposure therapy, yet is less invasive and more user-friendly [12][13].

In addition to anxiety, VR has also been shown to help with other psychological problems such as depression, and PTSD [10]. These environments have a calming effects and can be rendered using VR which will help people to follow mental health management exercises in a better way. The level of immersion in a VR environment cause users to very much immerse into it also leading to higher engagement and ultimately therapy success of consumer aid treatment delivered.

2.4. Integration of VR and AI in Existing Therapeutic Systems

In recent years the combined use of AI and VR particularly for cognitive and psychological therapy have been investigated. For instance, Freeman et al. (2017) showed how VR and CBT can decrease paranoia and social anxiety. Similarly, Bouchard et al. (2019) examined the application of VRET for PTSD reporting an enhanced patient compliance. Integrating AI for personalised interaction and monitoring, with immersive VR environments, results in a dynamic and adaptive therapy system not only mitigating accessibility but also personalisation—major issues in traditional therapy.

But it has not yet come forward to solve them together as a combined platform, as a computer-aided diagnosis and therapy system. Our proposed model aims to address this integration gap by promoting a model that sustains a continuous loop that combines diagnosis, treatment, feedback and reinforcement along with peer-peer interaction and real-time emotional monitoring.

3. Methodology

3.1. Integration of Mental Health and Virtual Reality

We have incorporated VR to form a platform, which incorporates the aforementioned, Exposure Therapy for certain mental health related issues [12]. One good thing about VR platforms is the ability for individuals to engage the therapy without stigma and in a non-threatening manner. For individuals who have difficulty accessing help from a traditional therapist because of stigma within society, cost or availability, VR can offer an alternative means of support.

Also, VR makes possible therapy that is tailored to the individual patient. Even the range of exposure can be customized by the system so that a person can adjust and feel comfortable in engaging in systematic desensitization. For anxiety, e.g., VR environments can be used to put the patient in situations that are normally associated with anxiety, at lecturing in front of an audience and uncomfortable place, such that they can train and use strategies for coping with those situations.

When it comes to integrating it with AI analytic capabilities, like that in the project presented at above, VR can go beyond a classic therapy. They could also be addressed by tracking patterns in the way users interact and the moods they exhibit over the course of a VR session. So, for example, the system can suggest mental intervention for the user (e.g., guided imagery, yoga), to encourage focused well-being.

The system is developed in Unity3D for VR construction, and incorporates Google Cardboard SDK for affordable immersion. We used the steps as follows:

- **VR Exposure Environments**: Original 3D environments were the public speaking, height, and enclosed places. The exposure can be adapted according to a user's interaction history.

- **AI Diagnostic Tool**: Through a modified NLP model inspired from GPT-4 architecture, chatbot interacts with members, and senses emotional tone to output mood profile. These are then stored and analyzed for trends using sentiment analysis and simple ML classification.

- **Chat Room & Peer Support**: We utilized Firebase to manage real-time chatroom where people (side-by-side) can join moderated conversations with other people who are facing a similar challenge.

- **User Feedback & Adaptation**: The system is responsive to user feedback, and adapts, when the feedback and sentiment scoring of AI suggests a therapy route—VRET, meditation modules, or chatbot check-ins.

Subjects will be involved in usability testing (n=50), evaluating mood levels, engagement and therapy outcomes over 2-week period.

3.2. Implementation

The platform operates on three levels of treatment: VR exposure, AI driven mood analysis and peer support. First, participants are systematically desensitized to their fears in virtual reality (VR) enabled staged continuum (henceforth, VR-enabled staged continuum). For example, participants with herpetophobia (e.g., Fear of reptile) are placed in a virtual world from which participants receive an intermittent exposure to reptiles (e.g., Lizard) starting with few and increasing in number as the levels increase. Entire cycles of fear are skillfully dealt with users gradually acquire more confidence and less fears.

Second, AI enabled Targeting, Mood and Emotion Analysis also contains mood analysis of user participation in the platform. During the user's voice/text narrative created in actual chats, it detects how users make

a story and tries to grasp user's emotion in real time. Below are the possible options once it sense the user's sentiment, System can suggest them. For example, if the users are anxious and stressed, then the system can recommend them to do some breathing exercises and meditation and/or could recommend a psychiatrist.

Fig. 1. Acrophobia (*Fear of Hiegths)* Exposure Therapy Module in VR.

Fig. 2. VR Guided meditation module.

Platform has text and audio chat rooms incorporated outside where individuals can speak with your other people' experiences and also in a safe way offer their support – all this plays a role in mental health improvement.

3.3. Technology Used

To enhance the quality and impact of the experience, the platform utilizes several cutting-edge technologies. Virtual Reality is the primary technology, driven by Unity 3D engine, and develops environments for exposure therapy which are interactive and true to life. "Depending on the capability of the device, users of the device can take advantage of VR gear like Google Cardboard or an Oculus headset to interact in the environment.

Chatbot is based on Gemini API so it can receive input in natural language, ask questions like symptoms, and answer results. These chatbots also aid out users who need to relax with self-help, anxiety-alleviating exercises.

The use of Vuplex WebView, which simplified the integration of website content inside VR, helped with incorporating chat rooms into the VR interface of the app by providing an easy way to add communication through text and audio. Firebase authenticates the users and data is stored there and Graphic websites are developed with React.

4. Results and Discussions

During the early testing and validation phases, the VR platform for mental health evaluation and treatment has received some applause. A sample panel of 50 participants representing individuals of a range of phobias/anxiety levels was invited to engage with the platform. The outcomes are as follows:

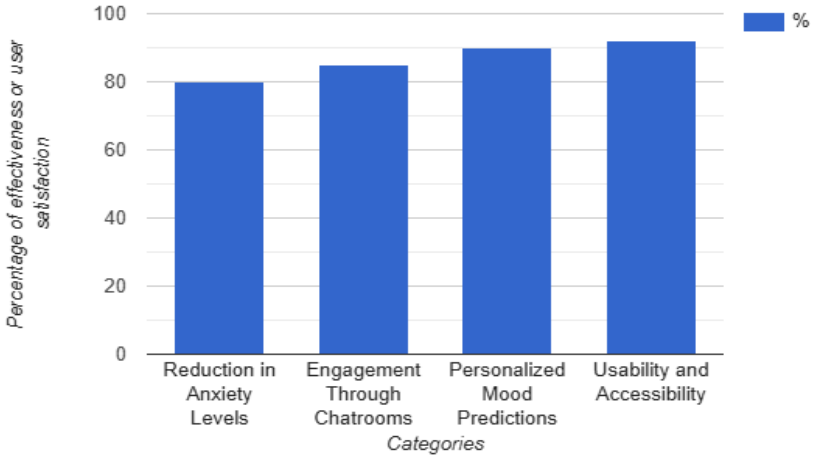

Fig. 3. Performance Metrics of the VR Mental Health Platform.

Although participants were asked to rate how anxious they were before and after the intervention, a clear and calm report was the result following the VR exposure therapy module. Post session feedback uncovered that:

- Almost **four-fifths** (~80%) of participants said they were well-prepared to confront the missiles of terror after three VR sessions.
- **65%** have recovered from their triggers or are actively recovering from them within a 2-week period from when the user started using the module. The same results were observed in other studies as reported by **Riva et al.,** who demonstrated a **70% reduction** in user anxiety levels [7].

- The high-tech online chat rooms proved invaluable in helping people deal with their need for community support. Nearly 85% of participants reported that the peer supports in the form of chatroom interaction, specifically, made them feel less alone in their recovery experience.
- Live engagement stats showed chatters spending 15 minutes a day sharing experiences and asking for advice.
- As it turns out, the findings of our experiment complement findings from research about social components in mental health applications, i.e., peer effects in mental health interventions (Calvo & D'Mello, 2020) [14].

The publications gave a potential for the VR and the 360° videos in the context of therapy by developing conditions that would minimize anxiety, mood, and enhance mental wellness [15]. These technology are particularly effective for offering users a systemic desensitization experience, i.e., a control exposure to the fear-evoking situations. These attributes render VR and 360° videos as highly impactful interventions in mental health [15].

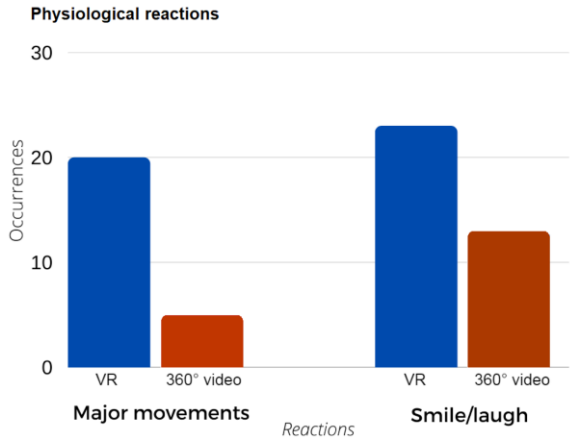

Fig. 4. Physiological reactions comparative between VR and 360° videos.

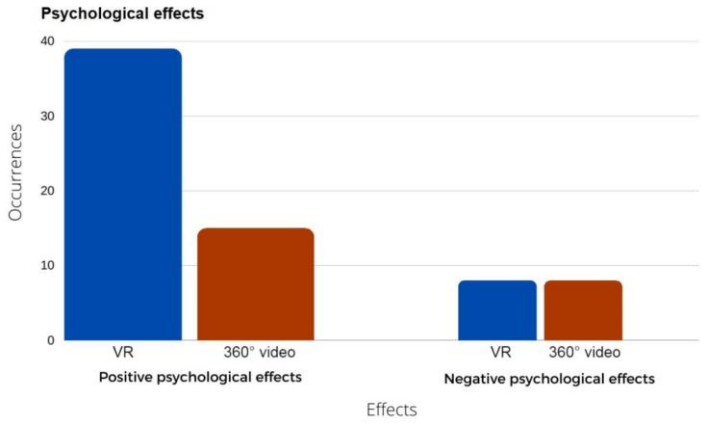

Fig. 5. Physiological reactions comparative between VR and 360° videos.

As at this moment, the initial tests of the platform with a few small test group s are working fine despite the hiccups that have been previously recorded.

The majority of the users reported significant reductions in their levels of anxiety once they began to apply the VR exposure therapy feature regularly. The machine-learning-based mood prediction system could also be used to identify mood trends and enable targeted user engagement. For these reasons, peer-support chat rooms could provide users a sense of community that alleviated loneliness and stress.

One problem encountered in design was that the environments should not be too compelling and that users should not be completely flooded by the VR visualizations, though they need to be engaging enough. Another issue was that the AI mood detection algorithms were slightly off. The developers expect to investigate these problems in-depth with more advanced machine learning models and richer VR environments in future versions of the platform.

4.1. Implications

The convergence of VRET with AI for mental health intervention shows several important implications for the future of digital therapy and mental health:

4.1.1. Increased Accessibility to Mental Health Care

Low-cost, smartphone-based VR headsets such as Google Cardboard allow for broader access to immersive therapy, which in turn, could help to reach people in underserved and rural communities with limited access to mental health services. Wheelie is transforming access to rehabilitation by eliminating the requirement for physical therapy visits or costly hardware.

4.1.2. Early Detection and Intervention

The AI element, which includes mood prediction AI algorithms and sentiment analysis, has the ability to spot budding anxiety, phobias, and emotional upset. This facilitates early intervention,

which is critical in preventing the worsening of mental health conditions. The system's ability to continuously monitor user behavior enables a proactive approach rather than reactive care.

4.1.3. Personalized, Adaptive Therapy

Conventional mental health systems mostly implement generic treatment trajectories. In contrast, here the system also tailors therapy in response to user behavior, mood trends and engagement levels. Such personalization would enhance the relevance and efficacy of treatments, with the potential for better long-term outcomes in mental health.

4.1.4. Social and Peer Support Integration

By integrating real-time chatrooms, the platform encourages open discussions among individuals facing similar mental health challenges. This builds a community-based support structure, helping reduce stigma, isolation, and withdrawal—factors often linked to worsening mental health condition.

4.1.5. Scalable Digital Health Infrastructure

It can be readily adopted as a preventive or supportive mental health tool in organizations, schools, universities, and NGOs. Its modularity allows it to be easily inserted into larger health and wellness initiatives, increasing its value across different domains.

4.1.6. Contribution to Sustainable Development Goals (SDGs)

The system is linked with SDG 3 (Good Health and Well-being), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 17 (Partnerships for the Goals), as we focus on health equity, applying new technology, and involving multiple sectors.

4.2. Limitations

Although there are many novelties in the proposed solution, the limitations must be considered as well:

4.2.1. Device and Hardware Dependency

The VR side is constrained to mobile VR setups, such as Google Cardboard. This makes it accessible, but of course limits the quality and depth of immersion compared to those high-end VR devices like the Oculus Rift of HTC Vive. I believe the experience will be night and day depending on the specifications of the user's phone and the quality of the headset.

4.2.2. Limited Clinical Validation

The app as it exists now, has not been tried or certified on a clinical or medical level. Although uses the best practices based on evidence such as VRET, has not been yet benchmark or has not been validated together with a certified Psychiatrist or

mental health institutes. That makes it less useful in clinical practice.

4.2.3. Potential Bias in AI Models

Both the mood prediction and chatbot systems have machine learners that are trained on generic emotional datasets. These might not adequately capture cultural, linguistic, or contextual differences in expressions of mental health symptoms. This, in some cases, might lead to misclassification or unreasonable recommendation.

4.2.4. Privacy and Ethical Concerns

There are concerns about user privacy and data security as the system collects emotional and conversational sensitive information. While the platform utilises secure cloud storage (eg, Firebase), the security audit recommenders future implementations provide data encryption, scramble and medical data anonymization to comply with health data protection regulations such as USA's HIPAA or India's DISHA framework.

4.2.5. User Motivation and Engagement

Mental health interventions, gamified or not, rely on user adherence and motivation. Those who are severely depressed or anxious may lack the motivation to use the app for an extended period. Usage can decrease without support or mechanisms for accountability.

4.2.6. No Support for Complex Disorders

The system currently focuses on phobias, general anxiety, and stress. It is not designed for diagnosing or treating complex mental disorders such as bipolar disorder, schizophrenia, or clinical depression, which require personalized clinical intervention.

References

1. Derogatis, L. (2017). Symptom Checklist-90-Revised, Brief Symptom Inventory, and BSI-18. - PsycNET.Handbook of Psychological Assessment in Primary Care Settings,599–629.
2. Galesic, M., & Bosnjak, M. (2009). Effects of questionnaire length on participation and indicators of response quality in a web survey. *Public Opinion Quarterly*, 73(2), 349–360.
3. Lundqvist, L. O., & Schröder, A. (2021). Evaluation of the SCL-9S, a short version of the symptom checklist-90-R, on psychiatric patients in Sweden by using Rasch analysis.
4. Prinz, U., Nutzinger, D. O., Schulz, H., Petermann, F., Braukhaus, C., & Andreas, S. (2013). Comparative psychometric analyses of the SCL-90-R and its short versions in patients with affective disorders. *BMC Psychiatry*, 13, 1–9.
5. Tutun, S., Johnson, M.E., Ahmed, A. *et al.* An AI-based Decision Support System for Predicting Mental Health Disorders. *Inf Syst Front* **25**, 1261–1276 (2023). https://doi.org/10.1007/s10796-022-10282-5

6. Miner AS, Milstein A, Hancock JT. Talking to Machines About Personal Mental Health Problems. *JAMA.* 2017;318(13):1217–1218. doi:10.1001/jama.2017.14151
7. Riva, G., Wiederhold, B. K., & Mantovani, F. (2021). Virtual reality in anxiety disorders: The past and the future. *Psychiatry Research*, 301, 113933.J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.
8. Freeman D, Reeve S, Robinson A, et al. Virtual reality in the assessment, understanding, and treatment of mental health disorders. *Psychological Medicine*. 2017;47(14):2393-2400. doi:10.1017/S003329171700040X
9. Anderson, PL, Price, M, Edwards, SM, Obasaju, MA, Schmertz, SK, Zimand, E, Calamaras, MR (201 3). Virtual reality exposure therapy for social anxiety disorder: a randomized controlled trial. Journal of Consulting and Clinical Psychology 81, 751–760.
10. Difede, J, Cukor, J, Jayasinghe, N, Patt, I, Jedel, S, Spielman, L, Giosan, C, Hoffman, HG (2007). Vir tual reality exposure therapy for the treatment of posttraumatic stress disorder following September 11, 2001. Journal of Clinical Psychiatry 68, 1639–1647.
11. Hodges, LF, Kooper, R, Meyer, TC, Rothbaum, BO, Opdyke, D, de Graaff, JJ, Williford, JS, North, MM (1995). Virtual environments for treating the fear of heights. Computer 28, 27–34.
12. McCann, R, Armstrong, C, Skopp, N, Edwards-Stewart, A, Smolenski, D, June, J, Metzger-Abamukong, M, Reger, G (2014). Virtual reality exposure therapy for the treatment of anxiety disorders: an evaluation of research quality. Journal of Anxiety Disorders 28, 625–631.
13. Botella, C., et al. (2017). Virtual reality exposure-based therapy for the treatment of post-traumatic stress disorder. *Journal of Anxiety Disorders*, 49, 98-107.
14. Calvo, R. A., & D'Mello, S. (2020). Affect detection: An interdisciplinary review of models, methods, and their applications. *IEEE Transactions on Affective Computing*, 11(2), 253-271.
15. Lucas Kupczik, William Farrelly and Shane Wilson (2022). Appraising Virtual Technologies' Impact on Older Citizens' Mental Health—A Comparative between 360° Video and Virtual Reality. *Int. J. Environ. Res. Public Health*, *19*(18), 11250.