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Virtual Reality based Stress Relief System

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***Abstract:** With the ascent of modern technology, the call for constant connectivity has led to growing physical and mental health concerns among the general masses. This inter connectivity has overwhelmed the populace with no room for relief. The objective of this project is to emulate environments and scenarios of the user's choosing through the use of mobile and dedicated virtual reality systems. These systems present an audio visual experience to the users with the added benefits of interactivity and immersion that become possible by using Virtual Reality as the base technology. These emulated environments are constructed to calm the user and help to immerse the user within these environments to calm the user in a stressful environment.*
***Keywords:** Stress, Emulation, Virtual Reality, Immersion, Audio Visual, Interactivity.*

I. INTRODUCTION

Stress has become the focal point as a major reason for mental health issues as researchers have continually reported findings that draw clear connections between the two. These factors have become even more prevalent in the modern era. The constant hustle bustle of daily life has contributed vastly to the issues of stress along with mental health deterioration especially among young adults. Stress has been found to contribute to the problems of various physical and mental health issues such as anxiety, depression, agitation, lower immunity, fatigue and so on. These issues can cause major setbacks to the well-being of the people impacted.

These stress related issues have especially compounded in the high pressure workplaces of today. As the infrastructure has improved, providing easier access to fast and reliable communication, it has also given rise to the sense of urgency and constant need to stay updated among the employees. The need to constantly stay on top of the workload has caused employees' mental and physical health to become strained. Younger adults especially are impacted by this high pressure work culture due to difficulties managing their work life balance as well as the sense of competition that needs to be possessed to be successful. This has led to feelings of self doubt, imposter syndrome and burnout among the employees. Deloitte conducted a workplace survey with 1,000 full-time US professionals and the results showed that a whopping 77 percent of respondents said that they had experienced employee burnout at their current job[1]. This showed that stress and burnout was prevalent across multiple industries and employees at different sections of the company hierarchy.

Different methods to overcome these issues have also gained traction in recent years. Research has been done to promote practices like yoga, meditation, therapy and other such ways to help reduce the stress felt in the daily lives of people. But of course, the effects of these traditional methods can be further boosted with the use of modern technology to help limit the effects of stress. Modern appliances have also allowed users to be exposed to different stress busting options available such as meditation apps, stress tracking devices and fidget gadgets. One of such technologies that can and have been used to reduce stress is the use of Virtual and Augmented Reality.

Technologies like Virtual and Augmented Reality have opened new doors towards research and development of applications in different industries. Industries such as education, retail, real estate, art, entertainment and many others. Due to their very nature, they have allowed developers to present a sense of interaction to their users that was not possible before. Virtual Reality allows the user to have a 360 degree audio visual experience with a certain level of interactivity that is not possible through the means of videos or games. This helps immerse the users into the world created by the developers. Augmented Reality has also gained traction as the proliferation of smartphones has made it available in the hands of the common consumer. These technologies have helped advancements in different industries especially where direct interaction with the systems may or may not be possible such as medical training, design and opens up a new perspective towards the fields of art and entertainment.

II. PROBLEM STATEMENT

Stress has been a major factor in the decline of human well being. Recent years have exacerbated this issue as we have become habitual to finding ourselves in constantly stressful situations. Advancements in technology have condensed this feeling of digital fatigue as well. People suffering from stress at work, in situations of daily life and exposed to other such stressors need to be helped through different means. These can be done using traditional as well as modern methods.

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III.NEED AND MOTIVATION

Since stress is a part of the hustle bustle of daily life, a means of combating this issue was needed. The effects of traditional methods such as meditation, yoga, mindfulness etc can be further enhanced through modern technologies such as Virtual Reality. Due to the very nature of the technology, Virtual Reality can enhance experiences that control and reduce stress through the means of Audio Visual feedback in a fully rendered three-dimensional world that can also offer the ability to interact with the environments.

By creating specific environments that please the senses of the user, stress can be reduced by mimicking a state of natural calm. These environments would offer the users a visual experience with proper visual feedback to help immerse the user into the virtual world created. This is done using techniques such as offering proper physics, spatial audio and rendering of the system.

However as most of the general populace don't have access to expensive VR headsets and machines powerful enough to run them, a smaller more viable option was needed along with the extensive systems. This smaller system would be easily available in the market and wouldn't incur the users extra costs for the hardware. With the recent proliferation of smartphones, mobile based VR and AR systems have become a possibility that simply wasn't the case before. With smartphones having Graphical Processing Units (GPUs) that are becoming more powerful day by day, it has become possible to render these intensive scenes onto the smartphones themselves. Through this, a wider audience can be reached and users don't have to purchase expensive hardware or software to experience this technology.

IV.METHODOLOGY

A. Modelling

Objects and models for the scenes were created using platforms like Blender and AutoCAD. Once the required objects appropriate for the scenes were created, a mesh layer was also generated for the same to ensure that proper collision detection is possible once the prefabs are imported into Unity3D without any issues. Some of the objects used were freely available on the Unity Store and were directly imported to the scene.

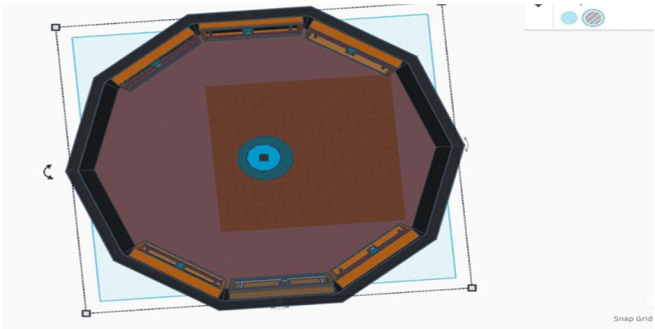

Fig. 1 Model for Selection Screen

B. Unity3D

The models created for these scenes were then imported into Unity3D inside a new project. Since the project targeted mobile devices, Google's Cardboard VR SDK was imported and used. This allowed the project to run on mobile devices that met the minimum software criteria. Proper API selection and development preferences were selected to ensure proper boot of the application.

C. Scene Creation

In order to provide a sense of comfort to the user, scenes were created of peaceful environments with the help of images available online being used as references. These stock images helped to provide a reference point as to the variety of objects needed as well as the positioning of these objects. These objects were placed on a terrain with varying altitude to create a sense of depth to the world. Along with this, proper shaders and materials were applied to the objects so that they exhibit proper lighting and features. Appropriate textures for the terrain and objects were also applied that were freely available on the internet. Different prop objects such as trees, animals, rocks, etc were also placed in the scene to provide a sense of belonging. These objects helped immerse the user within the scene. Proper physics simulation was also enabled so that all objects show proper weight and collision detection. Collision was enabled on all objects as well as the user to ensure no clipping or free fall occurs. This allowed user interaction and movement by the system while maintaining certain user boundaries. This also applied to the animal movement and interaction in the scene. The areas where movement was possible for non player characters were created using a navigation mesh.

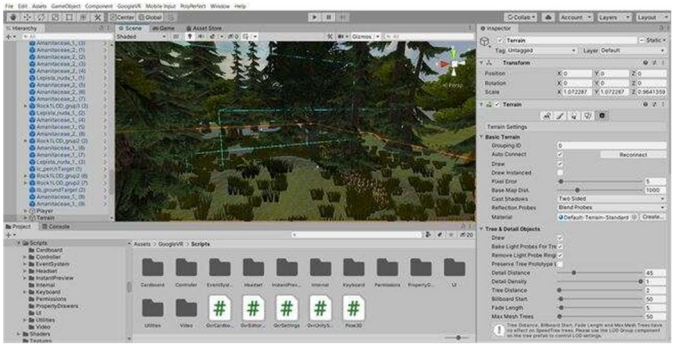

Fig. 2 Navigation Mesh

D. Lighting and Post Processing

In order to exhibit proper lighting and light interaction with the objects in the scene, Unity3D's inbuilt lighting model was used. This allowed proper light diffusion and interaction of light within the scene. A natural light system was used when the were natural. However, point lights were also used in order to create artificial lights where needed. Skyboxes were also used for environments along with moving clouds for immersion. Post Processing for these environments included particle systems and screen-space reflections. Opaque or transparent objects like water show reflections of their surroundings by using screen space. Along with this, particle systems were created that helped give depth to the environments and immerse the user such as falling leaves, fireflies, etc.

Fig. 3 Screen Space Reflections and Particle Systems

E. Audio

Audio was an integral part of the project and was necessary to properly immerse the user in the world. Using Unity3D's inbuilt audio system, proper sounds were given to the environments such as environmental sounds, object sounds, movement, etc. This audio was attributed to different appropriate objects. The audio was also given proper fall off so that as the user moves away from the object, the sounds also begin to drop off. This helped to create a proper world of audio that interacted with the user and followed real world attributes.

F. Optimisation

As the target system were smartphones in order to maximise the user base, optimisation was necessary. Proper optimisation was required to ensure good performance on relatively less powerful handheld devices in comparison to dedicated Virtual Reality systems. In order to increase performance, techniques such as baked lighting, Occlusion culling, Stereo pass rendering, billboard textures, etc were used. Baked lighting was helpful to reduce CPU overhead and used in environments where multiple light sources were not present. Occlusion culling is a form of optimisation where the scene is not rendered in full that exists outside the user's field of vision. This was especially helpful as VR allowed the user to look in 6 dimensions of the scene. Billboard textures and batching was used on things like grass which were used in large quantities, where 3D rendering was not required. Along with this, Stereo Pass Rendering was an inbuilt option in Unity3D where a single rendered image is sent to both eyes instead of individual rendering twice to save on performance. This optimisation helped to drastically bring down the cost of rendering for the mobile device.

V. RESULTS

The application was created on Android, and thus allowed the user to experience Virtual Reality through the use of Google Cardboard. The application includes multiple scenes that are available to the user to experience such as environments including forests, waterfalls, an underwater spectacle among others. These specific environments were helpful to immerse and calm the user with proper audio visual feedback and interactivity along with a 360 degree view available for the user to look around in. These environments exhibited proper lighting and physics appropriate for the scene. The application was compiled and run on multiple devices of varying software specifications in order to ensure compatibility on a range of devices.

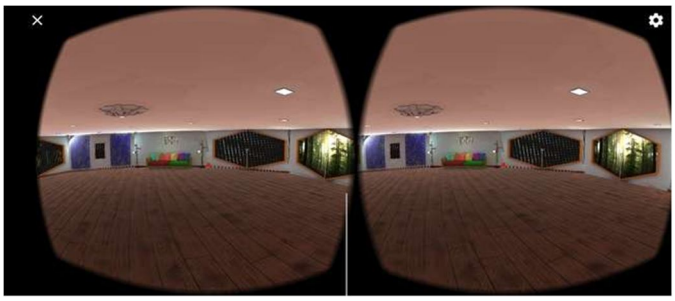

Fig. 4 Scene Selection Screen

Fig. 5 Forest Scene on Google Cardboard

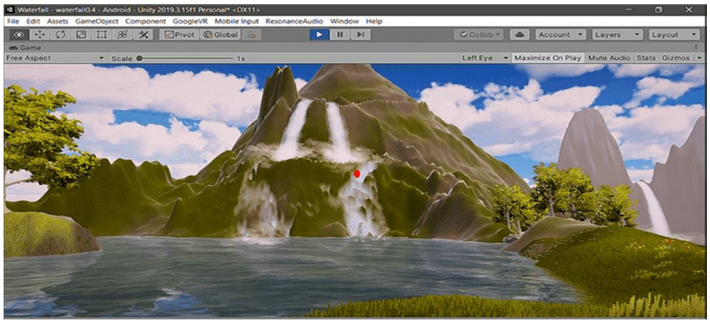

Fig. 6 Waterfall Scene

VI. CONCLUSION AND FUTURE SCOPE

Thus, the creation of this application has provided an insight into the future of technology that can be developed to reduce the stress epidemic harming the well-being of people. This technology has presented the opportunity to positively impact the society through virtual immersion of the user base while increasing the proliferation of this technology among the masses by targeting common available hardware like smartphones. The continuous advancement in technology as well as a well installed user base will positively influence the future of this technology which will bring superior hardware and software capabilities such as realistic rendering, better performance and compatibility. Along with this, separate systems can be added to the project such as real time health monitoring such as heart rate, blood pressure, etc. This will help provide better and more robust data analysis that will help target specific stress points and increase the overall effectiveness of the system. Research into this technology for related issues such as anxiety and post traumatic stress disorder (PTSD) may also be possible.

VII. ACKNOWLEDGMENT

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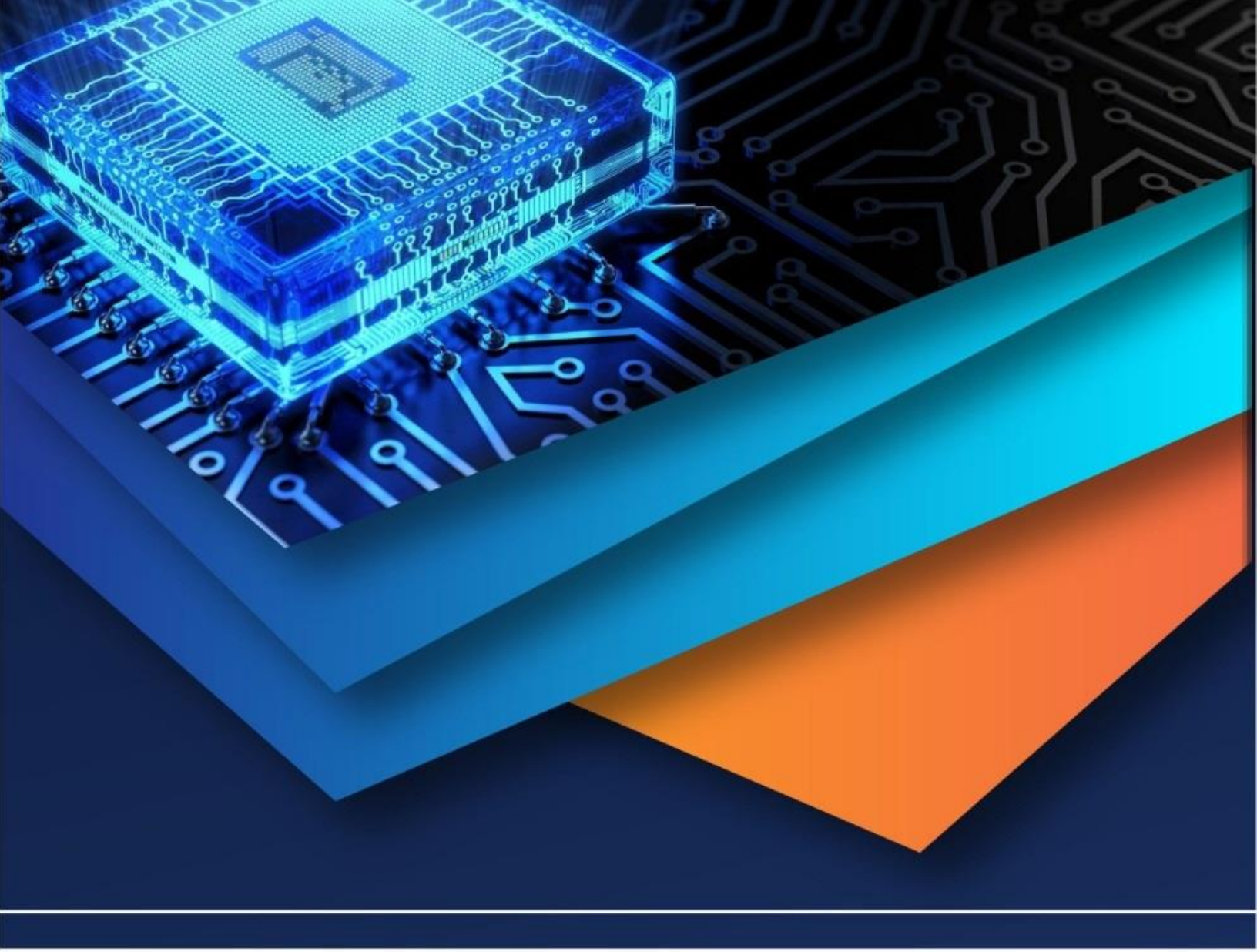

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