

Virtual Reality in Treating Mental Illnesses

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Abstract - Amid COVID - 19, the world has experienced an exponential rise in the cases of mental illness. In our country, there has been 20% increment in the cases of mental illness like anxiety, different phobias etc. Therapist asks the patient (suffering from phobias and other mental illness) to imagine certain things as a part to cure their problem, so it become difficult for patients to create the particular situation in their mind. So, in this term paper I am firstly going to introduce that what is virtual reality, what are their types and how this technology can be implemented in treating the mental illness. Virtual Reality is the technology by which a user can easily interact with a virtual environment, the environment can be the simulation of the real world or an imaginary world. This technology has the ability to create the virtual environment for the patient suffering from the mental illness so that they are shown such a content which can overcome their difficulties. The most established finding is that Virtual reality has the exposure-based treatment which can reduce the anxiety disorders. In my term paper I will also study that what are the ways of creating the virtual environment for treating the patient which include Modelling, Animation, Taking Pictures, Filming, Combination and sound. In spite of the benefits of the Virtual Reality there are certain limitations. I will also conduct survey as to analyze the current condition of mental health and If the people believe that Virtual reality can help them or not.

1.INTRODUCTION

The cases of mental illness is major concern among the teenagers. They often visit to psychiatric for their treatment and they ask the patient to imagine things as the part of their therapy. But they face difficulty on doing so. In my research paper I am going to learn that How the Virtual Reality therapy can make the imagination power more efficient. First of all, I am going to state briefly about Virtual Reality can how this technology can be implemented in treating mental illness.

Virtual Reality concept was first introduced in 1950's and now it is most evident in the field of entertainment. Our generation is most evident to this Virtual Reality concept. The most common example is 3D and 11D movies where we use motion chairs, glasses, gloves etc. to get the real time experience.

In simple words, Virtual Reality is the computer-generated simulation with images and sounds that represents a real place and situation and it could be experienced by people using some electronic equipment. Currently many big

companies like Google, Microsoft, Amazon, Samsung etc. are performing research and development on Virtual Reality concept.

There are many cutting edge tools of virtual reality for example – PrioVR, Leap Motion, Real 3D glasses etc.

1.1 TYPES OF VIRTUAL REALITY

1. FULLY IMMERSIVE

→ In this type of Virtual Reality one can experience full virtual experience because this type of virtual reality comes with a powerful computer. This computer can detect sounds, sight and even the slightest movement. The viewer will be given a head-mounted display (HMD) and also sensory gloves. To achieve this reality the device will make use of two monitors and a sound system.



Figure 1

2. NON-IMMERSIVE

→ This type of Virtual reality can be seen in the virtual flight simulator. It consists of widescreen PC with surround system and accessories like headphones, joystick etc. It is called non-immersive because the viewer does not get fully immersed in the reality this device produces.



Figure 2

3. WEB -BASED

→ This Virtual reality has been discovered to use virtual reality over an internet using the VR markup language (VRML). This gives an opportunity to the people to discover new and interesting things over the internet. People can interact and can have real experience with their friends on social media.



Figure 3

4. AUGMENTED REALITY

→ In this one can experience a real-world experience in such a way that it feels like a virtual reality experience. For instance, a person can visit a historical site on the internet and 3D mapping can show the person landmarks, building, historical locations and many more.



Figure 4

5. COLLABORATIVE

→ This reality is usually in the form of VR games and they are not fully immersive. This Virtual reality gives the viewer and interactive experience so one can share their experience with other person in the Virtual world.



Figure 5

1.2 DIFFERENCE BETWEEN VIRTUAL REALITY AND AUGMENTED REALITY

Virtual Reality is technically a computer-generated 3D environment which can be explored and interacted with by a human. In Virtual Reality, people become the part of the virtual world or environment or is immersed and is able to control objects or to perform a series of actions.

But Augmented Reality is used to enhance natural environments or situations and offer perpetually enriched experience.

2. LITERATURE REVIEW

One of the major concerns in this rapidly changing world is to deal with mental illness. Every second person is suffering from this. During 1840s **Dorothea Lynde Dix** started Mental Health Movement with the aim to change the view of people on mental illness. In earlier times people used herbs, acupuncture, and emotional therapy for treating mental illness. In today's life Virtual Reality has emerged as one of the way to treat mental illness

Between the time period 1990's and 2000's psychologists started to use VR with prolonged exposure therapy. This study was mainly done to look on the efficiency of VR based exposure theory which focused on the treatment of acrophobia and the outcome stated that it was fruitful.

Many arranged reviews (Freeman et al., 2017; Gregg & Tarrier, 2007; McCann et al., 2014;) and other meta-analytic studies (Rizzo, 2008; Powers & Emmel kamp, 2008) summarized that the most well-known finding is that VR exposure-based treatments can reduce anxiety disorders and PTSD. Many other researches had been on the efficiency of VR in treatment of fear of height, water, flying and many more.

As the use of VR is now quite handy it is no longer used for only gaming purpose. There are many emerging companies who are using Virtual and Augmented reality in treating mental health. Soon the days will come when this VR technology will make its way in operating rooms and clinic.

3. HOW DOES VIRTUAL REALITY WORKS?

→ Virtual Reality needs several devices as follows

- 1.) HEADSET - It displays content in front of user's eye.



Figure 7

2.) HDMI – It’s a cable that transfers images to the screen from the personal computer.



Figure 8

3.) LENSES - Some designers use lenses to change flat images into 3D images. Virtual Reality devices gives 100/110-degree field of sight.



Figure 9

To make virtual simulation look realistic ,60 frame rate per second is needed.

For users interaction with virtual world, we need: -

1. HEAD-TRACKING

→VR headsets use head tracking system that traces the head movement of the user to sides and angles. This system requires tools like accelerometer, gyroscope, LED’s around headset to enable the outside camera etc. to assign X, Y, Z axis of directions and movements. To avoid lagging of head movements, this system requires 50 millisecond or less latency rate.

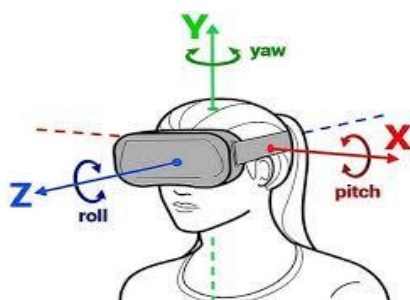


Figure 10

2. EYE-TRACKING

→The infrared controller of VR headsets tracks the movement of users’ eye. This system gives more realistic view to the user inside virtual world.



Figure 11

3. MOTION-TRACKING

→It works on the concept of 6 degrees of freedom.

Motion tracking falls into two groups

1. Optical tracking – the camera fitted on the headset follows the movements.
2. Non – optical tracking – it uses sensors on device or body.

Most of the VR devices have both optical and non - optical tracking.



Figure 12

4. WHAT IS MENTAL ILLNESS?

It is the health condition that changes thinking, emotion, mood and behavior of the person. It can be mild or severe. It is associated with distress and problems functioning in social, working and family activities. The most common examples these days are Schizophrenia, ADHD, PTSD, Anxiety disorder (which includes phobias), severe stress, etc.

Mental Illnesses are very common these days and can be managed by combination of medication and psychotherapy.

Nearly 13% or 970 million people across globe has some type of mental illness.

In India, 17% of the population suffer from some kind of mental illness.

Amid COVID 19, there has been 20% rise in the cases of mental illness across globe.

5. PROBLEMS FACED BY PATIENT SUFFERING FROM MENTAL ILLNESS

People suffering from mental illnesses cure their problem by going to psychotherapist.

As remedy, therapist often asks patient to imagine certain situations in their mind, these are the situations related to their problems and then therapist gives them the solution considering that patients are creating the scenario very well in their mind. But, in reality patients are not able to create the particular scenario in their mind. So, it becomes difficult for both therapist and patient to resolve the problem as imagining becomes difficult for the patient.

Also, therapist has to accompany patients to various places to give them real time experience. It becomes time consuming for therapist to do all these procedures.

6. HOW VIRTUAL REALITY WOULD HELP PATIENTS SUFFERING FROM VARIOUS MENTAL ILLNESSES

The use virtual reality technology in psychological therapy is called Virtual Reality enabled therapy or VR therapy.

This VR therapy has been proven a groundbreaking treatment and a promising new approach.

VR enabled therapy – This therapy includes specially programmed computers, visual immersion devices which creates artificial environment to give a simulated experience to diagnose patients suffering from mental illnesses.

When VR enabled therapy is automated and also the therapist is embedded within the program as an avatar, it helps obvious based treatment and may felicitate an oversized increase within the number of patients who is treated .VR enabled therapy is giving superior experience to patients.

The best thing about VR enabled therapy is that it provides powerful simulations in the environment without the perceived danger of a real life setting and patients can repeatedly go into the artificially created environment.

Therapist says that VR enabled therapy is easy to engage the patients and patients have found this therapy as a fun experience.

7. WAYS OF CREATING VIRTUAL ENVIRONMENT FOR TREATMENT

Mainly, we will be using different methods for creating virtual environment:

- Modelling with the help of Computer graphics
- Modelling animation with the help of animation program
- Taking photos of static objects and scenes with the help of special scanning techniques to create 360 degrees panoramas
- Combination of above-mentioned methods-

1. MODELLING

3D graphics plays a major role in modeling. With the help of 3D graphics, virtual world is becoming more realistic. Thus, modelling plays a very important role in virtual world. For modeling, we take help from the computers to create realistic scene illumination (shadows, reflection, refraction).

Methods of creating 3D model: -

→ Using curves: It is the method of creating surface model using multiple connected curves.

→ Polygon modeling: It is considered to be the widely used method for creating 3D model by plane (used to model human head) and individual curves are being cloned, thus creating surface model.

→ Box Modelling: Using basic geometric shapes, complex structure can be created.

There is high demand of creating modelled environment for treatment of phobias because this artificial environment gives compatibility and smooth implementation on variety of computers, also it gives good quality of pictures. Output software should be able run on a regular desktop (at psychotherapist's office). Several virtual reality tools are designed for this purpose, for example head tracker, virtual gloves, stereoscopic glasses etc.

2. ANIMATION

→ All objects in the real world are in motion. Humans are accustomed to movements and if everything would stop suddenly, then it would not consider as normal. So, simulation of real-world movement is important to make virtual reality thing work. The more realistic VR environment will evoke the feeling that the patient is really in real world and not in virtual world.

Animation of complex models can be implemented by the following steps: -

→ Creation of a model skeleton using tool bones

→ Creation of a network 3D model of an object

→ Connection between the network 3D model and skeleton.

Direct and inverse kinematic concept using animation tool is being used to establish relative movement of bones.

While displaying any feared situation through VR, it arises some concern for the patients suffering from phobias as they may get scared by only a vague thought or a bad memory. So, for increasing the success, a timeline to modeled scene will be created consisting of information about the change in position, shape, size and other parameters of individual objects.

For capturing the movement of individual object, we use system which is based on inserting key frames into the timeline and defining which parameter is to be remembered for that frame as a key. For example:- save the new position of about 10 frames forward .

For modeling exterior environment, simple animations can be used. For example: - to simulate the movement of sun , we can continuously change the angle of objects shadow.

3. TAKING PICTURES

Photography is less difficult to create than modeling and animation and it captures an almost exact picture of the scene. It includes summary of steps like photographing 360 degrees panoramas, processing them into interactive applications for different devices and final insertion into the application environment. So, it is appropriate for creating artificial environment for the treatment of phobias. There are many ways of shooting and creating real world environment using digital photographs.

- Taking photos from smartphone which has a function of creating panoramas or it could be done by using apps which are available at play store. In this case, while taking pictures, suitably rotate the phone and the software of panorama will automatically take care of everything.
- We can also capture picture from FFOV (Full Field of View) panoramas which is a multi-line panorama with full 360 degrees horizontal and vertical coverage.
- For best possible quality, we can use shooting digital SLR camera, though it is expensive. The panoramic head and photofinishing in specialized programs on a computer, we can manage to create difficult scenes and can achieve full control of exposure.

4. FILMING (VIDEO CAPTURING)

Filming is another way of capturing and processing 360 degrees panoramic images. This method must be adapted so that it could be played on different platforms and VR peripheral. For dynamic scenes or the scenes of fast-moving objects, we need to adopt technically more complex filming method where we will use 6 GoPro wide angled lens Camera's placed in a holder that holds the direction of rotation. When treating phobias, it is necessary to aim for patient's attention to a specific situation or object. For such situations it is necessary to capture detailed scenario in

which all of the conditions are captured : camera view, angle of view, dialogues, the reactions of people with the variety of video effects such as blur ,haze etc. are being used. When shooting environment for treatment of phobias in comparison to earlier means of technologies and creates the real world environment.

5. COMBINATION

This option is about analyzing all four methods, their advantages and disadvantages and suitability for creating different types of environment. Every method has its own setback, so combination of method would create a virtual environment exactly according to the needs of patients suffering from different mental illness.

6. SOUNDS

Sound is an essential part of Virtual Reality which evokes the environment and completes the environment. For some phobias for example phonophobia (where sound is the main stimulus for induction of anxiety and fear), it is very much essential. For variety of sounds, we need to create database of sounds for faster access and retrieval.

8. METHODOLOGY OF CREATION IN SOFTWARE

There are various types of software like Blender 3D, 3D Studio Max, Cinema 4D by which modelling, and animation of VR object can be done. Blender 3D is considered best as it is multiplatform open source software with small capacity. It focuses mainly on post – production activities, creation of interactive applications and creation of 3D virtual environment. It includes interactive elements like Blender Game Engine in the treatment of phobias.

For creating FFOV panoramas, a number of high-quality software solutions are used. For example, Autopano Giga software from Kolor.

9. SPECIAL HARDWARE

To immerse the patient in the virtual world environment, patient has to be surrounded by different stimuli. For example: - if patient turns to left side, the view of only left side should be available. Sight, hearing, and touch are mainly three senses through which virtual world could be sensed.

For entering into virtual world :-

The massive glasses contain two small LCD screens for both eyes separately. The basic principle of display is that each will get a slightly different view. Each eye will watch a particular point from a different angle.

Image analysis and spatial sensors are used to track the position and orientation. Spatial sensors tells about the current orientation and position. These are used in advanced simulators like in aviation and healthcare sector. Another hardware used is control device like data gloves. The control

device records the information and send the recorded information to the computer in the form of electrical signal. The computer transforms these signals to bring movement in the virtual hands.

All these hardware tools are used in the virtual world for the treatment of patients suffering from mental illnesses.

So, availability and affordability should be available at therapist's office.

10. HOW CAN WE MAKE VIRTUAL REALITY THERAPY AFFORDABLE?

By using less expensive virtual reality tools. We can also adopt method that requires less capital. For example, therapist can use 'taking picture' method in place of 'video capturing' method because video capturing method requires high end cameras which are very expensive.

IMPLEMENTING THE CONCEPT OF 3D THEATER FOR CLINICAL PURPOSE IN EVERY CITY-

In this concept, each city will have a theater where any certified therapist from that city would bring their patients to the theater, the patients will be given a 3D glasses and video will be shown of the situation related to their fear. The 3D glasses will create a pseudo environment in front of the patients and sounds will be produced to make the environment more realistic. The patient will pay to the therapist and the therapist would pay some amount for every session to the theater. By this way, each therapist would be able to treat his/her patient with the help of virtual reality without thinking much about the expenses.

11. LIMITATIONS

Everything comes with certain limitations, so is the case in Virtual reality therapy. The major side effect of this therapy is Virtual Reality induced sickness. In some trials of virtual enabled therapy, it has been found that patient started developing symptoms of dizziness, nausea, headache, eye strain, reduced postural control, decreased sense of presence and most importantly the development of inappropriate responses to the real world situations.

Some studies also showed that some patients developed addiction towards VR gaming after being treated by virtual enabled therapy.

12. FUTURE SCOPE

There's no doubt that virtual enabled therapy is emerging as the one stop solution for the treatment of patient suffering from various mental illnesses. For this project, in each area, reviews show the need of future research. It is also worth exploring the possibility of using the virtual reality within patient's home with less or no interaction with therapist. Depression is increasing day by day among common people, so, more research orientation initiative has to be taken in

treatment of depression as very less research has been done on depression.

All type of virtual enabled therapy requires expensive tools, so research is needed in the affordability problem.

In future VR interventional studies, it may be worth considering the use of side-effect measuring method, such as the Simulator Sickness Questionnaire (SSQ).

13. SURVEY REPORT

→The objective of my project was to show that how creating the artificial environment using Virtual reality would help patient in treating the various types of the Mental illnesses and phobias to imagine certain situations as part of their therapy.

The research was based on the primary data for which I have conducted survey from 115 respondents and secondary data.

→ Results from the survey shows that 34.2% respondents can't imagine a particular situation.

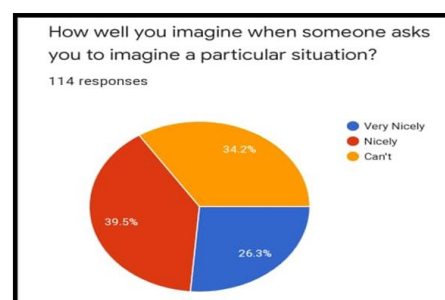


Figure 16

→65.2 % respondents agreed that Virtual Reality can help the them in imagine certain things.

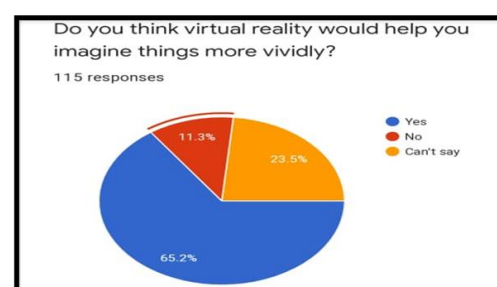


Figure 18

→60 % agreed to the fact that Virtual Reality can help in curing in different phobias.

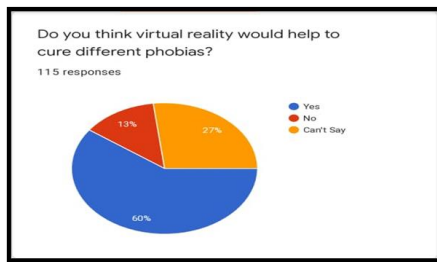


Figure 19

→60.7 % respondents are found to depressed always and 39.3% are found to be depressed sometimes which shows that depression is common among most of the teenagers.

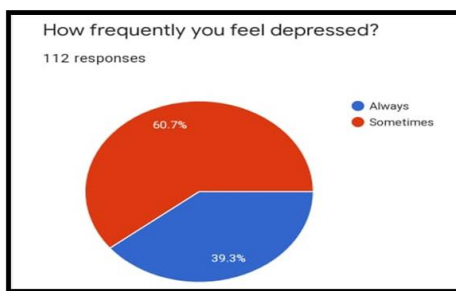
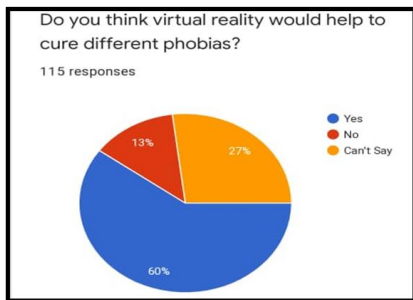


Figure 20

→60 % of the respondents agreed to the fact that Virtual reality can help people in curing different phobias.



14. CONCLUSION

→After studying my research paper, I came to a conclusion that Virtual Reality has the ability to cure certain mental illness like anxiety and many different phobias. It is very much difficult for the patient to imagine certain things as to cure mental illness, but virtual reality makes it easy. A survey of about 115 people was being conducted and it clearly shows that 65.2 % respondents agreed that Virtual Reality can help them in imagine certain things and 60.7% of the respondents agreed that they are depressed which has been increased in the past 7-8 months just because of Covid-19. My main focus of the term paper was to learn that Virtual reality can help the person to overcome the difficulty of mental illness or not and my survey reports clearly shows that 60% respondents agreed to the fact that ,different phobias can be cured with Virtual Reality. Every technology

has its own advantages and disadvantages. So Virtual Reality therapy has also certain limitations. In some of the trails it has been found that the patient have developed some of the symptoms like nausea, headache and many more which I have already included in my term paper.

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