Term Report

on

VR in Patient Rehabilitation

Submitted by

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Roll No. 21111056 of 2021-25

1st Semester, B.Tech

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0.1 Absract

Gaming refers to the act of playing electronic games on consoles, computers, mobile phones, or other devices. Virtual reality is a technique that aims to regenerate computer images and videos in order to create real-life visual experiences that go beyond what can be produced on a regular computer monitor and phone. Virtual reality is mostly used in VR training for medical students. Virtual reality medical training is a cutting-edge means of educating healthcare professionals. But a lesser known and a newer usage of VR in medical field is its usage in patient rehabilitation. Virtual Reality (VR) has lately emerged as a valid supplement to conventional therapy. Researchers are looking for new ways to improve motor therapy and make it more entertaining and successful. Virtual reality (VR) technology can offer an interactive, stimulating environment in which practise intensity and feedback can be adjusted to produce personalised retraining programmes. Virtual reality has the advantage of virtually unlimited possibilities. Virtual worlds may be tailored to the individual's cognitive and physical disabilities. An example of technology used in these type of rehabilitation is AppliedVR's SootheVR. Today, virtual reality-based telerehabilitation is a hot topic of study.

0.2 Introduction

Gaming refers to the act of playing electronic games on consoles, computers, mobile phones, or other devices. Gaming is a complex term that refers to regular gaming, potentially as a pastime. Although gaming has generally been a lonely hobby, internet multiplayer video games have made it a popular communal activity.

Virtual reality is a technique that aims to regenerate computer images and videos in order to create real-life visual experiences that go beyond what can be produced on a regular computer monitor and phone. Virtual reality systems achieve this by combining computer vision and powerful graphics to create 3D images and video with depth, as well as reconstructing the scale and distances between static 2D visuals. In short, virtual reality is all about creating a three-dimensional world with a device like a special 3D video or image camera that a user may alter and explore later or in real-time utilizing VR headsets and lenses, while feeling as if he or she is in that simulated world. A person browsing and interacting with VR content with VR gloves and a hand avatar. The glove sends motion from the hand to the VR computing or processing unit or system, which then reflects it on the screen. The stimulus will also be transmitted back to the user through the VR. As a result, it has two key features: computer vision to aid in object recognition and position tracking to aid in tracking user movement in order to properly place

objects on the display and change the user's experience so that they may "see the world."

Virtual reality offers a wide range of uses. While the majority of uses are related to gaming, it is also being used in medicine, engineering, manufacturing, design, education and training, and a variety of other sectors. Virtual reality is mostly used in VR training for medical students. Virtual reality medical training is a cutting-edge means of educating healthcare professionals. Users can utilise this technology to immerse themselves in diverse circumstances in virtual environments. Users can, for example, immerse themselves by viewing a virtual human body from different perspectives and scales. Students and interns will be able to receive more involved training, while doctors will be able to improve their professional abilities.

But a lesser known and a newer usage of VR in medical field is its usage in patient rehabilitation. In recent years, the use of virtual reality (VR) in healthcare has grown. The unique use of VR as one modality of a comprehensive rehabilitation strategy may minimise the issues faced by patients with protracted COVID-19-related hospitalizations — social isolation, disability, neurologic sequelae, adjustment-related anxiety, sadness, and stress. And this rehabilitation program can be extended to many other kinds of patients suffering with various kinds of problems. Thus we will be seeing how VR facilitates rehabilitation.

0.3 VR in Rehabilitation

Consider grasping for anything. It appears to be a simple process, but it is actually a complicated act. This activity is based on a series of motor actions that are processed at multiple levels across the brain and body. What appears to be a simple task, such as eating, typing an email, or reading a book, can become a problem for those with motor deficits after a brain injury. These processes include many elements of the central and peripheral nervous systems, and when one of them is disrupted, regaining motor functions can be a lengthy and laborious process. Intensive rehabilitation, repetitious motor training, and mirror therapy, among other recovery treatments, have all been investigated. But a newer strategy in which the scientists are looking into is VR rehabilitation.

Researchers are looking for new ways to improve motor therapy and make it more entertaining and successful. By merging rehabilitation tactics in an innovative and low-cost approach, Virtual Reality (VR) has lately emerged as a valid supplement to conventional therapy. VR-based therapy can be engaging and motivational, as well as providing a pleasant learning experience.

VR is seeing more utilization in treating patients suffering from strokes. Virtual reality (VR) technology can offer an interactive, stimulating environment in which practise intensity and feedback can be adjusted to produce personalised retraining programmes. The virtual reality simulations were designed to test range of motion, movement speed, fractionation, and force generation. Literature on VR show a possible advantage that should be further investigated. Research describes a virtual reality system that offers massed practise using target-based exercises, visual and force feedback during the exercises, quantitative outcome measures, adaptability to patient function variation, transparent patient data storage, and

an engaging and motivating user interface. These case studies show how this VR system was used to supplement rehabilitation training for improving hand motor function in patients who were in the chronic phase of a stroke.

Tasks can be personalised to the patients' demands with VR-based therapy, such as mimicry or video-game-like exercises. Virtual reality has the advantage of virtually unlimited possibilities. Virtual worlds may be tailored to the individual's cognitive and physical disabilities, which is important for maximising brain reconfiguration and reactivating brain areas involved in motor planning, learning, and execution, as well as maintaining engagement. Because of this possible customisation, VR was also used in rehabilitation of patients who got diagnosed with COVID-19. The healing process for COVID-19 survivors of respiratory failure and critical illness is still difficult, with many suffering from severe end-organ damage, neurocognitive deficiencies, malnutrition and dysphagia, physical and occupational debility, anxiety, and depression and many more. COVID-19's protracted illness and recovery time, combined with infection-prevention measures that make on-site family visits or "off-unit" trips difficult or impossible, exacerbates social isolation and loneliness.Therapeutic techniques that assist patients cope with changes in functional status and reduce these symptoms are particularly beneficial. Meditation and mindfulness-based therapies are becoming more popular as supplementary therapies, although Virtual reality (VR) may act as a vehicle to enhance access to these therapies in diverse health care settings in times of isolation and limited resources. Virtual reality has been investigated as a tool for mental health issues, specific motor impairments, and improving patient motivation and involvement with overall therapy goals. Because of its features as a distraction tactic, studies have also used VR as a therapy for acute and chronic pain management.

An example of technology used in these type of rehabilitation is AppliedVR's SootheVR. The commercially available headset comes programmed with a variety of experiences, including (1) guided meditation sessions set in highly realistic immersive nature scenes, (2) sessions set in highly realistic natural settings in

which patients can passively or actively explore natural and outdoor settings, and (3) cognitive stimulation games. The principles of virtual reality (VR) and brain computer interface (BCI) have been used by researchers at the University of South Carolina to treat chronic stroke survivors with varying degrees of motor dysfunction. Their multimodal technique employs virtual reality to show patients avatars of their upper limbs, followed by a combination of brain (electroencephalography, or EEG) and muscle (electromyography, or EMG) sensors and signals to visualise their attempted movement to complete the job. This has been proven to increase patients' motor imagery (their capacity to imagine and plan motions), re-engage motor circuits, and improve upper limb motor function recovery over time.

Today, virtual reality-based telerehabilitation is a hot topic of study. Patients can readily access and execute workout programmes prescribed by therapists using VR-based telerehabilitation from the comfort of their own homes. Virtual reality assignments provide patients with a safe and regulated environment in which to exercise. Clinical data is collected in real time and stored in online databases that may be accessed from anywhere.

0.4 Conclusion

Virtual reality is still in its infancy in medical and rehabilitation procedures, and physicians are grappling with unanswered problems about the technology, such as how to use it safely. However, initial results from pilot studies are highly encouraging, especially for post-stroke chronic patients, and provide insights on the effectiveness of VR-based motor rehabilitation including:

- It offers more advanced digital rehabilitation procedures as an alternative to traditional therapy, allowing rehabilitation measures to have a greater impact.
- It enables people with various neurological illnesses to carry out acts that they would otherwise be unable to do in real life owing to their limitations.
- It is capable of developing tailored treatment programmes based on comprehensive assessment and case-by-case therapy goals.
- It uses 3D virtual settings and video game-like tasks to increase patient engagement and motivation.
- It gives you instant and useful feedback.
- It improves results by analysing and measuring neurophysiological data.
- Telerehabilitation can take place in a controlled environment.

0.5 References

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