Chapter 2

Impact of Virtual Reality in Healthcare: A Review

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ABSTRACT

Virtual reality (VR) is the simulation of reality where the users would be immersed in an artificial/virtual environment that isn’t there but creates an illusion as if it really exists. People using this technology get a feeling that they are performing everything in real time. This gives users a sense of satisfaction. Initially, VR technology was used for gaming purposes, but now it is used in many sectors, including healthcare. There are many situations wherein, when it is expensive or impossible to do something, in reality, a probable solution is virtual reality. An important area where it is explored is healthcare for training doctors, diagnosis, and treatment of various ailments. The main objective of this chapter is to shed light on the applications of VR in healthcare and to discuss some applications showing how the medical field has already started reaping the benefits of VR.

INTRODUCTION

Overview of the Chapter

This chapter provides state of art review of the use of VR in Healthcare. Right from training medical doctors, it is used in treatment of various ailments and to aid in surgery. The use of VR in each of these areas is treated separately. The case studies presented in the chapter cover various VR applications in healthcare such as physical rehabilitation and physiotherapy, cognitive rehabilitation, reducing preoperative anxiety and pain management. The main idea is to put forth the advancements VR has brought in Healthcare and to prove its usefulness by presenting some case studies.

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Impact of Virtual Reality in Healthcare

1. **Background**: This section provides the readers with the Introduction to VR, definition, various Components and the essential Software used in developing VR applications.

2. **Benefits of VR in Healthcare**: This section highlights the various areas of healthcare where VR is in use namely
   a. VR in Medicine
   b. Training Medical Practitioners
   c. Reducing Stress and Pain
   d. Counseling
   e. Cognitive Rehabilitation
   f. Physical Therapy

3. **VR Diagnostics and Treatment**: The objective of this section is to give an understanding to the users as to how VR has been used in the diagnostics and treatment of some health conditions. Benefits of VR in Surgery is also presented, the topics discussed under this section are:
   a. VR in Dentistry
   b. VR in Autism
   c. VR in Mental Health
   d. VR in Surgery

4. **Case Study**: There are many real time Healthcare applications where VR was used. In order to familiarize the readers with these works various case studies performed by doctors/ Healthcare professionals and researchers are presented.

5. **References**: The journal papers, books, proceedings and Websites referred in writing the chapter are mentioned in the Reference section.

**Background**

Virtual Reality (VR) is a technology that makes it possible to experience anything, anywhere, anytime by actually convincing the human brain that something which is not actually there exists. Head mounted displays are used with headphones and hand controllers to provide a fully immersive experience. VR is emerging leaps and bounds as many large companies like Facebook, Google and Microsoft are investing billions of dollars into this area. There are a number of adventurous activities which we might dream of doing – going to Mars, swimming in an ocean, playing with elephants etc. But with the advancement of VR all these dreams are possible by sitting at home. VR actually simulates an imaginary world using high performance computers and sensory equipment like headsets, position tracker and a set of wired gloves. VR is not used only for entertainment but also to train pilots, physicians and for a scientist/ researcher to figure out complex problems.

The first actual VR head-mounted display (HMD) was created in 1968 by computer scientist Ivan Sutherland (Daniel Freeman & Jason Freeman,2017).From its development the essential elements of VR haven’t changed greatly over the years — a computer generates an image, a display system presents the sensory information, and a tracker feeds back the user’s position and orientation in order to update the image — but what’s new is the sophistication and affordability of the technology (Freeman & Freeman,2017).

Some of the definitions of VR: Virtual Reality is electronic simulations of environments experienced via head mounted eye goggles and wired clothing enabling the end user to interact in realistic three-dimensional situations(Coates,1992). Virtual Reality is an alternate world filled with computer-
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