Application of Virtual Reality in Medical Field

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Abstract

Virtual reality is an software technology that is used by the user to experience an real world scenario by sitting at their desired place. This paper is based on the analysis of how VR is used for solving medical related problem. VR provides a best way for planning major surgeries and it helps the young medical practitioner to excel their practical skills. It helps to make plan for any treatment before implementing it on patients. In this paper we will see its applications and uses in the medical field.(2)

Keywords

Virtual Reality, Visualization, Architecture, Diagnosis, Surgery.

Introduction

In the last 8 years, Virtual Reality(VR) have attracted the interest of many corporates and the general public . This technology provides a cut above opportunity for visualizing procedures in 3D during the teaching sessions. In many medical institutes the professors use this technology to make the students practically understand the medical procedures done on human body. Also they can gain a immense knowledge with holographic images by using the VR headsets.

During a critical surgery case the doctor can able to make a practice in shorter period. If there is number of treatment for a medical case, the doctors can take out all the methods and choose the feasible one out. Also it makes the patients to understand what type of procedures are employed in a surgery that they are undergoing , this builds confidence in the patients.

VR is very useful in the study of orthopedics, where it is used to identify the bone fracture. And it provides a great way to improve the finger and hand movement while a orthopedic surgery. Teenage doctors who are new to the medical field can practice surgery digitally using VR headsets , so that it helps to decrease their panic and built a strong skills inside them.

VR technology has different components like display , eye tracking and motion tracking element, optical lenses, an audio enabled material to provide an realistic sound effect. In the medical domain it encloses Robotic surgery, treatment of Phobia and skill improvement.. This innovation also helps to make a research and find a cure for the new diseases. A surgeons at present can make 3D simulation based training in a controlled environment that they choice.

This technology provides a better treatment with a lesser errors.(1)

History of Virtual Reality

Today's trending Virtual Reality technologies are built upon the base ideas of 1800s, almost in the early of live photography. In 1838, using double mirrors a stereotype was invented.

The term Virtual Reality came into existence in the 1980's when VPL research was founded by the scientist Jaron Lanier, then after he began to develop the gloves and goggles that are prerequisites requirements to experience the Virtual Reality . Even past of it the technological scientists put the effort to create a simulation environments where one can a 3Dimensional images digitally. One major milestone is the invention of Sensoroma in the year 1956. At that period of time technologist Morton Heilg's was working in the Hollywood motion picture industry . His desire is to provide a realistic feel of the movies to the public such that they should feel they are in the scenario of the movie . Heligs's also tended a device called Telesphere mask in which the display device is mount headed. And this discovery made many technologists to evolve around it keeping it as a base and keep on upgrading it to a great extent.

And by the year 1965, another scientist known as Ivan Sutherland produced an device called as 'the ultimate display' . In the time interval between 1970's to 1980's many advancement happened in the optical devices, so that it lead to accelerated development of Virtual Reality headsets which is the result of today's high affordability of VR's.(3)

Necessity of VR in Medical Field

In the medical sector , this machinery was established in 1990's to provide appropriate coaching and to make success rate in the surgical operations high. VR gave the opportunity to visit inside a human body to view and understand all the organs how they perform which is impossible by the traditional means. This is used to examine a medical practitioner to check whether he/she is really eligible to make a practical surgery or not. It is useful for making plan for complex surgeries like neurosurgical procedure , as it gives many ideas for sergeants about the time taken, cuts required, risks involved so that they can choose a best solution.

Patients are provided the opportunity to understand their conditions easily by a 3D simulation controlled image, which helps them to easily understand the things quickly even by sitting at their home.

Working of Virtual Reality

The Software architecture of VR is illustrated below. It mainly contains of 5 important components:

1. **Database:**
   SQL database is used in the VR to store all the virtual scenes encountered. All the 3D animations are stored in a memory card using SQL database.

2. **Web Service:**
   The web service responsibility is to manage provide a two way communication between the database and other modules responsible for the visualization using HTTP(Hypertext Markup language) protocol.

3. **Scene Editor Module:**
   The scene editor module helps us to devise the Virtual representation by merging the 3D illusions with multimedia contents stored in Database. It is done through web service.

4. **Visualization module:**
   It is in charge of implementing the logics of virtual images to create a realistic 3D image. And also it bundles the graphical assets from , aerial environments and terrestrial environments like fog etc.

5. **Controller Module:**
   The controller is used to overview all the visual depiction operations to the user and check for any possible errors. Its responsibility is to deliver high quality content to the user. (4)

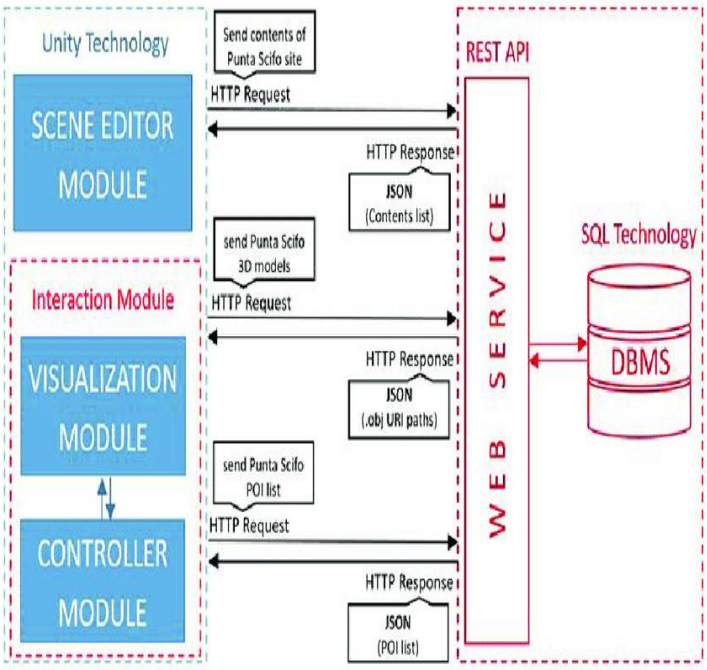

Fig-1: **Architecture of VR**

How VR is used in Medical Field

First, we need to define the medical purpose of VR and need to collect all the information(resources) required to perform the medical partition. In VR we have a lot choices in hardware such as which lens, sensors, audio device, displays to be employed and also in software side like Oculus Rift S, Oculus Quest, Oculus Go which helps to build a good 3D assets. And then 3D virtual data is created by merging all collected resources .

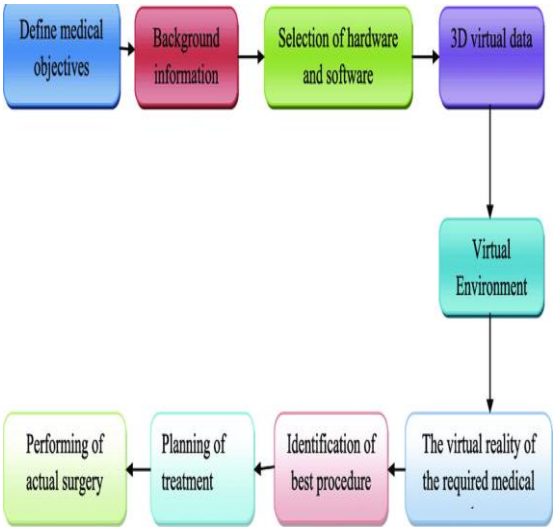

Fig-2: **Process of VR in Surgery**

Then then the doctors enter into the Virtual environment which is constructed using the given data. Then he chooses the specific medical condition and tries a different methods to perform the treatment and identify the best procedure among that , here doctor is given freedom to make a good reheraseal before the surgery so that he can be mentally prepared before the surgery. And then after choosing the best procedure to solve the problem they make the basic plans and perform the real surgery on the patients.(4)

VR's benefit in Medical Field

The present HealthCare industry showing a greater interest in the VR to improve the quality of treatment for the patients also this is useful for practical coaching for the students to gain a good knowledge in a compact environment. VR does not require huge amount of space as is compatible to smaller places also. VR gives a high effective solution for controlling the pain . The training provided along with VR will be more fun than the normal traditional method so that one who want a better understanding of the concepts can learn better along with fun . It can be used remotely as it is not only limited to work place, we can use it in our home also. VR can used multiple times by developing the content only once. And also sharing the one file from one device to another device is pretty easy and quicker. VR can be alternatively used for collecting of data to make an extensive data analysis on it. It can be also used as bridge between a patient and a doctor as it implies the doctor's ideas about the surgery to the patient's so that the patient's can easily easily understand the procedures.(5)

VR's Applications in Medical Field

1. **Medical Training:**
   VR simulation model is used for the training of medical students, so that 360-degree graphical video they can easily understand the topics very well.

2. **Diagnostics:**
   VR is a efficient diagnostic tool for a medical practitioner to carry out a diagnosis precisely. It is used in MRI/IT scans providing a pain free procedure.

3. **Pain management:**
   It acts as a distraction to the patients who are suffering from the severe pain , as the patient forget the pain as they play an interactive 3-D game.

4. **Surgery:**
   VR provides the surgeon an rehearsal before performing the actual surgery so that he can plan the complexity of the surgery, cuts , time involved etc. Also used for Robotics surgery.

5. **Mental illness treatment:**
   Visual therapy is one the common way for treating mental illness as when a mentally disturbed patients used a 3-D treatment video then their mental health will be improved a lot in a easier way.

6. **Other:**
   - VR for dental treatment
   - VR for treatment of Phobia(3)

Limitations

The major limitations of this innovation is the cost involved , it is very expensive to build the set up and needs an high end latest software to be installed also hardware's are a bit expensive. The prerequisite for VR for storing images is ample file space which is useless to discover new diseases . VR is limited to recognize only specific cases and requires a exact motion in the human body. And finally it cannot be useful in every surgeries performed .(3)

Conclusions

VR brings innovative features and facilities into the medical field providing a high success rate of treatment to the general ordains. This technology has huge applications in neurospace and physical therapy. It can greatly save the time for the surgeons to perform treatment for the people, so that they can increase their efficiency. From the past few years this technology is growing in

a rapid pace and this acceleration will be continued for the future as well. As the persons age increases his stress also increases , and this VR provides an excellent solution for stress management , though every individual can lead a life without stress being positive.(4)

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