Reviews of Virtual Reality and Computer World

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ABSTRACT- In this paper we present an overview of basic aspect of Virtual Reality (VR). We will describe important VR devices and there application when they are connected with three dimensional computer generated world, and how human can interact with the Virtual Reality.

Key Word: VR (virtual reality), VE (virtual environment)

I. INTRODUCTION

Virtual Reality is term used for computer-generated 3D environments that allow user to enter and interact with the virtual world [1].The "Virtual Reality" (VR) was initially given by Jaron Lanier. Founder of VPL Research (1989) [4]. Other related terms include "Artificial Reality" [5] and, more recently, "Virtual World" and "Virtual Environments".

A. Background

Many researchers and educational practitioners believe that VR technology offers strong benefits that can support education. The VR can change education in some different way.

In traditional instructional environment, students are expected to learn by assimilation, for example, by listening to an instructor lecture about a subject. Current education thinking is that students are better able to master, retain, and generalize new knowledge when they are actively involved in constructing that knowledge in a learning-by-doing situation [2].

And using VR technology we change traditional education in this manner.

- Teacher report their role in the classroom changing.
- Use of both pre-developed VR application and student development of VR worlds can be educationally effective.
- Student enjoy working with virtual worlds can be highly motivating.
- In practical terms, desktop VR is more suitable for widespread use than immersive VR technology.

Today, Virtual Reality is used in a verity of ways and often in a confusing and misleading manner. Originally, the term referred to "Immersive Virtual Reality ". In immersive VR, the user becomes fully immersed in an artificial, three-dimensional world that is completely generated by a computer [3].

B. Entering into the VR

A person may enter a world of virtual reality by putting on special glasses and headphones attached to a computer system running the virtual reality program. These devices immerse the user with the sightsand sounds of the virtual world. Some virtual reality systems allow the user to also wear gloves with electronic sensors that can be used to touch or move virtual objects. As the user moves his head or hands, the computer moves the virtual world accordingly in real-time.

Virtual Reality is a real-time and interactive technology. It means that the computer is able to detect user inputs and modify the virtual world instantaneously. Interactivity and its captivating power

contribute to the feeling of being the part of the action on the environment that the user experience. All human sensorial -channels can be used to have a high level interaction. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced simulators, use haptic systems which include tactile information, generally known as force feedback. So, we can summarize the above ideas of Virtual Reality in one definition is below.

Definition: Virtual Reality is a high-end user interface that involves real time simulation and interaction through multiple sensorial channels like visual, auditory or tactile.

Figure 1. VR

The above diagram suggeststhat it will be difficult or, even, impossible for human senses to distinguish between Reality and Virtuality, and that's the real challenging goal. But, to this aim, the Visualization Technology needs to realize a burst of speed.

II.STEREOGRAPHIC PROJECTIONS

Increasing the perception of three-dimensional depth in a scene is important in many applications.

There are two basic types of depth perception cues used by the eye-brain system, depending on whether they are apparent when one or two eyes used.

1. Monocular
2. Binocular

Principal of Monocular cues are: perspective (convergence of parallel lines); moment parallax (when the head moved laterally; near objects appear to more against a projection plan than far objects); relative size of known objects; overlap (a closer object overlap and appears in font of more distant object).

Principal of Binocular cues are the conversance angles of the optical axes of the eyes and the Retinal disparity (the different location of objects projected on the eye's retina is interrupted as differences in distance from the eye)[6].
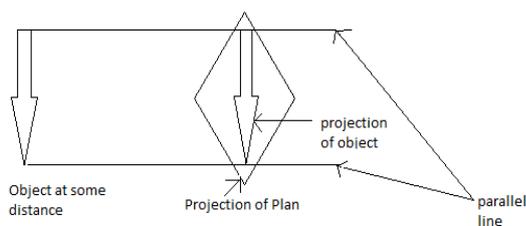
Figure2.Monocular cues
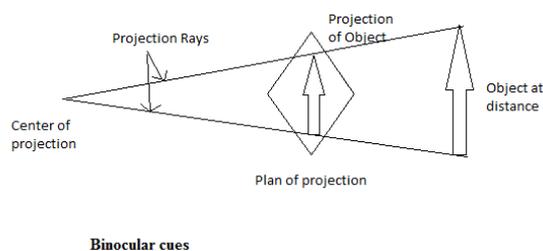
Figure3.Binocular cues

The monocular cues produce only weak perceptions of the three-dimensional depth. However, because the two separate and distinct images produced by each eye into a single image. The binocular

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cues produce very strong three-dimensionaldepth perceptions. Stereography attempts to produces to those for true binocular vision. There are several techniques for generatingstereo images. All depends upon supplying the left and right eyes with separate images.

III. VIRTUAL REALITY TYPES

We can categorize Virtual Reality System into three groups depending on the degree of immersion and interactivity. These three groups are

- Immersive System
- Non-immersive System
- Hybrid System

A. Immersive System

In this system replace our view of the real world with the computer-generated images that interact to the position and orientation of the user's hand.

Figure 4. Immersive system in VR

B. Non-immersive System

A non-immersive system on the other hand, leaves the user visually aware of the real word but able to observe the virtual world through some display device such as graphics workstation.

Figure 5.Non - Immersive system in VR

C.Hybrid system

A hybrid VR system permit the user to view the real world with virtual images superimposed over this view.

IV. CONNECTIVITY WITH VIRTUAL REALITY

A generic immersive VR system consists of three system elements interacting with each other to make the whole functioning system. These three elements are the Virtual Environment, the computer environment and VR interface. VE cover ideas such as modelling, introduction dynamic

features and physical constraints. The computer environment include the processor configuration, the I/O channels the VE database and the real-time operating system and VR interfaces encompass the hardware used for tracking head, recognizing hand gestures, detecting sound or haptic, 3D interfaces and multi-participant system. The connectivity between the system elements is depicted in fig.
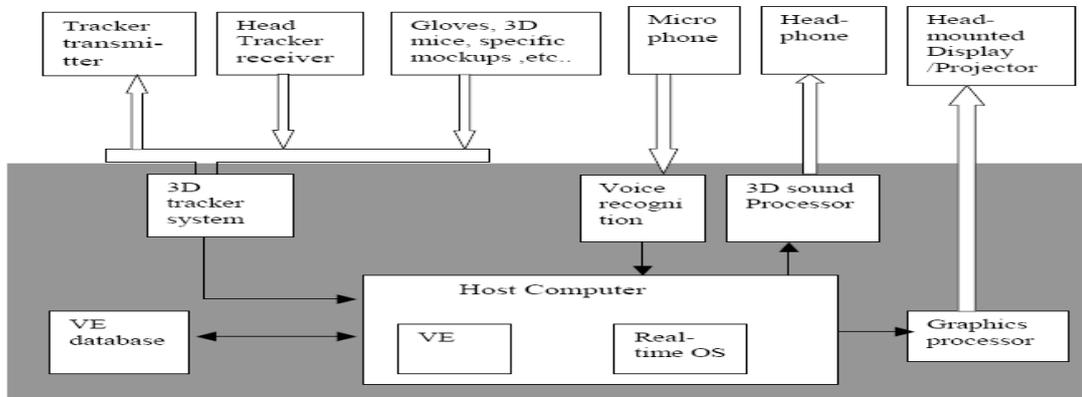
Figure 6.Connectivity between the elements and Virtual Reality system [5]

V. VR DEVICES

Humans are experienced in interacting with three-dimensional objects. Traditional computer configuration allows us to interact with virtual

A. Head Mounted Displays

The major aim of a Head-Mounted Display (HMD) is to give the user the sensation of immersion. In general, HMDs present the following characteristics.

Figure 7. HMD

(a) Headgear with two small display devices, each optically channelled to one eye, for binocular vision. (b) A tracking system for precise location of the user's head in real time

B. VR Glasses

Virtual Reality glasses are stereographic devices. Thus, perception of depth and the sense of space are enhanced when the user observe the virtual world [7]. Technology behind these equipment can vary form chromatic anaglyphic and ChromaDepth (encode depth into an image by means of colour) to liquid crystal display (LCD), also called in this paper shutter glasses, CrystalEyes and ElsaRevelator Glasses belongs to the LCD technology and are described below.

B.1 CrystalEyes

CrystalEyesis lightweight, wireless set of liquid crystal shutter eyewear for Stereo3D imaging in engineering and scientific application. The product delivers high-definition, stereoscopic3D images on all major UNIX platform and windows 2000. It is activated by an infrared emitter that connects to the user workstation.

CrystalEyes is supported by many professional software application used in mechanical CAD, molecular modelling, product visualization and simulation, GIS and medical imaging [7].

Figure 8.Crystal Eyes Shutter

Figure 9.Infrared Emitter

C. Data Glove

Data glove is an input device for human – computer interaction worn like a glove.
Data Gloves are hand measurements devices with sensors for both the flexion angles of the fingers and the orientation of the wrist.

Figure 11. Wired gloves

Here, in this figure
a. Accelerometer
b. Data board
c. Glow
d. Arm tracker

Fine motion control involves the sensors to detect the movements of the users hand and fingers, and the translation of these motions into signals that can be used by a virtual hand (for example, in gaming) or robotic hand (for example, in remote control surgery).

D. CAVE

The CAVE was developed to overcome some of the limitation of HMDs, especially for scientific application. The main goal is to provide high resolution, a large field of view, and stable display that did not encumber the viewer and would allow to multiple people to easily share the VR experience.
The CAVE technology was first developed at the University of Illinois at Chicago. It was built a multi-person 10x10x9 foot theatre, with images rear-projected on the walls, and projection down onto the floor, four projectors, one for each screen, are connected to graphics pipes of one or more high-end workstation.
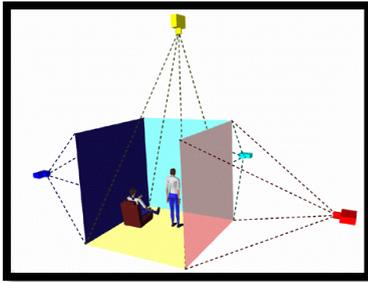
Figure 12.Concept behind CAVE   *Figure 13.Real-Time simulation in CAVE*

In the CAVE at Illinois 1024x768 resolution stereoscopic images are display on each screen at 96 Hz. Viewer wears stereographic liquid crystal shutter glasses to view the stereographic images. One user's hand is tracked with a 6 degree-of-freedom tracking system and images generated from that user's point of view.

VI. APPLICATION OF VIRTUAL REALITY

Virtual Worlds can represent in real or abstract 3D environments like Sculpture, Human anatomy, Crime scene reconstruction, Buildings, Landscapes, Underwater shipwrecks (Titanic), Training in various fields, Entertainment (gaming), In movie making etc.

A. Training

Virtual environments can be used to increase safety because doing so in real environment may be risky or may cause injury. Training can be given using VR in many fields like military training, driver training.

Figure 14. VR in Training

VR can be used in training to increase safety standards, improve efficiency and reduce training cost.

B. Medical

VR can be used in medical as education and surgical operation as well as training and treatment etc. VR is helpful for overcoming the disease like PTSD (Post Traumatic Stress Disorder). In this disease a person feels frightened, sad, anxious, and disconnected and it seems that a person is stuck between a constant sense of danger and painful memories.

Figure15.Person taking PTSD treatment

Figure 16.SurgicalOperation

C. Building & Architecture

The idea is to explore virtual buildings already designed but not constructed. Using CAVE client/user can walk into the virtual buildings and analyse its details.

Figure 17. Virtual Building

VR is widely used in this area, because using VR before doing any construction, architects or contractors can have idea about how the future building will look like.

D. Entertainment

Virtual Reality widely used in this field like gamming, movie making etc.

D.1 Movie making

Now a days VR is widely used in movie making business. The movie Avatar and Tron Legacy is the best example of this.

Figure 18. Movie making (Avatar)

In movie they generate virtual world using VR technology and the characters in virtual world (virtual) replicates the actions done by human having VR devices.

D.2 Gamming

Gamers love this technology because they always want to be a part of a game and VR gives them feeling that they are playing the game in real. Now a day's many games are available with VR devices two of them are displayed in the figure.

Figure 19. Gamming

E. Science

VR can be used in science in various ways one of them is to convert the data obtained from the experiments into the picture, because doing so will give the better understanding to the scientists.
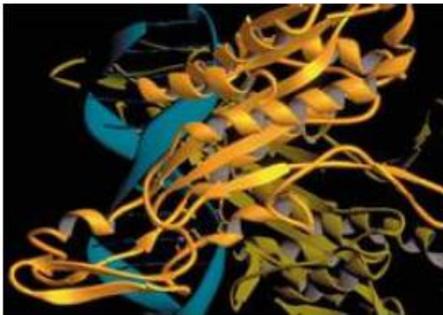
Figure 20.VR applied to Visualization of Scientific data
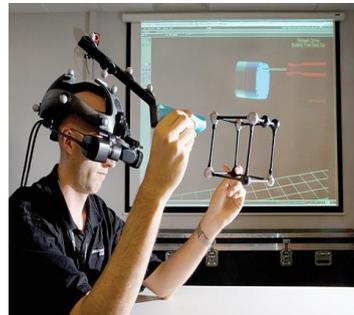
Figure 21. VR in Research

The Virtual wind Tunnel is an exampleof that. The Nanomanipulator [8], a user interface is another one.

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