ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 2, February 2017

Review on Virtual Reality and Its Challenges

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ABSTRACT: Virtual reality (VR) is a technology that enables a user to connect with a computer-simulated environment, whether it is real-world simulation or an imaginary world. This is the key to experience, feel and touch the past, present and future. It is the method of creating own universe, own customized reality. This could vary from making a video game to traveling around the world virtually from walking through own dream house to taking a walk on an alien planet. With virtual reality, by playing safe and with a learning perspective, user can experience the most intimidating and grueling situations. Nonetheless, very few people really know about VR, what its fundamental principles are and what its open issues are. A historical overview of the virtual reality is presented in this paper, which lists basic terms and classes of VR technologies. An informative study of typical VR systems is undertaken and the Virtual Reality challenges are found.

KEYWORDS*:* CAVE, Frame Rate, HMD, Image Resolution, Immersive Virtual, Latency, Levels Of Virtual Reality.

I.INTRODUCTION

Even the average user nowadays can switch into the environment of computer graphics. This obsession with a new (IR) world also begins and endures forever with computer games. Virtual Reality (VR) is an environment replicated to the computer. It simulates the physical presence of one person in the real and imaginary world [1]. It allows user to see the surrounding world in a different dimension and experience things that aren't accessible in reality or even formed yet. In fact, the universe of three-dimensional graphics has no boundaries or limitations, and can be generated and manipulated by user as he wishes – they can expand it with a fourth dimension: the dimension of imagination But not enough: people always want more. They want to move into and connect with this world – instead of just staring at a photo on the display. This technology is called virtual reality (VR) which is becoming overwhelmingly popular and trendy in the current decade [2]. Virtual reality is believed to have originated in the 1950s but it caught the attention of the public in the late 1980s and 1990s. This can be credited to researcher who is a pioneering computer scientist and introduced the world to the word ' virtual reality ' back in 1987. Many environments in virtual reality are mainly visual encounters that are viewed either on a monitor or through specialized stereoscopic displays [3]. Virtual reality might include auditory stimulation via speakers or headphones, as well. By using tools such as a keyboard, a joystick, or a wired glove, users can communicate with the virtual environment. Virtual reality history has been largely a story of attempts to make an experience more real. Most historical examples are visual and auditory to a lesser degree. That is because of all human senses; vision is by far the most information that is followed by listening [4].

II.HOW VIRTUAL REALITY WORKS

The concept behind VR is to provide a sense of being there by at least giving the eye what it would have received if it were there and, more importantly, having the image change instantly as the viewpoint changes. The understanding of spatial reality is guided by numerous visual signals, such as relative size, brightness and angular motion. One of the greatest is viewpoint, which in its binocular form is particularly powerful in that the right and left eyes see differing images. The stereovision is based on fusing these images into a single 3D representation. The depth perception provided by each eye seeing a slightly different image, eye parallax, is most effective for objects that are very close to user [5]. Objects farther away basically cast on each eye the same image. The characteristic VR dress code is a helmet

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with goggle-like displays, one for each eye. Each display provides an image with a slightly different perspective of what user would see if he were there. As he moves his head, the image is rapidly updating so he feels these changes are being made by moving his head (as opposed to the computer actually following your movement, which it is).

III.LEVELS OF VIRTUAL REALITY

Non-immersive: This level is typically encountered on a desktop computer where the virtual world is created without any special use of hardware or other processes. It may be used for the purpose of training. If the equipment is present, it is possible to simulate any scenario, which eliminates any impending dangers. Flight simulators allow pilots to learn and plan for scenarios that cannot be implemented in real-world training or are dangerous and expensive to implement. The impression of being submerged is created by the characters and actions generated by sensitive computers which the user can take [6].

Sensory-immersive (Semi-immersive): Real environment modeling plays an important role in this method in various applications of virtual reality, such as robot navigation, construction modeling, and airplane simulation. Within the virtual environment the user can navigate a visual representation of him. A common example is CAVE which is a cube of 10'x10'x9 in which user is surrounded by projected images; this gives the illusion of immersion in the virtual environment.

Neural-direct (Fully Immersive): Neural-direct is the basic principle for virtual reality. This kind of Virtual Reality reflects integration into a world where the human brain is connected directly to a database and the current position and orientation of the viewer. This completely neglects the hardware and the physical sense and projects a sensory input directly to the brain while actually projecting the conscious user into the virtual world [7].

IV.VIRTUAL REALITY SYSTEM

Virtual reality technology is a man-machine interface technology that creates environment simulating living and simulates diversified activities such as exploration and environmental interaction.

Components: Figure 1 displays most important aspects of the fundamental human (to) machine (to) human interaction loop for every immersive device in virtual reality. The consumer is provided with a head mounted screen, a tracker and, optionally, a tool for manipulation, such as a wand or a 3D mouse in the give figure. As human delivers actions such as strolling, rotating the head to shift his viewpoint, description of the user's behavior data is provided to the computer as an input from the devices input. The computer processes data in real time and returns a suitable result or output which is carried back to the user through output screens [8].

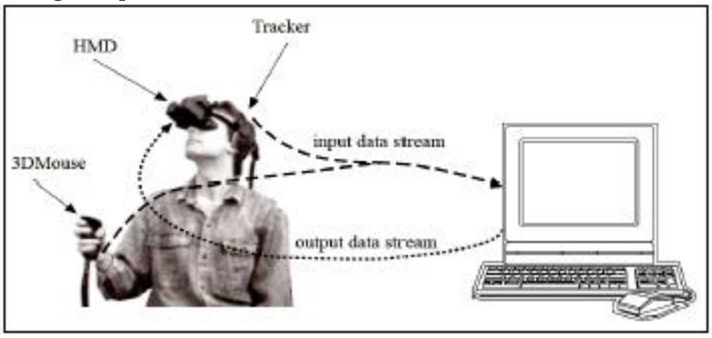

Fig. 1 Components of Virtual Reality

Design: A typical VR-system consisting of six main components:

1. Virtual World
2. Simulation Engine
3. Graphics Engine
4. User Interface
5. User Inputs
6. User outputs

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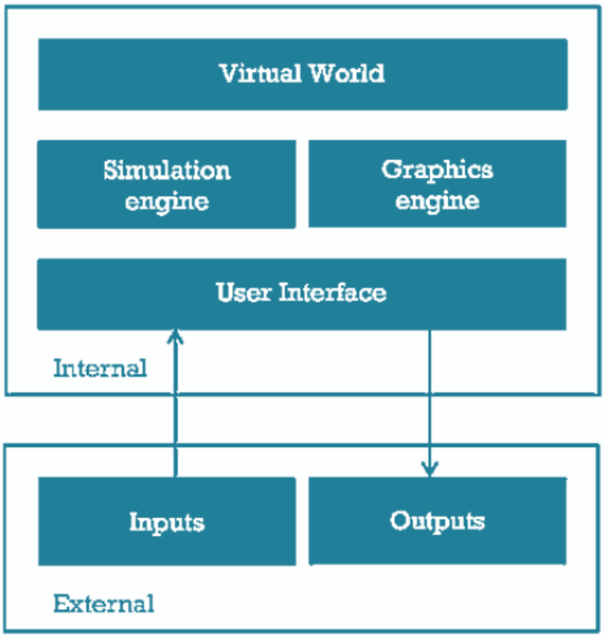

Fig. 2 Internal & External Design of VR

The virtual reality, graphic engine, simulator systems, and user interface serve as the internal parts; user inputs and user outputs act as Virtual Reality system's external components. The virtual reality consists of a database consisting of scenes with different geometric depictions as well as attributes that user will see inside the environment. The format of such representations depends on the engines used for graphics and simulations. The graphic engine is responsible for creating the picture or vision of what user is actually going to see in the VR environment. This is done mainly by considering the scene database and the current position and orientation of the user in the VR world, which is dependent on the user's head and body movement. The task of the simulation engine is to support, maintain alive and imitate an artificial (virtual) but real-looking environment. It is responsible for taking care of the behavior of the system-controlling changes in time and responding to the actions and expressions of the user [9]. It also includes handling any interactions or renders of programmed objects and physical simulation performances. The user interface is a part of the internal components which serves as a middleware that links the virtual environment, simulator engine and graphic engine with input and output devices for the user [10].

Important Factors:

(a) Virtual Realism: Since the primary purpose of virtual environments is to replicate the real world, developers need to learn how to "fool the senses of the user." This challenge is enormously complex: on the one hand they have to give the consumer a true feeling of being submerged, and on the other hand this solution has to be feasible.

(b) Image resolution: The computer-generated images are composed of separate pixels or picture elements. These vary in size and number according to the size and pixel density of the display. The pixels cannot be identified distinctly at higher resolutions and therefore the screen appears continuous to the user. Image resolution consists mainly of coloring and color brightness of what the user sees in the VR world. The graphics system has a significant burden as each pixel needs individual handling of its color and intensity to be illuminated.

(c) Latency: Latency, also known as lag, is a significant factor that addresses the level of realism and tolerability in the virtual environment. It is the lag caused between the action of the participant and the related response to the request. In the actual world the human senses in different situations are habituated to a certain speed of reaction for their actions. In the simulated setting, it is necessary to maintain that same pace, or the senses of the user becomes confused as the environment interacts with the brain used-to-real-world by the user. If it takes long to give the user some effect in the VR environment, the validity will be lost and the user will be able to take another action in the environment. The aim of each VR setting is, therefore, to keep the latency as low as possible for maximum realism.

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Navigation and Manipulation in VR System: Manipulating tasks requires choosing and moving objects. Users need to manipulate virtual objects with direct hand manipulation that allows users to relocate the object or to reorient it. After selecting the piece, the user must be able to move, rotate, scale, change attributes etc. This is done by identifying unique push buttons or hand gestures.
There are two main components of navigation tasks:

(a) Travel
(b) Way-Finding.

V.CHALLENGES FOR VIRTUAL REALITY SYSTEM

It's been a tradition that the number of problems has increasingly risen with technological advances.
Cost: Great work is involved in designing Virtual Reality systems. Creating the ultimate of virtual environments requires intricate geometric modeling and integrating countless functionality for realistic experience. Nonetheless, installing just a simple virtual environment with limited functionality, privacy, and scene databases is costing $250,000 at present.
Usability: In the virtual environment a user must be able to perceive and interact with information just like in the real world. But, it is very complex to include these features, as it requires accounting for different ways of representing information. Lots of power is spent on choosing which content structure is suitable for the activity of the user that needs to be performed in the specific virtual setting.
Modeling Software: Users can only participate in the virtual worlds through computer screens available in the current commercially systems. As a result, the user is not given the freedom to explore the world with a 360 degree view. The involvement of the user in the virtual setting is therefore limited by the screen size. Building an aircraft or spacecraft prototype and simulating through a particular terrain is one thing, but at the current point, using VR to model the universe and make trips to other planets is beyond reach. There are restrictions to how the brain works in the form of raw processing power, graphics and even understanding.
Dynamic Programming: Creating the virtual world is not only restricted to the design and modeling component of the environment, but also involves the interface with which the user can interact in the environment and how the feedback will be given to the user. To do this, they need to learn the awareness of the dynamism of the human brain – what are the brain's anticipated reaction times, how the eyes will experience the world, how the consumer will feel the objects, etc.

VI.CONCLUSION

There have been a lot of developments using VR and VR technologies. VR has spread across all aspects of human endeavors, including manufacturing / business, discovery, defense, recreation and medicine. The exciting VR sector has the potential to change human lives in many different ways. Now humans use mail or conference to connect while the person is not sitting with him but it doesn't matter because of technology. This technology gives immense opportunity to explore the 3D universe and your own imagination. VR technology is now widely known in science technological advancement as a major breakthrough.

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