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"An Overview of Virtual Reality"

Dr. AdilJamilZaru[(1)]Dr. Mohammad Alamgeer[(2)]
2.Assistant Professor, Department of Information Systems, King Khalid University,Kingdom of Saudi Arabia (KSA)
Corresponding Author:Dr. AdilJamilZaru

Abstract: *In today's world we are surrounded by a wonderful array of technologies. We have assimilated many of these technologies into our everyday lives. Increasingly, these different technologies are becoming integrated to provide new capabilities and services. And most frequently a computer is the heart of this integration. This is the case with Virtual Reality - a so-called technology which actually is a very sophisticated integration of a number of technologies.Virtual Reality (VR), sometimes called Virtual Environments (VE) has drawn much attention in the last few years. Extensive media coverage causes this interest to grow rapidly. Very few people, however, really know what VR is, what its basic principles and its open problems are. In this paper aoverview of virtual reality is presented, basic terminology and classes of VR systems are listed, followed by applications of this technology in science, work, and entertainment areas. An insightful study of typical VR systems is done. All components of VR application and interrelations between them are thoroughly examined: input devices, output devices and software. Additionally human factors and their implication on the design issues of VE are discussed. Finally, the future of VR is considered in two aspects: technological and social.*

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I. Introduction To Virtual Reality

Virtual Reality is a computer-based technology which incorporates specialized input and output devices to allow the user to interact with and experience an artificial environment as if it were the real world. A VR system permits the user to explore a three-dimensional virtual - or artificial - environment and to interact with life like and/or fantasy elements created by the designer. In the virtual world, the user can do things as routine as throwing a ball or as fantastic as flying through space. And these things can be made to occur by something as simple as a hand gesture or a nod or (one day) a sound.

Virtual Reality is generally a Computer Generated (CG) environment that makes the user think that he/she is in the real environment.

The virtual world is hosted on a computer in the form of a database (e.g. terrain database or environment database). The database resides in the memory of the computer. The database generally consists of points in space (vertices), as well as textures (images). vertices may be connected to form planes, commonly referred to as polygons. Each polygon consists of at least three vertices. The polygon could have a specific color, and the color could be shaded, or the polygon could have a texture pasted onto it. Virtual objects will consist of polygons. A virtual object will have a position (x, y, z), an orientation (yaw, pitch, roll) as well as attributes (e.g. gravity or elasticity). Virtual Reality (VR) provides the experience of perception and interaction through the use of sensors and effectors in a simulated environment. Advances in simulation technology allow computer resources to be interconnected with humans through the use of sensor systems and robotic devices. The goal of the simulation is to have a viewer see only the simulation -- as if the viewer were inside the simulation itself. Head motion and orientation are used to change the viewer's visual perception, making the experience appear real.

The virtual environment (also sometimes referred to as a synthetic environment) may be experienced with a Desktop VR System, or with an Immersive VR System.

DESKTOP VR SYSTEM :- With Desktop VR a computer screen is normally used as the display medium. The user views the virtual environment on the computer screen. In order to experience the virtual environment, the user must look at the screen the whole time.

IMMERSIVE VR SYSTEM :- With Immersive VR the user is 'immersed in' or 'surrounded by' the virtual environment.

II. Background

Virtual Reality (VR)
Technology has been identified both as a technology facilitator and a technology provider; applications using VR and/or VR as a technology itself. The major industrial fields, that drive the development of new VR technologies and force the improvement of the existing ones, have been identified and are the following: aerospace, automotive, engineering and design, energy and constructions, entertainment and culture.

III. Basic Definitions And Terminology

Virtual Environments (VE) and Virtual Reality (VR) are used in computer communityinterchangeably. There are some most popular used, among them are: Synthetic Experience, Virtual Worlds, Artificial Worlds or Artificial Reality. All these names mean the same:

- "Computer simulations that use 3D graphics and devices such as the Data Glove to allow the user to interact with the simulation.
- "Real-time interactive graphics with three-dimensional models, combined with a display technology that gives the user the immersion in the model world and direct manipulation."
- "Virtual reality lets you navigate and view a world of three dimensions in real time, withsix degrees of freedom. (...) In essence, virtual reality is clone of physicalreality.

Although there are some differences between these definitions, they are essentially equivalent.They all mean that VR is an interactive and immersive (with the feeling of presence) experiencein a simulated (autonomous) world (see fig. A1) – and this measure we will useto determine the level of advance of VR systems.

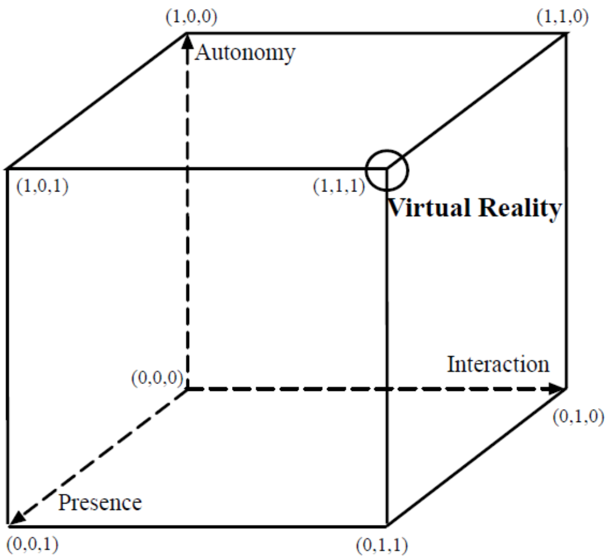

Figure A1. Autonomy, interaction, presence in VR – Zeltzer's cube

Many people, mainly the researchers use the term Virtual Environments instead of VirtualReality "because of the hype and the associated unrealistic expectations". Moreover,there are two important terms that must be mentioned when talking about VR: Telepresence andCyberspace. They are both tightly coupled with VR, but have a slightly different context:

• **Telepresence**is a specific kind of virtual reality that simulates a real but remote (in terms of distance or scale) environment. Another more precise definition says thattelepresence occurs when "at the work site, the manipulators have the dexterity to allow the operator to perform normal human functions; at the control station, the operatorreceives sufficient quantity and quality of sensory feedback to provide a feeling of actualpresence at the worksite"

• **Cyberspace**was invented and defined by William Gibson as "a consensual hallucination experienced daily by billions of legitimate operators (...) a graphicsrepresentation of data abstracted from the banks of every computer in human system". Today the term Cyberspace is rather associated with entertainmentsystems and World Wide Web (Internet).

IV. Applications Of VR

4.1. Inspiration to use VR

VR provides an easy, powerful, intuitive way of human-computer interaction. The user can watch and manipulate the simulated environment in the same way we act in the real world, without any need to learn how the complicated (and often clumsy) user interface works. Many applications like flightsimulators, architectural walkthrough or data visualization systems were developed relativelyfast. Later on, VR has was applied as a teleoperating and collaborative medium, and of coursein the entertainment area.

4.2. Architecture

An area in which virtual reality has tremendous potential is in architectural design. Already being created are architectural "walk-throughs" it allow designers and clients to examine homes and office buildings, inside and out, before they're built. With virtual reality, designers can interactively test a building before construction begins.

4.3 Training and education

The use of flight simulators has a long history and we can consider them as the precursors of today's VR. First such applications were reported in late 1950s and were constantly improved in many research institutes mainly for the military purposes. Nowadays they are used by many civil companies as well, because they offer lower operating costs than the real aircraft flight training and they are much safer. In other disciplines where training is necessary, simulations have also offered big benefits. Therefore they were prosperously applied for determining the efficiency of virtual reality training of astronauts by performing hazardous tasks in the space. Another applications that allow training of medicine students in performing endosurgery, operations of the eye.

4.4. Automotive

The automotive industry has been among the first sectors utilizing modernsimulation and visualization techniques and technologies in the productioncycle. Visual workstations are a must-have in the technical and styling departments, so as to diminish cost and time in the development process andenhance ideas and solutions sharing with non-specialized, high ranking,deciding personnel. VR technology in this field concurs not only in evaluating in a more naturalistic way the product under development, mainlyin terms of styling, but also in visualizing post-processed results of simulations,such as in DMU analysis and scientific visualization of fluid dynamicsor crash analysis results. Although such systems requested especially in the past vast investments,they have been embraced, as they allow both significant cost reductionthrough eliminating the need of physical mock-ups in early productionphases and extensive performance evaluation. As a result VR applications were established in the phases requiring visual representations for thirdparties (e.g. technicians and decisors), leading to a point, where almost allstyling and engineering departments in automotive OEMs are equippedwith at least stereo walls, or HMDs, while CAVEs® are also present in some R&D departments.

4.5.Constructions

The Constructions sector phases a major need in information management, as it is an information intensive industry. Therefore, a great amount of effortis invested by leading companies in developing models for informationmanagement. Nevertheless, yet no satisfactory results were produced, reposing the trust in VR to work towards a virtual information model for construction projects which can capture information related to each productlifecycle stage of a construction project. As project information isnormally not stored in an electronic form, preventing thus the sharing ofthousands of documents during a project, it is frequent that the significant human errors are made in managing documents, while data is normally not stored when created but only after the end of the project/construction stagewith possible leaks because of personnel with good command of the projectalready leaving to other projects before their input is captured.

4.6. Engineering

Some years ago process engineering moved from the use of pen and paper to the use of CAD software for drawing flow sheet and PI diagrams. Thenatural continuation is the adoption of 3D modeling.Large scale dynamic process simulation is primarily being used in the industry for design of process and control concepts, for automation testing and for operator training. The benefits from dynamic simulation are widelyacknowledged: the model shows how the system will behave, right andwrong operations in the plant. Yet the poor connectivity of simulationtools to the other software involved in plant engineering hinder furtheradoption of simulation technology. Although the necessary information fora functional simulation model (process component dimensions, controlparameters etc.) is known well in advance before the commissioning ofthe plant, the data is scattered in different systems, often incompatible.

4.7. Entertainment

Based on 3D Computer Graphics and are by now expecting more. Younger generations in particular, which are well acquainted with interactive 3Dgames, are seeking for new equivalent experiences. Therefore, new opportunitiesare created for Institutions in the Entertainment and Culture area toincrease attractiveness of their services.

V. Virtual Reality Visual Output Devices

Different type of VR systems – from desktop to full immersion – use different output visualdisplays. They can vary from a standard computer monitor to a sophisticated HMDs. Thefollowing section will present an overview of most often used displays in VR.

5.1 D glasses(see figure 1)

The simplest VR systems use only a monitor to present the scene to the user. However, the"window onto a world" paradigm can be enhanced by adding a stereo view by use of LCDshutter glasses. LCD shutter glasses support a three-dimensional view using sequential stereo: with high frequency they close and open eye views in turn, when the proper images are presented on the monitor (see fig.1). An alternative solution uses a projection screen instead of a CRT monitor. In this case polarization of light is possible and cheap polarization glasses can be used to extract proper images for each of the eyes. A head movement tracking can be added to support the user with motion parallax depth cue and increase therealism of the presented images.

5.2Head Mounted (Coupled) Displays (HMD) (see figure 2)

The head-mounted display (HMD) was the first device providing its wearer with an immersive experience. Evans and Sutherland demonstrated a head-mounted stereo display already in 1965. The Eye Phone from VPL Research was the first commercially available HMD (1989). A typical HMD houses two miniature display screens and an optical system that channels the images from the screens to the eyes, thereby, presenting a stereo view of a virtual world. A motion tracker continuously measures the position and orientation of the user's head and allows the image generating computer to adjust.

Since the HMD is mounted to the user's head it must fulfill strict ergonomic requirements: it should be relatively light, comfortable and easy to put on and off. As any visual display it should also have possibly the best quality.

5.3. Binocular Omni-Orientation Monitor (BOOM) (see figure 3)

The BOOM (Binocular Omni-Orientation Monitor) from Fake space is a head-coupled stereoscopic display device. Screens and optical system are housed in a box that is attached to a multi-link arm. The user looks into the box through two holes, sees the virtual world, and can guide the box to any position within the operational volume of the device.

5.4. Cave Automatic Virtual Environment (CAVE) (see figure 4)

The CAVE (Cave Automatic Virtual Environment) was developed at the University of Illinois at Chicago and provides the illusion of immersion by projecting stereo images on the walls and floor of a room-sized cube. Several persons wearing lightweight stereo glasses can enter and walk freely inside the CAVE.A head tracking system continuously adjust the stereo projection to the current position of the leading viewer.

Figure 1 Crystal Eyes LCD shutter glasses. **Figure 2** A head mounted display (HMD)

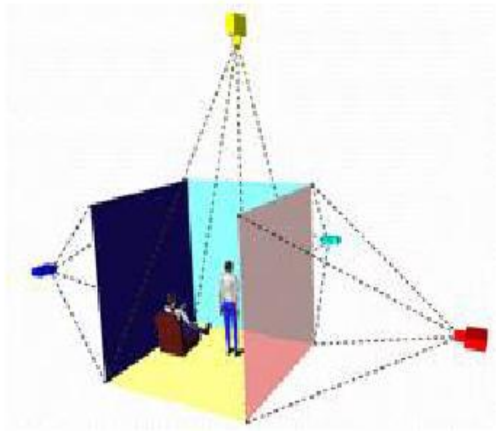

Figure 3 (Binocular Omni-Orientation Monitor)**Figure4**(Cave Automatic Virtual Environment)

VI. Input Devices And Other Sensual Technologies

A variety of input devices like data gloves, joysticks, and hand-held wands allow the user to navigate through a virtual environment and to interact with virtual objects. Directional sound, tactile and force feedback devices, voice recognition and other technologies are being employed to enrich the immersive experience and to create more "sensualized" interfaces.

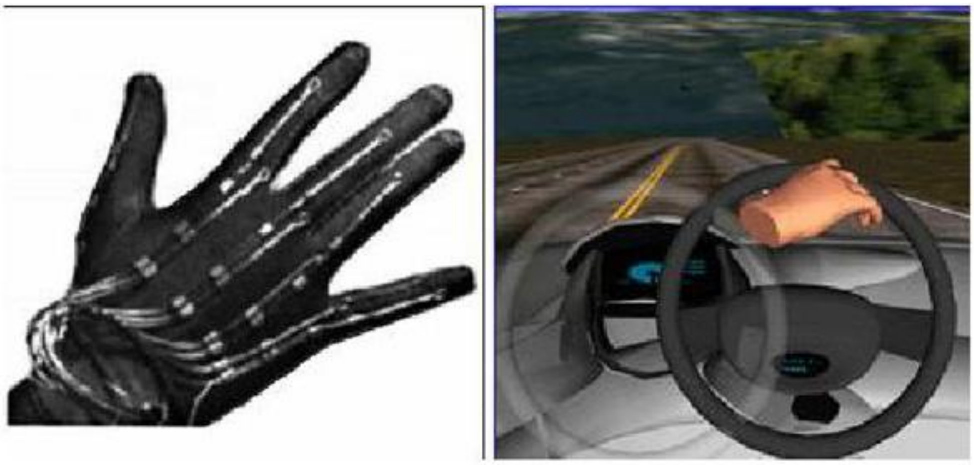

Figure 5. A data glove allows for interactions with the virtual world

VII. Virtual Reality Modeling Language (VRML)

Most exciting is the ongoing development of VRML (Virtual Reality Modeling Language) on the World Wide Web. In addition to HTML (Hypertext Markup Language), that has become a standard authoring tool for the creation of home pages, VRML provides three-dimensional worlds with integrated hyperlinks on the Web. Home pages become home spaces. The viewing of VRML models via a VRML plug-in for Web browsers is usually done on a graphics monitor under mouse-control and, therefore, not fully immersive. However, the syntax and data structure of VRML provide an excellent tool for the modeling of three-dimensional worlds that are functional and interactive and that can, ultimately, be transferred into fully immersive viewing systems.

References

[1]. M. Akamatsu et al.: Multimodal Mouse: A Mouse-Type Device with Tactile andForce Display. Presence, Vol. 3, No. 1, pp. 73-80 (1994)
[2]. R. L. Anderson: A Real Experiment in Virtual Environments: A Virtual BattingCage. Presence, Vol. 2, No. 1, pp. 16-33 (1993)
[3]. Ascension: Ascension trackers technical data. http://www.world.std.com/~ascen
[4]. Ascension: Ascension trackers technical data.ftp://ftp.std.com/ftp/vendors/Ascension/tecpaper.ps (1995)
[5]. P. Astheimer: Acoustic Simulation for Visualization and Virtual Reality.
[6]. EUROGRAPHICS'95 State Of The Art Reports, pp. 1 - 23 (1995)
[7]. Atlantis: Atlantis VR Systems.http://vr-atlantis.com/vr_systems_guide/vr_systems_list2.html
[8]. R. Azuma, G. Bishop: Improving Static and Dynamic Registration in an OpticalSee-through HMD. Proceedings of SIGGRAPH'94, pp. 197-204 (1994)
[9]. N. Badler, M. Hollick, J. Granieri: Real-Time Control of a Virtual Human UsingMinimal Sensors. Presence, Vol. 2, No. 1, pp. 82-86 (1993)VIRTUAL REALITY HISTORY, APPLICATIONS, TECHNOLOGY AND FUTURE- 61 -
[10]. W. Barfield, C. Hendrix: The Effect of Update Rate on the Sense of Presencewithin Virtual Environments. Virtual Reality: Research, Development andApplication, Vol. 1, No. 1, pp. 3-16
[11]. BeierPeter,VirtualReality:A short introduction,http://www-vrl.umich.edu
[12]. John Vince,Virtual Reality Systems,Addison-Wesley.
[13]. Rory Stuart,The Design Of Virtual Envoirnment,Barricade Books.
[14]. John Vince,Essential Virtual Reality Fast :How to understand the techniques and potential of Virtual Reality,SpringerVerlag.
[15]. Jed Hartman,JosieWernecke,RickCarey,The VRML 2.0 Handbook – Building Moving World on the Web,Addison-Wesley.

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