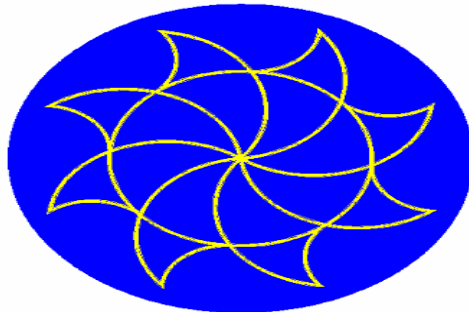


# **VIRTUAL REALITY**

**EXPERIENCE TO THE REAL WORLD**

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## 1. INTRODUCTION

The **Virtual Reality** uses a huge number of technologies to produce a Virtual world so that a user can interact and manipulate with the virtual objects in the so produced Virtual Worlds. With the aid of some specially developed gadgets like a Head Mounted Display, Electronic Glove and Mechanical armatures that fit the human organs we can immerse the human into the Virtual world. The simulation technique is combined with the motion of the human to produce the output that what human expects for. For example the person in a Virtual world looks at a particular object then he has to get the feeling that he is actually looking at that object and he should also get the feeling of the sounds that come from that object. The word **Virtual Reality** is an “*oxymoron*”. It means using two words that are contradictory to each other side by side. Virtual Reality is a collection of technologies for many people. The word Virtual Reality has many contexts. The word Virtual Reality is defined as follows in the book “The Silicon Mirage”. The most difficult thing in the Virtual Reality is to produce the interaction between Virtual world and the human but not the production of the Virtual world. The type of Virtual Reality in which the human is actually immersed into the Virtual world is called the **immersive Virtual Reality**. In

such a type of Virtual Reality the human is completely isolated from the outside world and he is placed an entirely computer generated world. The applications being developed for Virtual Reality are wide range utilities. Among them the real time applications occupy the prominent place.

## 2 CLASSIFICATION OF VIRTUAL REALITY

After a deep study of this emerging technology, we have classified Virtual Reality into three types.

### 2.1 VIRTUAL REALITY USING SOFTWARE

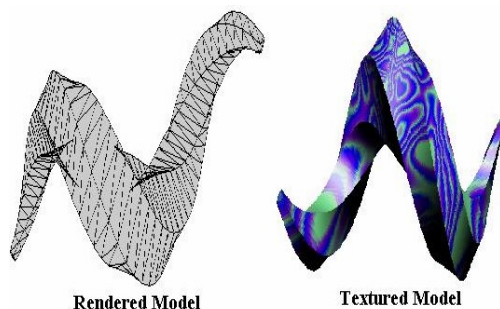
The first category of Virtual Reality that we consider is Virtual Reality using software. Here we use many tools to develop the virtual worlds. The most commonly used tools for developing 3d worlds are VRML v1.0, VRML97, VRML v2.0, 3d Studio max, Rhino3d, Amapi3d, ALICE99, BLENDER and other such software. The VRMLv1.0 is the child language developed from the XML family. There aren't many differences between the later versions of VRML (VRML97 and VRML v2.0). The programming paradigms are entirely different from VRMLv1.0 to VRMLv2.0. There are many companies dedicated to develop the tools for creating virtual worlds, such as Parallel Graphics Co., and Trapezium Co.,. Also there are many concepts of

developing the virtual worlds using the software.

They are :

### **2.1.1 RENDERING**

In this we are conscious about the rendering techniques. Here we use the technique of wire framing. A sample output and its wire frame model are shown below. After developing the wire frame model what we have to do is simply to apply the texture to it. This is called texturing. The texture applied can be a photograph or any predefined textures such as metal, rock, wood and cement flooring



### **2.1.2 PROGRAMMING**

The other tool available for developing the virtual worlds is by programming. There are many programming languages by which we can develop the virtual worlds. The best one we prefer is by using VRML v2.0. Prior to this language, people used to develop the virtual worlds using the traditional programming language, JAVA.

As we have mentioned earlier VRML is a language born from the family of XML. VRML is Virtual Reality Modeling Language. VRML v2.0 is more advanced compared to the version 2.0. Here we are presenting one simple program in each of the versions. For developing the virtual worlds using VRML we need a plug-in for the Internet Explorer or Netscape Navigator. With the help of this only we can interact with the virtual world. More information regarding the browser plugins, parsers and editors is included at [www.vrml.org/vrml/](http://www.vrml.org/vrml/).

## **2.2 VIRTUAL REALITY USING HARDWARE**

### **2.2.1 MANIPULATION AND CONTROL DEVICES**

It is a common thing that is three axes X, Y, Z. In order to track the motion of an object in the virtual world we need to track the motion of the particular object in all the three axes. These calculations may cause some latency. The latency is the major problem in any Virtual Reality systems. The simplest hardware for Virtual Reality is a Mouse, Track ball and a Joystick. These are the conventional hardware used for Virtual Reality using 2d systems. Creative programming can make them useful for 3d and 6d controls. Also there are a number of 3d and 6d mice, Track balls and joysticks. These have some extra buttons for controlling not only

the XY transformations, but also the Z transformations of the pointer, its rotation also. One other most commonly used motion-tracking device is an Electronic Glove. An electronic glove is different from a normal glove in the sense that it has a number of sensors. There are a number of sensors that can be used. The optical fiber sensors are used for tracking the motion of fingers and the magnetic sensors are used for the tracking of rest of the arms.

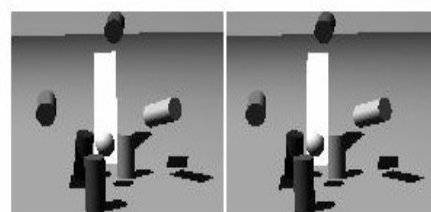
### **2.2.2 POSITION TRACKING**

There are many tools available for tracking the position of the object in the Virtual world. Some of them are as described below. Mechanical armatures are the most commonly used ones. They help in providing very accurate and fast results. Some of them seem like a table lamp while some others look as exoskeletons that are outfitted to objects in the Virtual world. The main disadvantage using them is that they are cumbersome. Ultrasonic sensors are also most commonly used tools. Here a set of emitters as well as receivers is used to note the time lags between the known relationships and the results. Though these are more effective, the main disadvantages are the time lags and echoes that come from the surroundings. Magnetic sensors use a coil to note the deflections produced in the fields due to the change in the position of the object. These are used to

determine the strengths and angles of deflections in the fields.

### **2.2.3 STEREO VISION**

Stereo vision is a technique where two different images are developed one for each eye. The two images developed may vary a little bit or may completely be the same. The Head mounted displays having two LCD's are for each eye is commonly required. Here the images are to be computed from a particular distances and angles at each moment. There are number of techniques for producing the two images. The two images can be placed side by side and the viewer may be asked to cross his eyes against each other. Using two differently polarized filters; we can project the images. There is another technique for producing the two images, i.e., by placing two different LCD's before each eye and producing the image. Thus by shutting down each shutter at perspective times the user can be made to think the depth of the image. The serious health hazard by this stereo vision is that the two eyes can be affected very adversely.



**stereo vision**

### **2.3 MAPPING AND STITCHING**

There is also software for producing the virtual 3D photos such as PHOTOMODELER. The technology used to develop a 3D photo is stitching. For producing a 3D photo of a scene several photos are taken and they are stitched together. The user gets a sense that he is in the middle and he is seeing the 3D photo by revolving around himself. QUICK TIME is used to see these photos. You can see one such model at

[http://www.bbc.co.uk/history/multimedia\\_zone/3ds/index.shtml](http://www.bbc.co.uk/history/multimedia_zone/3ds/index.shtml)

### **3 MORE ABOUT IMMERSIVE VIRTUAL REALITY**

- 1) An immersive Virtual Reality adds special gadgets like Head mounted displays, Boom, Multiple
- 2) Stereo scopic viewing adds enhanced features like deep peeping through the Virtual world.
- 3) Eliminating the real world and placing the human in a computer generated world is one of the enhancements.
- 4) The convincing factor about IVR is the auditory, haptic, touch and other non-visual senses.
- 5) Interactions with the objects in the Virtual world are controlled by a data glove, head mounted display and other gadgets.

### **3.1 HEAD MOUNTED DISPLAY**

The Head mounted display consists of two miniature display screens that produce the stereo scopic images and an optical position tracking system that tracks the orientation of the human's head in the Virtual world and that produces the impulse to the image generating large projection Areas to get more immersive feeling. The characteristics of the IVR can be summarized as follows. Using a Head mounted display can increase the capabilities like walk through, look around, fly through in the 3D Virtual world Computer. The image generating computer produces the respective view corresponding to the orientation of the user head in the Virtual world. This is the basic device used in the IVR. As a result the user can see in the direction that he wants and he can walk through the Virtual world.

### **3.2 BOOM AND CAVE**

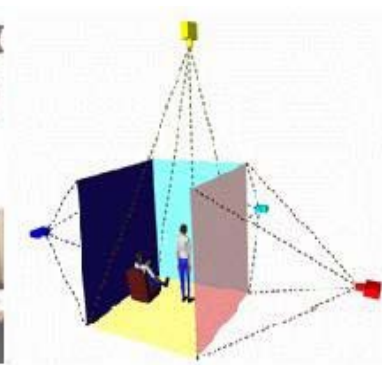
To overcome the intrusiveness with the HMD the Boom and Cave are used. These are also extensively used in the IVR. Screens and stereo scopic image generating apparatus are fixed in a box, which is attached to a multi link arm. The user peeps into the Virtual world through two holes, and controls his motions with the arms.



Head Mounted Display



Boom



Cave

The Cave is an interesting topic in IVR. A cave consists of a cube shaped room. The stereo scopic images are projected on to the walls and the floor of the room with the help of a number of projectors. The head tracking system worn by the leading user controls the view of the Virtual world. Several users may sit on the Virtual world at a time.

Defense Department to enable diverse simulators to be interconnected into a vast network .The soldiers can be trained to the war by developing a Virtual world that looks exactly the war field. This helps them in knowing how to deal in war fields. Distributed Interactive System (DIS) protocol has been developed by the Orlando Institute of Training and Simulation, which is the future of Virtual Reality in war strategies.

#### 4.2 VIRTUAL REALITY IN COCKPIT SIMULATION

The next interesting step in Virtual Reality is cockpit simulation. This is used in training the pilots. With the help of Virtual Reality the entire cockpit is simulated. The pilot is placed in the thus developed Virtual world and the computer guides him by giving the maps and the feeling that he is piloting an actual flight. This helps him in dealing with the critical conditions that may arise while he is piloting an actual



actual operation theatre

operation theatre produced by using a cave

### 4. REAL TIME APPLICATIONS

#### 4.1 VIRTUAL REALITY IN WAR STRATEGIES

SIMNET is the first war related Virtual Reality application. This project is standardization being pushed by the USA

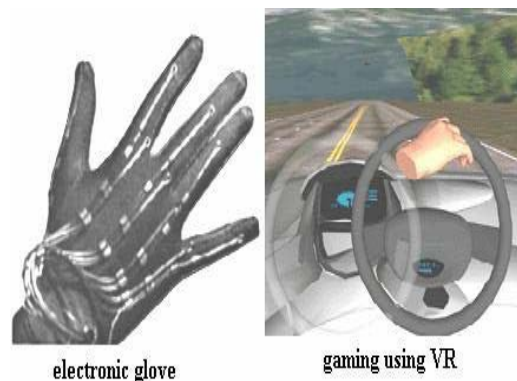
flight. The data glove plays a vital role in this type of training. A variety of instruments along with the data glove are used. The maps generated by the computers and the data available with the pilot are correlated to know the paths.

#### **4.3 VIRTUAL REALITY IN MEDICAL APPLICATIONS**

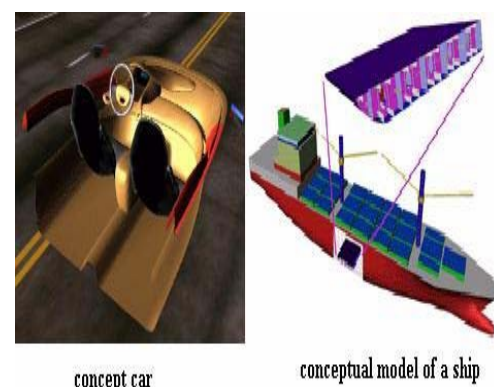
Virtual Reality is now being used to train physicians to carry out intricate surgical procedures such as laparoscopies, arthroscopies, endoscopies and other minimally invasive surgeries. Virtual Reality provides a view of the surgical field normally blocked during such procedures and enables trainees to get much needed practice in the left-right motion inversion obligatory for the operation of instruments in minimally invasive surgeries. In contrast to the use of cadavers which can only be dissected once and which are becoming more difficult to procure, it allows students to access libraries of healthy and pathologic body tissue 3-D images at their convenience, and perform the same. Nano surgery is another medical application, where the doctors located at a distinct place guide the robots. They guide the robots with the help of multilink arms that we have already seen in the case of booms.

#### **4.4 VIRTUAL REALITY IN DESIGNING ASPECTS**

Virtual Reality helps in designing the virtual models of the certain objects. By building the virtual models we can see how the model works, what the defects may be and how we can overcome the previous defects. These all can not be seen by actually developing the model as it includes a lot of cost and laborious time.



This concept of Virtual Reality is being is mostly used in the designing of conceptual cars.



Concept cars are being designed to study new ideas. Most of these designs are never

built. Virtual reality provides a tool for evaluating such designs in full scale without building time consuming and costly physical prototypes.

#### **4.5 VIRTUAL REALITY IN AMUSEMENT PARKS**

Virtual Reality is also playing a vital role in the amusement parks. The conceptual cars that we have discussed above and the racing games are being developed to attract people. With the help of electronic gloves, head-mounted displays and stereoscopic vision racing games attract the people.

#### **5 VIRTUAL REALITY TRANSFERRING PROTOCOL**

The capabilities of the Virtual Reality Modeling Language (VRML) permit building large-scale virtual environments using the Internet and the World Wide Web. However the underlying network support provided by the hypertext transfer protocol (http) is insufficient for large-scale virtual environments. Additional capabilities for many-to-many peer-to-peer communications plus network monitoring need to be combined with the client-server capabilities of http. To accomplish this task, we present a detailed design rationale for the virtual reality transfer protocol (VRTP). VRTP is designed to support interlinked VRML worlds in the same manner as http was designed to support interlinked HTML pages. VRTP will be

optimized in two ways: on individual desktops and across the Internet. VRTP appears to be a necessary next step in the deployment of all encompassing interactive internetworked 3D worlds.

#### **6 FUTURE OF VIRTUAL REALITY**

Yesterday Virtual Reality was a science fiction fantasy. Today it is a research topic in laboratories and amusement parks. Tomorrow it will certainly replace our televisions and computers. Many researches are being done to find more and more applications of Virtual Reality. In the forth coming days the web sites developed using Virtual Reality will replace the entire present web industry.

#### **7. CONCLUSIONS**

The ability of Virtual Reality to produce realistic worlds of data, objects, with which the users can interact and manipulate in a realistic and an intuitive manner, opens up a vast wealth of possibilities for work-related applications. The concept of Virtual Reality provides an innovative mix of entertainment, education and State-of-Art. From waterbeds to gyroscopes and hydraulic units, a variety of platforms will provide a new kind of travel; into Cyberspace; into virtual worlds where one can swim with the dolphins and experience intense sensory stimulation.. Working in many fields like medicine, rocket launching, massive constructions,



designing and modeling, war training and cockpit training, it is very important to be more precise and accurate and here Virtual Reality provides a solution by providing a platform which makes it possible by using the applications of Virtual Reality.

*Proceedings of Vision, Modeling, Visualization 2003*, 2003. In Print.

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