Virtual Reality- Concept and Modes of Implementation

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Abstract— Virtual Reality-A computer simulated environment which enables a person to experience a physical places and objects in imagined world. Virtual Reality enables to recreate virtual sensory experience like virtual taste, smell, touch or sound etc. This paper shall address virtual reality along with its various types and give brief idea on the implementation of it.

Key words: Virtual Reality, VR System, Simulation, Control

I. Introduction

The term 'Virtual Reality' was initially coined by Jaron Lanier founder of VPL Research(1989).It basically was nothing but the relationship between our actions and their perceivable results is ruled by what we call the laws of nature.It is general understanding that our actions act upon real objects, which the laws of nature. It is general understanding that our actions act on real objects which react according to law of nature, what then can be perceived. Virtual Reality Facilities simulate the actions perception relationship in a physically correct manner but without involving real objects or real events.

II. Basic Setup

Our current Virtual Reality setup consists of a head mounted display that provides subjects with visual information that is rapidly updated in response to their behaviours. All computations and image rendering is processed by a high performance SGI Onyx2 graphics computer.

A. Hardware

1) Main Devices:

(1) Simulation of walking
(2) Simulation of driving, picture 1, picture 2
  (1) also see our video of the simulator,
  (2) a video from the manufacture
(3) Simulation of biking.

Details:

(1) Locomotion
(2) 6-DF motion tracker (Intersense, IS-900)
(3) Head Mounted Displays
(4) Virtual Research: V8
(5) Eye Tracker (ASL: VR6)
(6) Driving simulator (Drive Safety, DS600C)
(7) Eye Tracking (Seeing Machine)

2) Other Devices:

Large screen stereoscopic display (FakeSpace).

3) Software

To develop a real time virtual environment, a computer graphics library can be used as embedded resource coupled with a common programming language, such as

(1) C++
(2) Perl
(3) Java
(4) Python

Some of the most popular computer graphic libraries:

(1) OpenGL
(2) Direct3D
(3) Java3D
(4) VRML

The use of multithreading can also accelerate 3D performance.

III. Types Of VR System

The VR system is broadly classified into 3 types depending whether the object to be explained is viewed abstractly.

The following are deeper explanation to the above.

A. HMD Enabled VR System

This type of VR system is implemented with the help of a Head Mounted Display(HMD) which acts as the eyes and ears of the person in the virtual world.

HMDs differ in whether they can display just a computer generated image (CGI), show live images from the real world or a combination of both:

(1) Most HMDs display only a computer-generated image, sometimes referred to as a virtual image.
(2) Some HMDs allow a CGI to be superimposed on a real-world view. This is sometimes referred to as augmented reality or mixed reality. Combining real-world view with CGI can be done by projecting the CGI through a partially reflective mirror and viewing the real world directly.

1) Features:

a) Positional Tracking

Precise, low-latency positional tracking opens the door to entirely new interactive and gameplay opportunities. Great positional tracking is a key requirement for virtual reality; with it, the Rift can accurately map all of your real world head movements.

Fig. 1: Example of position tracker.

b) Low Persistence OLED

DisplayDK2 uses a low persistence OLED display to eliminate motion blur and judder, two of the biggest contributors to simulator sickness. Low persistence makes the scene appear visually stable, increasing the potential for presence.

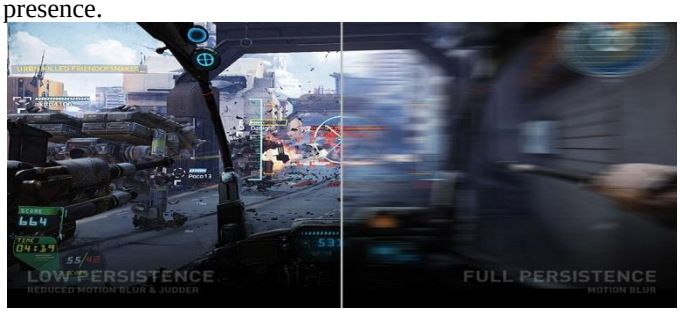

Fig. 1: Example of low persistence OLED

c) Built-In Latency Tester

We believe so strongly in the importance of low latency that we built a latency testing system into DK2. Real-time microsecond precision measurement of motion-to-photon latency lets you optimize your VR experience.

d) Engine Integrations

The Oculus Software Development Kit (SDK) includes out-of-the-box engine integrations for the Unreal Development Kit, Unreal Engine 4, and Unity 4 that make getting started with VR game development easier and faster than ever.

(GAMING ENGINES)

2) Specification

Resolution	960 x 1080 per eye
Refresh Rate	75 Hz, 72 Hz, 60 Hz
Persistence	2 ms, 3 ms, full

Table 1: Display

Viewing Optics	100° Field of View (nominal)

Table 2: Viewing Optics

Cable	10' (detachable)
HDMI	HDMI 1.4b
USB Device	USB 2.0
USB Host	USB 2.0 (requires DC Power Adapter)
Camera USB	USB 2.0

Table 3: interfaces

Sensors	Near Infrared CMOS Sensor
Update Rate	60 Hz

Table 4: Positional Tracking

3) Future Prospects

The major role of this HMD devices is currently in the field of gaming, tracking, display of information and other fields wherein the use of Personal Digit Assistant (PDA) can be minimalised.

But by integrating strong network foundations as well as live presence, the prospects of HMD's can be extended to phenomenal levels. It can be used majorly in two fields:

(1) Entertainment Industry: Live sports match can be broadcasted directly onto the HMD, providing the user with real life presence in the stadium, thus enhancing the experience of the user.

(2) Medical Field: The expert opinions by a doctor, miles away from the ER, while operating on a patient can be given with the help of this device, thus cutting down the cost on travelling and providing better medical facility to the patient.

The use of HMD can thus be extended with careful planning and implementation.

B. Gesture Control

Gesture control is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand.

Gesture control enables humans to communicate with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of Gesture control, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

1) Gesture types

In computer interfaces, two types of gestures are distinguished:[9] We consider online gestures, which can also be regarded as direct manipulations like scaling and rotating. In contrast, offline gestures are usually processed after the interaction is finished; e. g. a circle is drawn to activate a context menu.

(1) Offline gestures: Those gestures that are processed after the user interaction with the object. An example is the gesture to activate a menu.

(2) Online gestures: Direct manipulation gestures. They are used to scale or rotate a tangible object.

2) Implementation

The ability to track a person's movements and determine what gestures they may be performing can be achieved through various tools. Although there is a large amount of research done in image/video based gesture recognition, there is some variation within the tools and environments used between implementations.

C. 3D Holographic Technology

This is entirely a Latest and vary unique "Hi- Definition Projection Technology" in which a person is captured in 3-dimentional Aspect with a Sp. Hi-Definition Camera on a specially built Stage and Projected "As Is "at various Distant Locations "At A Time".

Viewers at the other end will feel the presence of REAL Person in front of them and also interact with the projected 'Virtual" person, without wearing any kind of 3D glasses, as they interact with 'Actual Person'.

1) 3.3.1 How is it implemented?

Holography is a technique that enables a light field, which is generally the product of a light source scattered off objects, to be recorded and later reconstructed when the original light field is no longer present, due to the absence of the original objects.

Holography can be thought of as somewhat similar to sound recording, whereby a sound field created by vibrating matter like musical instruments or vocal cords, is encoded in such a way that it can be reproduced later, without the presence of the original vibrating matter.

A clever reimagining of the Pepper's Ghost technique lets your magic happen. It starts with the patented foil completely invisible to the naked eye. Rig it at 45° across the stage and then bounce content off a projector screen. This is then reflected upwards, reflects off the foil and gives the impression of a real 3D volumetric image on stage.

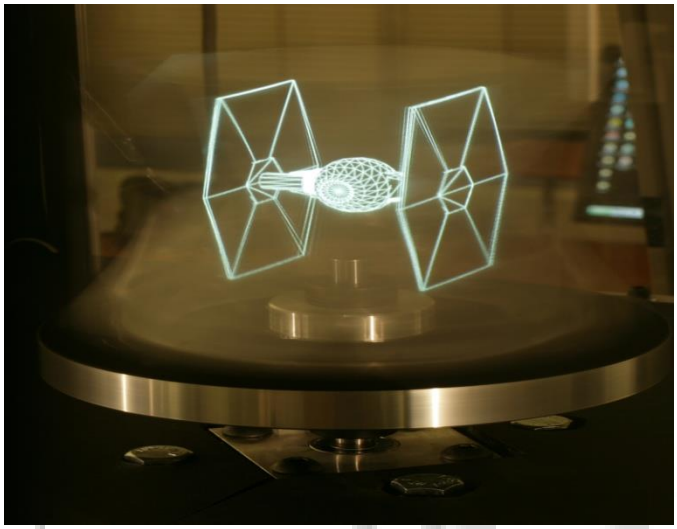

Fig. 3: Example of an 3D Holographic display

IV. CHALLENGES

A. Cost

Today, commercial VR systems that are sophisticated enough to offer complex models and diverse functionality are expensive relative to personal computers. About a quarter of a million dollars will get you the basics for a very small network of worlds.

B. Usability

A crucial issue for integrating VR into classrooms is system usability -- by students of various ages, by teachers, and by curriculum developers. The following comments are not intended as product reviews but are my assessment of how well current VR tools work, based on the systems Iíve used to build virtual worlds and on my teaching experience in classrooms from kindergarten through college.

C. Education

We need first to understand what VR is and is not. We must separate science from fiction; VR is not a book by William Gibson, it is an interface technique that now allows us more immediate access to a subset of what computers already do. We can make the technology available in the public domain for widespread exploration and evaluation.

D. Motion sickness

Motion sickness or kinetosis, also known as travel sickness, is a condition in which a disagreement exists between visually perceived movement and the vestibular system's sense of movement. Depending on the cause, it can also be referred to as seasickness, car sickness, simulation sickness or airsickness.

E. D audio effect

3D audio effects are a group of sound effects that manipulate the sound produced by stereo speakers, surround-sound speakers, speaker-arrays, or headphones. This frequently involves the virtual placement of sound sources anywhere in three-dimensional space, including behind, above or below the listener.

V. APPLICVATION OF VR SYSTEM

A. Flight Simulator

A flight simulator is a device that artificially re-creates aircraft flight and the environment in which it flies, for pilot training, design, or other purposes. It includes replicating the equations that govern how aircraft fly, how they react to applications of flight controls, the effects of other aircraft systems, and how the aircraft reacts to external factors such as air density, turbulence, wind shear, cloud, precipitation, etc.

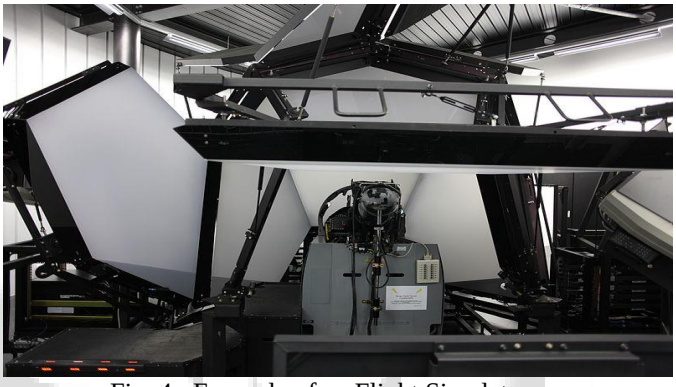

Fig. 4: Example of an Flight Simulator.

B. Google Glass

It is a wearable computer with an optical head-mounted display (OHMD). It was developed by Google with the mission of producing a mass-market ubiquitous computer. Google Glass displays information in a smartphone-like hands-free format. Wearers communicate with the Internet via natural language voice commands.

Fig. 4: Example of an Flight Simulator.

C. Other Applications:

(1) Google Glass applications are free applications built by third-party developers. Glass also uses many existing Google applications, such as Google Now, Google Maps, Google+, and Gmail.

(2) Many developers and companies have built applications for Glass, including news apps, facial recognition, exercise, photo manipulation, translation, and sharing to social networks, such as Facebook and Twitter.

(3) Google offers a companion Android and iOS app called MyGlass, which allows the user to configure and manage the device
(4) Other than the touchpad, Google Glass can be controlled using "voice actions". To activate Glass, wearers tilt their heads 30° upward (which can be altered for preference) or tap the touchpad, and say "O.K., Glass." Once Glass is activated, wearers can say an action, such as "Take a picture", "Record a video", etc.

VI. CONCLUSION

Virtual Reality is a giant step for mankind with its pool of various applications which will in turn bring humans closer to reality, while not being necessarily near the object of desire.With a variety of ways in implementing it, the world will be a smaller place.

The areas of gaming, entertainment and medicine can benefit in huge amounts if the VR technology is implemented properly.

It can serve a huge platform for Data Analysis, which will enable a quick way to understand the calculations being done on it.

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