A review paper on ELEMENTS OF VIRTUAL REALITY and proposing ideas on Generating a more realistic Haptic Feedback

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Abstract: This paper presents the basic idea behind the VR and its working, The paper also presents the working, application, drawbacks and explains how VR will revolutionise the way Humans interact with the world. Also, proposing the idea to integrate Neuroprosthetics using the "Myo" controller. At the end giving the concluding statements.

Keywords: Virtual Reality, Immersion, Haptic, Feedback, Neuroprosthetics, Simulation.

1. Introduction

1.1. Introduction to Virtual Reality

Virtual reality (VR) is a term that applies to computer-simulated environments that can simulate physical presence in places in the real world, as well as in imaginary worlds. Virtual Reality is a simulation in which computer graphics is used to create a realistic looking world. Moreover, the synthesized world is dynamic and responds to user inputs such as gestures and verbal commands.

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 called as force feedback. So, we can summarize the above ideas of Virtual Reality in one 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.**

1.2. History of Virtual Reality

The term "Virtual Reality" was initially coined by Jaron Lanier [1] in 1989, but it wasn't a new Idea! origins of VR can be traced back to "The ultimate display" a seminal paper given by Ivan Sutherland that introduced the key concepts of Immersion, Simulations, and Sensory input and output and these all are the very key concepts of the VR Devices we have today. It is a term used for computer generated 3D environments that allow users to enter and interact with the virtual environments. The users "immerse" themselves to varying degree in this computer generated environment [2].

VR was seen as a way to overcome limitations of standard human-computer interfaces also seen as virtual reality technology opens the door to new types of applications that exploit the possibilities offered by present simulation

2. Literature Survey

Introduction and History of Virtual Reality was inspired by the paper **"Introduction to Virtual Reality" Gilson Giraldi, Rodrigo Silva, Jauvane C. de Oliveria LNCC National Laboratory for Scientific Computing Scientific Visualisation and Virtual Reality Laboratory- {Gilson,rodrigo}@lncc.brr COMCIDS Research Group** where they gave the introduction to 'immersion' and 'stereoscopic' image viewing.

Introduction, Various Requirements and Enabling Technology inspired by the paper **Virtual Reality: Past, Present, and Future, by Enrico Gobbetti∗and Riccardo Scateni, CRS4 Centre for Advanced Studies, Research and Development in Sardinia Cagliari, Italy** where they stated various Requirement, various factors that affect the user's immersion in a Virtual Environment such as User Interface, Depth Perception, Accuracy and Field of View, Critical Fusion Frequency etcetera.

The idea of combining the Myo Controll prosthetic with Vitual Reality so as to allow the user to control a robotic arm over distances sitting in the immersed environment was inspired by the paper **"Intelligent multifunction myoelectric control of hand prostheses" C. M. Light, P. H. Chappell, B. Hudgins & K. Engelhart.**

Various application in the field of Telepresence inspired by **IEEE SIGNAL PROCESSING MAGAZINE NOVEMBER 20111053** where the scientists and researchers in the field of Virtual Reality across various Universities and R&D Dept. gave the various opportunities of Tele-presence through VR.

The application of Virtual Reality in the field of Defence, the drawbacks, the Technical and Cultural Challenges were inspired by vrs.org.uk/virtual-reality-profiles/vpl-research, **VPL Research** was a company founded in 1984 by **Jaron Lanier**, who is often regarded as the person who coined the term virtual reality, where he elaborated his research on the application of Virtual Realty in the Defence sector and how it could help the soldier train better for wars and various threats, also on how the soldier who suffer from post-traumatic stress disorder (PTSD) can be treated with the help of Virtual Reality, he extends his research to show us the what are the potentials VR holds and its related drawbacks, also states how our Legal system needs to adapt to various developing VR technologies.

3. Work Description

3.1. Requirements

The main aim of Virtual Reality is to put the user in an environment which is based on the real-time situation and is both responsive and autonomous to his/her actions. This aim is achieved by taking over various sensory inputs of the user so as to inhibit him/her into a virtual environment. The process requires various input-output devices and mechanisms as discussed later.

3.1.1. User Input

Human beings interact with the environment around them by Locomotion/Movement, Manipulation and Communication of information mostly by Voice, Gestures, and Facial expressions.

For practical purposes, it is possible to limit user input to a few selected channels but we Humans perform most of our tasks using our hands, it's the only physical part of the body that can perform a wide variety of tasks, hence, for now, hand motion tracking is sufficient for most our applications. Also, it's important to track user's head movement and eyes gazing direction so as to provide an accurate stereoscopic projection of environment according to the user's movement [3].

3.1.2. Sensory Inputs

3.1.2.1. Visual Perceptions

The factors affecting the Visual perception of the user so as to completely immerse the user in the experience depends on the followings:

3.1.2.1.1. Depth Perception

One of the reasons why VR is so ahead of all the other display technologies is the ability to give 'Depth' (Figure 1) to the images which are perceivable by the user, thanks to the Stereoscopic viewing (Figure 2). Human eyes are separated by an average distance of 6.3 cm and because of the geometry the objects further than 30m lose their depth characteristics when observed by the user. Depth is most effective at much closer distances, other primary cues (eye convergence and accommodation) and secondary cues (e.g. perspective, motion parallax, size, texture, shading, and shadows) are essential for far objects and of varying distances from the eye.

Figure 1

Figure 2

3.1.2.1.2. Critical Fusion Frequency

A video file which is produced by a Video Camera is basically a large number of static images in a sequence that are presented at a rapid speed. The critical fusion frequency is the rate at which humans are unable to distinguish between these successive visual stimuli. In cinemas, the movie is projected at the rate of 24fps, usually 60fps is considered to give the best video experiences. Hence it’s another factor which is needed to be considered to achieve quality immersion (See Figure 3).

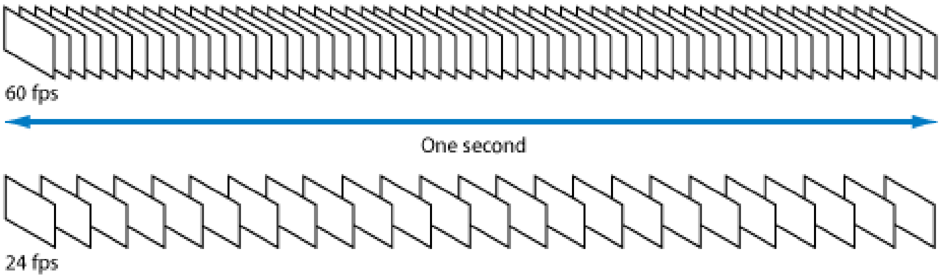

Figure 3

3.1.2.1.3. Accuracy and Field Of View

Field of View (FOV) is the total horizontal field of vision a human can perceive with both of his eyes. It's 180 degrees without the head/eye movement and its 270 degrees (See Figure 4 and 5) otherwise. Vertically it's over 120 degrees. For immersion an FOV of about 110 degrees is considered optimal.

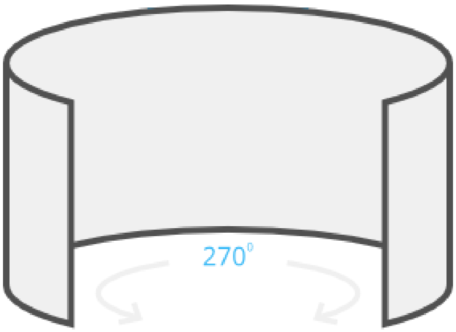

Figure 4

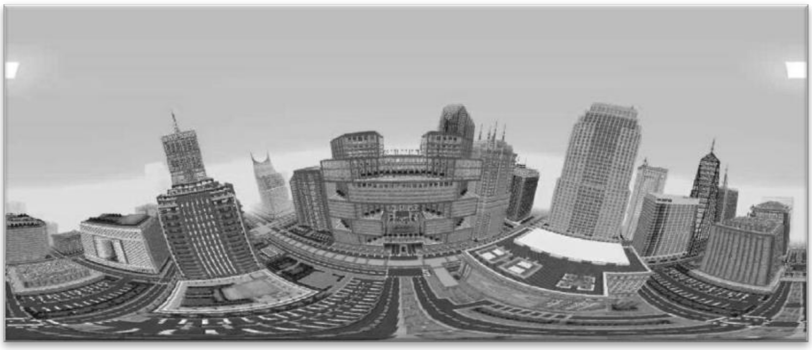

Figure 5

3.1.2.2. Sound Perception

Though Humans give more preference to the visual stimuli but one can’t just be immersed in an environment denying the factor of sound perception. Sound Perception is generally used for verbal communication, to get information from the invisible part of the world or where the **visual stimuli don't provide enough information**. For immersion, one needs to produce the 3D sound effect this can be achieved by recording the sound of the environment just the way we human perceive it, from our two ears! One can use two microphones placed adequately just like our ears are placed and our brain will do the rest of the work. Actually, it’s our brain that does all the complex task of calculating the tiny differences between the intensity and the time of arrival of sound at the two ear opening which allows the user to accurately perceive the source and its distance from the user.

3.1.2.3. Position Touch Force Perception

Humans interact with each other with their sense of touch sensing both what's happening and what's acting on the environment, hence this in another undeniable factor to produce immersion in VR. VR systems need to provide to provide adequate Haptic input and output, say, When we grab an object, the initial contact provided by the touch receptors in the skin provides information about the shape, state, texture of the object. Since we learn about the environment around us kinaesthetically [4] too, it's very important for the haptic feedback to provide adequate information to the user too. But Humans cannot only learn about the environment around them, also they tend to manipulate it by moving, rotating, pinching, by applying various forces on it and these forces can be of varying degrees depending upon various angles, the area of contact, the muscles used etcetera, hence making this a very complex requirement to be taken as an input from the environment.

Figure 6

3.1.3. Olfactory Perception

Olfactory Perception is the simulation of various odours of the real world scenarios in the virtual environment to make it feel more real and for some simulations like Medical professionals operating in the field during which he comes in contact with the various odours. There are still no concrete ideas behind its implementation. It is certain that the stimuli to the brain cortex are originated in the nose when molecules carrying odours are caught by the receptors neurons, but it is still unknown how the brain generates a recognition pattern isolating some scents from others and reconstructing missing parts. A VR environment giving olfactory cues should provide the possibility to diffuse the odours when needed and to purify and filter the air when the cue is no longer required.

3.1.4. Spatiotemporal Realism

In the above discussions we have talked about various input and output modalities. **There is a strict timing constraint which has to be met so as for the application to be usable by a person.** Say, for example Visual Feedback rate must be greater than 10Hz and Haptic Feedback rate must be greater than 1 KHz. There are a couple of serious issues; Human tolerances of synchronisation are quite small hence if there will be delays in each of the modalities then they will make synchronization even harder. In some cases when there is a limited bandwidth for communication it is preferable to sacrifice synchronization to enable low latency audio-only communication. Even a lag of 100ms degrades performance and if lag exceeds 300ms, Humans can start to dissociate their movements from the displayed effects, hence destroying the immersive effect.

Other problems like disorientation and nausea, similar to the symptoms of motion sickness are caused majorly due to these lags. The simulation of the VR and the actual motion of the users inside that VR seem conflicting leading to disorientation.

3.2. Enabling Technology and Hardware

Currently, a set of devices, hand measurement hardware, head-mounted displays, as well as 3D audio systems are popular and are available for general public to use, as well as, many research labs are working on defining and developing new devices such as tactile gloves and eye-tracking devices, or on improving existing devices such as force feedback devices, head-mounted displays and tracking systems.

3.2.1. Virtual Reality Inputs and Outputs

There are various inputs required for the VR to work properly. Those are Position Tracking, Eye Tracking, and Full Body motion tracking as well as to proper outputs like Sensory, Sound and Olfactory Feedbacks.

3.2.1.1. Position Tracking

Head tracking is the most valuable input for promoting the sense of immersion in a VR system. The types of trackers developed for the head also can be mounted on glove or body suit devices to provide tracking of a user’s hand or some other body part. There are five types of systems which could be used for this, Mechanical, Magnetic, Acoustic, Inertial and Optical Systems.

Mechanical systems measure change in position by physically connecting the remote object to a point of reference with jointed linkages; they are quite accurate, **have low lag and are good for tracking small volumes but are intrusive, due to tethering and subject to mechanical part wear-out**.

Magnetic systems couple a transmitter producing magnetic fields and a receiver capable of determining the strength and angles of the fields; they are quite inexpensive and accurate and accommodate for larger ranges, the size of a small room, but **they are subject to field distortion and electromagnetic interference.**

Acoustic (ultrasound) systems use three microphones and three emitters to compute the distance between a source and receiver via triangulation; they are quite inexpensive and lightweight but **subject to noise interference** and yield low accuracy since the speed of sound in air varies and there can be echoes.

Inertial systems (Figure 7) use accelerometers and gyroscopes to compute angular velocity about each axis and changes in position; they are fast and unlimited in range but, can detect only 3 DOF [5] and are not accurate for slow position changes.

Optical systems (Figure 8) can use a variety of detectors, from ordinary video cameras to LED's, to detect either ambient light or light emitted under control of the position tracker (infrared light is often used to prevent interference with other activities); **they can work over a large area, are fast and are not subject to interferences but are heavy and expensive**.

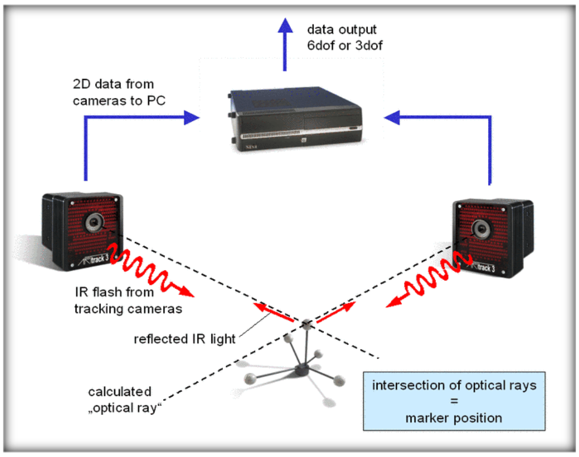

Figure 8

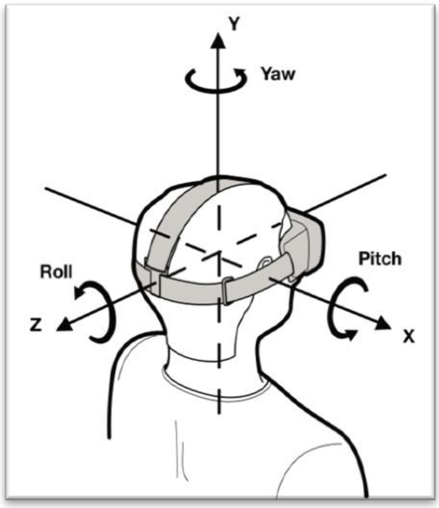

Figure 7

3.2.1.2. Eye Tracking

Eye trackers work somewhat differently: they track the direction at which the users' eyes are pointed out of the head. This information is used to determine the direction of the user's gaze and to update the visual display accordingly. The most conventional approach is Optical. It uses reflections from the eye's surface to determine eye gaze. Most commercially available eye trackers are Optical Systems and they usually illuminate the eye with IR LED's, generating corneal reflections. (Figure 9)

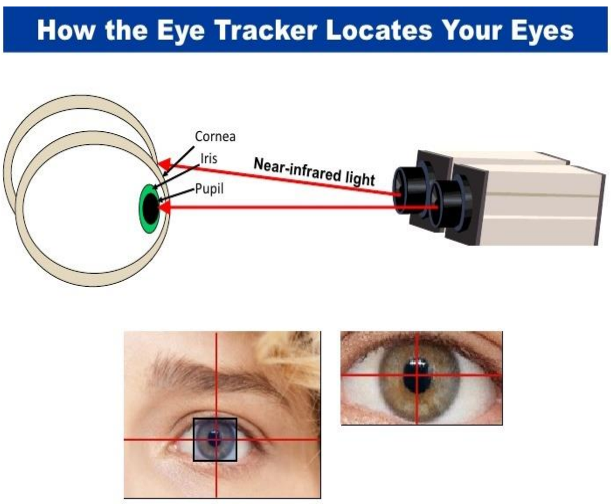

Figure 9

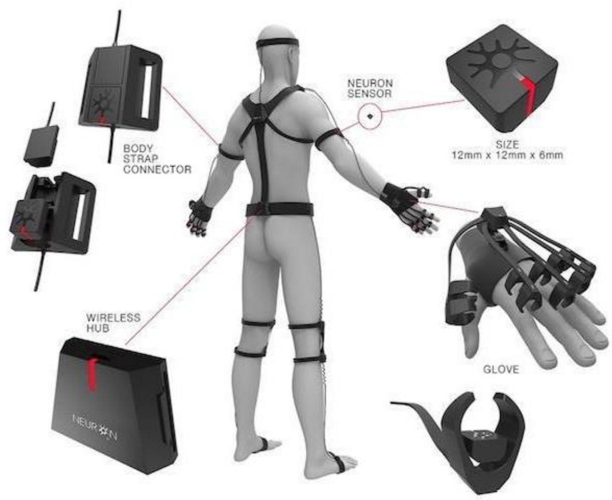

Figure 10

3.2.1.3. Full Body Motion

There are two kinds of motion we need to consider passive motion, and active self-motion. Passive is quite feasible to simulate vehicles with current technology. The usual practice is to build a "cabin" that represents the physical vehicle and its controls, mount it on a motion platform, and generate virtual window displays and motion commands in response to the user's operation of the controls. They are usually specialized for the particular application (e.g., flight simulators) and they represented the first practical VR applications for military and pilots' training use. More recently this technology has been extensively used by the entertainment industry. Self-motion interfaces, instead, are defined as those cases where the user moves through a VR environment. This is typically performed linking the body to a gyroscope, giving a 360o range of motion in pitch, roll and yaw. All these systems are usually quite expensive too. (Figure 10 above)

3.2.2. Sensory Feedback

3.2.2.1. Visual Feedback

Human beings are strongly oriented to their visual sense: they give precedence to the visual system if there is any conflict between the inputs of other modalities. For immersion, the Visual display should generate the stereoscopic vision and also should synchronise the display with the user's head movement. Presently the HMD use two displays for each eye to generate a stereoscopic vision but the research is on to make it better by generating the image straight on the retina of the eye to give even better experience.

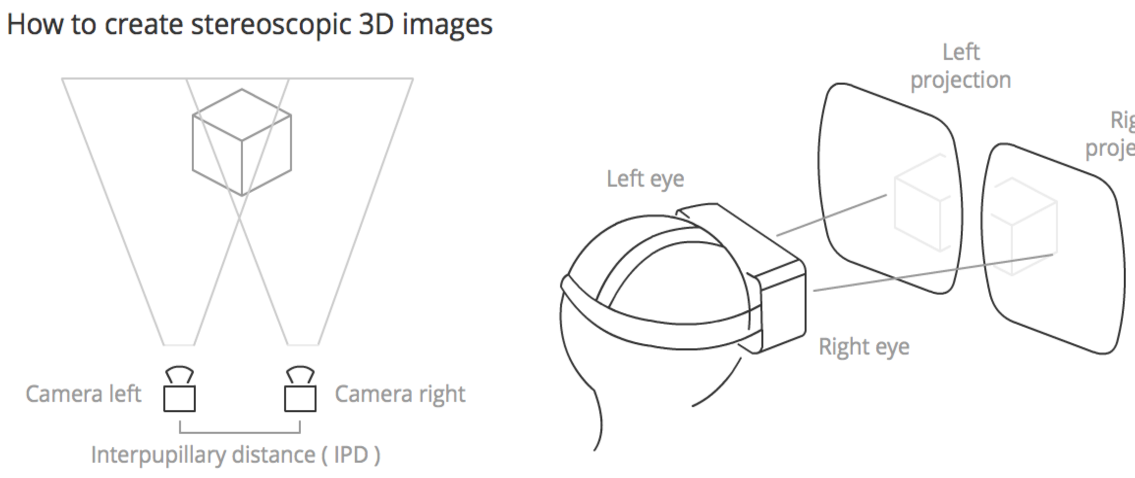

Figure 11

3.2.2.2. Haptic Feedback

As discussed earlier Haptic Feedback is quite a complex requirement and hence it's not available for practical everyday use.

Most of the research is based on making mechanical devices for example like mechanical pins activated by solenoid, piezoelectric crystal where changing electric fields causes expansion and contraction, shape-memory alloy technologies, voice coils vibrating to transmit low amplitude, high frequency vibrations to the skin, several kinds of pneumatic systems (air-jets, air-rings, bladders), and heat pump systems.

This won't feel like a real touch though, because it's just the haptic vibrations. One can approach the concept of **Neuroprosthetics** [6] where we generate the electric signals through over hundreds of Contact, Force, and Temperature sensors attached to the user's fingers and transmit it through nerves to the brain, so our brain can be deceived with a sense of real touch. Another great thing about electric signals is that we can transmit them over distances so one can actually touch and feel things objects remotely, provided there is a mechanical arm integrated with the same set of sensors on the other end.

3.2.2.3. Sound Feedback

3D sound is another necessity which can be produced by the Cetera Algorithm. Cetera removes the barrier between sound and the brain's ability to process signals. The Cetera technology is based on an innovative new algorithm- the complex mathematical formula that drives a hearing aid. Cetera's algorithm can match the exact characteristics of the wearer's ear. This customization removes the barrier that most hearing aids erect between the incoming sound waves and the data sent to the brain for processing. Hence, producing a 3D sound experience immersion.

3.2.2.4. Olfactory Feedback

Current market available systems use air streams to actually deliver the smell to the user. The odorants are dissolved in a solvent gas, such as carbon dioxide, and then directed to the user's nose through a hose. Several available technologies are considered to be used for odour delivery inside a HMD. Such portable system has to be miniaturized and lightweight and has low power requirements. Ink-jet printer nozzles are good candidates since they allow precise control of some odorants. Odorants can be stored in several different forms: liquid, gels or waxes. Most usually they are microencapsulated on flat surfaces. The system releases the odours scratching the desired amount of capsules, so discretely metering the dosage.

3.3. Virtual Reality Devices:

There are many devices that produce the Virtual Reality. We will be discussing the most popular devices such as, Globe, HMD, CAVE, and BOOM [7].

3.3.1. Virtual Reality Globe

The virtual globe is a 3D software model or representation of the Earth or another world. Now, Virtual globes are rapidly becoming an easy and accessible way of finding, distributing and visualizing all sorts of data in a geographical context. In fact, a virtual globe provides the user with the ability to freely move around in the virtual environment by changing the viewing angle and position. So it may be used instead of the CAVE with up to six surfaces, in future and will provide full sense of immersion for users

3.3.2. CAVE

The Cave Automatic Virtual Environment (CAVE) is an immersive virtual reality with spatially engaging environments. Basically, the CAVE's comprises of four projection surfaces on which images are projected with the uniquely immersive design. In addition, including the projection on the ceiling gives a full sense of being enclosed in the virtual world. Furthermore, projection on all six surfaces of a room allows users to turn around and look in all directions. This allows the user to interact with the virtual environment in ways with a better sense of full immersion. The following figure is a VR CAVE Application by Visbox.

Figure 12

3.3.3. BOOM

The Binocular Omni-Orientation Monitor (BOOM) (Figure 13) from fake space is a high-resolution stereoscopic viewing 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. Head tracking is accomplished via sensors in the links of the arm that hold the box. The main advantage of BOOM is that it has the ability to generate better images compared to HMD.

Figure 14

Figure 13

3.3.4. HMD

A head-mounted device (Figure 14) was the first device to create and provide its wearer with the unseen world of virtual reality. In 1965, Evans and Sutherland first introduced head mounted display. But unfortunately, it was commercially available only after 20 years by the name "Eye-phone" system. HMD device consists of two miniature display screens and an optical system. These two components channel the images from the screens to the eyes, presenting a stereoscopic imaging. Others use a single larger display to provide higher resolution, but without the stereoscopic vision. HMD provides virtual images by continuously tracking the position and orientation of the user`s head. This allows the viewer to look around and walk through the surrounding virtual environment. However, HMDs have cables which restrict our movement.

3.5 Applications of Virtual Reality.

3.5.1 Changes the way we human interact with each other.

VR has a great potential to change the way Humans Interact with each other today. In today’s world we have Video/Audio/Text Chat applications which have a great impact on the users but since the Idea of VR became popular and people realised its potentials and endless possibilities, big companies like Facebook, Google, Sony, Samsung, and HTC are developing VR devices.

3.6.2. Telepresence

3.6.2.1. Anybots

An Anybot (Figure below on Right) telepresence robot lets users project their presence to a work site. It is designed to function as a seeing and hearing personal avatar that can freely roll around an office, production site, sales floor, convention centre, or lobby. The system is operated via a Web browser using a wireless fidelity, third generation, or fourth generation wireless connection. A video camera and speaker mounted inside the robot’s head allows operators to converse with remote colleagues from a remote location while also being able to hear and see them.

Figure 15

3.6.2.2. Just like being there

JLBT is taking teleconferencing to the next level by dedicating some space of the conference room fitted with the required equipment which projects a remote user which could be a client or a senior manager to that dedicated part of the room just like he was sitting there (Figure above on the Left).

3.6.2.3. Microsoft Zhang

Microsoft's Zhang is one of many researchers focusing on creating a 3-D virtual audio-visual environment that's both life-sized and photorealistic. "Such as that when you meet remote people in that environment, you feel as if they were sitting with you at the same table," he says. "This means you have the correct mutual gaze, accurate motion and stereoscopic parallax, and immersive spatial audio." Zhang notes that his research is in a preliminary stage and is encountering the same road blocks that most advanced telepresence projects are bumping into: restricted Internet connection speeds and display resolution limits. "The current Internet bandwidth is not high enough, so we cannot send the full resolution of our entire 360° panoramic video," Zhang explains. "And even if we did send this in full resolution, a normal screen does not have enough resolution to display all of this."

3.6.3 Training Simulators

One of the most popular application of VR is in Training and Simulation due to its ability to produce any type of scenario required for any type of training whether it be a flight simulator or a train simulator, whether it be the target shooting range practice or a Military drill, It can be applied anywhere. Its several benefits are as follows, Reduces the cost of training, produces a training with more learning time. It provides safe and realistic 360 degree training environment. Games based immersive learning experience for better learning experiences for better learning outcomes. Conduct training irrespective of physical conditions. Ability to simulate any scenario such as weather, damage, faults. Run multiple trainees through training simultaneously.

3.6.4. Medical and Healthcare

For training the medical professionals performing various surgeries, also to simulate various medical emergencies so as to train the professional, with the olfactory feedback a VR device can produce real life situations even without the actual patients and situations. Virtual Reality can be used to develop surgery simulations or three dimensional images of the human body which the students can explore. This has been used in medical schools both in the UK and US. With the help of Anybots senior medical professionals can guide their colleagues even without being present there in the room, this could be helpful with various town and cities which don't have good medical professionals.

3.6.5. Education

For example, astronomy students can learn about the solar system and how it works by physical engagement with the objects within. They can move planets, see around stars and track the progress of a comet. This also enables them to see how abstract concepts work in a three dimensional environment which makes them easier to understand and retain.

3.6.6. Defence

These include: Flight Simulation, Battlefield Simulation, Medic Training, Vehicle Simulation, and Virtual Boot Camp. Virtual reality is also used to treat post-traumatic stress disorder. Soldiers suffering from battlefield trauma and other psychological conditions can learn how to deal with their symptoms in a 'safe' environment. The idea is for them to be exposed to the triggers for their condition which they gradually adjust to. This has the effect of decreasing their symptoms and enabling them to cope to new or unexpected situations.

Virtual reality training is conducted using head mounted displays (HMD) with an inbuilt tracking system and data gloves to enable interaction within the virtual environment. Another use is combat visualisation in which soldiers and other related personnel are given virtual reality glasses to wear which create a 3D depth of illusion. The results of this can be shared amongst large numbers of personnel.

What the military stress is that virtual reality is designed to be used as an additional aid and will not replace real life training. What is apparent is that virtual environments are ideal set ups for military training in that they enable the participants, i.e. soldiers, to experience a particular situation within a controlled area. For example, a battlefield scenario in which they can interact with events but without any personal danger to themselves.

The main advantages of this are time and cost: military training is prohibitively expensive especially airborne training so it is more cost-effective to use flight simulators than actual aircraft. Plus it is possible to introduce an element of danger into these scenarios but without causing actual physical harm to the trainees. Flight simulators are a popular theme in military VR training but there are others which include: medical training (battlefield), combat training, vehicle training and 'boot camp'.

But another use and one which is not immediately thought of is virtual reality and post-traumatic stress disorder (PTSD). PTSD or 'combat stress' has only recently been acknowledged as a medical condition but it causes very real damage to the person concerned and their family. Virtual reality is used to help the sufferer adjust to their symptoms and develop coping strategies whenever they are placed in a new situation. Generally, virtual reality training involves the use of head mounted displays (HMD) and data gloves to enable military personnel to interact with objects within a virtual environment. Alternately, they may be given virtual reality glasses to wear which display a 3D image.

3.6.7. Designing

Designers when immersed in the environment can make more practical, detailed designs because in VR they can simulate it in real time saving them a lot of time and resources which are spent in verification of practical sustainability also VR gives them the opportunity to test and change their designs in no extra time.

3.6.8. Engineering

During the development of the actual project one can simulate it in the VR to see the project feasibility and also how sustainable will it be in the real conditions without even taking the risk of testing the actual project in the live conditions.

3.6.9. Entertainment

The application of Virtual Reality is endless in the field of Entertainment Industry ranging from The VR movies to the VR games. The users say the VR is an experience they had never experienced before in their life. Sony recently launched their PlayStation VR and its gaining its popularity among the people whole across the world.

3.7. Drawbacks of this Technology

3.7.1. Security, Law Violations and Virtual Criminality

Say you own a private land where only authorised personals can come, but you see a VR controlled bot entering you restricted space, and there is nothing you can do about it 'Legally'. No one is liable for these events, as of now. So, it would seem the virtual world and second life is facing criminal problems of real-world.

A potential situation is one in which several people are immersed within a virtual environment but one of these participants becomes injured or traumatised due to the actions of another person in that situation.

Like all Internet-driven devices like Computer, Smartphones, Cameras, even Self-driving cars can be hacked by malicious users, and VR controlled devices are no different.

The concept of VR is relatively new to the Law enforcement agencies and thus they face a challenge to establish a Criminal Justice System. Say for example crimes like Theft of intellectual property, Money-laundering, Terrorist activities

3.7.2. Desensitization

Desensitisation means that the person is no longer affected by extreme acts of behaviour of violence/inappropriate environment and **fails to show empathy or compassion as a result**. In some situations, the user actively seeks out this type of scenario for the adrenaline rush and sense of power. Concerns have been raised about a possible relationship between virtual reality and desensitisation. This refers to virtual reality games in which there are high levels of violence or training exercises for the military in which soldiers engage in simulated combat scenarios which include **killing**. This has been noticed with gamers, especially those **who play first person shooters or role playing games which involve a high degree of immersion**.

3.7.3. Addictiveness

Another issue related to this is 'cyber-addiction'. There are people who become addicted to virtual reality games and as a consequence, **start to blur the boundary between real and virtual life**. They spend increasing amounts of time in the virtual environment which has a detrimental effect on their real world life.

3.7.4. Health Factors

The VR Headset can affect the functioning of motor neurons resulting in **distortion/loss of synchronisation between the coordination between our mind and our body**. The experience can cause nausea, eyestrain, and headaches. Headset makers don't recommend their devices for children. Samsung and Oculus urge adults to take at least 10-minute breaks every half-hour [8], and they warn against driving, riding a bike or operating machinery if the user feels odd after a session.

3.7.5. Effect on the brain development of Children

The child's brain grows as he/she sees, feels, tastes, smells and hears. Each time the child uses one of the senses, a neural connection is made in the child's brain. New experiences repeated many times help make new connections, which shape the way the child thinks, feels, behaves and learns now and in the future.

But if a child is being exposed to the violent or imaginary, impractical environment in the early ages, he would develop accordingly and if a child spends more time in this virtual world just imagine how hard it would be for him/her to adapt to this real world.

4. Conclusion

In this paper, Virtual reality types and structural elements of a virtual reality system are described. Two main of these elements: Virtual Environment and Virtual Reality Interfaces are explained further. Then applications of virtual reality that providing us opportunities in various domains are described and at last along with the drawbacks which comes along with this technology.

VR is newly born technology with great potential that can change we humans interact with the Information Technology and with each other. VR technology has been applied in various domains such as training simulators, medical and health care, education, scientific visualization, and entertainment industry. Virtual reality can lead to state of the art technologies like Second Life, too. Considerable achievements have been obtained in the last few years, and we can finally say that virtual reality is here, and is here to stay. Examples of its present application are such as in Simulation, Trainings, Entertainment, Design, Engineering and Education, as we live in a technological society. So it makes sense to implement virtual reality as one of several forms of technology in order to educate tomorrow's technological elite. Education has moved on from books, pencils and pens to the use of interactive technologies to help impart knowledge and understanding.

The idea of introducing the concept of Myo Controlled Prosthetic limb in the world of VR technology gives a great opportunity to produce realistic inputs and produce accurate feedbacks to and from the VR environment as this integration removes the mechanical barrier (Haptic Feedback) and can give real life like feedbacks in the Telecommunications and in VR controlled bots.

The marketing situation of VR is very dynamic. The technology while being ready for professional applications is not at the stage of settling down definite standards including possible leading manufacturers, compatibility specifications, performance levels, economical costs and human expertise. This uncertainty should not be confused with lack of confidence on the promising outcomes of the technology, but instead with the rapid mutation and evolution that characterizes the field, perhaps even more than for other information technology markets.

The disadvantages of virtual reality described above are minute in comparison to the wide benefits of virtual reality as a whole but it is very important that these issues are addressed the technology has a long way to go through before setting its standards and limits and gaining complete acceptance among Human society.

References

1. **VPL Research** was a company founded in 1984 by **Jaron Lanier.** (vrs.org.uk)
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3. Virtual Reality: Past, Present, and Future, by Enrico Gobbetti∗and Riccardo Scateni, CRS4 Centre for Advanced Studies, Research and Development in Sardinia Cagliari, Italy
4. **Kinesthetic** learning (American English), **kinaesthetic** learning (British English), or tactile learning is a learning style in which learning takes place by the students carrying out physical activities, rather than listening to a lecture or watching demonstrations.
5. In optics, particularly as it relates to film and photography, **depth of field** (**DOF**), also called focus range or effective focus range, is the distance between the nearest and farthest objects in a scene that appear acceptably sharp in an image.
6. **Neuroprosthetics**: in search of the sixth sense,By Allison Abbot.
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8. http://www.wsj.com/articles/what-does-virtual-reality-do-to-your-body-and-mind-1451858778