A Survey on New paradigm of Display Using Virtual and Augmented Reality

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Abstract-Virtual Reality (VR) and Augmented Reality (AR) are rapidly growing technologies since mid-60's, when they formally originated. VR and AR allow us to create environment that is hard or even impossible to create in real. Major Fields of their applications are education, training, entertainment and research in various domains. In this paper, we will elaborate some of the applications of AR and VR.

I. Introduction

Literal meaning of the word virtual is something that is almost or nearly but not completely. Online Oxford dictionary defines Virtual Reality as "Computer generated simulation of a 3-d object or environment that can be interacted with in a seemingly real or physical way, by a person using electronic equipment such as helmets with goggles and gloves with sensors." VR is all about creating a virtual environment that seems real and is interactive for the users. There are three levels of Virtual Reality:

I. Non- immersive- This type of VR is mostly desktop based equipment's like gloves and sensors are generally not used. It affects only one of four sensory systems that are hearing, vision, touch and scent.

II. Semi-immersive- This type of VR uses some equipments and affects two or three of the four sensory systems.

III. Immersive- This type of VR affects all four sensory systems. It enables the user to immerse fully into the virtual environment. Immersive VR is the most desirable Virtual Reality.

Cave Automatic Virtual Environments (CAVE) is one of the tools supporting VR, where the user is in a room where all the walls, as well as the floor, are projection screens (or flat displays). The user, who can wear 3D glasses, feels floating in the projected world where he can move around freely. CAVE environments are expensive and they need large of amount of space and they are not movable. All these restrictions make it difficult for them to be greatly used in education and training. As an example, CAVE technology is particularly used in Cultural Heritage education.

VR glasses or other Head Mounted Displays (HMD), which are usually used with headphones, can easily produce the feeling of actually being in the simulated world. For a complete immersion in a virtual world, all our five(including taste, even taste can be felt in VR.) senses should be affected. Nevertheless, most VR environments today do not actually address all of them but usually focus on two: vision and hearing. In particular, according to Classen "Sight is held to be the most important of the senses and the sense most closely allied with reason"

In the past, there were constrains in using HMDs or other such technologies. These technological devices were not very well spread and cost of them was very high. Moreover, their efficiency was not up to the mark. They often caused a feeling of dissatisfaction to their users due to lack of coordination between the movements of the head and the corresponding change in the scene. Now, these difficulties have been overcome. At commercial level, effective and efficient simulation is available at a reasonable price. This enhanced technology is greatly used in the field of education and technology. Furthermore, technology can now offer systems with precise tracking of movements that make usability better for the user and is capable of achieving his visceral reaction.

Augmented Reality is somewhat different from Virtual Reality. Literal meaning of the word augmented is something that is made greater in size or value. Augmented Reality is defined as taking something from reality and then adding it in the virtual world. Like Virtual Reality, AR too has many applications in plethora of fields.

With such innovation, mechanics could see directionswhat to do next while repairing an obscure bit of gear, specialists could see ultrasound outputs of organswhile performing medical procedure on them, fire contenders could see building formats to keep away from generally undetectable risks, officers could see places of foe riflemen spotted by unmanned observation air ship, and we could peruse surveys for every eatery in the road we‟re strolling

in, or fight 10-foot tall outsiders while in transit to work.

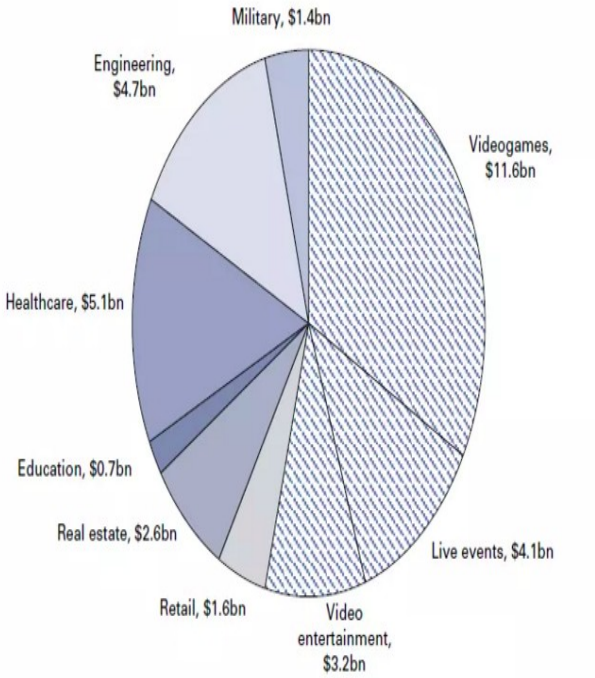

Figure 1: Uses of AR/VR software in various fields.

In Education: Technology enhances the productivity by reducing efforts from user's side. Therefore, the assistance of technology in the important domain like education is highly welcomed. Technology isneeded and very useful in pure science to simplify plenty of complicated and complex scientific concepts and processes. Without the help of technology, it is tough to convey the exact meaning of the learning content and to make learners understand. Because it is extremely difficult but not impossible to create the accurate experimental set up to teach various concepts. Physical set ups can be created once as they require high costs and cannot be moved. Limited things can be performed on one such set up. This restricts the range of their users. All these constrain can be overcome by the aid of Virtual Reality in education. Learning is all about gaining experience, knowledge and mastering the skills to be applied in the future incidents in real life instead of memorizing the facts and figures without understanding any of them. Knowing the context and exact application of a concept is the education in the truest sense. In the case of India, importance of VR in education becomes even bigger. The state of Indian educational institutes and the methodology taken for teaching has no secret. The emphasis is given to only rote memorization. Experimental learning is minimal. For such a scenario, VR aided education will be proven a boon for genuinely interested students in learning. Use of VR in education may help learners to innovate and apply their imagination,

Multimedia is being used in education before development of VR. Now VR has been blended with the multimedia(MM). Multimedia consists of five core elements (text, audio, graphics, video, animation and video) with the addition of three dimensional models. This makes learning even more interesting. Each of the elements in multimedia serves a particular purpose in making the users learn. The cooperation between these elements enhances learner's long term memory and helps them grasp the concept. VR makes education so captivating that learners don't consider it as a burden. What VR can do in the field of education is not less than a revolution especially, for India.

II. Applications of Augmented Reality

In Training: VR can be extensively used to create the situations that are impossible to be created physically or are infeasible be created physically because of high expenses involved. VR technology is able to vividly create such situations to provide the needed training.

Military training: Use of VR in military training is quite obvious. Thomas A Furness was one of the first persons to introduce VR in military training. He presented working model of a flight simulator. VR is used to create battle like situations to train the soldiers for wars without fearing about loss of human life and other resources. It can also make the soldiers aware about the working style of military specific vehicles and weapons.

Medical training: VR helps medical students understand, interact with and perform on complex anatomy. Virtual surgeries greatly benefit the surgeon by training them for most complex surgeries, without risking the life of the patient. By introducing VR in the medical training, animal cruelty can be reduced. An ideal, fully immersive VR would not need living creatures for drug experimentations.

Space training: NASA has been using space training for twenty years now. VR can create the experience of space when astronauts are still on the earth. VR can create zero gravity simulation. It also can help to do spacewalk.

Digital marketing: Virtual Reality opens a new path in digital marketing with its growth. VR in digital marketing enables the user to see a product completely in 3 dimensional forms. User can even interact with the product to know how it performs.

VR has so much scope in digital marketing as digital marketing is estimated to reach 333.5 billion by 2020. In India, few brands are using this technology but results are not satisfactory.

Social science and psychology: Every person has a different mind. There have been systematic efforts to classify the people based on how their mind works. VR can be very useful for such classification. VR can create a hypothetical seemingly realistic situation and then record how different persons react to the same situation. VR can also help in research of biases and stereotypes by putting users in simulation. It can also study the mind of people belonging to different age groups.

In Entertainment: humans have always been fond of entertainment. Entertainment has been growing drastically with the growth of the technology. Visual entertainment is very attractive. And VR provides that effectively. Visiting a fantasy world and interacting with it is interesting for almost everyone. So scope of Virtual Reality in entertainment is unlimited. In fact many people associate VR with only entertainment.

Cinema: A VR cinema allows users to have a 360 degree view. It makes the users feels as if they are part of the film. The world chess championship match between Magnus Carlsen and Sergey Karjakin was promoted as first sport to be broadcast in 360 degree view.
Non immersive and semi immersive VR are being used in cinema for quite a long time. In India, they are having huge market.

Gaming: Virtual Reality in gaming has tremendous scope because of the nature of the gaming industry. gaming industry is growing rapidly and competitive gaming is becoming popular. There have been even demands of considering video gaming as one kind of sport. VR can bring video gaming closer to physical sports. Apart from the characteristics of a typical video game, VR needs the sensory systems of the user. After all, virtual reality is creating an environment that seems real.
VR can be used in every genre of the video game like racing, arcade and shooting. But it suits best for Role Playing Games(RPG).

III. Applications of Augmented Reality

In Education: The involvement of multiple elements such as 3D models, animation, graphics and audio display in an
Augmented Reality environment is helpful for learning. A 3 dimensional model can attract learners but a static model could not able to continuously engage learners in the learning process. The combination of 3D models, animation, video, graphics, text and audio is able to enhance the understanding of the users.
AR allows the users to take some content from the real world and add something virtual to it. Using AR, learners can merge a physical 3 dimensional model into the world of virtual reality. This facilitates the learning of concepts.As AR has some real part in it learners can manipulate a real model virtually without actually changing it.
Constructivism is a paradigm that defines learning as an active, developing process of understanding knowledge and experience with the learners based on their prior knowledge. The learners as the information constructor linked the prior knowledge with new information. This theory was coined by Jean Piaget in the 80s'

Like VR, AR too can bring a revolution in the education sector.

In AEC: Architecture, Engineering and Construction has wide applications of Augmented Reality. With AR in AEC, we can know how a partially built structure will end up looking.
There are limitations that should be dealt with before these technologies will become dominant in the AEC industry. Tracking and rendering of software are some of these challenges.
Augmented Reality in AEC industry is no less than a blessing. AR allows the Architects, civil engineers to determine beforehand how a particular construction method will look on the partially built monument.AR can also be used for consumers of this industry.Consumers get to know about the end product through this technology.
AR can be a powerful tool to do research work about historical monuments. AR lets researchers understand the structural design of that monument without harming it physically. Internal structures of ancient monuments like Egyptian Pyramids and Taj Mahel are still unknown. AR can provide a new way to research in AEC by making a strong attempt to solve above mentioned mysteries.

In Digital marketing: AR finds vast applications in this field also. With the help of Augmented Reality, users can find how a particular brand looks on the physical things they own, without buying the brand or going to the actual store.
AR is already relevant in this field. Many companies are using this technology on their website. In India too such companies can be found.

In Entertainment: movie studios have been using AR technology to create special effects in their films.

Some virtual things are mixed with the footage of real shooting. Many advancements have been made in this filed. Now AR is capable to create so realistic models that it is difficult to tell real and virtual part apart.Many desktop software that are used for 3 dimensional modelling, provide a feature to see the

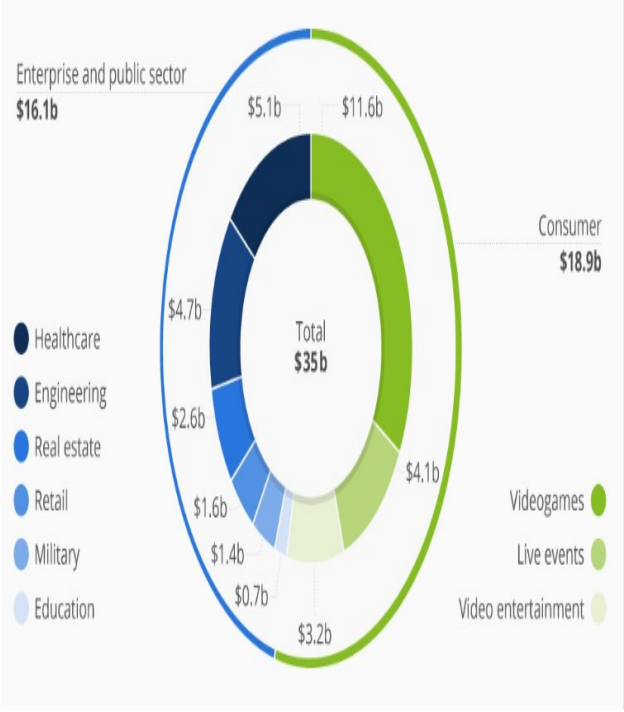

Figure 2: Diverse Potential of AR/VR

model created in them in AR. That model is added to real footage of the user that is taken from the camera in the computer.

In Translation: AR can translate a photo with text to some other language.

IV. Conclusion

Augmented Reality and Virtual Reality are having very large applications across the fields. Much advancement have been made, still there is plenty of room for the growth. These technologies have merit of being the next mesmerising concept in technical worldrld.

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