

Analyzing the Benefits and Value of Immersive Technology

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Abstract: This paper presents an overview of basic aspects of Immersive Technology. It describes the main fields in which immersive technology is applied nowadays that is in time of social distancing norms and nationwide lockdowns. Some characteristics of immersive technology will be discussed and this paper will provide an overview of them.

Keywords: Immersive technology, Virtual Realty, Augmented Reality, Mixed Reality

I. Introduction

The word Immersive Technology is derived from the word Immersive which is a process of temporarily expanding consciousness into areas of the unconscious—something like hypnosis, but retaining consciousness as one does in lucid dreaming states. Oxford dictionary defines immersion as “deep mental and social involvement in something” It creates an enchanting surrounding when combined with technology generating a three-dimensional image which appears to surround the user. Imagine students walk into their science class, and floating on top of a desk is the active volcano. As one of the students reaches out and touches the volcano, instantly the 3D image of the volcano opens to reveal the layers of the inner core of volcano giving them visual treat of erupting volcano. This learning environment can be created with Immersive technology which has transformed the digital experience by bringing together the virtual with users’ sight, sound, and even touch. One can define Immersive technology as power to access information in the most intuitive way and that will bring out the data from digital device to produce results. Immersive technology is a blend of simulation and artificial intelligence. Immersive technology is also capable of proposing analyses that would be impossible in real-world scenario

During this time when world is facing the crisis of COVID-19 pandemic, Immersive Technology is spreading some sense of optimism in the field of medicine, health care and education. We can say that COVID-19 has strengthened immersive technology’s prospects. The global pandemic has forced the sectors of healthcare and education to accelerate the adaptation of technologies and come up with new ways of how to manage processes in our new everyday realities. In the light of the pandemic, it has become evident that we need to adapt quickly with new technological resources that are able to operate at full capacity bearing the load of both functional and human resources system overload. Immersive technology open healthcare, business and education sectors to a variety of possibilities when it comes to accessibility, remoteness and safety. It provides unique capabilities to enhance learning processes, giving a new sense to reality in the form of Omni-learning. It has direct benefits for schools, universities, business and hospitals alike during pandemic crisis. It’s time that businesses understand the advantage of using immersive technologies to reach and effectively engage with their customers, especially in a time when the world is bracing itself for many ‘new normal’. Pandemic has significantly reshaped and innovated how we teach and engage with our business and healthcare facilities.

“In the good old days before the lockdown, there were two distinct experiences for all of us: The one that you had online and the one that you had, when you stepped out of the house. The coronavirus crisis has completely collapsed the latter. However, you still crave for those experiences, whether it is shopping in a mall, eating in a restaurant or working in an office with colleagues. This is where the sensorial elements of a restaurant, the immersive experience of going into a shop, the collaborative experience of working in an office. All of these can be recreated (to some degree) through good use of digital design elements and a deep understanding of the human psyche. Digital-twins of all outdoor experiential elements can help fill some of this gap,” explained Narendra Ghatge, Chief Designer-User Experience Design at Tata Elxsi [1].

Immersive technologies vary in terms of complexity, immersion and usually cost. For some, Immersive technologies are just the latest video-games headset on the market, but their uses are already much wider such as virtual house viewings, training firefighters, live guidance during surgery, workplace safety training and much more.

II. Trending Realities in Immersive Technology

1. Virtual Reality (VR): We can find several definitions of Virtual Reality (VR), but inclusive way of defining it is as follows: “A Virtual Reality is defined as a real or simulated environment in which a perceiver experiences telepresence”, This is the chosen definition because it put apart the technology’s implications, and in this way, there is no need to specify any Head Mounted Displays (HDM) or globes and we can focus on techniques and applications to try to figure out what is the path that the technology is following [2]. Immersion, presence and interactivity are eccentric features of Virtual reality. With virtual reality we trick our brain with things which are actually not real. We are completely disengaged from our true surroundings as headset block our view from the outside world.

Virtual reality assures, to improve the learning process, upgraded innovative ideas, training of employees and is integrating itself in the corporate world like traveling sector. Virtual reality is becoming an essential share of the process of travelers inspecting and selecting a travel destination. Virtual reality most noticeable role is in the field of medicine and healthcare. Stanford Medicine in California is using a new software system that combines imaging from MRIs, CT scans and angiograms to create a three-

dimensional model that physicians and patients can see and manipulate just like a virtual reality game. After putting a headset connected to the VR system, surgeons can clearly see the ballooning blood vessel, as well as the spot where neurosurgeon, would place a clip to repair it. Surgeons with the advent of virtual reality in Neurosurgical Simulation Lab practice an upcoming operation. Because they're practicing on images from the actual patient, rather than a generic brain, they can map out the surgery ahead of time. Virtual reality provides an opening in the form of a window into the brain of the particular patient they are going to operate on. The three-dimensional aspect of the imagery eases surgeons' planning and improves the accuracy of the surgery, with the aim of producing safer procedures [3]. Virtual Reality is offering an imperative role for fighting COVID-19 pandemic, through audiovisual-based virtual communication. Virtual reality technology has developed a platform to reduce the face-to-face interaction of doctors with the infected COVID-19 patients. Through live video streaming, it has helped to improve surveillance systems on the ongoing situation [4].

One of the virtual reality originations in India is ImpactAll, which provides an e-learning platform under its SaaS-based model and also 3D and VR services. An immersive experience is believed to help children remember what has been taught. Another platform is GazeMatic which allows user to teleport themselves into any land of their choice while they are on call [5]. IIT Madras has launched India's first consortium for virtual reality.

2. Augmented Reality (AR): Augmented reality can be defined as a technology that overlay 3-D content into user reality. That is with augmented reality we can deal the new information immediately direct or indirect therefore influencing the physical real-world environment which has been augmented by adding virtual computer-generated information to it. The goal of the augmented reality is to make the life of the user easier by providing the virtual information to his/her adjacent environment as well as to any indirect view of the real-world environment like the live-video stream [6]. The Augmented Reality technology has many possible applications in a wide range of fields, including entertainment, education, medicine, engineering, manufacturing and corporate sector.

Understanding human anatomy is essential for practicing medicine. Augmented reality can offer teaching method for anatomy education by providing visualization capabilities including the 3D rendering of anatomical imagery, sensory experiences in the form of tangible feedback. Part of an anonymous CT dataset can be augmented to the user's body and shown on the monitor. This creates the illusion that the medical trainee can look inside his/her body [7]. With Microsoft's HoloLens Headset, app users are able to see everything from muscles to the tiniest veins before their eyes on a dynamic holographic model. Google Glass is helping new mothers struggling with breast feeding. EyeDecide is one of its kind medical augmented reality app which uses the camera display for simulating the impact of specific conditions on a person's vision. Using apps like EyeDecide, doctors can show simulation of the vision of a patient suffering from a specific condition [8].

Augmented reality is increasingly being accepted in educational settings, often to help students with complicated subjects. For example, students struggling with geometry can use AR to see and manipulate 3D geometric forms. Another application of augmented reality in education includes teaching global viewpoints through virtual field trips, enabling students to interactively engage with other cultures. Labs equipped with AR technology can make students operate a chemical plant and experiment with different chemical reactions without any risks [9]. Educators can come up with interactive puzzles, and quizzes for their students, making learning much more stimulating with the use of place-based augmented reality information pop-ups.

In India too augmented reality apps have entered the marketplace and are extensively becoming prevalent among people. The Lenskart app and website both support the '3D Try On' feature. It gives access to your camera, and it'll show you what a frame looks like on your face. It records your face from multiple angles. Similarly, MakaanView app, allows you to look for houses simply by moving your phone around to look at the world around you. SIB Mirror the The South Indian Bank offers the feature of an ATM and branch finder. This shows you a list view, with locations and distances, and tapping the augmented reality button switches to a camera overlay, showing you exactly where the ATMs are [10]. At EdTech BYJU's pavilion there is a game based augmented reality lesson where what we scribble on pen and paper is almost magically read by a tablet and scores are given to us. Software giant TCS showcased a virtual chemistry lab. Wearing an Oculus headset, we enter a virtual lab where you see beakers with liquids. Using the controller, which simulates your hand movement, you pick up a dropper, dip it into a solution and put a drop in the beaker to test whether it is acid or base. These labs are being piloted in government schools in Tamil Nadu [11].

3. Mixed Reality: We can say that its an advanced version of augmented reality and is much more aware about the surroundings in greater depth, that is we are connected with true reality. More technically mixed reality is a blend of physical and digital worlds, unlocking natural and intuitive 3D human, computer, and environment interactions. This new reality is based on advancements in computer vision, graphical processing, display technologies, input systems, and cloud computing [12]. The three basic capabilities required for this technology first to understand the environment, that is device is permitted to perceive the size and location of all types of surfaces in the surroundings. Secondly, device is permitted to recognize and track its position relative to the real world. Lastly, device is permitted to estimate the environment's existing lighting conditions including shadows. For this to happen there are two main types of devices that deliver mixed reality experiences:

Holographic devices: These are characterized by the device's ability to place digital content in the real world as if it were there.

Immersive VR devices: These are characterized by the device's ability to create a sense of presence by blocking out the physical world and replacing it with a fully immersive digital experience [12].

Mixed reality has a promising future in the field of medicine, like it can help in gathering critical imaging information of internal anatomy of the patient and can help in picturing multifaceted medical data. That is with the help of mixed reality one can segment the data out of the multifaceted to perform surgery on correct part.

Mixed reality can direct the vision in 360 degrees across an entire space and in every direction. We can walk through the streets of Rome, see a beating heart as blood flows through it, design and be inside architecture prior to finalizing building design and much more. With mixed reality holographic learning, students work individually and collaboratively on 3D holograms to learn all of the parts of anatomy. If students want to examine the arm to understand precisely how its muscles and bones work together, they can

approach the limb more closely, look beneath the skin, and see precisely where muscles connect to the bone to allow flexion, extension, and other movements. To assist with study, instructors can make visual holographic labels to identify organs. By making the labels go blank, students can quiz themselves or take a formal assessment to ensure they are meeting learning objectives [13]. IKEA, the world-famous furniture company with the help of mixed reality created an app, which help users to test IKEA's products in real time. That is we can see if products suit our surroundings or not. The app automatically scales products, based on room dimensions, with 98 percent accuracy. Likewise, Fashion mirror is another example which permit you to have 3D product inspection. For example, sizing issue is resolved, we can try shoes without purchasing them. They will be real replicas for us to try. That is, we can try before we buy.

III. Some related technologies

The growth and widespread adoption of immersive technology is also dependent on an array of different technologies and telecommunications systems. Some of them are as discussed below:

1. AR Cloud: AR cloud technology enables the unification of the physical and digital world to create immersive experiences. This technology uses a common interface to deliver persistent, collaborative and contextual digital content overlaid onto people, objects and locations. This provides users with information and services directly tied to every aspect of their physical surroundings [14].
2. 5G and Edge Computing: They are potentially vital infrastructure for mixed reality experiences. Fifth generation mobile networks (5G) will bring not just ubiquitous, high-speed connectivity, but also facilitate edge computing, which is a form of cloud computing that brings digital content and computing resources closer to a user [15].
3. Smart Glasses or Digital Eyewear: The term "Smart glasses" refers to a device that brings with suitable technology a computer screen or display in front of a person's eyes in order to present data from the background information system. The display can be projected or reflected on the lens of glasses or it can be a separate component brought to the eye sight. An imperative fact is that the user can perceive the surroundings without distractions when he/she is not in need of the information provided by the smart glasses [16].
4. Spatial Computing: With this technology reality and the computer landscape becomes intertwined. Through this technology we can bring the real world and the digital world together in a much more significant way than ever before. Some basic examples of spatial computing are location sensors like GPS and location-based services [17].

IV. Conclusion

Covid-19 pandemic has made us appreciate the importance of technology in such grave situations. In time of social distancing norms and nationwide lockdowns through computer technology, the life has been made easy to some extent. The things which seemed to be impossible in times of lockdown has been made possible with the help of technology. But still there is lot of work to do in this field specially, in the developing countries like India. Like Indian government faces challenges at a local level. People are not ready to adopt such technology due to lack of digital infrastructure and digital literacy among people in rural India. In many developing countries there is a huge digital divide.

Beside this we need solutions for Internet shutdown on which these technologies hugely depend, that is we need shutdown measures. Also, there is fear of trust due to data security challenges. A user's privacy can be vulnerable because immersive technologies can "see" what the user sees.

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