RUNNING HEAD: INTERACTION BETWEEN VR AND AR

Interaction Between VR and AR

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**The iInteraction between VR and AR**

**Technical Topic:** Virtual or augmented reality hardware components.

**Design Topic:** User experience in a virtual reality.

**Introduction:**

Virtual reality (VR) and augmented reality (AR) are the latest buzz words in technology developments. Both technologies are aimed at providing and transforming user experience through the use of virtual and augmented realities. Augmented reality is referred to as an enhanced version of reality created using advanced technology. It provides the user with an experience of viewing details of reality in an augmented perspective. It does not require the user to enter a new world like in the case of virtual reality. Augmented reality use camera of a smartphone to capture a scene from reality and then present the user with added details to that reality and experience is then termed as augmented reality (Scholz and Smith, 2016). As compared to augmented reality, virtual reality creates a complete simulated environment and provide the user with an immersive experience. In virtual reality, the user can move around and have a full experience of the environment created using virtual reality. The report provides an insight into VR/Ar hardware components and the user experience design using VR technologies including application designs for virtual reality.

Virtual reality is an established tool in the development of various products. Enhanced capabilities of virtual reality equipment and simulated scenarios such as simulated cave environments that provide an immersive experience to the engineers. Product developers can experience three-dimensional visualizations of computer-aided designs of buildings and various other products. Virtualenvironmnets, when deployed in healthcare facilities, proved helpful in the treatment of anxiety, post-traumatic disorders, and autism due to the immersive capabilities created through simulated virtual environments targeting user experience. Such technologies when combined with stereoscopic projections and head tracking provide the users with correct and immersive experience of spatial perceptions of the simulated environment. Having all the new avenues of research and case study scenarios do not guarantee that virtual reality is an established tool in future work environments. The reason behind the situation can be associated high-cost, and segmentation of experts in different but related domains of virtual reality such as networking, graphics designing, application designing, and projection technologies.

**Discussion:**

Currently available virtual reality technologies are based on the stimulation of the five physiological senses. Technology that can directly stimulate the human brain to simulate reality is still a fiction. That is the reason behind the primary focus of all virtual and augmented reality equipment on the visual sense. Visual sense is the most important when it comes to the simulation of reality because it can be achieved by creating a visual illusion without stimulating the brain directly. Visual illusions are created through immersive stereoscopic displays used in head-mounted displays (Serino et al., 2016). Head mounted displays are the most important hardware components of experiencing virtual or augmented reality. Head-mounted displays are devices mounted on a user's head presenting eyes with various visual techniques to create an illusion perception. Head mounted displays also known as HMD’s usually have two liquid crystal display screens that provide a stereoscopic image of a simulated three-dimensional environment. Head mounted displays are not designed ergonomically and may have resolution problems. Any hardware issues such as reduced resolution and bulky construction material can alter the user experience in virtual reality.

The primary goal of virtual reality equipment is to provide the user with a sense of presence in the simulated environment cutting them out from the real environment. Tracked three-dimensional cathode rays tube monitors are also used in virtual reality. However, they provide a limited field to be viewed from the simulated environment. Same issues are present with autostereoscopic three-dimensional monitors that they provide a limited view of the field and poor resolution. Hardware components that provide a truly immersive experience in virtual reality are known as caves. A cave in virtual reality is essentially cubical projections that provide a room for the user to interact in simulated environments (Jung et al., 2016). Projections of simulated environments in such caves depend on the technology used for projection of the simulated program. Mainly three types of projections are used in virtual reality caves. The first is the use of active stereo with cathode rays tube monitors combined with shutter glasses. The second is filter technology based on interference filters combined with two video projectors. Interference glasses provide with a bright display and sound effect experience to users. The third projection technique employs polarised glasses and passive stereo sounds with two projectors for visual presentations.

An example of experience provided by these or combination of hardware components is such that if two projectors are deployed with a large projected screen of three meters with the acceptable field of view, then a person standing one and a half meter away will experience a resolution that is only thirty per cent of actual human eye resolution. Immersive projection technologies can provide better results and user experience, but they provide additional challenges for multi-user scenarios in which interaction between two or more viewers is required (Billinghurst et al., 2015). There are several hardware components related to virtual reality being sold in the market such as datagloves, joysticks, head-mounted displays and, metaphoric devices. However, the installation of such equipment and operation is still very complex as compared to the ordinary computer equipment and peripheral devices. Novice users have a very difficult time in training their minds for appropriate functioning of these complex hardware devices. Most of the readily available installations except head-mounted displays are used by experts. Head mounted displays are widely being used with gaming environments and consoles.

Among all of the interaction devices available to be used with virtual reality devices, datagloves are the most difficult to operate. Their use may not be as intuitive as perceived by the majority of the people. Engineers and user interaction application developers of virtual reality world are striving to create a more user-friendly environment as compared to what is currently available. The problem to be solved involves making these devices more efficient and increase their usability without compromising the quality of user experience offered by the interface devices. Virtual reality techniques are most commonly deployed in the design review process of digital prototypes (Sherman and Craig, 2018). Aspects such as stability, usability and, ergonomics of such interface devices and end-user equipment of virtual reality are reviewed using computer-aided virtual reality applications. Future trends of virtual and augmented reality hardware will be to make the interface devices and overall virtual reality equipment more portable than ever. People will prefer to experience virtual reality on their personal devices rather than visiting an installation place such as a virtual reality cave in some park. Integration of virtual reality systems into more transferable devices will bring more challenge for engineers designing hardware and programmers designing the applications as well.

Virtual reality provides an immersive experience to users that closes out the physical world. By utilising virtual reality gadgets, users can find themselves in a completely different world. Augmented reality, on the other hand, adds details to a live view of the physical world. An ordinary example of the augmented reality can be considered as the image filters of a social media application known as Snapchat. In addition to virtual reality and augmented reality, there exists mixed reality as well. Mixed reality combines components of both virtual reality and augmented reality. Basic idea and purpose behind all of the virtualisation technologies being developed are to provide a unique and immersive experience to the users. Building a virtual world is all about providing the best possible experience for users and building better interaction (Poushneh and Vasquez-Parraga, 2017). Extreme requirements of vivid three-dimensional images and better sound quality have opened new paradigms of research and development in information technology. Latest innovations in three-dimensional graphics for virtual or mixed reality worlds have made even the most promising two-dimensional screens as outdated and obsolete. Virtual reality technologies can provide similar results in various training institutions. For example, while on physical training a healthcare student may become overwhelmed. But in case of a virtual reality headset, the student will be able to grasp the same concepts of real-world scenario and in case of any trouble will remove the virtual reality headset.

Another example of virtual reality user experience can be of digital business meetings. Digital meetings will help in transforming businesses into virtual companies as well. In a VR business meeting, the person will feel as if they are physically present in a meeting as compared to the traditional paradigm of looking at a screen for an extended period of time. People are used to the interaction schemes offered by the touchscreen experience. Same interaction experience with even more refinements will be offered by virtual reality as more developers and business joins the fleet (Yilmaz, 2016). New user interface designs will provide a more immersive experience of virtual worlds. The interaction offered by any virtualised reality depends on three components known as the speed, mapping, and range. Speed refers to the time taken to execute the result of user interaction in the virtual world. If the simulation can handle the result of interaction in realtime, then the experience will be considered as immersive. The problem for researchers in designing personalised virtual reality systems is that they require to understand the real world scenarios before designing virtual reality programs. Analysis of the physical surroundings of the user is an essential step in the creation of quality user experience. The user must not feel at any point in time that his/her personal space is being invaded by the virtual reality experience.

In general virtual reality, applications are composed of two components known as environments and interfaces. Both components play an essential role in creating user experience better. The environment in virtual reality gadgets is the simulated graphical representation of the world also known as virtual world accompanied by he vivid three-dimensional graphics. An interface in virtual reality is the essential element that is used to interact and navigate into the environment. All of the virtual reality applications can be aligned to a two-dimensional axis representing the complexity of environments and interfaces used in a virtual reality application by the designer. As an example, the virtual reality equipment simulated roller-coaster ride will have a rich environment of vivid three-dimensional graphics and stereo sounds but will not have any interface (Bonetti et al., 2018). In this particular case, the interface will be locked for the roller-coaster ride only in which the user has no control requirement. Creating an effective application of virtual reality systems require the use of slow and progressive familiarisation using textual or visual tools is required to be embedded in the software. The user may not be aware of the working of the system, and thus the user experience can be compromised by loading the environment with too many guiding functions or no functions at all.

User experience mostly depends on the environment and interface used in the simulator. There is an important concept that is known to ruin user experience in virtual and augmented reality systems. It is defined as the simulator sickness that arises due to the inferior angle of resolution used in simulator environment. Graphical details must be vivid enough to allow wide viewing angles without significantly compromising the image quality. If the user has to tilt their head down for sixty degrees, that may put a burden of almost 60lbs. Prolonged exposure to such conditions may lead to damaged nerves and spinal cord problems. Thus, the user experience will be ruined by a poor quality environment used in simulator either of virtual or augmented reality hardware.

**Conclusion:**

Virtual and augmented reality solutions can provide various benefits to humanity if utilised with the central principle of improving the user experience. There are many available technologies and hardware components that provide users with virtual reality experience. However, they are not designed with the considerations of user experience. Effective model creation in virtual reality requires extended research in psychological and physiological human behaviours. Without effectively designing the environment and interface components of virtual reality equipment, the user experience cannot be guaranteed. Future endeavours in fields of virtual and augmented reality will consider the user experience in first place before designing hardware components.

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