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Virtual Reality: Issues and Challenges

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ABSTRACT
Virtual Reality systems have drawn much attention by researchers and companies in the last few years. Virtual Reality 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. Interactivity and its captivating power, contribute to the feeling of being the part of the action on the virtual safe environment, without any real danger. So, Virtual Reality has been a promising technology applicable in various domains of application 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. Like many advantageous technologies, beside opportunities of Virtual Reality and Second Life, inevitable challenges appear, too. This paper is a technical brief on Virtual Reality technology, issues and its challenges

INTRODUCTION
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. In other word, 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. Virtual Reality is a real-time and interactive technology. It means that the computer is able to detect user inputs and modify the virtual world instantaneously. Interactivity and its captivating power contribute to the feeling of being the part of the action on the environment that the user experience. 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 known 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. Virtual Reality technology has been a promising technology applicable in various domains of application such as training simulators, medical and health care, rehabilitation , education , engineering , scientific visualization , and entertainment industry.

VIRTUAL ENVIRONMENT
Virtual Environment as its name implies is a virtual representation of an existing or non-existing physical environment or an abstract information which offers end users real time interactivity and make them feel as if they are part of it. Due to the interactive and behaviors that occur in real, immersive nature of Virtual Environment have resemblance with behaviors that occur in real environments. The VE can take many forms; for example it could be realistic representation of

some physical environment such as the interior of a building, a kitchen or even an object such as a car. It could be that the VE does not have any physical basis at all. For instance, it might be a 3D database of a geographical, hierarchical network describing a multinational company or a multidimensional data set associated with stock transactions. Whatever the nature of the underlying data, a geometric model is required to represent atomic entities and their relationships with one another. Based on this geometric model a geometric database must be built to represent the environment and stored such that it can be retrieved and rendered in real time when required. The database storing VE includes 3D geometry, color and texture, dynamic characteristics, physical constraints and acoustic attributes HMD, BOOM, CAVE are common virtual environments now and virtual globe is an upcoming technology in virtual environments.

VIRTUAL REALITY APPLICATIONS

Gaming

This is one area where VR has been used since the 1990's. However, 2016 is pegged as the year when VR gaming might actually take off. There are so many games already available for different VR platforms. A number of developers including Valve and Sony have announced support for VR and are set to announce dedicated games. Improvements to Smartphone displays and processing have also opened up the way for Smartphone connected VR headsets for gaming.

Virtual Tourism

Since VR shows a 360-degree view, using it for virtual tourism is a no-brainer. VR demos of monuments, museums and popular tourist destinations likely number in the thousands. You can get started with the most basic Google Cardboard (or similar headsets) and your smartphone. Just search for VR in the app store and you'll find what you need. Will it affect real tourism? Maybe — but at least it's a lot more affordable than actually travelling the world

Crime Scene Reconstructions

VR has the ability to put you in a different place and time. This is perfect for crime scenes because it can help find and analyze something that was missed earlier. Scenes can be photographed in 360 with advanced cameras and a series of events can be reconstructed at a later stage. The investigator will be able to put on a simple set of VR glasses and look around to discover more clues. This is even more important when a crime scene's integrity will not last — such as on a busy street or inside someone's home.

Movies

When you put on a VR headset, it blocks all the ambient light and distractions so that your experience is not ruined. This makes VR a great option for watching videos and movies — it can actually make you feel as if you are sitting in a movie theatre, complete with seats and a screen. Netflx already has a VR app, compatible with Samsung's Gear VR headset. It shows content in 720p HD resolution.

Virtual Car Showrooms

Many automotive enthusiasts would like to visit different car showrooms — take in the ambience, sit inside, start up the engine and so on. Apps like Relay Cars are already available and you can do

exactly that. Step inside, look around, view videos about the car and even start up the engine to hear what it sounds like. The sounds are sampled from the actual cars so what you hear is what you get. Once adopted by mainstream manufacturers, you'll be able to visit a bunch of showrooms without leaving your home.

Live Streaming of Events

We always recall the OnePlus VR live stream of the OnePlus 2 Smartphone. All you had to do was install the app and you could instantly view the launch event in 360 degrees using a Google Cardboard or similar headset. Samsung also offered a taste of VR at the Samsung Galaxy S7 and S7 Edge launch in Barcelona a few weeks ago. Going ahead, this looks like a trend in the making. Viewers from all over can see events while sitting at home.

View Your Own Content

Since many VR headsets use your smartphone as a display, you can use them to access local content. For instance, a free VR Cinema app automatically splits videos stored on your phone to a side-by-side view so that it is viewable in a VR headset. Similarly, you can play 3D movies from your device on a VR headset. An app called Seen lets you capture 3D images with your phone that can be later viewed in VR.

Advanced Healthcare

CT scans can pinpoint anomalies with great accuracy. The problem is, doctors have to view these scans on flat screens and prints. With VR, doctors can see scans in much greater detail and manipulate them in 3D space at will. This will mean a faster and better diagnosis. Other applications in medicine include remote surgical tools, risk-free training of health care professionals and in some cases, even treatment of patients

Adding Dimensions to Home Shopping

Urban areas are rapidly moving to a delivery-only model. From clothes & shoes to groceries, everything is moving to apps. The next logical step is VR shopping. Large retail chains are already experimenting with virtual shopping where you could 'walk' into a store, search for and examine the products you want and add them to your basket. They will be delivered home without you ever leaving the couch. This could also progress to a mail which will have multiple shops under the same virtual roof.

Military Training

What makes the perfect soldier? It's training — as much as possible. VR can supplement the actual training, putting soldiers in a safe environment while simulating all possible situations and enemies. This is currently being done with flight simulation and battlefield simulation. Advanced moving VR rigs can also place soldiers on moving platforms for better simulation.

Drone Control

Drones are hot property and despite the ambiguity around their use in many parts of the world, numbers are only increasing. VR provides a way to control a drone even when you can't see it. It is now possible to send a drone on a reconnaissance mission - it will send a live feed from its

cameras to your VR headset so that you can remotely control it. Companies like FLYBi, Ghost Drone and Cloud LightFPV have consumer-ready products out in this space.

VIRTUAL REALITY ISSUES

Man-machine communication

Interactive programs have to establish a bidirectional communication with humans. Not only they have to let humans modify information, but they have to present it in a way to make it simple to understand, to indicate what types of manipulations are permitted, and to make it obvious how to do it. As noted by Marcus, awareness of semiotic principles, in particular the use of metaphors, is essential for researchers and developers in achieving more efficient, effective ways to communicate to more diverse user communities. As a common vocabulary is the first step towards effective communication, user-interface software development systems should assist developers by providing implementations of standard interaction metaphors. This has been a very successful approach for 2D interfaces. Recent research in the 3D interaction field has focused on exploring responsive 3D interfaces with better affordances, functional fidelity and mental appeal. Growing the vocabulary of 3D interaction metaphors is an active research subject.

Iterative construction

Good user interfaces are “user friendly” and “easy to use”. These are subjective qualities, and, for this reason, as stated by Myers, the only reliable way to generate quality interfaces is to test prototypes with users and modify the design based on their comments. Multiple iteration of the classic design-implement-test cycle have to be done, and it is difficult to evaluate the time that has to be spent before validation. A classic survey on user interface programming reports that more than 90% of the projects analyzed that included a user interface used an iterative approach to design and implementation. The same report shows that in today’s applications, an average of 48% of the code is devoted to the user interface portion. The report underlines the importance of user interface tools, such as toolkits, user interface management systems, or graphical user interface builders. In the case of virtual environment, no standard solution exists [41]. The design of software architectures to support construction and rapid prototyping of three dimensional interfaces, interactive illustrations, and three dimensional widgets is an important area of research

Parallel programming

Interactive applications have to model user interaction with a dynamically changing world. In order for this to be possible, it is necessary for applications to handle within a short time real-world events that are generated in an order that is not known before the simulation is run. Thus, user interface software is inherently parallel, and some form of parallelism, from quasi-parallelism, to pseudo-parallelism to real parallelism has to be used for its development. All problems inherent to parallel programming have thus to be solved (e.g., synchronization, maintenance of consistency, protection of shared data) . Furthermore, the multimodal aspect of virtual environment applications impose the use of true parallelism, as the various components of an applications have to receive input and produce output at considerably variable rates (e.g., 10 Hz for visual feedback and 1 KHz for haptic feedback).

Performance

Virtual reality applications have very stringent performance requirements. In particular, low visual feedback bandwidth can destroy the illusion of animation, while high latency can induce simulation sickness and loss of feeling of control. In order to be spatio-temporally realistic, and thus effectively useable, applications should meet latency and visual feedback constraints. This high sensitivity of humans to latency and visual feedback rates frequency requires that appropriate techniques be used in VR applications to minimize the latency and maximize the feedback frequency. These two aspects are related but are not the same thing: for instance, using pipelined multiprocessing to increase computation speed is a way to probably increase feedback frequency that is likely to also increase application latency. For this reason, simply optimizing standard applications is not sufficient.

Robustness

The contract model of software programming is a way to specify and understand the behavior of software units. With this model, precondition and post condition describe the benefits and obligation in the software contract that relates the software unit supplier to its clients. User interface software units is forced to have weak preconditions, since few assumptions can be made on the behavior of the external world. This makes its realization and verification more difficult.

Modularization

The ease of creation and maintenance of a piece of software is improved by decoupling it in units with very weak coupling, so as to develop and test them in isolation. Unfortunately, a complete separation between user interface and application is very difficult to obtain. In particular, the need of semantic feedback associated to the different operation tends to increase the coupling among application and interface components. This fact often forces a change in application parts because of changes in the user interface.

Information presentation

Presenting information in 3D space introduces problems which are not present in classical 2D interfaces. In particular, occlusion and perspective effects offer both new possibilities and new challenges to visualization. Treating 3D information is more complex than treating the 2D counterpart (e.g., because of the complexity of 3D geometric space) and, in particular, 3D manipulation requires more dexterity. A notable example demonstrating the potential of 3D interfaces for information presentation is Xerox Parc's Information Visualizer. Built using the Cognitive Coprocessor architecture, it takes advantage of the greater possibilities of 3D with novel means of information presentation, such as the cone tree and the perspective wall.

Perceptual requirements

The perceptual requirements of virtual reality application, summarized earlier in this report, are more complex to satisfy that those of standard graphical applications.

VIRTUAL REALITY CHALLENGES

Like many advantageous technologies, beside opportunities of Virtual Reality and Second Life,

unavoidable challenges appear, too. In fact, using Virtual Reality and Second Life offers both technical and cultural challenges. We can describe these challenges in following sections.

Technical challenges

Second Life in Virtual Reality environments functions by streaming all data to the user live over the Internet with minimal local caching of frequently used data. The user is expected to have a minimum of 300kbit/s of Internet bandwidth for basic functionality, with 1Mbit/s providing better performance. Due to the proprietary communications protocols, it is not possible to use a network proxy/caching service to reduce network load when many people are all using the same location, such as when used for group activities in a school or business. Due to Virtual Reality's and Second Life's rapid growth rate, it has suffered from difficulties related to system instability. These include increased system latency, and intermittent client crashes. However, some faults are caused by the system's use of an "asset server" cluster, on which the actual data governing objects is stored separately from the areas of the world and the avatars that use those objects. The communication between the main servers and the asset cluster appears to constitute a bottleneck which frequently causes problems. Typically, when asset server downtime is announced, users are advised not to build, manipulate objects, or engage in business, leaving them with little to do but chat and generally reducing confidence in all businesses on the grid. Cost is another issue. In addition to appropriate internet band width and virtual reality environment and interfaces charges, establishing Second Life in virtual environments offers several membership plans, too. For example for virtual learning, a premium account is required to purchase land, which is necessary to create a sustained and safe learning environment for students. However, increasingly powerful computer systems are becoming more affordable each year, but commercial VR systems that are sophisticated enough to offer complex models and diverse functionality are still expensive relative to personal computers.

Cultural challenges

Liability issues are still at question in virtual worlds. In Second Life private land can be pur-chased. Private land can be restricted to only authorized users. However, users in public areas may be subjected to violence or disruptive players (LaChapelle, 2007). There are many unresolved legal issues surrounding virtual violence, virtual assault, and sexual harassment that take place in Second Life and in other Virtual Reality worlds. And unfortunately no one is liable in these events, now. So, It would seem the virtual world and second life is facing criminal problems of real-world. Nowadays, the concept of "Virtual Reality" is new to law enforcement agencies around the world. Yet every day, millions of people connect in these worlds to socialize, shop and learn. Unfortunately, lawbreakers have also joined these virtual worlds and the full range of criminal activities is now also present. Common crimes are occurring every day in virtual worlds, including money-laundering, theft of intellectual property, exchange of child abuse images and even suspected terrorist activities. For these reasons, new virtual worlds and communities pose a unique set of challenges for the criminal justice system. Moreover, the near total lack of requisite jurisprudence means that criminals are often free to act with impunity. A more disturbing fact, believed to be caused by the same issue, is "inventory loss" in which items in a user's inventory, including those which have been paid for, can disappear without warning or permanently enter a state where they will fail to appear in-world when requested (giving an "object missing from

database" error). Linden Lab offers no compensation for items that are lost in this way, although a policy change instituted in 2008 allows accounts to file support tickets when inventory loss occurs. Many in-world businesses will attempt to compensate for this or restore items, but they are under no obligation to do so and not all are able to do so. Although "inventory loss" is much less from past years but it does still exists. Second life and most virtual Reality worlds do not have appropriate tools for system management. For instance virtual worlds and Second Life were not created for educational purposes, inherently. Nonetheless, they are being adapted by educators for teaching and learning. Faculty can integrate text information in the form of note cards and use Web sites, content slides, video, and audio in addition to creating 3-D objects. However, many of the features educators take for granted in Learning Management Systems do not exist in Virtual Reality and Second Life. Additionally, Second Life is a random access environment thus giving instructors very little control over lesson sequencing. Nowadays some of the Learning Management features that are lacking in virtual worlds are beginning to be addressed and efforts are underway to facilitate the use of these systems, in future.

CONCLUSION

Nowadays, 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. 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. Like many advantageous technologies, beside opportunities of Virtual Reality and Second Life, unavoidable challenges appear, too. 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, challenges of applying virtual reality technology are presented. Of course, efforts are underway to overcome the issues and challenges in future to use the advantages of this technology as more as possible.

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