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STUDY PAPER ON EDUCATION USING VIRTUAL REALITY

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ABSTRACT

This report provides a short study of the field of virtual reality, highlighting application domains, technological requirements, and currently available solutions. In today's market, virtual reality is playing an crucial role for the humans. If we consider the foreign countries than using virtual reality they try to create the same feelings not only for the school children's as well as for the upper education. In this paper, we have study the technologies used in virtual reality.

KEYWORDS: Virtual reality, application domain, technologies.

INTRODUCTION

Virtual reality is today the latest technology where a person can feel everything is happening in surroundings. It includes latest software and hardware that provide us or we can feel that we are in real enviroment. It helps to provide us digital created space by the the use of some latest computer machines and upgraded or developed software we can able to feel the same. Virtual Reality provides a different way to see and experience information. For example, we have played so many games in the malls, we can feel the same atmosphere like suppose if we are playing the car racing game than if the car collide, we will get the same feeling.

HISTORY

The first traces of virtual reality came from the world of science fiction. Stanley G. Weinbaum's "Pygmalion's Spectacles" is recognized as one of the first works of science fiction that explores virtual reality. Morton Heilig wrote in the 1950s of an "Experience Theatre" He built a prototype of his vision dubbed the Sensorama in the year of 1962, along with five short films to be displayed in it while engaging multiple senses (sight, sound, smell, and touch). In 1968, Ivan Sutherland, with the help of his student Bob Sproull, created what is widely considered to be the first virtual reality and augmented reality (AR) head-mounted display (HMD) system

Requirements

The goal of virtual reality is to put the user in the loop of a real-time simulation, immersed in a world that can be both autonomous and responsive to its actions. The requirements for virtual reality applications are defined by analyzing the needs in terms of input and output channels for the virtual world simulator.

User input

The input channels of a virtual reality application are those with which humans emit information and interact with the environment. We interact with the world mainly through locomotion and manipulation, and we communicate information mostly by means of voice, gestures, and facial expressions. Gestural communication as well as locomotion make full body motion analysis desirable, while verbal communication with the computer or other users makes voice input an important option. As stated in the 1995 US National Research Council Report on Virtual Reality , because human beings constitute an essential component of all [synthetic environment] (SE) systems, there are very few areas of knowledge about human behavior that are not relevant to the design, use, and evaluation of these systems.

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Discussion

The analysis of the requirements in terms of input and output channels has highlighted fidelity and performance requirements for the bare simulation of existence of synthetic objects. Successful virtual reality applications must combine new input and output devices in ways that provide not only such an illusion of existence of synthetic objects, but also the interaction metaphors for interacting with them. An ACM CHI workshop on the challenges of 3D interaction [16] has identified five types of characteristics that 3D user interfaces must have to exploit the perceptual and spatial skills of users.

These are summarized as follows:

1. **Multiple/integrated input and output modalities.**
2. **Functional fidelity**.
3. **Responsiveness**
4. **Affordances**
5. **Appeal to mental representation**

Sensory Feedback

Our sense of physical reality is a construction derived from the symbolic, geometric, and dynamic information directly presented to our senses. The output channels of a virtual reality application correspond thus to our senses: vision, touch and force perception, hearing, smell, taste. Sensory simulation is thus at the heart of virtual reality technology.

Visual Perception

Vision is generally considered the most dominant sense, and there is evidence that human cognition is oriented around vision [21]. High quality visual representation is thus critical for virtual environments. The major aspects of the visual sense that have an impact on display requirements are the following:

1. **depth perception**: stereoscopic viewing is a primary human visual mechanism for perceiving depth. However, because human eyes are located only on average 6.3 centimeters apart, the geometric benefits of stereopsis are lost for objects more distant than 30 meters, and it 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 importance for near ones;
2. **accuracy and field-of-view**: the total horizontal field of vision of both human eyes is about 180 degrees without eye/head movement and 270 7 with fixed head and moving eyes. The vertical field of vision is typically over 120 degrees. While the total field is not necessary for a user to feel immersed in a visual environment, 90 to 110 degrees are generally considered necessary for the horizontal field of vision [49]; when considering accuracy, the central fovea of a human eye has a resolution of about 0.5 minutes of arc [20];
3. **critical fusion frequency**: visual simulations achieve the illusion of animation by rapid successive presentation of a sequence of static images. The critical fusion frequency is the rate above which humans are unable to distinguish between successive visual stimuli. This frequency is proportional to the luminance and the size of the area covered on the retina [9, 23]. Typical values for average scenes are between 5 and 60 Hz [49]. A rule of thumb in the computer graphics industry suggests that below about 10-15 Hz, objects will not appear to be in continuous motion, resulting in distraction [27]. High-speed applications, such as professional flight simulators, require visual feedback frequencies of more than 60 Hz [4].

Sound Perception

Analyzing crudely how we use our senses, we can say that vision is our privileged mean of perception, while hearing is mainly used for verbal communication, to get information from invisible parts of the world or when vision does not provide enough information. Audio feedback must thus be able to synthesize sound, to position sound sources in 3D space and can be linked to a speech generator for verbal communication with the computer. In humans, the auditory apparatus is most efficient between 1000 and 4000 Hz, with a drop in efficiency as the sound frequency becomes higher or lower [49]. The synthesis of a 3D auditory display typically involves the digital generation of stimuli using location-dependent filters. In humans, spatial hearing is performed by evaluating monaural clues, which are the same for both ears, as well as binaural ones, which differ between the two eardrum signals. In general, the distance between a sound source and the two ears is different for sound sources outside the median plane.

Position, Touch and Force Perception

While the visual and auditory systems are only capable of sensing, the haptic sense is capable of both sensing what it is happening around the human being and acting on the environment. This makes it an indispensable part of many human activities and thus, in order to provide the realism needed for effective applications, VR systems need to provide inputs to, and mirror the outputs of, the haptic system. The primary input/output variables for the haptic sense are displacements and forces. Haptic sensory information is distinguished as either tactile or proprioreceptive information. The difference between these is the following. Suppose the hand grasps an object.

Olfactory Perception

It exists specialized applications where olfactory perception is of importance. One of these is surgical simulation, which need to: provide the proper olfactory stimuli at the appropriate moments during the procedure. Similarly, the training of emergency medical personnel operating in the field should bring them into contact with the odors that would make the simulated environment seem more real and which might provide diagnostic information about the injuries that simulated casualty is supposed to have incurred [22] The main problem about simulating the human olfactory system is, indeed, that a number of questions on how it works remain unanswered.

ENABLING TECHNOLOGY: HARDWARE

Currently, a set of devices, hand measurement hardware, head-mounted displays, as well as 3D audio systems, speech synthesis or recognition systems are available on the market. At the same time, 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

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. Many different technologies can be used for tracking. 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 to determine 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.

Eye Tracking

Eye trackers work somewhat differently: they do not measure head position or orientation but 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 approach can be optical, 13 electroocular, or electromagnetic. The first of these, optical, uses reflections from the eye's surface to determine eye gaze. Most commercially available eye trackers are optical, they usually illuminate the eye with IR LED's, generating corneal reflections.

Full Body Motion

There are two kinds of full-body motion to account for: passive motion, and active self-motion. The first 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 particular application (e.g., flight simulators) and they represented the first practical VR applications for military and pilots' training use.

Visual Feedback
Humans are strongly oriented to their visual sense: they give precedence to the visual system if there are conflicting inputs from different sensory modalities. Visual displays used in a VR context should guarantee stereoscopic vision and the ability to track head movements and continually update the visual display to reflect the user's movement through the environment. In addition, the user should receive visual stimuli of adequate resolution, in full color, with adequate brightness, and high-quality motion representations.

Haptic Feedback
At the current time, tactile feedback is not supported in practical use, that is, tactile systems are not in everyday use by users (as opposed to developers). Tactile stimulation can be achieved in a number of different ways. Those presently used in VR systems include 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.

Sound Feedback
The commercial products available for the development of 3-D sounds (sounds apparently originating from any point in a 3-D environment) are very different in quality and price. They range from low-cost, PC-based, plug-in technologies that provide limited 3-D capabilities to professional quality, service-only technologies that provide true surround audio capabilities.

ENABLING TECHNOLOGY: SOFTWARE
The difficulties associated with achieving the key goal of immersion has led the research in virtual environments to concentrate far more on the development of new input and display devices than on higher-level techniques for 3D interaction. It is only recently that interaction with synthetic worlds has tried to go beyond straightforward interpretation of physical device data [17].

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 [26], 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.

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.

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 quasiparallelism, to pseudo-parallelism to real parallelism has to be used for its development.

CONCLUSION
Virtual environment technology has been developing over a long period, and offering presence simulation to users as an interface metaphor to a synthe- 21 sized world has become the research agenda for a growing community of researchers and industries. 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. More and more research has demonstrated its usefulness both from

the evolutionary perspective of providing a better user interface and from the revolutionary perspective of enabling previously impossible applications. Examples of applications areas that have benefited from VR technology are virtual prototyping, simulation and training, telepresence and teleoperation, and augmented reality. Virtual reality has thus finally begun to shift away from the purely theoretical and towards the practical. Nonetheless, writing professional virtual reality applications remains an inevitably complex task, since it involves the creation of a software system with strict quality and timing constraints dictated by human factors. Given the goals of virtual reality, this complexity will probably be always there.

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