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A Review on Virtual Reality Environment Implementation and Applications on a Mobile System

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ABSTRACT: Virtual Reality (VR) aims to provide immersive visual experiences of real-world scenarios on head-mounted displays. One aspect of VR devices involves the use of alternative interfaces, and the development of new virtual and augmented reality applications. Unfortunately, this is one of the most inaccessible technologies for all but the best-funded educational programs in the world, almost exclusively limited to the developed world. The reason for this lies in the expense of what is largely prototype display hardware, and the accompanying application development and experimentation tools.We are using a low-cost platform that opens up application development to a much broader world, requiring the most minimal of hardware and computing infrastructure. We demonstrate how functionality that is typically limited to devices costing thousands of dollars, can be provided to students and educators with access to just a Mobile System such as Android. Android is a very convenient hardware platform which is a boon for developers so that they can spend less effort and time to realize their ideas. All these factors make android a viable platform for the development of VR applications. The open-source nature of this system helps further development in the VR scene.

KEYWORDS: Head Mounted Display, Interfaces, Haptic, Auditory, Simulation, Gyroscope, Accelerometer, Magnetometer, Compass, Virtual Reality Environment.

I. INTRODUCTION

Virtual Reality refers to a high-end user interface that involves real-time simulation and interactions through multiple sensorial channels.Virtual reality appears to offer educational potentials in the following areas: data gathering and visualization, project planning and design, the design of interactive training systems, virtual field trips, and the design of experiential learning environments.

However, virtual reality is still a developing field with constant advances being made. These advances need to be tested to determine how accurately a system is modeled with this new set of tools. The devices that exist in the current market are extremely expensive and price around $700 USD and are available only in developed countries. Countries such as India have barely had a glimpse of VR and its true capabilities.

We aim to design a VR HMD that uses smartphones as a platform for our VR application. This makes it both cheap and accessible to the developing countries, the device itself can be built at home with materials that cost under $5 USD and can be customized to the user's preferences.Our designed application will provide few utilities and tools to use the VR HMD. The ability to explore the design of a VR product with minimal expense and to verify its functionality using a prototype rather than building a physical HMD from start gives us a considerable advantage over systems like the OCULUS and HTC VIVE.

II. RELATED WORK

- Paper: Affordable Altered Perspectives - Making Augmented and Virtual Reality Technology Accessible.
  Author: Phillip Peralez Santa, Clara University
  This paper describes how a simple low cost VR kit can be built using an android smartphone and used to provide a VR experience similar to expensive HMD devices.

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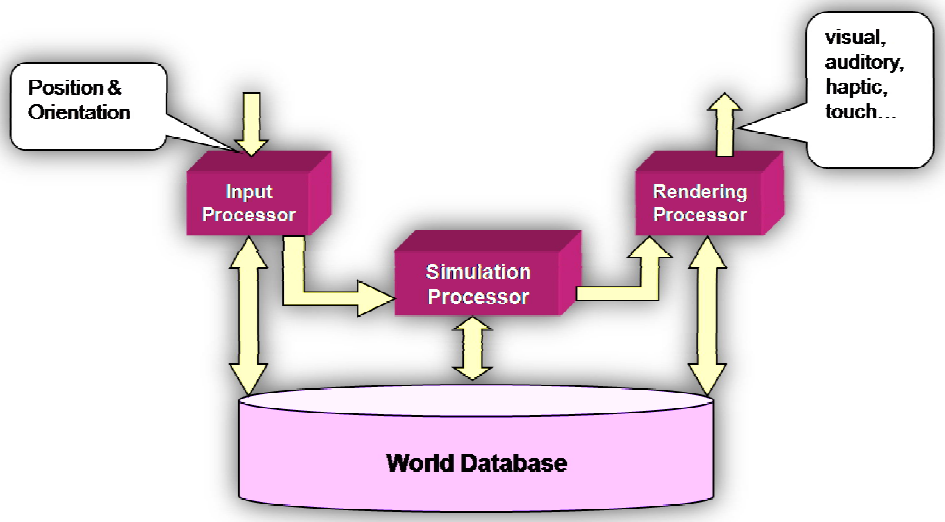
- Paper: Depth Augmented Stereo Panorama For Cinematic Virtual Reality With Focus Cues
  Author: JayantThatte, Jean-Baptiste Boin, HaricharanLakshman, Gordon Wetzstein, Bernd Girod, Stanford University
  This paper describes the depth augmentation system that is required in a HMD to provide immersion to the user and explains its working in detail.

- Paper: What is Virtual Reality?
  Author: J. Isdale
  This paper gives a rough idea about VR and explains the working of a generalized VR system.

- Paper: Virtual Reality: Definitions, History and Applications. "Virtual Reality Systems",
  Author: M. Gigante, Academic-Press
  This paper provides a systemic representation of a VR device and tells about the previous generations of VR and their applications.

- Paper: Geometric Considerations for Stereoscopic Virtual Environments. Presence,
  Author: L. Hodges, E. Davis
  This paper describes in detail the process of rendering a 3D world in a virtual environment via stereoscopic devices.

III. VR SYSTEM ARCHITECTURE:



- **Input:**
  The input to the system is given by the gyroscope in terms of (X, Y, Z) axes.
- **Input Processor:**
  Its job is to transmit input data to entire system with minimal lag.
- **Simulation Processor:**
  It takes input from user to determine the actions taken in the virtual world.
- **Rendering Processor:**
  Creates the sensations that act as output to the user wearing the device.
- **World Database:**

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Information about the world and its objects are stored here.

- **Output:**
  The output is given to the user via a display & audio unit.

IV. VR COMPONENTS

- **Reality Engines:**Virtual reality images are made with tiny dot like segments of a picture known as pixels, or picture elements. Each pixel itself is made up of hundreds of thousands of dots. Realistic images can be either opaque, in which all the viewer sees is the virtual world, or see-through, in which the virtual image is projected or superimposed onto the outer world. Reality engines are based largely on the same components that make up a personal computer (PC), although much more computing power is required for the reality engine than is available in a standard PC.

- **Head Mounted Display:**Head-mounted display (HMD) units use a small screen or screens (one for each eye) that are worn in a helmet or a pair glasses. Unlike a movie, where the director controls what the viewer sees, the HMD allows viewers to look at an image from various angles or change their field of view by simply moving their heads. HMD units usually employ cathode-ray tube (CRT) or liquid crystal display (LCD) technology.

- **Audio Units:** The audio portion of virtual reality is transmitted through small speakers placed over each ear. Audio cues may include voices, singing, and thud like noises of colliding objects— in short, any sound that can be recorded. Sounds that seem to come from above, below, or either side provide audio cues that mimic how sounds are heard in the real world. Three-dimensional (or omnidirectional) sound further enhances the virtual reality experience.

V. SYSTEM REQUIREMENTS

Hardware (minimum):

- RAM - 1 GB
- Screen Processor - 1.6 GHz
- Display Size - 4”
- Gyroscope
- Accelerometer
- Compass
- Magnetometer

Software (minimum):

- Android - 4.1
- Resolution - 1280x720

VI. CONCLUSION AND FUTURE WORK

Our main objective is creating a consumer friendly VR system that is widely accessible and available to the general public. We aim to redesign the VR Headset to make it compact and light.Development of MULTIPLE applications for interaction between User and the HMD.These include:

- 360° Panoramic Photo Viewer
- VR Video Player
- VR Internet Browser
- VR YouTube

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- VR EnvironmentCustomization

Providing an Immersive VR experience on a custom HMD of the user'schoice.VR devices cost up to 700$ (46200□), however our VR device is a low-cost alternative priced at 5$ (330□)It uses already available hardware from your mobile phones making it far more available to developing countries. The open source nature of our project makes VR more accessible and opens up development to a much broader world.The applications we develop act as a base to the VR system which can be improved with further iterations.

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