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Using Oculus Rift to create immersive virtual reality applications

Introduction

Recent advances in technology and the opportunity to obtain commodity-level components have made the development and use of three-dimensional virtual environments more available than ever before [1]. However, how well such components work to generate realistic virtual environments, particularly environments suitable for perception and action studies, is an open question. The purpose of this paper is to review Oculus Rift as an augmented virtual reality (VR) device and discuss the advantages and challenges of how it can be used to create immersive VR applications.

Commercial Applications

Immersive virtual environments (IVEs) allow the simulation of real-world experiences, like entertainment, military training, and education, simulation of scientific phenomena and scenarios that would otherwise be impractical to provide for reasons of cost or feasibility. Since such environments can provide highly controllable experiences, IVEs offer opportunities for understanding how users perceive and act in space [2] and this can be highly coveted information for scientists who are interested in human cognition.

These days, Oculus Rift, a VR device, is used to build ecosystems around virtual reality: businesses, schools, government and military applications. For instance, Arch Virtual, specialists in creating 3D environments with virtual and augmented reality, uses Oculus Rift to create virtual real estate, architectural planning, healthcare simulation modeling, automotive manufacturing and urban planning [3].

Oculus Rift is also starting to get used in educating students with special needs [4]. Mathieu Marunczyn, information and communication technology (ICT) leader, has introduced Minecraft Leap Motion for students with autism, and is working with Oculus Rift, to provide short structured lessons to support K-12 instruction [5].

Technology behind Oculus Rift

Oculus Rift's mask contains a large 7" OLED screen to help provide enough area to take up to 100 degrees of human vision at a time. Each eye looks through a different lens at a different part of the screen, which creates a stereoscopic 3D effect.

In order to track the way user moves his/her head and body, the Rift uses a Gyroscope and Accelerometer detect the tilt and the orientation. The latest version of the Rift also comes with an external camera that can see a number of infrared lights on the head-mounted display. When these indicators move, the camera detects these changes and translates them to the running application [6].

Hardware

The latest model of Oculus Rift, codenamed Crystal Cove, is available for preorder for $350 and has an OLED display screen of 1080p resolution. It offers a 960 x 1080 per eye resolution with a maximum refresh rate of 75 Hz. It also offers a full persistence of 2ms and a 100 degree field of view. Rift contains Gyroscope, Accelerometer and Magnetometer, which update at 1000 Hz, providing improved motion tracking. It also has a near infrared 60 Hz CMOS sensor which can be used for real time positional tracking [7].

Development

The Oculus Rift is paired with the publicly available Oculus Software Development Kit (SDK) which includes source code, documentation and code samples that serve as a getting started guide [7]. To begin, the developer could start by installing “Oculus Service”, “Oculus Manager” and “Oculus Configuration Utility”. Upon finishing the setup, he/she can import the SDK into Integrated Development Environment (IDE) of choice and start developing. Step by step instructions and demo code snippets are also available [8]. The current version of the SDK supports Windows, Mac OSX, and Linux. Additionally, the developer could use Unity-3D to get extended development support for the Rift [9].

Oculus Rift, as a virtual reality device, offers clean documentation and great SDK support. Unlike other VR devices, Rift can be used in conjunction with mbed NXP 1768 and other compatible drivers, like Phidget drivers, to inexpensively prototype portable VR applications [10].

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