Remote 3D Livestream for VR Headset

Virtual Reality Development for Oculus Rift

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Introduction

The concept of a virtual dimension or a photographic rendering that can come to life, that can be experienced for entertainment or otherwise, has been one that has fascinated mankind for centuries. From 15th century panoramic murals, 18th century nascent stereoscopes to flight simulators in post-world war jet age, efforts have always been concerted to somehow make images three-dimensional and immersive. Fast forward to early 21st century, and 3D Virtual Reality headsets are one of the most cutting edge and in demand gadgets.

Oculus Rift is among the new generation headsets, and has built itself an impressive reputation as one of the pioneers of a booming virtual reality market and research sphere. A myriad of softwares and platforms have emerged that aid in developmental endeavors, for research and commercial purposes. A Rift Development Kit by Oculus was also rolled out in early 2016, which can work independently or as a liaison between the headset and development softwares.

Hardware and basic operation

Components

A standard Oculus Rift box contains a headset, A two-pronged HDMI cable and DVI adapter, a positional tracker (the wireless sensor tracking movement) and a remote controller to navigate options once plugged in. The headset itself is a gadget of marvel. It is covered on the front and the back cap by Infrared LEDs, beneath the outer protective casing. They are integral to accurately determining head rotation and speed. The goggle part on the inside is covered with a flexible lycra micro-fiber that gives room to the two adjustable asymmetric lenses. The lenses provide windows to a split-screen stereo 1080p display that is ideal for immersion, with a pixel density of 456 px/inch. The scene is rendered twice, one for each eye, to account for perspective position-orientation This twin AMOLED display can switch color 15 times faster in less than a millisecond, compared to most of the current LED screens. Each frame image produced on the display is comprised of two eye images. Before the frame is generated, the image is rendered and then distorted for each eye. The success of Rift in creating an immersive view can be credited to the 90° - 100° field of view made possible by the wide screen. Furthermore, the screen is at an optimal distance (7 inches) from the lenses for the user to focus quickly and without any discomfort. The given setting boosts perceptual fidelity, which is described as the extent to which a user behaves and perceives as if in the real world. An ambient light sensor is also present bottom center of the lenses, to check if the headset is in use.

System Requirements

A fast and reliable system with a strong and powerful graphical processing unit (GPU) is a basic necessity for the Rift to give desired results &

function properly. The official recommendation are:

- Graphics Card: GeForce GTX 970 or AMD Radeon R9 290 or better.
- CPU: Intel Core i5 4590 or greater.
- RAM: 8GB or more.
- Video port: HDMI 1.3.
- USB port: 2 USB 3.0 ports.
- Windows 7 SP1 or new er.

After making sure that the system fulfills the requirements, the Oculus Rift can be setup simply by following the straightforward online instructions that appear on the screen once it is plugged in and connected.

Oculus SDK fundamentals

The Software Development Kit can be installed by visiting the Oculus Developer Center. Before downloading the SDK, it is advisable to install the Oculus Desktop App and Oculus Home. These apps will also give an opportunity to confirm whether the user system is compatible and meets the required specifications. To avoid complications, it is recommended to enable unknown sources in the runtime application. Once the SDK zip file is downloaded and extracted, sample solutions and project files for Windows Visual Studio can be tested. The SDK is based in C++, hence it is advisable to use object-oriented methods to achieve best solutions.

To account for the speed of rotation of a human head, and to maintain that live feed and experience, Rift uses a prediction algorithm which can be made use of in the SDK. Usually there is no need to resort to this functionality, since the Rift implements prediction all the time without developers having to turn it on.

While rendering, state changes are highly discouraged because they may result in an unpredictable amount of delay leading to lag. It also means that the GPU's power cannot be separately utilized in parallel with the CPU. The simplest and yet most important reason is that debugging presents a tough task, since the user has to sift through each section of code methodically, instead of the option of jumping to functions. Lastly, stereoscopy, a key method to make the rendering 3D, can be added by storing each eye's viewport separately. Source code for guided beginner examples can be viewed at https://github.com/OculusRiftInAction/OculusRiftInAction.

Popular Platforms

Oculus Rift, and virtual reality headset of any kind in fact, has been incredibly attractive to gamers. It won't be wrong to assert that innovation in and motivation for this field has been amply bolstered by the investment and support from the gaming industry. Plenty of software solutions, graphical user interfaces and engines have sprung up to make game development easier and more streamlined. However, the cream clearly stands out from the rest. Unity3D and Unreal Engine 4 are clear frontrunners by a distance in terms of support and developer choice. They are free platforms that offer plenty when flexibility, options and cross-platform integration are considered. Luxury features such as cloud build, analytics and visual scripting are available for personal use.

Unity provides its own Editor tutorials that are sleek, straightforward and user friendly. An Oculus Unity Integration package is required to comprehensively merge the engine with the SDK. Unity can also be used to create a 3D user interface. An important fact to be aware of is that Rift aspect ratio isn't the same as a typical monitor. Hence, it's important to be aware of resolution and aspect ratio and design the UI accordingly to make the interface readable and user-friendly. Quality of a scene or an application depends upon the frame rate it is rendering at.An ideal frame rate should be greater than or equal to the refresh rate of the Rift Display. Again, the importance of graphics quality cannot be stressed enough as it is pivotal to the photorealism of the rendered scene as well as making the setup as immersive as possible.

Outside of game development, live 3D broadcasting and streaming has garnered much interest. NextVR has established itself as the premier platform for live events in virtual reality. To achieve an immersive 3D video feed, key factors like frames per second, processing speed and data acquisition speed come into play. Only by stitching images together at a rate that matches the frame rate can a video feed be generated. Images stitching techniques vary, and a detailed breakdown is provided here. A powerful image-processing software that can give a vast array of functionalities is OpenCV. It contains an entire image stitching module, based in C++, that is ready to be deployed for any project.

Conclusion

Concepts pertaining to the functioning of the SDK and cross-platform integration have been essential to our understanding and completion of the project. Differences between theoretical ideas and practical application have sporadically been highlighted during the past year. The Rift is a powerful, networked and modular gadget. Online support forums and user guides illuminate the full breadth and reach of the components of the Rift, and unravel the complexities attached with tinkering and tweaking custom-built interface channels. Innovation and positive results can only be achieved by producing multiple experiments and being open to hacking solutions.

The potential impact of virtual reality development is far-reaching and incredibly exciting. From healthcare to military technology and urban planning, virtual reality can revolutionize the interfaces we use and the manner in which we interact with complex systems. New generation affordable and accessible head-mounted displays, led by Oculus Rift, serve a platform to build applications that test existing ideas about user interaction, and challenge basic assumptions of image-processing. The development suite that Rift provides, when used with a powerful graphics library, can help developers experiment the limits of their imagination.

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