

Virtual Reality Using Leap Motion and Oculus Rift

1. Introduction

The advent of more precise consumer virtual reality (VR) systems garnered the interest of numerous industries over the unimaginable potential of these head-mounted displays (HMDs). These HMDs, coupled with an input device, enables us to interact within the virtual environment - which boosts the sense of immersion. With recent advances in software, it has become easier to interact and manipulate objects within a virtual environment, leading to endless possibilities in developing projects for education.



Figure 1: Leap Motion Controller Mounted on Oculus Rift DK2

2. Aim

The aim of the project is to develop a working prototype of a practical experiment for use in education - utilising the Oculus DK2 to project the images for the virtual environment, and the Leap Motion Controller to grab and manipulate objects in the environment. A system like this could be envisioned for use as a means to perform pre-labs to prepare for an in person experiment, or to aid distance education students perform labs without the need of purchasing expensive equipment.

3. Tools Used

This section outlines the hardware and software used to develop the working prototype.

3.1 Oculus DK2

The Oculus Rift DK2 is the second development kit released by Oculus VR. It is an HMD that combines a high-definition resolution of 960x1080 per-eye, as well as a positional head tracking system which is tracked via an external infrared camera and infrared sensors on the HMD, allowing it six degrees of freedom. (Oculus, 2014)

3.2 Leap Motion Controller

The Leap Motion is an input device that continuously tracks the position of a user's hands and fingers. It is comprised of two cameras and three infrared LEDs in order to gather enough data to pass on to the Leap Motion software via USB (Colgan, 2014). The raw sensor data is fed into an advanced algorithm which eliminates background noise and objects. (Colgan, 2014) The conjunction of hardware and software allows it to be paired with the DK2, in order to achieve a more natural way of interacting with virtual objects.

3.3 Unity Game Engine

Unity is a game engine that allows developers to create 2D or 3D based multimedia content using some of the built in tools. Programs can be developed in C# or JavaScript and can be deployed to numerous platforms. The built-in physics engine is used to simulate real life physics in the environment.

4. Design

The scenario chosen was a simple distillation experiment to show students how to set up and conduct it. Students are asked to complete the experiment by following on-screen prompts that are displayed as a pop-up display. In addition, each step in the experiment involves moving and combining two objects, which are highlighted in red. Once those two objects are in the correct place, the next step highlights the next two objects to be manipulated in red.

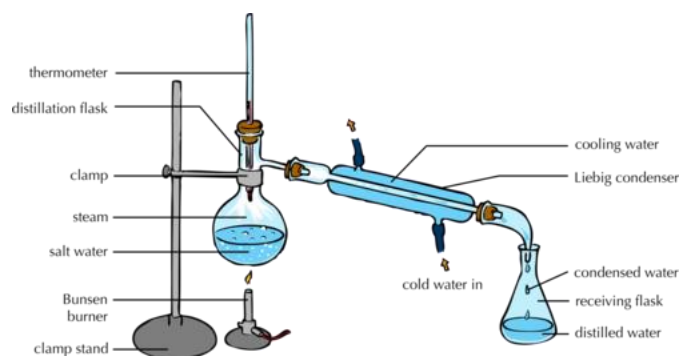


Figure 2: Simple Distillation Experiment - (workbooks, 2013)

A familiar lab environment is recreated within Unity so that potential students can interact with the objects.



Figure 3: Virtual Environment Created for Simple Distillation

5. Findings

Through conducting play-tests, users were impressed by how intuitive the system was to use. Picking up and dropping objects was seamless, however, occasional glitches can occur due to some inconsistencies in the code used to improve Leap Motion's existing libraries to detect the proximity of interactable objects. The use of Leap Motion as an input device was a clear improvement over using the mouse and keyboard or an external gamepad to interact with objects. The Unity Engine allows for simple integration of different scenarios and is quick and flexible enough to produce demos. An experiment like this could be transitioned to building electronic circuits, or as an educational aid to the Lapworth Museum at the University of Birmingham.

6. Further Recommendations

As of August 23, 2016, Leap Motion introduced an updated version of their interaction engine to help improve object manipulations within a virtual environment. This dramatic improvement would greatly reduce the occasional glitches that may occur in the first working prototype. (Leap Motion Interaction Engine, 2016)

References

Colgan, A. (2014). How does the leap motion controller work?

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