Development of Interactive Hologram (i-HO) System

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Keywords: Hologram; interactive; engine

ABSTRACT – Interactive Hologram (i-HO) is an interactive system for viewing real-time three dimensional (3D) content on a holographic pyramid panel. This system consists of i-HO engine and i-HO projection panel. Interactive Hologram engine is a program for processing 3D content, while i-HO projection panel is a pyramid viewing panel that enable the view of each side of 3D content. This paper presents a novel development of an interactive hologram engine which successfully overcome the limitation of traditional hologram, such as linear and video-based, no interaction and limited content representation. The developed system opens the possibility for creating an exciting 3D interactive content.

1. INTRODUCTION

From tabletop holograms to a "smart" artificially intelligent (AI) hologram, the field is booming [1]. Holography was invented by Denis Gabor, a Hungarian physicist who found basic principles of microscopy while exploring to improve the efficiency of transmission electron microscope in 1948 [2]. Abbasi et al. [3] present a study on the recent improvements in creating three-dimensional images and videos by holographic techniques and the potentials of holography to be applied in future. Abbasi and colleagues [3] conclude the advantages of holography such as the real 3D display without use of any other viewing aids and the quality of the science-art will be improved to an extent that will be impossible to distinguish between holographic images and the real objects. Oliveira and Richardson [4] explore the combination of art and holography. It is claimed that the holographic technologies help to transform the cultural perception of artists and art institutions to embrace holographic science. In addition, the holographic technologies enable to create new dimensions and the possibility for the display of a subject in 3D and beyond [4]. Hologram Table can display digital models of cities or buildings as miniatures, with the ability to zoom in down to single blades of grass or even smaller [5].

Interactive Hologram (i-HO) is an interactive system for viewing real-time 3D content on a holographic pyramid panel. This system consists of i-HO engine and i-HO projection panel. This system opens the possibility for creating an exciting 3D interactive content such as holographic games, learning tools, 3D simulation viewing panel for architecture and engineering.

2. INTERACTIVE HOLOGRAM ARCHITECTURE

Interactive Hologram (i-HO) development consists of two parts, which are i-HO engine and i-HO projection panel. The engine of i-HO is a program which process 3D content such as 3D model from Filmbox (FBX) format to make it interactable with input devices, like keyboard, mouse, joystick or gamepad, sensors, motion capturing namely Kinect and motion controller. The second part is i-HO projection panel which is a pyramid viewing panel that enable the view of each side of the 3D content such as frontal, back, left and right view in real-time. Figure 1 depicts the architecture of Interactive Hologram System. It shows how input devices, i-HO engine and the projection panel are being implemented.

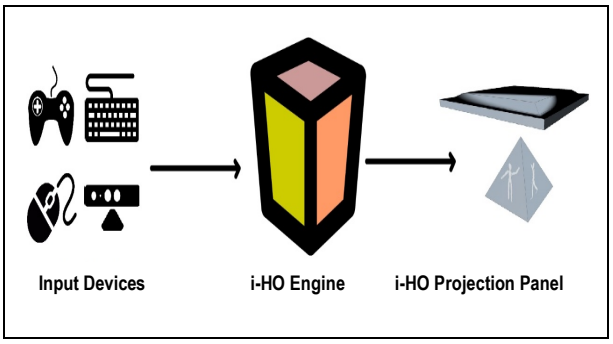

Figure 1 Interactive Hologram System Architecture

3. INTERACTIVE HOLOGRAM PROCESS

The basic i-HO architecture consists of capturing images from real-time 3D content, mapping and projecting phases. Figure 2 shows the i-HO engine process which integrating these processes. Interactive Hologram engine enable the user to interact in real-time with 3D content such as from FBX model. Interactivity is the main feature of i-HO because it enables the developer to customize the engine for 3D game development and other 3D interactive contents. Unlike many conventional hologram pyramid, the video or images were pre-rendered, linear and not interactive.

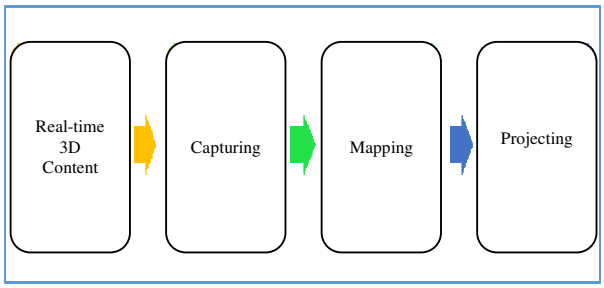

Figure 2 i-HO Engine Process

Capturing is basically a process of capturing a real-time 3D object from four different perspectives, which are frontal, back, left and right. Figure 3 shows an example of camera setup for capturing the 3D object in the virtual environment.

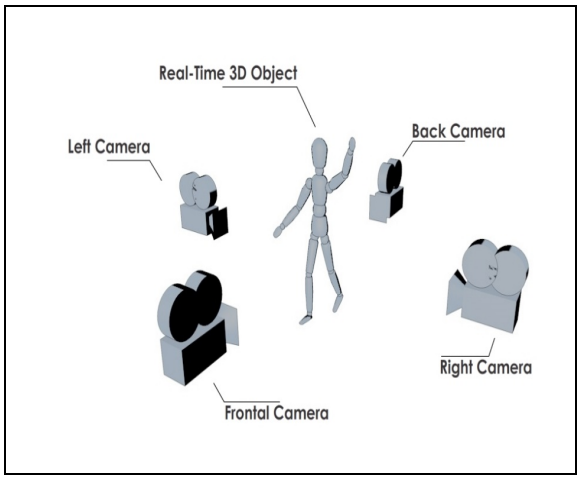

Figure 3 Interactive Hologram Capturing Method

The captured images will be mapped into a single plane accordingly. The arrangement of the mapped images are shown in Figure 4. The images are arranged in that manner in order to depict more accurate representation of the 3D object on i-HO projection panel.

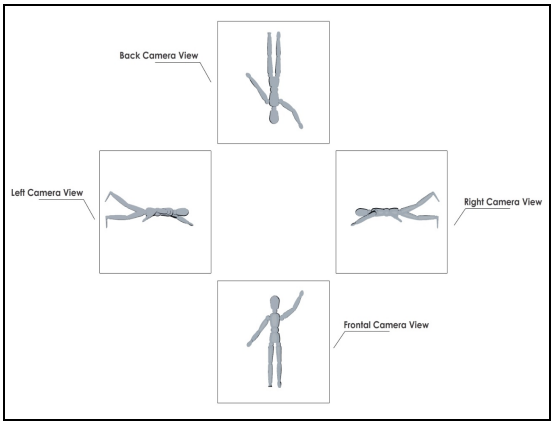

Figure 4 Interactive Hologram Mapping Method

The images from i-HO engine will be viewed on the corresponding LCD TV as i-HO projection panel. Figure 5 shows that the LCD TV is mounted over the pyramid panel where the LCD TV front is facing downward. The view from the LCD TV will be projected to each of the pyramid panel surface. The pyramid panel surfaces must have reflective and transparent material to reflect the projected images from the LCD TV.

The images shown on each of the pyramid surface will create holographic sensation and thus, reconstruct those images to become a 3D holographic object.

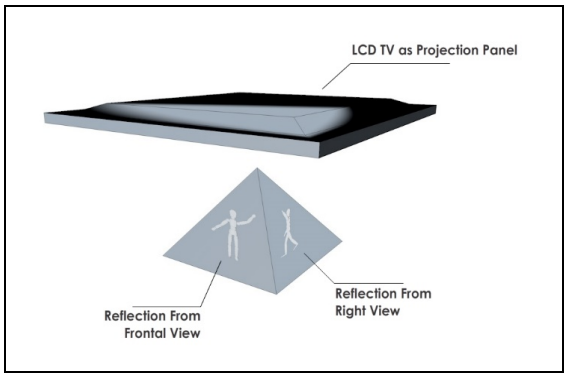

Figure 5 i-HO Projection Panel Setup

4. CONCLUSIONS

As a conclusion, the paper presents a novel development of i-HO engine as an interactive tool for various application such as 3D games, education, engineering, architecture, simulation, medical and others. Interactive hologram implemented offers such advantages compared to the traditional hologram e.g., interactive and immersive holography environment, besides real-time and interactive content in order to create better visualization.

ACKNOWLEDGEMENT

The developed Interactive Hologram System was used as an engine for an application, Interactive Medical Hologram: Ophthalmology. The product won the Gold Award Winner in the Innovation Carnival: UTeMEX 2017.

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