Immersive Training Games for Smartphone-Based Head Mounted Displays

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Introduction
• We have developed an inexpensive mobile virtual reality system using commodity components costing well under USD $300.
• We also implemented immersive training games for this system which provide features like stereoscopic photo panoramas and interactive 3D scenes.

Apparatus
Unity Game Engine

Current iPhone / iPod Touch
Display Specifications:
• 3.5 inch diagonal displays
• 960x640 pixels (326 ppi)
• 3:2 aspect ratio

Hasbro my3D Optics and Bluetooth Keyboard

System Configuration

Smartphone Software Stack
VR Training App
Unity Game Engine
Apple iOS

Bluetooth Keyboard
(selection and movement)

Apple iPhone or iPod Touch
(image generation and head angle)
• 960x640 Pixel Display
• Gyroscope
Hasbro my3D
(stereoscopic optics)

Users can navigate and interact with the virtual scenes using a combination of head orientation and keyboard presses.

Immersive 3D Training Games:

Memory
Stereo Panoramas

Discussion
The my3D uses an asymmetrical side-by-side format. The resolution for each eye is 450x592. Pixel coordinates for each eye are here:

Unity uses normalized coordinates to specify the render position of each viewport. Set the left viewport to (0.0, 0.0, 0.4685, 1.0), and the right viewport to (0.529, 0.0, 0.4685, 1.0).

360 Degree Stereoscopic Photo Panoramas
Stereo pairs taken with fisheye lenses result in interaxial distances that fall off with relative viewing angle.

Four pairs of stereo images are mapped to hemispheres to help compensate for this distortion.

Transitions between image pairs are made when the relative viewing angle reaches plus or minus 45 degrees, limiting falloff of the interaxial distance.

Future Work
• We hope this design will enable “pick up and use” immersive experiences, such as design reviews, mobile training, and classroom discussions.
• We are considering improvements, such as camera based tracking, simplified keyboards, and wireless networking for multi-user environments and driving virtual content from real world data.
• We plan to use this system as an accompaniment to live or mixed reality training, perhaps for providing introductory material.

http://projects.ict.usc.edu/mxr/