See-Through Vision for Mobile Outdoor Augmented Reality

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(a) (b) (c)

Figure 1 – (a) An Augmented Reality view showing an occluded area through a building (b) The wearable computer. All components are contained in the belt-mounted case and the helmet (c) An Augmented Reality view of an occluded building using a bimanually controlled magic-lens

ABSTRACT

We have developed a system built on our mobile Augmented Reality platform that provides users with see-through vision, allowing visualization of occluded objects textured with real-time video information. The users will be able to wear our lightweight, belt-mounted wearable computer and head mounted display. The display will render locations captured from the University of South Australia. These locations consist of 3D models of buildings and courtyard areas that are textured with pre-recorded video images. The system includes a collection of visualizations and tools that assist with viewing these occluded real-world locations; e.g. digital zoom and texture highlighting

KEYWORDS: Outdoor Augmented Reality, Wearable Computers, Telepresence, Image-based Rendering.

1 INTRODUCTION

In our demonstration we will present a see-through vision system [2] that augments the user's view with occluded real locations, using videos captured at remote locations, and 3D geometric models of the environment. We have developed a system that can render photo-realistic views of occluded locations that are displayed relative to the user's physical real-world location. An example of this see-through vision can be seen in Figure 1 (a). An otherwise occluded courtyard location can be inspected by the user. The real location of this courtyard is behind the building, but by rendering a correct view of the area on the AR display, the user can see through the building. As the user moves, the see-through view is drawn with the correct position and orientation at all times. Texture information is sourced from a video stream from the occluded location that is captured from a robot, other AR users, or surveillance camera. We assume that the source of video information is equipped with position and orientation sensors to aid the rendering system. When users view occluded objects in their real-world locations using AR, they can easily comprehend the position, orientation and size.

We recorded surveillance style footage from three separate locations on our university campus. The demonstration will be set up to allow people to don the wearable system and see some of these university locations rendered around the demonstration area. The system recreates the occluded area by texturing a 3D model with the captured video sequences. A variety of visualizations have been developed to help when viewing this types of information such as zooming and texture highlighting. In previous work [1] we implemented a bimanually controlled magic-lens seen in Figure 1(c). This allows the user to select which area of the display to display the occluded information on by dragging out a rectangular area with their hands.

Our wearable computer system is a powerful yet lightweight belt-mounted computer that connects to a head mounted display (Figure 1(b)). The computer is capable of high-quality graphic rendering and it, along with the other required components, have been miniaturized and compressed into a small box that can be comfortably worn on a belt. Ours is one of the only wearable AR systems of its size capable of being completely mobile outdoors, while providing up-to-date graphics rendering capabilities.

2 REFERENCES

[1] B. Avery, W. Piekarski, and B. H. Thomas. Visualizing Occluded Physical Objects in Unfamiliar Outdoor Augmented Reality Environments. In *6th Int'l Symposium on Mixed and Augmented Reality*. p 285-286. Nara, Japan 2007.

[2] B. Avery, B. H. Thomas, and W. Piekarski. User Evaluation of See-Through Vision for Mobile Outdoor Augmented Reality. In *7th Int'l Symposium on Mixed and Augmented Reality*. Cambridge, UK 2008.

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http://wcl.ml.unisa.edu.au/~sandorc/ismar08/ismar08-seethrough.mpg