Deskrama

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1. Summary

Deskrama is a low-cost interactive space browser for three dimensional architectural designs. Moving its light-weight LCD panel on a plan drawing of a building displays on the LCD panel a three dimensional interior view of the building model as if it were placed on the plan and sectioned at the position where the panel touches the drawing. The key idea is a spatial synchronization of different architectural representations such as a two dimensional abstraction and photo realistic three dimensional perspective.

Figure 1: A user moves a light-weight LCD panel on an architectural plan drawing.

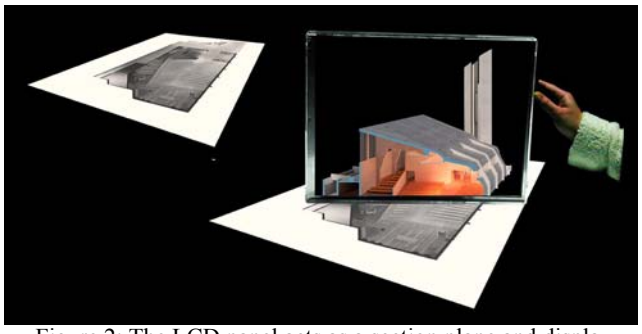

Figure 2: The LCD panel acts as a section plane and display window for the virtual model of a building placed on its plan.

2. Background

An architect deploys different kinds of media to represent a spatial design. They include plan, elevation, section, perspective, axonometric and scale model. With various degrees of abstraction and different projection angles, each has a unique role in architectural representation, and an understanding of a spatial design is mentally constructed through cross-relating and integrating information derived from these multiple media.

At an architectural presentation and review performed in a conventional style, those drawings are pinned up on a wall and physical models are placed in front of it. A careful layout of these drawings and objects allows viewers to freely examine and cross-reference various projections of the same object and to grasp the complex three dimensional spatial configurations of the interior and exterior of a building. With a limited resolution of the display device and pointing hardware, it is hard to achieve the same level of multiplicity and synchronization in a standard set-up of digital presentation.

Nagakura previously invented Digitarama (1997) for a museum presentation of a digitally reconstructed model of pre-Islamic Hagia Sophia. It spatially synchronizes multiple views of the building: its plan, exterior perspective, interior perspective, and a physical scale model. As a user moves on a carpet painted with the plan and around a scale model, the exterior and interior perspective displayed on rotating screens simultaneously change to corresponding angles.

3. Innovations

Deskrama is a low-cost and portable development of Digitarama. It is particularly designed to take a building's plan and its virtual 3D model, spatially synchronize them, and allow interactive sectioning of the building for a viewing user.

Through the use of a high-resolution position and rotation sensor embedded in a LCD panel, Deskrama achieves an exact spatial synchronization of architectural plan and three dimensional interior view of the corresponding virtual model placed above it. The interior view's angle is interactively adjusted to that of a viewer moving the panel, and its photorealistic perspective is generated on the run from a pre-computed radiosity solution file. A user moving the light-weight LCD panel feels that he or she is cutting a virtual 3D model of a building freely with the panel, and can interactively examine the interior space of the building through the cutting plane. Also, he or she can spatially correlate this virtual section model of the building and its corresponding plan drawn on a sheet of paper beneath the model. The plan drawing can be marked with an infra-red tag, such that altering a sheet of plan automatically changes the LCD's display to an interior model of a different building that corresponds to the plan.

4. Target application and future development

Deskrama has a potential to change the way we examine a three dimensional virtual model of an object with an important interior space. Unlike goggle-based interactive virtual reality hardware, there is no burden on viewer's eyes and many people can share the same image. Cutting a section of an object with an LCD display that shows the inside of the object through that section is highly intuitive and requires no explanation. Architectural model is its initial motivation, but its possible application in the future includes medical examination of human body, visualization of underground geological formation, automobile design, and others. Future development aims at synchronization of more number of different projections as well as allowing an LCD display to be place in the air at any three dimensional angle away from the plan on the table.

Nagakura, T. 1997. Digitarama. A Chapter in The Virtual Architecture. Tokyo University Museum Press. 110-121.

Oishi, J. 2004. A Tangible Interface for a Virtual Reality Presentation and Design. Master of Science thesis. Massachusetts Institute of Technology.

For information and demo, visit **http://cat2.mit.edu/deskrama**