

IEEE Virtual Reality 2007
March 10-14, 2007, Charlotte, North Carolina, USA
Published in Video Proceedings

The Collaborative Design Virtual Environment (CDVE)

Mohd Fairuz Shiratuddin, Desmond Fletcher, Jason Breland, Kevin Kitchens

ABSTRACT

In any construction project, designers are responsible to propose and develop designs based on the owner's requirement. Designs are primarily produced and presented in the form of 2D CAD drawings that can later be used by the builder to erect the facility. Nowadays, as technologies improve, the complexity of building designs also increases. Designs are produced by various designers residing either within the same firm, outsourced, or through collaboration of many design firms. Due to this nature of production of designs, effective communication and collaboration among individuals involved are important. Current design collaboration tools are mostly in non real time fashion and the designs are not in 3D. This video presents an application currently under development to support real-time design collaboration in a virtual environment (VE). This application is called the 'Collaborative Design Virtual Environment' or 'CDVE'. The CDVE support many collaborative real time 3D interactions such as moving, rotating, scaling, hiding, duplicate 3D object that exist in the VE.

Keywords: design, collaboration, collaborative virtual environment, game engine, virtual environment

1 DESCRIPTION

In any construction project, it is inevitable that many entities have to be involved in realizing an owner's intention of a facility. When a project is initiated, based on owner's specific requirements, designers begin designing the intended facility from scratch. In the past, designers used pencil and paper in producing and presenting their designs. Nowadays, due to time and business pressures, computers have become a necessity to designers in carrying out design works more efficiently. Design firms utilize computer aided design (CAD) software to design hundreds of layouts of facilities ranging from site plans, to architectural designs through to schedules of fixtures. These designs are produced by various designers from various disciplines, coming from within the same firm, outsourced, or through collaboration of many design firms. Due to this nature of production of designs, effective communication and collaboration among individuals involved are important.

Through the rapid improvement in computer processing power and computer graphics technology, many industry standard CAD software have the ability to produce designs not only in 2D but also in 3D. Current design collaboration tools are in the form centralized repositories whereby individual CAD file is downloaded and modified locally by individual designer, and then uploaded back to the centralized repository. The repository is will track of all the changes made and then amended them to match the most updated and acceptable copy of the design. This form of collaboration is performed in a non-real-time manner.

In this video, we present a 3D design tool that utilizes virtual environment (VE) and support real-time collaboration between

two or more users. The application is called the Collaborative Design Virtual Environment or CDVE, and is intended to support architectural designs. The CDVE is still under development and it is based on the Torque [1] Game Engine Software Development Kit (TGE SDK). The TGE SDK has been extensively modified to support real-time collaborative features of the CDVE. The main reasons for utilizing the TGE SDK are 1) low-cost licensing 2) good real-time rendering engine and, 3) full access to the entire source code that allows further add-ons and modifications to be made [2].

The CDVE can run either as a stand-alone application, or in a client-server environment. To date, CDVE can support up to 32 users. We plan to include the MMO (Massively Multiplayer Online) support to allow for almost infinite number of clients to coexist in the virtual environment. Text chatting feature has been put in place to allow communication between users. Voice Over IP (VOIP) and video conferencing is currently under development.

In the CDVE, real-time design changes can be made by any client PC connected to the master server. Real-time data communications between the master server and client PCs are continuously made to ensure that any changes can be seen in real-time on all the connected PCs. 3D objects can be moved, scaled, rotated, deleted and duplicated in real-time by any user in the VE. The move, scale and rotate functions can be performed on any 3D objects either in free-mode or by entering values for precision purposes. 3D objects that exist in the VE can easily be hidden should there be a need for a designer to view a concealed building component. In support for the Building Information Modeling (BIM) approach, 3D objects in the VE have embedded information that is stored in several databases.

Future research and development of the CDVE that will be investigated include 3D interaction techniques from the standpoint of a designer, designer's working protocols and right of access to make changes in the VE, and collaborative work behavior among designers in a VE. We foresee that CDVE has great potential to enhance collaborative design among designers.

REFERENCE

- [1] Garagegames (2006), Torque Game Engine. Website: <http://www.garagegames.com>. Last accessed: September 2006.
- [2] Shiratuddin, M. and Fletcher, D. (2006), Southern Miss' Innovation and Commercialization Park: Development of a Real-Time Virtual Reality Environment, Proceedings of 6th International Conference on Construction Applications of Virtual Reality, August 3-4, 2006, Orlando, Florida, USA.

School of Construction #5138, College of Science and Technology, The University of Southern Mississippi, Hattiesburg, MS 39406, USA. (mohd.shiratuddin@usm.edu)