Interactive multimedia walkthrough for museum-installations

Robert Kuchar*, Timo Schairer*

Figure 1: *Excavation-site and reconstructed virtual model*

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Introduction

The main intention of the presented work is to give interactive access on archaeological information to scientists and the public. The most important aspect is to display a highly realistic real-time presentation of a 3D-modell in a museum. The installation should offer an easy-to-use intuitive interface for people who are not familiar with virtual environments while providing additional information of the scene. Using our navigation-interface and a reconstructed virtual model of the archaeological facility, it is a fairly easy task for the archaeologist to create a model for presentation which is based on his discoveries and which can be used in museums, exhibitions and for educational purposes. The archaeologist is capable of presenting his work not only to a small group of scientists who have special interest in the topic, but to a much broader audience using a highly precise and scientifically serious virtual reality-model and vr-installation.

* Students at the WSI/GRIS, Wilhelm Schickard Institut für Informatik, Graphisch Interaktive Systeme, University of Tübingen, Sand 14, D-72076 Tübingen, Germany, E-mail: {robert.kuchar,timo.schairer} @student.uni-tuebingen.de,
Tel: +49 (0)7071 29-75461, Fax: +49 (0)7071 29-5466

Firstly, we extended the existing walk-through-environment *RadioLab* to work hand in hand with the controller-interface *Commander*. Secondly, in order to simplify the creation of realistic outdoor-scenes, we developped an automated realistic daylight-simulation based on correct physical data and used it for radiosity-lighting and displaying the sky dome. We added realistic visual effects and a 3D-sound-system using environmental audio effects to provide better immersion in the scene.

Technical details

The virtual reality-installation consists of two programs capable of running on one or two computers, connected via TCP/IP, wireless LAN, Bluetooth, etc. using various different communication-APIs. The reason for using two separate programs – one to control the movement and display information such as a map and particularly highlighted points of interest, and one to display the 3D-scene – is increased flexibility and a maximized spectrum of usage. When visualizing smaller scenes, both programs can be run on one computer using a graphics-card with multi-monitor-support; very detailed 3D-scenes with a high polygon count imply the use of two computers, one of those with a very powerful 3D-graphics-card to display the 3D-view.

The vr-installation uses a touchscreen as the input-device. It's not only robust and almost wear free, but it also directly connects the input- and display-device to the user, making it a good choice for unattended use in a museum or an exhibition. In order to get the user quickly accommodated to the user-interface, the controlling metaphor is straightforward: a person walking through the scene. This metaphor implies several restrictions to the movement of the virtual camera, mainly that the movement is normally restricted to a horizontal plane. The 2D-navigation corresponds to the 2D-input-device, making it very easy for people with no or very little experience in navigating 3D-space to understand the internal model of the interface, which on the other hand will help the user in understanding the system's behaviour from the very beginning.
The radiosity-software used to generate

Figure 2: *Museum-installation in use*

highly realistic lighting-scenarios is *RadioLab*, developed at the WSI/GRIS by Ralf Sonntag in the early 90s, distributed by *Pytha Lab* since 1997 and improved ever since. We extended the radiosity-simulation to correctly calculate the light-distribution in outdoor scenes using a realistic daylight-model. Lighting a scene with parts of it being in- and outdoors can be far more difficult than modeling it. The brightness outside often gets exaggerated while rooms tend to be very dark, all in all the scene having unrealistically low contrast. Our daylight-simulation is very easy to use and provides intuitive parameters while creating highly realistic indoor/outdoor lighting combined with an automatic generated sky dome, realistically lit volumetric clouds and lens-/glare-effects. The daylight-simulation generates high dynamic range radiance values that are transformed into displayable color values using a sophisticated tone-mapping-algorithm. It's also possible to automatically adjust the daylighting-solution that it matches the actual time.

Results

The museum-installation is in use since April 2003 at the ancient Roman "Villa Rustica" in Hechingen-Stein. We modeled all of the buildings, did the texturing and performed the lighting simulation using our daylight-model. The chief of the excavation project Dr. Schmidt-Lawrenz supervised the work guaranteeing historical correctness. To counteract the odd sensation of living on a small plate, the scene was embedded in the environment using high-resolution hand-measured height-data for the nearer surroundings. The more distant environment was created using satellite data. Additional pictures and movies can be found at [1].

Future work

The *RadioLab* system is capable of displaying real-time interactive animations which can be seamlessly integrated into the vr-installation. This way the scene can be enriched with animations ranging from illustrating simple mechanics to the blending of different building phases. The program *Commander* will be enhanced to display interactive multimedia content in the form of text, audio-files and 3D-animation presenting the user even more information of certain points of interest.
A PDA-version of the Software *Commander* communicating via wireless LAN, Bluetooth, etc. would be a handy tool for presentation, for example in a meeting. Lastly one could think of a communication interface for a multi-user environment making it possible to have many avatars walking around in the virtual scene, the computers connected via a local area network or the internet.

References

[1]http://www.gris.uni-tuebingen.de/projects/villarustica/index.html