An Interactive Planetary System for High-Resolution Media Facades

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ABSTRACT

In this demonstration paper we present a first use case of our space-simulation framework targeting media facades and other interactive display environments. This use case displays a planetary system with colliding space objects at the media facade of the Academy of Fine Arts Saar. We further integrated a web-based GUI to allow interaction with the real-time space simulation. Users can connect to the media facade via mobile phones and can directly start to interact with space objects on the facade.

Author Keywords

Space simulation; gravity simulation; media facade; virtual environment; interactive installation; demonstration.

ACM Classification Keywords

H.4 Information Systems Applications: Miscellaneous

INTRODUCTION

In this demonstration paper we present an interactive installation of our framework that computes and renders physical force-of-gravity simulations on media facades [4]. This demonstration targets the media facade at the Academy of Fine Arts Saar, which is shown in Figure 1.

Media facades and other interactive installations typically feature arbitrary 3D form factors that often cause problems for interactive components. This includes specific rendering-camera setups, display configurations, multi-display support and properly adjusted perspective distortions. Our framework is capable to satisfy all of these requirements and includes support for interaction interfaces like TUIO events [3] (standard protocol for multi-touch input).

In the remainder of this paper we will describe the demonstration setup for the media facade and the used scenario.

Figure 1. Media facade at the Academy of Fine Arts Saar

RELATED WORK

The recent trend in media-facade realizations tends to directly wire facades with physical structures and surroundings, which results in non-planar 3D form factors. This implies the need for continuous interaction capabilities with the whole facade in order to benefit from the full potential. With [1], Gehring and Krüger provided an approach to enable users to interact with a media facade through mobile devices. Cartographic map projections are used to realize an interactive 2D representation of the 3D surface.

There has been a huge variety of different space simulators that were designed for different purposes. Examples for such use cases are interactive exploration of gathered data and simulation of fictional and real scenarios in space. However, currently available frameworks and applications like *Space Engine* [5] and *Universe Sandbox* [2] are commonly limited to desktop-interaction concepts and display capabilities which makes them incompatible with media facades and similar interactive installations.

DEMO: MEDIA FACADE

The actual projection surface of the media facade at the Academy of Fine Arts Saar is depicted in Figure 3. The dimensions of the facade are about 3.4 meters high and 20 meters wide, located about 5.5 meters above the street level. It covers five windows of equal size (three windows on the left and two windows on the right, see Figure 2) and uses a back-projection canvas behind the windows with multiple projec-

Figure 2. Image of the simulation on the target media facade

tors. The canvas is subdivided internally into five groups via a projector-window mapping: a single projector is used for every window of the facade, which is perpendicular to the projection surface. The hardware behind the scenes uses a resolution of 1024×768 pixels to 1400×1050 pixels per projector. This sums up to a total resolution of 4096×768 and up to 7000×1050 pixels for the whole facade. In order to address these displays, a single graphics card (which natively supports up to six distinct outputs) is used.

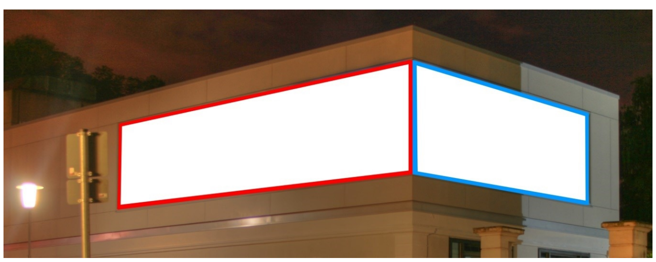

Figure 3. Sketch of the media-facade projection surface

A unique feature of this facade is the impression of a 3D-like perception when looking at the enclosed edge of the facade. This impression can be perceived from a specific observer spot but without the need for extra hardware like 3D glasses. It is perfectly suitable to attract distant passers-by who briefly stay and watch.

In this demonstration, we present a planetary system in form of an asteroid belt that is orbiting a single central sun. There is a direct relation between the mass of an asteroid and its size, which simplifies things for an observer in order to distinguish between heavy (large) and light (small) objects.

We also present a simple user interface for mobile devices to control the central sun in this scenario. One user at a time can connect to the facade to steer the central sun of the planetary system via touch events over the TUIO protocol. This allows to destabilize the asteroid belt and to see its direct and indirect influences on the gravity field. In cases of the absence of interaction events for a given period of time, the simulation automatically creates and fires asteroids into the belt.

In order to take advantage of this form factor and the 3D projection capabilities, the rendering-camera position and the final image distortion-masks have been adjusted properly. We set up the virtual-camera position in such a way that the central sun will be projected into the center of the enclosed room behind the facade. Moreover, the image distortions are configured to perform an on-the-fly transformation of the rendered images to the target layout. In brief, two regions of the final image (in form of the red and blue regions from Figure 3) are extracted and remapped to rectangles. By projecting this distorted image, the observers position and the perception of the rectangular projection surfaces automatically performs the inverse transform.

CONCLUSION

In this paper we presented a demonstration setup for simulating a planetary system on a high resolution media facade. The demonstration facilitates interaction through mobile devices via the TUIO protocol. In the future, we plan to integrate other interaction techniques and to automatize the customization step of adjusting cameras and image-distortion parameters.

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