An Immersive Environment for a Virtual Cultural Festival

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Abstract. This paper describes the development of a virtual reality (VR) system and the use of an immersive environment for a traditional Japanese virtual cultural festival. With the development of computer graphics (CG) and VR technologies, extensive researches have been carried out on digital archiving of cultural assets. The goals of our Virtual Yamahoko Parade project are to record and preserve digitally the Yamahoko Parade of the Gion Festival, an intangible traditional grand scale cultural event, as well as to open the product to the public. Therefore, not only the quality of the VR contents but also the display and demonstration are important to reproduce the atmosphere of the festival. The proposed system combines vision, sound, immersive display, and real time interaction, which enables the users to feel as if they are actually participating in the parade.

1 Introduction

Digital archives, which measure, record, and preserve tangible and intangible cultural assets using digital information technologies, have attracted increasing attention in the last two decades [1, 2]. In recent years, applications of virtual reality on cultural heritages have been attempts to cover not only individual tangible and intangible cultural assets but also large scale intangible cultural events, such as traditional festivals and behaviors of participants in cultural events [3–5]. This raises a problem that how to present these virtual cultural assets in an immersive environment to the audiences. Pre-rendered contents and traditional displays limited the options of interactions, which cause the users can not be involved in the virtual environment. Because the whole atmosphere in a cultural event is crucial, so a real time interactive environment is required.

The goals of our Virtual Yamahoko Parade project are to record and preserve digitally the Yamahoko Parade of the Gion Festival, an intangible traditional grand scale cultural event, as well as to open the product to the public. The Gion Fetival is one of Japan's greatest and biggest event, which is founded on Japanese history and culture (Fig. 1). Every year on July 17, the festival culminates in a parade of the Yama and Hoko, floats known as "moving museums." Every year the Parade attracts over 150,000 spectators from all over the world.

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In our previous work, We generated "Virtual Yamahoko Parade," which includes CG models and animations of the floats, crews, and spectators, as well as the music and ambient sounds heard at the time of the parade [6, 7]. We used a large scale cylindrical screen as the display and a gamepad as the input device to control the viewpoint. We received positive feedbacks from most of the users. However, according to the feedbacks from some users, the gamepad-controlled system is more like a video game other than an immersive festival experience. Gamepad indeed increased the flexibility of user control but reduced the immersive experience as well. In this study, we use an immersive and hands-free system to reproduce the Virtual Yamahoko Parade. The new system provides real time interaction and more realistic immersive atmosphere.

Fig. 1. Yamahoko Parade of the Gion Festival in Kyoto

2 Constructing the VR Contents of the Virtual Yamahoko Parade

We constructed the virtual parade and combine the motion and acoustics of the floats, crews, and spectators using a virtual reality toolkit called Vizard.

The components of the VR contents were created as follows.

(1) Virtual Kyoto: The street model of "Virtual Kyoto" [8] was developed using various technologies and materials, such as geographic information system (GIS) data, cadastral maps, aerial photos, street photos, and landscape paintings. We used the model of part of Shijo Street (approximately 550 meters), which is extracted from Virtual Kyoto. It is reproduced along with the buildings and arcades on both sides of the street.

(2) CG floats: Four CG models of the floats (Fune-hoko, Naginata-hoko, Kanko-hoko, and Kitakannon-yama) were created and introduced into the virtual environment for use. The CG models of Fune-hoko and Kanko-hoko were

built from the data obtained by measuring their miniatures (on a scale of one to eleven) using 3D shape measurement. As for the CG models of Naginata-hoko and Kitakannon-yama, their 3D models were created out of measured drawings. Figure 2 shows the created CG models of the Yama and Hoko floats.

(3) CG crews: Four kinds of CG parade crews belong to Fune-hoko were created: Hikikata who pull the float; Ondotori who direct the float; Kurumakata who control the traveling direction and the start-stop movement of the floats; and Hayashikata who play ohayashi music on traditional Japanese instruments on the hayashibutai, a stage on the upper part of the float. The body motion data given to each character model were obtained from actual actions using a motion capture technique. We captured a variety of these motions performed by a Fune-hoko crew who participated in our experiments. The textures of the costume for each character were created from the photographs of the costumes that are actually used. Figure 3 shows the created CG models of the parade crews of Fune-hoko.

(4) Crowd simulation: We have so far arranged 770 CG models of spectators on both side of the street to regenerate the atmosphere of the event. Idle motions were randomly added to these characters.

(5) Music and sound: We have employed a multi-point sound measuring technology to record and reproduce the acoustic environment. We also collected acoustic data by recording audio sources such as creaking sounds of the wheels of the float, speaking voices of the spectators, and noises made by the crowds, using the same technology [9].

Fig. 2. CG models of the Yama and Hoko floats: from left to right: Fune-hoko, Kanko-hoko, Kitakannon-yama, and Naginata-hoko

Fig. 3. CG models of the parade crews of Fune-hoko: from left to right: hikikata, ondotori, kurumakata, ohayashikata

3 Immersive Environment and Interactive Control

In our previous study, we displayed our Virtual VR contents on a large cylindrical screen and used a gamepad as the input device to control the viewpoint. In this study, as a new step, we introduced a more immersive and interactive display system to allow the users to have a more realistic virtual experience.

The new environment is based on a head-mounted display (HMD), an orientation sensor and a Kinect motion sensor, which are provided by Wirks of WorldViz. This system is the interplay between sensor, tracker, display, software, and content.

The Virtual Yamahoko Parade can be displayed in 3D using the HMD by separately rendering scenes for each eye. The orientation sensor attached to the HMD gives a feedback of which direction the user is facing, in combination with the head position information acquired from the Kinect to update the correct location and looking direction for HMD display. The motion tracking sensor of Kinect is connected with Vizard via a middleware called Flexible Action and Articulated Skeleton Toolkit (FAAST), which enables full-body control and provides a user friendly interface. Kinect allows us to track the user's position and movement in our virtual environment and can be used as a hands-free input device to control the viewpoint and carries out other interactions using gestures. The composition of the system is shown in Fig. 4.

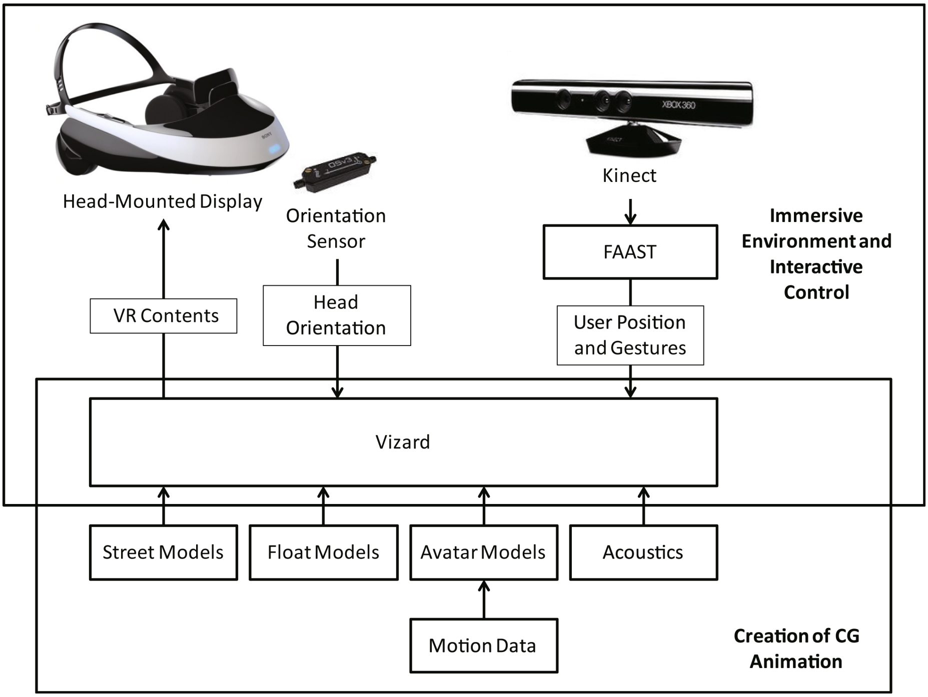

Fig. 4. Composition of the system

4 Results and Discussion

We set four different viewpoints. By gestures of "left hand left", "right hand right", "both hands up", and "crouch", the user viewpoint will be navigated to left crowd, right crowd, bird view, and close float view. At each viewpoint, the view will be linked to and dynamically follows the user's position and looking direction. We received positive feedback from the subjects of our pilot experiments. Figure 5 shows a subject who's using our system.

In current step, the interaction only limited to the viewpoint control. As our next step, we are testing a real time interaction technique that allows the users to interact with the spectators and the float crews in the virtual environment.

We also testing the use of the new interaction technique for our virtualk Yamahoko Parade experience system [10], which allows the user to experience the atmosphere of the parade from another viewpoint, that of the parade crews.

Fig. 5. Virtual Environment using HMD. The synthesized background is the VR contents of the Virtual Yamahoko Parade, which is displayed on the HMD.

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