WIIVIEW: A VIEW CONTROL INTERFACE FOR 3D TELE-IMMERSIVE ENVIRONMENTS

Morihiko Tamai[†], *Wanmin Wu*[‡], *Renata Sheppard*[‡], *Mahsa Kamali*[‡], *Klara Nahrstedt*[‡]

[†]Nara Institute of Science and Technology
Graduate School of Information Science
Ikoma, Nara 630-0192, JAPAN
morihi-t@is.naist.jp

[‡]University of Illinois at Urbana-Champaign
Department of Computer Science
Urbana, IL 61801, USA
{wwu23,rsheppad2,mkamali2,klara}@uiuc.edu

ABSTRACT

In this demonstration, we present *WiiView*, a view control interface for 3D tele-immersive (3DTI) environments. This interface allows the user to intuitively manipulate the virtual camera and graphical objects in a 3D tele-immersive virtual space, thus significantly enhancing the viewing experience for users in 3DTI collaboration. We have used WiiView in a dance class for creative choreography in Spring 2008 at University of Illinois at Urbana-Champaign. It allows for great flexibility, usability, and portability, as the dancers reported. Furthermore, the interface has become an interesting creativity tool for digital choreographers, as it creates a new element in the design space when dancers control the *virtual* view change and perform *physical* body movement simultaneously.

1. INTRODUCTION

The multi-site 3D tele-immersive (3DTI) environments [1] are emerging as the next generation technique for telecommunication. It allows geographically distributed users to participate in a wide variety of collaborative activities such as artistic performance, distance education/training, and video-conferencing. Compared to conventional fixed-view (e.g., 2D) video systems, an important feature of 3DTI environments is the *free viewpoint* made possible by the 3D reconstruction of participants and scenes. Users of 3DTI environments naturally wish to change the viewpoint from time to time for richer context awareness, without disrupting their physical activities. For example, a dance instructor may want to check a remote student's dancing pose from different viewing perspectives [2] in the shared 3DTI space. Unfortunately, existing user interfaces (e.g., 2D mouses, stylus) hardly serve this goal.

In this demonstration, we present WiiView, a wireless view control interface using Wii remote [3]. The design goals of WiiView are: (a) intuitive to use, (b) not disruptive for ongoing physical activities, (c) lightweight and portable, and (d) rich in functionalities. We will demonstrate how these goals are achieved by a study of WiiView in dance classes at a major university. Interestingly, we find that the interface further allows for *creativity* in performance art like dancing. Many dancers comment that they find WiiView a useful creativity tool, in that the view in the virtual space and their body can move simultaneously. In other words, they can control the view change and perform body movement at the same time, thus creating a new element in choreography design[1]. .

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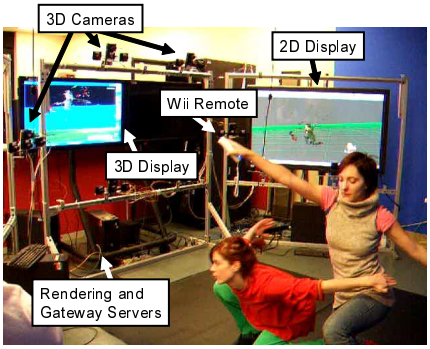

Fig. 1. Dancers use WiiView for creative choreography and dancing.

2. 3D TELE-IMMERSIVE ENVIRONMENT

A multi-party 3DTI system consists of multiple sites, with each site hosting a *local 3DTI environment*. Fig. 1 shows the setup of a local 3DTI environment, which has (1) multiple 3D cameras, (2) a gateway server, (3) a rendering server, and (4) 2D (and/or 3D) displays. The 3D cameras are mounted to take the physical scene from a wide field of views synchronously. All 3D video streams are forwarded to the gateway server, which in turn get forwarded to the rendering server and the remote 3DTI environments (i.e., gateway servers) that are requesting the streams. The rendering server then aggregates all

[1]As a dancer commented: "like in dance for camera work, the person behind the camera is the author and dictates the point of view, where the WiiView enables the same kind of control. In the 3DTI system you have the parallel experience of being behind the camera and also simultaneously controlling the camera view via Wii."

Fig. 2. Roll motion.

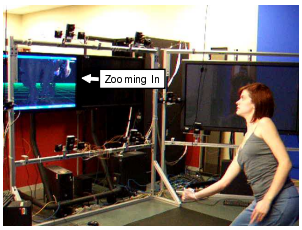

Fig. 3. Nose-down pitch motion.

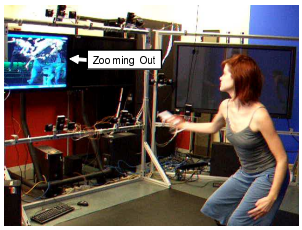

Fig. 4. Nose-up pitch motion.

3D streams and presents the constructed 3D virtual space to the users.

All 3D streams from one site constitute a *3D video object* in the virtual space. For fun interaction, *3D graphics objects* (e.g., graphical VR, terrain, animals) are also rendered together with the 3D video objects (e.g., dancers). Thus, the participants can not only interact with each other, but also with the graphical objects. The 3D video is super-imposed over the VR graphics. WiiView allows the participants to use a Wii remote to control the change for view (i.e., virtual camera) and video/graphical objects in each local 3DTI environment (Fig. 1).

3. WIIVIEW DESIGN

We choose to use the Wii remote controller because it is (a) wireless (Bluetooth communication interface), thus much more flexible than its wired counterparts, (b) lightweight and easy to carry; and (c) capable of sensing motion with built-in accelerometers.

As an overview, we map 3D view control operations to the buttons on Wii remote (Fig. 5). We also utilize the accelerometers for more intuitive view control using hand movement (e.g., rotating the view direction rightward by rotating user's hand rightward). The accelerometers can accurately track the space coordinates of the controller, and thereby the hand motion. The current states of the buttons and the accelerometer are obtained periodically (about every 30ms) through Bluetooth radio.

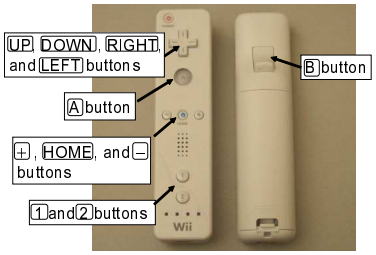

Fig. 5. Wii Remote.

WiiView has two control modes: *camera mode* and *object mode*, for virtual camera control (i.e., the view) in the 3D space, and the graphical/video objects, respectively.

In camera mode, WiiView provides two view types of views: *side view* and *aerial view*, which are self-explanary. For side view control, WiiView uses the LEFT and RIGHT buttons to change view direction (i.e., rotating the virtual camera around the target object). The users can also use roll hand motion to change view direction (Fig. 2). In addition, the users can use pitch hand motion to zoom in/out to/from the target object (Fig. 3 and Fig. 4)[2].

In object mode, WiiView supports the operations: *move* and *rotate*. In the *move* operation, a target object is moved forward/backward along the direction of the virtual camera using the UP and DOWN buttons, and moved leftward/rightward along the orthogonal direction to that of the virtual camera using the LEFT and RIGHT buttons. In the *rotate* operation, a target object is rotated around the axis vertical on the ground of the virtual space using the roll hand motion.

4. EXPERIMENTS

Through the video demonstration, we will show how the WiiView interface was used in a dance class by a group of students. Furthermore, we will present how the WiiView interface was used as a creativity tool for digital choreography. We anticipate our demonstration will provide a vivid example of novel user interfaces used in emerging distributed multimedia applications.

5. REFERENCES

[1] Z. Yang, W. Wu, K. Nahrstedt, G. Kurillo, and R. Bajcsy, ViewCast: View Dissemination and Management for Multi-party 3D Tele-immersive Environments, *Proc. of the 15th Annual ACM Int'l Conf. on Multimedia (MM'07)*, pp. 882–891, 2007.

[2] R. Sheppard, W. Wu, Z. Yang, K. Nahrstedt, L. Wymore, G. Kurillo, R. Bajcsy, and K. Mezur, New Digital Options in Geographically Distributed Dance Collaborations with TEEVE: Tele-immersive Environments for EVErybody, *Proc. of the 15th Annual ACM Int'l Conf. on Multimedia (MM'07)*, pp. 1085–1086, 2007.

[3] Wii controllers page, http://wii.nintendo.com/controller.jsp.

[2]Since a user moves her/his hand not only for view control but also for collaborative activity, the user needs to explicitly specify whether she/he is moving hand for view control or not. For this purpose, we make the user to hold the B button during view control using motions.