Mixed Reality Pre-Visualization and Camera-Work Authoring in Filmmaking

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ABSTRACT

In this paper, we introduce the outline of "The MR-PreViz Project" performed in Japan. In the pre-production process of filmmaking, PreViz, pre-visualizing the desired scene by CGI, is used as a new technique. As its advanced approach, we propose MR-PreViz that utilized mixed reality technology in current PreViz. MR-PreViz makes it possible to merge the real background and the computer-generated humans and creatures in open set or at outdoor location. The user can consider the camera-work and camera blocking efficiently by using MR-PreViz. This paper introduces the outline of the MR-PreViz project, the design of hardware configuration, camera-work authoring method and the results of prototyping.

CR Categories: H.5.1 [Multimedia Information Systems]: Artificial, augmented, and virtual realities

Keywords: Mixed Reality, Pre-visualization, Filmmaking, Camera-work

1 INTRODUCTION

The Key Technology Research Project on Mixed Reality Systems (MR-Project) carried out in Japan from 1997 to 2001 gave significant impact on works of Augmented Reality (AR) and Mixed Reality (MR) [1]. It is proven by the fact that people always ask us "what are you going to do next in Japan" at annual ISMAR symposium. People may expect us to open up new and unique frontier as ARVIKA Project [2] specializes its work on industrial applications. The MR-PreViz Project introduced in this paper is one of our answers to such expectation. The target of this project is limited to MR-based pre-visualization in filmmaking, not the whole world of AR/MR.

Several works already exist on the application of MR technology to filmmaking. "2001: An MR-Space Odyssey" [3] developed by the MR-Project is also one of such applications. This system makes it possible for actors to confirm composition of live action and computer generated images (CGIs), that is done at the post-production stage in ordinary filmmaking process, in a movie studio by wearing HMDs. One of the recent approaches is to make interactive storyboards at the preproduction stage [4]. Our MR-PreViz also aspires what are used in the preproduction stage.

2 OUTLINE OF THE MR-PREVIZ PROJECT

Recently, the PreViz (stand for Pre-Visualization), that envisions scenes with computer graphics before actual shooting, is proactively utilized in the production stage of feature films. It is also called "animatics." A director can use PreViz images to share the concept in her/his head with actors and staffs with blistering actions and complex camera-works that can not be expressed by the classical storyboard. Current PreViz movies are depicted by relatively simple CGIs. Such fully computer generated images have innate limitation in visual reality. A perfectionistic director may expect higher level of PreViz images. It is quite natural that she/he wants to confirm if the picture compositions she/he imagines are suitable for the actual scene especially when a large open set or overseas location site is selected. Our MR-PreViz is targeted to be used outdoor not only in a motion picture studio. Thus, the MR-PreViz movies are made at the location site by trying various camera positions and angles and changing footage and/or camera blocking. At the same time, the camera-works are marked up and stored as digital data to be used in the actual shooting.

The target of our MR-PreViz system is not only scenes where computer generated creatures or vehicles play some role but also live action scenes where actors play her/his role. The users can capture motions of a stunt man who plays blistering actions instead of a movie star.

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3 IMAGE CAPTURING AND COMPOSITING SYSTEM

A high definition (HD) digital camera is used for the MR-PreViz system. The purpose of MR-PreViz is to help decision of various factors in shooting such as camera-works and picture compositions, lenses, lights and other equipments have to be, traditional ones that are normally used in filmmaking.

The camera platform has two rotary encoders which detect pan and tilt angle of the camera and transfer them as digital signals to the computer. Since the zoom lens of the camera has a functionality to detect the optical zoom factor, CGI composition with the actual scene is performed in realtime according to the motion and zooming of the camera. However, because of the competence of the capturing board on PC, our first prototype can only composite and display movies of standard definition (SD) level in realtime. It takes a while until the movies of high definition (HD) level are produced.

4 GENERAL WORKFLOW

MR-PreViz is designed to be utilized after making a plan and writing a screenplay. MR-PreViz is not the replacement for traditional storyboard and PreViz but a powerful assistant to effectively visualize scenes that are not easily expressed until now.

The flow of filmmaking using our support tools is as follows.

Step 1: Selecting scenes suitable for MR-PreViz

The users select scenes that should be checked using MR-PreViz, after making rough PreViz of full CG.

Step 2: Preparing data materials required

The users collect CG data and action data before making MR-PreViz movies. They can edit hybrid sources composed of manually attached CG animation data, motion captured (MoCap) data, and 3D Video data. "3D Video" is a technology that allows you to reconstruct an image seen from any viewpoint in realtime from video images taken by multiple cameras [5].

Step 3: Placing CG objects

The users design MR space by placing CG objects and action data collected and edited in the **Step 2** on a PC.

Step 4: Making MR-PreViz movies at the shooting site

The users visualize MR-Space by referencing the layout data taken in the **Step 3** in the shooting site. Camera-Work Authoring Tools are utilized as tools for deciding camera-works and camera blocking at this stage.

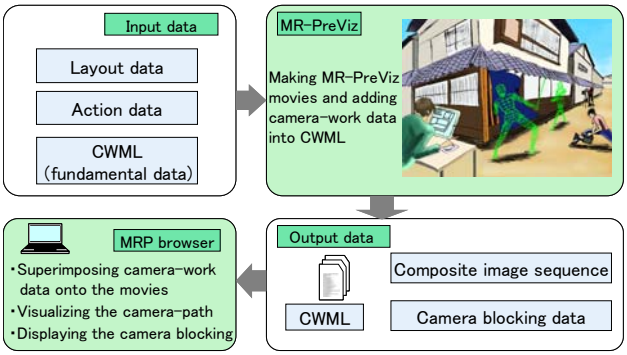

Figure1. The flow diagram of camera-work authoring tools

Step 5: Application to actual shooting

The users apply movies and data taken in the **Step4** to the actual shooting by MRP browser.

5 Camera-Work Authoring Tools

Camera-work authoring tools are used when making MR-PreViz movies for examining camera-works and facilitating shooting and composition. Figure 1 shows the flow diagram of these tools. MR-PreViz movies made by these tools are described and recorded using Camera-Work Markup Language (CWML). CWML is a new description language for camera-works advocated in this study. Data to reproduce camera-works are described as an instance of XML meta-language (XML document)

The overall flow of the process to examine and decide camera-works using this tool is as follows.

(1) Basic CWML data (text data) should be entered when collecting action data and laying out CG data at the **Step 2** and **Step 3** of Section 4. Figure 2 (a) shows the result of layout.

(2) The camera-work data are automatically recoded and added into CWML as soon as the users start making MR-PreViz movies. At the same time, MR-PreViz movies are also recoded.

(3) Multiple shooting data can be edited by post-processing so that camera blocking is performed and described in CWML.

(4) The users can see data recorded in CWML using MRP browser. You can repeat steps above until you can be satisfied with your MR-PreViz movies.

MRP browser is a viewer software to visualize data written in CWML (the relation between CWML and the MRP browser is analogous to that between HTML and Web browser). For the first stage of our project, we decided that the browser has the following viewer functions.

- **Camera-work viewer** superimposes camera-work information on the sequence of movies and displays camera-work information in easy-to-read format.
- **Camera-path viewer** indicates actual camera paths at MR-PreViz shooting and camera-related parameters for each point.
- **Editing simulator** indicates editing points on the sequence of movies and displays cascaded blocks sequentially so that users can confirm camera blocking.

6 Prototyping CWML Parser and Generator

Since our initial hardware system has only two degrees of freedom for the camera posture; panning and tilting, camera-works that can be examined using this system are limited. In order to seek what the tool should be including camera classes of more degrees of freedom, we tried to make a simplified prototype system based on a mixed reality system with magnetic sensors and a video see-through HMD that can handle six degrees of freedom. This prototype is made mainly to check the validity of CWML. In this prototype, the camera-works are simulated by HMD with

(a) (b)

Figure2. Superimposing various motion data into real scene (a) Editing various motion data (b) Superimposing 3D Video into scene of real world

build-in video camera what is moved while playing 3D Video as action data and superimposing them onto the scene of real world in realtime.

The prototype system has following functions.

(a) CWML 0.1 implementation: Fundamental data of the first version (0.1) of CWML consists of only scene number and aspect ratio. Both camera blocking data and camera-work information which is time-series 6DOF value of camera are described.

(b) Changing aspect ratio: Aspect ratios of films are examined. Aspect ratio is realized actually by filling black bars in upper and lower part of the screen.

(c) Handling of action scenes: Composed scenes can be played, fast forwarded, rewind, frame advanced and frame rewind.

(d) Recording MR-PreViz movies: Resultant movies are recorded in a PC. Figure 2 (b) shows a typical screenshot of MR-PreViz movie.

(e) Examining camera blocking: The user can set in-point and out-point while seeing a movie. Scenes to be cut out are explicitly darkened with gray translucent filter.

7 Conclusion

We have proposed MR-PreViz that utilized mixed reality technology in current PreViz. The main reason why we present the outline of our project at this early stage is that we believe such a new application could provide a new horizon of AR/MR technology. Filmmaking is a very attractive but severely demanding target. Thus, various problems to be challenged may be encountered while proceeding this project.

The PreViz technology cultivated through out this project can be applied to moving pictures other than films. As well , theatrical performances or live events in outdoor environment can be effectively pre-visualized and successfully simulated.

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Referernce

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