High Fidelity Digitization of Large-Scale and Intangible Cultural Assets

T. Matsuyama* K. Ikeuchi†
S. Okura† Y. Okamoto† T. Kakuta† R. Kawakami† T. Oishi†
L. Hill* H. Yoshimoto* T. Yamaguchi* T. Takai* S. Nobuhara*
*Graduate School of Informatics, Kyoto University, Japan
†Institute of Industrial Science, University of Tokyo, Japan

Abstract

We will demonstrate our high fidelity digitization technique for large-scale and intangible cultural assets by the following two systems: (1) "3D Video Viewer" with performer's viewpoint rendering *for intangible cultural assets and (2) "Virtual Asukakyo", a visualization system for large-scale cultural assets with realtime shading and shadowing techniques.*

1. 3D Video Rendering from Performer's Viewpoint

For high fidelity digitization of intangible cultural assets we have developed 3D video system which captures 3D objects as is. Our 3D video realizes a digitization of intangible cultural assets like traditional dances. Its applications include entertainment (e.g., 3D game and TV), education (e.g., 3D picture books), sports (e.g., coaching, training and analysis) and so on.

In this demonstration, we will show "performer's viewpoint rendering" of 3D video (Figure 1). This rendering allows us to re-experience professional performances such as traditional Japanese dance, Juggling, Capoeira, Samurai fighting and so on. The performer's viewpoint and view direction are estimated purely from multi-viewpoint videos; the performer does not need to wear any cameras.

Our 3D video viewer implements our latest rendering technique which improves the quality of rendering by compensating both calibration and 3D shape errors in real time using the GPU. Figures 2(a) and (b) show a comparison of rendering results with and without our calibration and 3D shape error compensation.

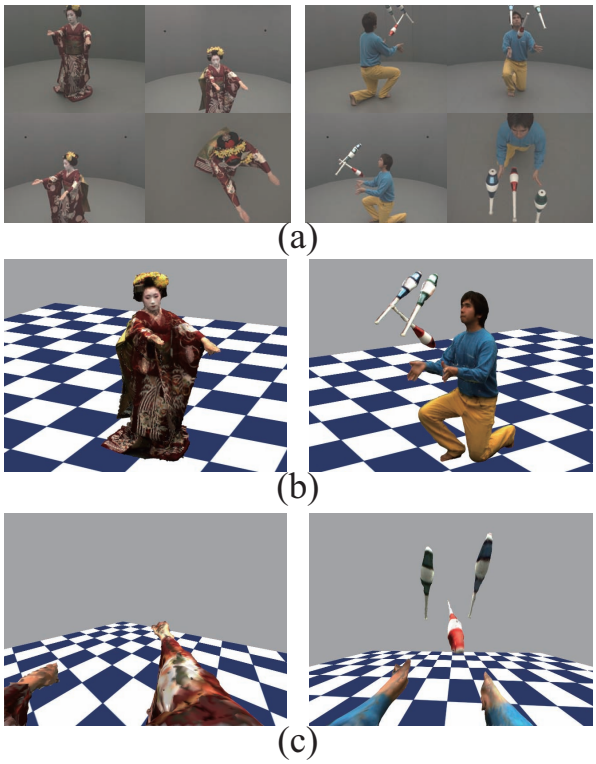
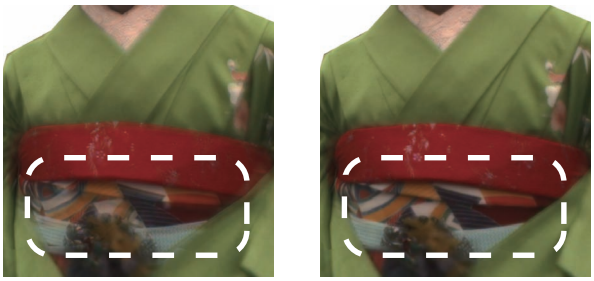


Figure 1. Performer's viewpoint rendering. (a) the original multi-viewpoint images (4 of 15 cameras), (b) rendering results from viewpoints close to real cameras, (c) rendering results from performer's viewpoints.

2. "Virtual Asukakyo"

"Virtual Asukakyo" intends to restore the ancient Japanese capital of Asukakyo to its original state by using Mixed Reality technology. We reconstruct the lost buildings of Asukakyo with computer graphics and synthesize them with the real landscape of Asuka



(a) (b)

Figure 2. Rendering results by (a) conventional view-dependent rendering and (b) view-dependent rendering with our calibration and 3D shape error compensation. Double exposure artifacts in the dashed rectangle of (a) are suppressed in (b).

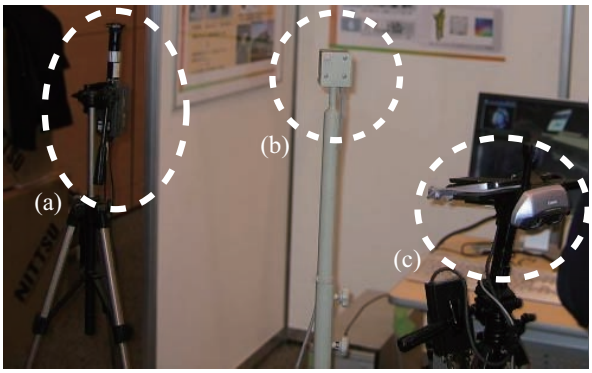
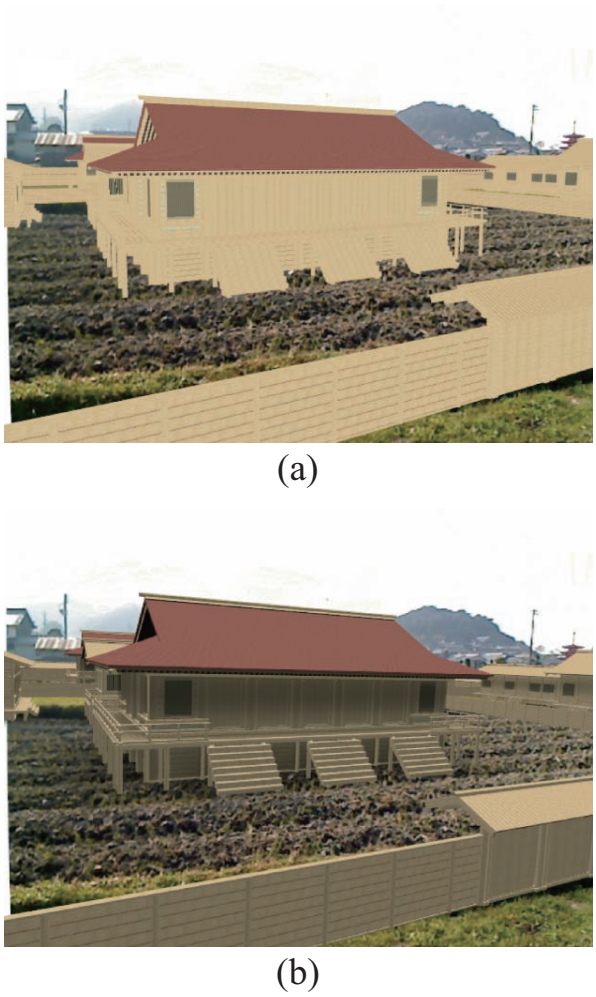


Figure 3. The “Virtual Asukakyo” system consists of (a) a fisheye lens camera for the lighting environment estimation, (b) a magnetic sensor device for estimating the position and posture of the performer and (c) a head mount display.

village (Figure 3).

The technical feature of Virtual Asukakyo is the real-time shadowing. The soft shadows of virtual objects are generated by using a set of pre-rendered basis images and shadowing planes (Figure 4).

There are a lot of real-time 3D viewers, but most of them treat indoor and small objects. It is true that some of them treat street or town modeling, but buildings or houses in their 3D model is CG, not actual model so that real time rendering can be realized. In addition to this point, conventional Mixed Reality systems are only constrained by geometrical consistency. Most of them can make shading, but not in real time or/nor not in real environment.



(a) (b)

Figure 4. (a) Synthesized image, (b) Synthesized image with shading and shadowing

Acknowledgment

This research was supported by the Leading Project: “Development of High Fidelity Digitization Software for Large-Scale and Intangible Cultural Assets” (MEXT), the GCOE Project “Informatics Education and Research Center for Knowledge-Circulating Society” (MEXT), the SCOPE-C Project 062307002 (MIC) and the CREST project “Foundation of Technology Supporting the Creation of Digital Media Contents” (JST).