A Virtual 3D Photocopy System

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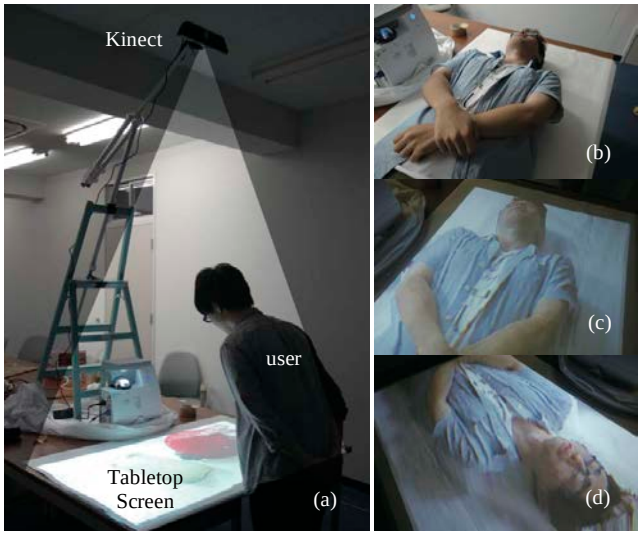

Figure 1: *Our system is composed of a tabletop screen, Kinect above the table, and a PC (a). Putting physical objects on the screen and removing them, the system scans the objects immediately and generates stereoscopic 3DCG with motion parallax (b). The user can observe the 3DCG objects from any places in all directions (c)(d).*

1. Introduction

We propose a novel system to scan 3D physical objects and show them as a stereoscopic 3DCG image (Figure 1). Putting physical objects on the screen and removing them, the system scans the objects immediately and generates stereoscopic 3DCG with motion parallax. The user can observe the 3DCG objects from any places in all directions, and feels as if the removed objects remain as they were. In our system, it is also possible to scan moving objects. The system synthesizes a stereoscopic animation of the objects and the user can observe the moving 3DCG objects with motion parallax. It is possible to interact with the 3DCG objects. When bringing a hand near to the 3DCG objects, the system computes the position of the hand and performs contact decision with the 3DCG objects. When it is judged to contact with them, the system deforms 3DCG objects and makes sounds. The user could feel touching the 3DCG objects with a hand. Our system would have some advantages that it is possible to treat large objects and see 3DCG objects from any places in all directions compared with "MirageTable" [Benko et al., 2012].

2. Methods

The proposed system is composed of a tabletop screen, Kinect above the table, and a PC. Kinect is used for scanning physical objects and tracking the user's viewpoint.

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When the user puts physical objects on the screen, the system scans the objects with Kinect and obtains the color data and the depth data. The system generates 3DCG objects which are composed of color points or color triangular patches.

After removing the physical objects, Kinect is used for tracking the user's viewpoint. The system regards the nearest point of depth data as a point of the user's head. Then the system estimates the position of the user's viewpoint and generates 3DCG images for the viewpoint every moment. As a result, the system can synthesize stereoscopy with motion parallax, and the user can see 3DCG objects from any point around the tabletop screen. The user could feel as if the removed physical objects were remained on the table as they were (Figure 1 (b)(c)(d)).

When the physical objects are moving, the system gets sequence color data and depth data of the objects, and synthesizes a stereoscopic 3DCG animation. The user can see the moving 3DCG objects with motion parallax from any point in all directions (Figure 2).

The user can touch and deform the 3DCG objects virtually with a hand. The system calculates the position of the user's hand by using depth data. Excluding the tabletop, the farthest point is regarded as a point of the user's hand. When a hand is close to the surface of the 3DCG objects, the system considers the hand touching the 3DCG objects, and deforms the surface of them by translating points of the 3DCG objects interactively (Figure 3). The system also makes sounds when the user touches the 3DCG objects. Observing from the user's viewpoint, the hand is just on the 3DCG objects in deforming, and the user could feel touching the 3DCG objects with the user's own hand.

Reference

BENKO, H., JOTA, R., WILSON, A.D., 2012, MirageTable: Freehand Interaction on a Projected Augmented Reality Tabletop, *CHI 2012*, pp. 199-208.

Figure 2: *Observing moving 3DCG objects from with motion parallax.*

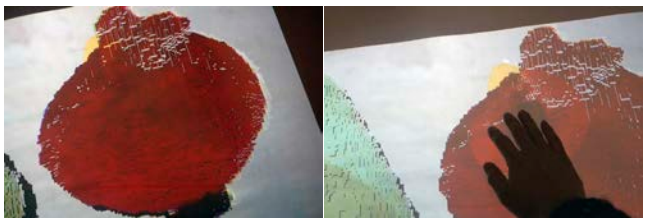

Figure 3: *Touching 3DCG objects virtually with a hand.*