Hand Gesture Recognition for 3D-Heritage-Tourism using Microsoft Kinect Sensor

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Abstract. Development new interaction methods between human and computer is taken most interest of researchers in human-comuter interaction realm. As well, computer with 3D applications makes the computer world more nature and realistic to users. In this paper, we present a 3D viewer application for heritage tourism, named HT3DViewer, using RGB camera and depth camera of Microsoft Kinect sensor. This application helps people to outlook the heritages through their computer in the realistic view. Also, it supports users to control the view with their hands gestures instead of using mouse or keyboard.

Keywords: Kinect, hand gesture recognition, 3D viewer.

1 Introduction

In the recent modern life, interest of the use of human gestures to computer is one of the most principle topics of human-computer interaction (HCI). There were several approaches to gesture recognition have been developed [1]. The low-cost Microsoft Kinect sensor integrated high-resolution depth and visual (RGB) sensing has become available for widespread use [2]. Also, it opens up new approaches in HCI such as people and objects tracking, movement recognition, voice recognition, and so on. Besides, 3D technology makes the computer world more reality to users who want to see the realistic world through their computer. In this paper, hence, we work with the combination between human gestures recognition [3] and 3D image [4] in order to make an application for heritage tourism. With the application, people can observe high quality and real heritage(s) through their computers without going out.

2 Heritage Tourism 3D Viewer

In this section, we briefly describe the whole process of making our 3D viewer for heritage tourism. We generate a heritage's 3D image by using multi-2D image of the heritage. Then, the 3D images are imported to our Heritage Tourism 3D Viewer (HT3DViewer). The HT3DViewer, which provides hand gestures library, supports users to control the 3D image such as moving, zooming, and rotation.

2.1 3D image Making Process

The 3D image making process including the following steps:

(a) Take multi-2D image of a heritage, the more images are taken the higher quality of 3D image is generated. The limited number of images is 40 images.

(b) Generate 3D image by using 123DCatch application [5].

(c) Import the 3D image to HT3DViewer. In order to import the 3D images generated from 123DCatch, it is needed to convert .3dp format file to .xaml one. Hence, we have used the PolyTrans tool from Okino Computer Graphic [6]. This tool also supports to convert between many kinds of file types.

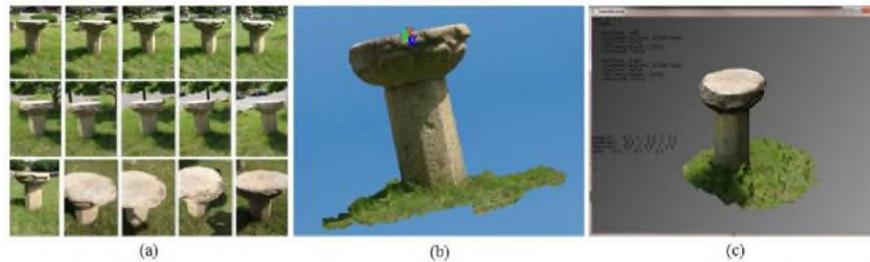Figure 1 shows an example of our 3D image making process.

Fig. 1. Process of making 3D image from muti-2D images.

2.2 Hand Gestures Recognition Library

In order to control the viewer, we proposed and developed a hand gestures recognition library using Microsoft Kinect sensor. This library will support users to control the viewer by using their hands. For example, when a user want to move the 3D image, he put his left hand over his head and move his right hand to up, down, left, or right side. The 3D image will be moved following the direction of his right hand. Note that the two hands states is open (released).

Table 1. List of hand gestures.

	Left hand	**Right hand**	**3D Image**
Hands Released (case 1)	Over the head	Move up	Is moved up
		Move down	Is moved down
		Move left	Is moved left
		Move right	Is moved right
		Move toward the Kinect	Is zoomed in
		Move backward the user	Is zoomed out
Hands Gripped (case 2)	Up	Down	Is rotated left around x axis
	Down	Up	Is rotated right around x axis
	Toward	Backward	Is rotated left around y axis
	Backward	Toward	Is rotated right around y axis

Table [1] lists all states of hand gestures that can be captured and commands to control current 3D image of the HT3DViewer. Note, in case (1) the right hand is not higher than user' head, and in case (2) both two hands are not higher than user' head.

3 Experiment Results

In this work, we did take and generate several 3D images of heritages around Gyeongju – South Korea. Then, we imported them to the HT3DViewer. A user stands within a radius of 2 meters in front of the Kinect device. Following the instruction of using hand gestures library, the user can control the 3D image such as moving, zooming, or rotate the 3D image which currently shown in the viewer.

Figure 2 shows several execution screens of the HT3DViewer.

Fig.2. Several results from HT3DViewer.

4 Conclusion

In this paper, we study on how to use Kinect sensor to recognize hand gestures, create a hand gesture library, and use this library to control a 3D viewer. In future works, we intend to improve the effectiveness of our application as well as extend our hand gestures library.

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