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AN APPROACH TO 3D MODEL APPLICATION WITH KINECT

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ABSTRACT

Moving 3D modeling is widely used in many areas such as cinema, gaming, robot control and training. Kinect is a system that can detect human movements and send them to computers. It was developed by Microsoft to play games for the Xbox game console and is being used over time for applications in other areas. This work aims to create a 3D human model using kinect.

KEYWORDS: Kinect, 3D Modeling, Kinect 3D Model Application.

INTRODUCTION

Kinect or Project Natal is a device that allows you to play games without any controller and a line of motion sensing input devices by Microsoft for Xbox 360 and Xbox One video game consoles and Windows PCs [1]. Kinect is a camera with a depth sensor. The convenience Kinect provides here is for the human to perceive the joint points and transfer the arm movements towards the computerized environment. Depth sensing systems such as Kinect are among the current research topics in computer vision and image processing [2].

Due to the increasing importance of your visuals, it is getting harder drawing operations that performed manually in the fields as technology, construction and architecture. It has become inevitable to present drawing and Computer Aided Design (CAD) models on paper or computer applications in the form of augmented reality. Kinect is a technology that grows in this point in human - computer interaction [8].

Recently, computer vision systems using Kinect, which costs less than traditional 3D cameras, have begun to be developed [3].

In this study, 3d model will be put on human skeleton onto Windows Presentation Foundation (WPF) screen by programming previously designed 3D models in visual studio application. Here, the software provides an integrity by adding control steps to the modeling phase of a skeleton using the data it receives from the sensors on the Kinect.

MATERIALS AND METHODS

Kinect Mechanism

Kinect is a special purpose camera system developed by Microsoft that has the ability to detect motion, depth and audio. The hardware structure of the device includes RGB camera, infrared projector, depth sensor camera and sound sensor microphones. The version produced for Xbox 360 game consoles is called "Kinect for Xbox 360" and the version produced for commercial use is called "Kinect for Windows". The device view of the Kinect for Windows version is shown in Figure 1 [4].

Figure 1. Kinect for Windows [4]

Kinect's optical components consist of IR Emitter, IR Depth Sensor, color sensor, tilt motor and microphone array. Kinect optical components in Figure 2 are as shown.

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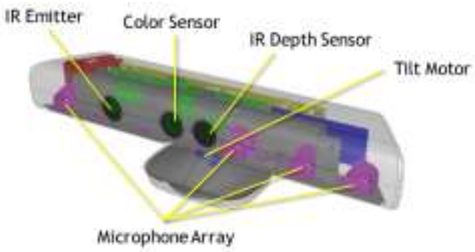

Figure 2. Kinect optical components [5]

Where, IR Emitter is emits infrared light beams, IR Depth Sensor is reads the IR beams reflected back to the sensor, Color Sensor is to make capturing a color images possible. The tilt motor is the mechanism that gives the sensor the ability to move vertically, and a simple DC motor is formed. Kinect can be moved by (+/- 27) degrees using software. In the grate at the bottom portion of the Kinect is available 4 microphone. These microphones are arranged at regular intervals on the bottom of the Kinect to capture the best sound quality and the angle that the sound comes from [5].

Normal cameras collect light that jumps between objects in front. The camera turns this light into an image that resembles our own eyes. The Kinect, on the other hand, records the distance of the objects placed in front of it. Kinect uses infrared light to create a depth image that captures where things are, not what objects look like [6].

3D Modeling of The Kinect Skeleton

Kinect forms the skeleton structure from 20 joint points as shown in Figure 3. Each joint datum belongs to a predefined body region in the Kinect coordinate space, which contains 3D coordinates and is shown as a time series. The Microsoft Kinect SDK and OpenNI libraries are available for real-time and advanced animations. Both of these libraries can track the 20 joins of the human skeleton.

The joint data representing the human limbs are updated with the depth image frames captured at specific time intervals without deteriorating the integrity of the Kinect skeletal structure. In order to adapt the 3D model to the motion capture data obtained by Kinect, the orientation information about the joints is needed in addition to the 3D coordinate information of the joint points [8].

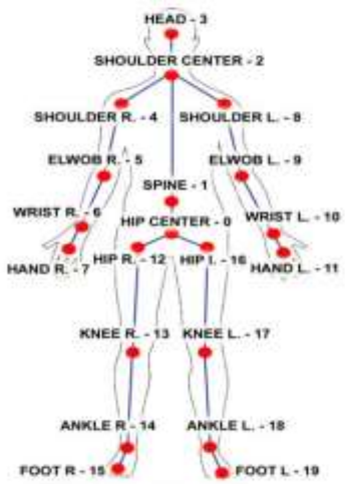

Figure 3. Joint points of the Kinect skeleton [7]

The 3d model to be used in this study will be designed in the IClone program. The IClone program is an interactive platform that allows you to create a model in the X, Y, and Z coordinate plane. The program is compatible with Kinect.

RESULTS AND DISCUSSION

In this study, the Kinect SDK application is loaded onto the computer and Kinect is connected to the computer via the USB cable. Kinect skeleton detection libraries are added to the project software. Once all the necessary configurations have been completed, Kinect will calculate the distance between the joints and detect the joint points on the human skeleton.

Control parameters of the mouse operations that correspond to human hand movements are added to the application. In this study, respectively 3D models to be put on human skeleton structure will be designed and 3D model covered will be done for perceived human skeleton structure. The movements of the human on the WPF screen will be captured and the 3D model worn on the skeleton will be adapted to these movements. Finally, a 3D model can be created that can make human-like movements on the real human image.

In the lower left corner of the pictures are shown the human skeletal structure that Kinect perceives. The operation steps of the application are shown in Figure 4.

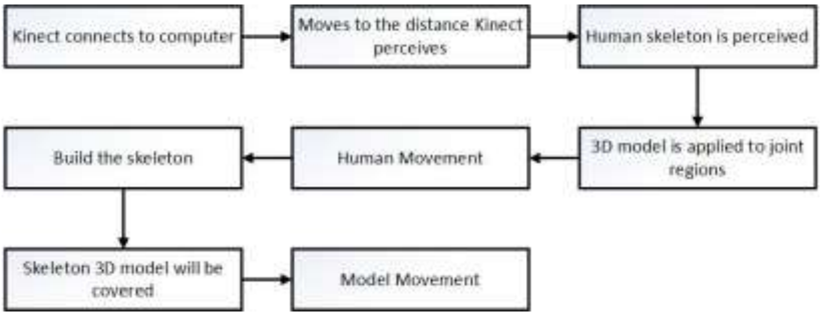

Figure 4. Process steps of the application

Kinect actually seems to have three eyes. Two of them are in the middle, the third side is the side. This "third eye" determines how Kinect works. However, Kinect's third eye is actually an infrared projector. Kinect's infrared beam shines the rays of the form of infrared spots on the person in front of the projector. We can't see these points normally, but we can see using an IR camera.

In this study, we first identified the joint points on the human skeleton with Kinect. Using the program code we wrote, we combined these joint points with a line so that the human body would form. In this way we have created the human skeleton structure of Kinect corresponding to the human skeletal structure. Kinect's depth information acts like a 3D scanner to detect human movements.

In the IClone program, we designed all the joint regions corresponding to the Kinect skeleton of the 3D model separately. The model shown in Figure 5 was designed in the IClone program, and the model was given motion characteristics in the 3D plane. In the IClone program, we designed all the joint regions corresponding to the Kinect skeleton of the 3D model separately. We have acquired this 3D model motion feature that we have designed using sensor data from Kinect. In Figure 5, the movements of the dressed 3D model are shown on the human skeleton.

(a) ***(b)*** ***(c)***

Figure 5. (a) right hand motion ,(b) left hand motion and (c) double hand motion

In Figure 5 (a), when we lift the right hand side up against the Kinect, the 3D model covered on the skeletal structure raises the right hand upwards. In Figure 5 (b), when we lift the left hand upwards, the 3D model covered on the skeletal structure raises the left hand upwards. In Figure 5 (c), when we lift the double elimination upwards, the 3D model clad on the skeletal structure lifts the double hand upwards.

As a result of this work: It shows that Kinect does not recognize his hands and recognizes joint regions. If Kinect can recognize the hands, an entirely human model can be created with Kinect. Sometimes we encountered minor problems in perception of joint regions. Due to these detected problems, Later, improvements will be made in terms of software to try to solve the problems.

CONCLUSION

In this study, an application was carried out to adapt 3D model designed in IClone application to human skeletal structure which Kinect created. With this study, a new application on Kinect has been realized. We have provided a road map for us to try Kinect on different platforms. We have seen that this new technology can be successfully used in different disciplines.

In this study, we have found that 3D image scanning, 3D animation and interactive training applications can be done easily with Kinect at low cost.

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