Research on Dynamic Virtual Fitting Method based on Kinect and Unity3D

Qing Zhu, Shu Pang

Beijing University of Technology, Beijing, 100124, China

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Abstract. The thesis obtains the data with the help of Kinect, combined with the platform of unity3D to research 3D virtual fitting. Using the stroke and a matching algorithm of hidden Markov chain model to establish the corresponding relationship between contour of the human body and the human body model. It is based on multimedia devices to access and the unity of the human body skeleton control method to realize real-time fitting. Combined with Kinect method, 3D virtual character models deformation and skeletal binding methods to achieve a breakthrough in the traditional Unity3D, interact naturally through simple body movements, can be well applied to the virtual fitting system.

Introduction

With the rapid development of e-commerce technology, Internet is becoming a compelling apparel sales channels. However, the characteristics of the clothing itself as judge determined that we cannot accurately judge other items like clothing fit and comfort. How to solve the virtual fitting realistic, personalized, real-time and other issues become the core issues related to research in the field of clothing, apparel e-commerce is also a key issue to break through the bottleneck of the development, Meanwhile, with the development of virtual reality technology, there is a growing emphasis on the realism of the virtual world, a sense of interaction and immersion, and Kinect and Unity3D fully integrated for the further development of the garment industry offers new opportunities as well as virtual reality application of technology has opened up new space.

Kinect

Kinect has three lenses, the intermediate lens is RGB color camera, for capturing a color image of 640*480, 30 frames per second up to acquire images, perform tracking based on bone Kinect device within the field of view of one or two moving images, tracking to 20 nodes on the human body. The left and right sides of the lens respectively structured light 3D depth sensors infrared transmitter and infrared CMOS camera posed, which is used to detect 3D images. Kinect also with a recovery coke technology, the base of the motor will rotate along with the focus moving objects, Kinect has built-in array microphone, radio microphone at the same time by more than after the elimination of noise. Based on the above features, Kinect devices do not need to use any controller, simply rely on the user's real-time 3D action capture, facial recognition and voice recognition input function can be achieved. Fig.1 is an overall configuration diagram Kinect device. The overall structure and function Kinect device:

Unity3D

Unity Technologies is the development of a type allows players to easily create interactive content, such as three-dimensional video games, architectural visualization, real-time three-dimensional animation and other integrated multi-platform game development tool, because of its unique cross-platform advantages and superior 3D rendering effect , Unity popular in the IT industry reputation contained Road, is a fully integrated professional 3D game engine.

Kinect application under Unity3D platform

In the development of somatosensory interaction, closely integrate Kinect and Unity3D technology makes human skeleton control issues have been resolved. The two joined forces to track makes somatosensory game directly through interactive nature of human bones, human bones for 3D control of the introduction of the powerful technical support. Combined with Kinect, deformation

and rigging methods implemented in Unity3D 3D virtual character models break with tradition and nature interact through simple body movements, can be well applied to the virtual fitting system.

Fig.1: Kinect

Study on dynamic virtual fitting method

3D modeling making

We are in the process of virtual fitting method of the study, the first step is to produce consistent with Kinect skeleton node mannequin dressed in clothes using a three-dimensional modeling software, the body of the model as a substitute for the user, when rendering pipeline, it would not be sent and so the final model can only see the clothes. Then the model skin and bone weights brush try, keeping the brush and debugging, making clothes mildness best. Finally export models, including Kinect skeleton node has good bones bound, model materials and textures.

Deformation model - model matching algorithm

In the virtual fitting method, as each person's body must be deformed in order to obtain a so similar to user size model of human body mode, so as to achieve matching clothes with the user's body, to show the most realistic fitting results.

Kinect emits infrared rays, and detects the reflected infrared light, which can be calculated within the field of depth value of each pixel, i.e., to obtain depth data from the depth of the first data is extracted from the main body and the shape of the object, and then use these shape information to match the various parts of the body, and finally out of the calculated matching each joint position in the human body. Based on the Kinect depth image analysis, the thesis gets the body contour information, as well as the size of each part of the body's bones information. In the model the deformation module mainly use various parts of the body contour information and size information.

Extracts the user body contour in the process from the Kinect depth image as three-dimensional model deformed in accordance with the human body, the original three-dimensional model of the human body is deformed into the human body model and the user's body in line, corresponding to this vertex to be three-dimensional contour points with the grid model together, these correspond to the vertices of the mesh as an anchor point to move to lead the three-dimensional contours of the human body model overall deformation, as shown in Fig.2

Fig.2: Correspondence between the contour points and the model vertices

This article uses matching algorithm based on stroke and hidden Markov chain model to establish correspondence between the model and human body contour.

Kinect skeletal tracking technology

Skeletal tracking (Skeleton Tracking, called ST) is responsible for the characteristic points by Kinect user identification and subsequent body movement tracking is Kinect's core technology, which can accurately calibrate 20 key points of the body, and to this 20 the point where real-time tracking. Fig. 3 is a schematic view of the body of the 20 skeletal points.

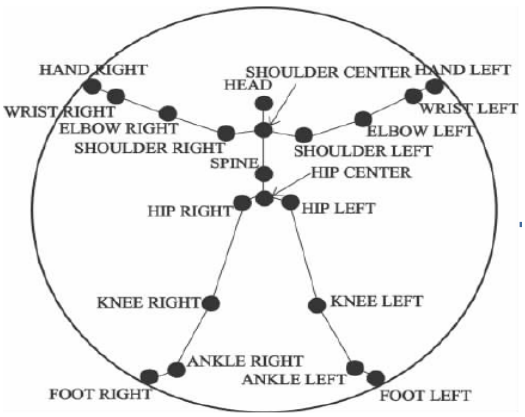

Fig. 3: 20 skeletal point's schematic

As previously described, Kinect infrared emitter and camera, which is capable of generating three-dimensional data , so that Kinect SDK obtain infrared data from infrared camera after its calculation processing, generating depth data, the depth of field of data processing technology by tracing the skeleton, in which a process eigenvalue of each parts of the body to be extracted quickly identify, to match the various parts of the human body, the current can be identified Kinect individual body portion 32, and analyzes the individual body portion 32 which give the body 20 joints data, thereby establishing the 3D coordinates of each joint of the body; and then use the 3D coordinate values to calculate the angle of rotation of each joint; and finally the results will be sent to the controlled object, complete control of the entire process.

Skeletal binding in Unity3D

In the Avatar system established in Unity3D, the deformation matches the real three-dimensional human body human model with Kinect skeletal joints corresponding to the characters and get the bones of the joint-point data through Microsoft Kinect SDK development kit, which is available to human. Kinect. Nui Skeleton Position Index corresponding bone joints, Kinect. Nui Skeleton

Tracking State and Kinect. Nui Skeleton Position Tracking State, using the code skeletal joints can get the current tracking status information. Finally, making the skeletal bones corresponding to Unity3D user node in the character models, so that the trajectory is consistent with the user response action figures made by the model.

Dynamic cloth simulation

Finally, adding unity cloth simulation results. Set cloth four parameters: the maximum distance from the offset, eccentricity and the radius of the collision and crash the ball away from the ball. Join fabric parameters: Bending Stiffness, Bending stiffness of the cloth, Stretching Stiffness, Stretching stiffness of the cloth Damping, Damp cloth motion, Use Gravity, Should gravity affect the cloth simulation, External Acceleration, A constant, external acceleration applied to the cloth, Random Acceleration, A random, external acceleration applied to the cloth, World Velocity Scale.

Fabric float back part is transparent way to write shader material to achieve double-sided. There are three ways in Unity Shader, Fixed Function Shaders with Vertex and Fragment Shaders can add a statement in the Shader code Cull off the head, thus rendering enforce sided effect. Cull off course, with the way the statement, made on both sides of textures, lighting, reflection, color, etc., are the same, which is contrary to common sense realities. So Fixed Function Shaders and Vertex and Fragment Shade in rendering subroutine can use two-sided rendering pass to achieve different materials. Surface Shaders rendering operation on the opposite side of the system of direct borrowing Diffuse Shader, texture textures follow positive in the opposite color to add a variable to simulate ambient light, mixed texture material to achieve the opposite effect. Code is as follows:

```
Shader "Hog's shaders/BumpSpec_Twoside" {
Properties {
_Color ("Main Color", Color) = (1, 1, 1, 1)
_SpecColor ("Specular Color", Color) = (0.5, 0.5, 0.5, 1)
_Shininess ("Shininess", Range (0.03, 1)) = 0.078125
_MainTex ("Base (RGB) Gloss (A)", 2D) = "white" {}
_BumpMap ("Normalmap", 2D) = "bump" {}
_BackColor ("Back Main Color", Color) = (1, 1, 1, 1)
_BackSpecColor ("Back Specular Color", Color) = (0.5, 0.5, 0.5, 1)
_BackShininess ("Back Shininess", Range (0.03, 1)) = 0.078125
_BackMainTex ("Back Base (RGB) Gloss (A)", 2D) = "white" {}
_BackBumpMap ("Back Normalmap", 2D) = "bump" {}
}
```

Application Effect

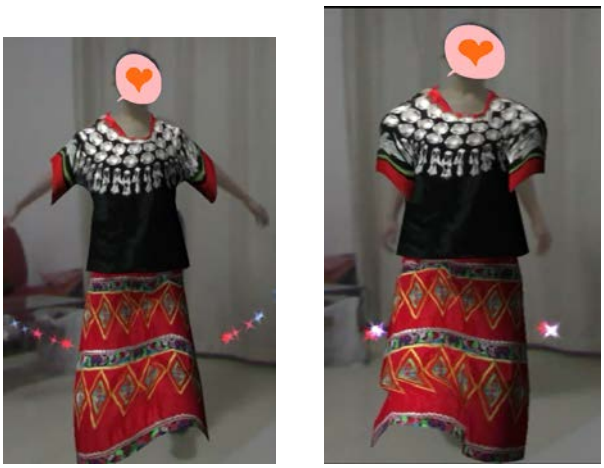

Fig.4: Test Results

Software development and testing environment for WIN7 + VS2012 + Kinect for Windows SDK1.7 + unity3D4.0, after completion of the project through the multiplayer testing, test results showed that: Combining Kinect, deformation and rigging methods implemented in Unity3D 3D

virtual characters break the traditional model, interact via simple natural body movements, can be well applied to the virtual fitting system. The test results are shown as below:

Conclusions

Based on Kinect and Unity 3D virtual fitting method can effectively match the human body in real time, motion capture human movement, and as people move to showcase clothes cloth simulation results. This method is applied to the virtual fitting experience, making the body a sense of interactivity and virtual reality technology to the application areas of real life.

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