Application of VRML in Distance Vocational Education

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Abstract

VRML is mainly to help realize the three-dimensional animation effect, and solve User interaction problem based on the three dimensional object in the homepage. VRML can provide the three dimensional virtual scene which allows the user to participate in and to control interactively, and improves the insufficiency of network courseware which only has the static picture and the traditional three-dimensional animation that makes interactive control in the distance learning impossible. The paper describes the methods to create three-dimensional scene using VRML technology and to achieve real-time interactive features of scenes with an application example, and it gives a key part of code.

Keywords: Virtual reality, Distance vocational education, Three-dimensional modeling, Human-computer interaction

1. Introduction

The distance education takes an independent education shape. It originated from the 19th century 40's correspondence educations. In the 20th century 70's, many kinds of media distance education developed rapidly. For the first time, it drew the wide attention from the world education domain. It was considered as a significant revolution in human history of education. By the end of 20 century, the information technology application domain. It was considered as a significant revolution in human history of education. By the end of 20 century, the information technology application had opened the modern distance learning prologue. With the information technology powerful support, the modern distance learning has the unprecedented compatibility and the flexibility. And the governments of various countries realize that modern distance learning becomes the first choice of lifelong education. Compared with the first generation of correspondence education and the second generation of many kinds of media distance learning, the modern distance learning has already developed from the edge pattern of education to the mainstream pattern. The modern distance learning no longer takes only one kind of substitution of the education form which provides remediation of study for the people who missed the opportunity for accepting high education, it also becomes a kind of representation form of the development direction for the future education. It has been eagerly anticipating the through revolution for the various countries' education fields.

The main form of the modern distance education is the online education. Because of its unique advantage, online education will become the first-selected form of lifetime study. Online education can make more people, especially those unable to enter the college campus to accept advanced education. The distance education has already become a kind of major form of education.

In essential, the virtual reality is one kind of advanced computer connection technology. By various technologies, it makes things in the real world and those originally not existing in real world such as hearing, touch, taste, smell, and etc., all work together coordinately. And it can provide interact between users and the environment to make the users realize that they seem to be personally in a real world.

Virtual reality technology has the superiority that can't be compared in the modern distance education. It can make up for the insufficiency of long-distance teaching condition, avoid all kinds of dangers which may happen in the real testing's operation, break both the time and space limit thoroughly, and depict character image. Now more and more long-range educational institutions have already realized the importance of virtual reality and have done relevant discussions. Some schools have set up the system of fictitious campus among them. As VRML becomes the new standard of the network 3D, and is constantly improved, constructing the modern long-range education system based on VRML has already become the important subject. This paper introduces VRML relevant technology and the designed system based on modern distance education of VRML.

2. VRML Overview

Virtual Reality Modeling Language (VRML) is one of the main recent developments in web three-dimensional technologies (VRML Consortium. 1997). It provides a modular infrastructure for rapid development of web-ready virtual worlds that can run as platform independent applications in any web browser with an appropriate plug-in.

VRML is a "file format for describing interactive three-dimensional multimedia on the Internet" (VRML Consortium. 1997) which allows computer users to visit and move through three-dimensional virtual environments over the Internet. As a description language for three-dimensional models and their behavior, VRML is very well suited for the development of Web-based simulations and animations. First, VRML is an international standard and allows for the platform-independent definition of animations and simulations. Second, VRML offers a higher level of rendering technique and its file size is small so that it can be transferred faster and more conveniently compared to other CAD model formats. Third, the basic building blocks of VRML are nodes. VRML has a particular "inline" node that can include other models from anywhere on the Internet.

VRML was standardized in 1997, after a long period of world-wide consultation over the Internet. It consists of a framework of 54 nodes/objects, event types and routes. The nodes are stand-alone objects that contain a number of fields, as well as input and output events. The user can override the fields and thus customize the nodes by specifying new values for the fields.

Communication between VRML nodes is achieved by exchanging messages ('events') between them. An event is passed from one node to another by a connection, called a 'route', which is normally hard-coded in a VRML program. Propagation of events through a VRML program is called 'event cascade'. Most VRML can receive events, but only some nodes can generate them.

The processing capabilities of VRML applications are achieved with scripting languages. Currently, there are two languages that can be used for scripting: JavaScript and Java. The former can be embedded directly into the VRML code, thus becoming a part of the VRML application, and the latter can be developed as a standalone application and referred to as an external URL from the VRML code.

3. The advantages of combining VRML technology and distance vocational education

Virtual reality is a new rapid-developed technology. The emergence of virtual reality had a profound impact in education, which changed the conventional teaching ideas and educational models, and constituted the denial and deconstruction of the certain traditional teaching fashions. The technology of virtual reality presented the infinite possibility of the educational technique, broke through the parochialism of the traditional teaching model, developed the space of the existing teaching method, which has established the rationality, transcendence and innovation of the non-feasibility, and provided the new space.

The technology of virtual reality could provide many kinds of information, such as the sense of vision, the sense of hearing and the sense of touch. The participants could interact with the virtual environment in a natural way, and could personally participate in the changing process of the event in the virtual environment, which has obtained the degree of freedom of the control and operation of the entire event. This kind of multi-dimension interactive information environment would provide the new ways for the participants to master new knowledge and skills.

Distance education is a kind of communication media with learner as the main body, and computer technology, multimedia technology, communication technology and network technology as the main means of teaching, is a new kind of interactive network education methods of images, text, animation, audio and video combine. It has a rich media resource, flexible time regional and convenient interaction, therefore increasingly is welcomed by the teachers and students.

As we all know, the main contradiction of web application is the transmission speed, but the three-dimensional animation document is also very huge. Before VRML appears, to achieve the three-dimensional animation is basically not possible on the network. Birth of VRML technology in 1994 effectively solves this problem, although at that time the technology is not quite ripe. By 1997, VRML97 appeared and became the first ISO International Standard in web page.

The principle of VRML technology to solve the three-dimensional animation problem is to provide some basic three-dimensional graphics database in Client, real-time shading and rendering in run-time, thus the amount of data transmitted over the network is largely reduced. VRML file is a text file, can be opened by any text editor. When you click VRML file on the page, the computer will first download VRML file to the local machine, and then will explain and run it on the local machine. So you do not need to download anything from the internet.

Therefore, at this time the speed is dependent only on the speed of your computer, has nothing to do with the speed of the network.

4. Create three-dimensional scene

Modeling is the most crucial step in creating three-dimensional scenes. Modeling should be realized using the modular modeling method. First, decompose the complex object into a number of simple sub-objects, then separately create each sub-object model, finally connect these sub-object models according to certain relations. The three-dimensional scene's modeling flow may be as shown in Figure 1.

Virtual reality scene of nurse training is mainly composed of table, medicine bottles, intravenous tube, and rack, and hospital beds, patient and so on. Level structure drawing of Virtual reality scene of nurse training is as shown in Figure 2.

4.1 create the virtual model using VRML

VRML2.0 has the rich modeling function. Various three-dimensional models can be created by Geometry node and Appearance node. Light and viewpoints can be created by Light node and Viewpoint node. A table model created using VRML2.0 shown in Figure 3. The table model simply uses the Cylinder node and Box node of VRML2.0, then uses Transform node to control the location of each node, and its code is as follows.

```
#VRML V2.0 utf8
Shape {
    appearance DEF color1 Appearance {
      material Material {
        diffuseColor 0.5 0.4 1.0}}
      geometry Box {size 6.0 0.2 6.0} }
Transform {
    translation      2.6 -2.1 2.6
    children [
        DEF leg Shape {
          appearance Appearance {
            material Material {
              diffuseColor 0.5 0.4 1.0
              specularColor 0.5 0.4 0.4}}
          ometry Cylinder {
                  radius 0.15
                  height 4.0}}]}
    Transform {
        translation      -2.6 -2.1 -2.6
        children [USE leg ]}
    Transform {
        translation      2.6 -2.1 -2.6
        children [USE leg ]}
    Transform {
        translation      -2.6 -2.1 2.6
        children [USE leg ]}
    Transform{
        translation      0.0 -0.6 2.6
        children [
            DEF    board Shape    {
```

```
        appearance USE color1
        geometry Box {
            size 5.0 1.0 0.1}}]}
    Transform{
        translation      0.0 -0.6 -2.6
        children [ USE board ]}
    Transform{
        translation      2.6 -0.6 0.0
        rotation 0.0 1.0 0.0 1.571
        children [USE board ]}
    Transform {
        translation      -2.6 -0.6 0.0
        rotation 0.0 1.0 0.0 1.571
        children [USE board ]}
```

4.2 create the virtual model using 3DSMax

3DS Max is a professional 3D animation rendering and modeling software package used mostly by game developers, design visualization specialists, and visual effects artists. Learn tips to create rich, complex design virtualizations, realistic game characters, or 3D film effects.

Game development, television, film, and web, multimedia, and marketing communications professionals will want to explore this latest release of the comprehensive animation, 3D modeling, and 3D rendering software.

3DS Max Design software helps you expand the visual context of your design concepts for more effective design validation and visual communication. It offers digital continuity with AutoCAD®- and Revit®-based products for design visualization workflow. With 3ds Max Design animation and visual effects software, you can:

Explore design concepts—Create unique organic forms. Generate and control architectural forms procedurally with scripts, and explore your concept's impact early in the design process.

Validate design concepts—Put your design in context. Create animated walk through, line-of-site studies, and physically-accurate daylight analysis, so you and your clients can better understand how the design functions.

Communicate design concepts-Help customers make crucial decisions during design reviews and gain valuable buy-in at every stage. Create emotionally engaging narratives to communicate information quickly, compellingly, and persuasively.

As shown in Figure 4, create glass-bottle shape in the 3DSMax software interface, and paste the appropriate map, to produce more realistic models of the bottle. Then select ". Wrl" format of "Export" command in the "File" menu in 3DSMax software, then the VRML form virtual model is produced which can be directly used in the VRML software.

5. Realization of Human-Computer Interaction

The interactive virtual reality scene may be constructed with "Sensor" node and "Interpolator" node in the VRML2.0.

In VRML2.0, the detector is mainly used to examine the browser's movement in the virtual scene, and to realize the interaction between user and the virtual environment through event's transmission.

The detector may be divided into two kinds. One kind is the contact sensor, and the other is the sensation detector. This is mainly decided by the browser's operation of the object in the scene.

These nodes are able to perceive the change in the running program, and enable the observer to operate the space shape to move, click and drag and so on.

VRML has provided six interpolator nodes, which stand separately for Position Interpolator, Orientation Interpolator, Scalar Interpolator, Color Interpolator, Coordinate Interpolator, and Normal Interpolator. In the procedure movement process they may change all kinds of conditions of the object, like size, dimension, position and color and so on.

In order to show the details, the VRML model should enable interactive operations. In the virtual reality scene of nurse training, the learner clicks left key of mouse on the needle, the needle inserts on the medicine bottle mouth. As shown in Figure 5(a) (b), "the needle" clicked in the scene, simulation effect of "the needle" inserts on the medicine bottle mouth. Its code is as follows:

```
DEF zhen Transform {
        translation 0.0 -3.0 0.0
        children [
 Inline {
url   "zhen.wrl"}
DEF touch TouchSensor {}
 ]
}
DEF ping Transform {
        translation 1     2    0
        children [ Inline {url      "ping.wrl"} ]}
DEF clock TimeSensor {
    cycleInterval 5.0}
DEF path PositionInterpolator {
        key  [0 1]
        keyValue [0.0 -3.0 0
            1 1 0]}
ROUTE touch.touchTime TO clock.startTime
ROUTE clock.fraction_changed TO path.set_fraction
ROUTE path.value_changed   TO   zhen. translation
```

Route's function is to connect a node's "eventin" and another node's "eventout". Through the simple grammar structure, the channel between two nodes is established. When an event occurs, events are transmitted along this channel.

With events and route, animated effects and interaction between browser and the environment can be created; and the virtual scene can be made closer to reality.

6. Conclusion

To create the virtual model using VRML makes up the insufficiency in the distance learning courseware which only has the static picture and in which the three-dimensional animation cannot be controlled interactively, and is an improvement on network courseware of distance vocational education. Combined with the technology XML, VRML, the Virtual Reality technology originated from the Computer Graphics makes a great leap with the effect that is a good likeness of the reality.

References

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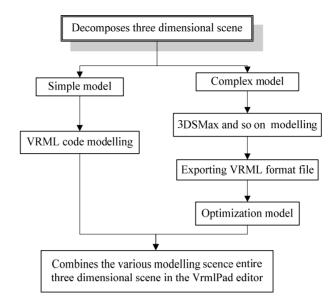
```
                    ┌────────────────────────────────────┐
                    │  Decomposes three dimensional scene │
                    └────────────────────────────────────┘
                        │                        │
                        ▼                        ▼
              ┌──────────────┐          ┌──────────────┐
              │ Simple model │          │ Complex model│
              └──────────────┘          └──────────────┘
                     │                         │
                     ▼                         ▼
           ┌──────────────────┐     ┌────────────────────────────┐
           │ VRML code        │     │ 3DSMax and so on modelling  │
           │ modelling        │     └────────────────────────────┘
           └──────────────────┘                │
                     │                          ▼
                     │               ┌────────────────────────────┐
                     │               │ Exporting VRML format file  │
                     │               └────────────────────────────┘
                     │                          │
                     │                          ▼
                     │               ┌────────────────────────────┐
                     │               │ Optimization model          │
                     │               └────────────────────────────┘
                     │                          │
                     ▼                          ▼
          ┌──────────────────────────────────────────────────┐
          │ Combines the various modelling scence entire      │
          │ three dimensional scene in the VrmlPad editor     │
          └──────────────────────────────────────────────────┘
```

Figure 1. Three-dimensional scene modeling flow chart

```
              ┌──────────────────────────────────┐
              │  Virtual reality nurse trains scene│
              └──────────────────────────────────┘
     ┌──────┬──────────┬───────┴──────┬──────┬──────────┬─────────┐
  ┌─────┐┌───────────┐┌───────────────┐┌────┐┌──────────┐┌────────┐
  │Table││Medicine   ││Intravenous tube││Rack││Hospital  ││Patient │
  │     ││bottle     ││               ││    ││bed       ││        │
  └─────┘└───────────┘└───────────────┘└────┘└──────────┘└────────┘
```
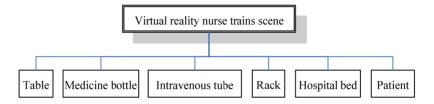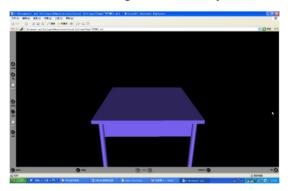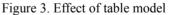
Figure 2. Level structure drawing of Virtual reality scene of nurse trains

Figure 3. Effect of table model
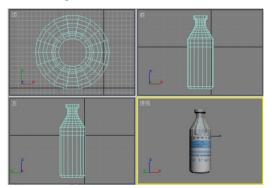
Figure 4. Three-dimensional modeling process of medicine bottle
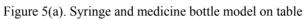
Figure 5(a). Syringe and medicine bottle model on table

Figure 5(b). Simulation effect of needle insertion medicine bottle