



RESEARCH ON APPLICATION OF 3D MODELING TECHNIQUE BASED ON NETWORK IN DRAWING EDUCATION

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ABSTRACT

In this paper a three-dimension web-based modeling technique is introduced. VRML (Virtual Reality Modeling Language) and other 3D modeling technique are applied to develop virtual reality model database of engineering drawing on internet.

Keywords: *3D Modeling, VRML, Web*

1. INTRODUCTION

With the rapid development of computer technology, multimedia-aided teaching has been widely used in graphics education. The vivid three-dimensional computer model and 3D animation have replaced the traditional flip charts and models, and become an important adjunct to the configuration capabilities of the student's space. However, these models and animation are usually set in advance according to the teaching demonstration requirements by software designers, learners only passively accept knowledge, cannot implement a real-time interaction in order to play the subjective initiative. In addition, these graphics and animation files pass slow online, and difficult to adapt to online teaching and learning development needs, in Figure education needs to introduce a flexible, simple, easy-to-network transmission with good human-computer interactive 3D modeling techniques, model library, built in network drawings to build a good participation in the network learning platform for learners.

VRML (Virtual Reality) modeling language is a web-based 3D modeling techniques, similar to the HTML markup text language to describe the three-dimensional scene through the network transmission, dynamically generate a virtual scene on the client browser, providing learners with a Dynamic, real-time and interactive 3D virtual learning scenarios. Through active participation in the 3D virtual learning environment, students can multi-perspective model, to increase interest in

learning, a great mobilization of the learning initiative.

2. OPENGL TECHNOLOGY

OpenGL is an open 3D graphics standard, can be programmed directly on the computer screen to draw three-dimensional graphics. This technology development is difficult, the developer must have a more in-depth understanding of OpenGL, involved in modeling not only the geometric model, as well as the environment, light, texture, and animation of the objects is described, but also involving a very broad area, Germany CARD / 1 software in this regard has been quite successful. However, through the scene created in this way can not obtain its three-dimensional model, it cannot use again in 3DSmax.

Now, we propose a new three-dimensional modeling: VRML modeling. The VRML to establish a road model, the technical difficulty compared to OpenGL for convenience, and AutoCAD-based modeling compared to a lot of advantages in the modeling approach, model effects. VRML language has been developed to version 2.0 of its modeling approach has been perfect, of VRML to 3D, text, multimedia integration into a unified whole, these media types can be closely integrated and the functions of the Internet will produce a new interactive applications

3. VRML MODELING METHODS

VRML modeling, there are many ways to complete its model, 3DSMax, but the form is too

manual, and is not recommended. Through external tools to create and modify VRML, VrmIPad is a powerful and flexible VRML authoring tool, which can make the design and develop professional VRML tools, and can create a VRML world and publish to the web. The plug-in functions are provided to facilitate the completion of the VRML model created. Right use of VRMLpad watch road model.

Due to the complex particularity of the road model, we prepared special software to complete the establishment of the VRML model. First, we must study the characteristics of the VRML language, the following description of VRML three-dimensional model of a highway as an example.

3.1 Definition of Environment Variables

VRML defines the environment variable not a simple background graphic applied VRML language from the six directions defined background: top, bottom, front, rear, left, right, six pictures on the ground scene shooting information, so that can really achieve a virtual tour in reality. VRML to define the object variable using the DEF, the environmental background objects, the Background object attributes, Background01 object name, which is defined in the following format:

```
DEF Background01 Background {
  frontUrl "../maps/bjtx8.jpg"
  backUrl "../maps/bjtx1.jpg"
  leftUrl "../maps/bjtx2.jpg"
  rightUrl "../maps/bjtx3.jpg"
  bottomUrl "../maps/bjtx5.jpg"
  topUrl "../maps/bjtx6.jpg" }
```

3.2 The Definition Of The Light

Light of the definition is similar to the lighting parameters in 3DSMax settings, including the type of light source, light intensity, color, light position, scope. In VRML expressed as follows:

```
DEF Light_0 PointLight {
  intensity 2
  color 0.7059 0.7059 .7059
  location 519.4 2012 736.5
  on TRUE,
  the radius 12 891 }
```

3.3 The Definition Of The Camera

The camera is an important tool for our field roaming camera movement, you can complete a simulated driving on the highway route also set according to their own route through the mouse roaming view of highway. The setting of the camera is very simple, the Viewpoint's are defined as follows:

```
DEF_dCm Viewpoint {
  position -416.9 107.2 -47.51
  orientation 0.0006254 -1 -0.0006501 -1.609
  fieldOfView .6446
  description "_dCm" }
```

Camera movement description is more complicated, we need to calculate the trajectory of the camera movement, the movement of the frame interval.

Description of camera movement, including the coordinates of the trajectory interpolation (Position Interpolator), and orientation trajectory interpolation (Orientation Interpolator), its value based on the coordinates of the line-by-pile in the road route calculates a movement of the camera trajectory using the VRML language to describe the following:

```
DEF_dCm-TIMER Time Sensor {loop TRUE
  cycle Interval 26.67},
DEF_dCm-POS-INTERP Position Interpolator {
  Key [0, 0.00375, 0.0075, 0.01125, 0.015, .01875,
  0.0225, .02625,
  0.03, 0.03375, 0.0375, 0.04125, 0.045, 0.04875,
  0.0525, 0.05625,
  ...]
  KeyValue [-416.9 107.2 -47.51, -420.6 107.2
  -47.37, -424.4 107.2 -47.22,
  -428.1 107.2 -47.07 -431.9 107.2 -46.9 -435.6
  107.2 -46.73
  ...]
DEF_dCm-ROT-INTERP OrientationInterpolator
{Key [0, 0.00375, 0.0075, 0.01125, 0.015, 0.01875,
0.0225, 0.02625,
  0.9825, 0.9863, 0.99, 0.9938, 0.9975, 1]
  KeyValue [0.0006254 -1 -0.0006501 -1.609,
  0.0005364 -1 -0.0005589 -1.612,
```



0.0004487 -1 -0.0004688 -1.615 0.0003593 -1
-0.0003764 -1.617, ...]}}

The three-dimensional model is to establish the most critical of the VRML model. Three-dimensional objects on the road pavement, railings, marking, green belt, the model of the ground, trees, ditches, slope protection, signs, etc., these objects in organic combination, plus the environment, lighting, animation is a real VRML scene. 3DSMax and Autocad article has a very detailed introduction to the modeling of three-dimensional objects, so we are now the focus of the study to establish the three-dimensional model of the object through the VRML language. In the VRML language, through translation to define the center of the object coordinates, the coordinates of other points through the sum of the coordinates is considered; light parameters include the following: diffuse light (diffuse Color), ambient light (ambient Intensity), mirror reflex (specular Color), natural light (shininess), transparent optical (transparency) the radiation light (emissive Color,); define the material properties of objects Texture and Texture Transform. Then the object is divided into several triangles, calculate the coordinate values of each vertex and the vertices of each face constitutes a sequence (cord the Index). Need to give the material objects, but also need to calculate the object map file path material coordinates (Texture Coordinate,) and the material sequence (Texture Coordinate Index) calculated the relative 3D coordinate calculation is complex, space is limited, no detail. Following is described to open VRML Pad VRML model which is a cut slope example (Figure 1), from which you can see using the VRML description of the road model is effective in terms of material coordinates, data accuracy, and performance practices are the superior general modeling tool.

It can be seen from the above, VRML language describes the clear three-dimensional scene structure, high efficiency, which will help computer program based generated.

4. WEB-BASED 3D MODELING TECHNIQUES

4.1 Introduction of VRML

Virtual Reality Modeling Language of VRML (Virtual Reality Modeling Language) is a 3D modeling language for the description of a platform-independent interactive 3D worlds and objects, is the core of the Virtual Reality features 3Dweb technology. It to 3D, 2D, text and multimedia integrated into a unified whole, with the

functionality of the Internet combine to produce a new

Interactive applications: Application of VRML, you can create a strong interaction with surfers, closer to the real world, participate in virtual learning space, providing a more natural learning experience.

VRML has the following characteristics:

(1) Interactivity. VRML provides a rich interface for receiving the input operation and browse communications, VRML event passing and programmable so that it has human-computer interaction, that is, when users want to control each object, change its running direction and outcome of the real part to throughout the process.

(2) Platform independence. The VRML written documents can be run on any platform, it does not require precompiled to be directly demonstrated in the browser results.

(3) To support multimedia. VRML support for 3D sound and a variety of formats, audio, video and animation, the use of these features, can make their own virtual world more realistic.

(4) Structured. VRML elements of a good interface and describe a simple syntax.

(5) Scalability. VRML support user-defined node, and JavaScript, and Java language provides a call interface.

(6) Low bandwidth requirements. VRML transfer instruction code is to describe three-dimensional world, not rendering the scene, and thus significant savings in network bandwidth, while exploiting the processing power of client-side.

(7) Enhanced static scene. VRML2.0 in new features makes the scene more realistic.

4.2VRML Composition

VRML language from the prototype modeling, script, routing components: the prototype of which node in the domain into the event and a statement of the incident; the shape of the object scene graph nodes describe objects and their properties, VRML. The scene graph data structure creates 3D entities, including the geometric relationship, quality materials, texture, geometric transformation, light, point of view as well as a nested structure; script is a set of procedures as part of the implementation of an event cascade, a Script node contains a Script program, this program languages such as Java or JavaScript to write the script can accept the event, processing the information in the event, and

produces output events based on the results; route is to produce the connection between the channels in the event and receive nodes. VRML composition is shown in Figure 1.

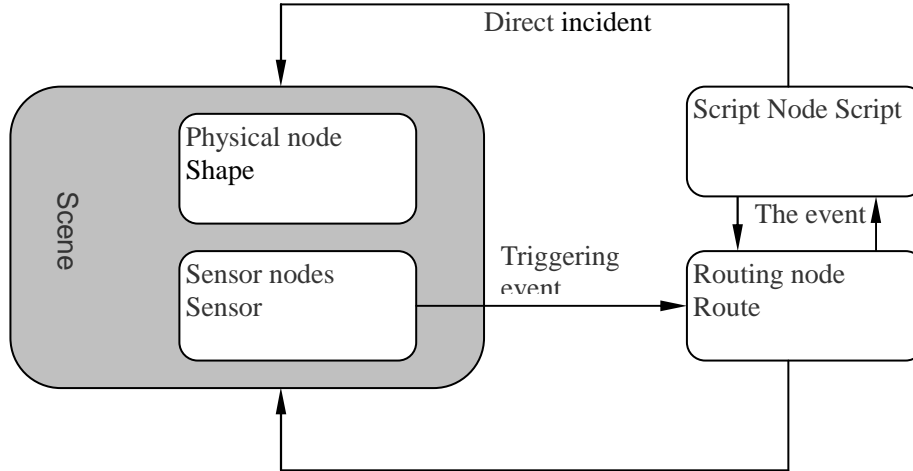


Figure 1 VRML Composition

5. WEB-BASED THREE-DIMENSIONAL MODELING

5.1 Create Three-Dimensional Model

VRML technology creates 3D models by the following way.

Using VRML programming to build the scene model is relatively simple, more suited to be used to create the shape of a relatively simple model, manual programming is more difficult, but when the complexity of the model structure.

For example, the following procedure is to use the VRML language programming to create a radius of the sphere of the source code.

Of VRML V2.0, the utf8

```
Shape {
  appearance {
    material Material {}
  }
  geometry Sphere {
    radius 3
  }
}
```

borrowed third-party 3D modeling software modeling:

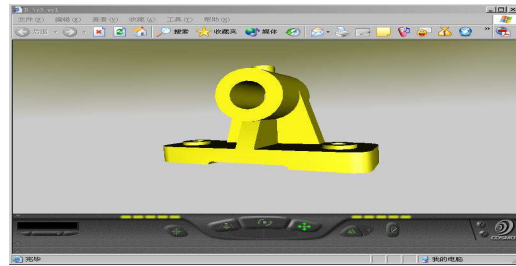


Figure 2 VRML Modeling With Third-Party 3D Software

Construct the complex structure of the model object by VRML programming efficiency is low, we can use third-party 3D modeling software and VRML phase: a three-dimensional solid model using a three-dimensional modeling software, AutoCAD, Autodesk Inventor or SolidEdge built a good model file input to the 3DSMAX 3DMAX in effects processing, and then use the 3DSMAX VRML interface output for the VRML model. VRML solid model created using the method shown in Figure 2.

The use of Matlab VRML modeling: Matlab software provides a virtual reality creation tool for modeling, running Matlab vrbuid2 editor in vrbuid2 environment can quickly and easily VRML modeling. Its features are: three-dimensional modeling, visualization and VRML source code to edit and modify the settings of the virtual scene immediately reflected in the model window. It also can use the Matlab toolbox institutional simulation.

VRML modeling with vrbuid2 is shown in Figure 3.

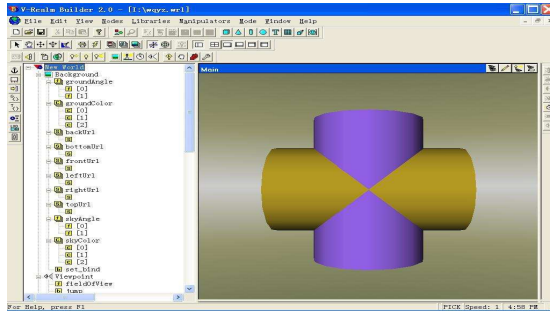


Figure 3 VRML Modeling With Matlab

5.2 The dynamic interaction

VRML modeling needs to build and modify virtual reality scenes, including: the set of interactive features of the design, spatial point of view, browse the design of the way.

The interactive features of the design: Order to be able to simulate the real world, the virtual reality scene VRML model needs users to participate in the action to make a variety of responses, this function is called interaction. Virtual reality technology has interactive features through a set of sensor nodes. VRML provides nine kinds of sensor nodes, whose role is to detect the user's behavior, to provide interactive and dynamic response behavior to meet the real interaction between the user and the computer, allowing users to have total freedom to manipulate, control objects in the VRML environment.

Figure 4, Figure 5 threaded assembly, for example, when the user mouse moved to be connected pieces at the three-dimensional model of the response action connection for auto-complete bolt assembly. Time sensor node, Time Sensor contact sensor node and Touch Sensor set, are based on mouse clicks to create route statement Route animation, animation playback control via a mouse click corresponding action according to user needs.

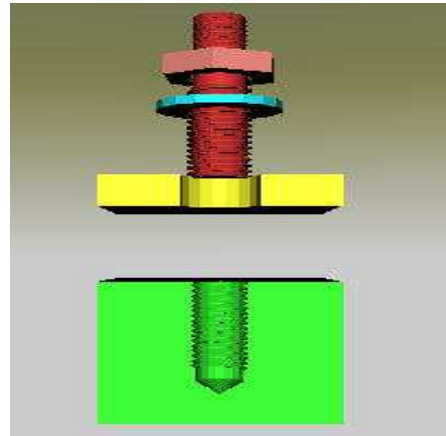


Figure 4 Initial State Of Model

Space point of view of set: Viewpoint node is able to navigate in the virtual world of space viewpoint for effective control. Viewpoint node in the virtual world pre-set the appropriate space point of view, users can have a general understanding of the virtual model, and switching the observation point of view you can grasp the shape of each side of the model. Figure 4 virtual environments, the use of four Viewpoint node, respectively, front, top, left and front-left, said the model view, top view, left view, and three-dimensional diagram. Here is part of the source code space viewpoint set:

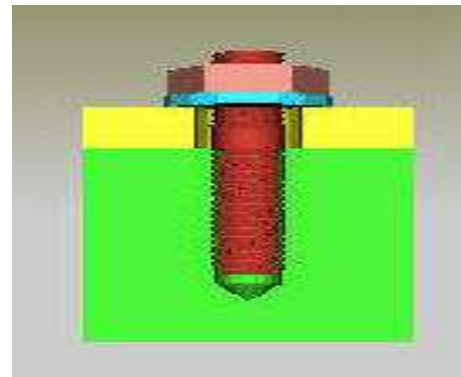


Figure 5 Interoperate Complete Thread Assembly

```
Viewpoint {
    position 0.0 0.0 200.0
    description "front"
},
Viewpoint {
    position -135.0 0.0 0.0
    description "left"
    orientation 0.0 1.0 0.0 -1.57}
```



VRML editor, the position of the space point of view, orientation, field of view, modify parameters, but not real-time display of results, it is difficult to grasp. Use the 3DMAX or the Matlab vrbuild2 editor, and space point of view has the ability to easily set up and edit.

The design of browsing: Users view a virtual reality model, so you need the help the browser, such as cosmoplayer, live3D. When the viewer through the VRML browser view these models, in fact, is to simulate a real person in the virtual world move to observe. VRML virtual world, browse the WALK, the FLY, EXAMINE, NONE four kinds. Navigation Info node can set various parameters browsing, browsing, speed and effective control.

Here, we describe our problem as following. There is a time-sensitive distribution network. The network consists of two layers. The first one is the wholesale distributors and the second layer is the retailers.

In this distribution network, there are N retailers that can be served by M wholesalers. We need to ensure the entire retailer can be served and choose S wholesalers to serve them. $w_j (j = 1, 2, \dots, N)$ is the demand of each retailer. $t_{ij} (i = 1, 2, \dots, M, j = 1, 2, \dots, N)$ is the responding time of wholesaler x_i to retailer y_j . p_{ij} is the time parameter and its value is determined by t_{ij} .

Two sub objectives are considered in our modeling; they are benefit maximization and benefit equity maximization. If we treat distribution system as a whole economic organization, we cannot sacrifice benefits of some demand nodes to maximize the benefits of other nodes, so we emphasize economic benefit equity.

6. CONCLUSIONS

VRML modeling techniques used in network 3D model library create a Web-based three-dimensional virtual reality space, to provide learners with a good interactive feature of the online learning environment, and can contribute greatly to the teaching and learning of engineering graphics course. If combine the VRML modeling techniques and software together, you can also complete the Web-based Products, virtual assembly, agencies simulation, not only can become a good means of teaching aids, but also for the company, product R & D, production and sales design, display platform.

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