

# Virtual display and digital realization of furniture products

Weirong Wang <sup>1,2,\*</sup>

<sup>1</sup> Zhejiang Gongshang University Hangzhou College of Commerce, Hangzhou, China

<sup>2</sup> Department of Art, Kharkiv National Academy of Art and Design, Kharkiv, Ukraine

**Abstract.** In this paper, the three-dimensional display system of furniture products combines the three-dimensional model and the image. Thus it can better show furniture products and their scenes in the shape of 3D in front of all users. In addition, the design of humanized interaction and artistic interface enhances the sense of reality and visual aesthetic in the process of the products browsing experience. According to the specific demand, this system chooses the method of three-dimensional transformation which uses two-dimensional graphics afterwards. At the same time, it uses the pictures of the real furniture products which are treated as mapping in order that model texture could realize the reality of the real furniture and improve the speed of the system in turn. Meanwhile, in order to simplify the mode, it makes use of LOD technology or a two-dimensional image as texture mapping.

## 1 Introduction

With the rapid development of the economy and the continuous improvement of people's requirements for quality of life, furniture products have become one of the important consumer goods in people's lives, and the marketing methods of furniture products are also constantly breaking through. Today's furniture product display methods mostly stay in the use of pictures and text information and other traditional two-dimensional level, consumers are difficult to dynamically understand the selected products, and the three-dimensional display form with rich expressiveness has the incomparable advantages of two-dimensional flat images. The three-dimensional display form can show the appearance of the product in an all-round way, and can also use interaction to demonstrate the function of the product, so that you can make full use of digital multimedia means to display product information, so as to achieve the purpose of promotion.

The three-dimensional display system of furniture products constructed in this paper puts various furniture products in a three-dimensional virtual environment for all-round, interior and exterior expression through three-dimensional modeling, and then uses appropriate material maps to make these three-dimensional models more realistic, and begins digital interactive technology to achieve interactive \*functions.

## 2 The overall design of the system

### 2.1 User needs analysis

The demand analysis of the three-dimensional display system of this furniture product mainly considers the following aspects:

- (1) The product display method adds a three-dimensional browsing mode, and users can observe the product from multiple angles, and can change the material for the product.
- (2) Users can see rooms with different scenes in the exhibition hall, and can experience the authenticity of the product in multiple ways by changing the color of the wall, floor and furniture of the room.
- (3) Users can learn about product production by watching animations or videos.
- (4) Create a friendly man-machine interface, so that the external form and internal mechanism of the user interface meet the needs of different users.
- (5) The design of the system should take into account the convenience of installation, configuration and maintenance of users as much as possible.

### 2.2 Overall framework of the system

#### 2.2.1 The function of the system

Through the study of related technologies, the three-dimensional display platform of user-oriented furniture products is constructed, which aims to break the traditional product display mode, and use three-dimensional modeling technology and interactive technology to realize the three-dimensional interactive browsing of the display platform.

The functions of this system mainly include: providing users with three-dimensional product virtual

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\* Corresponding author: wangwr@126.com

scenes to achieve interactivity; The construction of 3D models is combined with image processing to ensure that users can browse the information of the product, and can change the product style, ground color and scene environment through interactive operation, so as to enhance the realism and realism of the product browsing experience.

### 2.2.2 The composition of the system

The main elements that constitute the three-dimensional display system of furniture products are system scene, system interaction, system operation and testing, etc. System scene modeling is the main part of the system, which determines the main style and picture quality of the system. System interaction is mainly for users, is a bridge between connecting the system and users, through interaction design users can independently change materials, colors and environments, more clearly understand the characteristics and functions of furniture products. System operation and testing is mainly to verify the operating status and stability of the system.

### 2.2.3 System development process

The development process of the three-dimensional display system for furniture products is shown in Figure 1.

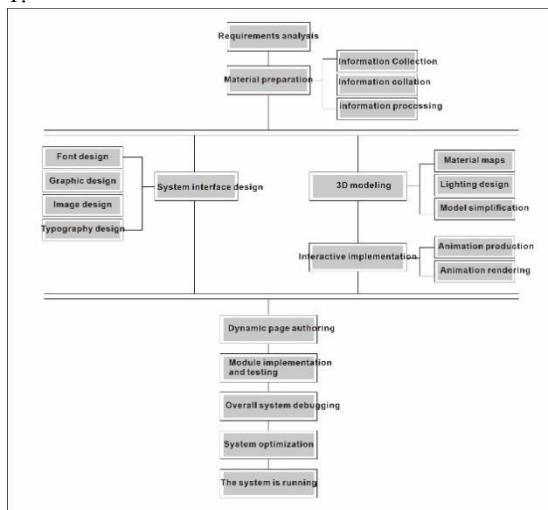


Fig. 1. System development process

## 2.3 Detailed design of the system

### 2.3.1 System scene design

The three-dimensional display system of furniture products is a system that realizes the matching and placement of indoor furniture in different scene environments and the virtual display of three-dimensional effects. In order to allow users to have an immersive feeling when entering different scenes, it is necessary to pay attention to the design of display scenes:

First of all, by processing the image to a certain extent, pay attention to the material map and lighting settings when building the model, so that it is closer to the real thing in the real scene.

Secondly, by controlling the appearance of each model other than the furniture model, such as walls, lamp styles, carpet decors, curtain fabric patterns, etc., so that the furniture shows its own style characteristics.

### 2.3.2 System interface design

The main interface design that determines the system interface is the overall main interface design and the icon design in the interface. As a three-dimensional display of furniture products, its interface design should be fashionable, exquisite, and bring people a fresh visual experience, so the overall style needs to be simple and generous. In the selection of interface color style, the basic interface background color is bright white, plus a faint linear pattern and geometric elements of the logo, the composition is fresh and elegant, the same interface color should not be more, try to avoid incompatible colors together.

### 2.3.3 Button icon design

Buttons are diagrams that allow users to click to perform an action, which can be rectangular, circular, or arbitrarily shaped, or even text-only buttons. The button state of this furniture product display system takes the actual use needs as the starting point, and selects the default state, mouse up state and click range state. The button is black, which is different from the shading color, giving a three-dimensional dynamic visual experience.

## 2.4 Selection and application of system development tools

In the establishment of three-dimensional model and model integration, the three-dimensional display system of furniture products chooses to use two-dimensional drawing technology and three-dimensional modeling technology to establish a three-dimensional scene model, and uses the corresponding technology to process the face sheet, and accelerate the computing speed of the entire system by reducing the computer capacity, so as to achieve the real-time effect of the system. In terms of model map production, the two-dimensional flat image collected from multiple angles of furniture products and processed is used as material map material to achieve authenticity and convenience. In order to realize system interaction and interaction design, combined with the characteristics of the system itself, the virtual technology development platform is used to achieve a dynamic interactive experience.

## 3 Key technical analysis of three-dimensional display system for furniture products

### 3.1 Construction of scenes

#### 3.1.1 3D modeling

The establishment of the three-dimensional model is the basis for the realization of three-dimensional display of the entire furniture product. This system draws the dimensional structure lines required for modeling through AutoCAD, and then directly extrudes the solid model into 3D software, which can improve the accuracy and efficiency of modeling

### 3.1.2 Materials and textures

After the model is established, the model should be assigned materials and textures, this system in order to make the model map can reflect the texture of different objects, and the structural complexity of the surface texture of the object can also be reflected, the use of on-site physical photos, and Photoshop for cutting, stitching and other processing and obtain bitmaps as the map of the stereogram object. This does not affect the real effect, and the implementation operation is not complicated. Take a stool as an example, select the corresponding material, and assign the material and texture to the model to achieve the effect of material rendering.

### 3.1.3 Baking technology

Baked mapping is a way of turning lighting information into a texture, and then applying this texture to the scene. The model is baked to fuse the original texture information and lighting information to form a new map, so that the amount of computation will be smaller when the scene is rendered, saving time. At the same time, since the rendered texture directly carries the information of the lighting, it enhances the realism of the entire scene.

### 3.1.4 Model simplification

In the entire three-dimensional display system of furniture products, there will be a large number of three-dimensional models in the three-dimensional scene generated by three-dimensional software, and the model will affect the running speed of the computer, so in the process of scene modeling, LOD technology or texture mapping can be used to reduce the number of model surfaces and enhance the realism of the picture. In addition, for objects that are always facing the viewer, using a two-dimensional image in the scene and rotating it can have a three-dimensional effect without real modeling without affecting the sense of realism.

## 3.2 Display platform interaction design and production technology

### 3.2.1 Action scripting technology

A considerable part of the interface of this system is to complete special animation settings through script settings. ActionScript commands can be divided into timeline commands and touch commands according to different settings. The timeline command refers to the command effect produced after setting the command, without the premise of human-computer interaction.

Touch command refers to the setting of the command, the presentation of the command effect must be through human-computer interaction, through the user's operation, to see the effect of the command, is the main way to show the effect of human-computer interaction.

### 3.2.2 Button technology

Buttons play a key pivotal role in human-computer interaction, encoding Action Script commands through button elements. This system uses the way movie clip symbols are created to create dynamic buttons to achieve button diffusion animation.

Create a button symbol named "anniu". Place the content of the first movie "bounce" in the keyframe of the bounced state, place the content of the second movie "after" in the keyframe passed by the pointer, and copy the content of "anniu" on the keyframe of the clicked keyframe so that the range of the button sensing area is consistent with the size of the button in the bounced state.

### 3.2.3 Mouse tracking technology

Before the user clicks the button, the mouse can pop up a dialog box through the button, telling the user the role of clicking the button, combined with the location of the button, the user clearly predicts the result of clicking the button to determine his own selection path.

Create a new layer and type "Click here to change the color for the wall" via the text tool to place it above the color patch. Select the color block and fill it with a linear gradient in the color mixer to complete the color adjustment.

Select the layer keyframe, select the startDrag command in the movie clip control in the action, and write the AS code:

```
startDrag("track", true);
```

The next step is to go to the "anniu" button symbol editing center, create a new layer 2, establish a blank keyframe on the "pop-up" keyframe, insert the movie symbol "track2" on the "pointer over" keyframe, and "click" the content to copy the content of layer 1 so that the button sensing range is consistent.

The keyframe over which the pointer of the button passes is the technique of a movie clip symbol, and the user moves through the range of the button to play the effect of softening the edge.

## 3.3 Image information acquisition and production technology

### 3.3.1 Acquisition of image information

The shape, pattern and color of furniture and other information can be obtained by photography, in order to ensure the quality of post-processing and reflect the detailed characteristics of furniture, attention should be paid to the accuracy of the picture obtained. It is necessary to consider the different lighting forms that the furniture should have due to the differences in physical objects. For furniture of different materials and different volumes, shoot according to the reflected light

index of the entity to achieve accurate exposure. Understand the relationship between distortion and distance to reduce distortion.

### 3.3.2 Image processing

The next is to use the Lens Correction and other commands of the Distort command group under the Filter Options in the Photoshop file to solve the image defects caused by photographic hardware limitations such as perspective distortion and shadows.

Precise keying is achieved by establishing paths with anchor points. Use the Pen tool to establish a straight path and drag to create a Baez curve path. Adding or subtracting anchor points facilitates the creation and editing of object paths. Edit the normal anchor point to obtain the conversion of the straight anchor point to the curved path to make the path more consistent with the shape of the object. Then use the path conversion selection function to turn the established path into a selection.

Process the hue, saturation, contrast, and brightness of your images with curve tools, filters, smart sharpening, and de-screening. the comparison of furniture photos before and after distortion adjustment, keying and bottoming, and display effect adjustment.

## 4 The realization of three-dimensional display system for furniture products

This system takes the wooden door display as an example to introduce the design and production of Logo, the establishment of the three-dimensional scene environment, the specific implementation of the wooden door display and system interaction.

### 4.1 LOGO design and production

The graphic of the logo uses the letter "H" as the main design element, and the overall form is the state of the door open, which is unique and unobtrusive. The overall composition pays attention to simplicity, pays attention to the reasonable layout of text and graphics, and the font color is presented in 25% grayscale, which is coordinated with the interface background color.

### 4.2 Scene Modeling

(1) Through AutoCAD, the overall frame of the restaurant and the internal props are drawn according to the designed dimensions, stored as a recognizable version of 3DS MAX, and the height and thickness of the wall are made using the relevant extrude tools to obtain the basic main structure model of the restaurant background wall.

(2) To use the line tool to draw a linear frame on the elevation view, and use the lofting tool to loft the corresponding linear frame to obtain a decorative line effect.

(3) To use the Material Editor tool to select the relevant floor tile materials from the material library for floor tile

material mapping, and complete the setting of reflection, shadow, projection and other related data.

(4) To use the lights tool to make certain adjustments to the color, brightness, light and shade, shadow, and angle of the light as needed.

(5) Through repeated renderings and meticulous lighting adjustments, the desired effect is achieved.

(6) Through Photoshop layer composition and layer effect technology, the reflection, projection and reflection of furniture are processed to make the scene more realistic.

## 4.3 System interface implementation

The interface of the three-dimensional display system of the entire furniture product should be beautiful and generous, simple and smooth, easy to operate, and harmonious in color, which not only has a certain sense of design and interest, but also can reflect the characteristics of the system, so that users can see at a glance.

### 4.3.1 Intro implementation

The title is the first impression to the user, this title is displayed dynamically through the abstract way, using the Logo graphics processed by artistic means, and automatically and quickly enter the welcome interface after display.

### 4.3.2 Interface implementation

The upper part of the welcome interface displays the Logo icon and welcome message, and the middle part is the living room, bedroom, dining room and toilet four scene displays, users can directly click on the picture to enter the corresponding scene module. Use gradient effects to make background colors, synthesize logos and texts, and complete the background effect of the welcome interface.

The scene renderings are converted into button elements and imported into the stage in the scene in the form of buttons.

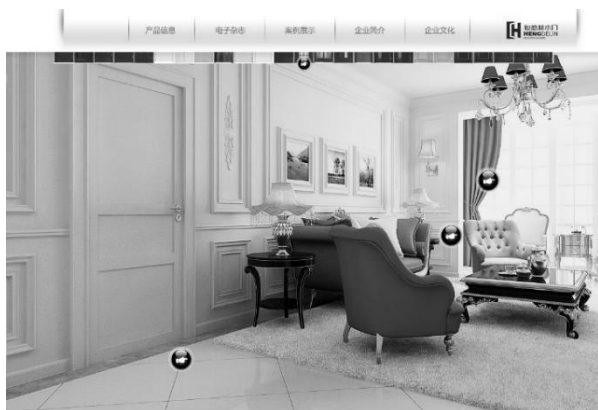
Import the left and right buttons, and create their own layers, select one of the buttons, set the "stop" command in the keyframe, select the button on the stage, set the command as follows:

```
on (press) {
    gotoAndPlay(2);
}
```

Through the settings of the AC command above, the implementation and control of the scroll effect animation is completed.

The renderings in each scene are button states, click on the respective renderings, and enter the four scenes of the dining room, bedroom, bathroom and living room, that is, enter the directory interface. This is shown in Figures 2.





**Fig.2** Table of contents screen

#### 4.4 Interactive Implementation

Through interactive operation, users can change the color of the wall and sofa, the material of the curtains and the floor, and can intuitively and truly feel the effect of different wooden doors with different colors and materials of furniture. The implementation of the interface interaction function is achieved through the storyboard, stage layout, and corresponding script behavior settings.

The next is to arrange the wooden door styles and store them in PNG format, and then set the navigation bar and restaurant renderings as two layers. The movement of the drawer menu is animated by the film technique.

The third step is to put the button in the new layer, set the keyframe command "stop", select the button on the Stage, and set the global function to:

```
on (press) {  
    gotoAndPlay(2);  
}
```

In the next two keyframes, the same command "stop" is set, and the same global function command is set to complete the drawer-like movement effect in the way of a movie.

The final step is to import the perspective wooden door into the layer, convert the wooden door into the graphic state of the first condition for moving animation by converting the graphic commands in the symbol, establish another keyframe and use the tween technique to complete the entire animation replacement effect.

#### 5 Conclusion

According to the characteristics of the three-dimensional display system of furniture products, this paper proposes the design and development scheme of a three-dimensional display system of furniture products by integrating the advantages of related technologies. Analyze the relationship between the various links of the three-dimensional display system, establish the structure, function and specific development method of the three-dimensional display system, and make a more comprehensive overall design of the three-dimensional display system of furniture products. Through the arrangement of scene three-dimensional modeling method, interface interaction realization technology and

image processing technology, the production of three-dimensional display system of furniture products was realized, and the original idea of the design was verified by testing.

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