

Design and Application of Rendering Module of Online Furniture Image Processing Platform

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Abstract. In the steady development of social economy, the application level of computer hardware and software is getting higher and higher, and the professional modeling and graphics processing technology software is becoming more and more mature, which provides a new platform for online furniture design innovation in the new era. On the basis of understanding the modern online furniture design platform, this paper studies related technologies of photorealistic graphics and rendering cloud computing services, and completes related design optimization while providing 3D display, interactive functions and photorealistic rendering functions, and finally verifies the application advantages of the overall platform module.

Keywords: Furniture; Graphics Processing; Rendering Module; Internet.

1. Introduction

Cloud computing technology, as the main trend of modern technology research and application promotion, has become an important direction for the migration of enterprise hardware and software services in the IT industry. For example, the traditional office software requires users to purchase installation CDS and spend a lot of time on the computer platform to install a file of about one G, while the online version of office is now used. Users do not need to install, do not need to spend time waiting, and even individual users do not need to buy, they can use all the functions provided by traditional office products, while sharing their own documents on the network, which for enterprises, can reduce the work pressure of file servers, coordination office efficiency and quality are getting higher and higher. In essence, cloud computing refers to the use of the Internet platform to provide software services, through the web browser interface to achieve various functions. Users do not need to install server or other client software to join the cloud computing, they can access the Internet access operation anytime and anywhere, this service model is also known as software as a service. For Autodesk, traditional users are professional users who use professional software and professional knowledge such as CAD to complete design operations in various fields, and some ordinary users carry out simple design activities, such as interior design and clothing design. Under the restrictions of traditional technology platforms, the design operation of ordinary users is difficult to achieve, but after the promotion of cloud computing platform, ordinary users only need to put the data in the cloud, and they can design and interact through browsers or mobile devices. Therefore, with the continuous development of social economy and science and technology, now provides an online version of furniture design tools for user design, which includes 3D rendering and realistic rendering functions, which can not only solve the technical hardware limitations, but also simplify the design operation steps and reduce the design threshold.

Nowadays, rendering has been widely used in many fields such as computer simulation and TV special effects, and it is the focus of 3D image technology research. Essentially, rendering refers to the entire process of using computer software to generate images from multiple models within a model or scene. Common rendering forms are divided into two types, one refers to real-time rendering, such as simulation or games, usually 20 to 120 stitches per second, which will be the minimum rendering speed acceptable to human eyes as the basis for fully demonstrating the reality of high-

quality photos; The other refers to realistic rendering, such as video, which is often seen in complex image scenes, rendering time is a few seconds to a few days, and there is no strict distinction between the two, but there are studies that pay more attention to the realistic effect, and it is believed that with the continuous improvement of science and technology, the two kinds of rendering can be gradually integrated.

There are more and more rendering algorithms, but the software used for rendering usually uses a combination of techniques to get the final image. From the perspective of practical application, tracking all the light particles in the scene takes a long time to calculate, even if only the tracking part needs unlimited time. Therefore, some scholars have proposed several more effective optical transmission modeling technologies to study the corresponding algorithms, which can be divided into four types: first, it refers to rasterization, which projects the objects in the scene onto the video surface, thus forming an image; Secondly, it refers to the light projection, which will observe the scene from different angles, combining the basic optical response, reflection intensity and geometry calculation to observe the scene; Third, it refers to the radiosity, which mainly calculates the light channel when the light leaves the light source to illuminate the surface of the model, and then uses other algorithms to render; Finally, ray tracing, which uses the Monte Carlo method to achieve real results, effectively reduces the rendering speed. After understanding the functions of online furniture design platform and rendering module, this paper systematically studies the design idea and application algorithm of the module according to the basic requirements of the rendering module, conducts testing and analysis in combination with practical applications, and finally clarifies the application direction of the rendering module in online furniture design platform.

2. Method

2.1 Online Furniture Design Platform

The online furniture design platform is composed of a browser, which supports users to complete the design operation in 2D and 3D view, and can provide users with a rich choice of product functions, the specific structure is shown in Figure 1 below:



Figure 1. Structure diagram of online furniture design platform

From the perspective of client structure, on the one hand, it refers to the interactive graphical interface based on flash format, which is convenient for users to operate and use the design editor, and the other part refers to HTML and JSP pages. Among them, the design editor is divided into the following modules: First, the 2D designer. Users can create, open and delete the design collection to complete the furniture design according to their own needs. Users can also change the perspective by

zooming in, out and dragging the canvas. Users can also view the list of items currently designed or export the design format pictures to share their design results on various platforms. Second, the 3D designer. Users can directly view the three-dimensional effect of the current design, change the wall picture, adjust the height of furniture such as closets, etc. Third, the product catalog. Users can add various operations in the product catalog on the right side of the editor, such as rooms, walls, etc., and adjust various parameters while designing the room; Fourth, product behavior rules. The product has the design arrangement rules that comply with the general rules. If the item definition has certain rules, the system will place the item independently according to the defined rules; Fifth, effect management, which includes creation, modification, modification and sharing, etc., this part of the function can provide interface support for the rendering function.

2.2 3D Rendering Module Requirements

The 3D rendering module is also known as generating 3D effects of 2D designs. In the platform editor, users can design room drawings and place furniture. The furniture model is provided by a professional team, which contains 3D models and rendered pictures from every Angle from zero to 359 degrees. By rendering rooms and furniture in 3D renderings, users can get a true 3D effect in the correct cropping and blanking. From the perspective of non-functional requirements, 3D rendering has two requirements: on the one hand, real-time. In the case of users switching to 3D view, you can get the corresponding renderings as soon as possible, but it is likely to involve multiple items, loading the image takes a lot of time, but this will not affect the real-time operation of the system, and can react as soon as possible when changing colors or dragging items; On the other hand, correctness. When using existing items, ensure that most of the situation is correctly cropped and hidden.

2.3 3D Rendering Module Application Algorithm

In essence, 3D rendering function is based on 2D view rendering 3D view, at this time the 3D view is not a real 3D model, but the effect of adding the depth value of the item through the image, all the item model is just a picture, each item has 360, vertical Angle is 0, horizontal Angle from 0 to 350 degrees of the picture. In the rendering process, there are many algorithms that can effectively sort, which can be divided into the following types:

First, scan line algorithm. This method will sort the vertices according to the order in which the y coordinates appear, calculate each row or scan line of the graph using the intersection of the scan line and the previous polygons in the list, and calculate down the image to update the list and discard the invisible polygons, as shown in Figure 2 below:

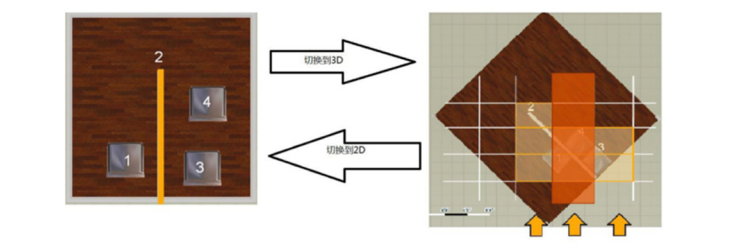


Figure 2. Structure diagram of scanning line algorithm

Second, the ray tracing algorithm. This method is a technical method based on geometric optics, which uses the principle of ray tracing to obtain the relative distance from the object to the vision, and thus regards it as the depth value of the object. To detect the Angle of the object and the wall, for example, the right-most wall should be selected as a side first, and the point of the camera should be combined to form a triangle. Detect the bounding box intersection of triangles and other objects, first draw the wall on the right side and then draw the object, traverse other objects and walls, and finally merge all the results.

Finally, the sorting algorithm. Combined with the sorting algorithm flow chart shown in Figure 3 below, it is possible to grasp the depth value and put the sorting result into the cache:

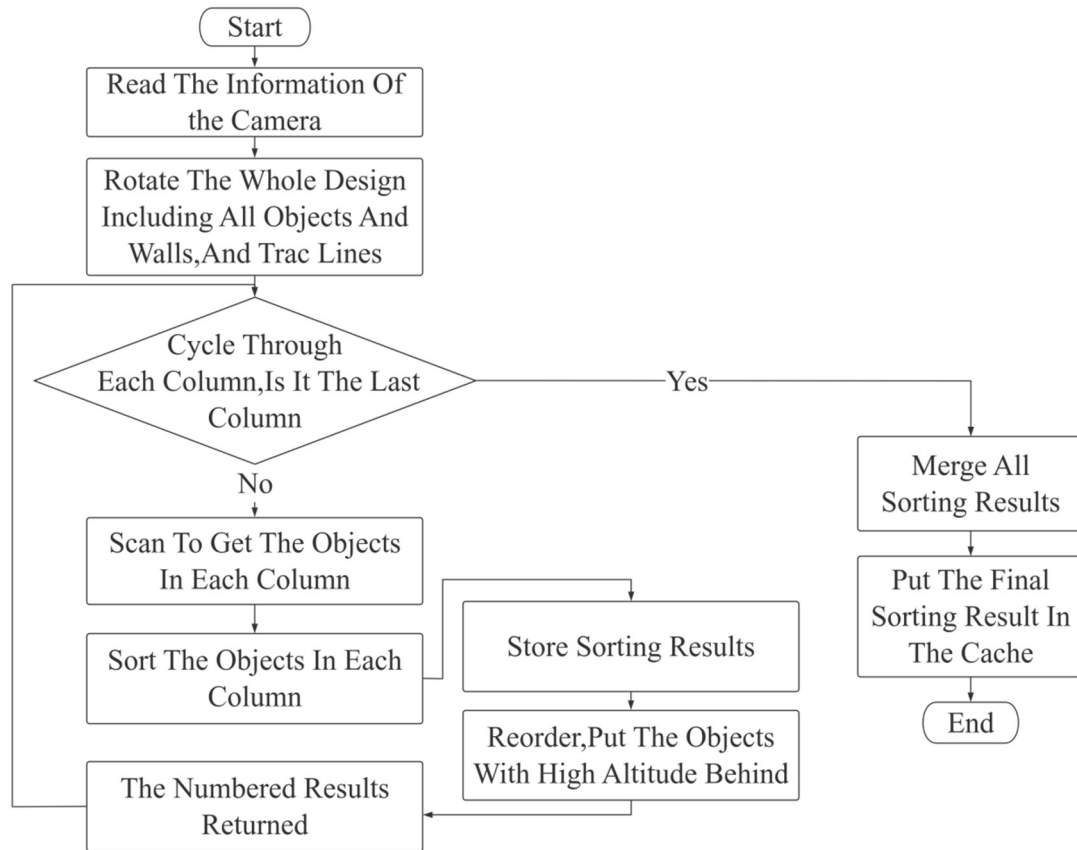


Figure 3. Flowchart of sorting algorithm

2.4 Rendering Module Design Operation

Combined with the rendering function architecture diagram shown in Figure 4 below, it is applied to the online furniture design platform. The client can obtain the server operation by using the interface upgrade. The server side will be divided into three modules according to the interaction level or division of labor, one is the rendering portal of the effect diagram, the other is the data conversion module, and the third is the rendering service scheduling.

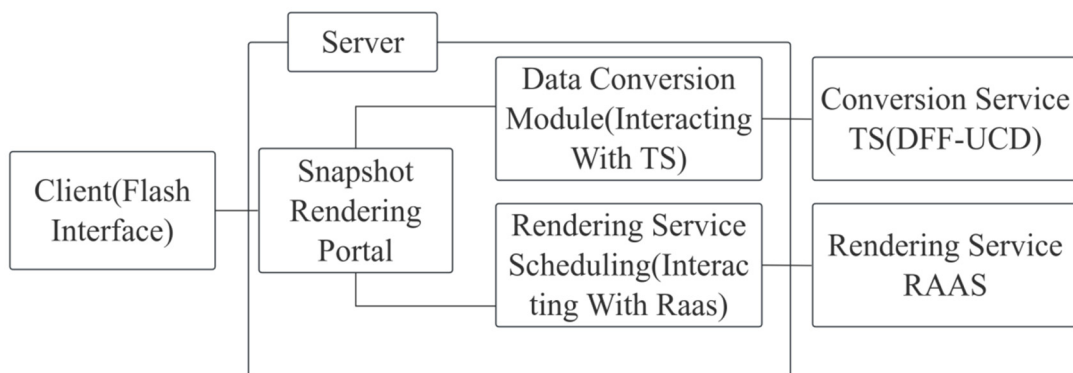


Figure 4. Architecture diagram of rendering function

Taking the data conversion module as an example, it mainly obtains the data provided by the rendering portal of the renderings, converts it directly to the server, generates UCD packages for files in DFF format, and returns the corresponding connection to the uploaded file server. At the same time,

it can set the material information in the design file to RaaS material information. Finally, UCD file connection and material mapping information will be returned to the rendering portal. Figure 5 shows the file format of the sample design:

```
<FloorPlan id=""_bt:a2a2c9c6-f14d-13dc-c9ad-ae23237ec067" version="2.4"
  conversionFactor="0.288" unit="IMPERIAL" baseBoardEnabled="true" baseBoardHeight="4">
  <Room id="Room:f4aae2d3-9422-9c63-0b0d-63c2c5df1ed1" materialId=""
  counterTopMaterialImageURL="http://***.com/**/H4eIAAAAAAAAAA8NOCfaOd3GzHj1wNDBwRj7T9dV1CQ3QWITaAAIAOc-8zh0AAAA/Top.png"
  baseBoardEnabled="true" baseBoardHeight="4" baseBoardMaterialId="" rotation="0">
  <Walls>
  <Wall id="Wall:b0caf044-b5b1-9ac5-70bb-ec0b52a1df8" materialId="" baseBoardMaterialId=""
  startPoint="1486.6127999999999,1271.3904" endPoint="1656.5328,1271.3904"/>
  <Wall id="Wall:5750fe24-1f5a-e37d-b88e-744d6635d34f" materialId="" baseBoardMaterialId=""
  startPoint="1656.5328,1271.3904" endPoint="1656.5328,1441.3103999999999"/>
  <Wall id="Wall:d78a153e-6e10-6bc3-e253-bbf06437a7e" materialId="" baseBoardMaterialId=""
  startPoint="1656.5328,1441.3103999999999" endPoint="1486.6127999999999,1441.3103999999999"/>
  <Wall id="Wall:cefa83e28-55d3-cd24-4948-098a590d1ec4" materialId="" baseBoardMaterialId=""
  startPoint="1486.6127999999999,1441.3103999999999" endPoint="1486.6127999999999,1271.3904"/>
  </Walls>
  <DivWalls/>
  <Content>
  <ContentItem id="ContentObject:7c6b4bd-7066-fd44-15c2-0e8423338d29"
  angleStartIndex="1" type="CONTENT_SEATING" typeId="H4eIAAAAAAAAAA8NOCfaOd3GzHj1wNDBwRj7T9dV1CQ3QWITaAAIAOc-8zh0AAAA"
  disableRules="" behaviorType="SEATING+SOFA"
  categoryTags="FURNISH/LIVING_ROOM/SOFA,SWELL/FURNISH/LIVING_ROOM/SOFA"
  startPoint="1542.7728,1331.8271999999999" rotation="0" depth="36.576" width="64.22399999999999"
  height="25.055999999999997" elevation="0" needsDepth="true">
  <AttachmentRules/>
  </ContentItem>
  </Content>
  </Room>
</FloorPlan>
```

Figure 5. File format diagram of the sample design

Take the depth sorting algorithm as an example. When switching to 3D view, the scan line algorithm is directly called and all objects and camera parameters in the canvas are regarded as input basis. The specific operation process is shown in Figure 6 below:

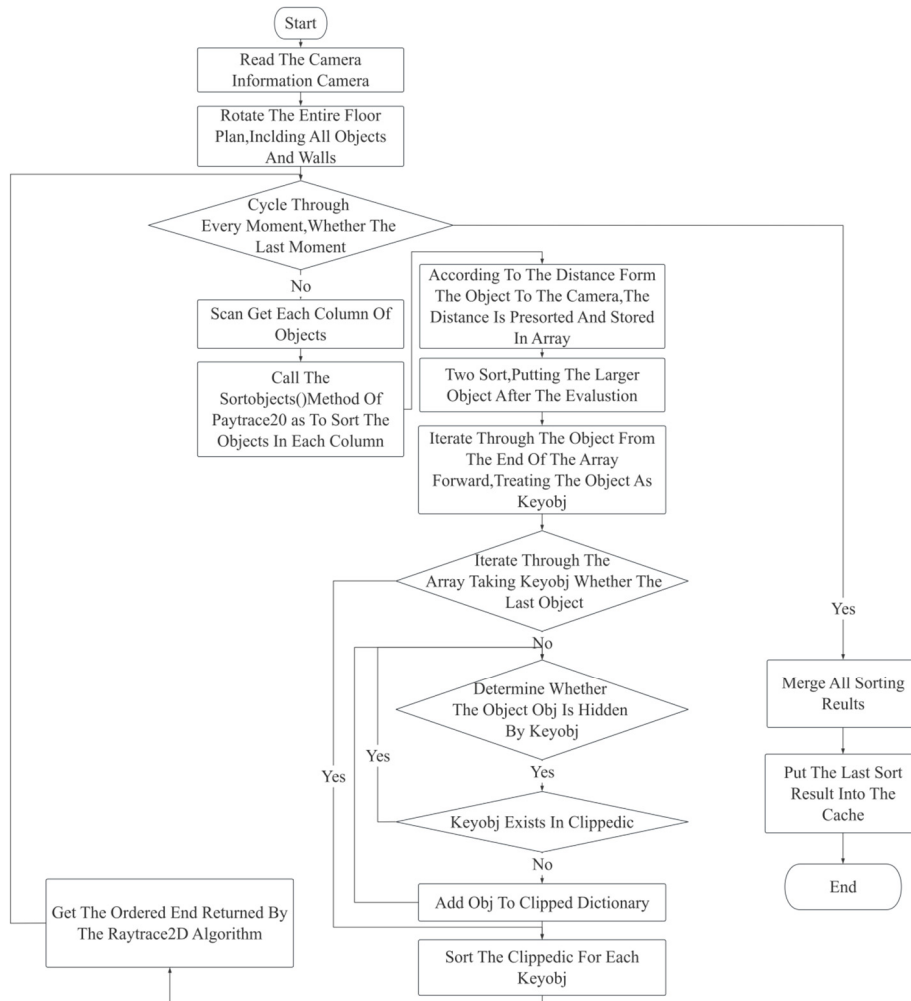


Figure 6. Flow chart of 3D rendering module

3. Result Analysis

According to the application design requirements of rendering module of online furniture image processing platform, functional testing, unit testing, regression testing, load testing, performance testing and system testing methods are selected for research, and the test is selected in two forms: manual operation and automatic operation. The final results show that with the continuous increase in the number of users, the number of system requests or higher and higher, the number of request failures does not change, the number of tests per second gradually increases, and the number of test failures does not change, which proves the important role played by the system module, the efficiency and quality of system operation are guaranteed, and the test cases and execution results meet the expected application requirements. And found a lot of problems, systematic study of test results and professional evaluation, can put forward effective solutions as soon as possible. Through the investigation and research of furniture design products and professional systems currently used in the market, it can be found that the renderings module can provide users with interactive interfaces, facilitate users to design and adjust the Angle of the renderings they want to obtain, analyze various format files of the online furniture design platform, use scheduling algorithms to complete the design tasks in an orderly manner, improve system processing efficiency and reduce user waiting time. Nowadays, various technical services are still being updated and reformed, and more effective module functions will be added in the future, so 3D rendering will also be optimized and innovated in combination with functions.

4. Conclusion

In summary, according to the basic needs of professional users and ordinary users for the rendering module, the 3D rendering module function is proposed in the existing furniture image processing platform, which can not only meet the potential needs of users, but also obtain high definition and realistic image files, which has a positive impact on the development of home technology in the new era.

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