Unity3D-based conference room scene preparation and construction

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Abstract. With the continuous development of society, the trend of digitally enabled online teaching is becoming more and more obvious. In order to ensure the quality of online teaching and add fun to education, teacher and student teaching should be combined with virtual scenes. This paper provides a simple example of a virtual classroom for teachers and students by introducing the basic operation of Unity3D engine, the design and construction of conference room scenes, and the implementation of drawing interaction functions and mobile devices porting and script editors to explore the possibility of adding a new form of teaching in 3D virtual space. The test results in this study show that the virtual scene can improve the interactive experience and bring immersion to users, which has some practical significance.

Keywords: unity3D development, online teaching, virtual indoor scenes, teaching interaction.

1. Introduction

With the continuous development of 3D technology, it has a richer and richer effect on the expression of object forms, bringing visual vividness and more realism to the user than 2D scenes. As a result, a large number of developers now prefer to build scenes and characters with the help of advanced 3D development software, and a significant portion of them choose to use visual advantages to develop game scenes with a strong sense of experience, or precise reconstructions of real-life buildings, etc. And in the rapidly developing modern life, digital learning highlights its advantages in both space and time, which are more in line with current educational advantages. In order to improve the form of online learning, it is of practical significance to combine 3D conference room scene construction with online education. This paper uses the Unity3D engine, understands the editing interface and 3D objects as the basis, then proceeds to create scenes, and finally uses the scenes to interact with users to improve the practicality (word painting writing, mobile porting) to achieve the construction of a simple conference room, carry out preliminary exploration of the effects of 3D teaching, so as to bring more possibilities for the future form of teaching, and also make further efforts to add more fun for students during the teaching and learning participation.

2. Unity basic operation and scene preparation

Unity3D as a more complete development engine, users can find the corresponding editing tools through the operation panel, intuitive operation and editing in the scene panel, also can import different three-dimensional graphics. Its built-in physics engine can simulate many real-life physical phenomena, such

as collision, gravity detection, etc. The light and shadow baking system can adjust the light and shadow effects of the scene, such as the shadow intensity, light color difference, and area of the light and shadow [1].

The Unityhub, a Unity resource manager, is a convenient way to manage Unity versions and personal development projects, and it is accompanied by tutorials that are friendly for both initial and advanced learning. It is important to note that in order to view the conference room scenes on mobile devices, one must download the Unity engine from Unityhub, if download it directly from the official website, people may not be able to add Android or iOS modules. The main teaching contents of Unity 3D-based game development course include Unity 3D basics, Unity scripting and common APIs, terrain scene editing, light source and light baking, etc [2].
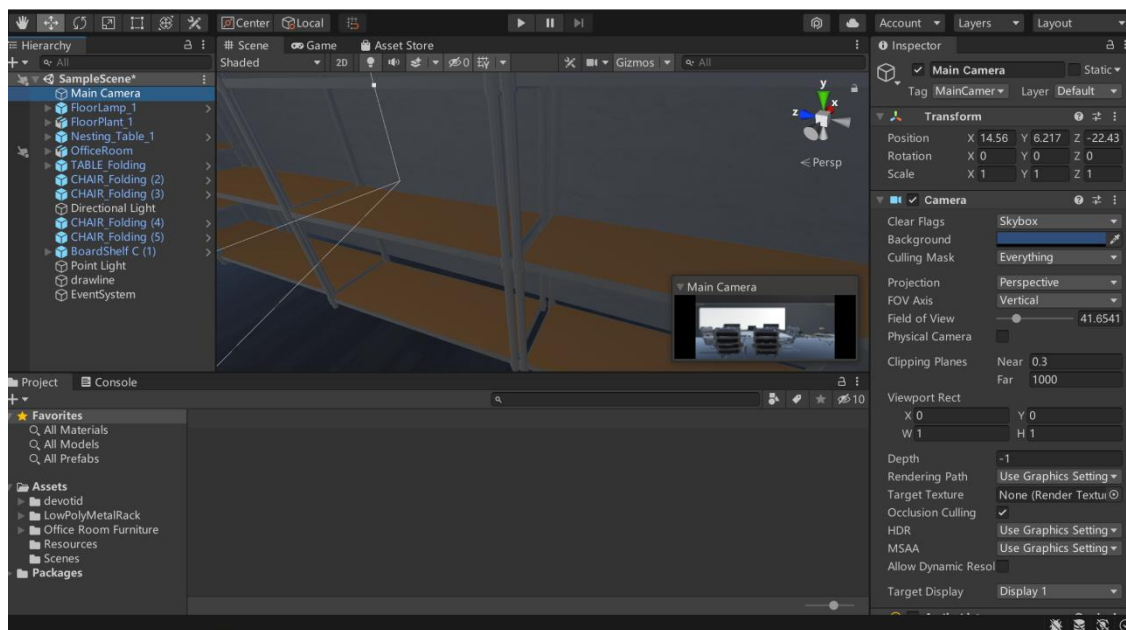
Figure 1. Unity working interface.

After choosing the 3D development module, people need to understand the home editor interface first. The editor interface is roughly composed of four major parts, left, middle, right and bottom, just like the one shown in Figure 1. The middle display part shows the 3D scene, in addition to playing and stopping the running of the scene, the content in the scene can be selected for adjustment, while scaling the viewpoint, rotating along the center point to change the viewpoint, pulling the viewpoint, etc. can be realized by a series of shortcut keys. The left panel lists the objects in the scene through a tree structure, making it easy to select multiple objects and add functions. When an object is selected, the right panel displays the object parameters for easy adjustment of object details and preferences. The bottom panel is where the files in the project are stored, whether they are script files or scene files, or script files and preset files.

Immediately after, you need to understand the creation of 3D objects (GameObjects), which can be imported from external 3D models in addition to the basic geometry and text and terrain provided in Unity. For example, a model made from 3ds Max with suitable materials can be imported into Unity3D, and the models can be combined to form a static indoor scene by "dragging and dropping objects" [3]. Each object is composed of different components. For example, Transform part, Mesh Renderer part, Collider part, etc.

Unity scripting is developed in C#, an object-oriented language that includes classes, objects, inheritance, polymorphism, etc. By using C# to implement concrete operations, we can deepen our understanding of the process of solving problems by computer, and make complex engineering problems "abstract, algorithmic, and automated" [4]. Specific functions can be achieved by dragging and dropping scripts directly onto the destination object.

3. The construction of the conference room scene

3.1. Scene construction ideas

The design idea of the meeting room scene comes from the main function of the meeting room. The developed conference room scene realistically reproduces the actual classroom and after-school scenarios, including the main meeting area for meetings or classes as shown in Figure 2 and the group discussion area for private communication in Figure 3, while basic daily necessities such as plants, stationery, electronic devices, floor lamps, and storage shelves are added to meet realistic needs. The practical applicability was also taken into account while considering the construction of the meeting room, so small parts of the interactive experience were added, such as writing functions and mobile browsing.
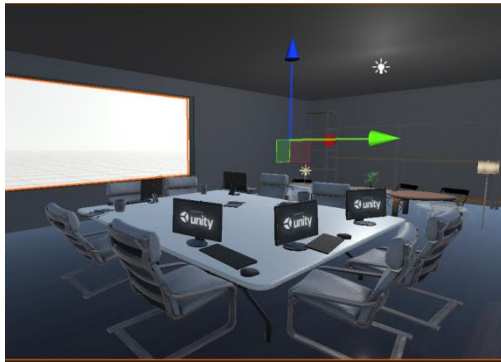
Figure 2. The main meeting area.

Figure 3. The group discussion area.

3.2. Preliminary scene construction

The conference room scene is built mainly by using Transform component to adjust the position coordinates, rotation angle and scaling of objects. Since there are more objects, you can link multiple objects in the same area into a whole, i.e., create a parent object and a child object in the left panel, so that by selecting only the parent object, all objects belonging to the parent object can be panned, rotated, scaled, etc. at the same time. If you need to align the objects when adjusting the position, you can select the four corners of the object to be aligned after copying the object to achieve quick alignment. The scene materials come from Unity's own resource store, which contains a variety of categories of resources such as environment, characters, props, tools, etc. You can also refine the resource categories according to your needs. Directly downloading objects from the resource store as scene objects is more friendly to novices when creating scenes, providing users with a convenient access to resources and avoiding distortion or inexperienced modeling that degrades the overall scene experience. At the same time, open the Templates - Tutorials in the Resource Store, which contains PSD files of the models for users to understand and learn from. Use Unity's package manager to import the resources and then perform some of the previously mentioned building techniques (it should not be overlooked that some resources have extra requirements for the Unity version).

3.3. Adding details to the scene construction

When a more complete scene is created according to the design ideas, the Mesh Renderer is used to render the objects, of which the more commonly used is the material. Rich material performance is one of the main advantages of the application of three-dimensional scenes. 3D technology can be a reasonable selection and design of materials and lighting, can create light conditions that are difficult to create in nature, design a more ideal light source, and can show the texture of the object [5]. In addition to adding the metallic nature of the material, the normal mapping and height mapping in the material are also techniques to enhance the realism of the scene. Normal mapping can adjust the surface lighting of objects to achieve surface-level masking; while height mapping highlights the bumpiness of objects

and has a more enhanced masking effect. This can be seen in the application of normal and height mapping in other software. For example, in SD software, a normal map is generated using a normal node, where the pattern and material are blended into a normal node, the intensity is adjusted according to the desired bumpiness, and finally a high quality normal to height map (normal_to_height_hq) node is used to generate a height map [6]. In addition, choosing a suitable shader for shading and rendering is also an important step to increase the realism of the room. It can be compared to OpenGL's rendering module, which not only provides basic rendering, model management, texture management and shader management for objects in the engine, but also records the light source information in the scene in real time during rendering, dynamically generates the corresponding shadow maps, and sends them to the required shaders to render the specified screen content [7]. Unity's standard lighting model (Standard) is the most basic and most commonly used, while the Unlit Shader does not participate in lighting calculations and does not produce shadows under light. Unity also supports third-party plug-ins to add in other shaders as needed.

3.4. Implementing functions in building scenes

Finally, the implementation of functions such as browsing the scenes on the mobile side and drawing and writing functions help to strengthen the interaction between teachers and students and the virtual scenes. First of all, considering that the headset is costly and smartphones have become widely popular, mobile devices are chosen as the running platform of the software [8]. Connecting to the mobile terminal requires adding the relevant modules of Android or IOS in Unity, for example, in the Android module, SDK, NDK, and OpenJDK are essential contents. After the installation is complete, enter the developed project. Switch operating platforms via Build settings, connect mobile and PC via data cable, find your personal mobile device and click on the "Build and Run", as shown in Figure 4. It should be noted that if the personal mobile is not in developer mode, you have to open the developer mode first.
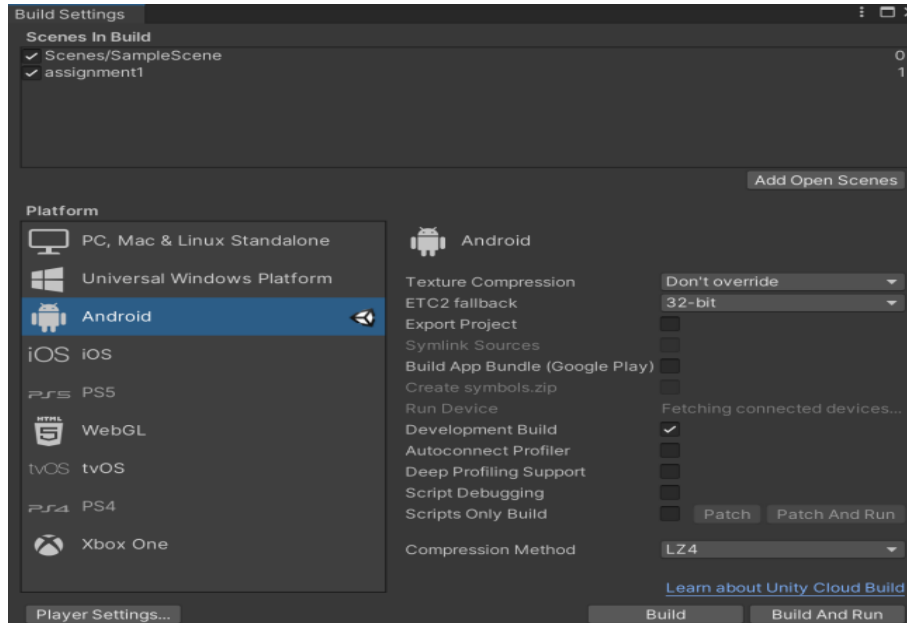
Figure 4. Switching operating platforms.

After successful connection, people can transfer this project to the mobile terminal, so that you can watch the conference room on the mobile terminal at any time.

The drawing function is then written by creating game objects such as drawline and scripting them and adding the script to the game object. The script creates two main actions in C#, which are Input.GetMouseButton(0) and Input.GetMouseButtonDown(0). Input.GetMouseButton(0) is to control the left mouse button to draw a continuous line, and Input.GetMouseButtonDown(0) and line cloning

are to break the line and recreate the beginning of the line each time the left mouse button is clicked, thus realizing the basic writing and drawing function. The code is as follows：

```
private void drawline()
        {
                if(Input.GetMouseButtonDown(0))// The moment the mouse is pressed
                {
                        GameObject cloneLine = Instantiate<GameObject>(originLine);// Cloning linrander
                        selfLine=cloneLine.GetComponent<LineRenderer>();
                        selfLine.startWidth = originWidth;
                        selfLine.endWidth = originWidth;
                        posList.Clear();
                }
                if(Input.GetMouseButton(0))// The mouse keeps pressing
    {
                        Vector3 desPos = Input.mousePosition;
                        desPos.z = 5;
                        Vector3 worldPos = Camera.main.ScreenToWorldPoint(desPos);// Screen to world
coordinates
                        posList.Add(worldPos);
                        selfLine.positionCount = posList.Count;
                        selfLine.SetPositions(posList.ToArray());
                }
        }
```

3.5. Evaluation of conference room effectiveness

After the conference room was built the workers created a meeting that included the teacher and the students to show the workers' operational view in the conference room. The operator could use the Oculous headset to convert to VR view, enter the conference room as a student, move freely, pick a seat, and write on the board, clear it, and so on. The entire conference room brings a certain sense of immersion to the user, and the presentation of this new form of teaching based on virtual space is new and interesting to the teachers and students in the room.

4. Conclusion

Whether the development scene is added to the headset by setting up the Oculous environment in Unity or simply browsing through the mobile, the entire conference room scene can be clearly seen. The function of drawing and writing adds realism and interest, and gets a better simulation for teaching. However, since this is only a simple attempt of virtual reality scenes, it still has many shortcomings. For example, in order to obtain detailed 3D data of the image scene, 3D reconstruction is needed based on the image. The quality of the reconstructed scene after the 3D image scene reconstruction method based on Unity3D is obviously improved, and it has good processing performance for more complex images [9]. However, considering the demonstration role of scenes, there is no precise reconstruction of realistic scenes through Unity3D, but simply creating virtual scenes based on personal thoughts, which will have some authenticity deviations. Discovering the scene reconstruction function of Unity3D will better solve this problem. At the same time, it is also necessary to realize multiple people to enter the meeting room to interact and communicate, and create the atmosphere of discussion and learning in the meeting room, so that it will be improved by connecting to the server. In the future development, we can keep exploring the possibility of virtual teaching, adding more functions to provide more realistic interaction experience and improve the quality of teaching.

References

[1]   Rutao Du. Development of Unity3D shooting games [J]. Computer Programming Skills and

Maintenance, 2022, No.448(10):141-144. DOI:10.16184/j.cnki.comprg.2022.10.049.

[2]   Xiang Bing. Exploration of the reform of teaching mode of game development course based on Unity 3D [J]. Teachers, 2022, No.506(23):84-86.

[3]   Yin X.H., Jiang Y.Y., Zuo G.H., et al. Design and development of educational game for home visitation based on Unity 3D technology [J]. Computer Knowledge and Technology, 2022, 18(18):77-79. DOI:10.14004/j.cnki.ckt.2022.1028.

[4]   Chenchen Fang, QI Qi, Chen Long, et al. Experimental teaching design of C# programming under CDIO concept [J]. Computer Technology and Development, 2022, 32(10):194-200.

[5]   Ning Li. Analysis of the application of animation three-dimensional technology in the development of information technology [J]. Computer products and circulation, 2020(04):158.

[6]   Xiuwen Zhang, Ma Kai. Research on virtual representation of embroidery texture based on SD and CLO3D software [J]. Journal of Beijing Institute of Fashion (Natural Science Edition), 2022, 42(03):44-50. DOI:10.16454/j.cnki.issn.1001-0564.2022.03.001.

[7]   Luo R, Z-Xuan Li. A 3D real-time rendering engine based on OpenGL [J]. Information and Computer (Theory Edition), 2021, 33(18):112-115.

[8]   Junwei Zhou. Research on the key technology of cell phone augmented reality virtual reality registration [D]. Huazhong University of Science and Technology, 2011. 22-25.

[9]   Shen Yang. Application of Unity3D virtual reality technology in 3D image scene reconstruction [J]. Information and Computer (Theory Edition), 2022, 34(21):79-81.