Development of AR + AI Learning Assistant Based on Unity

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Abstract: This article analyzes the research and development process of AR + AI learning assistant based on unity and vuforia, presented in the form of an app, and finally has the function of augmented reality. It can present 3D stereoscopic models and videos through the recognition of flat pictures. And can realize the interactive function such as rotation, zoom.
Keywords: Augmented Reality; Image Recognition; 3D Model; Interactive Operation

1. Introduction

AR (augmented reality technology) is a technology that calculates the position and angle of the camera image in real time and adds the corresponding image. It has been widely used in military, sales, entertainment, education, technology, media, tourism, medical and other field. AR technology has a low development threshold. Developers can use Unity and vuforia to quickly develop example apps of AR applications. The user's use is also very convenient, only a mobile phone to recognize the target object, it can present a three-dimensional AR effect, and can be rotated, zoomed and some other operations.

2. Introduction to development tools

2.1 Unity 3D

Unity3D is a multi-platform comprehensive game development tool developed by Unity Technologies that can easily create 3D video games, architectural visualization, real-time 3D animation and other types of interactive content. It is a fully integrated professional game engine with superior effects and higher expansion space.

Unity has the following advantages: It uses a visual programming interface to complete various development tasks, and supports scripting languages such as JavaScript, C#, Boo, etc., which can be used for efficient script editing. Unity supports the direct import of most 3D models and animations. This article completes 3D modeling by 3ds MAX and saves it in FBX format and imports it into Unity. In addition, Unity's built-in NVIDIA, PhysX physics engine belt can bring a realistic interactive feeling, real-time three-dimensional graphics mixed audio stream, video stream. Unity also provides a highly sophisticated light and shadow rendering system with soft shadows and baked light maps to achieve better visual effects.

2.2 Vuforia

Vuforia is an augmented reality software development kit, launched by Qualcomm's subsidiary Qualcomm Networking Experience, and is mainly aimed at AR applications on mobile devices. Developers can add advanced computer vision functions to any application to enable them to recognize pictures, scenes, and various models in the real world, and then display the additional information added virtually to achieve the effect of augmenting the real world.

Vuforia is mainly composed of three parts: Vuforia engine, a series of tools and cloud recognition services. The Vuforia engine is a static link library, which is encapsulated into the final App as a client for the most important identification function. A series of tools provided by Vuforia are used to create objects, manage object databases, and manage program licenses. The cloud recognition service can recognize a large number of image objects by storing the recognized objects in the Vuforia database. Vuforia Web Services allows operators to easily manage a large number of object databases, and can establish an automatic workflow.

3. Research on key technologies

3.1 Implementation of interactive operation

Mobile devices such as mobile phones and tablets perform interactive operations through gestures. Therefore, in the specific implementation process, we must first determine the number of touch points Input. Touch Count (that is, the number of fingers touching the screen). When the number is 0, it means that the screen is not touched and no operation is performed; When the number is 1, the rotation operation is performed. The rotation angle of the model is determined based on the size of the increment x and y (range between -1 and 1) of the finger on the x-axis and y-axis. The zoom operation is performed when the quantity is 2. The zoom operation first records the initial touch position of the two fingers and the final position after the finger is moved, and compare the distance between the two. If the distance becomes smaller, it means zooming out, call the zoom-out function; If the record becomes larger, it means zoom-in operation, call Zoom function.

(1) The key code to perform the rotation operation:

```
if (Input. Get Mouse Button(0)) {
if (Input. touch Count == 1){
Touch touch = Input. Get Touch(0);
Vector3 delta Pos = touch. delta Position;
transform. Rotate(Vector3.down * delta Pos. x, Space. World);
transform. Rotate(Vector3.right * delta Pos. y, Space. World);
transform. Rotate(Vector3.forward * delta Pos. z, Space. World);
}
}
```

(2) The key code to perform the zoom operation:

```
if (Input. touch Count == 2) {
if (Input. Get Touch(0).phase == Touch Phase. Moved || Input. Get Touch(1).phase == Touch Phase. Moved){
Vector2 temPos1 = Input. Get Touch(0).position;
Vector2 temPos2 = Input. Get Touch(1).position;
if (is En Large(oldPos1, oldPos2, temPos1, temPos2)) {
float old Scale = transform. local Scale. x;
float new Scale = old Scale * 1.025f;
transform. local Scale = new Vector3(new Scale, new Scale, newS cale);
}
else{
float old Scale = transform. local Scale. x;
float new Scale = old Scale / 1.025f;
transform. local Scale = new Vector3(new Scale, new Scale, new Scale);
}
oldPos1 = temPos1;
oldPos2 = temPos2;
}
```

```
}
bool is En Large(Vector2 oP1, Vector2 oP2, Vector2 nP1, Vector2 nP2) {
float length1 = Math f. Sqrt((oP1.x - oP2.x) * (oP1.x - oP2.x) + (oP1.y - oP2.y) * (oP1.y - oP2.y));
float length2 = Math f. Sqrt((nP1.x - nP2.x) * (nP1.x - nP2.x) + (nP1.y - nP2.y) * (nP1.y - nP2.y));
if (length1 < length2){
return true;
}
else{
return false;
}
}
```

4. Effect display

Figure 1. Harmony operating system experience video with AR effect.；**Figure 2.** The effect of CPU model with rotation function.

This App calls the camera with the user's permission, then recognize the pictures stored in the database in advance to realize the functions of superimposing the text, 3D model, 3D animation, video, audio, etc., on the original picture with the AR effect. Also it can realize the rotation, zooming, etc. Interactive functions. The following is part of the effect display.

5. Conclusion

This App innovatively applies AR to the field of education. The AR learning assistant also facilitates the teaching of teachers and the learning of students, concretizing, three-dimensional, and visualizing complex and abstract knowledge. Students' interest is enhanced by rotating and zooming 3D models and convenience the video experience brings. In the future, the author plans to optimize the App in terms of content presentation, number of recognized pictures, virtual buttons, scene creation, etc., and strive to improve the quality of the App, hoping to use AR technology to bring users a better experience. I also believe that AR technology will have greater potential and playa broader rolein the future, and have more important research significance and value.

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