

# *Design and Implementation of AR Vehicle Display Model Based on Unity3D*

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**Abstract:** Augmented reality technology is a technology that combines real information with virtual information. It is difficult for people's facial features to feel the reality information that computers imitate in reality. Through this technology, this kind of virtual electronic information can be transmitted to the real world, which is felt by people, and the reality is mixed, so that people can experience the fun of the virtual world. In this paper, 3Dmax is used to model the car model in three dimensions, then the unity3D is used to construct the virtual car model and environment, and the Vuforia toolkit identifies the object feature points, so that the model of the 3D car can be generated in the virtual scene, the way of real and virtual interaction, to achieve the experience of experience in the real world.

An APP for car display, through the virtual scene, allows the user to experience the visual experience of the car's vision and close-up, and 360-degree observation around the car model. Then through the button operation, the scene is cut into the interior of the car, and the interior of the car is meticulously understood. At the same time, the corresponding data display can be called up by operation to perform some operations of zooming in and reducing. Furthermore, by watching the running of the car on the ordinary street and the effect in special weather, the user can make the customer more aware of the comprehensive performance of the car, thereby stimulating the customer's desire to purchase.

## **1. The Unity3D AR technology**

### **1.1 The Key technologies for mobile augmented reality**

AR is also called mixed reality, which is based on virtual reality. The virtual electronic generated objects and virtual scenes and prompts can be superimposed in the real scene, which is a special technology that uses electronic technology to realize people's perception of reality. The development of the AR system contains many academic theories. Fig. 1 below shows the specifics of the AR system. Framework diagram:

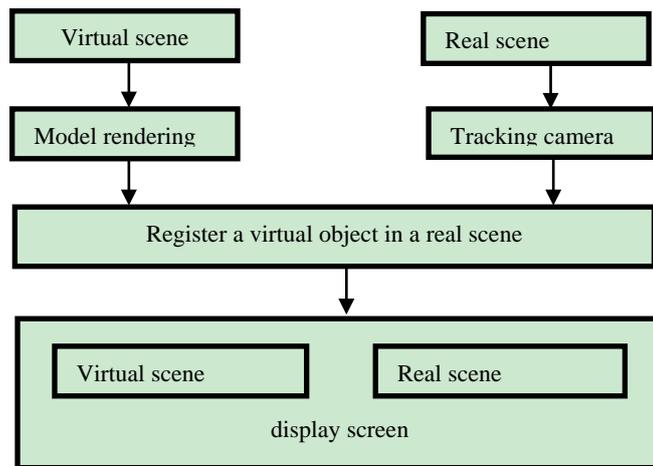


Fig. 1 Schematic diagram of the AR system

The AR system needs to establish a virtual space coordinate system and a real space coordinate system to generate a conversion relationship between them, so that the virtual scene can be accurately superimposed into the real scene, which is the specific process of registration. However, the user's position is not static, and the coordinate system of the conversion needs to be re-adjusted. This process is the process of tracking. The simple AR system is not able to perfectly superimpose the virtual scene into the real scene, which is difficult to blend. The combination of virtual and real technology can solve this problem well. He can match the virtual scene with the deeper information of the real scene, such as lighting, shadow, etc., so that the virtual scene can obtain the same deep information as the real scene, thus interacting more naturally and completely.

## 1.2 Unity 3D technology

Unity3D is a tool for a graphical development environment. Unity3D compiler can run on many platforms, including windows, mac, android, etc. It also supports web browsing on mobile and computer. However, the plugin for Unity web Player is required for the release of web-based applications.

This paper makes an AR system based on unity3D, which can accurately superimpose the scene of the virtual world into the real scene, thus achieving the perfect combination of virtual and reality.

The method consists of three steps:

- (1) Create a cloud database;
- (2) Manage the object, download and bind the identification code;
- (3) The release of Vuforia.

Among them, the second step is to take some advanced operations on the object, and Vuforia is used to generate the written AR system, which is mainly done in Unity3D.

## 2. The system 3D user interface design

The user interface design is mainly divided into three parts: 3D environment, UI and animation. When using the toolkit Vuforia identified by AR, you need to close the main camera, use the AR camera of the toolkit, and adjust several parameters and attributes to achieve the recognition effect.

3D environment:

- 1) First create a plane object in the main environment, adjust its color to transparent in the property, and set its length, width and height, and its position coordinates, as the entire scene can be allowed to pass or place objects. The lowest plane.

2) Then, in order to display the recognized 3D model in the virtual scene, an object needs to be set and bound to the image to be recognized. After the image is recognized, the object will be displayed and the object is adjusted in a virtual environment. The location that is ultimately displayed. Find the Imagetarget entity from the imported Vuforia toolkit, drag it into the sub-objects of the AR Camera entity, set their binding relationships and associated Inspector properties, and adjust the specific 3D coordinates and rotated 3D in this meta-square. Angle and proportion, so that the object display is more reasonable and true.

3) Set the environment around the unobstructed environment, that is, the sky box. It is composed of 6 sets of images with different angles. The rendering is similar to the 360-degree background after there is no obstruction in the real world, as shown in Fig. 2.



Fig.2 Skybox settings

4) Drag the previously imported 3D car model into the scene, as shown in Fig. 3, and place it under Image target. In the same way, drag the other exhibition halls, houses and roads into the scene to make specific adjustments and put them in the main environment. Create a stage object that simulates the portion of the booth that is higher than the plane. Thereby better highlighting the image of the car.



Fig.3 Introduction of the car model

UI:

- 1) Open the 2D perspective and create a Canvas object for drawing in 2D plane.
- 2) Create a row of button objects at the top to switch the color of the car, as shown in Fig. 4.



Fig. 4 color toggle button

3) Create a switch button inside and outside the car on the left side, and click the button to switch between the inside and outside of the car freely, as shown in Fig. 5.



Fig. 5 Switch button inside and outside the car

4) Create a button in the upper right, set the click to view the car's speeding animation in the scene. Animation: Shows how the car is moving in the scene.

### 3. The detailed design of the "car display model"

The specific design of the system is mainly divided into the following aspects: image recognition, exterior of the car, interior of the car and car animation.

Image recognition: By identifying a specific image, a matching car model can be displayed in the arranged scene.

Exterior of the car: The user can slide the left and right sides and slide the view up and down to observe the external condition of the car from various positions. By sliding the distance between the two fingers, you can zoom in or out and move the lens.

Inside the car: The user's field of view is transferred to the inside, and the situation and details of the various instruments in the car can be clearly seen. For areas that need to be carefully viewed, click 2 to zoom in, and the specific area information will be displayed in the narration. The car can be viewed from a 360-degree angle of view.

Car animation: You can experience the reality of the car in various scenes in the virtual scene.

Some of the code is as follows:

```
void Update ()
{
    if(Input.GetKeyDown(KeyCode.Space)){
        rotationEnabled = !rotationEnabled;
        toggle = !toggle;
        if (!toggle)
        {
            mouseOrbit.enabled = true;
        }
    }
    else
```

```

{
    mouseOrbit.enabled = false;
}
if(toggle)
{
    sportsCars[index].transform.Rotate(transform.up*rotationSpeed);
}
if (Input.GetKeyDown(KeyCode.R))
{
    autoRotated = !autoRotated;
}
if (autoRotated)
{
    x += Time.deltaTime *xspeed * distance;
    y = 0;
}
if (rotationEnabled || autoRotated)
{
    sportsCars[index].transform.rotation = rotation;
//     if (tempCar != null) {
//         tempCar.transform.rotation = rotation;
//     }
}
}

```

#### 4. The experiment and test results

The identification of these four markers under different conditions was tested and found to be well recognized. Under the influence of darkness and illumination, the recognition was slightly worse. The following are some real-life screen shots from the test:

- 1) When scanning the image, the virtual 3D car will be displayed inside the phone, as shown in Fig. 6.



Fig. 6 Scanning a car picture

2) When observing outside the car, see Fig. 7:



Fig. 7 Exterior view of the car

3) When observing inside the car, see Fig. 8:



Fig. 8 Interior view of the car

4) Open the door outside the car for observation, see Fig. 9:



Fig. 9 View of the door opening

5) Observe the view after switching the car, as shown in Fig. 10:



Fig. 10 View after switching the car

6) The situation in which the car is running in the tunnel is shown in Fig. 11:



Fig. 11 View of the car on the runway

The Unity3D-based mobile AR car app offers many conveniences for users who purchase vehicles. It effectively solves the problem that consumers must go to the field to inspect when they are watching the car, saving a lot of time and energy. In the future, there will be more and more complete online AR systems, which appear on the platforms of major car purchases. Users can easily view their favorite cars by downloading the corresponding software. Moreover, the development app can also add features to help engineers who repair cars to better solve the various problems of the car.

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