Design and Implementation of the Converging Media System Based on WebAR

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Abstract: Augmented Reality (AR) is a technology that calculates the position and angle of camera images in real time and adds corresponding images, videos, and 3D models. It is widely used in education, medical, entertainment, and industrial fields. Nowadays, with the rapid development of AR techonlogy, the current mainstream AR has some drawbacks. For developers, the development of iOS and Android platform is relatively expensive, and the promotion is difficult; it is also relatively expensive to download an APP for user, resulting in a large user turnover rate. The rapid rise of WebAR technology has subverted the traditional AR technology and is widely used in various fields. At the same time, the rise of WebAR has pushed H5 interaction to a new level of experience. In the context of media convergence, based on the EasyAR development engine, combined with 3D modeling, 3D model rendering, web front-end technology, PHP back-end technology, this paper aims to design and develop a media convergence system based on WebAR which is light and efficient, and it has great significance for the further development of augmented reality.

1. Introduction

Augmented Reality (AR) is a new technology that integrates real world information with virtual world information seamlessly. AR not only displays the information in the real world, but also visualizes the virtual information at the same time, and the two kinds of information complement and superimpose each other. In visual augmented reality, users can use the headset to combine the real world with computer graphics to see the real world around it [1]. AR includes new technologies and new methods such as multi-media, 3D modeling, real-time video display and multi-sensor fusion, real-time tracking and registration, etc. Through AR, participants interact with virtual objects in real time to gain a wonderful visual experience; it can break space, time and other objective constraints, and obtain the experience that cannot be experienced in the real world. But as more and more AR games and events continue to emerge, on one hand, it becomes easy for us to forget and distract because of countless apps, it is difficult to focus on an app and get a top user experience; on the other hand, many apps have brought us a lot of trouble. AR on the web has changed this situation. WebAR has the advantages of light mode, fast propagation, efficient production, fast deployment, etc. It can be used to experience the AR scenario without downloading the App. The AR scenario is transplanted to the web for development, it is easy to deploy and easy to maintain on the Web which shortens the development cycle and promote the development of WebAR.

In this paper, the WebAR technology we discuss is based on EasyAR. It integrates AR technology with the Web platform. It is different from native AR application. It has the characteristics of being light-weighted, fast deployment and strong communication. It can be easily run on the web browser of Android, iOS, Windows, Mac and other systems. The converging media system designed and developed in this paper mainly includes four parts, 3D modeling, image recognition, model rendering and video playback. Users only need to turn on the mobile phone camera to scan pictures,

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and then can experience the audio, video and animation that WebAR brought. The interaction creates an immersive experience that is more interesting and personalized than traditional media [3].

2. Key technologIes

2.1 Image Matching and Recognition

First, the implementation of WebAR requires the support of three technologies: recognition, tracking, and rendering. Before the identification, the video stream of the mobile phone camera is first acquired. With the video stream, the feature points can be extracted and analyzed, and the computer vision algorithm is used to identify the things in the video stream. The matching recognition algorithm mainly analyzes the image features. Image feature is similar to image fingerprinting; it can be uniquely labeled and distinguished from other images. It is a very abstract concept, and its precise definition is often determined by the specific problem or application type. Regardless of the angle, displacement, and brightness of the same image, the extracted features should be the same. Image features are the starting point for many computer image analysis algorithms, so the success of an algorithm is often determined by the features it uses and defines. Commonly used are color features, texture features, shape features, and spatial relationship features. Color features are global features that describe the surface properties of a scene corresponding to an image or image area, for example, a gray-scale histogram or the like. Texture features are also global features that describe the surface properties of a scene corresponding to an image or image area. For example, the second-order moment of the angle, and the local stationarity [2]. The shape feature is a local feature that describes the shape properties of objects in a local area. For example, boundary features, etc. The spatial relationship feature refers to the mutual spatial position or relative direction relationship between multiple targets segmented in the image. After the feature is detected, it can be extracted from the image. This process may require a series of image processing calculations (such as the well-known computer vision image processing library OpenCV). The result is called a feature description or a feature vector. Currently it needs to open the webpage with the https protocol, so as to access the camera. In the paper, cloud recognition is required, and a cloud library needs to be applied for and used on the EasyAR official website.

2.2 Image Tracking and Positioning

Second, the identification tracking technology is the core technology of WebAR. The acquired video stream can be regarded as images of many frames, so the process of processing the video stream can be understood as the process of image processing [5]. At present, there are two main technologies that can realize image tracking and recognition. The first method is Marker based AR. This method is mainly based on Marker recognition, which uses a simpler identifier, usually square and clearly distinguishable on all four sides. This type of recognition algorithm is relatively simple, usually solved by template matching, and the effect is also good. It is the Marker recognition of the early ARToolKit engine. The second method is MarkerLess AR. This method mainly uses SLAM, synchronous positioning and map construction, firstly proposed in the field of robots, it refers to: the robot starts from an unknown location of the unknown environment, and locates its position and posture through repeated observation of environmental characteristics during the movement. And then build an incremental map of the surrounding environment according to its own location, so as to achieve the purpose of simultaneous positioning and map construction.

2.3 Rendering and Interaction

Finally, model rendering uses three.js. Three.js is an open source framework for WebGL. WebGL (Web Graphics Library) is a 3D graphics protocol that allows JavaScript and OpenGL ES 2.0 to be combined. By adding JavaScript and binding it to OpenGL ES 2.0, WebGL can provide hardware 3D accelerated rendering for HTML5 Canvas. This allows web developers to use system graphics to streamline 3D scenes and models within the browser, as well as create complex navigation and data

visualizations. Obviously, the WebGL can be used to create website pages with complex 3D structures, and can even be used to design 3D web games [6].

Three.js mainly includes several elements such as renderer, scene, camera, object, mesh, etc. The renderer is used to render 3D scene, it contains multiple rendering modes, such as vector rendering, cartoon rendering, WebGL rendering, etc. Scene is a container for any 3D object within the engine. The camera uses a perspective camera and a non-perspective distortion camera as default. Mesh is a 3D object which generally consists of three classes that describe different properties, a material style that manages the surface texture of the 3D object, a material class that describes the 3D structure, and a geometry structure class that describes the 3D structure of the object.

3. System design and implementation

3.1 3D Modeling

3D modeling can be roughly divided into two types: NURBS and polygon mesh. NURBS has been well applied for models that require being sophisticated, flexible and complex, and is suitable for quantitative production purposes. Polygon mesh modeling is based on the ramen method, which is suitable for rendering animations and complex scenes. This paper uses the 3D Studio Max software to make 3D models. 3D Studio Max is the world's widely-used 3D modeling, animation and rendering solution for visual effects, character animation and next-generation games, and has won more than 60 industry awards to date. It inherits the success of the past and add a new IK system for character animation, integrating the new subdivision surface and polygon geometry model for the interactive graphical interface of the next generation of games and the industry's most widely used modeling platform [9]. At the same time, it integrates the rendering capabilities of the new ActiveShade and RenderElements features. 3D Studio Max also provides connections to advanced renderers such as Mental Ray and Renderman to produce special rendering capabilities such as panoramic lighting, focus and distributed rendering. 3D Studio Max delivers rich, sophisticated visual design that generates realistic characters for mostly-welcomed games and brings 3D effects to the big screen.

Figure 1. 3D dinosaur model

Figure 2. 3D car model

Indicated in Fig.1 and Fig.2 are the dinosaur model and the car model generated by 3D Studio Max.

3.2 Image Recognition

In this paper, image recognition needs to apply for a cloud identification library on the EasyAR website, uploads the identification image and uses the image. The identification image requires obvious features and high contrast. The corresponding 3D model is loaded with three.js by processing the Meta information of the picture returned by the cloud server. This paper implements scanning different recognition images to load different models.

3.3 3D Model Rendering

The rendering of the 3D model utilizes three.js, which implements the operation of the CPU with JavaScript, writes 3D programs, and realizes the true meaning of 3D on the browser side. The rendering of a 3D model first requires a drawing environment, and then creates a camera, renderer, and scene. Among them, the scene is used to accommodate graphic elements, including all the containers of 3D objects and other related elements that need to be displayed. The role of the camera is to determine how the 3D scene is projected onto the 2D canvas, defining the visual field and determining which graphic elements are visible. The renderer is responsible for how to render the image, whether it is using WebGL or Canvas for the final drawing of the brush [4].

The model loading function implemented in this paper requires certain requirements for the animation model. The animated model requires a single mesh (editable mesh), the bones can only be one set, and the mesh vertices can be limited. There should be no more than 4 controlled bones, and the using the curve grid should be avoided. Animated model textures need to use JPG or PNG files. PSD files can't be used as the texture source file. The animation file format supported by three.js is only FBX, DAE, and JSON. FBX format file requires ASCII and binary files. It is best to have the source project file. There are incompatibilities that require manual adjustment. The model should be scaled to 1, the model can only be a mesh, and a single model independently corresponds to a map and independently corresponds to a set of bones. Before exporting, the model history and irrelevant nodes need to be emptied. The model coordinates need to attribute to the center of the coordinate point, and the coordinate data need to be reset to zero [7].

This paper mainly describes how the system recognizes the identification images of the dinosaur and the car scanned by the computer camera, which hence render respectively the corresponding 3D dinosaur model and 3D car model.

Figure 3. 3D dinosaur model rendering

Figure 4. 3D car model rendering

Fig.3 and Fig.4 are the dinosaur model and car model corresponding to pictures of dinosaur and car scanned by PC camera.

3.4 Video Playback

We can load different videos by turning on the phone's or the computer's camera to scan the recognition images. In this paper, the corresponding introduction video will be loaded after scanning images of the dinosaur and the car.

Figure 5. Dinosaur video playback

Figure 6. Car video playback

Fig.5 and Fig.6 are to scan the dinosaur picture and the car picture to render the introduction video of the dinosaur and the introduction video of the car respectively.

4. Conclusion

This paper mainly describes the implementation of web-side AR technology based on EasyAR cloud recognition service. Specific technologies of this technical framework are composed of 3D modeling, 3D model rendering, web front-end display, PHP backend, etc. This paper aims to promote the development of converging media services by implementing AR technology on the web. In the era of Internet, the implementation of web-based AR technology instead of traditional AR has become an urgent need. In the future, we can use technologies such as smart converging media, 5G, cloud computing for the implementation of web-side augmented reality technology platforms, which are smart and light weighted [8]. Through the design and implementation of the converging media system based on WebAR, certain shortcomings of traditional media, such as plainness, limited coverage, and low interest, are compensated. AR is integrated into the media system to enhance the readability and interest of the traditional media. To a certain extent, it expands the scope of communication and better integrates technology into life.

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