Research on Dynamic Content Control Method in Virtual Projection

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Abstract. With the rapid development of virtual projection technology, it has been widely used in art, stage design, cultural communication and other industries due to its unique characteristics of combining virtual with reality and its advantages of strong interactive immersion. In traditional stage design, the projection position and coordinates of virtual projection are fixed in advance, and actors must remember the projected coordinates of virtual image during performance, so as to accurately match the projection. This imposes great limitations on the performance of actors, and due to the complexity of the stage, it is difficult to achieve good interaction effects. Starting from the novel "dynamic" control technology in the virtual projection, this topic studies the intelligent control method of dynamic content in the projection. In the video projection process, FBX model is loaded dynamically, and the animation on the model is loaded and called dynamically.

1. Introduction

In recent years, with the rapid development and popularization of virtual projection technology, more and more people use virtual projection to participate in the design of stage art[1]. With the progress of The Times, the present stage performance art has entered a new journey of the integration of technology and art. In particular, the rich digital image has been most widely used in various performance occasions and stage design. Live performance of stage art and cross-boundary integration of various digital image contents have become a new form of expression of contemporary stage performance, while virtual projection provides a convenient technical means for the perfect presentation of digital image on stage. After the rapid development of virtual projection technology, due to its strong interactivity, real-time performance, integration and other obvious characteristics, it was quickly discovered and applied to enhance the performance space and performance of the stage by the stage art creators seeking for reform. Represented by virtual projection of the multimedia technology and the fusion of a variety of art has become a trend of stage art innovation, this method not only improves the traditional drama stage curtain switch inflexible problem, add a lot of convenience to the stage, and to implement more rich creative drama stage, more exciting stage effect, more liberal performance rhythm provides a new technical means.

The existing stage display system usually adopts the method of manual or time-varying scene to realize the combination of virtual image and real scene. The problem of this kind of projection design is that the projection position is relatively fixed and can not be adjusted in real time. Projection time,
projection position, projection content, and projection change are all fixed in the predetermined projection area and cooperated with actors. In this way, the interaction between performers and the stage scene and virtual image cannot be realized, which can no longer meet the higher requirements of people. The stage effect combining virtual image with real scene needs further technical improvement.

Aiming at the above problems, this paper mainly studies the control method of dynamic content in virtual projection. In real stage performance scene, this method can make the projected virtual image follow the actor's position and specific nodes to locate the projection coordinates in real time, and is no longer limited to the pre-set area. It also can control the change of the virtual image according to the action of the target character. This control method allows the virtual image to cooperate with the actors' actions to achieve a stronger sense of interaction, to give the actors more flexibility in performance, to achieve a better combination of virtual image and real scene stage effect, and to improve the audience's enjoyment. It can solve the problems of weak interactivity, strict positioning, actors cooperating with the image, and enhance the flexibility of virtual projection in the actual scene.

2. Related Works

Virtual projection technology [2] is a space augmented reality technology that USES projection to change the appearance of objects in the real world. Its feature is that it does not need additional wearable devices and can display digital content on any object surface of any shape. Therefore, it is widely used in stage art, advertising design, history and culture and other fields. The application of existing projection technology [3] often USES static objects such as projective surfaces of architecture, sculpture or characteristics, or rigid moving objects such as curtain plates as projection media. The application of virtual projection technology in studio stage design can best reflect its features of novel appearance, strong three-dimensional sense, and strong interactive experience combined with reality and reality [4]. It can not only produce vivid virtual images, but also make it interact with actors and perform on the same stage to produce brilliant and gorgeous stage effects. The key to the application of virtual projection in art design lies in how to properly use this technology in stage performance to bring the audience wonderful and shocking visual experience.

2.1. Purpose of Dynamic Content Control

This topic mainly studies the control method of dynamic content in virtual projection [5]. In the real stage performance scene, this method can enable the projected virtual image [6] to follow the position of actors and locate the projection coordinates in real time, such as specific nodes, and is no longer limited to the pre-set area. And can control the change of the virtual image according to the action of the target character. This control method allows the virtual image to cooperate with the actors' actions to achieve a stronger sense of interaction, to give the actors more flexibility in performance, to achieve a better combination of virtual image and real scene stage effect [7], and to improve the audience's enjoyment. It can solve the problems of weak interactivity, strict positioning, actors cooperating with the image, and enhance the flexibility of virtual projection in the actual scene.

In the virtual projection of the stage application, the projection [8] content is various, including pictures, videos, models of people, animals and gorgeous dynamic effects. Stage performance has many variations. No matter the stage background or props, there will be many changes or even substitutions in the whole stage performance. In order to achieve the stage performance scene transformation and stage style change. Therefore, the content of the virtual projection on the stage must also change with the changing demands of the stage. The projected video changes with the changes of the drama plot or the stage program, and the projected model often only appears during the special performance. In addition, unlike the stage scene or props and other real objects in the stage performance need a large number of backstage personnel manual handling, layout; The content of virtual projection is digital image, which relies on the backstage personnel to manipulate the computer to realize dynamic changes. Compared with that, it has great maneuverability and can realize more flexible changes.
3. Research On Dynamic Content
The control method of dynamic content in virtual projection studied in this paper is generally divided into three functional modules: background video playback module, foreground model control module, and dynamic invocation model module. The aim is to solve the above problems in the process of dynamic content projection and control the virtual image more flexibly. The final projection effect is that the background can play the video with any resolution, and the model can be dynamically called when the program is running. The model can block the background video and play the animation effect on the model at the same time.

3.1. Background video playing
In unity3D [9] play Video using VideoPlayer plug-in. Vediopalyer is a new cross-platform video player that supports not only local video resources but also links to video resources. This can be a network link or a local resource address.

![VideoPlayer](image.png)

Figure 1. VedioPlayer

VideoPLayer has an official API that allows you to control the play and stop of a video in your code, and you can add trigger events at the beginning or end of a video. This makes it easy to match certain events with video playback. VideoPLayer is used by adding this component directly to the object that serves as the curtain and selecting the appropriate video source.

The Field Render Mode under VideoPLayer refers to the Render Mode when the video is played and contains the following five options.

- CameraFarPlane: Camcorder based rendering, rendering on the far plane of the camera, need to set the camera for rendering, and change the alpha channel value for transparent effect, available for background player.

- CameraNearPlane: Camcorder based rendering, rendering on the near plane of the camera, need to set the camera for rendering, and change the alpha channel value for transparent effect, which can be used as foreground player.

- MaterialOverride: Copies the video screen to the Material rendered as selected. To select the object with the Render component, you can select the assigned material property. Can produce 360 panoramic video and VR video.

- APIOnly: Render based on API calls.
3.2. Dynamically invoke the model module

In practice, 3D objects in front of the video are typically generated dynamically, which involves loading FBX files and dynamically calling (i.e., playing) animation segments on the model while the program is running.

There are four ways to use dynamic models in Unity. First, create the Resources folder in Assets and import the model files into it. In the script, the object is called through resource-load ("path"). Second, you package the resource files into an Asset bundle and use AssetBundle.load to extract the model and create the Assets object when invoked dynamically. Third, Addressable Sable, this method can set any resource file in the Asset to a callable state and set the path, and can also add labels to the model so that objects with the same label can be called uniformly. Fourth, use external plug-ins. The first three method invocation models all require the model to be imported into Assets and cannot dynamically invoke external resources. Therefore, external plug-in Trilib is used in this design to invoke the model dynamically.

Using Trilib to invoke the animation model, a script needs to be written to invoke the model-loaded function to realize the model-loaded function, and add some content to control the size and location of the model. The script is also mounted on an empty object in the scene. The location of the empty object defaults to the location where the model is loaded, but can also be changed in the script. The main content of the script is the function that calls Trilib. Normal model loading and automatic animation playback can be realized at runtime.
4. Experiment Results
Since most animation segments of the same model in the Asset Store today are presented in multiple FBX models, you want to focus all animation effects on the same model when the model is called, which is also possible in Trilib. Unity has a special API for animating the model, which can be modified by scripts.

The first step is to call all the models loaded with animation segments and get the animation on them.

The second step, and then put a model on the camera only visible range, and the other animation through Addclip visible () are added to the model, because a single animation FBX file is the default animation names Take001 in unity, and in control of the flash, only through the animation in the script name calls, so when add animation to object section must be changed according to animation cartoon section names;

The third step is to play the Animation through the Animation component and the name of the Animation.

The results are shown in the figure below.

5. Conclusion
It can be seen from the running results in the figure that this design has preliminarily completed the
functions of realizing virtual projection in Unity, adding the model dynamically before projection, and playing the animation. The screen resolution of the exported running program is perfectly consistent with the resolution of the video, and the playing effect of the background video is basically completed. Moreover, the quality and color effect of the video picture are also basically consistent with the video source.

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References
[1] Xin Sun, Kaifa Deng. Research on Media Convergence of Projection Art involved in Deductive Scenes [J].The House of Drama, 2019.
[2] Julia Plotts. Virtual Projections of Ideal Urban Landscape. 2014, 9(4):243-268.
[3] Kunming University of Science and Technology. A remote interaction method based on dynamic capture and holographic projection [P].China, ZL201710466807.8, 2017.12.12.
[4] Xinrong Li, Dongfeng Liu, Xiangyu Zhang. A System Integrated with C# Programming and Real-Time 3D Observation for Learning Virtual Reality Technology. 2019, 7(3):127-135.
[5] Jiwu Wang, Weixin Zeng. Research on the Realization Method of Augmented Reality based on Unity3D. 2019, 6(3).
[6] Xiao Xiao. A stage interactive integration system combining virtual image and real scene [P].China, ZL201621044824.x, 2017.03.08.
[7] Xiaolin Li. The influence of holographic imaging technology on the development of stage design art [J].Drama Home, 2014.
[8] Jian Huang. Development and application of 3D holographic projection technology [J].Technology for Performing Arts, 2015.
[9] Min Cao, Yong Duan. A technical method to realize 3d real-time holographic projection by UNITY3D [J].Electric Power Technology, 2.