"Summer Resort" Three-Dimensional Virtual Tour Creation

Ping Zhang *, Fangjing Du, Jiayi Chi

School of Digital Media, Liaoning Communication University, Shenyang, 110135, China

* Corresponding Author Email: Wyyg_2000@163.com

Abstract. The Summer Resort is a theme vacation villa inspired by the Monticello estate in the United States, characterized by Roman Neoclassical architecture. Through three-dimensional virtual technology, the overall building and surrounding scenes are showcased, creating a unique Roman-style retreat that provides an innate sense of harmony in both visual and tactile experiences. The main structure features a Doric-style door frame, a white dome, and a combination of low red bricks, complemented by the surrounding green grass, red leaves, and blue sky, effectively reflecting the characteristics of the Summer Resort. The use of virtual reality technology allows the work to be constructed from an imaginative level into an extraordinarily immersive and realistic experience.

Keywords: Virtual Reality, 3D modeling, Environment setup.

1. Introduction

In today's fast-paced life, the development of technology accelerates rapidly. Virtual reality (VR) technology advances significantly and gradually integrate into daily life, being applied in more and more fields. The emergence of virtual reality technology provides numerous benefits [1]. For instance, GPS navigation allows individuals to view virtual routes, assisting those who are lost. Furthermore, VR technology enhances the tourism industry by digitizing virtual scenes from around the world, enabling people to select their ideal destinations without leaving home. This innovation fills the gap in visual experiences and greatly promotes the development of tourism, facilitating virtual exploration of various attractions. In domestic technological development, virtual reality technology is prioritized as a key focus area. In the future, virtual reality technology is expected to have broader prospects and further development.

The 3D virtual tour of the Summer Resort is a project realized through virtual reality technology [2]. By constructing an overall interactive design of the Summer Resort, it enables a highly realistic experience. The production process involves using 3ds Max to create the basic model of the resort and perform UV mapping. Subsequently, materials for the resort and the scene are developed in Adobe Substance 3D Painter [3]. Finally, textures are exported and applied in UE4, where the scene, atmosphere, and lighting are constructed.

2. Theory of Creation

2.1. Overview of Summer Resort

The overall architectural structure of the 3D virtual tour of the Summer Resort is inspired by Monticello, the estate of former U.S. President Thomas Jefferson. Monticello is a Roman Neoclassical building renowned worldwide. It is located atop a small hill, surrounded by lush greenery and a serene pond. In autumn, the leaves create a gradient of colors ranging from red to yellow. Monticello faces almost entirely west, allowing Jefferson to sit on the porch and gaze at the sunset over the distant Blue Ridge Mountains, located more than 40 kilometers away. The estate is encircled by tall sycamore trees, with a verdant lawn beneath them. Each day, Jefferson dines, writes, reads, and hosts friends under these trees. This pleasant and comfortable atmosphere attracts many, inspiring the creation of a Summer Resort in a similar style.

2.2. Neoclassical Architectural Style

The architectural style of the 3D virtual tour of the Summer Resort primarily embodies Neoclassical architecture. This style is inspired by the classical architecture of ancient Greece and Rome [4]. In the United States, it represents significant public buildings constructed from the post-American Revolution era through the 1800s. Neoclassical design is essentially an evolved form of classical architecture, achieved through modern techniques that preserve classical qualities, imbued with rich artistic expression.

Neoclassical architecture is characterized by vibrant and diverse colors. These buildings employ bold hues, creating an ethereal architectural presence. Both furniture and accessories complement the noble and elegant identity of the inhabitants, with elegance and harmony serving as hallmarks of the Neoclassical style. This architectural approach is distinctive, combining a vintage feel reminiscent of classical architecture with the shapes and textures of modern design.

Such a decorative style imparts a sense of grandeur, natural beauty, and aesthetic appeal to the overall interior. However, this style is rarely seen today, especially in residential settings. The uniqueness of the style deters many from attempting it, coupled with the intricate demands of interior decoration and processing techniques that require considerable skill. Nevertheless, in Europe, this style continues to be favored by many residents.

2.3. Virtual Reality Application Status

Since its inception, virtual reality technology has gained increasing popularity, with most individuals willing to immerse themselves in such environments [5]. In China, virtual reality is primarily recognized by young people, driven by youthful energy. This indicates a promising future for virtual reality technology, as more young individuals are expected to enter this field. With the continuous development of technology and production ecology, the evolution of virtual reality is actively promoted. The work "The Summer Resort" effectively demonstrates the application of virtual reality technology. It is believed that, in the near future, virtual reality technology will become more advanced and provide more convenient services for humanity.

3. Production Process

3.1. Creative Preparation

At the beginning of the design process for "The Summer Resort," extensive literature and images of foreign villas are researched online. The reference building, Monticello, is thoroughly studied, including its architectural features, style, and historical background. This theme is chosen because European-style villas are rare in China, yet there is a significant appreciation for this style. Neoclassical architecture represents a blend of classicism and simplicity, embodying a luxurious yet elegant and fashionable aesthetic that provides a comfortable and relaxing visual experience. By collecting relevant materials, the layout structure, environmental atmosphere, and overall material effects of the villa are carefully analyzed, leading to an initial design of the villa and the creation of its three-view drawings. This approach allows for a more intuitive understanding of the villa's structure. Subsequently, considerations are given to the feasibility of realizing the envisioned design, including whether the modeling can achieve intricate details and if the texturing can be lifelike. The design process involves defining clear workflows, familiarizing with necessary software, and identifying the appropriate tools to create special structures and materials. The basic model of the front of the villa is shown in Figure 1. Mastery of all functions is essential to lay a solid foundation for producing high-quality work.

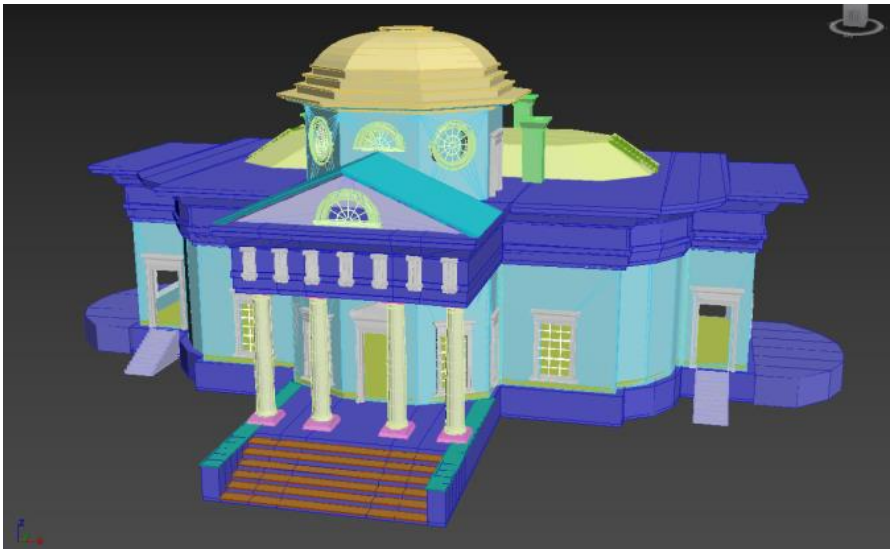

Figure 1. Basic model of the front of the villa

3.2. Pre-production

The primary task of the initial production phase is modeling. The basic model of the villa scene is created using 3DMAX. The first step involves modeling the villa building, which has a complex structure, taking the most time and being the most critical part of the project. The main feature of the entire scene is this building, requiring careful attention to detail. The overall structure of the building consists of three sections: left, center, and right. The left and right sections contain rooms for guest accommodation, while the center features a living room. The living room has front and rear doors that provide direct access to the front and back yards. The windows are designed as floor-to-ceiling units, and there is a staircase leading to an upper terrace, which includes a table for dining. During the modeling process, the construction of the walls primarily utilizes point-level dragging techniques. The creation of the windows employs Boolean commands to achieve a hollow effect. Subsequent details incorporate basic functionalities such as extrusion, insertion, bridging, beveling, and additional Boolean commands for the loft area above.

In this scene, the villa is situated in the center, reflecting a Neoclassical architectural style. The villa includes an internal structure and furniture arrangements, predominantly featuring European design elements. The exterior of the villa is divided into front and back sections. The front area includes a gazebo and a swing, with seating modeled using basic shapes such as cylinders and rectangular prisms. The overall outline is created by flexibly utilizing the five levels of points, lines, boundaries, surfaces, and elements, followed by detailing the features. The back area consists of various recreational facilities, including a swimming pool, beach chairs, and umbrellas, which are also created using multiple commands in 3DMAX. Special attention is needed for scale issues, ensuring that the size of the pool and the placement of the chairs are reasonable in relation to the villa. Continuous observation is necessary to achieve the best visual effect. The indoor furniture, including tables, chairs, carpets, and beds, is also produced using 3DMAX, employing similar techniques. Mastering proportions is crucial for successful modeling.

In summary, the modeling process of the villa involves the use of numerous rectangular structures, utilizing points, lines, and surfaces to outline the general model. A critical aspect is to avoid the creation of excessive quadrilateral faces. When applying Boolean commands, the generation of multiple variable faces can occur, which may inadvertently lead to issues with the model. Careful inspection of any unnecessary faces and points is essential, along with attention to any reversed faces. If this step is not executed properly, it may affect the subsequent UV mapping process. Finally, placing the furniture inside the villa completes the basic model construction.

3.3. Mid-production

The mid-stage preparation involves the UV mapping phase. First, the model in FBX format is imported into 3DMAX. Within 3DMAX, the UVW Unwrap command is applied to the model. Before unwrapping, it is necessary to select all faces and reset the UVs, merging the automatically generated UVs together. The unwrapping process then proceeds according to design preferences. At the irregular connection points of the model, edges are selected for cutting, dividing the model into several flat surfaces. Successful UV mapping occurs when all surfaces are evenly laid out in the scene without overlapping UVs or stretching. If stretching occurs, the Relax tool can be used to re-unwrap the faces. Then, all UVs are evenly arranged within the UV space, allowing for slight reductions in the UVs that are not visible. This ensures uniform precision, preventing issues in the texturing phase. The node display of water material is shown in Figure 2.

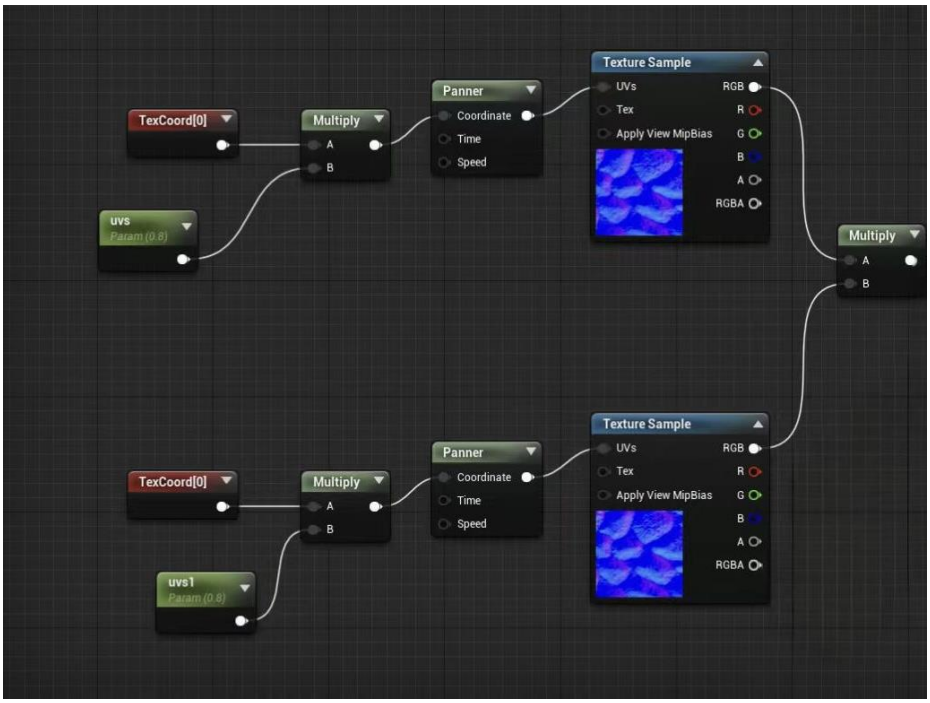

Figure 2. Node display of water material

Next, the UV-mapped model is imported into Adobe Substance 3D Painter. A new fill layer is created to apply color to the model. In this new layer, a black mask is added, allowing for the use of brushes to create color variations on the model's surface. Generators can also be added to incorporate materials, enhancing the realism of the effect. Once completed, the baking process for the textures begins. The textures are categorized into color maps, normal maps, and additional maps such as roughness maps, metallic maps, and ambient occlusion (AO) maps. Finally, these textures are imported into UE4 for connection in the material nodes. The textured material is then assigned to the model and placed within the scene, completing the mid-stage production.

3.4. Post Production

The post-production is primarily conducted in UE4, encompassing the creation of material spheres, scene construction, and the development of sky atmospheres, fog, and wind. First, terrain is selected from the mode, utilizing this function to create a landscape. At this stage, a material sphere is produced to allow the terrain to paint three different materials simultaneously. The painting function is then used to depict the effect of a path. Subsequently, the sculpting command is applied to shape hills, completing the terrain construction. Next, the villa, pavilion, swimming pool, umbrellas, and beach chairs are arranged in the scene according to the design plans, ensuring that proportions are accurate. For the outdoor environment, a large number of trees and flowers are required. The vegetation option is selected in the mode, enabling the placement of numerous flowers and trees into

the scene. Models are dragged into the material, where the painting tool is utilized to position trees and flowers throughout the scene. The brush size, strength, and density are adjusted to vary repetitions. Different types of trees are placed in distinct locations; for example, two rows of red trees are positioned on either side of the villa entrance, creating a striking appearance that makes the entrance easily identifiable. Two ponds are then created within the scene. First, the water material is developed by connecting nodes within the material sphere and creating an instance to produce the water texture. Next, a hole is sculpted into the terrain to form the base of the pond. The brush is used to apply a stone texture, and the water model is placed into the excavation, completing the pond. Finally, two clusters of lotus flowers are added to the pond, along with numerous stones and mushrooms around its perimeter, enhancing the visual appeal of the scene. The creation of the swimming pool follows a similar process to that of the pond. The sculpting tool is first employed to carve out a pit sized for the pool, after which the pool model is inserted, and water is added. Beach chairs and umbrellas are placed around the pool area. The flowers and grasses surrounding the villa, as well as the stones along the path, are gradually positioned, contributing to a more vibrant and diverse scene. The video clip is shown in Figure 3.

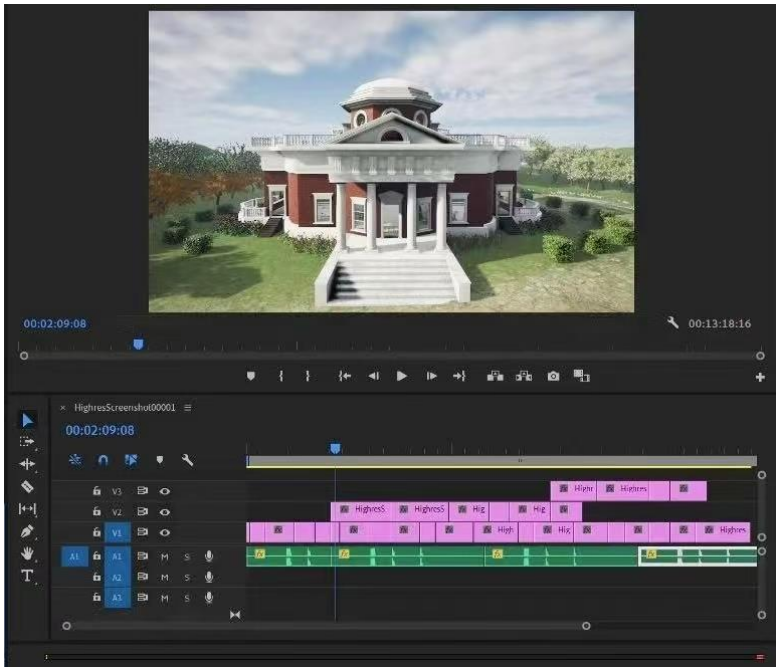

Figure 3. Video clip

4. Conclusion

In this design, virtual technology is utilized to draw inspiration from the structures and layouts of Monticello, along with adopting various environmental construction techniques. A significant amount of materials in the Roman Neoclassical style is explored during the material creation process, resulting in a final presentation that is both innovative and realistic, thus achieving the desired effect. Virtual reality technology is an emerging field with considerable development potential, and future societal progress will increasingly rely on virtual reality technology, much like the current dependence on the Internet. Regardless of how technology evolves, the integration of art design with technological advancements to enhance visitor experiences remains a primary focus in contemporary art design.

In the project production process, the application of virtual technology is also employed. A successful work is important in evoking an immersive experience. The greatest advantage of the Summer Palace is its unified style, creating a comfortable and clear overall atmosphere.

References

[1] Xu, J. (2019). Application of 3D Max and VRay in Architectural Design Presentation. Journal of Changsha University, 33(02), 6-8.

[2] Zhang, Y. (2021). Implementation of Virtual Modeling Technology Based on Geometric Models for 3D Animation Scene Modeling. Modern Electronic Technology, 44(07), 82-86.

[3] Bian, Y. (2017). Application of Material Textures in 3D Games. Digital World, (10), 52.

[4] Niu, Y. (2010). Discussion on Postmodern Architectural Thought and the Influence of Classical Style in Postmodern Architecture. Mass Culture, (04).

[5] Wu, Y. (2020). Application of 3D Virtual Reality Technology in Virtual Exhibitions. Literary Education, 03,150-151.