

Application of VR Technology Based on Actual Projects in the Protection of Local Historical Sites

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Abstract: *Under the guidance of the existing design framework and norms for the protection as well as construction of historical and cultural relics, the feasibility of the application of VR technologies in the construction of historical and cultural relics is explored in this paper, relying on the protection and reconstruction project of the sacrificial space for the Li Clan of Shanggang Tujia Nationality in Shizhu Tujia Autonomous County, Chongqing. While perfecting predecessors' application theory of VR in cultural heritage construction, a relatively complete design system for the construction of local historical sites with the participation of VR is formed, and public participation is increased to improve the recognition of heritage protection in China. At the same time, the project plays a positive role in inheriting Tujia traditional culture and increasing cultural identity.*

Keywords: *Vernacular architecture, Historical sites, VR, Tujia culture*

1. Introduction

In the process of traditional architectural landscape design, designers mainly show their ideas through hand drawings or renderings, so as to communicate with users. However, for the protection and reconstruction project of local historical and cultural relics, users' requirements for their site spirit are more intuitive, such as the requirements for people's intuitive sense of space and atmosphere. Through traditional ways of expressing on paper, emotions often can't be directly transmitted. Therefore, the introduction of newly developed VR^[1] technologies has become one of the best solutions at present.

With the innovation of technologies and the development of urbanization, the integration and concept of historical and cultural protection as well as technologies are constantly being developed and expanded together with the future protection of urban history, culture and ancient buildings, which will be further explored. Through most of VR technologies^[2], the possibility of virtual simulation can be explored based on the interaction of VR experience itself, but few of them are combined with local historical sites.

Under the guidance of the existing design framework and norms for the protection as well as construction of historical and cultural relics, the feasibility of the application of VR technologies in the construction of historical and cultural relics is explored in this paper, relying on the protection and reconstruction project of the sacrificial space for the Li Clan of Shanggang Tujia Nationality in Shizhu Tujia Autonomous County, Chongqing. While perfecting predecessors' application theory of VR in cultural heritage construction, a relatively complete design system for the construction of local historical sites with the participation of VR is formed, and public participation is increased to improve the recognition of heritage protection in China. At the same time, the project plays a positive role in inheriting Tujia traditional culture and increasing cultural identity.

2. The Protection and Reconstruction Process of Li Shougui's Tomb in Chongqing

2.1. Li Shougui's Tomb

Li Gui's 11th Tomb has been worshipped by descendants of local public servants, which is an important carrier of local history and culture as well as a symbol of national spiritual culture. By combining theories with examples, the project team applies the results of related literature analyses and base research on the project of the site design of Li Shougui's tomb. Taking the local culture and customs as the breakthrough points, the function and form of Li Shougui's tomb are reformed, then the local residents are invited to make an interactive evaluation of the reformed design by means of digital media, and the results are presented.

Location: the project is located in Shangwan Mountain, Lichang Township, Shizhu Tujia Autonomous County, Chongqing, flowing by the Yangtze River. Shizhu County is located in the fold zone of eastern Chongqing, belonging to the Zhongshan area of Dalou Mountain in Wushan. Shizhu County is located in the humid monsoon region of the middle subtropical zone, where there is mild climate, abundant precipitation and four distinct seasons. Because of its large altitude drop (119m ~ 1934.1m), the vertical difference of climate is great.

Humanistic background: Li Shougui was born in Yuan Dynasty, who was eager to learn when he was young and had a strong desire to join the army, being rich and handsome and was full of meritorious military service. Li Gui's descendants are now all over the countries home and abroad, with 100,000 ethnic groups currently. Li Clan was a large family in Lichang Township, which once built an ancestral hall attaching great importance to clan culture. Once, all the major events and trivial matters in the village were discussed in the ancestral hall, where the genealogy was also placed. Before liberation, it was destroyed by a fire. The ancestral hall of Li's ancestors' tomb is an important carrier and spiritual symbol of local culture.

Site: Shangwan is located in Jiming Mountain, with rugged mountain roads, about 4.4km away from Yinbai Expressway. It can also be reached through waterway routes. At present, rural dirt roads and cement roads are the main roads beside the tombs, which are connected to other historical sites in Shangwan Village: General Mansion, Ancestral Hall and Jiming Shanzhai Gate, together with their walls and stone tablets, etc. Li Guifen is backed by a retaining wall, where the surrounding vegetation is lush. The tomb is 6m above the external road, which reflects the respect of children for their ancestors.

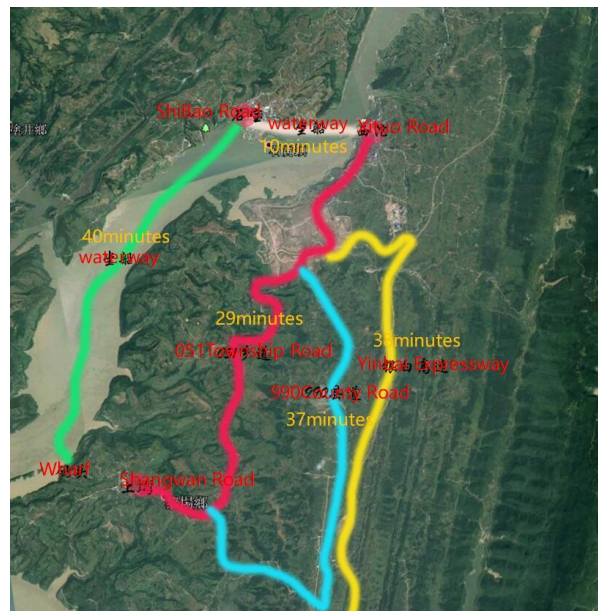


Figure 1: Traffic near Shangwan

2.2. Pre-willingness Research

In order to enhance the involvement of many parties and calculate the initial objectives of the project, the researchers communicated with local villagers, presented the general situation of the project, and shared the existing information of the project with the villagers, so as to understand the main objectives of the investigation, the size and complexity of the investigation plot. According to statistics, the villagers' design intention for Li Shougui's general cemetery is as follows:

(1) At the top of the retaining wall at the back of the crypt, design a pattern of "two dragons robbing treasures". The top of the retaining wall is paved with red glass tiles.

(2) "Li Shougui Gong Jian" is set in the middle of the retaining wall, and several merit monuments are designed on the left and right sides.

(3) This mausoleum is divided into two platforms. The upper one is a prayer platform, which is level with the height of the main tomb. It cannot be hardened, but can only be changed. The monument in front of the main tomb is set below three meters, an incense burner is placed in front of it, there are two lions on both sides of the end of the steps, and the rest of the open space is used for planting trees.

(4) Railings are set on both sides of the ladder and the platform fort above. The height difference between the upper and lower platforms is 2.5 meters, which is a masonry fort. A silver tiger totem can be designed on the wall of the fort.

(5) The following platform, which is an area where worshippers assemble, is about 4m broad. It is all designed as a green belt. Sitting on this platform, you can see the Tomb Protection Convention, the donation list and the totem on the fort.

According to the villagers' current design wishes, the restoration technology of digital model is used to reflect the ecological status of the graveyard, and the villagers' wishes status effect diagram is retrieved.



Figure 2: Front view of the cemetery

2.3. Design Ideas

According to the requirements of villagers' environmental wishes and the preservation of basic functions, we should pay close attention to the combination of historical protection, embed historical and cultural elements in the whole and details of the design, highlight the Tujia culture and clan culture, organize professionally and optimize the design.

The design optimization concept of this case is aimed at the protection of historical heritage^[3]. On the basis of location, the planning of Shanggang area is studied, the present situation of the site and its surroundings are sorted out, including the introduction of roads, the sight of the landscape and its relationship with the elevation, etc., fully considering the needs of the villagers to participate in the design and consultation, functional areas are divided, which provide the needs of public gatherings such as sacrifices, dances, speeches and other activities, meanwhile people can stay and rest in leisure exhibition spaces such as historical and cultural exhibitions with memorial service^[4]. After combing a smooth streamline, the vertical spatial structure is carried out, the display of historical and cultural details is added, the landscape environment is improved, and the local as well as regional characteristics are also respected and highlighted in the material and plant configuration^[5], so as to further ensure the historicity and vitality of the design results.

2.4. Design Process

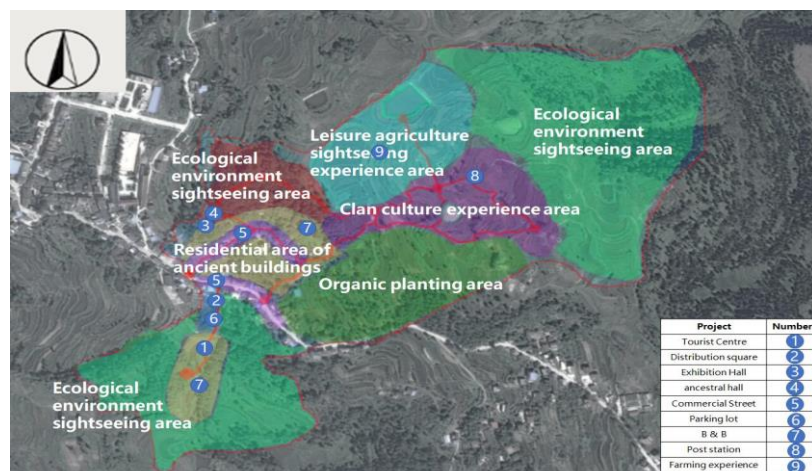


Figure 3: Front view of the cemetery

On the premise of multi-party participation and taking the protection of historical heritage as the first priority, the project selects General Li Shougui in the tourism planning area for renovation. Li Shougui's General Cemetery is located in the clan culture experience area (pictured), which is also included in the residential area of ancient buildings. This affects the designer's initial cognition of the site. The renovation of the tomb mainly carries the local clan sacrificial culture, and also makes full investigation and research on the local ancient buildings and landscape shapes, and flexibly integrates them into the design to make the old serve the new.

There is a soil slope with a height difference of about 4m behind General Cemetery, which, at present, is covered with many native plants, but the plant configuration can still be adjusted to reflect better ecological, aesthetic and cultural values. In addition to at least two entrances and exits, one of which is the main entrance and exit, there is the site of Lijia Ancestral Temple. At present, the main road at the entrance has been stepped to deal with the height difference. The designer suggests that it should be changed to a tortuous gentle slope, which can not only be used as a safe passage for the disabled, but also carry more functions meanwhile creating richer spatial changes, making the streamline experience richer and more interesting.

In terms of functions, at present, there is no clear place for people to have a rest or hold large gatherings in the base, nor is there a carrier that reflects the local clan or sacrificial culture. Therefore, the designer plans to cooperate with the roads, arrange some nodes along the way for rest and cultural display, and widen the meeting place in front of the tomb.

According to an online survey and questionnaire survey, it is concluded that ancestor worship activities for Li family mainly include: speech mourning, procession, bow down and praying (pictured). Combined with the universal function of the universal memorial cemetery and the requirements of local villagers, the site is divided into three parts: the rest and cultural exhibition area, the assembly and worship area and the entrance exhibition area. On the whole space, the sequence will show a rhythm that is suppressed first and then promoted from static to dynamic, which at the same time can also reflect the spirit of respecting ancestors in clan culture.

As a memorial space of clan type, the most important thing of Ligui Cemetery is to express the historical spirit and culture, and to connect users' understanding and inheritance of history and culture with places. The material space of design is to build a bridge of communication between designers and users. The design of this cemetery mainly shows two aspects:

As the historical spirit carrier of Li Shougui's branch in Shizhu County, Li's family united and worked hard here;

As a cultural heritage place for Li-style descendants to gather and sacrifice.



Figure 4: Front view of the cemetery



Figure 5: Ancestor worship activities of Li family in Shizhu County

2.5. Design Results

It is the main tomb area where the main body is gathered and worshiped, connecting the winding gentle slope in the east and the entrance exhibition pavilion corridor between the site of Lijia Ancestral Temple and the main tomb in the south.

The gentle slope in the east serves as not only a relief to the terrain with a high altitude difference, but also a historical symbol of Li's long journey, with a linear sign set on the way. There is a genealogical origin information node of Li's Li Shougui branch on it, whose migration history stated in chronological order can be learned about by visitors following the path while having a rest at the roadside linear facilities, showing a static sense of mourning. This is the "line" and the main entrance passing through the ground.

As the end of space axis and the focus of landscape vision, Li Shougui's spiritual leader position in the main tomb area is highlighted in the mind of descendants of the clan. Besides the tomb itself, there is an expanded platform activity space with functions including speech, mourning, procession, bow down and praying. This is the "face", which represents the core of ancestral hall culture and has become an eternal native flame condensed in the mind of the descendants of Li.

As a "point", the secondary entrance is located on the southern side of the main tomb, which is connected to the site of the Li Ancestral Hall through a path. The secondary entrance is set on the path, and the entrance is used as an exhibition area, where a semi-closed landscape pavilion will be designed to display the culture Tujia Ancestral Hall. As a checkpoint to enter the main tomb, Shizhu Township can be overlooked to the south, creating a sense of historical dialogue.

2.6. Design and Display

The starting point of the tunnel in the main tomb area is the front square in front of the residential area, which is a public space for local residents' activities, gatherings and entertainments, taking over the residential area and main structures of the entrance hall.

The main entrance structure in front of the main tomb area serves as a "boundary monument" and a gathering space, which serves as not only an "entrance" that spatially divides the functional space, but also a sacred "boundary" that mentally isolates the atmosphere of daily life and the worship dignity of daily residents. Local materials, clay blue bricks, are taken as the main materials, supplemented by local lime tile wood and other materials, which reflect the simple texture.

It is the tunnel site outside the main tomb area to the north. With the elevation of the terrain, landscape facilities such as a planting altar, a gentle slope and falling water are arranged. At the edge of the gentle slope ladder, there are linear kerbstones with different height differences, engraved with the historical

nodes of the genealogy of Li's Li Shougui branch. The axial sense of vision and historical commemoration mean that people come one after another and that his family spirit is passed down from generation to generation.

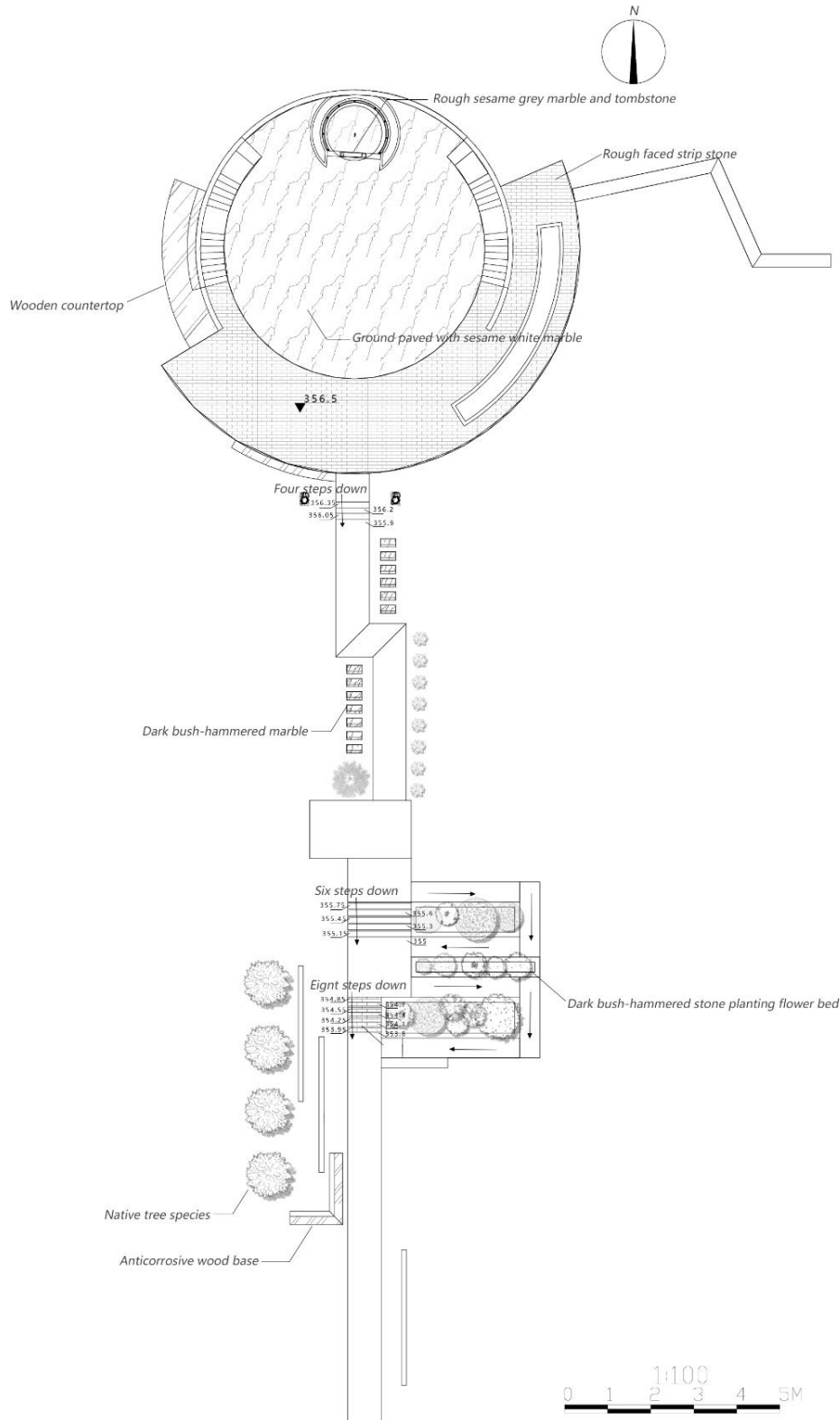


Figure 6: General layout

The main tomb area is a centripetal platform, and the display part of the landscape wall contains information such as "Li Shou Gui Gong Jian", "Tomb Protection Convention" and "Donation List" according to the villagers' early wishes. The ground is mainly economical and practical, where local stone

materials are adopted. An aggregated circle is formed through different paving methods. Brocade patterns and white tiger totems related to Tujia culture are all reflected in the detailed decoration of the ground, which is simple, calm and low-key, showing the spirit of the regional ancestral hall.

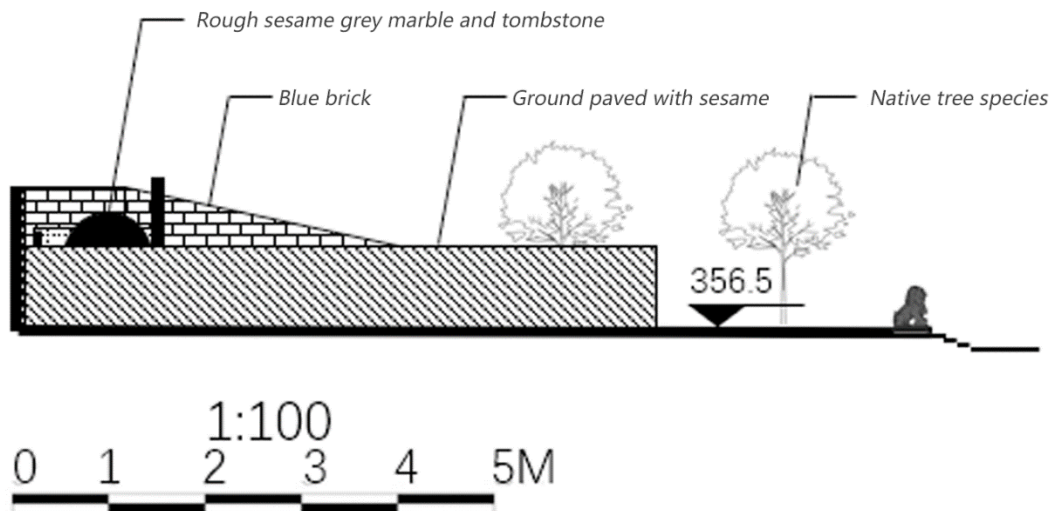


Figure 7: Section plan 1

The entrance space is relatively flexible, and the tortuous space corridor becomes a part of the elements of the land ancestral hall. The functional freedom is realized through the non-cut-off path and the semi-open wall. A blue-brick hollowed-out wall is used for lighting, which increases the mottled sense of history. A concave and convex wall is disposed into the culture of the ancestral hall site, serving as a "cultural wall" for rest and visit.

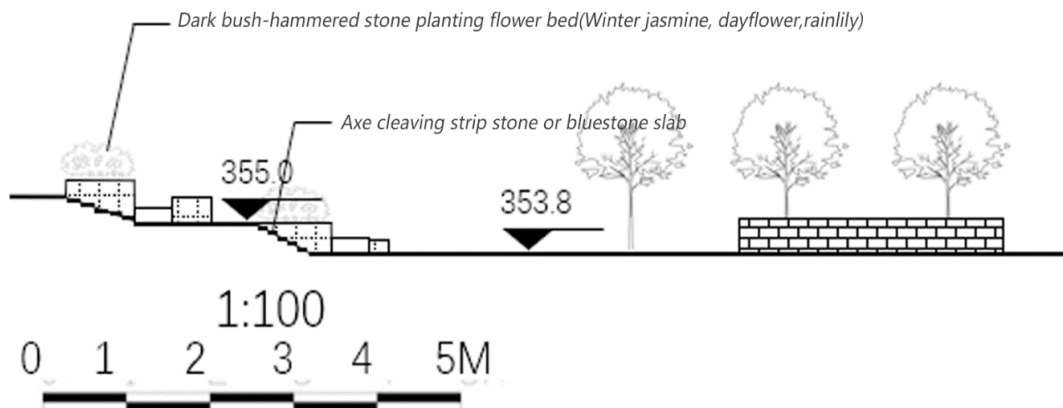


Figure 8: Section plan 2

2.7. VR Utilization of VR technology

Means of realization:

Using HTC VIVE to immerse VR wearable devices, connecting modeling software to restore three-dimensional space, VR panorama can display the specific design scheme of tomb site in all directions, lead users through the destination, experience the space environment in all directions, and make an immediate evaluation. It greatly enhances the user's sense of experience and involvement, and makes villagers or visitors who are not at the scene of the scenic spot have the feeling of being there. In the later stage, it can be used as an experience project of cultural sites and scenic spots to help the scene spirit reproduction.

Advantages of VR:

(1) Through VR technology, villagers, governments, designers and builders can directly experience the design impact of any small change in the design process. Instead of cold drawings and models, all parties face an immersive impact experience. This advantage is particularly conspicuous in cultural heritage buildings. Because the humanistic experience of architecture can only be the true experience in the real situation.

(2) Based on the synchronization of VR cloud, more people can participate in the design, and instantly put forward amendments, and get rid of the traditional feedback mode that the designer and Party A take a long time and have cumbersome steps.

3. Conclusion

Using VR virtual simulation technology to build a bridge between people and intangible cultural heritage, thus changing from unilateral intervention in design to multi-subject participation of government, villagers and professionals, so that local aborigines can actively participate in the historical protection of architectural heritage. Using VR platform for barrier-free communication among participants can make people more aware of the importance of the disappearance and revitalization of traditional regional culture. It is meaningful to explore this aspect.

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(Project Leader:Haoke Xu, Instructor:Liya Ma.)

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