

Research on Cultural Heritage Information and Digital Visualization

Taking Confucius Museum as an Example

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Abstract: Cultural heritage information includes intuitive information and hidden information of cultural heritage, which is the precious wealth left by history to mankind, the basic basis for judging cultural identity and cultural sovereignty, also the great significance to human civilization. In recent years, many explorations and practices have been made in the collection, preservation and dissemination of cultural heritage information. With the rapid development of digital visualization technology and Internet technology, the development level of digital visualization technology is constantly improving. Because of its powerful and efficient information processing ability and diversified display methods, it has been used by more and more historical and cultural institutions. Taking Confucius Museum as a specific case, this paper analyzes the development status of digital visualization of cultural heritage information, discusses the design method of digital visualization, and makes innovative exploration.

Keywords: cultural heritage information, digital visualization, museum

1. Introduction

At the meeting held on November 16th, 1972, UNESCO adopted the Convention on the Protection of World Cultural and Natural Heritage, which pointed out that cultural heritage is 'cultural relics, buildings and sites with outstanding and universal value in history, science and art[1]'. These cultural heritages are the basic basis[2] of cultural identity and sovereignty, which are of great value to the development of the country and society, and also of far-reaching significance to the preservation and study of human civilization. For a long time, the protection of traditional cultural heritage has been carried out in an orderly manner. However, with the increase of archaeological discoveries and the public's attention to intangible cultural heritage, the number of cultural heritages that need to be protected and studied has actually increased greatly, and it is difficult for existing means to deal with these heritages quickly and in large quantities. At the same time, due to the development of industrialization, modernization and globalization, the cultural environment is constantly changing, and the difficulty and urgency of cultural protection are also increasing. In terms of cultural education, there is also a contradiction between the new situation and the old methods. Cultural heritage information needs to be transmitted to the public in a more efficient and direct way to feed back the work of cultural protection. In recent years, with the development and application of digital technology, the cause of protection and development of cultural heritage information has taken on a new look. Digital technology has powerful and efficient information processing capability and

diversified display modes in combination with various terminal usage modes, and it has been continuously developed with the development of science and technology. Both digital input and output means are rapidly increasing, so it has broad development space. The significance of studying cultural heritage information and digital visualization lies in this. Only by constantly exploring the relationship between audience and equipment, network, society and cultural heritage information, and the cooperative operation among various elements, can we maximize the advantages of digitalization and promote the development of cultural protection and public education. This paper will study the digital visualization technology in digital technology, and take Confucius Museum as a specific case to analyze the possibility of its design method and innovation.

2. Necessity of Digital Visualization of Cultural Heritage

Digitalization of cultural heritage information is not only a trend, but also a necessity for its existence and development. In today's situation, the protection of cultural heritage information is facing many difficulties. Using digital means can not only solve these difficulties to a certain extent, but also provide corresponding opportunities.

2.1. The Urgency and Complexity of Cultural Heritage Information Protection

China's existing cultural heritage is huge in quantity, different in form and distributed all over the world, so it is extremely difficult to protect itself. Due to the development of urbanization and modernization in recent years, many material and cultural heritages have been damaged to varying degrees in the process of urban construction. At the same time, with the change of lifestyle, many traditional cultural information is also rapidly lost. Therefore, in many cases, the traditional way of protection can no longer meet such huge and urgent needs, while the digital way is used by more and more historical and cultural institutions because of its powerful and efficient information processing and diversified display methods, and has become an important means of preserving cultural heritage information.

2.2. To Strengthen Historical and Cultural Education and Enhance National Cultural Identity Requirements

With the accelerated development of digital technology and Internet technology, today's cultural environment and educational model are also changing. How to maintain and enhance the vitality and vitality of our traditional culture in the context of globalization has become an important issue. In recent years, China has always emphasized the construction of cultural self-confidence[3]. All walks of life not only need to adjust and change the dissemination mode of cultural heritage information, but also need to actively think about how to deal with the educational challenges brought about by cultural impact. This needs a lot of basic data and research support, and digital technology can provide basic guarantee and the premise of innovation and development for this demand. Furthermore, the information in cultural heritage can be extracted by digital visualization and image technology, and applied to the design of cultural products, so as to enhance people's recognition and sense of belonging to tradition.

2.3. The Challenge of Protection and Dissemination of Cultural Heritage Information in the Form of COVID-19 Epidemic

The outbreak of COVID-19 in the spring of 2020 not only disrupted the economic and social development of various countries, but also caused a great blow to the museums in various countries. In terms of exhibitions, many countries have imposed many restrictions on people's travel activities,

greatly reducing or prohibiting large-scale gathering public activities, which made many museum exhibitions have to stop, which not only affected the public's enthusiasm for visiting exhibitions, but also caused a heavy blow to the income of museums. According to the survey report published by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in May 2020, there will be about 95,000 museums in the world by 2020, of which 90% will be closed due to the impact of the epidemic, and more than 10% will be closed down[4]. In addition, the investigation, maintenance and preservation of many cultural heritage information have also been affected, and it is difficult for many protection organizations and research teams to get full contact with inheritors of intangible cultural heritage, thus reducing the collection and protection efficiency of cultural heritage information. In a word, the COVID-19 epidemic hindered the effective interaction between cultural institutions and the public and the protection and dissemination of cultural heritage information, forcing various institutions to develop and find other effective ways. In fact, the need for digitalization of cultural heritage information is not caused by the epidemic, but the epidemic has indeed accelerated the development process in this field, making it a general trend from an exploration or attempt.

3. Research on Digital Visualization Design Method of Confucius Museum.

This paper will take Confucius Museum as an example to analyze the application of digital visualization technology in museum design. The Confucius Museum was built near the Three Holes of the World Cultural Heritage, with a collection of more than 700,000 cultural relics, including documents and archives preserved by Confucius, rare books of ancient books after the Song Dynasty, clothes and costumes in the Ming and Qing Dynasties, and ritual instruments used to worship Confucius. During the design and construction of Confucius Museum, a variety of digital interactive display technologies were used, with Confucius culture as the core, cultural relics as the foundation and science and technology as the means, creating a place for the public to learn and understand Confucius culture. The digital equipment in the Confucius Museum basically covers the entire venue. Designers have specially designed digital interactive and display programs for some specific exhibition areas so that the audience can better understand Confucius' thoughts. Besides, interactive guide screens are installed outside and between each exhibition hall. Reading screens are installed in the hall for visitors to read Confucian classics in various languages and versions. The art design of some exhibition halls also uses digital means to create a sense of harmony between ancient and modern for visitors.

3.1. The Combination of Traditional Digital Technology and Virtual Reality Technology: Digital Cultural Relics and VR Museum

In recent years, VR technology and digitalization of cultural relics have been widely used in museum exhibitions. Confucius Museum combines these two technologies while using them. The designer adopted the way of web browsing, providing the audience with panoramic viewing and VR viewing, and the two modes can be switched at any time. Ordinary viewers can directly visit the exhibition contents of Confucius Museum online, or turn on VR equipment by themselves when conditions permit, and click VR button to switch the viewing mode (Figure 1). In VR mode, the audience can switch their viewing angles 360 degrees by their own actions and operating handles, and watch the exhibition. Because they can see the whole exhibition hall, VR mode can get more immersive experience than ordinary webpage mode. After selecting the viewing mode, the audience can operate the page to watch. As for the visiting route, the designer designed the visiting route according to the sequence of one central hall and six main exhibition halls in Confucius Museum, and marked the forward guidance in each scene. In both viewing modes, the audience can click the arrow at the bottom of the page to move forward or backward. When the audience wants to visit a specific

exhibition area, they can also transfer the thumbnail at the bottom of the page to jump directly to the designated position, or click on the map in the upper left corner of the page and directly select the coordinates to jump (Figure 2). The Confucius Museum has also produced display pages of digital cultural relics and 3D cultural relics for some important cultural relics. The audience can see the sign of magnifying glass on the panoramic display page of these cultural relics. After clicking, the high-definition photos, detailed introduction and voice explanation of the cultural relics will pop up automatically (Figure 3). Clicking the zoom button again on this page will display the 3D model of the cultural relics, and the audience can drag, rotate or zoom by themselves (Figure 4).

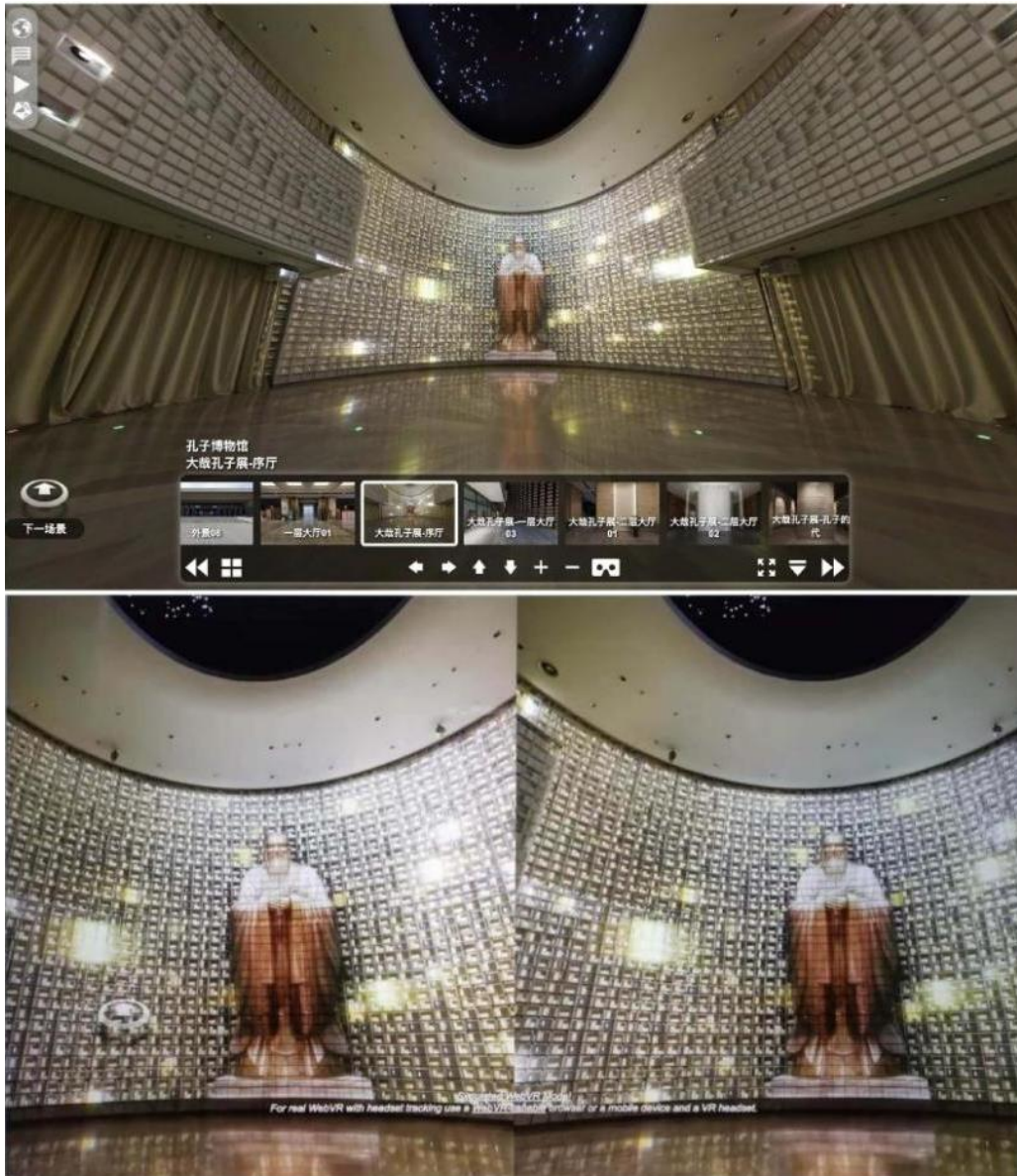


Figure 1: Digital Confucius Museum in ordinary webpage mode and VR mode.

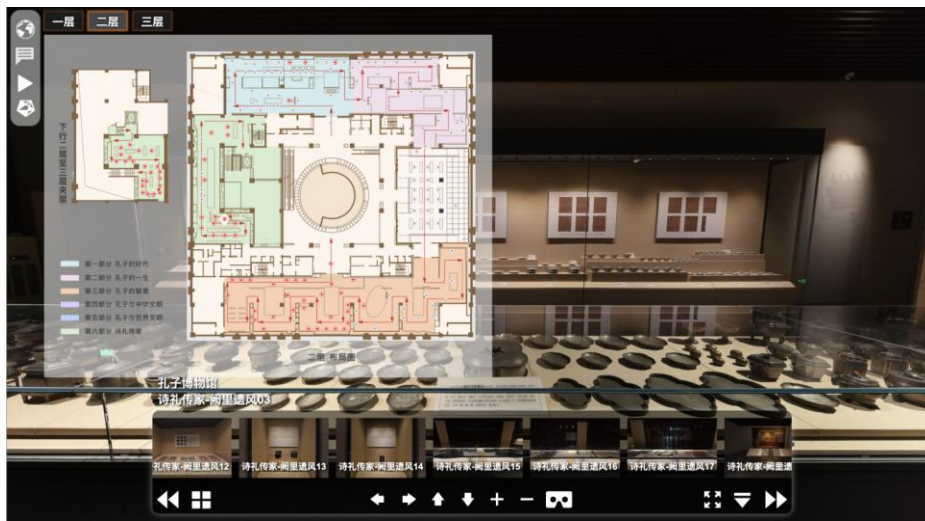


Figure 2: A guide map of the Digital Confucius Museum.



Figure 3: Text cultural relics display page.



Figure 4: The viewing effect of 3D cultural relics.

This online tour mode of combining digital cultural relics with VR Museum makes visitors' tour routes more flexible, which not only allows visitors to get a real-life experience, but also reduces the time and energy consumed, and can display some key cultural relics in more detail and comprehensively.

3.2. Interactive Touch Screen Design: Learn from Confucius

Traditional etiquette is also an important part of cultural heritage information, but it has not been well protected due to the change of lifestyle and the lack of means of communication. Taking the ceremony of worshipping teachers in this case as an example, the ceremony of worshipping teachers is an important social etiquette in ancient China and an important part of Confucian culture. It has been a tradition of Chinese people since ancient times to respect teachers, but such solemn and traditional etiquette is often not adopted in modern society. In Sankong Zhongyuan will regularly simulate the ceremony of worshipping teachers, so that the participating audience will wear disciple clothes and participate in the whole process of worshipping teachers. However, because of the epidemic situation, there is often a risk of stopping the ceremony, and it is difficult to provide more audiences with the experience of worshipping teachers because of too few times. The digital experience project 'worshipping Confucius' provides more people with the opportunity to learn and experience the ceremony of worshipping teachers.

'Learning from Confucius' applied the concept of somatosensory interaction and designed different interactive gestures according to the traditional etiquette of learning from Confucius (Figure 5). In the teaching link, the perspective of the first person in the project design and the direction of the teaching action are the same as those of the audience, and the voice is played for guidance while teaching (Figure 6). Traditional etiquette requires disciples to stand in front of the teacher with their hands folded on their chests, their left hand palms attached to the back of their right hands, their right thumbs up, their left thumbs up over the jaws of a tiger, and the remaining four fingers clasped in their palms, then bow to the teacher and salute them, and then present the gifts they bring to the teacher for offering gifts (Figure 7). In this project, the process of salute is decomposed into concrete actions. When the equipment captures the changes of the audience's actions, the corresponding interaction will be given on the screen. After the ceremony is completed, a doll in disciple's uniform will appear on the screen. After the audience takes pictures, they can stick their own facial images on the doll (Figure 8). After several audiences have successfully taken a group photo, they can download, save and share it by scanning QR code (Figure 9), and their photos would be placed in the background wall alongside Confucius and his disciples, which further enhances the sense of participation and socialization of the project. In addition, the audience will receive a unique number after completing the apprenticeship, and the system will tell the audience which 'disciples' they have become, which also enhances the audience's personalized experience. Overall, among the various digital interactive experiences in the museum, this project is the most popular among the audience. Because audiences like projects that they can participate in rather than click on a screen. When someone in the audience couldn't move on to the next stage because of an incorrect move, the audience around him would tell him that the move was wrong. They also point out each other's locations when several photos of the audience are displayed on the background wall. This interaction therefore enhances the viewer's experience as well as their knowledge of traditional etiquette.



Figure 5: Confucius Experience Zone.



Figure 6: the visitor stand in front of the screen.



Figure 7: The visitor follow instructions to complete their movements.



Figure 8: The visitor takes a photo.



Figure 9: Visitors' photo and QR code.

3.3. The Combination of Interaction Design and Virtual Experience: the Long Digital Scroll of Confucius' Sacred Map and Confucius' Wisdom Unit Set

The Confucius Museum has designed the interactive content of 'dialogue' scenes in the large interactive hall of Confucius' Holy Site Map and the wisdom unit of Confucius. The basic material used is the traditional Chinese painting 'Holy Site Map of Confucius' made by Qing Dynasty painter Jiao Bingzhen. This painting in ink silk condensed 180 classic stories of Confucius, and introduced various sacred sites of Confucius, which spanned from Confucius' childhood to Confucius' later years. The designer designed a screen with a length of 28 meters and a height of 2.78 meters for this painting,

and displayed the contents of the sacred relics and the classic sentences in the Analects of Confucius in a digital way on the screen, so that the audience could walk freely throughout the exhibition area (Figure 10). In addition, the audience can also talk with Confucius by touching another screen on the platform below (Figure 11). The display content of this screen is also the Picture of Confucius' Holy Site. However, because this picture scroll itself is a large comic book, the project has made animation for each story scene on this touch screen. The animation is still based on the original landscape and buildings, and the appearance and interactive actions for the characters in the painting are designed separately. When the audience chooses the corresponding story, the scroll will unfold automatically, presenting the complete synopsis of the scene story and the corresponding original historical materials. Therefore, when watching, the audience sees not only various scenes, but also story animations with plots. This way increases the atmosphere and experience of the tour, and makes the audience understand the contents of the picture scroll and the connotation of Confucius culture more intuitively and deeply.

In addition, the project also designed many interactive games based on intelligent mobile terminals, such as 'teacher's question and answer' (Figure 12). Viewers can scan the QR code in Confucius' wisdom unit set to enter the game page and interact with Confucius in question and answer. This link further increases the audience's immersion and active learning of cultural information.



Figure 10: Digitized scroll of Confucius' holy relics.



Figure 11: Interactive touch screen.

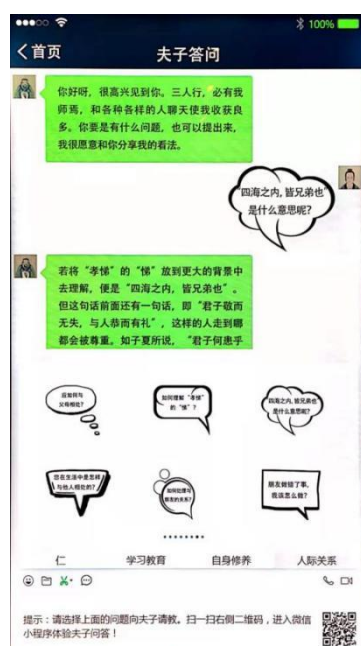


Figure 12: Teacher answers questions.

4. Exploration of Digital Visualization Innovation in Confucius Museum

In view of the development and application trend of digital technology of cultural heritage information, Confucius Museum should also continue to develop its existing resources and unique advantages, and enrich the display ways and channels of Confucius culture. In the following, the author puts forward some own thoughts.

4.1. Develop Serious Games Based on Cultural Heritage Information

Although games have long been widely used for leisure, there are still few projects that use games to support cultural heritage or enhance museum visits. Some scholars put forward the concept of 'serious game', which began with the book of the same name written by C. C. Abt in 1970[5]. After 2000, with the increase of academic discussions and the refinement of concepts, the attention of serious games has been continuously improved. Nowadays, it is generally believed that serious games are in the form of games, and at the same time, for the purpose of education, knowledge is transmitted through entertainment.

Therefore, the author thinks that we can design and make serious games with Confucius culture as the core in combination with the collection resources of the museum. In general, games are composed of four elements, namely mechanism, story, art and technology[6], which have a lot of room for traditional culture education. One of the main exhibition contents of Confucius Museum is the life experience of Confucius, and there are a lot of relevant materials in the museum. Therefore, the author thinks that the game plot can be directly started from Confucius' life as the main story. The basic template of the game can directly use the national maps of China in the Spring and Autumn Period, and add corresponding historical events in different countries and regions as background supplements according to historical records, so as to provide players with a variety of subplots during the game and make a plot collection of each region. In terms of game mechanism, the character's behavior pattern can directly refer to the traditional etiquette and the social and cultural background in the Spring and Autumn Period, and the player's behavior choice can be taken as a reference for the plot promotion. In view of the interactive experience of players during play, the game producer can

arrange 3D scene maps of various scenes such as banquets and trips according to the cultural relics in the museum, and simulate and restore Analects of Confucius stories and historical events. When players click on specific instruments or characters, the corresponding introduction entries pop up, and the producer can use these entries as clues to make subsequent knowledge quiz, plot reasoning, scene interaction and other contents. This way can not only comprehensively display the connotation of cultural heritage information and the relationship between different information, but also entertain and educate, thus increasing the public's acceptance of cultural heritage information and learning efficiency. In the aspect of game art, the producer can incorporate a variety of traditional Chinese painting elements such as ink painting elements and landscape painting elements into the game to increase the traditional cultural atmosphere of the game.

4.2. Establish an Online Intelligent Navigation System Linked With 'Three Holes'

In recent years, Apps on tourism have been developed in many cultural places, and various technologies have been continuously integrated and developed, which has greatly promoted the development of online intelligent navigation technology. The author thinks that Confucius Museum can also try to play its own characteristics in this respect.

The Confucius Museum is geographically adjacent to the 'Three Holes', a world cultural heritage, and belongs to the category of Confucius culture as well as the 'Three Holes' in terms of collection and display contents, which complement each other in content and structure. Therefore, the author thinks that the four scenic spots can be taken as the core to make overall planning for local tourism services, and make corresponding online intelligent tours, and design intelligent route planning, AR technology real-life tours, professional explanations and other functions (Figures 13 and 14). In addition, it is also possible to integrate the digital resources of Confucius Museum and some cultural relics in Sankong, establish an overall online digital exhibition center, add information boards in different exhibition areas of Confucius Museum and different scenes in Sankong. The audience can scan the corresponding QR codes to obtain the exhibition positions of other related cultural relics in different places. The author thinks that this will not only make the cultural heritage information of the four scenic spots communicate with each other, enrich the historical information available to tourists, increase the density of cultural heritage information dissemination, and enable tourists to have a more comprehensive understanding of Confucius culture in this area, but also enhance the tourist experience.

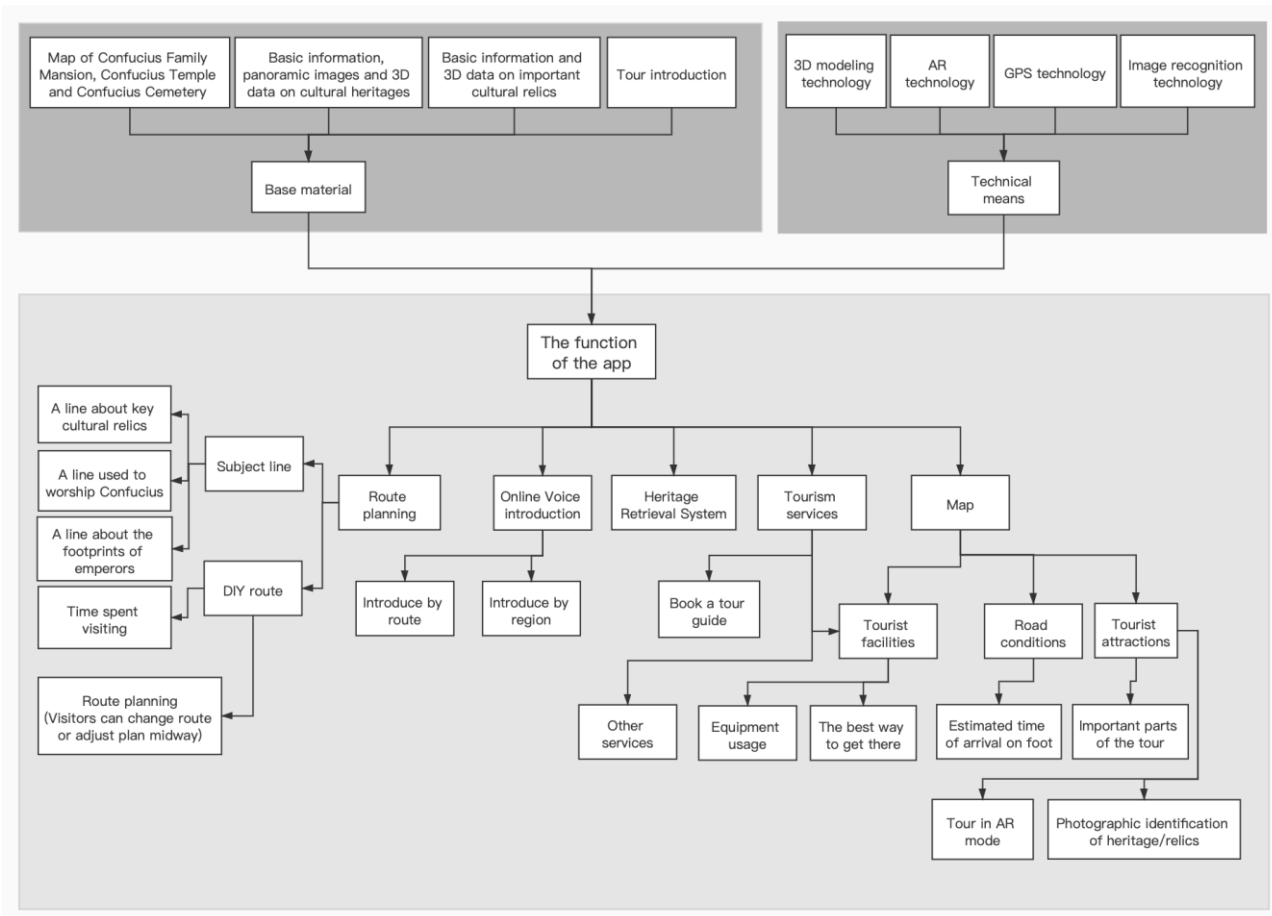


Figure 14: Main function design of intelligent navigation system.

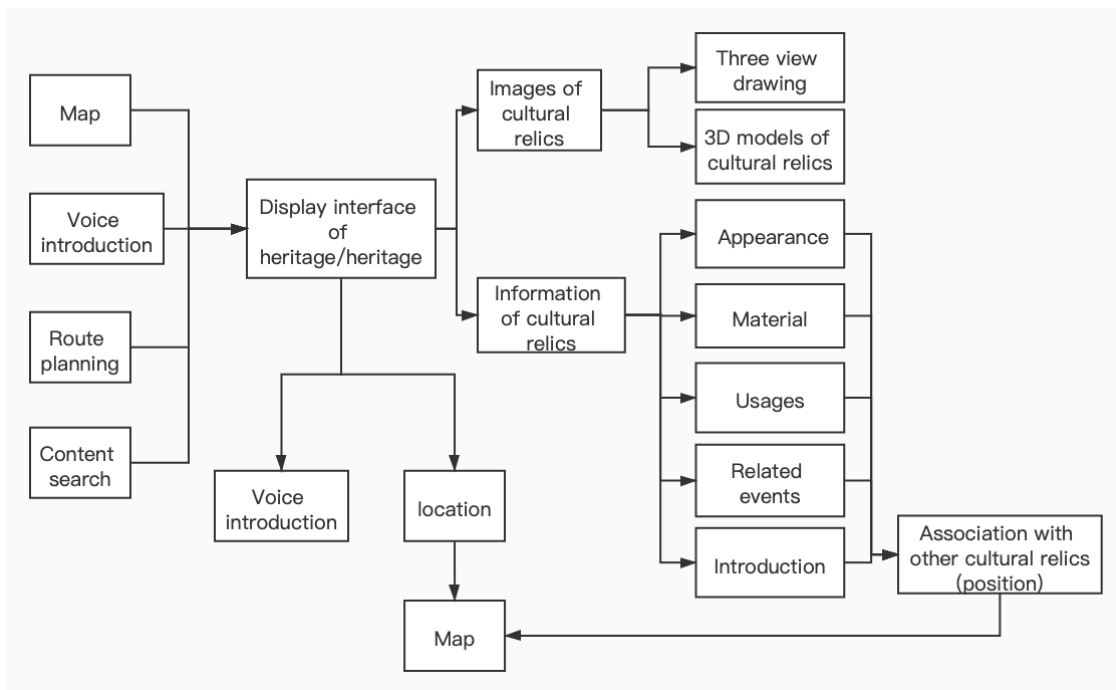


Figure 14: Design of cultural relics display page of intelligent navigation system.

5. Epilogue

Taking Confucius Museum as an example, this paper makes a concrete analysis of the development status of digital visualization of cultural heritage information, discusses the design methods of digital visualization in museums and other cultural institutions, and makes innovative explorations. There is still much room for development and exploration of existing cultural heritage resources and digital technology, and there are still many possible schemes for their combination. Therefore, the visualization of cultural heritage information will continue to be an in-depth discussion topic from all walks of life for a long time. The author thinks that with the progress of science and technology, digital input, digital information management and digital output will all develop, and the data collection and integration will be more perfect. In the future, there may be a super-large cultural heritage digital platform based on the national cultural heritage information database, which will manage the cultural heritage information in various regions in a unified way. Then, we can make a subordinate public service platform, cooperate with local museums and cultural institutions to develop a variety of comprehensive cultural services and experience projects, and provide rich conditions for people to learn, communicate and experience. In this paper, the relevant experiments and explorations of Confucius Museum prove the value and prospect of this technology, which can not only save and construct a large number of cultural heritage information databases, but also provide great convenience for the mobilization and utilization of knowledge and enhance the final display effect.

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