Digital Protection and Display Research of Revolutionary Sites in Dabie Mountain Area——Taking the Dawang Temple as an example

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Abstract: The article analyzes the status quo of digital protection at home and abroad, and takes the Dawang Temple, one of the Dabie Mountain revolutionary sites, as the research object, uses the digital technology to virtually repair it, and presents two demonstration methods of on-site display and online exhibition hall to explore and design the Dabie Mountains. The digital protection and display strategy of the revolutionary sites provides an effective reference for the protection and display of similar revolutionary sites, so that the red culture contained in the revolutionary sites can be inherited and carried forward.

1. Introduction
On March 8th, 2016, the State Council issued the "Guiding Opinions on Further Strengthening Cultural Heritage Work", stating that: “implementing the ‘Internet Plus Chinese Civilization’ action plan, bringing into play the leading role of technological innovation, and making full use of cloud computing, big data, and other ‘Internet Plus ’modern information technologies to promote the integration and innovation of cultural heritage protection and modern technology[1]. As an indispensable part of Chinese culture, red culture is the precious spiritual wealth of the party and country, and the source of power for the construction of patriotic education in China. Dabie Mountain Area has a long history of red revolution as the old revolutionary area of Hubei, Henan and Anhui provinces. In the fierce battle, the people of the Dabie Mountain Area and their indomitable revolutionary spirit have formed a deep red culture in the mountainous region of Dabie. However, due to many reasons such as remote location and backward technical support, some revolutionary sites in the Dabie Mountain Area are on the verge of disappearing or have missed. Carrying out research on the digital protection of revolutionary sites in the Dabie Mountain Area is of great theoretical significance and practical effects to enhance the connotation of red culture, improve the function of educating people in red culture, and realize the sustainable development of revolutionary sites in the Dabie Mountain Area.

2. Status Quo of the Digital Protection of Cultural Heritage

2.1. Digital Protection
In recent years, the rapid development of computer and Internet technologies and people's increasing awareness of the protection of architectural cultural heritage, coupled with the popularization of digital technologies such as cloud platforms, big data, virtual reality technology, and mobile phones and portable computers, have laid the strong foundation for the digital protection of cultural heritage.
The steps of digital protection are first of all to obtain the digital information of the protected object by technologies such as the commonly used digital photogrammetry, 3D scanning technology[2]; the second is to process the collected digital information through information processing technology such as the widely used digital model building technology, virtual repair processing technology, etc.; the third is to display the processed information through digital technology such as visualization technology, virtual reality technology, etc.; the fourth is to use other related technologies such as cloud storage technology, optical technology, etc. The application of digital technology in the protection of revolutionary sites mainly identifies, organizes, protects and displays the relevant information of revolutionary sites, and finally achieves the purpose of displaying and continuing the red culture, and providing new methods and approaches for the protection of revolutionary sites.

2.2. Status Quo of the Application of Digital Protection in Cultural Heritage

Research on digital protection has been carried out by scholars at home and abroad. For example, Spanish scholars Roque Angulo and Francisco Pinto have used digital photogrammetry, reverse engineering, and visual programming to complete the virtual restoration of the entrance to the front courtyard of the San Agustin-En Monastery in Seville (Spain) and showed its complete historical features[3]. Domestic scholars have used 3D laser scanning technology, geographic information system and other technologies to digitally manage, repair and display the reliefs on the walls of the Yungang Grottoes in Datong, Shanxi province, which reduces the loss of visitors’ touching while sharing the resources. Relevant researchers even have established real and complete 3D digital model archives of the tomb of Jingjiang King's Mausoleum in Guilin, Guangxi province, through advanced digital means such as drone aerial photography, 3D laser scanning technology and ModelPainter processing software, and provided data references for further reparation of the cultural relics[4].

3. Digital Protection of Dawang Temple

3.1. Digital Protection and Reparation of Dawang Temple

3.1.1. Data Collection. The data collection of Dawang Temple can be basically divided into two parts. Through visits and interviews, the research has collected, recorded and organized relevant documents and materials including the historical development of the Dawang Temple area and its building process.

The research has used modern measurement technologies such as total station, GPS, digital photogrammetry, and drone photogrammetry to complete the 3D data measurement task of the Dawang temple and simultaneously used a 3D laser scanner to record the characteristic information of the Dawang Temple.

3.1.2. Digital Processing of Measured Data. According to the steps of digital protection, the measured data is completely entered into the computer to be identified, sorted and stored, and then the measured data is repeatedly verified in conjunction with relevant literature. If the verification showed that there is not much difference, the verified data is used in order to be digitally analyzed and processed by relevant processing software. Then, the research finally constructs a relatively accurate three-dimensional model of the building entity of Dawang Temple and also improves and optimizes the database.

For the processing of various information data of Dawang Temple, the mainly applied digital technologies is showed as follows (Table 1).
Table 1. The Relationship between Digital Technologies and Dawang Temple Relics

| Technological Methods      | Dawang Temple relics                                                                                     |
|----------------------------|-----------------------------------------------------------------------------------------------------------|
| Scanning Technologies     | Two-dimensional: photos of the building facade, interior decoration, structure, etc.; literature;         |
|                            | Three-dimensional: plan, elevation, section; indoor and outdoor perspective;                               |
| CAD Technologies          | Plan, elevation, section; detail;                                                                         |
| Modeling Technologies     | Three-dimensional model of the Dawang Temple, including structure, materials, colors, spatial layout and other information[5]. |

3.1.3. Digital Reparation. The current site of the Dawang Temple was restored on the basis of the site (Figure 1): 3 main halls, 11 side rooms and front row buildings. The restored Dawang Temple (Figure 2) restored the original pattern of the site. The main building group is in the layout of the courtyard, and the surrounding road organization is more reasonable, so it is more convenient to communicate with the outside world, and supporting facilities and signs are more complete.

![Figure 1. Site Map](image1)

![Figure 2. Restoration Diagram](image2)

The main content of the virtual restoration of the Dawang Temple includes the entrance hall, front yard, front hall, middle yard, back hall, chamber, back yard, courtyard wall, etc. (Figure 3, Figure 4, Figure 5, and Figure 6.) The concrete implementation of restoration involves the decoration of doors and windows, eaves, and the use of masonry, wood and other materials. For the detailed list of the reparation content of each part, as Table 2 shows.

Table 2. Reparation Content

| Part               | Description                                                                 |
|--------------------|-----------------------------------------------------------------------------|
| Entrance Hall      | Restored the basic components of the Dawang Temple’s entrance hall, including the ridge wall, plaque, ornament, marble arch, drum-shaped bearing stone and other structural and decorative components. The main body is a masonry structure. |
| Front Yard         | Restored the stone slabs, the drainage ditch on the west side, adjusted the vegetation position, and moved the monument to the east of the courtyard. |
| Front Hall         | After the original front hall was removed, restored the blue brick wall and door leaf columns with reference to the lifting beam and roof beam structure of the back hall. |
| Middle Yard        | Restored the stone slabs and the drainage ditch around the courtyard.        |
| Back Hall          | Lowered the ground and restored the slate paving on the east and west sides of the back hall. |
| Chamber            | Restored east and west rooms and the blue brick wall                          |
| Back Yard          | Leveled and greened the mud ground.                                          |
| Courtyard Wall     | Restored the facade effect of the courtyard wall and the blue brick wall.     |
3.2. Digital Display of Dawang Temple

The rapid development and popularization of the Internet has brought tremendous changes to the lives of the people. At the same time, the scale of Internet users has been expanding year by year, which has brought great development prospects to the cultural industry, and also provided a solid mass foundation for the display of heritage sites. Due to the limitation of viewing mode, viewing scale, viewing dimension, etc., traditional display methods can no longer meet the needs of the masses. By contrast, digital display, which is not limited to the mode, size, and dimension, has become an inevitable trend of display methods. Recently, the mobile application “Learning China”, which is very popular among younger generations, illustrates the role of digital display in spreading social and cultural values. In terms of the inheritance and dissemination of the red culture, digital display will also play a major role in enabling the red revolutionary spirit to be inherited and carried forward in the new generation. It can be seen that the digital display of the Dawang Temple is an objective demand and a necessary means. The digital display of the Dawang Temple will be explained from the two aspects of display methods and display media.

3.2.1. Display Methods. According to the nature and characteristics of the Dawang Temple revolutionary site, the main display methods are on-site display and online exhibition hall. At the same time, it can also be displayed by the assistance of developing digital publications, books, digital publications, and animations.

On-site Display. Combined with the topographical features, natural environment, and other characteristics of the Dawang Temple site, it can be displayed by digital technologies, giving visual and auditory impressions to visitors, and spreading the cultural value and connotation of the site to them. The applicable display methods include: holographic projection, VR experience, virtual restoration, lighting, audiovisual technologies, etc. Depending on the carrying capacity, important parts of the Dawang Temple can be restored on-site, or a mini version of the original site can be virtualized indoors with digital technology accompanied by audiovisual and other technical means to create a three-dimensional model or two-dimensional model which shows the panoramic view of the site. The walking-in audio and video technology can be combined with intelligent robots to explain to visitors in real time, enabling them to receive different information at different sites. The virtual animations are also introduced to reproduce the historical scenes, and touch-screen interactive facilities are also set to better transmit relevant information to visitors. The link between the digital
technology and the heritage site enables visitors to receive a new visual impact of specific events and spirits of Dawang Temple accurately and timely. Take the revolutionary stories of the "Lixia Uprising" as an example, which is reproduced by various visualization technologies such as the production of documentaries, 3D movies, 2D cartoons, etc. Thus, the revolutionary history related to Dawang Temple can be reproduced and displayed. In addition, the performance stage can be arranged on site to reproduce the story scene of Dawang Temple, so that visitors can experience the history, culture and revolutionary spirit of Dawang Temple timelessly at a short distance.

Online Exhibition Hall. The online exhibition hall is an online public space based on the Internet in the form of electronic pictures, electronic documents, etc., which displays exhibits through the Internet[6]. The Dawang Temple Online Exhibition Hall is a service system that collects and summarizes the movable and immovable, material and non-material materials in the Dawang Temple relics, and accurately manages, displays, and collects them through computers. The display methods includes digital exhibition hall, multimedia display, picture and video display, etc., which is not restricted by time and space. All visitors can retrieve the required information through the database, and at the same time perform business management services on the network to obtain certain economic and social benefits. The advantages compared to traditional exhibition halls are that as long as there is a network, visitors can view the contents of the collection, which is more flexible, and allows the further and maximum development and collection of social resources such as the public’s evaluation, thoughts, communications, and memories.

3.2.2. Display Media. In order to better publicize and protect the relics, it is necessary to choose appropriate display media for entering the information age.

Method A: Set up an official platform. The official platform mainly includes the official website, official Weibo account, and WeChat public account. These three official platforms can complement and cooperate with each other based on their advantages and disadvantages. The official website is mainly for the overall introduction and business services of the Dawang Temple. The official Weibo account is mainly for the unified announcement of important information of Dawang temple. The WeChat public account, as a more friendly means, can serve as an interactive platform for public communication, evaluation, and feedback. The principles that all three need to grasp in operation are time-effective, authoritative, and diverse, so as to make the best use of everything and everyone to do their part.

Method B: Develop a mobile application. The rapid development and popularization of the mobile Internet has penetrated into various details of public life, and the channels for users to obtain information through downloading the mobile application have become a trend. It is not uncommon for cultural heritage to use applications to promote themselves. The way can be set for users to scan the QR code and download the application at the site of Dawang Temple to receive services. At the same time, the official creative products can be added to the application for visitors to purchase freely. On the one hand, it solves the pressure of tour guides and tourists and reduces the awkward experience of visitors’ shopping. On the other hand, it carried forward the revolutionary spirit of the Dawang Temple.

4. Conclusion
By sorting out the characteristics and status quo of digital protection, and applying the digital concept to the protection and display of the Dawang Temple, the article also provides new ideas for the protection and display of other revolutionary sites in the Dabie Mountain Area. From the perspective of protection, the application of digital technology has further made up for the deficiencies of traditional surveying and mapping such as the difficult operation and low accuracy. On the other hand, the Dawang Temple database has been established to provide data references for the future protection of it and other revolutionary sites in the Dabie Mountain Area; from the perspective of display, the application of digital technology has enriched the display methods and approaches, which can show the value connotation and cultural significance of the revolutionary site of Dawang Temple in a more
detailed and comprehensive manner. While increasing the red cultural tension of the revolutionary site in the Dabie Mountain Area, it also increases people’s awareness of the protection of red cultural heritage.

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