Innovation of Intangible Cultural Heritage Tourism Resources on Digital Platform Based on Internet of Things and Artificial Intelligence

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Abstract Intangible cultural heritage is an ancient and fresh culture, and a concrete expression of people's spirit, ideal, morality and wisdom, carrying the unique spiritual value, aesthetic awareness and cultural connotation of the nation, and an indispensable precious wealth of the country. The research object of this paper is the material cultural heritage with cultural marks, such as the specific cultural landscape of ICH (Intangible Cultural Heritage) cultural tourist attractions. The ICH digital cultural content required by the AI (Artificial Intelligence) intelligent ICHT platform in the Internet of Things (IoT) environment was completed through the network physical system aided design system, mainly including situational digital 3D models, digital animation, digital images, graphics, text and other digital morphological visual graphics images related to ICH. Cultural labels were designed according to the cultural content corresponding to ICH material media carrier, and were used for real-time tracking and registration of the system to the real environment. The system generated ICH digital cultural content by extracting cultural digital morphological data for real-time rendering. AI intelligent ICHT platform pushed augmented reality video images to intelligent terminals for display and output through virtual reality registration and integration. AI intelligent tourism application based on CPS (Cyber Physical Systems) system prototype development and design can overlay and integrate the content objects of digital culture into the target objects of real scenes in real time, and virtual reality integration can be carried out by intelligent terminals. 12.191% people were very satisfied with the experience of tea culture tourism products. This paper would further promote the development of ICHT resources.

Index Terms Intangible Cultural Heritage Tourism Resources, Internet of Things, Artificial Intelligence, Digital Platform

I.   Introduction

The research on the inheritance and dissemination of ICH, whether from the academic research of ICH protection or from its social practice projects, requires the active participation of multi-disciplinary and multi perspective research. In the process of developing ICH, appropriate and reasonable tourism development methods should be selected according to the local actual situation, and according to the needs of living protection, so that it can continue to use its cultural value to restore and build the cultural atmosphere of ICH. People should not rush for quick success and instant benefit, demolish and build. When determining the model, people should first respect the local cultural connotation, and consider the local cultural needs, and then innovate its cultural connotation and spirit from the perspective of tourism development. Mobile phone mobile digital platform should be an "active participant" in the protection of ICH.

The protection, inheritance and tourism development of China's ICH need to be strengthened. Promoting the development of ICHT and improving cultural soft power would become a strong support for China's ICHT development. According to Zhang Yue, ICH had the characteristics of locality, uniqueness and vividness. Based on the analysis of the characteristics of resources and the typical positioning of the celadon cultural industrial park in the market, he proposed the building objectives and response strategies of the celadon cultural park by systematically introducing digital technology in the scenic planning, project initiation and tourism management mode [1]. According to Su Xinwei, although bearers played a central role within this group, it was not sufficient to study the sustainability of ICH only from the viewpoint of bearers. As value perceptions are the basis for guiding people's behaviors, the perceptions of value of ICH bearers may be the starting point for understanding their behaviors [2]. Katelieva Maria presented the difficulties and potential of the related knowledge of local and traditional nature as a tourism resource and revealed how it can be integrated into the process of construction and conservation of ICH. He also discussed the "uniqueness" and "ownership" of intellectual or ICH [3]. Massing

Katharina argued that since 2003, the preservation of ICH has been the focus of cultural heritage protection policies at all tiers in China. However, limited attention has been paid by academic research to ICH conservation in theme park settings. The basic criteria in favor of ICH preservation are the inclusion of ethnic minorities in the preservation process, their access to management positions, and a greater focus on education and communication [4]. According to Su Junjie, the role of government was crucial in resolving the conflict between conservation and access to tourism heritage. Nevertheless, the different perspectives of cultural heritage officials have not been fully studied, especially in the field of tourism intangible cultural heritage. China is a country where there is a clear contradiction between the preservation of ICH and the commercialization of tourism [5]. The ICHT they studied did not explore its economic value in depth, so this paper would explore it in depth.

In the tourism development of ICH, people should always adhere to the development principle of "building tourism with culture, and promoting tourism with tourism", to avoid the tragedy of "emphasizing development over protection". Halder Somenath believed that UNESCO advocates ICHT (Intangible Cultural Heritage Tourism) because it has dual benefits, namely, promoting economic development and encouraging sustainable development. The combination of mature geological tourism and ICHT can not only further promote the protection of geological heritage, but also complement each other, and can also open up a new road of tourism economy [6]. Su Xinwei's research introduced subjective vitality into ICHT, and proposed a theoretical model involving subjective vitality, authentic experience, experience quality, perceived value and tourist behavior intention [7]. Chen, Yeong-Shyang believed that as an ICH, the tradition of vienna cafe culture attracted tourists. He inspected how the intangible heritage tourism of vienna cafe culture developed and constructed through the relationship network of social practice, and how it became an important heritage of Vienna cultural tourism development [8]. Wesener Andreas discussed the concept and experience of local authenticity related to ICH. ICH activated and promoted authentic experience. Some heritage concepts evolve from their narrow historical background and provide current authentic experience [9]. Henderson Malorey believed that climate change not only increased the vulnerability of cultural resources, but also increased the cultural value deeply embedded in cultural resources and landscapes. Therefore, heritage managers are faced with an imminent protection challenge and need to consider the significance of the site in the adaptation planning process. Their research results showed that community members have deep local ties, and their cultural resource values are closely related to the concept of local attachment (local identity and local dependence) [10]. Ruhanen Lisa believed that tourism is considered a tool to help maintain the tangible and intangible elements of indigenous cultural heritage, including language, stories, songs, art, dance, hunting methods, rituals and customs. In general, cultural heritage products developed for tourism were expected to provide many socio-economic opportunities for the communities concerned. However, tourism may also pose challenges because of problems with the self-management of indigenous cultural products and cultural identities. He aimed to further discuss how to develop indigenous tourism to maintain indigenous cultural heritage [11]. Their research did not pay attention to the overall planning and coordination of ICHT.

This paper has established a database of ICH art symbols that are used to express modern life, including living scenes, character modeling, character movements and related props modeling, and integrated existing digital technologies, and applied them to the design of AI intelligent ICHT platform. The computer aided ICH art CPS display and AI assisted ICHT scheme design have been innovatively completed. In the digital statistics of the Internet, there are about 620 million short video users.

II. Innovative Exploration Methods for ICHT Resources

II. A. Tourism Development of ICH

The inheritance and protection of ICH only focus on its non use, while tourism development focuses on its utilization. In the process of actual development, there is a conflict between the inheritance and protection of ICH [12]. Especially under the condition that the market allocates resources as the basic function, people only pay attention to its utilization value, and blindly convert it into tourism commodities to achieve its actual economic benefits. Therefore, in the development of ICH, there are a series of low-level and even devastating problems, which would have a certain impact on it [13].

The logical composition of ICH values is shown in Figure 1. Like most public goods, ICH has strong externalities. In the supply and operation of ICH, it often brings benefits to the third party, which cannot be accurately reflected by the price mechanism, that is, it cannot fully use the market to fully reflect its value [14]. The reasons why ICH cannot be traded are as follows: first, due to the diversity of its functions and values, it is impossible to accurately measure its value, while there are overlapping and overlapping; secondly, the ownership of China's ICH is not clearly defined. The interest subject is not clear, and the market transaction costs are too high.
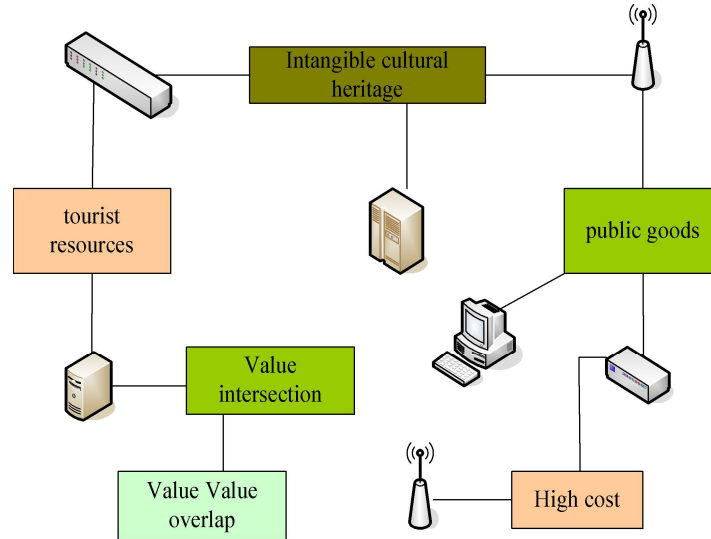
Figure 1: Logical composition of ICH values

(1) Protective development principles

Due to the fragility of ICH itself, people must attach importance to its protection and development to preserve its cultural connotation and living environment. Here, it can be divided into protecting culture and protecting local environment. The protection and development of culture means that in the process of development, tourism companies should pay attention to both the value of culture and the excavation and development of culture. They should have the awareness of protecting the history, culture, emotion and other information behind ICH, and explore and innovate the content of ICH from a multidisciplinary perspective, so that tourists can experience the tourism experience while focusing on feeling the culture [15]. Cultural protection refers to the protection of its authenticity. Tourism resources are closely related to the ecological environment. People should avoid destroying the ecology at the cost of sacrificing the ecology, resist destroying the natural tourism infrastructure, and realize the sustainable development of tourism resources. At present, due to the excessive commercialization of some historical and cultural heritages in China, a large number of tourism infrastructure has caused serious damage to the original ecological environment and irreparable damage to the local ecological environment. Therefore, in the development process, people should focus on protection, pay attention to the protection of cultural expression and participation of the residents of the heritage site, and give consideration to the equitable enjoyment of the environment of the residents of the heritage site. The construction of tourism facilities should also be carried out on the basis of sustainable development [16].

According to the calculation formula n_m of the minimum sampling quantity in ICH statistics, namely:

$$n_m = \alpha \left(\frac{z/m}{2p} \right) \tag{1}$$

$2p$ represents reliability coefficient (confidence level).

The calculation method of non use value f_s of ICH is:

$$f_s = mN(WTP) \tag{2}$$

Among them, WTP represents the average willingness to pay, and N represents the overall range.

(2) Planning and development of ICH resources

Today, when cultural tourism is popular, cultural tourism represented by ICH is favored by more and more people. Therefore, in the process of development, people must deeply explore the tourism resources of ICH to identify which products can be developed and which brands can be tourism [17]. At present, the development level of China's ICH is relatively low. The deep reason is that its development has not been combined with the concept of living protection. Therefore, if people want to excavate it comprehensively, systematically and living, people must excavate it from the perspective of living.

(3) Cultivation of ICH inheritors

The role of human not only lies in the protection of living state, but also the role of human in tourism development. Tourism development can not only provide professional tourism talents for the scenic spots, but also make rational use of ICH to cultivate a group of outstanding talents locally, promote local residents to actively participate in tourism services, and promote and display ICH. It also promotes its professional and systematic development, stimulates residents' right to create culture, enables residents to master the initiative of tourism development,

retains the cultural connotation of ICH more authentically, and enables ICH to achieve sustainable development and innovation [18].

Sample m is taken from the total number of ICH tourists. F_X of F at a point x is estimated:

$$F_X = \frac{1}{NK} \sum K \left(\frac{m-N}{H} \right) \tag{3}$$

The standardized matrix X_i of ICH data based on the IoT is:

$$X_i = (x_1, x_2, \cdots, x_i) \tag{4}$$

The correlation coefficient G_L between tourism development and ICH is calculated:

$$G_L = (M + m\omega)/(\Delta(k) + \gamma m) \tag{5}$$

II. B. Construction of AI Intelligent ICHT Platform

(1) Digital acquisition

2D scanning: an ordinary photo is scanned into a digital image, and then saved in the computer without fading. For example, plane displays such as calligraphy and painting, murals, etc. can be digitally saved through digital technology.

Digital image: digital image is suitable for static images of various scenes. Digital camera can directly capture the static images in real life, and quickly and effectively perform two-dimensional or three-dimensional processing on the computer. Digital photography is suitable for shooting various scenes, especially dynamic scenes. After capturing the real scene, it can be quickly and effectively stored in the computer for later editing.

3D scanning: in the collection of digital cultural heritage, 3D scanning technology is usually used [19]. The application of laser scanning technology makes it possible to accurately obtain the detailed information of cultural relics and truly reproduce the real face of cultural heritage, thus greatly improving the utilization efficiency of digital cultural heritage.

ICH can be inherited through written narration, audio recording, video recording and video recording [20]. Using digital image processing technology, audio recording technology, 3D scanning technology, AI modeling technology and digital animation technology, digital information collection, classification, compilation and production are realized. Its goal is to establish an effective management service information system for future data input and query.

According to the analysis of user needs, this paper designs a platform structure scheme, which represents the core functions of the system platform. The platform functions include ICH design, traditional ICH knowledge, video sharing and material shopping mall. It emphasizes the importance of independent design and production of ICH and the core function of traditional ICH art appreciation, and includes the function of "appreciation of excellent works", which helps to establish the intangible cultural circle, so that users can more easily understand the ICH art, make ICH works, and appreciate other people's excellent works.

This article focuses on the independent design and production of ICH products, the core role of traditional ICH art appreciation, as well as the "excellent works appreciation" and other functions to facilitate the construction of the ICH circle, so that users can more easily understand, produce and appreciate other people's excellent works. The preliminary functional scheme design of the platform is shown in Figure 2.
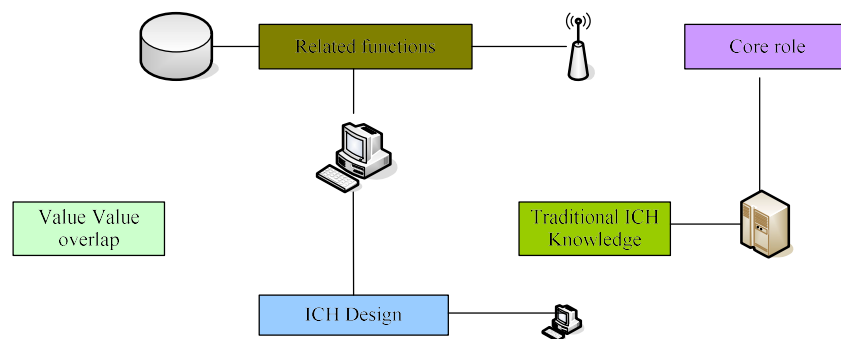

Figure 2: Preliminary functional scheme design of the platform

The database system of the ICH protection platform is the foundation of the platform. Other information and application systems are based on the database and complete their work through certain interactive ways. This database system includes other sub databases:

Traditional ICH multimedia database: this database is collected by two-dimensional scanning, image photography, image collection, text input and other digital technologies. It includes outstanding ICH modeling works,

ICH art history and culture, ICH performance skills, ICH tools, ICH plays, dramatic singing, ICH films, animation, etc. It is a literature collection of the development and evolution of ICH art and the performance of folk culture.

To protect the ICH, people should not only collect, store and display multimedia through digital technology, but also fully display the vitality of its culture. The main function of the modern ICH material library is to analyze the traditional ICH art character modeling, scene modeling, character action analysis, etc., so as to form scene modeling, common action material resources, which is the basis for users to design ICH plays creatively. Therefore, the database is an information resource for promoting the development of ICH.

Modern ICH drama innovation database: the ICH drama innovation database is a collection of excellent ICH drama creations designed by using the platform innovation design application system. Users can enjoy the sharing of different users here, forming an ICH art circle. Here, users upload their own creations, and all users can vote to select the most popular and popular works.

(2) System software architecture

The application development of CPS system prototype is mainly aimed at the real environment of the three major categories of material media carriers of ICH. The digital implantation of national cultural content is implemented in the three major categories of carriers of ICH museum, ICH cultural landscape and national handicrafts to achieve users' deep perception and experience of the cultural connotation of national characteristics. The application development of the system prototype adopts the three-dimensional tracking registration method based on computer vision, takes C# as the basic tool, uses VuforiaSDK, AndroidSDK and Unity3D as the integrated development environment, and uses the third-party software 3DSMAX/Maya as the main tool for cultural digital content design and creation.

AI smart tourism application based on CPS system prototype development and design requires that the digital content corresponding to cultural labels be accurately superimposed on the target object. In the real scene, the image of the target object is obtained in real time; the video picture is analyzed and processed, and the cultural identity of the target object is identified in the actual scene; based on the information of the actual scene video frame where the cultural mark is located, the position and attitude information of the camera relative to the target object is determined, that is, the external parameters of the camera are obtained, so as to determine the location of the cultural digital content object in the actual scene. The realization of 3D registration means that the content objects of digital culture are superimposed and integrated into the target objects of the real scene in real time, and the virtual reality is integrated by the intelligent terminal.

1) Digital image data acquisition module in the actual scene: the camera integrated on the intelligent terminal is used to compress the real-time digital video image of the target object in the real environment, and then send it to the cloud service platform for processing. The research object of this paper is the material cultural heritage with cultural marks, such as specific exhibits of ICH Museum, specific handicrafts, and specific cultural landscapes of ICH cultural tourist attractions.
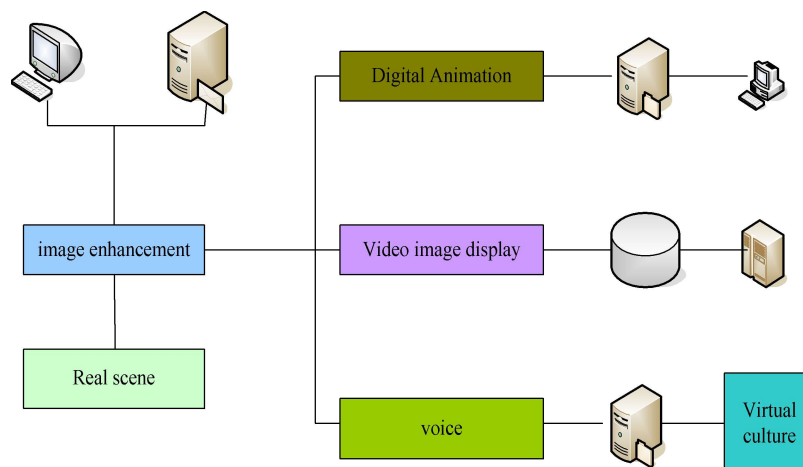
Figure 3: Composition of AI intelligent ICHT platform software system based on CPS

2) Real scene target object tracking and positioning module: the system tracks and locates the real scene target object through real-time detection and recognition of cultural labels in the video image of the target object, mainly including video image preprocessing, cultural label recognition and video image coordinate information acquisition.

3) Interactive processing module: the user not only responds to the system parameters related to setting and control, such as the size of the video acquisition window, but also needs to achieve interactive interoperability between the user and virtual objects, and objects in real scenes. For example, users use interactive interfaces to move and control virtual objects in real scenes.

Display and output module of virtual and real fusion video image: the content of virtual culture and real scene are digitally superimposed, and the fused video image is displayed and output to the user terminal screen in real time, providing users with a mobile augmented reality experience. The composition of AI intelligent ICHT platform software system based on CPS is shown in Figure 3.

The value of public goods includes two aspects: use value and non use value. Among them, the value in use is a real currency that can be estimated through market valuation techniques, while the non use value reflects people's will and understanding tendency of things more, which is the difficulty and core of value evaluation. It cannot be measured by market price, but only by valuation outside the price. The ICH value naturally has the above attributes, which can be divided into two parts: use value and non use value. Its value composition formula can be expressed as:

$$f_w = v_u + v_s \tag{6}$$

In order to measure the value of ICH, it is necessary to use random consistency index to calculate, and pass consistency test w_y.

$$w_y = \sum \beta(a_m + a_n) \tag{7}$$

III. Results of Digital ICHT Resources

In view of the fact that the survey data came from the local area and the ICH of the case site had a large impact on the local area, the total population size was finally selected as the total scope, that is, the WTP (willingness to pay) was 550 million yuan per year. According to different payment motives, people can get their existence value, heritage value and choice value. In the actual questionnaire survey, the subjects are often unable to distinguish the values of the three, resulting in overlapping and overlapping of different values. Although the above three values are biased, they still have a certain reference value. Their main performance is that the value of existence and heritage far exceeds the value of choice, indicating that the awareness of inheritance and protection of ICH is still stronger than the awareness of development. This is consistent with the concept that tourism development belongs to the inheritance and protection of material cultural heritage. The proportion and value of willingness to pay are shown in Figure 4 (the proportion of willingness to pay is shown in Figure 4 (a), and the value of willingness to pay is shown in Figure 4 (b)).
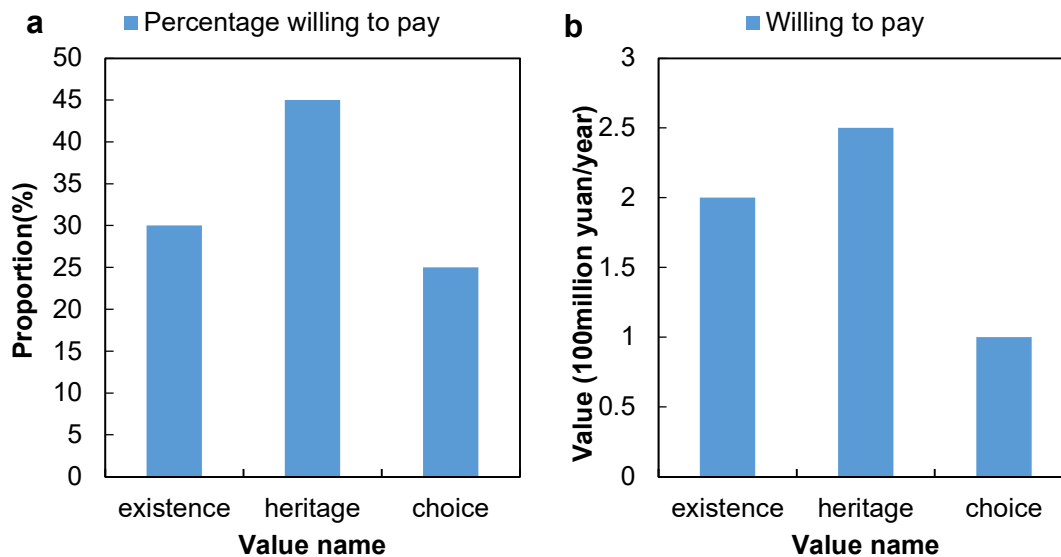

Figure 4: Willing to pay ratio and value

Tourists had a high overall satisfaction with the tea culture tourism products in M Town. 12.191% were very satisfied with this; 41.053% felt satisfied; 37.574% felt average; 9.182% felt dissatisfied. Therefore, it is necessary to improve the existing tourism product development level of M Town from the aspects of cultural connotation, participation, interest and creative content. The tourists' evaluation of the tea culture tourism products in M Town is

shown in Figure 5 (As shown in Figure 5 (a), it is very dissatisfied, not very satisfied and average. As shown in Figure 5 (b), it is relatively satisfactory and very satisfactory).
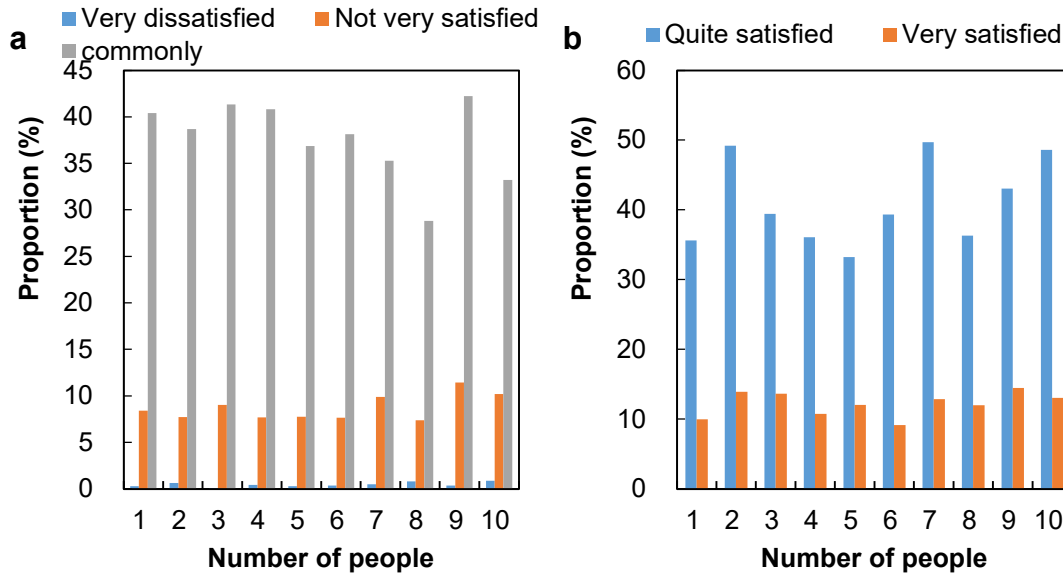

Figure 5: Tourists' evaluation of tea culture tourism products in M Town

With the rapid development of digital technology, the popularization of intelligent products, and the emergence of new technologies and new media, the traditional mode of information dissemination has been changed. At the same time, people's living and consumption habits are also being changed, enabling ICH protection units to integrate resources and information through a variety of platforms. By December 2021, the number of Internet users in China has exceeded 800 million. In this age of big data, online video has gradually been integrated into people's daily life. The number of online video users is increasing rapidly from communication channels to consumption areas. Among them, 620 million are short video users. At present, the short video platform has become an important digital video platform integrating e-commerce and social networking. With the continuous development of various short video platforms, traditional skills in the Yellow River region such as Chinese traditional crafts, singing and dancing, and folk music have gradually come into people's view. At the same time, a number of ICH skills have also spread on the short video platform, setting off a wave of learning. On short video platforms such as "AAuto Quicker", "Tiktok" and other short video platforms, various types of short videos of ICH have broken through 100 million, which fully reflects the development of digital technology on ICH, and gives birth to ICH with a long history. The number of Internet users and videos under the development of digital technology is shown in Figure 6.
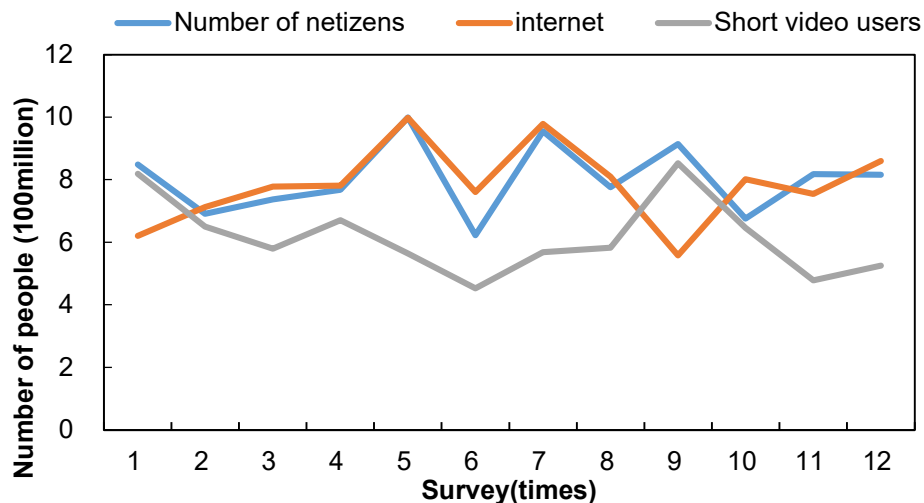
Figure 6: Statistics of the number of Internet users and videos under the development of digital technology

China plays an important role in the protection and inheritance of ICH, providing a good external condition for it. The Chinese traditional culture has been valued and traced by the general public, as well as the efficient transformation and output of commercial companies, which are opportunities for the development of contemporary ICH. The construction of intelligent ICHT platform is to meet the needs of the development of the times. On the one hand, to establish an AI intelligent intangible heritage tourism platform, a perfect database must be established. The AI intelligent ICHT platform has opened up a unified online sales channel, making the relationship between the inheritors of ICH skills and consumers closer. They are the core of inheriting ICH. Through interaction with netizens, they can receive information in a timely manner, so as to create products that meet the market demand and improve economic efficiency. The construction goal of the intelligent ICHT platform is to establish a connection with users through digital technology, spread intangible culture through network technology, and promote the "self hemopoiesis" of cultural heritage, so as to achieve the extension of the vitality of cultural heritage. The proportion of AI intelligent ICHT platforms downloaded by different ages is shown in Figure 7. It accounts for about 41% of the people aged between 20 and 30 who downloaded.
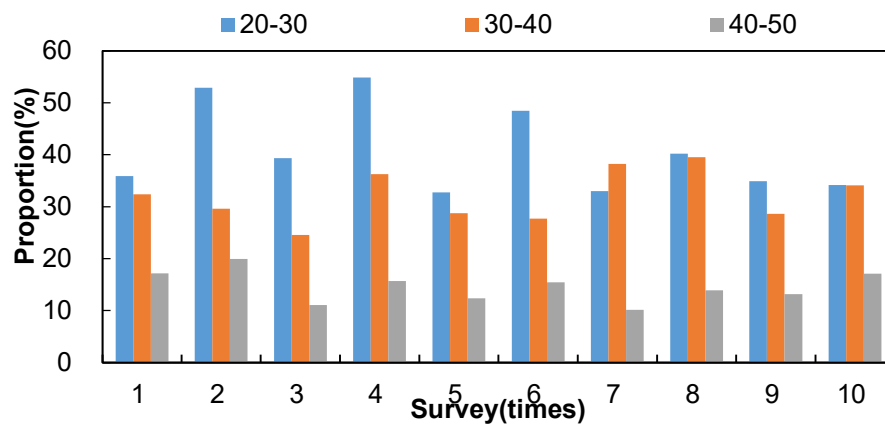

Figure 7: Proportion of AI intelligent ICHT platform downloaded by different ages

In recent years, great progress has been made in the protection of cultural relics in China, such as the roaming of the virtual Forbidden City, the digital display of cultural relics in the Three Gorges, the digital reconstruction of many ongoing museums, the Nanjing Museum and the China Friendship Museum. These projects have certain reference value for the protection of digital technology. Among many projects protected by digital technology, the "Digital Forbidden City" and "Digital Dunhuang" are better. The "Digital Forbidden City" digitizes the cultural relics in the museum, and users can view relevant information through mobile phone APP. "Digital Dunhuang" has made new exploration in the application of digital technology, which not only preserves the precious objects of cultural relics, but also brings new possibilities to the application of Dunhuang grotto art. It is shown in Figure 8.
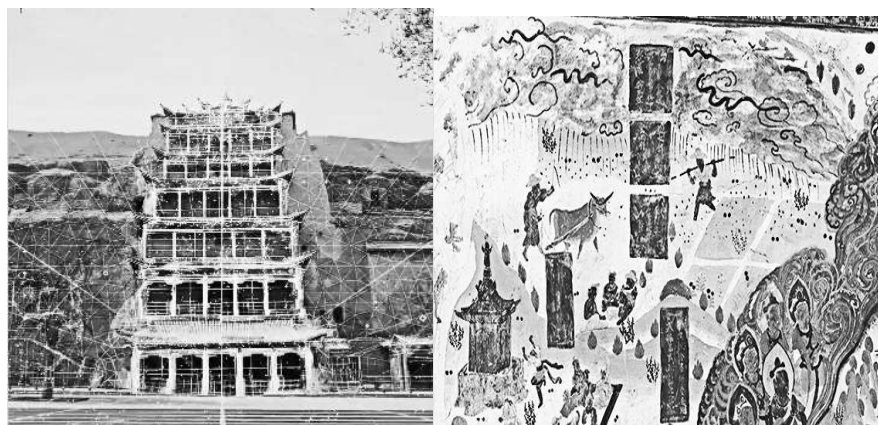

Figure 8: Digital dunhuang display (http://f6z.cn/sc84k and http://f6z.cn/NQuxM)

Under the traditional communication conditions, the region, time and display process of ICH in the Yellow River region are restricted by the field, so it is difficult to achieve vivid and accurate communication. Moreover, the audience is not present, so it is impossible to obtain on-site experience. In an intelligent communication environment, Internet technology and mobile media are used to realize the combination of online and offline. On the one hand, the video, scene and interactive communication of the ICH of the Yellow River are realized, so that people can personally experience the history and culture, production process, product form, etc. of the ICH of the Yellow River. In addition, the IoT or AI technology is used to "travel through time and space" by means of specific time, space, environment and other means to bring the audience a feeling of "being on the scene", so that the charm of the intangible heritage of the Yellow River is more deeply rooted in the hearts of the people, and the audience can become the successor of the Yellow River heritage from the beginning, and carry out the second pass with the inheritors of intangible heritage. Through situational communication, peole can promote the "going out" of the ICH of the Yellow River, make the ICH spread across regions, nations, cultures and countries, and further expand its social impact. The development path of ICHT resources of the Yellow River under AI and IoT technology is shown in Figure 9.
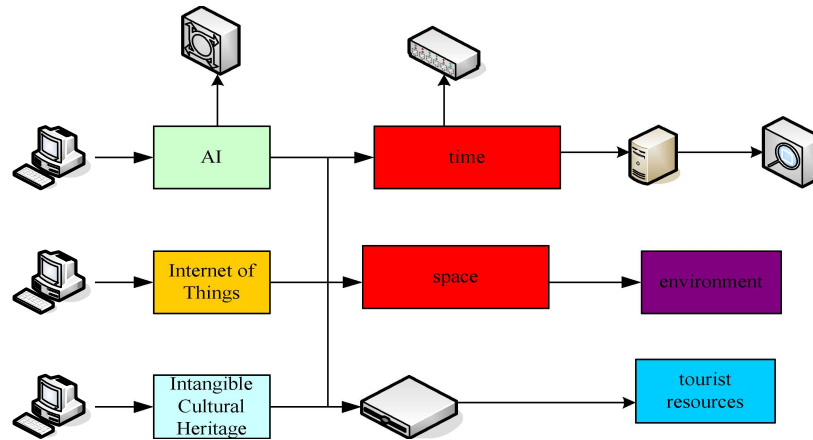

Figure 9: Development path of ICHT resources of the Yellow River under AI and IoT technology

The development of ICH can not only create employment and real economic benefits for local residents, but also create rich tourism income for local governments. It can also turn the rich cultural resources in the region into a real market and provide funds for them. The actual economic benefits generated by tourism development directly reflect its use value. Its use for heritage inheritance and protection is to explore its non use value, so that its existing value is gradually recognized by the academic community and the government.

Using tourism development to explore the value of ICH can change people's unreasonable possession and utilization of ICH in the past. ICH is invisible, and its inheritance and protection must be based on a certain carrier, namely the successor. In the past, some young people were unwilling to learn and inherit. The development of tourism can not only enhance the country's attention to ICH, but also strengthen the cultural self-esteem of local residents, so that more people can spontaneously join in the inheritance and protection of ICH.

The excessive use and consumption of ICH would bring irreparable damage. Here, "intergenerational equality" emphasizes not only the inheritance and protection of ICH, but also the necessity of developing ICH. The proposition of goal value orientation is aimed at the destructive development caused by the lack of understanding of its value in the past tourism development practice. In the process of development, people should always remember protection and development, and find a balance between development and protection.

Seen from the current situation, under the current objective circumstances, it is impossible to completely protect all ICH, and priority should be given to projects that are in a disadvantageous position and face heavy losses. Especially, the order of using digital working objects in the process of inheritance is particularly important, and priority should be given to projects that are more difficult to protect. As the protection of traditional cultural heritage cannot be fully realized, it is necessary to adapt it to the life of contemporary society without taking risks with the support of technical means.

IV. Conclusions

ICH is an intangible asset, and the inheritor is an important carrier of its inheritance and development. The protection of ICH in China has made remarkable achievements, and has made great progress in inheritance system, protection mechanism, etc. Although the protection of cultural relics in China has been further developed,

there are still many problems in the process of inheritance due to social and cultural changes. In the process of implementation, it is necessary to strengthen the evaluation of inheritors in heritage protection, and make appropriate adjustments to its contents. In this paper, the IoT technology was used to build a database of ICH under the guidance of shared learning mechanism. It has laid a theoretical basis for the development of AI ICH development platform. This paper introduced how to use various application interface designs for reference and combine the characteristics of ICH art to develop the AI intelligent ICHT platform. The interactive design in the AI intelligent ICHT platform has been enhanced, so that users can learn ICH art knowledge in a pleasant interactive experience, and inheritors can draw creative inspiration in social interaction, grasp fashion trends, increase the economic conversion rate of cultural resources, and realize the active protection and inheritance of ICH art. The application of digital technology in the process of inheritance should be based on a full understanding of the characteristics of the protected ICH, and select the appropriate technology, so as to better support the traditional inheritance. Scientific and technological innovation is an important driving force for cultural development, promoting cultural innovation.

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