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Design of Virtual Display Platform for Intangible Cultural Heritage Based on Meta-universe

Hailong Liu[1,2]

[1]*School of Humanities, Tongji University, Shanghaiy, China, 200000*
[2]*Shanghai Xuanyuan Cultural Technology Co., Ltd, Shanghai, China, 200000*

Abstract: *The protection of intangible cultural heritage is of great importance, but traditional display methods are limited and difficult to attract young groups. The rapid development of meta-universe technology has great potential in the field of culture, which brings new opportunities for the inheritance of intangible cultural heritage. This paper focuses on the virtual display platform of intangible cultural heritage in meta-universe, which covers the platform design concept and architecture, related technology application, digitization and creation of intangible cultural heritage, functional module implementation and operation, and promotion strategy, etc. Through the use of various technological means, such as VR, AR, 3D modelling, blockchain, etc., and the construction of the platform through multi-source data collection, storytelling and narrative, the platform realizes the functions of virtual showroom browsing, interactive experience, social sharing and other functions. The platform helps to increase the popularity of intangible cultural heritage, promote heritage and innovation, expand the audience, provide innovative ideas and effective ways to protect intangible cultural heritage, and is of far-reaching significance in the field of cultural heritage.*

Keywords: *meta-universe; non-heritage culture; virtual display platform; digital exhibition; cultural preservation*

1. Introduction

In the rapid development of science and technology, cultural heritage is facing unprecedented opportunities for change. As a treasure of national spirit, the traditional inheritance mode of culture has encountered bottlenecks in the wave of modern society, and the distance between the young generation and intangible cultural heritage has gradually widened, while the traditional display mode is difficult to fully show the profound connotation and unique charm of intangible cultural heritage. At same time, meta-universe technology has emerged, reshaping the pattern of cultural experience with its virtual reality, augmented reality and other innovative means. It breaks the shackles of time and space, and injects new vitality into the display and inheritance of intangible cultural heritage.

2. Overview of Relevant Technologies

2.1 Explanation of Meta-universe Core Technology

With the help of head-mounted devices and other hardware, VR technology can build a completely virtual non-heritage scene space through high-resolution display and accurate tracking system. For example, in the display of traditional opera non-heritage, users can be "in" the ancient theater building watch the performance, from the visual, auditory immersion in a full range. AR technology utilizes terminals such as smart phones or smart glasses to superimpose non-heritage related images, text or animation information in real time in the real scene. For example, when visiting ancient architectural sites, users can scan their cell phones to see the complete non-heritage decorative details and historical introductions of the former buildings, which enhances the cultural connotation and interest of the real space. 3D modeling makes the real artifacts look as if they are in front of you through accurate measurement and digital reconstruction of non-heritage artifacts and scenes. For example, ancient carvings are modeled in an all-round way, their textures and shapes are carved in detail, and then rendering technology gives the models realistic material, light and shadow effects, making the digital models come to life. Blockchain technology is based on distributed ledger and encryption algorithm, which gives unique encrypted identity to the non-heritage digital assets. In the authentication process of

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non-legacy digital collections, detailed information is recorded from the source of creation, including the creator and time of creation, etc. In the traceability process, the flow path and transaction records of the collections can be clearly queried to effectively protect the intellectual property rights of the non-legacy and prevent the emergence of fake and shoddy digital products.

2.2 Feasibility and Advantages of Technology Integration

The integration of VR and 3D modeling allows 3D models to build highly realistic VR virtual spaces. In the virtual display platform of non-legacy culture, it allows users to enter the original environment of the birth of non-legacy as if they traveled through time and space, greatly enhancing the sense of immersion. At the same time, the combination of AR technology and 3D modeling can display 3D models of non-legacy in real scenes, so that non-legacy culture can be seamlessly connected with modern life scenes. The blockchain technology protects the data security of the whole platform, ensuring that all the digital assets of non-heritage culture on display are real, reliable and untamperable, so that users can experience and disseminate them with peace of mind. Synergizing with each other, these technologies can not only improve the performance of the platform, reduce data errors and security risks, but also optimize the user experience in terms of visual experience and interaction, laying a solid foundation for the inheritance and innovation of non-legacy culture in the meta-universe, conforming to the new trend of cultural development in the era of digitization, and expanding the new boundaries of the dissemination of non-legacy culture.

3. Platform Design Concept and Architecture

3.1 User-centered Experience Design

It is necessary to deeply explore the cultural connotations of intangible cultural heritage, use geographic information system data and historical documents to accurately restore the geographical features such as mountains, rivers, landforms, and architectural styles of the birthplace of intangible cultural heritage, and reproduce traditional festivals, sacrificial celebrations, and other folk activity scenes. 3D panoramic roaming technology and surround sound effects can be utilized to construct realistic virtual environments. For example, when showcasing the ancient streets and alleys where traditional handicrafts originated, users can stroll through them to feel the historical context of intangible cultural heritage inheritance, trigger emotional resonance, and strengthen cultural identity, making intangible cultural heritage deeply rooted in their hearts in a more vivid and lively form. The concept of diverse interaction can serve as the foundation for designing rich virtual operation processes. For example, when simulating the steps of traditional embroidery needlework, users can accurately operate the embroidery needles through the handle and experience the exquisite craftsmanship of intangible cultural heritage; When building the intangible cultural heritage Paper Cuttings virtual workshop, users can freely create Paper Cuttings patterns and see the effect in real time. At the same time, to promote further user engagement, we can also develop various interactive games, such as intangible cultural heritage puzzle games and online intangible cultural heritage knowledge competitions.

3.2 Overall Platform Structure Design

The display interface adopts a simple and intuitive layout, with the classification display area of intangible cultural heritage projects as the core, subdivided by traditional skills, folk culture, folk literature and other categories, making it convenient for users to browse in a targeted manner. The popular recommendation area is based on big data analysis of user browsing habits and interest preferences, intelligently pushing popular intangible cultural heritage projects. The search function is equipped with intelligent association and precise filtering, and users can quickly locate the target intangible cultural heritage content by entering keywords. In addition, a high-definition image carousel is set up to showcase the exciting moments of intangible cultural heritage, and a video playback area presents intangible cultural heritage documentaries and skill demonstrations, attracting users' attention from all aspects. The user permission management module divides ordinary users, professional users, administrators, and other different permission levels based on user registration information and behavior data, and assigns corresponding operational permissions[1]. The data interaction process adopts efficient asynchronous loading technology to ensure smooth and seamless user operation, such as quickly loading relevant data when clicking on intangible cultural heritage project details. The

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dynamic update logic of display content is based on time nodes, user feedback, and cultural hotspots, automatically pushing new intangible cultural heritage projects, updating story scripts, maintaining the timeliness and attractiveness of platform content, and ensuring stable and efficient operation of the platform. The intangible cultural heritage digital resource library integrates multiple sources of data, including high-definition images, videos, 3D models, text materials, etc., and uses distributed storage technology to ensure data security and scalability. User data storage covers registration information, browsing history, interactive behavior, etc. Through data mining and analysis algorithms, it deeply analyzes user interests, preferences, and behavior patterns, providing data support for accurate recommendation of intangible cultural heritage content and optimization of platform functions, providing scientific basis for platform operation decisions, and promoting the sustainable development and innovation of the platform.

4. Digitization and Content Creation of Intangible Cultural Heritage

4.1 Digital Collection and Organization of Intangible Cultural Heritage

Ultra high definition camera equipment is used to capture every subtle movement and expression of intangible cultural heritage performances from different angles and scenes; High fidelity audio recording equipment is adopted to accurately record the emotions and tone changes in the narration of the inheritor, as well as the unique sounds in the traditional craft production process; Advanced 3D scanning technology is utilized to complete comprehensive and high-precision scanning of traditional craft products, recording their shape, texture, and material details. At the same time, the geographical environment and related scenes of the origin of intangible cultural heritage are photographed using drones to ensure the integrity and accuracy of data from multiple dimensions, laying a solid foundation for the digital preservation of intangible cultural heritage. According to the classification standards of UNESCO's intangible cultural heritage projects, combined with the characteristics of domestic intangible cultural heritage, the collected data will be classified. By dividing and labeling the areas to which intangible cultural heritage belongs by region, local characteristics and cultural differences are highlighted; By taking time as the axis, the historical evolution, inheritance, and development trajectory of intangible cultural heritage are sorted out; Further subdivision is required based on the category of intangible cultural heritage projects. Finally, It is very important to establish a structured database to provide an efficient path for data storage, retrieval, and management, optimize the data classification and labeling process using intelligent algorithms, improve data utilization efficiency, and promote the deep development and utilization of intangible cultural heritage resources.

4.2 Storytelling and Multimedia Fusion Display

We should go deep into the source areas of intangible cultural heritage to achieve in-depth exchanges with local cultural scholars and folk artists, and explore the historical stories hidden behind intangible cultural heritage projects, from the aspect of ancient legends and family traditions to cultural preservation in the changing times. In order to bring intangible cultural heritage to life in stories and inspire users' exploration and awe of intangible cultural heritage, we should carefully write these materials into narrative scripts, connect the origin, development, and inheritance of intangible cultural heritage with storylines, integrate emotional elements and cultural interpretation, and create a window for users to deeply understand intangible cultural heritage culture[2]. When constructing a multimedia fusion framework on a virtual display platform, a detailed introduction of intangible cultural heritage projects is provided through text as the basic information carrier; The exquisite moments and physical details of intangible cultural heritage are displayed through high-definition images; The original narration and traditional music of intangible cultural heritage inheritors create a strong cultural atmosphere by inserting audio for playback; The complete performance and inheritance process of intangible cultural heritage skills is presented through playing videos; The production steps of complex intangible cultural heritage techniques are decomposed using animation technology, and vivid dynamic demonstrations are presented to allow users to intuitively understand. Users can smoothly enjoy a comprehensive and multi angle display feast of intangible cultural heritage on different devices through multi terminal adaptation technology, thereby enhancing the infectivity and influence of intangible cultural heritage display.

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5. Implementation of Platform Function Modules

5.1 Virtual Exhibition Hall Browsing Function: Immersive Exploration of Intangible Cultural Heritage

In terms of spatial layout, the creation of atmosphere space is based on different intangible cultural heritage themes and styles, and the simulation of lighting effects is also the same. The exhibits are arranged in an orderly manner according to the era or type of craftsmanship, while incorporating cultural context and visual aesthetics. Map navigation provides a panoramic view of the overall exhibition hall layout and path planning. At the same time, guidance signs and information prompts are set up at key exhibits or scenes to facilitate users' quick positioning and exploration. When the user clicks on the exhibit, a high-definition pop-up window is instantly triggered, in which text is used to explain historical heritage, cultural significance, regional characteristics, etc., and high-definition images are used to display the details and overall style of the exhibit from different perspectives. The 360 degree rotating view utilizes virtual reality technology to make users feel as if they are playing with the exhibits themselves. The production process video breaks down the entire process from raw materials to finished products in a dynamic form, presenting the historical background, artistic charm, and craftsmanship essence of the exhibits in all aspects, creating a deep cultural appreciation experience for users.

5.2 Interactive Experience Function: Diversified Interaction Unleashes New Perception of Intangible Cultural Heritage Techniques

Taking the simulation of paper cuttings as an example, the opening and closing action of the scissors is simulated through the handle, and the pressure sensing technology is used to let the user feel the toughness and cutting strength of the paper during paper cuttings. At the same time, the screen feeds back the shape change of paper cuttings in real time, and combined with gesture recognition, the complex paper cuttings pattern can be operated by both hands. The embroidery experience utilizes a specially designed interactive device to simulate the feeling of needle threading and thread pulling. Users perform embroidery operations based on virtual pattern prompts, and the system evaluates the accuracy of needlework in real time. In pottery production, the rotation of the pottery wheel is also simulated through a handle, and users can adjust the shape of the clay through gestures. The force feedback technology allows users to experience the tactile changes of clay in their hands. The intangible cultural heritage puzzle game selects representative patterns or cultural relic images of intangible cultural heritage, sets different difficulty levels and time limited challenges, and stimulates users' competitive awareness. The traditional folk knowledge quiz competition covers rich content such as folk festivals, folklore, and traditional etiquette. It adopts models such as timed quiz and multiplayer battles. The winner can receive virtual rewards or unlock special intangible cultural heritage content, promoting the dissemination of intangible cultural heritage knowledge in a fun way and enhancing user participation and cultural awareness.

5.3 Social Sharing Function: Building an Ecological Network for Cultural Exchange of Intangible Cultural Heritage

Users can embark on a personalized community journey by registering and logging in. Personal information management facilitates users to showcase their unique connection with intangible cultural heritage. The dynamic feature encourages users to share their experiences or insights on the platform, their perceptions of intangible cultural heritage works, and their own creative processes or achievements, thereby promoting deep communication among users. The liking and comment function builds a bridge for user interaction, allowing users to dynamically express their opinions and exchange experiences with others, creating an active community cultural atmosphere. Users can click the share button on the virtual exhibition platform to share the wonderful virtual exhibition hall of intangible cultural heritage tour clips, interactive experience results, personal creations, etc. to the WeChat circle of friends, microblog updates or Tiktok short videos with one click. The shared content can automatically generate attractive copy and topic tags, thereby attracting more social network users' attention and effectively expanding the scope of intangible cultural heritage dissemination. With the powerful dissemination and influence of social networks, intangible cultural heritage can reach a wider audience and trigger a wave of public attention to intangible cultural heritage.

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6. Platform Operation and Promotion Strategy

6.1 User Experience Optimization and Continuous Updates

Adhering to the concept of putting users at the core, we promote platform optimization and use big data analysis to analyze user behavior data such as browsing paths, duration of stay, and interaction frequency on the platform, in order to accurately understand user preferences and pain points. Based on this, visual optimization of the interface design can be carried out, such as adjusting color matching, simplifying the operation process, and enhancing the convenience and friendliness of interaction[3]. At the same time, we also need to regularly update the intangible cultural heritage content resource library, introduce emerging intangible cultural heritage projects, and innovate display forms, such as combining virtual reality technology to launch immersive intangible cultural heritage story experiences. In terms of functional modules, we need to continuously iterate interactive gaming and social sharing functions, add personalized settings and intelligent recommendations, to ensure that the platform always meets user expectations, maintains freshness and attractiveness.

6.2 Cooperation and Promotion

In terms of cooperation, we will deeply collaborate with inheritors of intangible cultural heritage and invite them to join the platform to conduct online live teaching, showcase their works, and interpret their skills, in order to enhance the platform's professionalism and authority. We also need to collaborate with cultural institutions such as museums and cultural centers to jointly plan online and offline integrated intangible cultural heritage exhibition activities, achieving resource sharing and complementary advantages[4]. In terms of educational promotion, we will work together with schools and educational institutions to develop an intangible cultural heritage curriculum system, using the platform as a practical teaching base to cultivate students' interest and awareness of intangible cultural heritage inheritance. At the level of market promotion, we use social media to accurately advertise, participate in cultural and technological exhibitions for platform display, cooperate with tourism agencies to create intangible cultural heritage tourism routes and promote them online, enhance platform awareness and influence through multiple channels, and broaden the coverage of user groups.

7. Conclusion

This article is based on the virtual display platform of intangible cultural heritage in the meta-universe, integrating diverse cutting-edge technologies to open up a new path for the inheritance of intangible cultural heritage. Through carefully designed user experiences, intangible cultural heritage is vividly presented, such as immersive scene restoration and interactive settings. The display of intangible cultural heritage content has been enriched through digital collection and storytelling. The functional modules cover browsing, interaction, and social sharing, meeting the diverse needs of users. In terms of operation and promotion, the enhancement of platform influence is achieved through parallel optimization of user experience and multi-party cooperation. This platform has significant innovative value in the process of protecting and inheriting intangible cultural heritage. Although there are still challenges such as technological optimization and content expansion, with the evolution of meta-universe technology, it is expected to showcase its unique charm in global cultural exchanges and promote the widespread promotion and deep inheritance of intangible cultural heritage in the new era.

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