



A Study on the Construction of an Online Database for Birch Bark Craftsmanship

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Abstract. As a precious intangible cultural heritage of forest ethnic groups in northern China, birch bark craftsmanship carries unique regional ecological wisdom and cultural memory, but currently faces challenges such as fewer inheritors, disappearing traditional scenarios, poor preservation of physical relics and scattered materials, making digital protection crucial; this paper focuses on constructing an online database for birch bark craftsmanship to realize systematic preservation, multi-dimensional presentation and decentralized communication of relevant materials via digital technology, form a closed-loop system of "documentation–preservation–communication–innovation", and transform the craftsmanship into sharable public cultural resources to inject modern vitality into its living inheritance.

Keywords: Birch bark craftsmanship, online database, intangible cultural heritage, digital protection, living inheritance

1 Introduction

Birch bark craftsmanship is rooted in the forest ecological environment of northern China, It is a crystallization of the wisdom of ethnic minorities such as the Oroqen, Ewenki and Hezhen in adapting to and utilizing nature, encompassing the manufacturing techniques of various practical and decorative products. On May 20, 2006, "Birch Bark Craftsmanship", applied for by the Oroqen Autonomous Banner of Hulunbuir City in the Inner Mongolia Autonomous Region, was approved by the State Council and included in the First National List of Intangible Cultural Heritage[1], attracting extensive attention from the cultural and academic circles. Given the scattered literature, fragile physical relics, lack of inheritors, and insufficient digital preservation of birch bark craftsmanship, establishing an integrated online database for preservation, exhibition, retrieval and communication is crucial for inheriting the craft and protecting national cultural heritage.

2 Research on the Construction Strategy of the Online Database for Birch Bark Craftsmanship

2.1 Demand Analysis for the Construction of the Online Database for Birch Bark Craftsmanship

Traditional birch bark craftsmanship is preserved through physical collections and oral transmission, which lead to damage, skill gaps and information distortion. Digital databases can convert products, techniques and inheritors' experience into permanent digital assets for research and inheritance. The decorative patterns are unique cultural symbols reflecting the life and beliefs of nomadic peoples^[2], but low social recognition due to regional limitations. The Internet and digital display break communication barriers and enhance public understanding. A multi-dimensional platform promotes the living inheritance of intangible cultural heritage, strengthens cultural confidence and contributes Chinese wisdom to global civilization^[3]. The database should meet the needs of researchers and inheritors, support data retrieval, skill display and cultural communication, maintain timely updates and integrate functions such as storage, display, search, interaction and innovation to promote the inheritance and development of birch bark craftsmanship.

2.2 Reference to Existing Domestic Intangible Cultural Heritage Databases

Existing online intangible cultural heritage databases in China can be classified from two core dimensions: coverage scope and ICH type. In terms of coverage scope, national-level databases, with the China Intangible Cultural Heritage Network · China Intangible Cultural Heritage Digital Museum as a typical representative, boast supreme authority. Provincial and lower-level local online ICH databases are mostly carried by exclusive online platforms built by local ICH protection institutions. This can provide a highly targeted reference approach for presenting the regional cultural connotations of birch bark craftsmanship, a distinctive ICH item of Heilongjiang Province. Classified by the types of ICH covered, comprehensive databases such as the China Audio Network ICH Database embrace a variety of ICH categories with abundant resources and extensive coverage. As for specialized databases, there is currently no publicly available online specialized database for birch bark craftsmanship open to the general public in China, yet other specialized digital projects for traditional handicrafts hold significant reference value. Examples include the Pattern-based Computer Paper-cutting System^[4] and Computer-aided Paper-cut Image Generation^[5] developed by Professors Zhang Xianquan, Yu Jinhui, Jiang Linglin and others, as well as the Innovative Design System for Handicrafts^[6] developed by Zhejiang University. These projects have accumulated mature experience in digital simulation of traditional craftsmanship, visualization of manufacturing processes and interactive experience design, which can provide specific technical and model references for the presentation of birch bark craftsmanship techniques and the development of interactive functions.

3 Module Design of the Online Database for Birch Bark Craftsmanship

3.1 Basic Function Design

The online database for birch bark products must closely align with the artistic features of birch bark crafting, the differences in craftsmanship characteristics among various ethnic groups, and the inheritability of intangible cultural heritage. Therefore, in terms of module design, the database shall focus on the digital archiving and multi-dimensional display of birch bark products, adopting a three-dimensional classification method based on theme, function and craftsmanship. The theme category is divided into animal patterns, plant patterns, natural phenomenon patterns, geometric patterns and life scene patterns. The function category includes practical utensils and decorative artworks. The craftsmanship category covers cutting and carving, pyrography, and sewing and shaping. Each product is accompanied by high-definition images and labeled with basic metadata.

The Cultural Interpretation Module systematically presents the cultural connotations and historical context of birch bark craftsmanship, helping users form a three-dimensional cognition of it. This module sorts out the complete development context of the craftsmanship. Integrating archaeological discoveries and documentary records, and accompanied by historical images and excerpts from archaeological reports, it restores the evolutionary course of the craftsmanship. Centering on the five core processes—barking, softening, cutting, decorating and shaping—it details the key operational points of each step through forms such as 5–8 minute videos per process, step-by-step exploded views and textual analyses.

The inheritor thematic module highlights the core role of inheritors and fully records the living inheritance context of the craftsmanship. It collects information about national, provincial, and municipal inheritors and establishes complete biographical archives, including personal experience, learning process, craftsmanship characteristics, representative works, and inheritance pedigrees, supplemented by high-definition portraits and on-site videos recording their production processes and oral interviews. It presents the inheritance stories of inheritors in text and audio, exploring the difficulties they encountered, their attempts at innovation, challenges in inheritance, and corresponding solutions. Meanwhile, it updates information on inheritors' activities in real time, endowing the database with strong humanistic connotations.

As shown in Figure 1, the detailed design of the basic functions of the online database for birch bark craftsmanship covers three core modules, providing a clear framework for digital protection and dissemination.

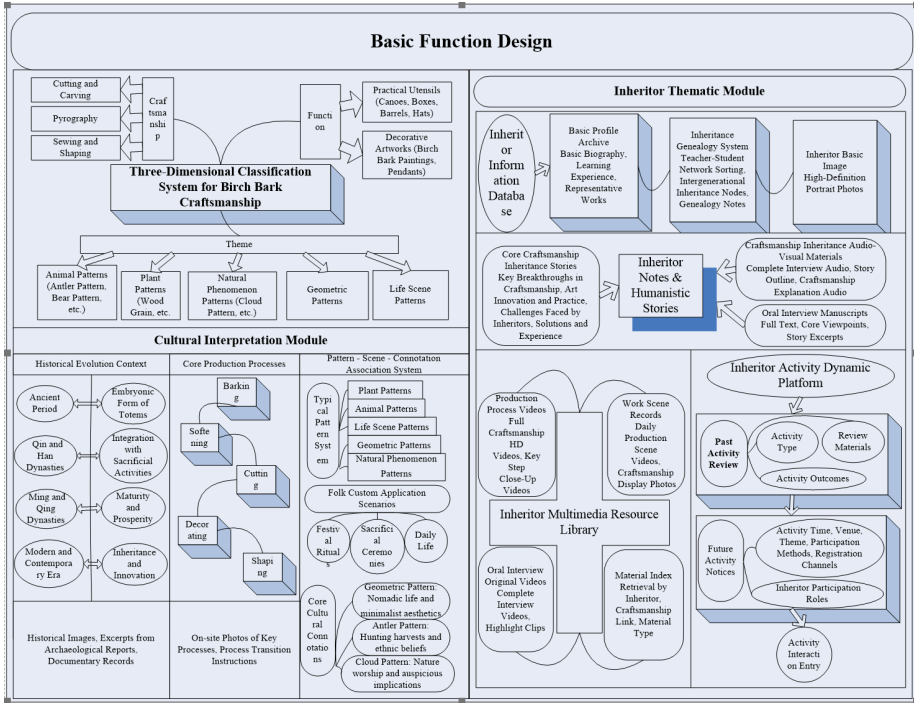


Fig. 1. Detailed Design of Basic Function Modules

3.2 Interactive Function Design

The Work Sharing Area allows users to upload self-made birch bark works, which, after passing review, can be labeled with the work name, creative inspiration and craftsmanship applied. Other users may like and comment on the works and exchange production experience. The Q&A Exchange Area sets up three sub-columns: Craftsmanship Consultation, Cultural Discussion and Inheritance Suggestions. The Feedback and Suggestion Area is dedicated to collecting users' opinions and suggestions on the database's content and function design, which serves as an important reference for the continuous optimization and upgrading of the database.

The intelligent retrieval function improves information retrieval efficiency through multi-dimensional design to meet precise query needs. The homepage search box supports precise searches by work name, theme, function, craftsmanship, inheritor, and keywords such as "birch bark boat" and "pyrography", while also providing advanced retrieval and fuzzy matching mechanisms for combined conditions or automatic error correction recommendations. Combined with user history and popular queries, hot keywords like "birch bark painting creation" and "inheritor interviews" are displayed to guide access; it also supports voice input with real-time text conversion, adapting to convenient access in mobile scenarios.

The immersive experience function uses digital technology to restore craft scenes and production processes, greatly enhancing user engagement. High-precision 3D

models of birch bark boats, decorative boxes and other works allow 360-degree rotation and detail inspection, presenting the craftsmanship intuitively. A 360° panoramic virtual folk custom exhibition hall restores real-life scenes, enabling users to roam virtually and appreciate the deep integration of the craft and daily life. A simplified interactive system simulates core procedures such as peeling, softening, cutting, decoration and shaping. Users can create small decorative works with virtual tools, and the system provides real-time feedback and guidance, bringing an intuitive production experience.

The cultural interpretation module systematically presents the cultural connotation and historical context of birch bark craftsmanship, helping users form a comprehensive understanding. It sorts out the complete development history by integrating archaeological findings and historical records, supplemented by historical images and excerpts of archaeological reports to restore the evolution of the craft. Focusing on the five core procedures—bark stripping, softening, cutting, decoration, and shaping—the module details the key operations with videos, step-by-step diagrams, and textual explanations.

As shown in Figure 2, the interactive function design of the online database for birch bark craftsmanship includes four core modules, each with sub-functions, providing users with diverse and convenient digital interactive experiences.

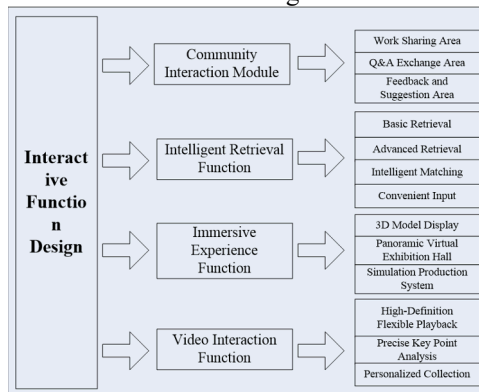


Fig. 2. Interactive Function Design of Birch Bark Craftsmanship Database.

4 Technical Implementation of the Database

In response to the regional uniqueness and living inheritance needs of birch bark craftsmanship as an intangible cultural heritage, this study breaks through the limitations of traditional digital archiving and constructs a new paradigm for its digital protection. We build a multimodal data collection pipeline using 3D scanning, spectral analysis, AI image recognition and other technical means^[7]; combined with 3D collection strategies, we carry out comprehensive scanning and preprocessing including texture enhancement and detail sharpening to accurately restore craft traces, use 4K ultra-high-speed cameras, macro photography and hyperspectral imaging to record core production processes and capture microscopic material changes to address the

limitations of traditional 2D images, and adopt high-precision 3D scanning and motion capture technology to form interactive dynamic digital archives^[8], which record inheritors' hand movements and force changes, integrate oral narratives, and establish an associated knowledge base of "motion–craft–culture" to realize the computable inheritance of the craftsmanship.

To address the issues of complex feature dimensions and excessive redundant information arising from multimodal data acquisition, the database incorporates the Recursive Feature Elimination (RFE) algorithm. By iteratively evaluating feature importance and eliminating invalid information, the algorithm preserves the core features associated with the patterns, craftsmanship and morphological characteristics of birch bark products^[9]. Meanwhile, an adaptive lossless compression algorithm is applied to the texture features of birch bark, and the processed data is stored in a hybrid architecture of distributed object storage + time-series database + graph database. Among them, object storage is used to store unstructured data such as the collected high-definition images and 3D models; the time-series database records the dynamic parameters of the birch bark crafting process; and the graph database constructs a semantic association network among inheritors, works, craftsmanship and cultural symbols based on knowledge graphs, thereby enabling cross-dimensional knowledge retrieval.

WebSocket technology is used for real-time message push in the works sharing and Q&A sections, ensuring instant feedback for likes, comments and questions. An RBAC-based authority management system distinguishes permissions for ordinary users, reviewers and administrators to ensure content compliance. The intelligent search integrates a search engine with multi-dimensional indexing, supporting precise, advanced and fuzzy retrieval, and recommends popular content based on user behavior analysis. Three.js is adopted for 3D visualization and interactive display of birch bark products and 360° panoramic virtual exhibition halls for smooth immersive experience. The system is deployed via Docker for environment consistency, with data backup and disaster recovery mechanisms to ensure stable operation, providing reliable technical support for the digital inheritance and communication of birch bark craftsmanship.

5 Conclusion

As a precious intangible cultural heritage of northern forest ethnic groups, the digital protection of birch bark craftsmanship is crucial to addressing its inheritance crisis. Establishing an online database enables integrated information management and effective dissemination of birch bark products, techniques, and inheritors through diverse modules and interactive experiences. This provides a systematic solution for the living inheritance of birch bark craftsmanship, overcoming the limitations of fragile physical collections and oral transmission. Furthermore, it offers a reference for the digital inheritance of similar traditional handicrafts of ethnic minorities, helping to preserve cultural genes and lay a solid foundation for building a strong cultural country.

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References

1. Hou J. 2025. Thoughts on the Path of Cultural and Creative Products Empowering Rural Revitalization: A Case Study of Birch Bark Art. [J]. *Tiangong* ,(21):1–3.
2. Liu Y N, Sun Y. 2025. Protection and Inheritance of Intangible Cultural Heritage under the Background of Culture and Tourism Integration: A Case Study of Birch Bark Craftsmanship. [J]. *Tourism Overview* ,(10):132–134.
3. Pan L S. 2026. Living Inheritance and Innovative Development: A Study on the Independent Knowledge System of China's Intangible Cultural Heritage. [J]. *China Intangible Cultural Heritage* ,(01):19–25.
4. Zhang X Q, Yu J H, Jiang L L, et al. 2006. Pattern-Based Computer Paper-Cutting System. [J]. *Computer. Eng.* ,(11):248–250.
5. Zhang X Q, Yu J H, Jiang L L, et al. 2005. Computer-Aided Generation of Paper-Cut Images. [J]. *Computer. Aided Des. Computer. Graph.* ,(06): 1378–1382.
6. Jiang H, Sun S Q, Pan Y H, et al. 2002. An Innovative Design System for Handicrafts. [J]. *China Mech. Eng.* ,(04):93–96+6.
7. Li R F, Zhou Y. 2025. Research on the Construction of the Pattern Database of She Nationality Costumes in Jiangxi. [J]. *Liaoning Silk* ,(04): 92–93+199.
8. Wang S Q. 2026. Research on Immersive Exhibition Space of Xinyang Intangible Cultural Heritage from the Perspective of Interactive Design. [J]. *Shoe Technol. Des.* ,6 (01): 42–44.
9. Garg M , Aggarwal S , Kumar A , et al. 2025. Enhancing digital preservation of Indian art heritage through fusion based deep learning CBIR system. [J]. *npj Heritage Science* , 13(1): 468-468. <https://doi.org/10.1038/S40494-025-01918-1>.

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