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The Application of Blockchain Technology in Document Management for the Library

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ABSTRACT
This paper discusses the application of blockchain technology in document management for the library. With the characteristics of encryption algorithm, distributed ledger, distributed architecture and traceability, this technology is of great significance in enhancing the security of document resources, optimizing the copyright protection, improving the efficiency of resource sharing and collaboration, and optimizing the experience of reader services. Its application covers the joint collection and edit system of document resources based on blockchain, decentralized storage and distribution platform, knowledge graph co-construction and sharing, and evaluation and contribution incentive mechanism participated by readers, so as to promote more efficient and intelligent library services.

KEYWORDS
blockchain technology; document management for the library; application innovation

With the rapid development of information technology, document management for the library is facing new opportunities and challenges. With its decentralization, immutability, traceability and other characteristics, blockchain technology provides innovative solutions for document management in the library, which is expected to solve many problems in the traditional management mode, promote libraries to better fulfill the mission of knowledge dissemination and service in the digital era, and open a new chapter in document management for the library .

1 The Significance of Applying Blockchain Technology to Document Management in the Library

1.1 Enhance the Security and Integrity of Document Resources

In the field of document management for the library, blockchain technology provides a solid guarantee for improving the security and integrity of document resources with its unique encryption algorithm. The encryption technology of blockchain adopts asymmetric encryption to encrypt the metadata and content information of the document and generate unique digital signatures, and any unauthorized tampering will be quickly detected by nodes in the blockchain network, thus effectively preventing the document from being maliciously modified or stolen.

Taking the digitalization of precious ancient books as an example, after the ancient books are converted into digital documents by high-precision scanning, their data is divided into multiple encrypted fragments and stored on various nodes of the blockchain. This distributed storage enables no single control center to access or tamper with the data at will, and even if some nodes are attacked, other nodes still keep complete copies of the data, thus ensuring the originality and authenticity of ancient digital documents, providing a reliable and accurate data basis for academic research, and greatly improving the security and integrity of document resources in the library.

1.2 Optimize the Copyright Protection Mechanism

The distributed ledger characteristics of blockchain technology shows significant advantages in the copyright protection of documents in the library, and provides an effective way to improve the transparency of copyright management. From the beginning of document creation, key metadata such as the author's identity information, creation time, and modification record are encrypted and recorded on the blockchain to form an immutable evidence chain [1].

With the dissemination, borrowing and citation of documents between libraries, their transmission paths and usage are also recorded one by one, and these information can be traced and verified. For academic papers and electronic books, whether they are distributed on interlibrary loans and online reading platforms, or created through secondary citations, their copyright ownership is clear, and each use authorization and transaction are automatically executed through smart contracts to ensure that the rights and interests of all parties are legally protected, which makes the entire management process fair, transparent, and accurate, and effectively promotes the virtuous circle of knowledge creation and dissemination.

1.3 Improve the Efficiency of Resource Sharing and Collaboration

The distributed architecture of blockchain technology has revolutionized resource sharing and collaboration in document management for the library. The application of blockchain makes each library become a node in the distributed network, and the information of documents in libraries is encrypted and securely recorded on the blockchain, which realizes the real-time synchronization and sharing of information. Based on the trust mechanism of blockchain, libraries can quickly and safely carry out resource sharing and collaboration without cumbersome coordination and verification by intermediate institutions. Taking joint collection projects as an example, each library can clearly understand each other's collection characteristics and resource distribution through blockchain, and accurately integrate and deploy resources, so that document resources can flow in a larger scope, thus greatly improving the utilization rate of resources, and providing readers with more abundant and convenient document access channels. At the same time, it also reduces the communication, coordination and management cost of libraries in the process of resource sharing, and promotes the collaborative development of library industry.

1.4 Optimize the Experience of Reader Services

The application of blockchain technology in document management for the library has greatly optimized the reader service and experience, and also indirectly guaranteed the security and integrity of document resources. The traceability of blockchain can build a detailed and immutable source information chain for each document, so that readers can clearly track the whole process of the document from creation, publication to collection. It not only enhances the credibility of the document, but also makes it difficult for any illegal or infringing documents to mix in the collection system, thus guaranteeing the quality and safety of the document resources from the source.

Based on smart contracts, libraries can automatically recommend personalized documents to readers based on their historical borrowing behavior, academic interests and other data to meet their diverse needs [2]. At the same time, in terms of borrowing authority authentication, smart contracts can quickly verify readers' identities and borrowing qualifications to reduce tedious manual review processes, and improve service efficiency. This efficient, accurate and credible service mode can make readers deeply feel the reliability and professionalism of library services, significantly enhance the trust and satisfaction of readers in library services, promote the good interactive relationship between libraries and readers, and further promote the rational use and safe management of library resources.

2 The Application of Blockchain Technology in Document Management for the Library

2.1 Joint Collection and Edit System of Document Resources in Libraries Based on Blockchain

In the joint collection and edit system of document resources in libraries based on blockchain, several libraries form a closely coordinated document collection network by building an alliance chain. The collecting and editing staff of each library is given the corresponding authority to accurately input the newly acquired document information, including the title, author, publishing house, publication year, content abstract and other detailed data, into the blockchain platform. After encrypted processing, the information is distributed and stored on each node of the alliance chain to ensure that it cannot be tampered with once on the chain, thus ensuring the authenticity and reliability of the document information.

For example, in the joint screening and procurement of documents in specific subject areas, the collecting and editing staff of each library can initiate the document procurement intention and screening criteria on the blockchain platform according to the library's collection characteristics and the needs of service objects. The system uses smart contracts to automatically summarize and analyze the needs of each library to generate a comprehensive purchase list, and allocate procurement tasks according to the budget of each library. After the procurement is completed, the detailed information and storage status of the documents will be synchronized to all members of the alliance chain in real time, so that each library can timely understand the latest trends of the documents, thus avoiding the phenomenon of repeated procurement caused by poor information, and greatly optimizing the allocation efficiency of procurement funds. For small libraries, with the help of the alliance chain, they can break through the limitations of their own resources and funds, participate in large-scale document procurement projects, and share rich document resources to effectively improve the collection structure of the library, improve the ability and level of serving readers, and promote the balanced development of the library industry.

2.2 Decentralized Digital Document Storage and Distribution Platform

Under the architecture of the decentralized digital document storage and distribution platform, the distributed storage advantage of blockchain technology can be fully utilized. First, for large-scale resources from electronic journals

and databases, the system will split them into numerous fragmented data blocks that are encrypted, which are distributed and recorded on multiple nodes in the blockchain network through a specific algorithm [3]. Each node stores a part of the document fragments, and the nodes work independently and cooperatively to jointly maintain the integrity of the entire document resources.

When the reader initiates a document access request, the blockchain platform quickly starts the smart contract mechanism to quickly locate from many nodes according to preset rules, obtain the required document fragments, and reorganize these fragments into a complete document for readers to use in a very short time. For example, when students need to query electronic journal articles in an academic database, the platform built by the university library alliance can retrieve the relevant fragments of data from the storage nodes of various libraries within the alliance, whether these nodes are located in different branches of the university or off-campus partner libraries.

This distributed storage and distribution model significantly reduces the enormous storage pressure undertaken by a single library. At the same time, because there is no single storage center, it effectively prevents the document loss caused by a single point of failure (such as server crash, hard disk damage, etc.), greatly improves the security of documents, provides readers with a more reliable and convenient experience of digital document services, and effectively promotes the wide dissemination and efficient utilization of digital document resources.

2.3 Document Knowledge Graph Co-construction and Sharing Empowered by the Blockchain

With the support of blockchain technology, the co-construction and sharing of document knowledge graph can be efficiently realized. First of all, each library will standardize the metadata of the documentary collections, such as the title, author, keywords, publication year, subject classification of books, as well as the abstracts and citation relationships of journal papers, and upload them to the blockchain platform to realize the convergence and integration of different library data.

The combined data can use the natural language processing and machine learning algorithm to build large and detailed knowledge graphs on a global scale [4]. For example, in the field of biomedicine, the metadata of numerous medical libraries and scientific research institution libraries can be integrated through blockchain to organically correlate knowledge nodes such as disease names, symptoms, therapeutic drugs, and gene sequences. When exploring the treatment of a certain rare disease, researchers can follow the association path of knowledge graph to quickly obtain comprehensive knowledge from basic medical research results, clinical case analysis to the latest drug development progresses and other aspects, thus crossing the traditional disciplinary boundaries and analyzing the deep knowledge association.

In interdisciplinary research, this blockchain-enabled knowledge graph plays a key role. For example, in the interdisciplinary study of environmental science and sociology, researchers can find the potential connection between ecosystem changes and human social behavior patterns and quickly locate relevant documents from different disciplinary perspectives from the graph to avoid the dilemma of blindly searching in massive documents, thus significantly accelerating the process of scientific research and innovation, and providing a powerful knowledge tool for solving complex practical problems.

2.4 Document Evaluation and Contribution Incentive Mechanism Participated by Readers

The blockchain platform provides readers with a convenient and reliable document management channel. When readers read the library's document resources, they can directly evaluate the accuracy, readability and practicality of the document content on the blockchain platform, and elaborate their views and feelings in the form of star rating and text comments [5].

If readers find information errors, typesetting problems or irregular references in the document, they can correct errors through the specific functions of the platform, clearly point out the errors and provide correct information.

At the same time, for some documents in professional fields, readers can also supplement valuable annotations by combining their own knowledge reserves, such as adding the interpretation of the era background for classic literary works, expanding the details of experimental methods for academic papers, etc., to further enrich the connotation of the documents. These operations such as evaluation, error correction and annotation are recorded in detail by the blockchain, and their time stamps and operation traces cannot be tampered with, which ensures the authenticity and credibility of the data.

The library, according to the preset rules, assigns corresponding points to the readers' positive contributions, which can be used to redeem the borrowing duration, the priority of the reservation of popular books, etc. Or when the readers accumulate a certain number of points, the library will award them honorary titles, such as "excellent document contributor", to encourage more readers to participate.

3 Conclusion

The application of blockchain technology in document management for the library shows great potential. By improving the safety of resources, optimizing the copyright protection, improving the sharing and cooperation efficiency and optimizing reader services, it can inject new vitality into library development. Although there are challenges in the implementation, with the maturity of technology, it will certainly promote the transformation of library management mode, realize the efficient use of resources and the improvement of service quality, and then play a more important role in knowledge inheritance and innovation.

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References

[1] Bao Yuanfang, Wang Tao. Application of "block chain" in University libraries Based on the Internet [J]. Journal of Academic Library and Information,2019,37(2):111-113.

[2] Zhang Jing. Digital Resource Management of Smart Libraries Based on Blockchain Technology [J]. Cultural Industry,2024(1):81-83.

[3] Duan Chao, Tu Yu. Analysis of Digital Resource Management of Smart Library Based on Blockchain Technology [J]. Intelligent Building and Smart City,2023(6):112-114.

[4] Chen Peipei. Library Management Innovation under the Blockchain Environment [J]. Cultural Industry,2023(14):76-78.

[5] Zhang Xuli. Study on the Digital Copyright Management Path of Public Library Red Literature Driven by Blockchain Technology [J]. The Library Journal of Shandong,2023(6):57-62.