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Analysis of Digital Copyright Protection Issues Based on Blockchain Technology (Post-Print)

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Abstract

With the rapid development of information technology and the continuous deepening of digital transformation, digital copyright protection is confronted with a development bottleneck characterized by contradictory imbalance, influenced by factors such as the proliferation of stakeholders and conflicts between copyright protection and sharing philosophies. The ecological and healthy development of copyright protection—not only for traditional electronic text works but also for internet-based audio-visual programs such as radio and television—urgently requires a copyright protection model that aligns with the characteristics of the digital industry. The emergence of blockchain technology has brought new hope and opportunities to digital copyright protection. This paper analyzes the current issues in digital copyright protection and proposes recommendations for the specific application of blockchain technology in this domain, aiming to provide reference for digital copyright protection practices in China.

Full Text

Preamble

Title: An Analysis of Digital Copyright Protection Issues Based on Blockchain Technology

Abstract: With the rapid development of information technology and the deepening of digital transformation, digital copyright protection faces a developmental bottleneck characterized by conflicting imbalances, influenced by factors such as the increasing number of stakeholders and conflicts between copyright protection and sharing concepts. The healthy ecological development of copyright protection for not only traditional electronic text works but also internet audio-visual programs in broadcasting and television urgently requires a copyright protection model that matches the characteristics of the digital industry. The emergence of blockchain technology offers new hope and opportunities for digital

copyright protection. This paper analyzes current issues in digital copyright protection and proposes recommendations for the specific application of blockchain technology in this domain, aiming to provide references for digital copyright protection practices in China.

Keywords: Blockchain Technology; Digital Copyright; Protection; Application

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Currently, the internet has not only become an important tool for people's learning and work but also a crucial platform for obtaining information and entertainment. The publishing industry is the mainstay of national cultural construction and development, playing a vital role in maintaining social harmony, improving citizens' overall quality, and promoting economic development. Driven by internet and new media technologies, the publishing industry has deeply entered the digital era. Although digital transformation has brought enormous development space and profit margins to the publishing industry, creating more possibilities for information dissemination, the lag in digital copyright protection technology has become an obstacle to further demonstrating the advantages of digital transformation.

1. Blockchain Technology and Its Characteristics

Blockchain technology utilizes existing digital technologies to establish interconnection transmission transaction protocols among different internet nodes, similar to the TCP/IP network communication protocol, which embodies a brand-new network interconnection structure concept. As an important component of China' s intellectual property protection, digital copyright protection urgently needs the application of blockchain technology to achieve integration between industrial development and new technology. Currently, blockchain technology has brought opportunities to address the pain points hindering the development of the digital publishing industry. Blockchain technology mainly has the following four characteristics:

1. **Blockchain Structure:** Data blocks composed of "block headers" and "block bodies" serve a connecting role. Authentication messages about the previous block and new data are stored in the "block header," while data transaction information is stored in the "block body." The mutual verification link with the next block is formed through random authentication markers.

2. **Open-Source Collective Participation:** Although blockchain has chain characteristics, there is also interconnection openness between nodes. Those with the same data content on the blockchain have the right to jointly participate in block construction, enabling "equal rights" in data production.[1]
3. **Distributed Data Management:** Data information in each block of the blockchain is distributed across corresponding nodes. This distributed structure gives data management tamper-proof characteristics. Moreover, the loss of individual block information at the same level will not affect the information storage of other blocks, ensuring absolute data integrity and stability.
4. **Self-Service Verification Mechanism:** Blockchain has a unique time data label. When block data information reaches consensus, this label is automatically generated by the system and stored in the corresponding block.

2. Potential Application Scenarios of Blockchain Technology

All sectors of society have actively explored the possibilities of blockchain technology application and envisioned future application scenarios. Its four characteristics may bring about leapfrog innovation.

2.1 Reconciliation Through Encryption Technology

In current reconciliation systems, when institutions conduct transactions, they send detailed information to the receiving party, who then adds new information to their own ledger. This approach increases uncertainty in information transmission. Information is easily misread during transmission, and accuracy cannot be guaranteed. The proof-of-work mechanism in blockchain technology can effectively solve this problem. Each node supervises and verifies each other, and consensus algorithms can avoid the "Byzantine Generals Problem."

2.2 Data Replication

Currently, many institutions replicate large amounts of data to try to avoid erroneous data as much as possible. The benefit of massive data replication is that if data is wrong somewhere, it can be verified against other data for accuracy. However, this approach not only greatly increases system operating costs but also places higher demands on system storage capacity, which appears somewhat clumsy in the internet era.

2.3 Access Control

The main practice for controlling access permissions is using private keys and signature technology to grant ledger access rights. If a manager needs to inspect

data transactions, they must provide an observation key to have auditing permissions, but the observation key can only obtain permissions when authorized by the court. This practice requires a series of complicated procedures and is not very operable compared against the background of intelligent development in various aspects.

2.4 Transparency and Privacy

Since institutions make backups when establishing ledgers, they share ledgers to verify the correctness of database content when checking record authenticity. However, this high degree of transparency exposes certain private documents, thereby creating risks of information leakage. In a blockchain platform, every server performing algorithmic calculations on the blockchain technology platform is an independent and peer node. Their main function is to use encryption algorithms to record block information and announce reconciliation to other nodes. Mutual node participation can ensure data security while avoiding the risk of information leakage.

3. Blockchain Applications in Digital Copyright Protection

3.1 Achieving "Decentralized" Copyright Confirmation

Blockchain copyright confirmation is a "decentralized" technology that embeds hexadecimal passwords into original works. Various product passwords are stored in the blockchain system. Due to the asymmetry of these passwords and the influence of the trustless mechanism, large-scale trusted and collaborative value exchanges can be seen during transactions, while providing reliable security guarantees for transaction information.[2] Distributed ledger-embedded copyright confirmation centered on blockchain technology is like obtaining a unique, permanently valid, and tamper-proof "original electronic ID card" for original works. From a cost perspective, using the main chain to confirm copyright costs approximately 0.3 yuan per transaction, while using side chains costs even less. From an efficiency perspective, this copyright confirmation method is almost instantaneous for a complete operation, greatly simplifying the copyright confirmation process. From a transparency perspective, since blockchain itself has certain public characteristics, copyright confirmation through blockchain allows the rights holder' s ownership and changes of work rights to be open to the public.

3.2 Achieving "Smart Contract-Based" Copyright Transactions

First, make rational and full use of the immutable attribute inherent to blockchain. The entire process from inspiration emergence to work construction and completion should be completely and effectively recorded, and a smart contract should be automatically generated around this dynamic systematic process. This can effectively break the stage limitations of copyright partners' participation in work copyright establishment. All ownership forms and

traceability norms regarding the work will be recorded through smart contracts. In this way, when constructing a copyright database based on blockchain technology, the abruptness of mid-term participation can be avoided, starting participation from the copyright confirmation stage to thereby enhance transaction efficiency in the copyright market and achieve centralized copyright transactions primarily in smart contract form.

Second, since traditional copyright transactions lack a unified trading platform, the problem of data dispersion has always existed. Under the traditional transaction model, a work's property rights may be sold separately, with each specific property right having independent scope of rights, transaction contracts, and authorization times. The gaps between these data information exacerbate the chaotic situation in the copyright market.[3] Therefore, it is necessary to use blockchain technology to establish a decentralized copyright trading platform that centralizes dispersed data. This can not only provide more choices for rights holders and copyright service providers but also provide stronger protection for rights holders' rights.

Third, reasonably set copyright pricing standards. Once copyright enters the transaction process, the first important step is pricing. In terms of the quantification possibility of pricing, it is quite substantial, as traditional securities markets have left behind large amounts of transaction data, which are important foundational data for achieving quantitative pricing. However, in current actual situations, it is difficult to obtain relevant data from copyright transaction markets. Even if partial data is obtained, its authenticity needs further verification. Copyright information created based on blockchain technology can be purchased by copyright buyers, and the entire process will form a blockchain record. Based on this record and platform, copyright fees can be paid to copyright owners. The construction of third-party credit platforms can also be further improved based on authentic data generated during the copyright buying and selling process between transaction parties.

Finally, properly resolve royalty settlement issues. To achieve the load of each transaction work on blockchain nodes, all must be processed through a load balancer, after which copyright transaction smart contracts are automatically generated for copyright settlement. The load balancer polls blockchain nodes centered on backend transactions. All successfully created smart contracts, after being processed by elastic computing servers, uniformly store the latest data in the backend distributed relational database.[4] The first step in generating copyright transactions is initiating the transaction, where users find the corresponding work' s copyright transaction smart contract on the blockchain based on their own blockchain address. Transaction requests for each link will be recorded in the smart contract. The determination of copyright transaction amounts follows the agreed shares in the copyright settlement smart contract, and blockchain transaction addresses are allocated in real-time to work authors and relevant participants.

3.3 Achieving "Real-Time" Copyright Protection

Traditional centralized copyright management websites are easily attacked externally, highly manipulable, and severely lack credibility and seriousness in information traceability functions, which greatly increases the difficulty of investigation and evidence collection to a certain extent. Blockchain technology can record subsequent information such as copyright registration, changes, and transactions in real-time, and all information can be retrieved and tracked through the transaction network. The application of blockchain technology in copyright protection has real-time capabilities, significantly enhancing the copyright protection capabilities of original creators and rights holders, while also promoting the development of copyright protection toward tool-based and standardized directions. Lowered barriers to rights protection mean the input-output ratio of rights protection operations has improved. Such simple, convenient, and low-cost copyright rights protection reignites the enthusiasm of original creators and rights holders for protecting their rights, and also achieves continuous purification of the copyright ecosystem.

In conclusion, as an extension and expansion of internet technology, blockchain technology has achieved value transmission independent of centralized organizations on the basis of internet information transmission that does not rely on centralized organizations. The application research of blockchain-based digital copyright protection still has enormous potential value. Digital copyright protection, with encouraging innovation as its fundamental purpose, requires active support and cooperation from industry management departments and the industry to allow blockchain to make more attempts and developments in the field of digital copyright protection, stimulating people' s enthusiasm for creating high-quality digital content and maintaining internet content dissemination order, which has extremely important practical significance and theoretical value.

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