Construction of Blockchain Technology Digital Copyright Management Platform

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Abstract: This paper proposes the idea of building a digital copyright management platform for online literature based on blockchain technology. By leveraging decentralization, privacy, traceability, and anti-tampering features of blockchain, along with techniques like distributed storage, smart contracts, consensus mechanisms, and perceptual hash algorithms, the platform aims to address the challenges of infringement and rights confirmation in the online literature industry. It facilitates creation deposition, copyright registration, inquiry, and transaction, while also providing infringement monitoring services. This approach enriches existing literature and holds both theoretical and practical significance for digital copyright protection.

Keywords: Digital Copyright, Protection Blockchain, Platform Construction, Online Literature

1. Introduction

1.1 Research Background

China's online literature industry has huge market potential and derivative value. Online literature is forming an IP industrial chain with film, TV and games, realising multi-media integration, with huge market value, and is an important part of digital copyright.

1.2 Research Significance

Online literature faces the problem of piracy, and traditional copyright protection means are difficult to adapt to the way of Internet dissemination. Blockchain technology can effectively ameliorate the problem of copyright infringement [1]and establish a digital copyright management platform for the protection and management of online literary works.

1.3 Research Object and Research Content

This paper investigates a digital copyright management platform for online literary works protection based on blockchain technology and neural network.

1.4 Innovation Points and Contributions

The purpose of this paper is to illustrate the idea of constructing a digital copyright management platform designed based on blockchain technology in the field of online literature to solve the problem of digital copyright infringement. The platform is expected to interface with several online literature reading and creation platforms to optimize the management and protection of online literature works.

2. Review of Relevant Concepts, Theories and Literature

2.1 Digital copyright

2.1.1 Definition of Digital Copyright

The society has not yet formed a unified normative definition, but it can be defined from various

perspectives, such as the flow of works, dissemination links, medium of dissemination, and types of works.[2] According to the White Paper on Blockchain Digital Copyright Application, digital copyright refers to the author's right to digitally preserve, reproduce, and distribute digital works. Digital works are the main object of digital copyright protection, which can be divided according to the storage method and file type.[3]

2.1.2 The Management Dilemma of Digital Rights

The management dilemmas of digital copyright mainly include:

(1) Piracy and infringement are widespread. It is difficult to effectively control the dissemination of digital works, and the diversified forms of online piracy have hindered the benign development of China's digital copyright industry ecosystem.[4]

(2) It is not easy to confirm the rights of digital copyright. There is a lack of effective copyright registration and ownership confirmation mechanisms for digital works, making it difficult to defend rights.

(3) Difficulty in obtaining authorisation. In the online environment, most authors choose to create works anonymously, making it difficult to determine the true identity of the copyright author. This, coupled with the fact that IP addresses may not be fixed, makes it very difficult to locate the right holder and obtain a licence. The difficulty in identifying authors makes cross-border copyright licensing challenging.[5]

(4) Complicated coordination of interests of all parties. In the age of digital network information, digital media distribution suffers from unfair distribution of interests and low prices.

(5) The process of defending rights is costly. Rights holders are constrained by two factors: the difficulty of obtaining evidence and the difficulty of determining the amount of compensation, which leads to the persistence of online piracy.

(6) Copyright management is prone to monopoly. Large digital copyright websites harvest profits by means of exclusive trade and unfair competition, and there is an imbalance in the distribution of copyright proceeds.

2.1.3 Digital Copyright Protection Technologies

Currently, copyright protection technology programmes are divided into three main types of stages:

Pre-circulation stage: (1) Blockchain technology: We use blockchain for copyright deposit, tracking and curing of infringing materials. (2) Trusted Timestamp (DTS): We provide a complete and testable timestamp of electronic data at a specific point in time as valid evidence. (3) DCI (Digital Copyright Identifier) Protection System: We assign a unique identification to the copyright owner of digital works and achieve online detection, forensics and rights protection tasks by obtaining and authenticating DCI codes.

Stage in circulation: Digital Rights Management (DRM): We unified supervision and management of digital information content in the process of distribution, transmission and utilisation through digital licensing, restricting the circulation and scope of copyright use.

Post-circulation stage:Digital DNA technology: We use big data crawlers and image search technology to find personal information of suspected infringers and compare it with original or deposited digital content works, once the similarity reaches a certain threshold, it is regarded as a valid infringement.

These technical solutions provide copyright protection measures at different stages, including functions such as copyright deposit, anti-counterfeiting and traceability, digital watermarking, digital licensing and infringement detection, in order to safeguard the legitimate rights and interests of intellectual property.

2.2 Blockchain

2.2.1 The Main Classifications of Blockchain

Blockchains are divided into three main types: Public, Federated and Private chains.

2.2.2 Core Technologies of Blockchain

(1) Distributed storage technology. (2) Cryptography.

(3) Smart Contract. (4) Consensus mechanism.Affiliations

2.2.3 Key Features of Blockchain

(1) Decentralisation.(2) Privacy and anonymity.(3) Traceability.(4) Tamper Resistance.

2.3 A Review of Relevant Literature

Blockchain as an alternative can enhance digital rights management and is particularly applicable to emerging economies.[6] Businesses and university libraries in China hold concerns about blockchain technology to address digital rights management challenges. The advantages of blockchain to build a digital rights management platform include increasing transparency and information credibility, providing copyright identity markers, and enabling intelligent services. [7]Application models include alternative, expansion and improvement. Challenges include technical speed and capacity limitations, business model acceptance and profitability issues, legal fair use and work registration issues.

3. Technologies for Building Digital Rights Management Platforms

3.1 Core Technologies

3.1.1 Sub-Subsection Titles

Perceptual hash algorithm generates digital fingerprints by acquiring data feature values to achieve high precision retrieval. It can detect malicious codes in online literature, avoid attacks and issue infringement warnings to improve the effectiveness of auditing.

3.1.2 Simhash Algorithm

Simhash algorithm detects the degree of similarity between texts by comparing the similarity of text Simhash. In this paper, we use the Simhash algorithm to construct a platform combining TF-IDF technology and cosine similarity algorithm to improve the efficiency of checking online literary works and ensure originality.

3.1.3 Consensus Mechanisms

In this paper, four consensus mechanisms are used to achieve trust and proper functioning of the blockchain network. These mechanisms include Proof of Work (PoW), Proof of Stake (PoS), Proof of Share Authority (DPoS), and Practical Byzantine Fault Tolerance (PBFT) algorithm. Each mechanism has its own characteristics and application scenarios, ranging from highly decentralised and secure (PoW) to resource efficiency and token holders' rights and interests (PoS, DPoS) to solving the Byzantine Generals problem and providing fault-tolerant performance (PBFT).

3.1.4 P2P peer-to-peer network

P2P peer-to-peer network is the basis of distributed information storage in blockchain, which provides digital information recommendation and secure storage functions by exchanging tasks between equal nodes and achieving dynamically balanced information rights and digital responsibilities.

3.1.5 TCP/IP Protocols

TCP/IP protocol is a group of protocols, including FTP, SMTP, TCP, UDP and IP, which are used to ensure timely and complete transmission of user information and data in the network.

3.1.6 Smart Contract

Smart contract is a protocol under blockchain technology in the form of programmable code saved in the blockchain. It can automatically execute, read and write blockchain data, realising the function of legalisation into code.

3.1.7 Asymmetric Encryption Algorithm

Asymmetric encryption algorithm uses public and private keys for encryption and decryption to ensure the security and uniqueness of communication. The asymmetric encryption algorithm used in this platform is ECC, which is used to protect copyright records, enable digital signatures and authentication, and ensure the security of copyright attribution and transaction records.[8]

3.1.8 Merkle Tree

Merkle Trees (Merkle Trees), also known as hash trees, is constructed as a class of classical binary tree construction, which can prove the existence or non-existence of an element in a collection, and at the same time, can quickly compare the massive amount of data and locate modifications. Merkle trees can be used to verify any kind of data that can be saved, processed and transmitted in a computer network

and between computer systems, thus allowing data to travel unaffected in P2P peer-to-peer networks, without being corrupted or altered while the data can be used freely in any medium.

3.1.9 Timestamping

This paper uses the Trusted Timestamp Service provided by the United Trusted Timestamp Service Centre to manage online literature. By binding the Hash value of the data to an authoritative time source and digitally signing it, a point-in-time e-commerce document that cannot be tampered with is generated. In this way, users can effectively prove the uniqueness of data rights with the help of timestamps, achieving the goal of non-repudiation and anti-repudiation of data rights.

3.1.10 Neural Network

Neural network is a technique of Artificial Intelligence which is used to deal with complex problems. In artificial intelligence, neural networks can be trained and designed to recognise text images and intelligently identify the content of information that disseminates illegal information and monitor online piracy and infringement. Through automatic retrieval of live ports, computer vision systems, and big data analysis, platforms can quickly take appropriate sanctions.

4. Construction of Digital Rights Management Platform

4.1 Platform Technology Architecture

In this paper, based on the characteristics of online literature as a digital work, we design a digital copyright management technical architecture based on blockchain technology, which contains application layer, contract layer, consensus layer, network layer and data layer.

4.1.1 Data Layer

The data layer is the basic layer contains a large number of data information blocks, chain structure, hash algorithm, asymmetric encryption, timestamp, Merkel tree, Simhash algorithm, perceptual hash algorithm, neural network and other information. The chain structure of the layer consists of two types with different degrees of centralization, which can more effectively provide data information services that meet the needs of each participant.

4.1.2 Network Layer

The blockchain-based digital copyright platform adopts P2P peer-to-peer network and TCP/IP protocol to disseminate data, with decentralisation, distributed storage, high security and expandability, to realise the deposit, transaction and dissemination of digital copyright.

4.1.3 Consensus Layer

The technical architecture of the blockchain-based digital copyright platform includes a private chain consensus mechanism for regulators and a federation chain consensus mechanism for authors, copyright holders and buyers. Hybrid algorithms (e.g., PoW, PoS, DPoS, and PBFT) and legal systems are used to ensure data security, integrity, and timely and effective access for all subjects.

4.1.4 Contract Layer

The contract layer is part of the architecture of the blockchain-based digital copyright management platform, which adopts the form of smart contracts to formulate contracts for work storage, copyright registration and protection, copyright query and copyright transaction. It improves the timeliness of operation and accuracy of data processing, ensures openness and transparency and reduces the probability of human intervention and errors, saving users' time and costs.

4.1.5 Application Layer

The top layer of the technical architecture of the blockchain-based digital copyright management platform is the application layer, which is oriented to relevant departments, authors, copyright holders and buyers. Private chain and alliance chain are used to meet the performance requirements and carry out identity authentication and permission checking. The private chain supervises and manages the whole process of digital copyright of online literature, while the alliance chain provides services such as uploading, registration, querying and transaction, enhancing the efficiency of copyright transaction. The platform monitors the infringement situation, provides the function of reporting and cancellation, and assists in defending rights and calculating losses.

4.2 Platform Protection Strategy

The blockchain-based digital copyright management platform improvement strategy includes distributed storage, smart contracts and consensus mechanisms for different subjects.

4.2.1 Adoption of Distributed Storage and Cryptographic Protection

Union chain and private chain realise data access and management within the scope of authority and provide an open and transparent environment. The platform requires users to carry out identity authentication and use accounts with bound identities for work publication and transactions. Cryptographic methods such as timestamps, hashes, asymmetric ciphers and hash algorithms protect data security and tamperability. Distributed storage and online work upload and evidence retention features improve management and forensics challenges.

4.2.2 Placing Smart Contracts to Meet Different Situations

Smart contracts optimise the process in the blockchain-based digital copyright management platform to achieve work storage, copyright registration, query and transaction. The work storage contract carries out copyright deposit, hash algorithm detects malicious code, and calculates the storage price. The copyright registration contract stipulates the registration process, quickly completes material collection and transaction settlement, and ensures integrity. The copyright query contract confirms the registered copyright works and enters the work library. The copyright transaction contract sets the transaction rules and solves the problems of legal differences and revenue distribution, improving the accuracy and efficiency of the transaction. The smart contract makes the whole process more convenient, efficient, safe and reliable.

4.2.3 Designing Consensus Mechanisms for Different Subjects

The digital copyright management platform based on blockchain technology realises the data interconnection and intercommunication of various subjects in online literature copyright transactions by establishing a database for the whole process. Storing information such as work content, creation deposit, copyright registration and fee bills on the chain ensures data security and consistency. Permission control enables authors, copyright holders, buyers as well as regulatory and confidential agencies to access the corresponding data information, solving the problem of information asymmetry. Decentralisation and consensus mechanism improves data transparency and transaction efficiency and ensures system stability.

4.3 Front-end Function Design

4.3.1 User Registration

In the blockchain-based digital intellectual property management platform, users can register and log in by filling in personal information and identity verification, which ensures the authenticity of user information and provides a data basis for copyright management and supervision.

4.3.2 Work Deposit Confirmation

The work deposit and registration module is for authors, including uploading and storing works, copyright enquiry and registration. Users can upload work files and pay fees to complete the deposit, and then carry out copyright enquiry or registration operations. Works with registered copyrights can be traded online, while unregistered ones can apply and wait for review to protect their works and confirm their rights.

4.3.3 Copyright Transaction Management

The copyright transaction management module provides search, transfer, authorisation and other operations for users who hold copyrights of works and intend to conduct copyright transactions. After successful transaction, you can check the flow of copyright and revenue. Infringed users can protect their rights and interests through the reporting function. Copyright holders can edit the works on the shelves and view the transaction details.

5. Summary and outlook

5.1 Summary

The digital copyright management platform utilizes blockchain technology to strengthen the digital copyright management of network literature. Aiming at the management and other problems faced by digital copyrights at present, this paper combines the types of infringement encountered in online

literature as a written work, and at the same time takes into account the extremely high security requirements of copyright stakeholders for the copyright storage and transmission links, and constructs a platform to optimize the digital copyright management of online literature, which adopts distributed storage and encrypted protection, to ensure the continuity, authenticity, and security of the data. And smart contracts are put into the platform to meet the needs of users at different stages. According to the needs of different subjects, it has designed a union chain for authors, copyright holders and copyright purchasers and a private chain for supervisory and management authorities and authoritative grading organizations to ensure the consistency and credibility of data information. The platform is also equipped with functional modules for registration, work entry and registration, and copyright transaction management.

5.2 Outlook

Blockchain technology has the potential to improve the efficiency and transparency of copyright management in digital copyright protection. However, blockchain-based digital copyright management platforms are still in the exploratory stage and need to address challenges such as technical flaws, legal issues and business model sustainability. The construction of a digital copyright management platform for online literature can unify the management of digital copyrights of online literature and the provision of services by cooperating with multiple original platforms for online literature, so as to realize the benefits of economies of scale.

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