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BLOCKCHAIN FOR COPYRIGHT PROTECTION AND DIGITAL CONTENT OWNERSHIP

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ABSTRACT

In the digital era, content creators struggle to protect their intellectual property due to piracy, unauthorized use, and lack of transparency in ownership rights. Traditional copyright systems rely on centralized authorities, making them vulnerable to manipulation and inefficiencies. Blockchain technology offers a decentralized, immutable, and transparent framework for digital copyright protection. This paper explores how blockchain can revolutionize digital content ownership through smart contracts, tokenization (NFTs), and decentralized identity verification. It also examines the challenges, implementation strategies, and the future of blockchain-based copyright protection. Keywords: Blockchain, Copyright Protection, Digital Ownership, Smart Contracts, NFTs, Decentralization, Intellectual Property, Digital Rights Management, Tokenization,Cybersecurity

INTRODUCTION

1.1 The Importance of Copyright Protection in the Digital Age

Copyright protection is essential for artists, writers, musicians, and software developers to claim ownership of their work. However, in the internet era, protecting digital assets is increasingly difficult due to:

- **Piracy** – Unauthorized distribution of digital content.
- **Plagiarism** – Others copying and using content without permission.
- **Lack of transparency** – Difficult to prove original ownership.
- **Middlemen exploitation** – Platforms like YouTube, Spotify, and Amazon take large commissions from creators.

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1.2 Why Blockchain for Copyright Protection?

Blockchain provides a decentralized, tamper-proof ledger where digital assets can be registered and tracked. This offers:

• **Immutable records** – Ensures copyright cannot be altered or forged.

• **Smart contracts –** Automate royalty payments to creators.

• **Tokenization (NFTs)** – Allows content to be bought, sold, and transferred securely.

• **Global accessibility** – Eliminates geographic restrictions in copyright protection.

2. How Blockchain Works for Copyright Protection

Blockchain can be used in digital rights management in three key ways:

2.1 Content Registration on the Blockchain2

• When a creator uploads a song, book, artwork, or software code, it gets a unique digital fingerprint (hash) recorded on the blockchain.

• This serves as proof of ownership, preventing disputes over originality.

• Any changes to the content will be detected, preventing unauthorized alterations.

2.2 Smart Contracts for Royalty Distribution

• Smart contracts are self-executing contracts stored on the blockchain.

• When content is purchased or streamed, smart contracts automatically send payments to the rightful owner.

• No need for intermediaries like record labels, publishing houses, or agencies.

2.3 Tokenization of Digital Content (NFTs)

• Non-Fungible Tokens (NFTs) allow digital content to be uniquely identified and owned.

• Creators can sell limited editions of their work with proof of authenticity.

• NFT royalties can be programmed so that the creator earns a percentage every time the asset is resold.

3.LAYERS OF BLOCK CHAIN DATA LAYER

This layer gather and validate data's or records and this contains the following components- data blocks, timestamp, Merkle root tree and hashing. The" timestamp" here is a small data stored in each block which has unique serial .secondly, the "Merkle tree root "is same as binary search tree with nodes linked to one another

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using hash pointers this has the ability to prevent data tampering. In fine the "hashing" is the process of mapping up of set of data's and those converted into hash key (unique code) using hash function.

3.1 NETWORK LAYER

The network layer describes the hardware aspects of block chain. This makes the block chain function and holds the copy and verify the transactions. The components of this layers are-"P2P network, verifications and broad protocols".

3.2 CONSENSUS LAYER

This is a crucial layer deals with the enforcement of network rules and agreement, generation and verification of blocks. The main components are-"proof of work, proof of stack". POS and POW are algorithm which is used to confirm transaction and add new blocks in chain.

3.3 CONTRACT LAYER

The software needs to be verifiable, secure, and reliable and free of potential weakness so, there is a mandatory need for this contract layer. Major components of this are-"smart contracts, script coding". Smart contracts and computer coding are self executing contract i.e. an agreement between sender and receiver so, it cannot be erased.

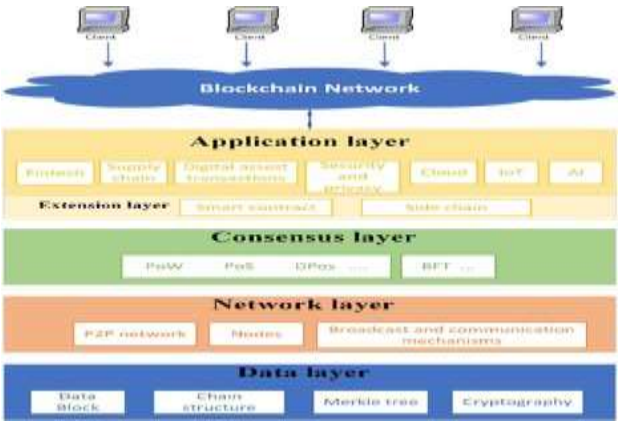
3.4 SERVICE LAYER

As block chain technology offers stable, safe keeping, secure services (D-App) and manage higher level connection state, many financial and non – financial industries like crypto – currencies, IBM Azure etc... Are nowa-days started to adopt this technology.

3.5 APPLICATION LAYER

This layer focuses on developing block chain system to make use of this across different applications and industries (smart city, smart transportation, and smart health care). The user interacts with the server with the help of application layer.

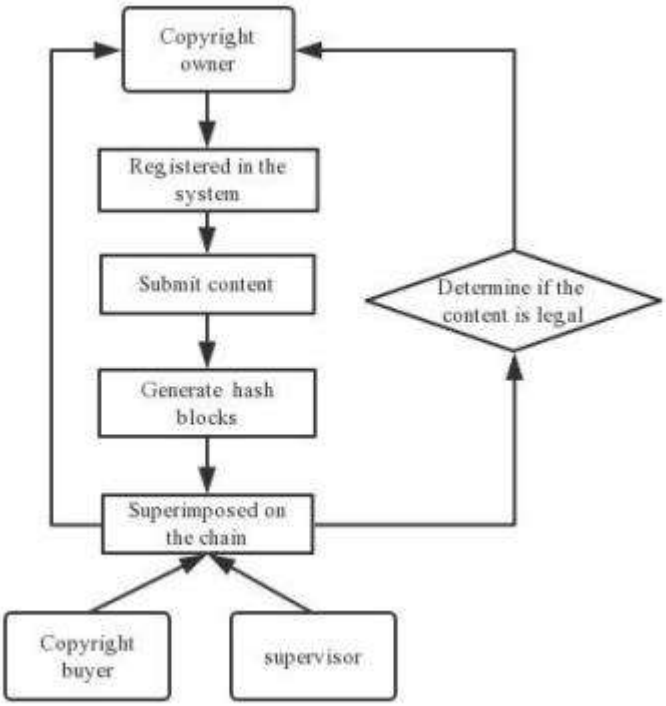
ISSN 2581-7795



A) ARCHITECTERE LAYERS OF BLOCKCHAIN

4. Methodology:

The network environment of Blockchain ensures the convenience of trading and creates a safe and efficient trading environment for digital copyright transactions. The copyright transaction of blockchain is clear in its rights and responsibilities, and the credit mechanism of the algorithm is more secure and reliable.



B)Schematic diagram of the system flow

4.1 Simple registration method

Compared with the registration of traditional copyright works, the digital copyright system based on blockchain technology designed in this paper is simpler and more

convenient to use. The copyright owner can fill out the form and pass the review. The winding is completed in three seconds after the audit, which greatly reduces the time cost and simplifies the registration process. Because there is no third party to conduct the audit, there is no need to pay the relevant handling fee in the whole process of registration.[6] It saves a large amount of digital copyright registration fee for the user, and is also beneficial to promote the copyright towner's copyright registration awareness.

4.2. Safe and reliable trading process

The parties to the transaction need to jointly develop a contract and complete the signature of their respective private keys to ensure the validity of the contract and to avoid the interference of malicious acts on contract execution.[7] In the process of the entire transaction, no third-party intervention is required, and the right to use digital copyright can be circulated between the owner and the purchaser. After the transaction is completed, the fundsare immediately recorded. The whole process is free of fees and is open to the whole network to ensure the safety and reliability of the whole process. In the smart contract, the commitment is presented in the form of data. The participants of the contract broadcast the agreement to the blockchain system in advance. The transaction needs to ensure that the proportion of the digital signature using the private key is not less than the set weight, otherwise the transaction cannot take effect. This greatly reduces the risk of copyright in the circulation process and improves the security of the transaction.

4.3. Encryption of information

The copyright information is also the information stored in the block, including the block hash value, the transaction volume, and the time of the first publication. In the copyright protection blockchain application, the user includes the copyright owner, purchases the copy right owner, and purchases the copyright owner. For example, video authors, commercial party, media studios, etc.[8]All the information of the works that have passed there view and found no plagiarism can be registered for the copyright certification.

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After the work information is certified and successfully linked, no modification can be made. For the above information, the system needs to ensure that the information is not tamperable and absolutely credible, and the use of block chaining to prevent fraud.

5. REALIZATION OF SYSTEM FUNCTION 4

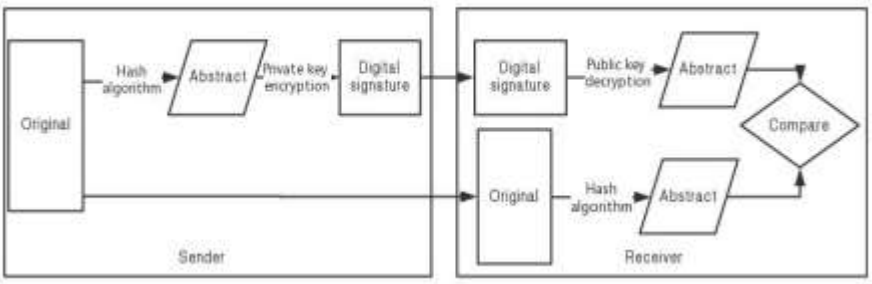
main functions of the block chain based protection and transaction system are copyright information encryption, copyright information review and digital copyright security transaction. The digital copyright information is guaranteed to be safe and reliable from the software level. The following is the realization of the system function.

Carry out detailed instructions.

5.1 The protection and encryption of Digital copyright

If there is relevant information input in the system, the key pair will be generated by the algorithm, that is, the public key and the private key. In the process of data transmission, the digital signature will be added at the end of the digital currency, after a certain process. Will be sent to the next user, to ensure the asymmetric

Encryption in the transmission process. This paper mainly uses the elliptic curve digital signature encryption algorithm to generate the corresponding key pair and digital signature in the process of encryption.



C) Schematic diagram of the encryption process

The key pair is mainly an asymmetric encryption that implements the entire information transmission process. First, the transaction information stored in the block

is hashed to obtain key information, and the sender encrypts the key information by private key and adds a digital signature to the end of the information. When the recipient receives the digital signature, the sender's public key is used to decrypt the information, and the summary information is restored. By comparing with the key information generated by the original text, only the exact same information will proceed to the next step. The first is asymmetric encryption, which refers to the key associated with a pair of mathematical algorithms. The information obtained by encrypting one of the keys can only be decrypted by using a key associated with another encryption algorithm. The public key can be called publicly, and the private key cannot be disclosed. The public key protection path when the public key is decrypted is as follows: The private key is mainly used for encryption, and the private key is saved as follows:

5.2 . Verify of digital copyright information

When the user clicks the review button, the system enters the intelligent analysis state. The record enters the message queue, is processed by dt and converted into a fingerprint file, and the id and status of this record are pushed to the message queue. After the service system listens to this message, it adjusts the record status to match the copyright library and invokes the fingerprint comparison interface to verify whether the newly generated fingerprint exists in the fingerprint library. If the fingerprint already exists or partially exists, the status is updated to be confirmed, and there is a link for the user to view. The link contains the original digital copyright address and metadata, at which point the user can choose to continue submitting or not submitting. If not submitted, it is unsuccessful. If you continue to submit or the status is adjusted to be reviewed. By default, there are some general descriptions for quick selection during digital copyright review. The entire process of auditing only needs to query the block comparison information.

5.2 The Transaction of Digital copyright

Combining the traditional process of copyright transaction and the conceptual model of copyright service contract, using the 5 characteristics of blockchain technology and group integration, this paper mainly constructs an eutralized copyright transaction model, and proposes a smart contract blockchain model.

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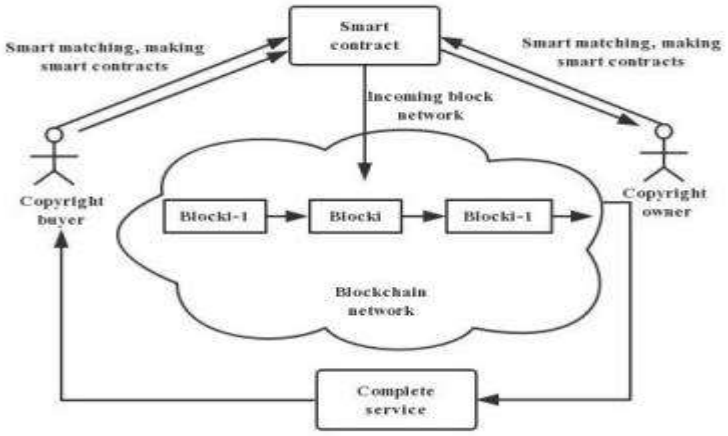

D) Schematic diagram of digital copyright transaction

6. Implementation of Blockchain for Copyright Protection

Steps to Implement Blockchain Copyright System

Step 1: Establishing a Decentralized Copyright Registry A global blockchain network for registering copyrights should be developed. National governments or rganizations like WIPO (World Intellectual Property Organization) can oversee this.

Step 2: Integrating NFTs for Digital Content Ownership Creators should register content as NFTs on blockchain networks like Ethereum, Solana, or Polygon. Platforms like Open Sea, Rarible, or Foundation can facilitate NFT sales.

Step 3: Smart Contract-Based Royalty Payments Music streaming services (e.g., Spotify) can integrate smart contracts to pay artists per stream. Writers and authors can receive automatic royalties when their e-books are sold or borrowed.

Step 4: Implementing Blockchain in Content Platforms YouTube, Spotify, and Amazon can use blockchain for copyright verification before uploading content. Digital watermarking combined with blockchain can prevent illegal content duplication.

7. Future Scope of Blockchain in Copyright Protection

AI and Blockchain Integration for Copyright Detection AI can scan the internet for copyright violations and register them on the blockchain for legal enforcement.

5G and IoT for Live Content Protection Live performances, online classes, and webinars can be secured with blockchain timestamps to prevent illegal recording.

ISSN 2581-7795

Global Copyright Blockchain Network Countries can collaborate on a unified blockchain registry to protect content internationally.

8. Conclusion

Blockchain technology offers a powerful and transparent solution for protecting digital content. By leveraging decentralized copyright registries, smart contracts, and NFTs, creators can ensure ownership, fair payment, and secure distribution of their work. While challenges exist, legal frameworks, technological advancements, and widespread adoption can make blockchain the future of copyright protection.

Blockchain technology has the characteristics of decentralization, non-tamperability, and scalability. It can effectively solve a series of existing problems of digital copyright registration protection, which plays a key role in safeguarding the rights of original creators and the protection of digital copyright works and is a new way of digital copyright information management. Blockchain technology can not only be cited in the protection of digital copyright, but also can continue to be extended to financial services, social services and global connectivity in the future with the development of technology.

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