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Application and Mechanism of Blockchain Technology in Libraries

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ABSTRACT

This paper presents an overview of the current state of blockchain technology and explores its potential applications in libraries. In the digital era, blockchain technology has emerged as a key area of interest, with numerous studies highlighting its potential benefits. However, further investigation is needed to fully understand the potential of blockchain in library settings and determine the best implementation strategies.

Keywords: Blockchain Technology, Libraries, Secure Ledger, Decentralized Platform

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1. Introduction

Blockchain technology provides a secure, immutable way to store online information. It can be likened to a big notebook that anyone can see and add to, but it cannot be erased once something is written down. This publicly accessible database, known as a blockchain, records data in chronological order using blocks. Cryptography encrypts the data, ensuring user privacy and preventing alterations. Blockchain maintains public transactional records across several databases, collectively called a digital ledger.

In today's digital age, access to digital resources is crucial for online knowledge exchange, academic research, development, and other activities (1). Every transaction in the blockchain ledger is authenticated with the owner's digital signature, protecting it from fraud and aiding in verification. This makes the information in the digital ledger highly secure. Blockchain's distributed, decentralized, and tamper-resistant nature, along with the advantages of smart contracts, offers numerous possibilities for revolutionizing current network and data storage models.

Blockchain technology is increasingly being adopted in business and banking due to its benefits for security and transparency. It also presents new methods for managing digital rights for multimedia educational resources (2). The application of blockchain technology in libraries is a relatively new concept. This survey paper explores the current state of blockchain technology in college libraries and its potential for managing digital rights effectively. As a decentralised digital ledger, blockchain technology records transactions unalterably, securely, and transparently. Applying this technology to college libraries can provide a secure, decentralised platform for digital rights management. This paper aims to provide an overview of the current state of blockchain technology and examine its potential applications in libraries.

2. Literature

Several studies have explored the potential applications of blockchain technology in libraries, drawing on various websites, e-books, and e-journals. These research articles provide insights into blockchain technology and how it can be utilised in library settings. (3) examined the use of blockchain technology in libraries, explaining the differences between public and private blockchains and detailing how blockchain can be integrated into library systems. Kshetri (4) highlighted the potential benefits of blockchain for digital rights management, including increased transparency, reduced costs, and enhanced security.

Zheng et al. (5) focused on the application of blockchain in the music industry, emphasising its potential for digital rights management in music libraries. This study illustrated how blockchain could manage digital rights more efficiently. One notable example of blockchain use in the music industry is the platform "Musicoin" (6). Musicoin allows musicians to upload their music and receive payments in cryptocurrency when their music is streamed. This platform provides a secure, transparent, and decentralised system for managing digital rights, which can be applied to libraries. Another example is the "Open Rights Exchange" (ORE) platform (7),which facilitates the exchange of digital rights, including licensing and distribution rights, securely and transparently. This decentralised platform for managing digital rights can also be adapted in libraries.The increased use of Blockchain may eliminate corruption, enhance security, improve efficiency services, and better time management. The literature states that an unawareness of technology, unskilled personnel, and monetary constraints are barriers to adopting BC in libraries.(8)

There is an optimistic perception of how blockchain can assist libraries and archives in storing more distributed information. This refers to the gathering, preserving, and sharing authoritative information while assisting archivists in creating a unique, verifiable record accessible to whomever in the archives. (9)

3. Research Issues

The application of blockchain technology (BT) in libraries and information centers aims at giving unlimited access to digital content and print collections to all possible users in the participating library systems while minimizing risky conditions that might threaten the privacy and identification of the user. Blockchain is a new and reliable technology for securing, authenticating, and archiving information. (10) The term blockchain technology, in straightforward terms, came into existence with the first cryptocurrency called Bitcoin. This is a highly new, complex, and trustworthy technology that researchers are working to find a way to apply in different domains. (11) In this work, we provide a very brief conceptual discussion about blockchain and its application in libraries and information centers to improve library and information services in the future and present. This paper mainly supports a rudimentary insight into blockchain technology, such as what a blockchain is and what it is, its characteristics, pros and cons, types, and help in education and libraries. Blockchain is a disruptive technology, almost remaking every sphere of human life and its operations. This technology runs on the principles of immutability and distribution, thus making it impossible for anyone to alter, duplicate, or falsify any transaction. The study is another initiative to sensitise these library professionals to this emerging disruptive technology and induce them to do something beneficial for the appropriate application of blockchain technology in libraries.

4. Methodology

The proposed study aims to comprehensively evaluate the potential benefits and challenges of using blockchain technology in libraries and suggest modifications to current blockchain-based platforms for more effective implementation. This study collects and gathers information on blockchain technology and its library application. Information was collected via various online sites, including e-books, e-journals, etc. There have been few studies conducted by researchers because blockchain technology is a new developing technology in the field of libraries in India and is used in Western countries. As a result, only a tiny subset of blockchain technology is considered in this study.

Conceptual Description

Data is stored in blocks that are connected in a chain in a blockchain database. This storage type is frequently called a “digital ledger”. In other words, distributed ledger technology (DLT) is a subset of blockchain technology. DLT is a digital platform continuously records transactions and related data across several locations. It permits open information exchange within a business network.

In a society that is becoming more digital, blockchain is a new technology that offers several advantages. The first factor is a decentralised system. Blockchain transactions are smoother, safer, and faster since they are completed by user consensus than before when regulatory organisations like a government or bank had to approve the transaction. When the trigger’s requirements are satisfied, blockchain technology’s programmable capacity to generate systematic actions, events, and payouts automatically comes into play. The second factor is security. Using blockchain technology, it is challenging for other users to damage or change a person’s data since it uses a digital signature function to conduct fraud-free transactions.

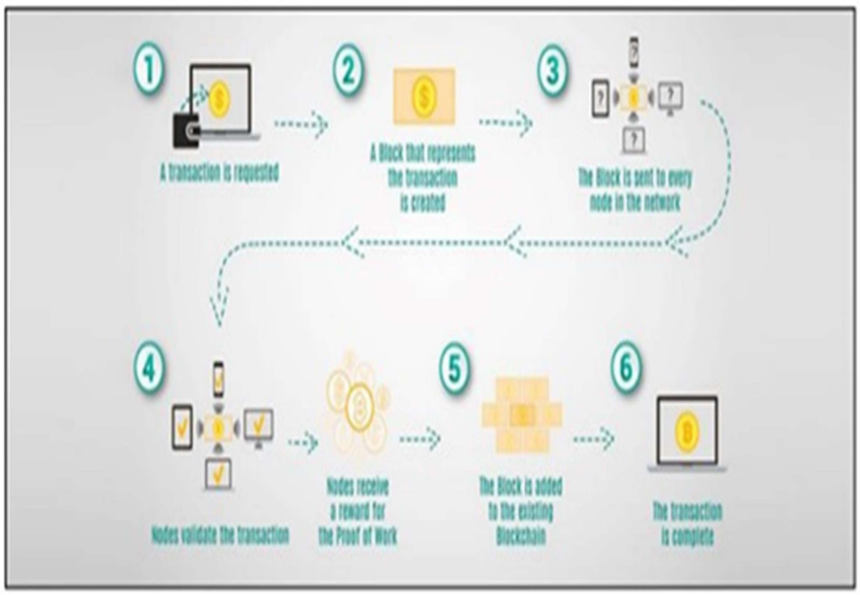

Figure 1. Blockchain technology mechanism

The above figure explains the mechanisms behind blockchain technology. It also shows its workflow process.

5. Blockchain Technology for Libraries

Blockchain technology is opening new opportunities. Blockchain-based solutions may be used in other areas linked to libraries, such as financial services. Digital tracking and preservation Community-based collecting for exchanging goods, equipment, and services. For example, "Blockchain-based currencies for international financial transactions (IFLA)," "Inter-Library Loan and Voucher System," "Library card," "Archives/special collections where provenance and authenticity are essential," "Corporate library records keeping," "Organizational data management," and "Intellectual property for R&D," etc. (12, 13)

Blockchain can be used to keep track of books and other materials. This way, everyone knows what is checked out and when it is due back, and there is no chance of someone losing the information. It can also help keep track of who has used a particular book or resource before, making it easier for librarians to find out who might have more information about a specific topic. Using blockchain technology, libraries can ensure that their information is always accurate and up-to-date and can quickly and easily find what they need. And because the data is stored safely and securely, it can never be lost or damaged, making it easier for students and researchers to access the information they need when needed.

6. Application of Blockchain In the Library

The following are the areas where blockchain technology is being used

· **Peer-to-Peer Sharing of Digital Content** Blockchain technology used in libraries facilitates peer-to-peer sharing of digital books and thereby helps community members certify the availability of different services for money-saving sharing economies. It also provides people with the necessary resources to attend meetings, work on critical projects, or prepare reports.

• **Protect Digital Sale Rights** The Digital First Sale, which arises from clear possession and digital scarcity, is another potentially disruptive idea for data ecosystems. A rights management system developed on blockchains is at the core of the numerous existing blockchains. Libraries are particularly intrigued by this potential to function as a lever for early digital sales rights.

• **Connect Library Networks** Academic institutions such as libraries and universities may utilise the blockchain for the Interplanetary classification system (IPFS), a peer-to-peer protocol for a future internet that combines BitTorrent, Bad Guy, and Blockchain.

• **Blockchain Plagiarism** Using blockchain technology to detect plagiarism in library documents reduces fraud and fosters greater trust in the use of stolen electronic data

• **Facilitate Partnerships across Centres/Organizations** With a blockchain platform, libraries will collaborate with museums, colleges, and governmental organisations to exchange brandy records, authority management, and user-generated information.

• **Promote Community-Based Collections** Implementing a protocol to encourage community borrowing and collections could help the average library collection to leave the building and become more widely available. (14, 15)

7. Scholarly Published

The blockchain involves data storage in a decentralised, secure environment. This aligns with what librarians have traditionally done, which is collect, store, and disseminate reliable information. Librarians can accomplish this activity with the aid of the blockchain, particularly in scientific publications. The time-stamped, verifiable creation of journal articles could be one application for the blockchain. Using the Bitcoin blockchain "as a low cost, an independently verifiable mechanism that may be widely and easily utilised to audit and confirm the reliability of scientific investigations" was successfully tested by Irving and Holden. They achieved this by converting a trial protocol document's plaintext into a cryptographic hash and using it to generate a new private Bitcoin key. As a result, a time-stamped record is created in the blockchain that other researchers may easily verify. If the document is altered, the new document's hash will differ from the one that is recorded in the blockchain. (16)

8. Digital Rights Management

Digital Rights Administration Digital resources are intrinsically replicable, which presents problems for publishers and libraries. To prevent libraries and customers from copying their goods, publishers have applied strict, frequently ineffective DRM technologies. Thanks to the blockchain's ability to produce a unique, verifiable record that anyone can access, publishers could be reassured that no copies were being made. The blockchain could be tied to digital resources to demonstrate their "provable scarcity." This would allow digital materials to be uniquely identified, controlled, and transferred.

9. Challenges and Considerations

While the potential benefits of blockchain technology in libraries are clear, some significant challenges and considerations must be addressed. One challenge is the need for a large-scale adoption of blockchain technology in

libraries, which requires substantial investment and resources. Another challenge is the lack of standardisation inblockchain technology, which can lead to interoperability issues and difficulties in integrating different blockchain platforms. Privacy and security concerns are also associated with using blockchain in college libraries. These concerns must be addressed to ensure that sensitive information is protected and that users have control over their digital assets.

Future work on implementing blockchain technology in libraries for digital rights management will focus on extending the concept of blockchain technology to other library areas, such as e-books, journals, and multimedia content. There will be an increased emphasis on implementing and evaluating blockchain technology in real-world library settings to determine its effectiveness and identify areas for improvement. Developing new blockchain-based platforms specifically designed for libraries to manage digital rights will also be a key area of focus in future works.

10. Conclusion

In libraries, blockchain technology is used in various ways, such as to improve the metadata system, safeguard digital first-sale rights, promote peer-to-peer sharing, and more. Besides the already mentioned, the technology is most appropriate for academic settings and can advance libraries. It can be applied to secure library user information, record purchases, and enhance collection upkeep. Applications for special collections might make it possible to locate and learn about unusual holdings. Another use case for blockchain is the scholarly record, which enables scholars to distribute knowledge and record and date their thoughts. Blockchain technology presents a significant opportunity for libraries to improve user privacy, boost collaboration, and change their operations.

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