

# *Future Trends in Library Services: The Role of Blockchain Technology*

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*Abstract--Blockchain technology has been a emerging current topic in different online platforms, especially in 'tech blogs'. This paper discusses the current use and future impact of blockchain technology in academics, beyond optimizing teaching and learning processes, interoperability for certification, and so on. Blockchain has the probability to transform industries and the way they interact with data. This technology can be utilized to develop the efficiency, security, and transparency of various processes, such as data protection, digital rights management, and smart contracts. Libraries may face challenges in keeping up with advances and keeping their systems up-to-date and secure. Among these emerging technologies, blockchain can revolutionize libraries and transform them into intelligent libraries. Acceptance of cutting-edge technology is essential for the growth of library culture, even though its application in academic and library settings may move more slowly than in the technology industry. Blockchain technology is a broad and mostly unexplored field of study, offering opportunities and challenges for librarians looking to improve and broaden their service offerings.*

Keywords: Blockchain technology, architecture, libraries, applications of blockchain technology in library services

## I. INTRODUCTION

Certain individuals are forced by conditions, statelessness, employment (either full-time or part-time), or mobility to relocate permanently or temporarily owing to social change. As a result, library resources become more and more important. It takes a lot of information to locate and communicate community integration, innovation, job services, research, crisis management, and other assistance for people of all ages who are homeless, displaced, immigrants, migrants, or immigrants. Amusement. Communities will receive services from libraries that cannot be found elsewhere; yet,

these individuals typically lack an ID card and are not entitled to seek information from the library. The blockchain system will be used in numerous libraries to tackle this issue, and its security will be guaranteed for the data that contributes. Libraries will make advantage of this to communicate. All current and prospective users who join the library through supervision risk will have continuous access to digital content and print collections thanks to blockchain technology to verify that every user's privacy, including personal privacy, is protected. A blockchain application called Sovereign Identity (SSI) enables people or institutions to recognize and manage their digital and physical identities. As users establish safe identities in order to access any or all of the materials in these libraries, there will be a greater push to collect data and promote digital inclusion..

## II. LITERATURE REVIEW

An international literature search yields only a few studies that address blockchain as a research topic in libraries. Related research can also be found in other fields such as banking, medicine, healthcare, and supply chain business management. Blockchain has been the subject of discussion on various online platforms, especially on "technological blogs", both as a boon and as a bane. It is also discussed here.

[1],[2], [3], [4], [5],and [6] discussed the current use and future impact of blockchain technology in education, everything is an example now and in the future. The use of blockchain technology in education, such as issuance of valid certificates, evaluation of educational results, storage of student grades, recording of online lectures, and digital payment. Regarding the application of blockc

chain in libraries, [7] suggested in his research that collecting, storing, and blockchain technology makes it simple to share proof, Nausea. As a result, it might also be a way to avoid legal issues.

The result is unique, verifiable records that are difficult for outsiders to duplicate. In addition, he proposed a method for creating versions of journal articles with verified timestamps. He said the negative effects of blockchain are technological complexity and environmental inefficiency. [8] On the online blog ZBW Media Talk, there are similar obstacles. He doubts that librarians are reluctant to develop new blockchain technologies for libraries.[9] Proposes utilizing blockchain innovation to hold electronic receipts as advanced prove and exchange cash from libraries to benefactors. It ought to be built up that the blockchain will end up more powerful within the close future as this innovation spreads all through libraries and related businesses.

The Blockchain has been defined by various institutions, organizations, and authorities as follows: According to [10] a blockchain is an ever-growing list of records linked to the creation of a block, each block contains a cryptographic token of the previous block, Time, and transaction data. [11] States that blockchain is a distributed ledger technology consisting of a series of cryptographically generated data blocks. This statement is confirmed, [12]. A Blockchain is defined as a decentralized ledger containing blocks of data that are linked together using a script. [13] Consider an encrypted ledger that is distributed and synchronized across multiple nodes. In addition, the authors state that the blockchain is a technology that connects blocks of data and various contents in a distributed ledger, and each block contains [14]

A distinct code, or hash, that serves as a connection to and identification of the prior block. The blockchain is a peer-to-peer, recordable system that offers data security, privacy, immutability, and transparency, claims [15]. [14] A system that saves and maintains data in a way that makes it hard or impossible for someone to manipulate, hack, or trick the system [16]. The basis of the blockchain architecture is distributed ledger technology (DLT), which is a means of preserving data records throughout several platforms. One type of distributed ledger that is shared and replicated across multiple systems in a network is called a blockchain. Because hashes are immutable cryptographic signatures, [16] proposes blockchain as a type of DLT where transactions are recorded using hashes.

Blockchain: [17] This paper is the outcome of multiple discussions conducted over the last 24 months, as well as NITI Aayog's own hands-on experience with blockchain systems in a range of settings. This book is meant to be a "must read" for anyone who is considering creating blockchain systems in India, as well as a reference for more extensive thought in this field. First, the study looks into how blockchain might support the development of trust in the private-public sector connections. Before exploring the elements to take into account when assessing blockchain use cases for deployment, anticipated challenges, and takeaways from his experience implementing blockchain technology at NITI Aayog.

[18] This research report addresses several blockchain-related issues in education, extending beyond the optimization of instruction and learning procedures and certification process compatibility. The four fundamental characteristics of block certificates as well as the function of digital certificate issuers and verifiers are also covered in this paper. [19] The primary data protection issues with decentralization, digitization, encouraging and enhancing lifelong learning, and blockchain applications in education are discussed in this article.

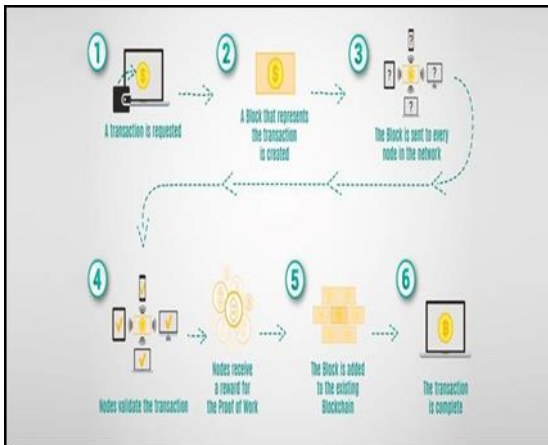
### III. WHAT IS BLOCK CHAIN TECHNOLOGY

Blockchain, now and then alluded to as dispersed record innovation (DLT), combines logical hash and decentralized to form each electronic asset's history straightforward and unchangeable. A Google Doc may be utilized as an easy-to-understand case of blockchain innovation. Once an thing is made and shared with numerous individuals, it gets dispersed instead of being found and passed on.

The result may be arranged that permits concurrent get to substance for all clients. Whereas all archive area item changes are reported over time, making changes totally straightforward, no one is holding up for upgrades from the other side. Blockchain is combined with a really inventive and promising innovation that diminishes hazard, kills extortion, and gives straightforwardness in a profoundly adaptable way for numerous applications. [20]

What is the technology behind blockchains? How does it work?

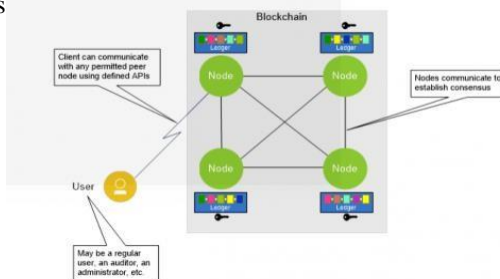
#### How Does Blockchain Work?



**Figure 1** How does blockchain work

### A. Technical Architecture View of Blockchain

A blockchain system typically consists of several nodes, each of which is home to a local copy of the ledger. The nodes in most systems are affiliated with distinct organizations. Nodes coordinate and validate transactions without the need for a central authority by speaking with one another to reach a consensus.



**Figure 2** Blockchain Application Architecture [22]

Consensus-building is the process of reaching this agreement, and several algorithms have been created to do this. To carry out the functions that the blockchain is intended to carry out, users submit transaction requests to it. A record of a transaction is added to one or more ledgers after it is finished and cannot be erased or changed. We refer to this characteristic of the blockchain as immutability [23]. The Public Blockchain, Private Blockchain, Hybrid Blockchain, and Consortium Blockchain are the main Blockchain models.

### B. What is Hyper ledger Sawtooth?

Hyperledger Sawtooth allows you to execute custom smart contracts without requiring you to comprehend the system's underlying architecture. An open-source enterprise blockchain as a service platform is called Sawtooth. Supporters of this overarching association for blockchain development include the Linux Project, IBM, SAP, and Intel. Sawtooth is compatible with a number of consensus techniques, including Practical Byzantine Fault Tolerance (PBFT) and Proof of Elapsed Time (PoET). [24]

### Proposed Model blockchain for library

Hyper ledger Sawtooth Core consensus (RAFT) for 3 nodes ( trusted entities) 1)Program Coordinator, 2) Main Librarian & 3) Assistant Librarian can you give me a smart contract that has the following functions (checking book availability, managing user access) where the student is accessing the system for the issue and return the book by itself.

### Hyper ledger Sawtooth Smart Contract for Self-Service Library Management

Here's a sample smart contract written in Python for Hyper ledger Sawtooth Core (RAFT) with a self-service approach for students to issue and return books while maintaining librarian oversight:

```
from sawtooth_signing import Crypto Factory
from sawtooth_processor.handler import Transaction Handler
# Define roles and their public keys
PROGRAM_COORDINATOR_KEY =
"<program_coordinator_public_key>"
```

```
MAIN_LIBRARIAN_KEY = "<main_librarian_key>"
```

```
ASSISTANT_LIBRARIAN_KEY =
"<assistant_librarian_key>"
```

```
Class Library Management Handler (Transaction Handler):
def __init__(self):
```

```
    self._crypto_factory = Crypto
Factory(signer_lib="pyosigner")
def _get_state_data(self, address):
    """Retrieves data from the state."""
    context = self._context
    return context.get_state([address])[0].decode() if
context.get_state([address]) else None
```

```
def _set_state_data(self, address, data):
```

```
    """Stores data in the state."""
    context = self._context
    addresses = [address]
    data_values = [data. Encode()]
    context.set_state(addresses, data_values)
```

```
def _create_approval_address(self, book_id):
```

```
    # Implement a unique address generation mechanism
```

```
# ...
return f"approval-{{book_id}}"
    @property
def family_name(self):
    return "library-management"
return ["1.0"]
@property def family_versions(self)
    function handle(self., transaction):
        payload = transaction.payload.decode()
        action, user_key, book_id = payload.split(",")
        # Validate student role
        # ... (implementation details based on student
        identification)
        # Check book availability
        if action == "check_availability":
            book_data = self._get_state_data(book_id)
            available = "available" if book_data is None else
            "unavailable"
            return
        TransactionHandler.make_successful_transaction_response(
            payload=f"Book {{book_id}} is {{available}}"
        )
        # Issue book
        elif action == "issue_book":
            book_data = self._get_state_data(book_id)
            if book_data is not None:
                return
            TransactionHandler.make_invalid_transaction_response(
                msg="Book is not available"
            )
            # Initiate librarian approval process (modify as needed)
            approval_address =
            self._create_approval_address(book_id)
            self._set_state_data(approval_address,
            f"pending,{{user_key}}")

            # Return transaction response with approval address
            return
            TransactionHandler.make_successful_transaction_response(
                payload=f"Book issuance request initiated.
                Approval address: {{approval_address}}"
            )
            # Return book
            elif action == "return_book":

                book_data = self._get_state_data(book_id)
                if book_data is None or book_data.split(",")[0] !=
                user_key:
                    return
            TransactionHandler.make_invalid_transaction_response(
                msg="Invalid book return request"
            )
```

```
# Update book state and remove approval request (if
pending)
self._set_state_data(book_id, None)
approval_address =
self._create_approval_address(book_id)
pending_approval =
self._get_state_data(approval_address)
if pending_approval:
    self._set_state_data(approval_address, None)
    return
TransactionHandler.make_successful_transaction_response
(
    payload=f"Book {{book_id}} returned successfully"
)
# Librarian approval (adapt based on chosen approval
process)
elif action.startswith("approve"):
    librarian_key, approval_address = action.split(", ", 1)
    if librarian_key not in [MAIN_LIBRARIAN_KEY,
ASSISTANT_LIBRARIAN_KEY]:
        return
    TransactionHandler.make_invalid_transaction_response(
        msg="Insufficient access to approve"
    )
    pending_approval =
    self._get_state_data(approval_address)
    if not pending_approval or
    pending_approval.split(",")[0] != user_key:
        return
    TransactionHandler.make_invalid_transaction_response
(
```

#### IV. WHY IS BLOCKCHAIN TECHNOLOGY USED IN THE LIBRARY

By staying traditional, libraries can capitalize on this technology and charge for blockchain eventualities. Blockchain technology destroys a big chance for libraries to become more collaborative, better at insulating stoner patrons, and transform how they engage with their communities and neighbors. [13]

##### A. Application of Block Chain in Library:

Building enhanced and connected information systems for libraries and information centers: Building decentralized, permission less databases is critical. Because a blockchain that acts as an information ledger does not require a gatekeeper, It can be applied to build an extremely scalable information system for networks of institutions and libraries. When it is made open, the OCLC blockchain enables any organization to use the system. Without additional fees. The system is well-balanced, but the quality of the information is

maintained by selecting the read/output replacement of the supported hash language information.

#### B. Protecting digital pre-emption rights

Another topic that can disrupt the data ecosystem is digital pre-emption, which is a product of digital ownership and uncertainty. A copyright management system built on a discoverable blockchain is at the core of many blockchains today. Important to libraries is the ability for these resources to take advantage of pre-purchase rights. Griffey worked with world-renowned copyright experts to research the sub-title argument, and in the summer of 2017 published a paper detailing the facts. And DRM of any kind is not attractive, and if the attack on the block is pushed, we may trade for the ease of accepting digital marketing rights, which is expensive for libraries.

#### C. Enables peer-to-peer digital sharing using

Blockchain technology, which can benefit locals shares a variety of tools and services. or for the sharing economy. When a match is completed, a desired project is executed, or a report is successful, the blockchain provides the tools that people need. When you need to share files, an online degree course can be special. Although it is difficult to change these shared files blockchain, it makes the files more secure.

#### D. Connecting to library/university networks:

*libraries and universities can use blockchain as part of the Inter Terrestrial Forecasting System. a peer-reviewed procedure for the upcoming web. using Bit Torrents, Bad Guys, and the Block. ITFS bypasses ISP gatekeepers and large Internet companies. The system expects online surfers to save a copy of the website on their computer. The library/university network can be cast-off to confirm credentials for a replica of a web - comparable to what colliers do with Bitcoin.*

#### E. Promote inter-agency/institutional collaboration

*Libraries collaborate with colleges, museums, and governmental organizations to handle copyrights, exchange brand data, and handle user-generated content via blockchain technology.*

#### F. Support for community-based collections

Protocols that support community-based classification and lending can expand standard library collections to the community. Libraries can implement blockchain-based systems that include "smart contracts" to enable the sharing of community resources (equipment,

vehicles, expertise) in a real network. Divide. The Block determines something, who owes something, etc. This may be in the form of relationships with code generators and businesses.

A worldwide connect library advance pilot program for the Worldwide Alliance of Library Affiliations (IFLA) voucher framework may be created utilizing blockchain. Reusable vouchers are advertised by IFLA to form it less demanding for libraries to yield demands for worldwide interlibrary advances. Each voucher is an case of a ordinary installment for a single exchange. Due to the outside trade exchanges included in this interlibrary advance trade [25] and the value-based nature of interlibrary credits in common, blockchain might loan itself well to universal wiped out. Blockchain is as often as possible utilized to affirm the legitimacy and exactness of information all through its advancement. This may involve differentiating the blockchain's hash with the hash of the interesting docs. In case the more than one hashes are not the same, the records are changed.

#### V. ADVANTAGES OF BLOCKCHAIN IN LIBRARY

Integrating blockchain technology into library services can provide several advantages, enhancing the efficiency, security, and transparency of various processes. Here are some potential benefits:

- *Enhanced Data Integrity and Improved Security*

Blockchain ensures the immutability of records, making it nearly impossible to alter or tamper with data. This guarantees the integrity of the library catalog, user records, and other important information. Blockchain's cryptographic features provide robust security for sensitive data, such as user information and transaction records. This cuts the hazard of unauthorized access and data breaches.

- *Transparent and Trustworthy Catalogs*

The decentralized nature of blockchain can create a transparent and trustworthy catalog system. Users can have confidence in the accuracy and authenticity of the information available in the library's catalog.

- *Decentralized Digital Repositories*

Blockchain allows for the creation of decentralized digital repositories for e-books, research papers, and other digital assets. This ensures secure and tamper-proof storage with transparent access controls.

- *Efficient Resource Sharing*

Smart contracts on blockchain can facilitate automated resource-sharing agreements among libraries. This can streamline interlibrary loans and resource exchanges, reducing administrative overhead.

- *Smart Contracts for Automated Processes*

Implementing smart agreements can mechanize different processes within library services, such as book checkouts, returns, and fine collection. This increases operational efficiency and reduces manual errors.

- *Digital Rights Management (DRM):*

Blockchain can be utilized to manage and enforce digital rights for e-books and other digital materials. This ensures that content is accessed only by those with the appropriate permissions, protecting intellectual property.

- *Traceability of Assets:*

Blockchain's transparent and traceable nature can be applied to track the movement of physical assets within the library, helping with inventory management and decreasing the risk of lost or misplaced items.

- *Improved Interoperability:*

Blockchain can enhance interoperability between different library systems and networks, making it easier to share and exchange data seamlessly.

- *Reduced Administrative Overhead:*

Automation through blockchain technology can lead to reduced administrative workload, allowing library staff to focus on more strategic tasks rather than routine processes. While these advantages are compelling, it's important to consider potential challenges such as scalability, user acceptance, and regulatory compliance when implementing blockchain in library services. Customization based on the specific needs of the library is also crucial for successful integration. Plate.

## VI. CONCLUSION

Blockchain technology is a revolutionary approach that provides a reliable way to confirm transactions, including the parties involved, the submission date and time, and the specifics of the transaction, all without the need for middlemen. Even while blockchain technology is still relatively new, it has a lot of potential, and academics are working hard to explore its many uses. Blockchain is one of these cutting-edge technologies that has the power to completely change libraries and make them sentient. Libraries are experts in obtaining, maintaining, and sharing correct data;

blockchain technology can help with these goals by using a decentralized, timestamp-based method to guarantee the legitimacy and ownership of documents adopting cutting-edge technology is essential for the development of library culture, even though it may happen more slowly in academic and library contexts than in the technology sector. Library professionals looking to improve and broaden their service offerings have both opportunities and problems as they delve into the huge and largely untapped field of blockchain research.

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