



3. Block Chain-Based System: Applications and Challenges

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ABSTRACT

Internet of Things (IoT) is a prominent computer paradigm. In a wide range of applications, such as smart healthcare, smart grids, smart finance, and smart cities, it's increasingly being used to make human life more convenient. A wide range of difficulties, from scalability and interoperability to security and privacy, are faced by Internet of Things (IoT) applications. These issues have lately been alleviated by the development of block chain technologies. Smart contract innovation and improvement are now inseparable from the rapid development of block chain technology and industry around the world. The benefits of block chain technology (BT) include improved trust, collaboration, organization, identification, and legitimacy. While providing a transparent, immutable, and consistent data repository, block chains improve the quality of data, they also introduce new data management difficulties.

KEYWORDS

Block Chain, IoT, architecture, BT, Bitcoin, Data Blocks.

Introduction:

Transparency and accountability are two of the possible benefits of the block chain technology that can be used to handle electronic data.

A block chain is a public ledger of transactions where any member of the network may see an identical copy.

Network members verify each other's entries into the ledger; once a record has been made, it cannot be rewritten (OECD, 2020). In the early days of cryptocurrencies, block chain was designed to eliminate the need for middlemen like banks while simultaneously guarding against the significant danger of fraud and theft. [1]

Satoshi Nakamoto, who used the pseudonym Satoshi Nakamoto to discuss how cryptology and an open distributed ledger may be merged into a digital currency application, first suggested the concepts of bitcoin and block chain in 2008. [2]

Block chain, the technology behind bitcoin, was initially hindered by its high volatility and many countries' scepticism about its complexity, but it has since gained a lot of attention because of its many advantages.

The distributed ledger, decentralization, information transparency, tamper-proof construction, and openness are some of the benefits of block chain. [3]

This could have an influence on the same size as TCP/IP had on the Internet. Health care providers and biomedical scientists are interested in block chain technology for a variety of reasons, including how it can improve longitudinal medical records, automate claims and other aspects of the healthcare system, help with drug development and interoperability in the population health and consumer health care sectors, create patient portals, secure medical research data, and lower supply chain costs. [4]

Each participant has his or her own copy of the block chain ledger, which is shared among all participants and records every transaction made by any member. [5]

Each transaction is, technically, contained within a block. Multiple transactions can be included in a single block, which is why it is important for the members to verify each block individually.

A hash-chain, or block chain, is formed when each block includes the hash value of the previous block's header. [6]

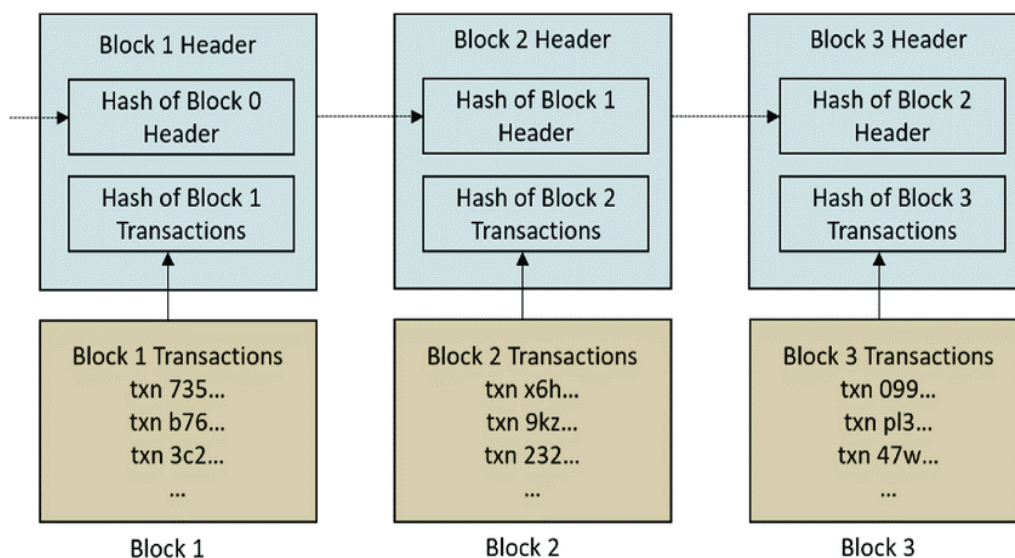


Figure 1: How Data Blocks Form a Block chain

Block Chain Properties:

Using block chains as a component of a large software system provides a trustworthy and neutral data storage platform.

The unique design of the ledger structure, the network, consensus protocol, and cryptographic technologies it employs result in trust and neutrality. [7]

- **Transparency:** All members in the block chain network have access to the data stored on the block chain. Data on a public block chain can be seen by anybody on the Internet because of this.
- **Immutability:** Once data are added to the block chain, they can't be modified or deleted because of the distributed consensus process. In the case of block chains utilizing specific consensus procedures, immutability may only be probabilistic. The block chain network maintains a record of every transaction. A public audit trail is created from these unchangeable records.
- **Consistency:** The immutability and distributed consensus of the block chain network ensure that all committed data can be seen by all subsequent data manipulations, resulting in a single version of the truth.
- **The same rights for everybody:** Due to disintermediation, the block chain can be manipulated and accessed by any member of the network. Participants' computation power or stake may be taken into account when determining the weighting of these rights under various consensus processes.
- **Availability:** A complete copy of the block chain data can be hosted by any participant in the block chain network. As a result, as long as there is at least one node in the block chain network, the data are accessible. [8-10]

Review of Literature:

According to Gartner, Kandaswamy, and Furlonger [11], at least one creative startup built on block chain technology will be worth \$10 billion by 2022.

While the value of block chain is expected to expand to \$360 billion in 2026, it is expected to reach more than \$3.1 trillion by 2030.

Block chain's expected exponential growth is enticing to businesses who want to change their business paradigms in favour of a more secure and distributed transaction model.

Various academic fields have examined block chain technology. The underlying technology of the block chain, for example, distributed storage, peer-to-peer networking, encryption, smart contracts, and consensus algorithms have been investigated by various researchers (Christidis and Devetsikiotis 2016[12]; Cruz et al. 2018[13]; Kraft 2016[14]).

Block chain-based decentralised cooperation may be able to better support the dynamics of social sharing, according to Pazaitis et al. [15].

Sun et al. (2016) [16] discuss the impact of block chain technologies on the three major aspects of the sharing economy (i.e., human, technology, and organization). They also examine the role that block chain-based sharing services play in smart cities.

To implement corporate partnerships and inter-organizational business procedures, block chain can be utilised to create smart contracts.

Using smart contracts on a block chain, businesses can perform transactions without the need for human intervention. Smart contracts, for example, can be used to automatically file tax returns for firms (Vishnevsky and Chekina 2018) (17). [18] Zyskind et al. proposed the use of decentralised systems to achieve transparency, ownership, and privacy in the supply chain. Liang et al. [19] address the issue of data provenance.

For data accountability, the paper offers a provenance database and a block chain network to produce tamper-proof records.

Objectives:

- To study block chain architecture
- To study challenges and application of block chain architecture
- To study how data will be blocked in block chain system
- To study how IoT integrated in block chain system

Research Methodology:

Research is a voyage of discovery; a journey; an attitude; an experience; a method of critical thinking; an activity caused by instinct of inquisitiveness to gain fresh insight/find answers to question/acquire knowledge.

A research methodology is a universal way to addressing a study subject through data collection, data evaluation, and results based on the findings of the study. A research technique is a plan for carrying out a research study.

The methodical gathering and analysis of facts and information for the advancement of knowledge in any area may be loosely defined as research. The goal of the study is to use systematic techniques to find solutions to intellectual and practical problems.

Result and Discussion:

The proof of asset delivery and transactions between two parties is provided by block chain-based systems.

As can be seen in Figure 2, which also depicts the asset delivery implementation process, the various roles in the block chain-based asset delivery management system are demonstrated to be interdependent. [20]

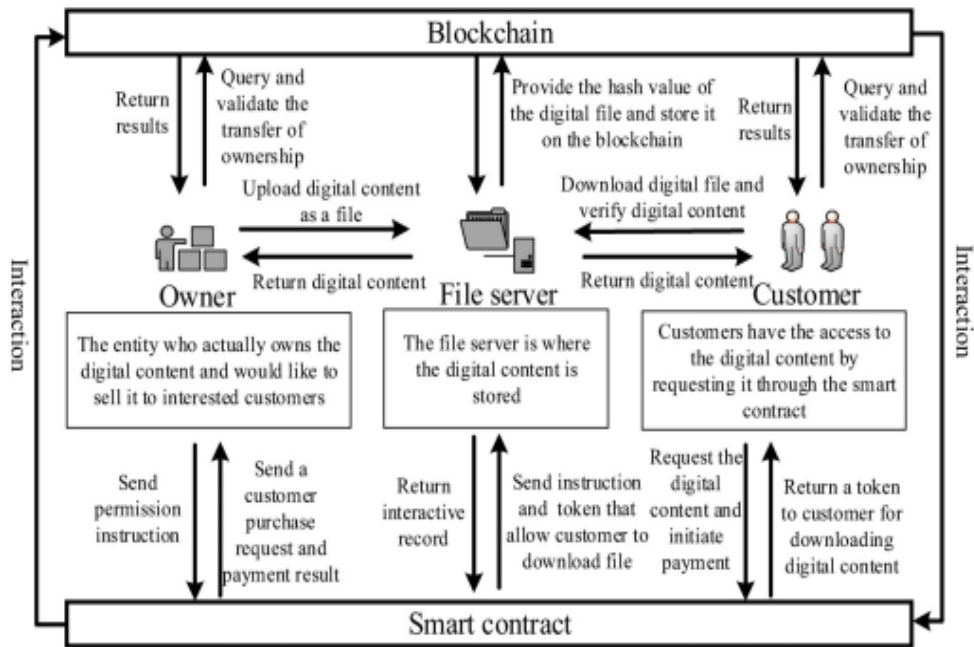


Figure 2: Implementation process of block chain-based asset delivery

IoT devices are vulnerable to cyberattacks due to a variety of Internet security flaws. There is still a lack of efficient measures to prevent attacks and privacy leaks in the IoT device network in terms of network security and algorithms [21]. The Internet of Things (IoT) data security issues are predicted to be alleviated by the use of block chain technology. Fig 3 outlines the features of block chain that are combined with IoT, as shown. [22]

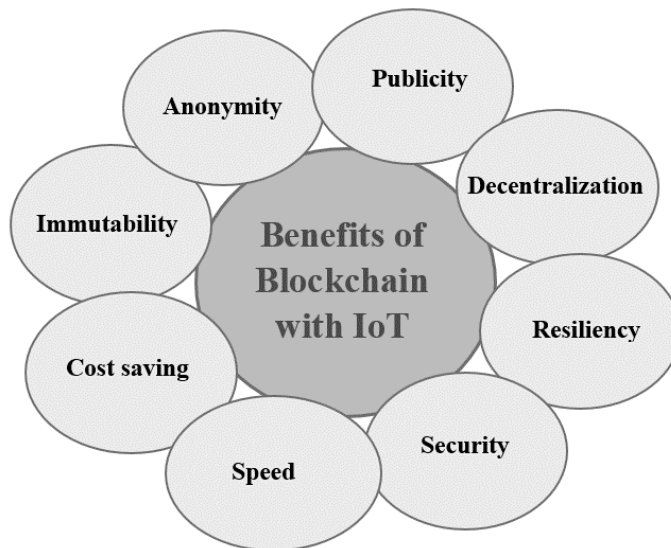


Figure 3: Block chain features integrated with IoT:

Figure 4 depicts a more thorough and in-depth classification of block chain-based applications, taking into account the current and future variety of block chain solutions.

In the following sections, we classify the block chain-enabled applications that exist based on what we've learned from the research. [23]



Figure 4: Mind map abstraction of the different types of block chain applications.

This section focuses on the most pressing challenges in building and integrating block chain-based IoT applications.

Block chain techniques have been designed with high-performing devices for internet scenarios, but this is far from the IoT reality; transactions utilizing the block chain approach require a cryptographic identity and this capability must be supplied for machines capable of working with a currency. There are several challenges and future trends mentioned in this part, as indicated in Fig. 5[24].

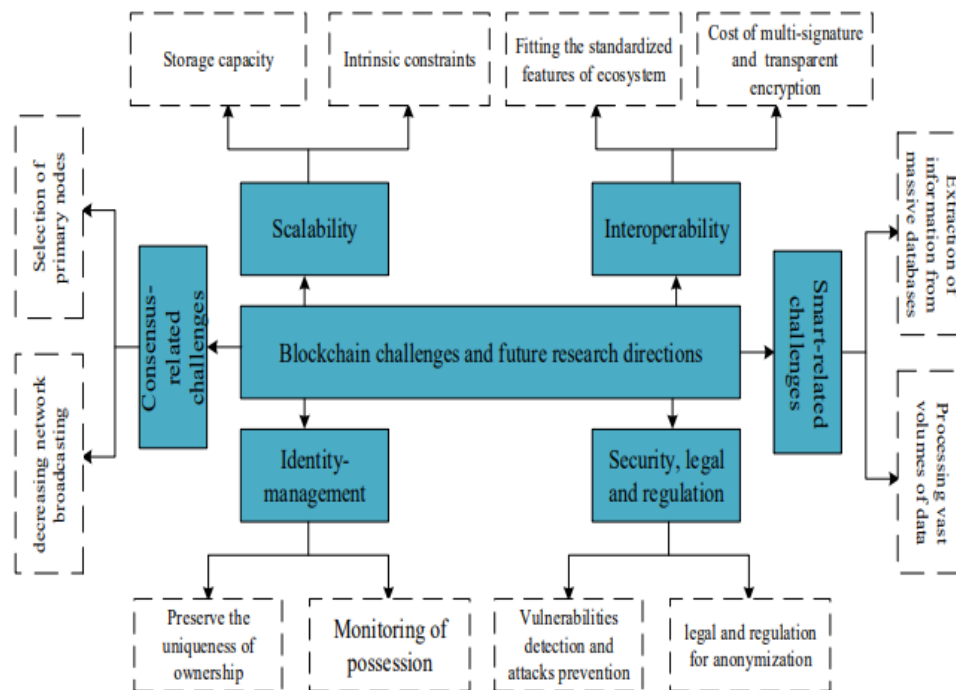


Figure 5: Block chain challenges and future research directions

Conclusion:

Block chain is a promising new technology that has the potential to impact a wide range of industries. The concerns surrounding block chain's business applications are therefore crucial for both academic and social practice, in our opinion. Block chain technology has a lot to offer businesses. Block chain technology may be used for accounting settlement and crowdfunding, data storage and sharing, supply chain management, as well as smart trading if organizations have these needs. Block chain is a novel technology architecture that enables decentralized, secure storage systems to be realized via the merging of several computer technologies. The decentralized models of block chain can overcome the trust-lacking difficulties in the traditional centralized institutions and improve data security, compared to the traditional centralized models. The concentration of cloud services and cloud storage can be lessened, and numerous businesses can gain, from the implementation of block chain.

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