

A Comprehensive Review on Blockchain Technology for Interactive Healthcare Systems

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Abstract— Large health care companies use blockchain for securing private and confidential records. The block chain models are used in latest medical health records for safeguarding the patient details and accessing information. This paper defines the concepts and recent trends in blockchain technology. A review has been made of blockchain for interactive healthcare applications.

Keywords— *Blockchain, Cryptography, Transactions, Consensus, Distributed ledgers, Federated blockchain*

I. INTRODUCTION

Medical healthcare systems are the recent advanced technology for the current lifestyle of modern human beings. Blockchain technology takes quality data using an online electronic personal records system [1].

Blockchain technology is typically defined as a structure type that stores transaction records. The records are also known as the “blocks” of the public database. The chain in a network is connected through peer-to-peer nodes. A set of rules and workflows are used to carry out blockchain operations. Before the entire block is added to the communication network, the nodes in the network system are to be checked regularly.

Figure 1 specifies the network structure of blockchain concepts. The blockchain is sometimes referred to as Distributed Ledger Technology (DLT). This type of network makes any digital asset unalterable and transparent through techniques such as decentralization and cryptography hashing. The types of network traffic are defined as follows.

A. Centralized network

A centralized type of network is made up of third parties whose characteristics are known.

B. Decentralized network

In this type of network, everybody can participate and transact on the file which is known as decentralized. Thus, a centralized and decentralized ledger should be used in any highly regulated transaction such as financial companies and business fields, etc.

C. Distributed ledgers

A distributed ledger is a physically shared database and synchronized across multiple websites, institutions, accessible by various people. This technology is used by blockchain, which is the same as bitcoin technology [2].

The remaining sections of the paper are described as follows. The second section is about reviewing the literature. Next is the third section explains the structure of blockchain technology. The fourth section illustrates the types of blockchain technology. The fifth section mentions the blockchain consensus algorithms. The sixth section determines the major applications related blockchain technology. Finally, the seventh section concludes the paper.

II. LITERATURE REVIEW

Enormous researchers have illustrated the work about block chain technology. Anton et al. have defined blockchain technology in health sciences. The work includes electronic health records, and personal health files were taken into consideration in health care systems. [3].

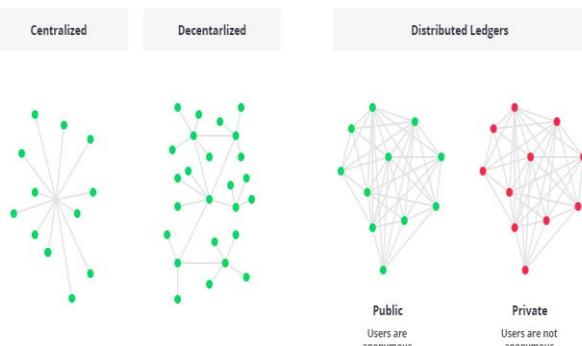


Fig 1: Network structure of blockchain concepts

Omar et al. have defined health care situation during covid-19 pandemics. The health providers are finding distress in the supply chain of orders, procurement, and distribution services [4]. Iqbal et al. have used machine learning algorithms in animal healthcare industries. The work focuses on veterinary management based on analytics modules [5].

Kleinaki et al. have defined blockchain services for biomedical research. The scientific contribution for biomedical science uses various authoritative database services [6].

Roehrs et al. have defined health record providers and their implementation using personal health files. This work explains distributed and integrated data in health systems [7]. Perumal et al. have used blockchain technology for sleep medicines and healthcare technology. The work uses electronic medical files and an information exchange program [8].

III. ARCHITECTURE DETAILS

Following section describes about the architecture details of the blockchain technology. Figure 2 describes the structure of blockchain.

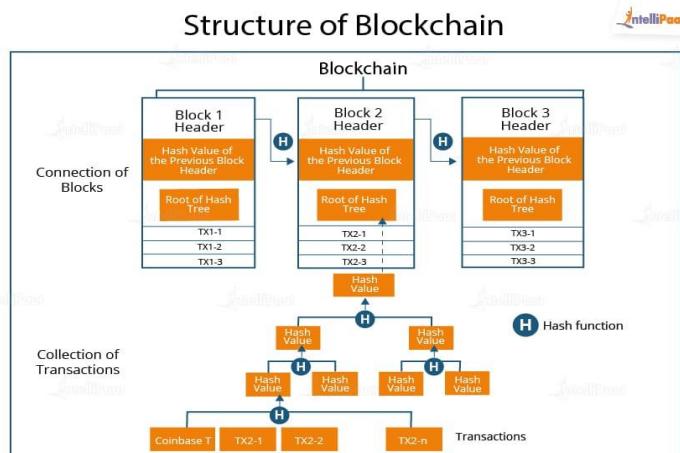


Fig 2: Structure of blockchain

The structure of blockchain comprises of connections and blocks of headers and collections of transaction using hash functions.

Various constituents of the block header are defined as follows.

1. Timestamp

Timestamp in the blockchain is used as proof that the particular block is used at what instance of a time.

2. Version

In blockchain technology, we have different versions in the blockchain or the system's protocol.

3. Merkle root

A Merkle root uses mathematical formulas to check if the data is not corrupted, hacked, or manipulated.

4. Previous hash

This function is used for the conversion of input letters to encryption form to a converted output length. If anyone has changed the data in a block, then we get another hash value for the modified data is called the previous hash.

IV. TYPES OF BLOCKCHAIN TECHNOLOGY

There are three different types of blockchain defined. They are given as follows.

1. Public blockchain:

A public blockchain means the information and admission to the system are available to everyone who is keen to participate, such as bitcoin, ethereum and so on.

2. Private blockchain:

Specific users and private organizations use the private type of blockchain. The login details are provided only to the authorized users with authentic information.

3. Federated blockchain:

In a federated blockchain network, multiple entities make use of the network. A Federated blockchain allows various organizations to use the network. Federated blockchain types are usually used in the banking sector and financial applications.

V. THE ALGORITHMS

There are consensus algorithms in blockchain technology that agree on one particular state of a blockchain. If the new block is added to a blockchain, this block will be defined with the help of the consensus algorithm [9]. Here we can agree on one particular state of a blockchain in the entire network. There are some consensus algorithms defined for block chain operations. They are given as follows [10].

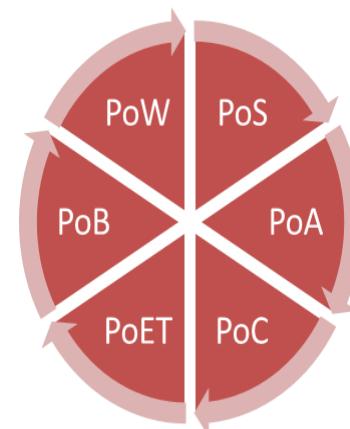


Fig 3. Block chain algorithms

Figure 3 depicts various consensus algorithms related to block chain technology. These algorithms are defined in detail in the following section.

1. PoW (Proof of Work) algorithm:

The algorithm is used to solve complex mathematical problems on the new block before approving the block to the ledger.

2. PoS (Proof of Stake) algorithm

This algorithm is given as an alternative to the proof of work method. This type of work uses validators to invest in the bitcoins of the system as a stake. Then the validators will start validating the blocks after that [11].

3. PoA (Proof of Authority) algorithm

This algorithm is dependent on the specific value of identities of a network. This type of authority blockchain network is safeguarded using validation nodes based on responsible parties. The model uses fixed blocks of validators for network participants to check each transaction.

4. PoET (Proof of Elapsed Time) algorithm

This algorithm is also known as the fairest algorithm for selecting the next block using appropriate means. Here every validator on the network gets a fair chance to create their block. The block from the winning validator node gets appended to the blockchain.

5. PoC (Proof of Capacity) algorithm

In this type of algorithm, the validators are used to invest in their hard drive space. This work has the most chances for mining selection for the block reward.

6. PoB (Proof of Burn) algorithm

This algorithm uses validators for having a long-term commitment in exchange for their short-term loss. This type uses miners to burn the native currency of the applications of blockchain or bitcoin.

VI. APPLICATIONS

Following are the applications related to blockchain technology. Figure 4 describes various blockchain applications. Major applications of block chain technology include cyber physical systems, cloud computing, interactive healthcare systems, social networking, mobile networks, government services, internet of things, financial services, industries and business [12].

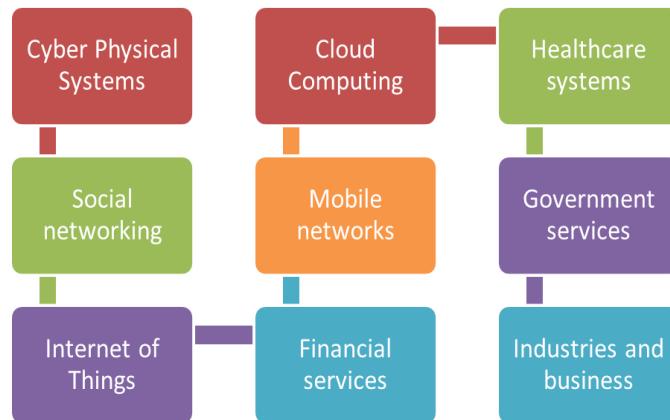


Fig 4: Blockchain applications

Table 1 shows the blockchain issues in real time systems which can be adopted in the further research work.

Table 1: Five blockchain problems

Block chain security issues
Block chain privacy issues
Block chain legal issues
Block chain regulatory issues
Block chain ethical issues

VII. CONCLUSION

Blockchain technology uses various transactions and operations using distributed technology in a distributed manner. The applications of blockchain are adopted across multiple use cases for secure smart systems. The blockchain method uses safe data sharing modules in personal healthcare systems.

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