

THE FUTURE OF BLOCKCHAIN IN HEALTHCARE SECTOR

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ABSTRACT

This paper describes the potential usages and areas of opportunity for blockchain technology in healthcare sector. As we all know that the digital technology has transformed healthcare sector. And this transformation is expected to continue in the shared and completely transparent information stored on an immutable ledger that can be accessed only on permission by network members. As long as healthcare organizations and healthcare professionals keep their minds open and create the required infrastructure and systems, there is no saying how far digital technology can go in healthcare. Storing the medical data of patient is very important in healthcare. These data are very sensitive and this is on prime target of cyber-attacks. So, we can discuss advantages, disadvantages and some real world use cases of blockchain technology in healthcare sector to secure healthcare records and information with patient consent.

Keywords: Blockchain, Distributed System, Crypto-Currency, Healthcare;

1. INTRODUCTION

Blockchain is proved to be a fundamental technique for various application domain like cryptocurrency (Bitcoin, Litecoin, Namecoin etc) and Decentralized Apps. Blockchain is new technology which provides decentralized, anonymity, auditability and consensus through cryptograph and other theories. Blockchain can be described as a data structure that securely links multiple blocks of transactions. These blocks can hold sets of information. Blocks have certain storage capacities and, when filled, are closed and linked to the previously filled block, forming a chain of data known as the blockchain. All new information that follows that freshly added block is compiled into a newly formed block that will then also be added to the chain once filled[1][2].

“Blockchain technology can be defined as a tamper- resistant decentralized digital ledger that can securely store records of all transactions on network.”

Each transaction verified by the majority of participants of the system. It contains every single record of each transaction. Blockchain Technology first came to light when a person or Group of individuals name ‘Satoshi Nakamoto’ published a white paper on “BitCoin: A peer to peer electronic cash system” in 2008. Blockchain being distributed over a network of connections provides visibility to all parties involved in any kind of transaction and gives them control over how their data is viewed. Cearley Burke [3] explains that using a public blockchain can remove the need for trusted central authorities in record transactions and dispute arbitrations. This is because trust is built into the model through immutable records on a distributed ledger.

In healthcare sector, we need to carry data which is sensitive and important. To protect patient’s medical information we need security, privacy and transparency. In this digital era, sharing the records and prevent data on cloud storage have risk of malicious attacks. As health information is becoming more easily to obtain through smart devices, and patients are traveling to multiple doctors, the sharing and privacy of this information are a concern. [4][5]Blockchain helps for the decentralized protection of data in healthcare and avoid problems like interoperability, data sharing, the transfer of medical records and authentication. Blockchain can also used to store the data and sure that the record cannot modify by unauthenticated person. This decentralized network is used with all commodity hardware in healthcare system; researchers allow

computing estimates for therapies, medicines and remedies of diverse illnesses and disorders using the resources saved by these devices. [6][7] According to “India Brand Equity Foundation (IBEF)” report the “healthcare industry” in India has grown into one of the largest sectors in terms of revenue and employment generation. The public as well as the private healthcare sectors have flourished at an exponential rate.

2. NEED OF BLOCKCHAIN IN HEALTHCARE

In recent years, a report found that 83% of medical imaging devices were running on unsupported operating systems that left organizations vulnerable to cyberattacks. There is need of a system which record medical data and provide necessary information for medical analyses, studies, and research. This facilitates the work of hospitals, financial institutions, health insurers, medical supply companies, pharmaceutical firms, and other personnel that review medical records. There are some issues like to preserve and portable patient data, integrity, security, utilization of collected medical data to its maximum potential and real time updating the data. The current system does not resolve these problems. So the healthcare system needs a technology which minimizes all these challenge. Blockchain technology is implemented to resolve these issues. This technology enhances security, data exchange, interoperability, integrity, and real-time updating and access when correctly implemented [12][13].

3. ADVANTAGES OF BLOCKCHAIN IN HEALTHCARE

Here are the main benefits blockchain technology brings to different healthcare sectors:

Blockchain for healthcare organizations:

- Improves decision making as blockchain allows several doctors from different location to view the same data in real time
- Transforms patient medical records to a decentralized system that can't be tampered with
- Speeds up medical credentialing

Blockchain for patients:

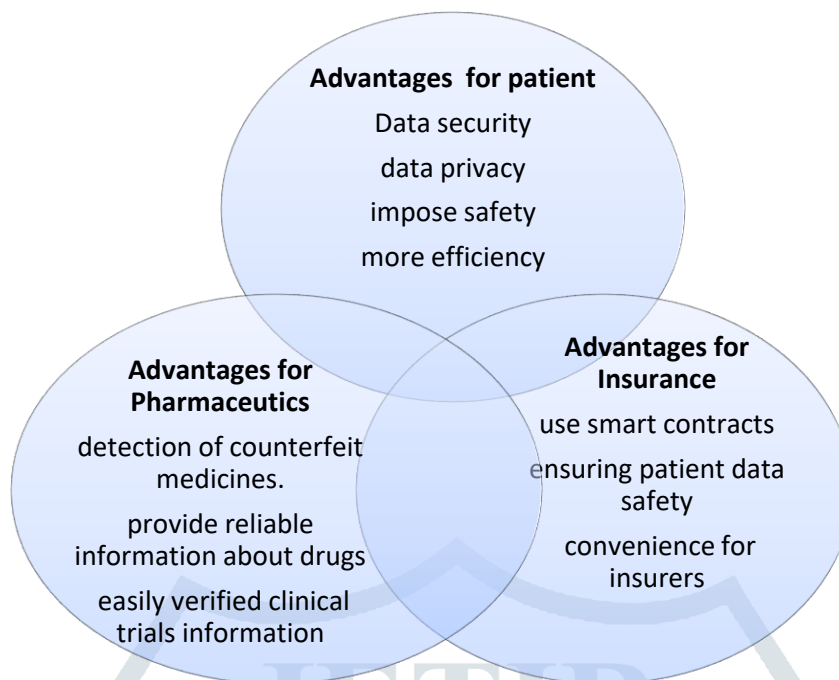
- Empowers patients to assume ownership of their medical data
- Supports consent mechanisms prohibiting healthcare providers from accessing information without patient permission
- Enables patients to participate in research and otherwise monetize their data without intermediaries
- Collects and stores data from wearable devices in a secure manner

Blockchain for pharmaceuticals:

- Helps to recruit participants for clinical trials
- Supports reliable and auditable documentation of clinical trials with its immutable records
- Allows spotting counterfeit drugs

Blockchain for insurance:

- Speeds up confirmation obtaining process
- Unlocks the opportunity for insurers to draft and manage agreements using smart contracts
- Cuts down costs by eliminating intermediaries



4. DISADVANTAGES OF BLOCKCHAIN IN HEALTHCARE

There are several disadvantages to adopting blockchain in healthcare stemming from the nature of this technology:

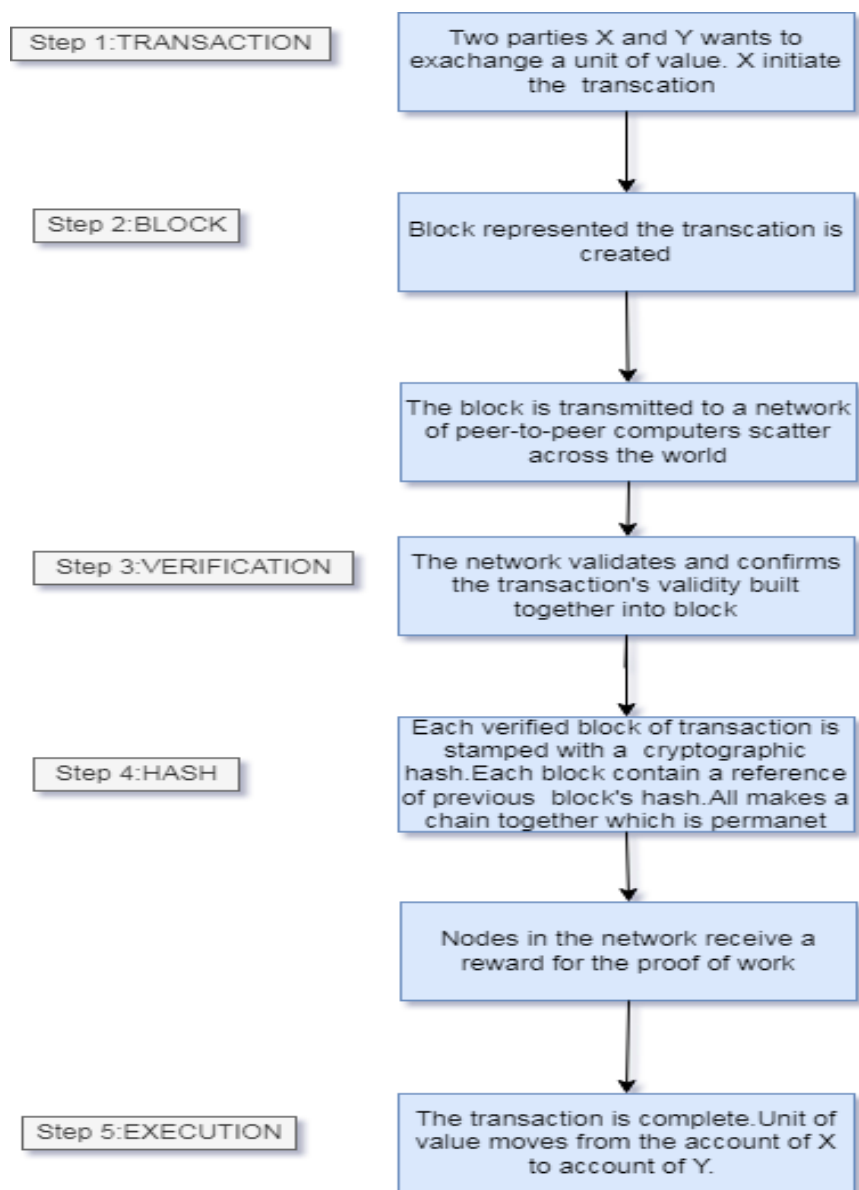
- As the number of blocks grows, the transaction time increases, causing delays
- Inability to permanently delete records. The network simply creates more blocks that reflect the invalidation of existing records
- For this technology to function, every involved organization needs to be on board with it
- Potential problems with large patient files, such as MRI scans
- High planning, developing, and maintenance costs

5. WORKING OF BLOCKCHAIN TECHNOLOGY

A blockchain ledger consists of two types of records, individual transactions and blocks. The first block consists of a header and data that pertain to transactions taking place within a set time period. The block's timestamp is used to help create an alphanumeric string called a hash [8][9].

After the first block has been created, each subsequent block in the ledger uses the previous block's hash to calculate its own hash. Before a new block can be added to the chain, its authenticity must be verified by a computational process called validation or consensus. At this point in the blockchain process, a majority of nodes in the network must agree the new block's hash has been calculated correctly. Consensus ensures that all copies of the blockchain distributed ledger share the same state. Once a block has been added, it can be referenced in subsequent blocks, but it cannot be changed. If someone attempts to swap out a block, the hashes for previous and subsequent blocks will also change and disrupt the ledger's shared state. When consensus is no longer possible, other computers in the network are aware that a problem has occurred and no new blocks will be added [10].

There are mainly five steps in executing and verifying transactions data in a blockchain.



6. BLOCKCHAIN TECHNOLOGY IN CURRENT HEALTHCARE MARKET

Blockchain can enhance interoperability across a global market, eliminating system boundaries and geographic limitations. [11][12][13] Now in this time, a number of health care companies, including IBM, SAP, Centers for Disease Control and Prevention, Patientory, and Nebula Genomics are using enterprise blockchains and focused on tasks such as:

- Verification of credentials
- Sharing medical records
- Tracking costs and payments
- Tracking organs and transplants
- Following the pharmaceutical supply chain

Companies invested in blockchain to replace their traditional systems. The blockchain market size is expected to reach \$67.4 billion by 2026. This is due to increased investment in technology, extensive use of blockchain solution in banking, medical, cybersecurity as well as in finance, insurance, personal identity security and among hundreds of other fields. Blockchain provides a shared and transparent history of all the transactions to build applications with trust, accountability, decentralization, transparency, and immutability.

A market report says [14]

- Around \$126 billion — the projected value of blockchain technology in the healthcare market in 2030.
- Nearly \$100 billion — the amount saved annually by healthcare companies through the adoption of blockchain for improving their IT operations.
- About \$242 million — the amount pharmaceutical and medical device.
- The blockchain technology in healthcare market is valued at USD 1.08 billion in 2019 and is expected to grow at a CAGR of 68.1% during the forecast period.
- Biopharmaceutical & medical device companies accounted for the largest market share in the end-use segment in 2019.
- The supply chain management segment held over 25% market shares, with regard to application, in 2019.
- Clinical data exchange and interoperability segment of the blockchain technology in the healthcare market is expected to expand at a considerable CAGR during the forecast period.
- Clinical data exchange and interoperability are some of the most vulnerable processes affected by huge data breaches and drug counterfeiting. For instance, as per the Health Research Funding Organization (HRFO), in 2017, nearly 10-30% of drugs in emerging countries were not original, representing a huge market for drug counterfeit. The U.S. healthcare industry, in 2017, bore a loss of about \$200 billion annually, due to counterfeit issues.
- The public segment dominated the market in terms of network type, in 2018.
- Europe held the leading market share by region in 2019, which is attributed to an increase in the incidence of data breaches, supportive government policies, favorable reimbursement schemes, rise in awareness, and increase in number of training programs.

7. REAL-WORLD USE CASES IN HEALTHCARE

Blockchain can help digital health by making it easier to share data securely, with patient consent, across very fragmented healthcare systems [15].

Use cases	Major challenge	Key benefits of blockchain	Companies
Supply chain transparency	ensuring the provenance of medical goods to confirm their authenticity	<ul style="list-style-type: none"> • Customer confidence • Compliance • Supply chain optimisation 	<u>MediLedger</u>
Patient-centric electronic health records	incomplete view of medical histories	<ul style="list-style-type: none"> • View updated medical records • build digital health solutions • medical data exchange • assured integrity of a patient's medical records 	<u>Medicalchain</u>
Smart contracts for insurance and supply chain settlements	automate the policies and services	<ul style="list-style-type: none"> • shared digital contracts • reduce disputes over payment chargeback claims • manage medical insurance contracts for patients 	<u>Chronicle</u> <u>Curisium</u>

Medical staff credential verification	Problem in medical officer's credential verification	<ul style="list-style-type: none"> • track the experience of medical professionals • provide Transparency and reassurance • inform patients about medical staff experience 	<u>ProCredEx</u>
Drug Supply Chain Management(No drug traceability No visibility	<ul style="list-style-type: none"> • transactions are immutable and timestamped. • Drug information stored on blockchain • Pharmacist or patient can verifies origin of product 	pharma supply chain
Clinical Trials and Healthcare Research Improvement	Not accessed by unauthorized	<ul style="list-style-type: none"> • improves structured protocols • easy for researcher because no one changing test parameter at mid trail • more trustworthy results 	Pfizer Clinipace Novo Nordisk

8. CONCLUSION

Blockchain technology presents a study of decentralized network and gives an overview about the great potential use of block chain in healthcare. This study aims to conduct an organized analysis of previous literature about the automation of blockchain in healthcare and to identify the current status of blockchain research and application in healthcare with its advantages and disadvantages. Furthermore, it includes an existing outline of research about real use cases of blockchain in the healthcare sector.

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