

# Blockchain and Distributed Ledger Technology in Health Care

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**Abstract:** *Data today isn't often shared among doctors or patients. Patients themselves have to request copies of their medical histories. So, to ensure that all healthcare participants (e.g., doctors, surgeons, pharmacists, nurses, patients) to have access to the data there is only one way that is using Distributed ledger technology and Blockchain technology in health care. Recently, Estonia which is a part of Europe country is using blockchain to secure its citizen's medical histories. A blockchain is a distributed database or ledger that is shared among the nodes of a computer network. As a database, a blockchain stores information electronically in digital format. A distributed ledger is a database that is consensually shared and synchronized across multiple places and is for maintaining a secure and decentralized record of transactions. It can change medical services by returning ownership over clinical information to the patient. It has a potential to keep whole health care industry in the hands of people. The main benefits of merging or incorporating blockchain in health care is to eradicate Drug Counterfeiting and increase safety of people, quality of medicine and save money. It can bring an overwhelming change in whole healthcare industry.*

**Keywords:** Blockchain

## I. INTRODUCTION

A blockchain is a type of Digital Ledger Technology (DLT) that consists of growing list of records, called blocks, that are securely linked together using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data (generally represented as a Merkle tree, where data nodes are represented by leafs). The timestamp proves that the transaction data existed when the block was created. Since each block contains information about the block previous to it, they effectively form a chain (compare linked list data structure), with each additional block linking to the ones before it. Consequently, blockchain transactions are irreversible in that, once they are recorded, the data in any given block cannot be altered retroactively without altering all subsequent blocks. Distributed ledgers use independent computers (referred to as nodes) to record, share and synchronize transactions in their respective electronic ledgers (instead of keeping data centralized as in a traditional ledger). Blockchain organizes data into blocks, which are chained together in an append only mode. There are different several challenges restraining the mainstream usage of blockchain technology in the healthcare sector. Some of them are Drug counterfeiting, Storage issues. These can be eradicated completely using this blockchain technology and distributed technology. But there are also some major problems or constraints on implementing these blockchain, distributed technology in healthcare industry.

## II. LITERATURE SURVEY

[1] Thakur, A. (2022). A Comprehensive Study of the Trends and Analysis of Distributed Ledger Technology and Blockchain Technology in the Healthcare Industry. *Front. Blockchain* 5: 844834. doi<sup>2</sup>: 10.3389/fbloc

- Incorporation of blockchain along with distributed ledger technology (DLT) owes the potentiality to cater to the interoperability restraints in health IT systems and enables medical researchers, healthcare entities, and healthcare providers to share electronic health data in a secured and well-mannered system.
- Successful implementation of blockchain technology and DLT necessitates efficient infrastructure, connectivity, and other factors.

- This technology is widely used to ensure the availability of patient-related information, enhance patient engagement, combine and coordinate the information from multiple providers, and enable secure communication between the providers and patients.

[2] Jafri, R., & Singh, S. (2022). Blockchain applications for the healthcare sector: Uses beyond Bitcoin. In *Blockchain Applications for Healthcare Informatics* (pp. 71-92). Academic Press.

- Medicine is an inevitable part of our lives, making medical data such as prescriptions, patient medical history, etc., an essential part of treatment.
- The medical database is still prone to tampering or even permanent deletion. Information blocking is another issue that occurs when someone from the outside wants to access data without the permission of the patient or hospital.
- There should be a patient-centric model to give priority to patients. The patient should be aware of data provided to an insurance company, data provided to a blood bank, etc., to provide flexibility.

[3] Mamun, Q. (2022). Blockchain technology in the future of healthcare. *Smart Health*, 23, 100223.

- The overarching vision of Blockchain technology for the future would be to address many problems affecting the Healthcare industry today with the creation of a shared archive of health-related information for physicians and patients independent of their electronic diagnosis, improving safety and secrecy.
- Several potential problems need to be addressed if biomedical and health care systems want to adopt this technology.
- Data is both a powerful resource and a limitation when it comes to the healthcare industry's multi-level ecosystem. Several problems are associated with data management, such as excessive paperwork, lengthy delays, and miscommunication. Blockchain has become the go-to option for data-intensive industries, including healthcare, and it is no more a secret.

[4] Khezr, S., Moniruzzaman, M., Yassine, A., & Benlamri, R. (2019). Blockchain technology in healthcare: A comprehensive review and directions for future research. *Applied sciences*, 9(9), 1736.

- Blockchain technology moves in the direction of persistent revolution and change. It is a chain of blocks that covers information and maintains trust between individuals no matter how far they are.
- The blockchain technology is gaining significant attention from individuals, as well as organizations of nearly all kinds and dimensions. It is capable of transforming the traditional industry with its features, which include decentralization, anonymity, persistency, and auditability.
- Cross-border sharing of health data where different and often conflicting jurisdictions exist may hinder the benefit of blockchain's data sharing. Indeed, the expectation of individual's privacy varies from one country to another based on the government regulations.

[5] Adere, E. M. (2022). Blockchain in healthcare and IoT: A systematic literature review. *Array*, 100139.

- According to the literature, blockchain technology is mostly utilized for data management operations in healthcare and IoT, specifically to improve data security, which includes data integrity, access control, and privacy preservation.
- The most frequently covered area of IoT is a smart city, where blockchain is utilized to improve real-time data sharing, and electricity trading, and so on.
- Facilitates real-time information exchange and improves traffic-related performance in the context of smart transportation applications through a reward system that is demonstrated with designed instantiations.



### III. METHODOLOGY/RECENT TECHNOLOGY

#### 3.1 Methodology 1

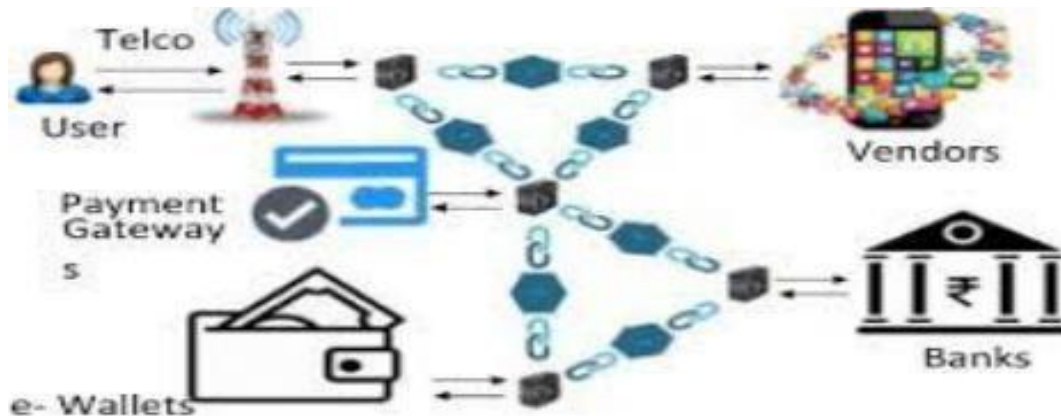
Block chain implementing in Claim management and billing system

- The main cause for implementing this blockchain in Health care to eradicate this claim management and billing system.
- Due to this people who are eligible for claiming several claim policy are not getting benefited
- So, by implementing this blockchain technology in this claim management will definitely give benefit to all the poor people.
- Actually nowadays, for claiming claim policies in hospital for poor people is a very big task for them.

The main problems faced by the people in healthcare is

1. Fake Activities
2. Time consuming
3. Highly priced
4. Patients getting cheated.

So, The best solution for this is to implement blockchain in Claim management and Billing system in the hospitals.

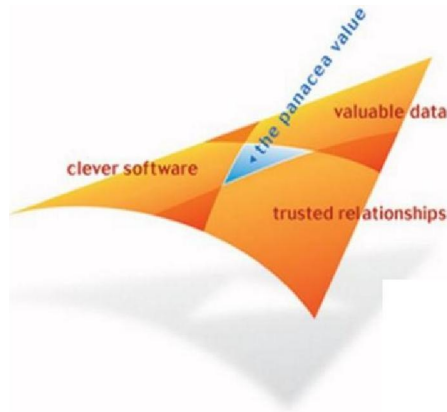


#### 3.2 Methodology 2

Panacea Software in Data Exchange

- The main use of this software is it stores the data in correct format and it will let us exchange in proper way whenever we want.
- Nowadays, Data is increasing rapidly like the population increase. So for that huge data the patients don't even have access to that data.
- This software will help in exchanging data to the patients and ensure their safety and the data can be only shared by taking permission from patients and doctors.
- It will ensure data security and give data recovery and gives us the ability to get data whenever we wanted.
- It will ensure there will be no data breaches and data loses chances and help doctor and patients by securing their data.

Rich data helps you make better choices and manage projects more efficiently: Panacea coordinates the charging rates of multiple suppliers, it helps you schedule your workload and monitor time spent, it keeps track of every purchase made, and it gives a complete audit trail of every stage in every job so any issues can be rapidly resolved.

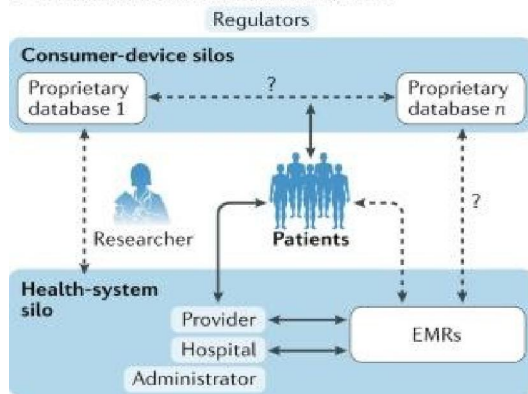


### 3.3 Methodology 3

#### Pharmaceutical Counterfeit Controlling

- A counterfeit drug is a medication or pharmaceutical item which is produced and sold with the intent to deceptively represent its origin, authenticity, or effectiveness.
- A counterfeit drug may contain inappropriate quantities of active ingredients, or none, may be improperly processed within the body (*e.g.*, absorption by the body), may contain ingredients that are not on the label (which may or may not be harmful), or may be supplied with inaccurate or fake packaging and labeling.
- Drug manufacturers and distributors are increasingly investing in countermeasures, such as traceability and authentication technologies, to try to minimise the impact of counterfeit drugs.
- It is biggest International Issue which is a gaint problem nowadays. When implementing the blockchian in healthcare will give traceability. So, we can trace the medicinee from its manufacture to its delivery. Which reduces counterfeiting of drugs.

**a Current situation: centralized servers**



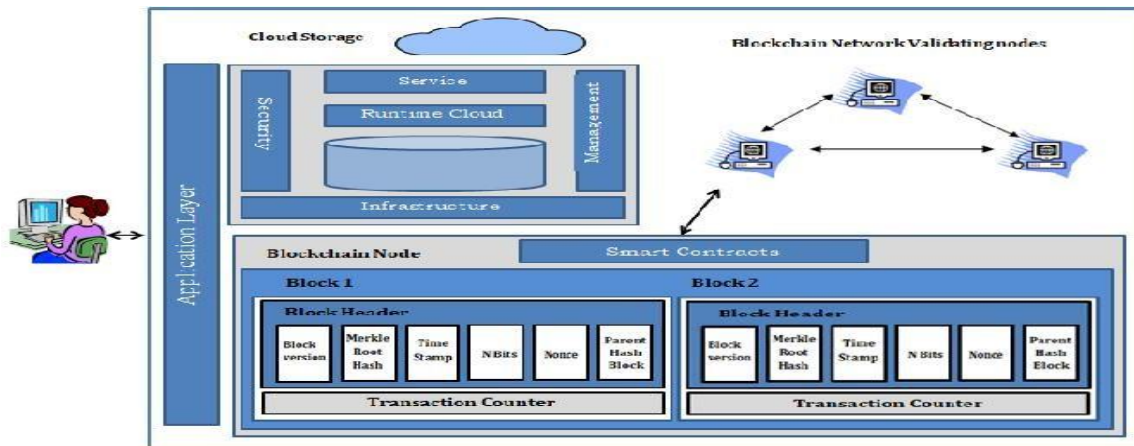
**b Blockchain: data-centric, distributed**



### 3.4 Methodology 4

- Implementing Blockchain in Accessibility of Electronic Health Records
- Implementing blockchain in Accessibility of EHR is to because of securing data in cloud for safety.
- It also increases the speed of data transfer between two parties.
- Sometimes data sharing between the doctors is really important when they came across the some critical situations and new diseases, they have to get know about that new disease and treat that person based on previous medical history.
- By using cloud storage we can reduce the equipment cost and we can get data when ever we want at any time.
- The blockchain integrated within the cloud haas the architecture shown in the below figure.

Anyone can access the data from anywhere in this world which also very easy for the everyone.



**IV. RESULTS AND DISCUSSIONS**

There were lot of uses in implementing the blockchain in Healthcare industry. Nowadays healthcare industry is very polluted and its not that much efficient and there were a lot of problems in this healthcare industry are raised. The major problems of healthcare industry is Drug counterfeiting, Data storing issues, Data Exchanging, Data losses, Claim management and billing system, Clinical and research trails, Accessibility of Electronic Healthcare Record (EHR). These are the giant problems that were faced by the today healthcare industry. If these problems are not sorted then upcoming years will be really terrified and the quality of medical treatment is get ruined. There are some methods for eradicating these problems in this healthcare industry. The best solution is implementing the blockchain in this healthcare industry.

There are several ways to implement this blockchain in this healthcare industry. One of the best way is Digitizing the whole payments of healthcare industry. It will increase quality and transparency and also decrease the malpractices of additional costs and also various fraud activities. Another one is implementing the blockchain technology in medicine manufacturing. This will help storing the data of medicines right from their manufacturing to the delivery to the patients. This will help patients identifying the right medicine and also there will be no chance of counterfeiting of drugs happens. This will also help the manufactures by increasing their profits and also their genuine quality service and most importantly it will save the life of patients. In US, there was nearly a \$400 billion dollar fraud happened due to counterfeiting of the drugs. It's a really international issue. So, by implementing this blockchain in this will definitely helps a lot by giving traceability of medicines.

There were also several use cases of blockchain in Healthcare industry. One of them is PANACEA Software, which is software that is used to keep track of all the medical data in the correct format and efficient sequence. The reason behind implementing this software in healthcare is In olden days i.e before this software, there were a lot of data breaches and system crashes that leads to data loses and its very hard for them to retain the data again. So, then Rachel Wynne founded this software in 2004, It is also called online process management software. There after implementing this software in this healthcare decreased all the data losing chances and increases efficient accessibility of the data and arranged data in the accurate format. Which really helped the doctor in exchanging the data from one place to another. It will also make doctors to help each others at any new disease situation. It will also help doctor to solve new diseases by taking the reference of the old practices. So for this there must be a proper format of data and proper exchanging of data as always.

**V. CONCLUSION**

Different application areas of blockchain technology in the healthcare sector. Application of blockchain is expected to go above the range in the field of economics, with the fact that its potentiality largely depends upon its acceptability in the healthcare system. Blockchain is based on the concept of “append-only” open ledger, according to which every contract occurring within a setup, is added to the ledger, when verified by the connections in the system. This technology is widely used to ensure the availability of patient-related information, enhance patient engagement, combine and coordinate the information from multiple providers, and enable secure communication between the



providers and patients. Transparency in the information structure, distributed nature, and immutable record-keeping features of blockchain enable the businesses to easily minimize the costs and increase the efficiency. Blockchain may not only be the remedy for all the healthcare challenges, but it certainly offers the potentiality to eliminate the mediator and optimize the workflow activities over the forecast period.

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