

Medical Asset in Blockchain

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Abstract: Blockchain though comes into the market as a crypto currency transaction purpose but currently it stores different types of digital asset in immutable, decentralized, transparent way. Medical field also gets benefit from it. In this paper, we have discussed different scope of preserving patient's data and medical details using Blockchain Technology. Also, fifth generation network 5G applications gives the benefit of Blockchain in Healthcare and gives support to preserve data in immutable transparent way. Here we analyses works related to the capturing patient's data using blockchain technology and how it will be helpful for future medical benefits. This proposed model with the help of blockchain technology, can share data very easily and securely for medical consultation.

Keywords: Blockchain, Digital Asset, Medical field, healthcare, 5G, proof-of-work

I. Introduction

Medical field is witnessing a reforming change where huge amount of health data of patients is compiled for treatment and prognosis. Data such as medical report of patients, previous history and such huge amount of information needs to be stored securely in an efficient system. After Covid 19 pandemic, Blockchain technology is regarded as a perfect solution for recording and safeguarding health care data. Blockchain technology has transformed the health care sector by increasing the privacy, security, and interoperability of health related data. Blockchain Technology also provides a novel model by making Electronic Medical Records more efficient and secure. The Health Care industry are generating new data everyday such as medical records, remote monitoring, laboratory test results and many other sources which is often trapped in isolated databases or replaced by the hackers which will lead to life risk of patients[1]. Blockchain overcomes these problems by protecting sensitive data from being hacked and giving patients more control over their information. Hence it is necessary to analyze the Blockchain Technology in Medical Field to make the Healthcare industry safer and secure for everyone.

In this paper we have discussed the basic of Blockchain in section 2, in section 3, we analyze the previous related works, application of 5G in medical field is highlighted in section 4, in section 5 we discuss our proposed work and its future scope and concluded in section 6 with references.

II. Basic of Blockchain:

Blockchain Technology, which is also known as *Distributed Ledger Technology (DLT)*, is a system that is used for storing and preservation of data. The data is stored in such a way that it was unchangeable which makes the data more secure and safe from hacking or from any misuse.

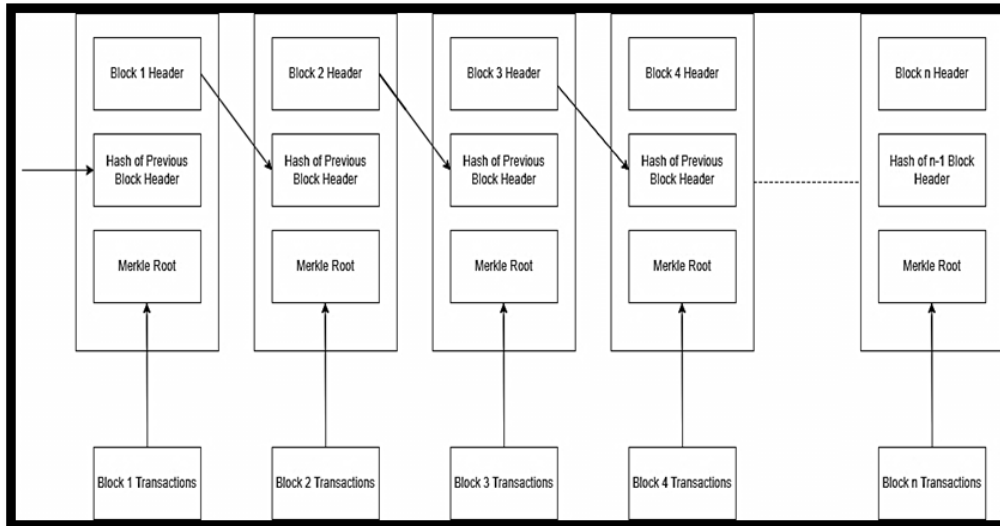


Fig1: Structural workflow of Blockchain Technology

In the figure 1, it is shown that the transaction is made in block following Merkle root principle. Here each block within the blockchain will contain data and hash value of previous node. Thus every leaf node is a hash value of transactional data and non-leaf node is a hash of its previous hash value.

Different types of Blockchain Technology are:

2.1. Public Blockchain:

A public Blockchain is permission less platform where anyone can join, read & update data. It is completely decentralized and all nodes of the Blockchain have equal right for access the data. All nodes can also create new blocks and can validate it with proof-of- work [8].

Examples: Bitcoin, Ethereum are public blockchains.

2.2. Private Blockchain:

A private Blockchain which can also referred as a permissioned or managed blockchain. It is operated in a closed network generally accessible to the people belonging to a single organisation. Here, a central authority of the organisation can grant permission to selective nodes and also with not full rights to perform all function. This ensures security, authorisations and privacy.

Examples: Ripple and Hyperledger, Fabric, Sawtooth, Cords are some of the the private blockchain.

2.3. Consortium Blockchain:

A consortium blockchain is a semi-decentralized type where more than one organization manages a blockchain network. It is just opposite to private blockchain, which is managed by a single organization. More than one organization can act as a node and exchange information or do mining. Consortium blockchain are typically used by banks, government organizations, etc.

2.4. History of Blockchain:

The work for cryptographically secured chain of blocks was started in 1991 by Stuart Haber and W. Scott Stornetta. Their main objective was to implement a tamper-proof document with time stamps system. After that, they together along with Dave Bayer, enhanced its effectiveness by allowing multiple document certificates to be collected in a block that was incorporated using Merkle trees. **Merkle Trees** [11] are used to make a 'secured chain of blocks.' It stored a sequence of data records, and every data records connected to the one before it. The newest record in this chain contains the history of the entire chain. In **2004**, cryptographic activist and scientist **Hal Finney** introduced a system called **Reusable Proof of Work (RPoW)** as a prototype for digital cash. This was a noteworthy step in the history of crypto currencies. The **RPoW** system functioned by receiving a distinct or a non-fungible **Hashcash** based on proof of work token in return. It also creates an **RSA-signed** token that further could be communicated from person to person. By keeping the ownership of tokens registered on a trusted server, **RPoW** solve the double-spending problem. This server was aimed to allow users throughout the world to authenticate its accuracy and reliability in real-time. In 2008, Satoshi Nakamoto invented a new way to achieve social consensus, confirming the truth of all transactions without the involvement of a third party [3]. He improves the proposal in a way to add blocks to the first chain

without signed by the trusted parties. The revised trees now contain a secure history of data exchanges and utilises a *peer – to – peer network* for time stamping and validating each exchange which could be accomplished autonomously without having a central authority [5]. These enhancements were so helpful that makes blockchain as the backbone of crypto currencies. Now a day, this design serves as *public ledger* for all transactions in the crypto currency space.

III. Related Work:

Now-a-days, Blockchain Technology is described as the safest method to preserve something confidential about the Healthcare center. Several studies on the application of blockchain can be seen in the field of medical science [2]. This technology also helps to preserve medical data of patients and can be exchanged whenever required. In addition, the framework of blockchain and its application scenarios, its integration with other technologies in health care is also discussed.

We can use drones for Medical Purposes as well [3]. Such technologies provide us with safety flying, data transmission and personal privacy. Drones enable fast medical service to the patients who suffer from long distance. Applications of Drones in healthcare are broad. They include: Pre-hospital Emergency Care, Expediting Laboratory Diagnostic Testing and so on. Now-a-days, Drones are used to deliver vaccines. They are also used to identify mosquito habitats and drowning victims at beaches.

Another study [4] introduces architecture of a system which ensures the security of private data. This architecture is based on Blockchain Technology and Federated Learning. The proposed model is termed as Model or Internet of Medical Things (IoMT) which connects to healthcare computer systems through computer networks. After collecting data from devices these are transferred through the internet to track or improve the delivery of medical care. This model generally uses Cloud Infrastructure since it allows access to databases for different agents in many geographic areas.

In another paper [6] we can see an application of Blockchain and IoT for (i) Data Traceability (ii) Managing Data Records. Data Traceability is the method of detecting the uniqueness and legitimacy of the product that allows all stakeholders to track and trace the transactions at every phase in the supply chain. IoT or Internet of Things is generally a network of connected objects that contains embedded technology to communicate and interact with the physical environment. IOT devices with sensors not only monitored patients health record but also used for tracking real time location of medical equipment.

Some studies are propagated to investigate the usefulness of blockchain in the medical field in relation to transactions with and propagation of PHRs in a private blockchain [7]. Those studies shows a major applications of blockchain in healthcare such as (i) Data Transparency – Here, Blockchain provides openness to see the actions which are performed by every patient, (ii) Data Security – Cryptography are used in Blockchain transactions which helps in securing data.

IV. Applications of 5G in Medical Field:

5G has several applications in Medical Field which are discussed below:

- **Remote Patient Monitoring:** The use of digital devices to pick up medical and health data from patients and transmit the information to the remote healthcare center is known as Remote Patient Monitoring or remote physiologic monitoring. Weight, Heart rate, blood pressure are the health data which are generally collected by Remote Patient Monitoring or RPM. After collecting, the patient's data are sent to the Healthcare office using a software application which can be installed on a tablet or smart phone. Remote Patient Monitoring also increased engagement of patient and make them engaged enough to understand their health conditions. It also provides information about patient's personal condition every day to the patient [9].
- **Medical Drones:** Medical Drones is an application of 5G in Healthcare which is generally used in monitoring some remote places where Healthcare units are not available. Since, 5G occupies vast area as compared 4G, data can be stored from a large area as compared to 4G. Other use of Drone is that to liver medicines to the patients [9].
- **Huge Data Files:** Everyday Healthcare industry produces huge amount of data. From medical data to images files which are created in PET scans. Here 5G data provides quick transmission of data between doctors and hospitals [8].

V. Proposed Work:

In this paper we have proposed a model of sharing electronic medical data securely with the help of Blockchain technology. It will prevent data lost, alteration or information leakage while sharing ones medical health data. In fig 2, we have explained the process of sharing the medical records among health care provider (doctors) and the patients. To ensure security at first all members both doctor and patient have to register themselves for authorization. After authentication completed, in STEP 1 and 2 the user submits the medical

records after data masking [10]. Here we have use generalization process, occlusion and generalization process to secured the submitted data. Nowadays medical records are of various forms which take lot of storage space specially the medical imaging file may lead to block expansion problem.

For these reason in STEP 3 & 4, we are using Interplanetary File System (IPFS) format to upload the medical data which will return a hash value of current uploaded file. This will ensure security of the uploaded file and will also save storage space in Blockchain. In STEP 5, we use Merkle root technique [10] to verify the data blocks passed are undamaged and unaltered. Now in STEP 6, blocks are included in Blockchain by POW after verification with our proposed consensus algorithm. At last at STEP 7, it is shown that the data can be fetched from the Blockchain according to the query of the user.

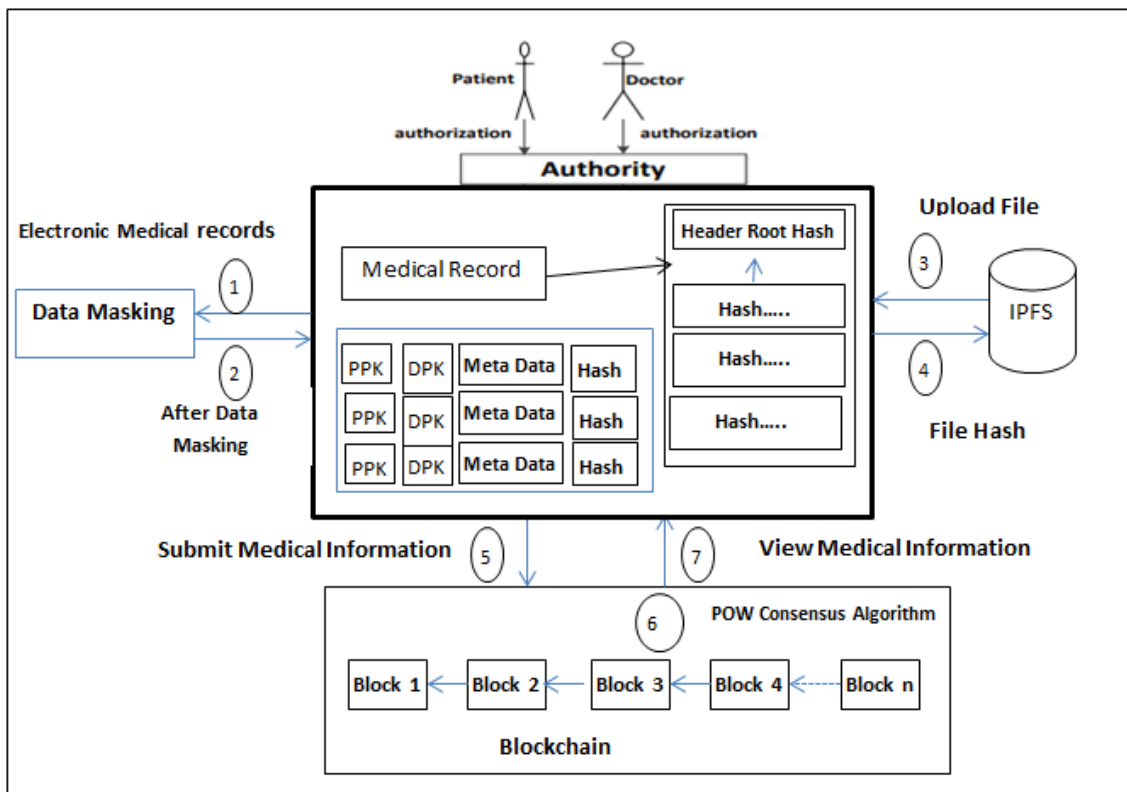


Fig 2: Workflow of our proposed system of keeping Medical record using Blockchain

By nature Blockchain technology is transparent and immutable and by using these features, it becomes too useful roles mainly in medical government institutions or other large medical sectors. It is responsible for checking and storing huge medical records in block format in blockchain. This design helps to avoid data mislead and also guide the safe and stable operation of the consensus algorithm through the credibility of top medical institutions and government hospitals.

The detailed process of the consensus algorithm is as follows:

Patient Data Collecting Algorithm

START

STEP 1: The patient or doctor submits the patient id /details as public key for searching available patient’s medical record.

STEP 2: A set of block act as authorizing boards accept the request if checked correct.

STEP 3: The authorizing board node then broadcast the message for receiving a request in the block.

STEP 4: The current node adds the record to the transaction based on the patient records in public key and simultaneously broadcasts the transaction.

STEP 5: The Monitoring node checks the records and the other nodes update the data according to the broadcast message.

STEP 6: Check the number of transactions in the block every 1 minute, reach the agreed quantity to form a data block, and calculate the Merkle root of the data block.

STEP 7: After reaching the appointed time (e.g, 10 minutes for bitcoin) anchor the Merkle root of all newly

generated blocks to the blockchain.
STEP8: Return to step1.
STOP

VI. Conclusion

In this paper a model for sharing medical records based on blockchain technology is proposed. This method can provide an efficient safe solution for exchanging medical information which is very private data for a patient. Stored data cannot be easily tampered or lost in the process of sharing as we are using blockchain technology and also save the valuable storage resources on the blockchain. In this way by using blockchain technology we can able to store a large number of patient data in such a way which nobody can damage or misuse. Field of Blockchain technology is still developing for preserving and sharing of data more securely. So as a future scope we will try to increase the security of data exchange by including smart contract with encrypted data to prevent data leakage.

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