

# Block Chain and its Application in Electronic Health Records

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**Abstract:** In last few years, blockchain technology has gained popularity and found its usage in different fields and solved many critical problems of these domains. In domain of healthcare blockchain technology has huge potential, because of the requirement of an efficient patient centric approach towards healthcare systems and increases the accuracy potential of electronic healthcare records (EHRs). With Patient-centred approach we have to face different challenges and requirements around privacy as well as security, use of technology, governing process must be taken in consideration for such type of data sharing in order to generate a good outcome. Blockchain technology makes this transition possible through five processes: patient identity, digital access rules, data liquidity, data immutability and data aggregation. A lot of problems are faced in blockchain enabled electronic health records i.e. in terms of managing data that is huge, privacy and security of the data. Patient-controlled interoperability is a new trend in healthcare, understanding these challenges it remains to be identified as a challenge to know if blockchain can make it possible to change the transition from institution-centric to patient-centric in terms of data sharing.

**Keywords:** Block chain, Data Privacy, Electronic Health Records, Patient-Centric.

## 1. Introduction

As we already know, not much work has been done in the healthcare field in regards with block chain. The EHR's provide access to the health records of different patients, and helps in storing the records. There are various security issues related to the storage of the data, if it is the records or some other data. In healthcare how are we storing data is very important. Data related to health is very delicate and they are also easy target for cyber-attacks. Hence it is essential to secure all sensitive data. Another feature is authority over data that will be managed by the patient. Some of the problems faced are integrity of the data, confidentiality etc. These problems can be handled using the new technology blockchain, Blockchain is powerful against attacks and less prone to failures, and access control is managed by various methods along with privacy. Blockchain technology is immutable by design and provides the tamperproof storage of the data. The security flaws of the EHR's are removed using blockchain technology. Blockchain provides a very good structure for healthcare related data and other services associated with it. Electronic Health Records (EHRs) are

completely managed by hospitals instead of patients, which make it difficult seeking medical advices from different hospitals. Patients have to come across a lot of difficulties in managing their healthcare records and to restore their medical data. With the advancements in blockchain technology and its usage in healthcare department has led to patient records and their medical data immutable, secure and made access to EHR's free of cost from websites and treatment providers.

## 2. Theory in brief

- **Blockchain Technology:** Blockchain is a system of records to transact value (not just money) in a peer-to-peer fashion. it means is that there is no need for a trusted intermediary such as banks, brokers, or other escrow services to serve as a trusted third party. Blockchain is not just a piece of technology, but a combination of, game theory, cryptography, and computer science engineering.
- **Cryptography:** It is the most important component of blockchain. The idea is to encrypt the plaintext using an encryption algorithm and a key that produces the cipher text. The cipher text can then be transmitted to the intended recipient, who decrypts it using the decryption algorithm and the key to get the plaintext. Cryptographic Hash Functions: Hash functions are the mathematical functions that are the most important cryptographic primitives and are an integral part of blockchain data structure. They are widely used in many cryptographic protocols, information security applications such as Digital Signatures and message authentication codes (MACs).
- **Game Theory:** Game theory is a theory on games. Most are situations where two or more parties are involved with some strategic behaviour. A "game" can be defined as a situation involving a "correlated rational choice. "Game theory is a study of strategies involved in complex games. It is the art of making the best move, or opting for a best strategy in a given situation based on the objective. It is the method of modelling real-life situations in the form of a game and analysing what the best strategy or move of a person or an entity could be in a given situation for a desired

outcome.

- *Computer Science Engineering*: computer science binds together cryptography and game theory. It binds pieces of data structure and peer-to-peer network communication technique.

A. Application of blockchain in EHR's

Blockchain technology is a distributed ledger technology, peer to peer network which is used to store records of agreement, sales etc. Its advantages are decentralized maintenance, block-then-chain structure for data saving; secure transportation, tamper-proof and proper data security. With all the above mentioned features in a EHRs system, blockchain allows the management of authenticity, confidentiality, accountability and data sharing and also maintaining privacy, medical resource saving and building a smarter healthcare system. Let's assume EHRs system to be stored on a cloud platform and the information about patient's health care, insurance details, pharmaceutical details could all be stored in a single block that would make it easier for any of the departments to access the details and provide required services to that individual. When the patient goes for treatment in any other hospital or medical clinic, all it needs to do is check its availability on blockchain and go for its authentication, once that is done doctors can carry out their work and store it on the blockchain. Any details related to his health like his medication details, his drug allergies etc. would be known beforehand making his treatment and diagnose easier for the respective doctor. Doing this saves a lot of work for the doctor as well as the patient needs not to carry a lot of documents.

Disadvantage of Existing System:

- Patient do not have control over their EHR's, they are totally managed by hospitals
- Between service providers, hospitals, research we have Interoperability challenges
- Less security

Lot of work has been done in this field to overcome these drawbacks. By taking in account the blockchain technology and the health department.

collaboration with blockchain are described below. Electronic Health Records are a secure and convenient way of managing the patient's resources and data. In current system only doctors have access to patient's data but because of EHRs patients can have access to their own data and they can decide which data they want to share by using multiple attribute signature scheme.[1] Designing an efficient key management scheme for protecting psychological data as in health blockchain there is a problem of monopoly of psychological data and there is a huge need to improve the robustness of data. [2]. Collaboration of EHRs and physicians has led to an effective healthcare system that is more secure, safe to use by patients and has almost all the solutions to patient related problems. [3]. Healthcare architecture that includes BSN smartphones (sensor data provider) and has a patient centric approach, patient centric and has blockchain and healthcare provided interface that continuously monitors the condition of patients and sends updates to the concerned hospital or doctor so that incase of any emergency first aid would be provided by doctors by adjusting the working of machines by hospital itself. Block chain provides that the message passed is tamperproof, available always and avoids single point of failure [4]. We know that blockchains are open and the data in them is public, so the security of the data lies in the key, we need to decide a key management scheme for enhancing the security of our data and making it tamper resistant. For this we are designing a lightweight backup system and a key recovery system using a BSN for designing the required design. [5] Metric data is generated for calculating dyslexia in children. With mobile multimedia, IoT and auto grading algorithms combined together we design a system which lets us know about the percentage of dyslexia in a patient and can be shared over the globe by mobile medical practitioners. [6] Using smart contracts and access control mechanism to know about the data and annul the access to data in case of any violation of data. A model is designed in order to share data by using blockchain between cloud service providers.[7] By accessing the electronic health records doctors, physicians and nurses save a lot of time that was otherwise lost in documentation and going through all the previous medical history of the patient. It also led to cost reduction, less paper work and generation of an effective electronic health record system [8] Blockchain is used in building smart contracts, to develop a processes that allows to interact in a trust less and auditable manner. The contacts made are cryptographically verifiable and cannot be modified hence ensure that both the parties abide by the norms of the contract. [9] In a beekeeper system, Homomorphic computations can be done on a data without learning anything from them. Its fault tolerant as its protocol works effectively until threshold numbers of servers are honest and active [10]. Blockchain is used to provide a wider platform to the students, as they can access all the platforms regarding their studied based on their credits. It provides a decentralized as well as globally trusted platform for students [11].

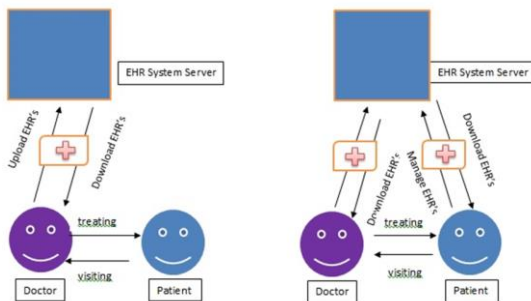


Fig. 1. EHR System

3. Literature review

Various health related fields in which we have seen a

#### 4. Results

Blockchain as a technology is continuously growing and is has been applied in various fields where it has shown tremendous results. In field of health it has been of great use, since transfer of data is done on a blockchain so we need to address the security of data and maintain privacy of patient's records. Blockchain provides with data authentication, security, integrity and confidentiality all these features can further be extracted to make electronic health records more secure, easy to use and save time of doctors as well as patients. The document is a template for Microsoft *Word* versions 6.0 or later.

#### 5. Conclusion

EHR'S in collaboration with blockchain provides following features: accurate, up-to-date, and complete information about patients at the point of care , Enabling quick access to patient records for more coordinated, efficient care, Securely sharing electronic information with patients and other clinicians, Helping providers more effectively diagnose patients, reduce medical errors, and provide safer care, Improving patient and provider interaction and communication, as well as health care convenience.

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