BLOCKCHAIN FRAMEWORK FOR MEDICAL HEALTHCARE RECORDS

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Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 20 April 2021

Abstract: Electronic health records (EHR) are the digital version of a patient's medical paper chart. EHRs are patient-centered records that make information available instantly and these are secure and can be accessed only by authorized users. A patient stricken by a heavy medical condition needs to maintain the long history of the treatment method and post-treatment rehabilitation. Storing and sharing knowledge between multiple entities and maintaining access solely complicate the method of a patient's treatment. This paper introduces a record storage system by implementing blockchain technology to store the data that helps to realize integrity and security. By incorporating medical records in a blockchain, genuineness and rigidity of records will be typically maintained; that put together helps to remain the data safe from third parties. Our system presents ways in which the authority can maintain the medical records with efficiency. Authorities like hospital management and patients can be authorized to add and access the information within the medical records.

Keywords: Electronic Health Records, Integrity, Security, Blockchain Technology, Smart Contract.

1. Introduction

Blockchain technology is decentralized, distributed ledger technology that records the history of a digital asset such that any involved record cannot be altered without the alteration of subsequent blocks. When we tend to produce a document and share it with a gaggle of individuals, the document is distributed rather than derived or transferred. This creates a redistributed distribution chain that offers everybody access to the document at constant time. Each blockchain contain data, hash value and the previous hash value. The present hash value is linked with the previous hash value. This gives everyone access to the document at the same time. This records transaction between two parties efficiently and in verifiable and permanent method. This is permitting any two willing parties to interact directly with one another while not the necessity for a trusty third party. Block chain is more complicated than a google document. A new block is created when a new transaction is sent by a user on to the block chain network. These blocks are distributed to all the nodes in the network. Each node in the network have a copy of complete block chain, this is used for verification process. If verification is success then it adds the block into the blockchain.

An Electronic Health Record (EHR) could be a digital version of a patient's paper chart. EHR are defined as key to increasing of quality care. EHR systems are designed to store data precisely and to capture the state of patient across time. It eliminates the need to track down a patient's previous paper medical records and assists in ensuring data is accurate and legible. EHRs build information accessible instantly and firmly to approved users. Electronic medical records increases the ease with which they can be accessed by healthcare professionals, but can also increase the amount of stolen information by unauthorized persons or unscrupulous users. EHR will contain the medical and treatment histories of patients, associate EHR system is made to travel on the far side customary clinical knowledge collected in a vary provider's workplace and may be comprehensive of a broader read of a patient's care. It contains a patient's history, diagnoses, medications, treatment plans, immunization dates, allergies, radiology pictures, and laboratory and takes a look at results. Also allow access to evidence-based tools that suppliers will use to create choices a couple of patient's care.

2 Related Work

The author [1] describes concerning work knowledge entries in an exceedingly redistributed manner. This new technology has been urged to disrupt a good vary of data-driven domains, as well as the health domain. It does not decentralize critical information.

The author [2] summarizes the proof on the ways and frameworks used to implement block chains for patient knowledge in health care to confirm privacy and improve ability and quantifiability. It is anticipated this review can assist within the development of recommendations that may assist key stakeholders in health care block chain implementation, and facilitating deciding of patients, health care suppliers, and researchers. The wide scale deployment of block chain technology in supply chain is still out of reach for many.

The author [3] describes about concerning reworking the attention system; through its redistributed principles, block chain will improve accessibility and security of patient data, and can so overturn the attention hierarchy

and build a replacement system within which patients manage their own care. The information cannot be changed due to formation of a block within the chain.

The author [4] describes concerning timely sharing of electronic health records across suppliers, whereas making certain knowledge security and privacy, is crucial for prompt care of patients, as well as for the event of medical analysis and also the improvement of customized medication. Yet, it's not trivial to attain economical consent management, knowledge exchange, and access-control policy social control, especially, in redistributed settings, and given the gravity of many medical conditions. In this the system operates in very limited integration.

The author [5] describes concerning importance to beat ability and security challenges of the EHR and EMR systems in eHealth. the most objective of this work is to point out a review of the prevailing analysis works within the literature, relating the new block chain technology applied in e-health and exposing the potential analysis lines and trends within which this technology. To provide Information to Technology and Intelligent Systems. The technology cannot be accepted by organizations.

3 Objective

The main objective of this paper is to design a framework to avoid duplications by providing longitudinal patient health care records and master patient indices to make EHR interoperability and data storage a reliable process by the usage of sophisticated API's.

4 Project Description

Existing System

From the start the health care systems are using manual and computerized, for storing and retrieving information which has been easier. There has been no security of that information. The current state of health care records is disjointed. Health care suppliers track and update a patient's common clinical information and medical service at any time is provided. The data includes common place information, like the patient's gender and date of birth, address, family details. Moreover the medical information of the patient will not be stored accurately.

Proposed System

We are proposing a method which saves all the records, the documents are safe within the digitalized type in Block chain where you can't manipulate the records. A framework for administering and EMR sharing information for cancer patient care. In collaboration with a Hospital, a framework is enforced during a paradigm that ensures privacy, security, availableness, and fine-grained access management over EMR information.

The proposed work will considerably cut back the turnaround for EMR sharing, improve deciding for treatment, and cut back the value. This provides a novel chance to design and implement a secure, trustable EMR information management and sharing system victimization using blockchain. Blockchain Technology can embody application to verify a patient's digital identity, or prescriptions history and provides patients complete possession of their medical records, permitting them to grant and revoke supplier access to their information by use of their personal keys with suppliers successively having the ability to issue prescriptions on the block chain.

Advantages of Proposed System

No human error
Data accuracy
Decentralized
Reliable

5 System Architecture

The Fig. [1], shows the components of our system nodes to integrate with existing EMR infrastructure. We assume that many nodes, and in particular care providers, already trustfully manage data-bases with patient data stored on servers with network connectivity. Our design introduces three software components: Ethereum Client, Database Gatekeeper and EMR Manager.

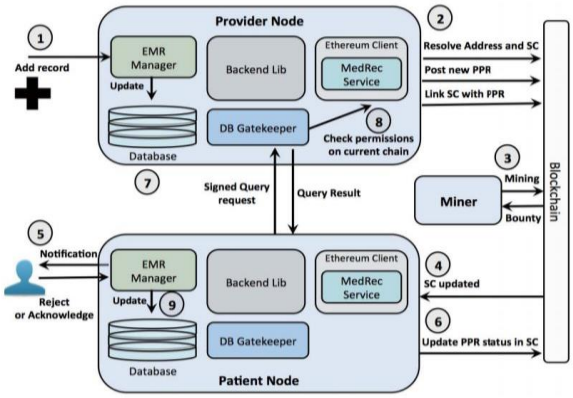

Figure 1. Architecture diagram of EMR

Steps 1 and 2 in the Fig. [1] illustrates the backend implementation of a scenario where a provider adds a record for a new patient.

Steps 4 to 6 in the Figure1 continue the utilization case delineate above from the patient node perspective. The patient's modified Ethereum shopper ceaselessly monitors her SC. Once a new block is strip-mined with the recently connected PPR, the client issues a proof which ends up during a user notification. The user can then acknowledge or decline her communication with the supplier, change the good Contract consequently.

Steps 7 to 9 in the Fig. [1] illustrate how a patient retrieves personal data from the provider node. Note that our components similarly support third parties retrieving patient shared data: the patient selects data to share and updates the corresponding PPR with the third party address and query string. If necessary, the patient's node will resolve the third party address victimisation the Registrar Contract on the block chain. Then, the patient node links their existing PPR with the care supplier to the third-party's outline Contract. The third party is mechanically notified of latest permissions and can follow the link to find all data required for retrieval. The three nodes which are present in the architecture i.e, the provider node, the miner node and the patient node are detailed below.

Provider Node: The provider is responsible for adding records into the database. This node consists of an EMR manager who updates the records. The DB gatekeeper checks permissions on the current chain.

Miner Node: This node plays a major role in the entire system. Mining is the mechanism where it allows the block chain to be decentralized. It secures the entire system and also it enables a system without any central authority. The role of a miner is to validate new transactions and then record them on the global ledger i.e, the block chain if everything is accurate. On an average it is said that a block is mined for every 10 minutes.

Patient Node: In this node on can only able to view the data. With this technology, patients can be able to connect to other hospitals and can collect their medical data automatically. The patient node links their existing PPR with the care supplier to the third-party's outline Contract. The third party is mechanically notified of latest permissions, and can follow the link to find all data required for retrieval.

6 Design Phase

Data Flow Diagram

A data flow diagram is generally used to represent the flow of data. The below diagram shows how the data is carried into a block.

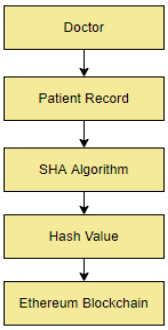

Figure 2. Data flow diagram

Fig. [2], The doctor makes note of all the patient's data and then validates it again because once the data is entered the block it cannot be changed, so validation is the most important aspect. Once the doctor finds the data accurate then by generating a hash value by the usage of SHA algorithm the data is entered the block.

Use Case Diagram

A use case diagram is used to represent how the user is going to interact with the system, how many users are involved in the process and their functionalities.

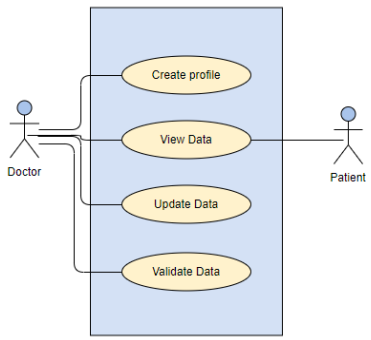

Figure 3. Use case diagram

The Fig. [3] describes about the relationship between the doctor and the patient. The patient will be able to view his/her own data where as the doctor collects the data of the patient, validates it and then updates the data. Finally we can say that this pictorial representation provides a high level view of the system.

Sequential Diagram

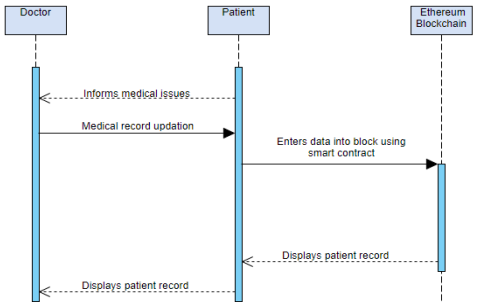

Figure 4. Sequence diagram

Sequence Diagrams are those diagrams that detail how the operations are carried out in the system. They capture the interaction between objects that are present in the system of a collaboration. The Fig. [4], shows the order of the interaction visually by using the vertical axis of the diagram to represent time, what data is sent and when.

7 Module Description

Ethereum Platform

In this module we are going to use ethereum platform which is an open-source, block chain-based, decentralized software platform used for its own crypto-currency which is known as ether is shown in Fig. [5]. It enables Smart Contracts that are to be built and run without any downtime, fraud, control, or interference from a third party.

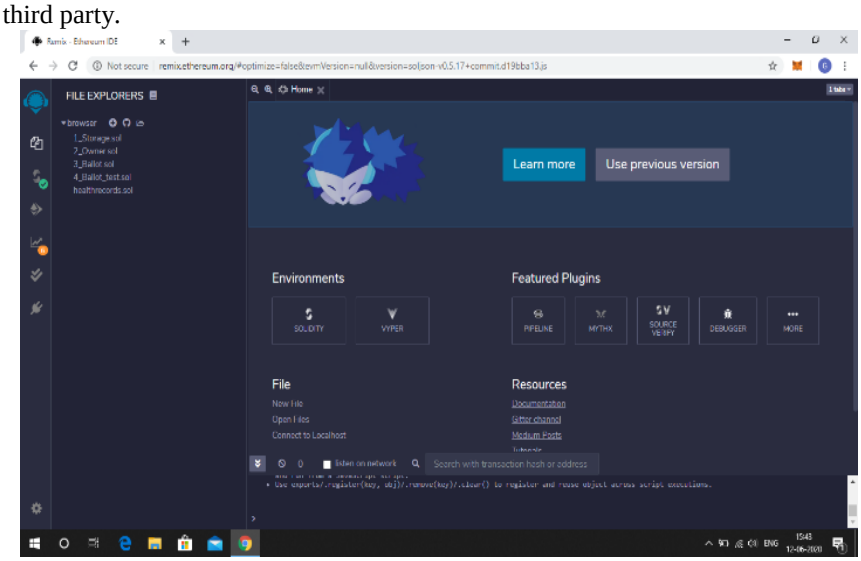

Figure 5. Ethereum platform

Solidity Programming

After getting into the ethereum platform we have to write solidity programming which is an object-oriented, high-level language for implementing smart contracts. Solidity programming was influenced by C++, Python and JavaScript and is designed to target the Ethereum Virtual Machine (EVM).

Smart Contract

For making a smart contract is shown in Fig. [6], we need to add a extension named meta mask to our browser, this meta mask acts as a crypto wallet which consists of ether for making transactions for contract deployment so that we get a confirmation of blocks in which we can store the data and for generating hash value Secure Hash Algorithm (SHA 256) is used.

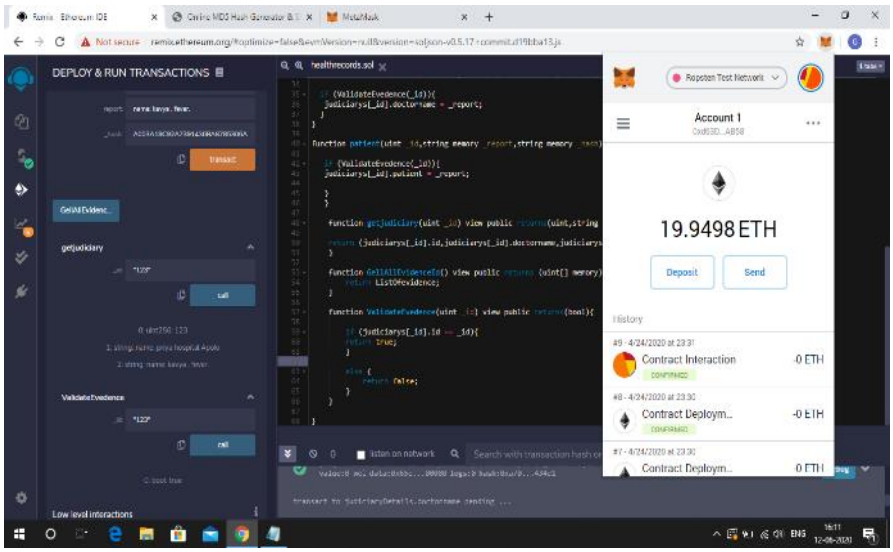

Figure 6. Smart contract

8 Implementation

Smart contracts are applications that run on the Ethereum Virtual Machine. This also includes Solidity Programming which is an object oriented programming language for writing smart contracts on various block chain platforms. The authentication phase which includes system setup, key exchange, and authentication and key agreement, System setup involves generating parameters necessary to compute the shared key for system. The Authentication and key agreement describes the creation of the shared key for the user and issuer along with symmetric key. The shared key computed by the user and issuer is used to encrypt and decrypt information pertaining to account registration and verification. The issuer sends an encrypted form which requires pre-set regulation and user details pertaining to the group concatenated with a proof of verification. Proof of Verification (PV) defines the validity of the response for the encrypted form containing details of user.

Input Design

In this module the main aim is to allow the doctor to make a record patient's data and cross verify the data with patient so that there will not be any fake information is shown in Fig. [7]. Once the patient approves the doctor is supposed to enter the data.

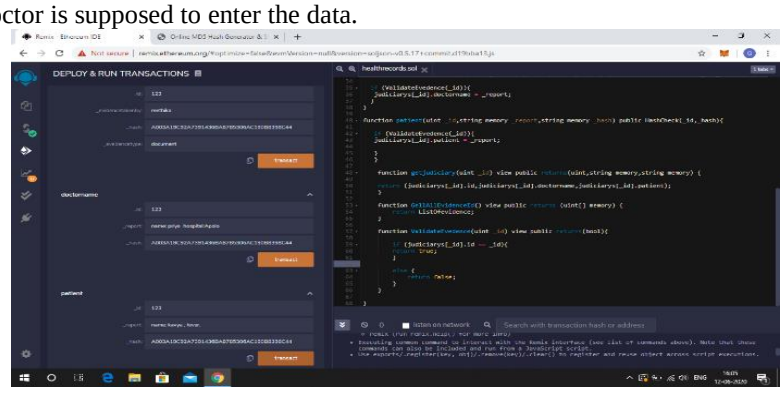

Figure 7. Capturing patient's data

Output Design

In this module patient will be able to only view the data where as the doctor will be able to update the data. After making a successful transaction we will be provided with details of the block which can be viewed on the ethers can website is shown in Fig. [8].

Figure 8. Transaction details

9 Results and Discussions

Efficiency of Proposed System

A blockchain powered health information exchange may unlock actuality price of ability. Blockchain-based systems have the potential to scale back or eliminate the friction and prices of current intermediaries. The promise of blockchain has widespread implications for stakeholders within the health care system. Capitalizing on this technology has the potential to attach fragmented systems to come up with insights and to higher assess the worth of care. Within the future, a nationwide blockchain network for electronic medical records might improve efficiencies and support higher health outcomes for patients.

Comparison of Existing and Proposed System

In the existing system from the beginning of computerized Healthcare records, though storing and retrieving data has been easier, there has been no security of that data. The current state of health care records is disjointed and stovepipe due to a lack of common architectures and standards that would allow the safe transfer of sensitive information among stakeholders in the system. Whereas the proposed system is to build a decentralized application using blockchain technologies for healthcare records. Blockchain Technology will include application to verify a patient's digital identity, or prescriptions history and gives patients complete ownership of their medical records, allowing them to grant and revoke provider access to their data by use of their private keys with providers in turn being able to issue prescriptions on the blockchain. Data put away on the blockchain could be all around accessible to a particular individual through the blockchain private key components, empowering patients to impart their data to healthcare organizations considerably more flawlessly.

10 Conclusion

This paper provides an innovative approach for handling medical records, providing interoperability, auditability and accessibility via a comprehensive log. Designed for record granularity and flexibility, blockchain framework for medical healthcare record enables patient data sharing and incentives for medical researchers to sustain the system. Medical information management could be a noteworthy flattering position of blockchain innovation.

11 Future Enhancement

The future it will be enhanced with additional features like clinical data and medical policy claim to increase the security and avoid malpractice. Moreover, doctors won't have to be compelled to worry concerning the patient giving them an honest medical record, reducing any probable medical record errors.

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