Enhancing the Safety Aspect of the Patients and Increasing Information Access Block Chain Method

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Abstract— Block chain has been an interesting area of research for a long time, and the benefits it offers have been used by many different industries. Likewise, the healthcare industry will benefit greatly from block chain technology due to security, privacy, confidentiality, and decentralization. However, electronic health record (EHR) systems face issues with data security, integrity and management. In this article, we discuss how block chain technology can be used to transform EHR systems and may be a solution to these problems. We propose a framework that can be used to implement block chain technology in EHR healthcare. The purpose of our proposed framework is firstly to implement block chain technology for EHRs and secondly to provide secure storage of electronic records by defining fine-grained access rules for users of the proposed framework. Moreover, this framework also Discuss the scalability issues typically faced by block chain technology through the use of off-chain storage of records. This framework provides the benefits of a scalable, secure and complete block chain-based solution for EHR systems.

Keywords: Block Chain Method, Electronic Health Record (EHR)

I. INTRODUCTION

Recently emerging technologies are impacting every aspect of human life and are changing the way we used and perceive things before. Just as technology has brought about changes in every other area of life, it is also finding new ways to improve healthcare. The main benefit of technological advancement is to improve safety, user experience and other aspects in the healthcare sector. Electronic health record (EHR) and electronic medical record (EMR) systems provide these benefits. However, they still face some issues regarding the security of medical records, user ownership of data, data integrity, etc. The solution to these problems could be the use of a new technology; Blockchain. This technology offers to provide a secure, a tantrum-proof platform for storing medical records and other healthcare-related information.

Before the advent of modern technology, the healthcare sector used a paper-based system to store medical records, i.e. using a handwritten mechanism. This paper-based medical record system is inefficient, insecure, disorganized and impatient. It also faces issues of data duplication and redundancy, as all the institutions the patient visits have different copies of the patient's medical records.

The healthcare industry is facing a shift towards EHR systems designed to combine paper and electronic medical records (EMRs). These systems are used to store clinical records and laboratory results in their various components. They are proposed to enhance patient safety by preventing errors and increasing access to information. The goal of an EHR system is to solve the problems faced by paper medical records and provide an effective system to change the state of the healthcare industry. Since the EHR system has been implemented in many hospitals around the world benefits it mainly to improve safety and its cost-effectiveness. They are considered an important part of the healthcare sector as it provides a lot of functions for healthcare. These functions are electronic storage of medical records, patient appointment management, billing and accounts, and laboratory testing. They can be used in many EHR systems used in the healthcare sector.

II. EXISTING SYSTEM:

It is a way of exchanging information between different information systems. Information should be exchangeable and must be available for further purposes. An important aspect of an EHR system is its health information exchange (HIE) or general data sharing aspect.

As many EHR systems are deployed across hospitals, they have varying levels of terminology, technology, and functional capabilities, making it impossible to have a universally defined standard. Also, at a technical level, the medical records being exchanged should be interpretable and the information from that interpretation can be used further.

III. DISADVANTAGE:

Information should be exchangeable and must be available for further purposes. An important aspect of an EHR system is its health information exchange (HIE) or general data sharing aspect.

As many EHR systems are deployed across hospitals, they have varying levels of terminology, technology, and functional capabilities, making it impossible to have a universally defined standard.

If a patient wants to access his medical records, he will have to follow a long and tedious process to access them. Information is centralized to a single healthcare organization, and control is provided only to the hospital or organization.

These benefits make storing patient medical records on it a logical choice, as technological innovations in the healthcare industry have made the security of patient medical data a priority. Many researchers also found that the use of block chain technology in healthcare would be a viable solution,

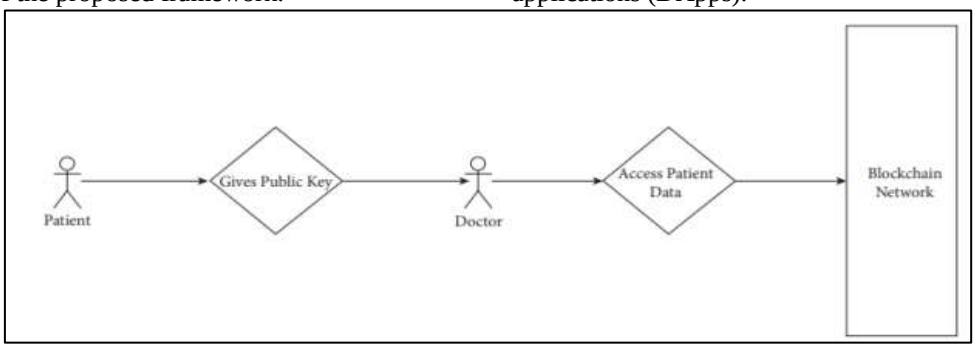
IV. PROPOSED SYSTEM:

As mentioned earlier, they offer certain solutions to common problems in block chain technology. The research discussed mainly addresses scalability and data sharing issues via block chain.

They came up with a solution using the underlying database, involving some ONC requirements and any other

defined standards to solve these problems. In contrast to these solutions, our proposed framework addresses this scalability issue by using IPFS's off-chain scaling mechanism. Furthermore, Ethereum is used for the overall implementation of the proposed framework.

The main advantages offered by the Ethereum platform include programmable blockchains. It offers users the option to create their own applications on Ethereum. Applications built using this platform are called distributed applications (DApps).



They contain many protocols that are packaged together to create a platform for DApps. These DApps contain smart contracts that contain user-defined code to perform certain defined tasks of the application. The code is deployed and executed using the Ethereum Virtual Machine (EVM). Therefore, applications created using smart contracts actually run on the EVM.

V. ADVANTAGE:

Eventually, this blockchain idea was used in various other areas of life. The healthcare sector is also one of them intending to use it. A number of researchers have already done research in this area, and these research efforts have focused on whether the idea of using blockchain in healthcare is feasible. They also identified advantages, threats, issues or challenges associated with using the technology.

Additionally, the framework discusses the scalability issues that blockchain technology typically faces through the use of off-chain storage of records. The framework provides EHR systems withbenefits of having a Scalable, secure and complete block chain-based solution.

The healthcare industry is facing a shift towards EHR systems designed to combine paper and electronic medical records (EMRs). These systems are used to store clinical records and laboratory results in their various components.

VI. MODULE DESCRIPTION:

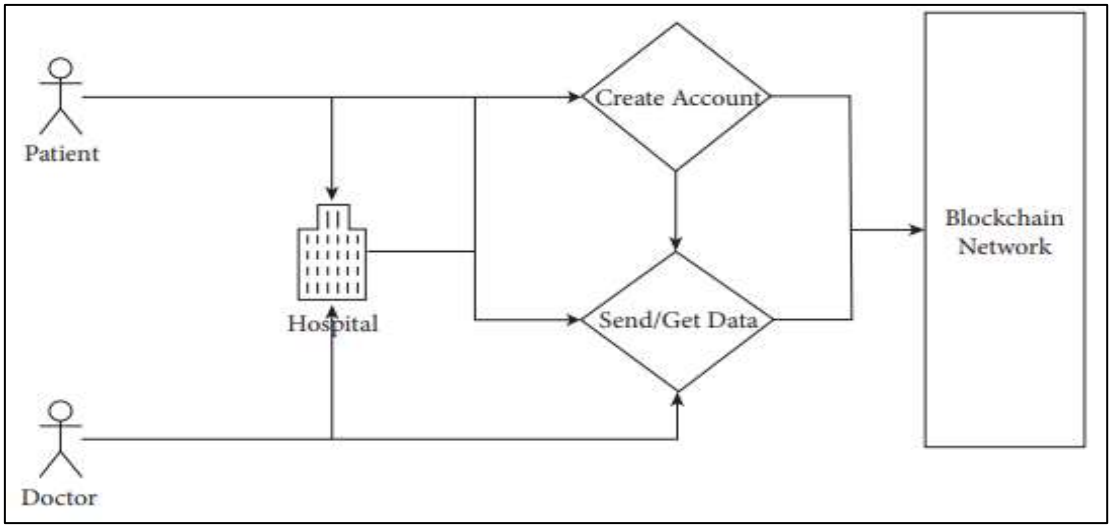
A. Health Records

This part includes modules, architecture, and various elements that combine to form the framework of the overall system. As mentioned, the purpose behind this proposed framework is to create such a decentralized system that is a riot-proof, secure and confidential system of blockchain-based electronic health records.

Blockchain technology can be used in healthcare and how it can be used for electronic health records. Despite the advancements and technological innovations in the EHR system in the healthcare sector, they still face some of the problems that this new technology (i.e. blockchain) solves. we propose framework is a Secure record storage combined with fine-grained access rules for these records.

B. Electronic Health Records

An electronic health record (EHR) is an electronic version of a patient's medical history that is maintained by a provider over time and may include all key administrative clinical data related to the person's care under a particular provider, including demographics, progress notes, Questions, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports.



EHRs automate access to information and have the potential to streamline clinician workflows. EHRs are also able to directly or indirectly support other care-related activities through a variety of interfaces, including evidence-based decision support, quality management, and outcomes reporting.

C. Decentralization

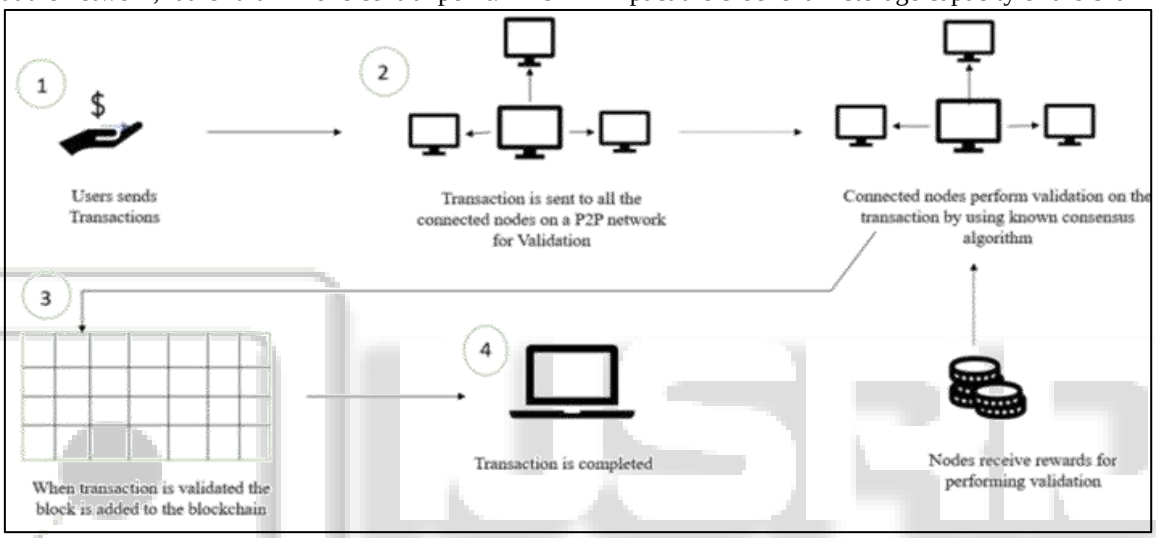
Likewise, the healthcare industry will benefit greatly from blockchain technology due to security, privacy, confidentiality, and decentralization. However, electronic health record (EHR) systems face issues with data security, integrity and management. In this article, we discuss how blockchain technology can be used to transform EHR systems and may be a solution to these problems.

With blockchain, information is distributed throughout the network, rather than in one central point. This also enables control of information to be distributed and processed through consensus from shared inputs from connected nodes on the network. Data that was previously centralized in one central point is now handled by many trusted entities.

D. Scalability

Storing data on the blockchain causes two major problems, confidentiality and scalability. The data on the blockchain is visible to everyone present on the chain, which makes the data vulnerable to attacks is not aExpected results for decentralized platforms.

The data stored on the blockchain will contain patient histories, records, lab results, X-ray reports, MRI results and many other reports, all of these massive amounts of data will be stored on the blockchain which will greatly impact the blockchain storage capacity of the chain



validity check, the physician can add the patient's record and then end the function by saving that record.

VII. ALGORITHM:

The algorithm for defining the patient record smart contract is given below. It defines all the actions that are being performed in it and the various conditions associated with it. It also explains how to maintain roles to grant access to specific functions.

Algorithm 1 explains the function of smart contracts patient records. This algorithm has five functions that are to define roles, add, view, update and Delete Record. These functions are used by administrators and other users of the system. Algorithm 1 defines the first function of the role, performed by the administrator, and includes two variables new role and new account; these will be used to add new roles and accounts in the role mapping list. This list will be used later to access the roles of system users.

The second function is to add patient records, which is performed by the doctor after the administrator assigns them this role in the define role function. This function also checks if this task is performed by the public address of the authenticated doctor account and not by any other third party. To do this, they use the term "msg.sender" in the programming language, the Solidity language used by Ethereum to identify a user's address. After completing this

VIII. TECHNIQUE:

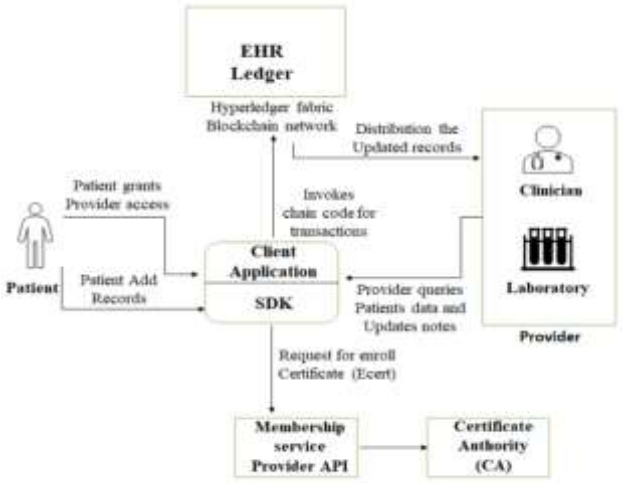
The Ethereumblockchain uses a peer-to-peer network. In this network, all nodes are connected together as peers.

No node acts as a central node that controls all functions of the network.

The reason for using this network is because the idea is to create a distributed platform rather than a centralized one. Therefore, using a network where all connected nodes have equal status and rights is the best option this technology can do.

EHRs are the next step in the ongoing advancement of healthcare and can strengthen the relationship between patients and clinicians. Data and its timeliness and availability will enable providers to make better decisions and deliver better care.

It necessarily includes data structures and data elements that reflect these provider systems. To bring some structure to this emerging field, the Institute of Medicine defined the basic functionality of EMR, which was then referred to as computer-based medical records (CPR). The Institute of Medicine definition remains the gold standard.



IX. METHODOLOGY:

They also define the proof-of-work consensus algorithm and the mining of block chain concepts. The authors emphasize that scalability is a serious problem facing block chains and propose some solutions to the scalability problem, including SegWit and the Lightning Network, Bitcoin Cash and Bitcoin Gold. The paper also explains Ethereum and its dependencies and differentiates the Ethereum Blockchain from the Bitcoin Blockchain.

Blockchain technology usually follows some consensus rules to complete and calculate transactions. For this, it needs some consensus algorithm to keep the Blockchain temper-proof and secure.

The Ethereum Blockchain uses a Proof of Work (PoW) consensus algorithm, and the reason for using it is also to ensure that the governance of the blockchain is maintained in a trustworthy manner, which is through the consent of all trusted nodes connected to the blockchain network.

X. LITERATURE SURVEY:

Eberhardt and Tai [20] conducted a study to understand possible solutions to the blockchain scalability problem and to identify such projects aimed at solving the problem. They define blockchain as a combination of various computational and economic concepts based on a peer-to-peer system. The purpose of this study is to find out which data should be stored on-chain and which data can be stored off-chain. This study proposes five off-chain data storage modes, and also includes the basic ideas and implementation frameworks of these modes. The authors explain that on-chain data is any data that is stored on the blockchain by executing transactions on the blockchain. Whereas off-chain data storage is where data is placed elsewhere in any other storage Moderate but not on-chain, nor does it include any transactions.

Vujičić et al. [21], gives an overview of blockchain technology, Bitcoin and Ethereum. Author Definition The field of information technology is constantly changing, and blockchain technology is benefiting information systems. They interpret Bitcoin as a peer-to-peer distributed network for executing Bitcoin transactions. They also define the proof-of-work consensus algorithm and the mining of blockchain concepts. The authors emphasize that scalability is a serious problem facing blockchains and propose some solutions to the scalability problem, including Seg Wit and the Lightning Network, Bitcoin Cash and Bitcoin Gold. The paper also explains Ethereum and its dependencies and differentiates the Ethereum blockchain from the Bitcoin blockchain.

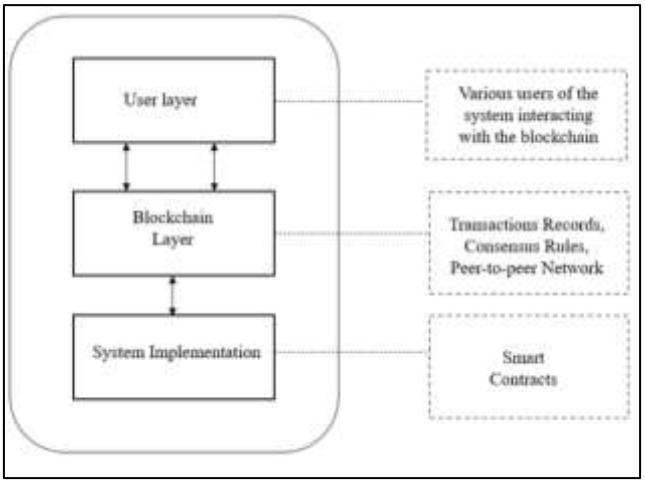
Wang et al. [22], conducted a study focusing on smart contracts and their application in blockchain technology. They first introduce the smart contracts, their working framework, Operating system and other important concepts related to it. The authors also discuss how smart contracts can be used for the new concept of parallel blockchains. They determined that the reason for the use of smart contracts in the blockchain is due to the decentralization provided by the programming language code written in it. After covering the basics of smart contracts, the author explains how the various layers of the blockchain fit together to keep the system running. These layers are data layer, network layer, consensus layer, incentive layer, contract layer and application layer. The paper not only discusses the architecture and framework that smart contracts follow, but also provides insight into their applications and challenges. The paper also discusses important future trends in parallel blockchains, aiming to create blockchains that can optimize two distinct but important modules.

Guo et al. [23], conducted a review discussing several applications of blockchain in biomedicine and healthcare. The authors found that there are many advantages to using Blockchain in this area, some of which are decentralization, persistence of clinical or medical records, data lineage, continuous accessibility of data, and finally secure information accessible to biomedical or healthcare stakeholders. The limitations of blockchain technology were identified as threats to confidentiality, speed, scalability, and malicious attacks, or 51% attacks. The authors argue that these restrictions are critical for the healthcare or biomedical sector, as they are used to store sensitive medical or clinical records. The authors propose solutions to these problems by storing sensitive medical data off-chain, encrypting the data to ensure confidentiality, and finally using a VPN (Virtual Private Network) to ensure security from malicious attacks.

XI. ARCHITECTURE

To understand blockchain architecture, let us use Figure 1 below to explain the entire process of sending a transaction from a user on a blockchain network.

The blockchain network proposes to create a new block. A block in the blockchain is used to hold the transactions in it, and these blocks are distributed to all connected nodes in the network. Transactions placed within a block are broadcast to all nodes in the network. All nodes in the network have a complete copy of the blockchain that helps them with the verification process. When a block containing user transactions is broadcast to all connected nodes, they verify that the block has not been tampered with in any way. If this verification is successful, the nodes add the block to their own copy of the blockchain.



XII. CONCLUSION:

In this article, we discuss how blockchain technology can be useful for the healthcare sector and how it can be used for electronic health records. Despite the advancements in the healthcare sector, and the technological innovations in EHR systems, they still face some of the problems that this new technology (i.e. blockchain) solves. Our proposed framework is a combination of secure record storage and fine-grained access rules for these records. It creates a system that is easier for users to use and understand.

In addition, the framework proposes measures to ensure that the system utilizes IPFS's off-chain storage mechanism to address data storage issues. And role-based access also benefits the system, as medical records are only available to trusted and relevant individuals. This also solves the problem of information asymmetry in the EHR system.

XIII. FUTURE WORK:

For the future, we plan to implement the payment module in the existing framework. For this, we need to have certain considerations because we need to decide how much the patient is willing to accept It is this decentralized system that runs on the blockchain that pays doctors for consultations. We also need to define certain policies and rules that are in line with the principles of the healthcare sector.

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