IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, August 2023

Electronic Health Record System using Blockchain

Rohit Divekar[1], Prof. Archana Said[2], Prasun Bhunia[3], Pallavi Shinde[4], Sushant Kulkarni[5]
Students, Department of Computer Engineering[1,3,4,5]
Professor, Department of Computer Engineering[2]
AISSMS Institute of Information Technology, Pune, India

Abstract: *Electronic health records possess the patient's medication details and their health history. It is an efficient and effective method for exchanging patient health records between various hospitals and other significant players in the healthcare sector in order to improve patient diagnosis and treatment on a worldwide scale. However, the present EHR systems mainly fall short when it comes to providing adequate security, entrusted access control, and resolving privacy and secrecy issues and obstacles in current hospital infrastructures. Attackers are drawn to the health records because they contain important information. An incorrect medication or operation is the result of a lost electronic health record. In this paper, we discuss how the blockchain technology can be applied to change the EHR systems and potentially provide a solution to these problems. Our suggested framework aims to adopt blockchain technology for EHR in the first place and to offer safe storage of electronic records by setting specific access guidelines for users. This framework offers the EHR system the advantages of having a scalable, secure, and integrative blockchain-based solution.*

Keywords: Blockchain, IPFS, Ethereum, Security, EHR.

I. INTRODUCTION

An Electronic Health Record (EHR) is a digital version of a patient's medical record that contains comprehensive health information about the patient. EHRs are designed to be accessible to authorized healthcare providers and staff from different organizations, providing a more comprehensive view of the patient's health history and allowing for coordinated and efficient care.

EHRs can store details about a patient's medical history, drug regimens, results of diagnostic tests, immunization history, allergies, and treatment plans. They may also comprise patient demographics, insurance details, and billing information.

One of the main advantages of EHRs is that they make it simple for healthcare professionals to exchange health information with one another. This facilitates better care coordination and improves patient outcomes. By automating processes like medicine orders, alerts for possible drug interactions, and reminders for preventive care, they can also increase efficiency and decrease errors. Patients can also access their own EHRs through patient portals, which allows them to review their medical information, request appointments, and communicate with their healthcare providers effectively using the patient portal.

Blockchain technology has the potential to play a significant role in EHRs by providing a secure and decentralized way of managing patient health information. It is a system of recording information in a way that makes it difficult or impossible to change, hack or cheat the system. Blockchain is defined as a distinct, decentralized and distributed ledger that contains all transactional records pertaining to active members. Blockchain transactions are made and kept in chronological sequence, enabling parties to track digital assets (such as digital currency and data) without centralized recordkeeping. The fact that each participating node in the network will have a copy of the entire blockchain is one of the main characteristics of blockchain technology. On the blockchain, all transactions must be authorized because they are only valid if all participating members have agreed to them. Additionally, because every transaction is recorded, it is impossible to carry out fraudulent transactions.

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II. LITERATURE SURVEY

Shahnaz et al. [1]proposes a framework that creates such a decentralized platform that would store patient's medical records and give access of those records to providers or concerned individuals, i.e., patient. They also intend to solve the scalability problem of blockchain, as it is not in the design of blockchain to store huge volumes of data on it. So, they would use off-chain scaling method that makes use of the underlying medium to solve the scalability problem by storing the data on that medium. Moreover, their proposed work is intending to solve the above-mentioned information asymmetry and data breaches problem faced by the EHR system.

Radhakrishnan and Joseph [2] suggested the blockchain based healthcare system that uses a multilevel authentication mechanism to combat user wallet threats by introducing an additional layer of security. The blockchain storage required by the blockchain-based healthcare system is enormous, which is still a difficult challenge.The blockchain-based EHR storage and sharing system links the relatedhealthcare providers.

Pariselvam el at. [3] The concerns and different preventative measures for safeguarding the confidentiality of health information in the cloud were covered by Pariselvam Basedon challenges and variable security, a novel cloud-based approach to preserving patient information has been proposed. This method enables the cloud-based mergerof protected data from numerous sources without revealing the content, as well asthe encryption of strong and safe indicators utilising distinct cryptographic keys.Additionally, it offers dependable data access, enabling users to submit specificdata requests to the cloud without knowing how it would react.

Zalloum and Alamleh et al. [4]proposed the notion of e-healthcare in the conventional health system. Existing e-healthcare platforms, on the other hand, are not properly established and stable and, hence, lack the level of privacy, authenticity, identity, and user confidence that are required for universal use. The level of patient attention in the healthcare industry, as well as the quality of healthcare services provided, are two critical factors of any successful healthcare operation. In order to solve privacy issues, security issues like data access, identification, and transparency must be addressed, as end-to-end security is difficult to achieve without them.

Mohammed Misbhauddin et al. [5] offer an architecture that can be utilised to create scalable blockchain applications using an off-chain solution, allowing doctors, lab staff, and patients to securely manage medical records. In order to further reduce the capacity of storage on the IPFS network, they also intend to find and employ watermarking as a potential security solution to save patients image-based test results. In addition, the IPFS objects stored on the P2P network will also be encrypted.

Sahoo and Baruah. [6] proposed a scalable framework of blockchain using Hadoop database. In order to solve the scalability problem of blockchain, they proposed to use the scalability provided by the underlying Hadoop database along with the decentralization provided by the blockchain technology. They used the method to store blocks on the Hadoop database, the blockchain on top of this framework includes all of the needed dependencies of blockchain but the blocks are stored on Hadoop database to improve scalability of the blockchain technology. To tackle the scalability problem of blockchain platform this study offers to use Hadoop database system, along with SHA3-256 for hashing used for transactions and blocks.

III. CURRENT EHR CHALLENGES

In the context of the healthcare business, where the storage, transfer, and interoperability of EHR are the major difficulties that need to be solved utilizing blockchain-enabled solutions, the shift of blockchain technology from hype to reality offers considerable challenges. A thorough understanding of the technology is necessary, as well as what it implies to accomplish the intended goals, to enable better exploitation and implementation of blockchain. Following are some of the difficulties that the present Hyperledger Forum and commercial entities are facing:

- **Data security**: A blockchain network is a distributed ledger where all parties involved in healthcare, including patients, keep their essential electronic medical data. Users of the platform can access this highly sensitive personal information. Because most patients and other stakeholders do not wish to use their personal information against rivals, it poses substantial privacy challenges. Due to their fear of losing their competitive advantage, many potential stakeholders are shy and hesitant to join the network, especially when competing businesses, such insurance firms and pharmacies, are involved in the supply chain.

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- **Security:** The resistance of blockchain technology to all forms of attacks, including cyberattacks, is one of its most important benefits and selling features. The implementation network is exposed to hackers due to malicious actors using the blockchain network, according to a recent cybersecurity assessment, which also points up other security threats. Due to the development of immature processes and systems, the present blockchain implementations have inherent flaws and weaknesses. For instance, due to the lack of standards and procedures, phishing scams, technology vulnerabilities, implementation exploits, and malware are posing serious issues.
- **Lack of Standardized Regulations:** The quality, safety, efficacy, transfer, and interchange of EHR among various healthcare stakeholders are all things that health regulatory authorities must monitor and maintain. These health authorities are in charge of ensuring that EHR data is retrieved, stored, transferred, and exchanged in a manner that is more secure, open, scalable, and interoperable in order to deal with patients' health-related problems and challenges in a more effective and well-organized manner and offer better health solutions. The role of regulatory agencies is more important and complex in blockchain-enabled solutions since it is challenging for these health authorities to establish the legal parameters and regulatory framework for blockchain technology. For instance, it can be challenging for these authorities to define the requirements when a new patient transaction is carried out on the network.

IV. PROPOSED SYSTEM

We are proposing a system that stores all of the records and the records are secure within the digitized form in Blockchain where they cannot be altered. Private block chain for every patient would have all the details of doctors with whom they have ever interacted. The system has modules which are classified by stakeholders of the system that are to be addressed separately and further integrate them accordingly. Apart from keeping track of documents, patients can consult or book an appointment with doctors. The medical history of a patient who has provided his/her private key and examine accordingly. The EHR system is used to improve the current systems because it provides inter-operable, secure, and effective access for medical records by patients. The proposed framework consists of users that could be patients, doctors, and administration. They were given granular access as they should have varying level of authority

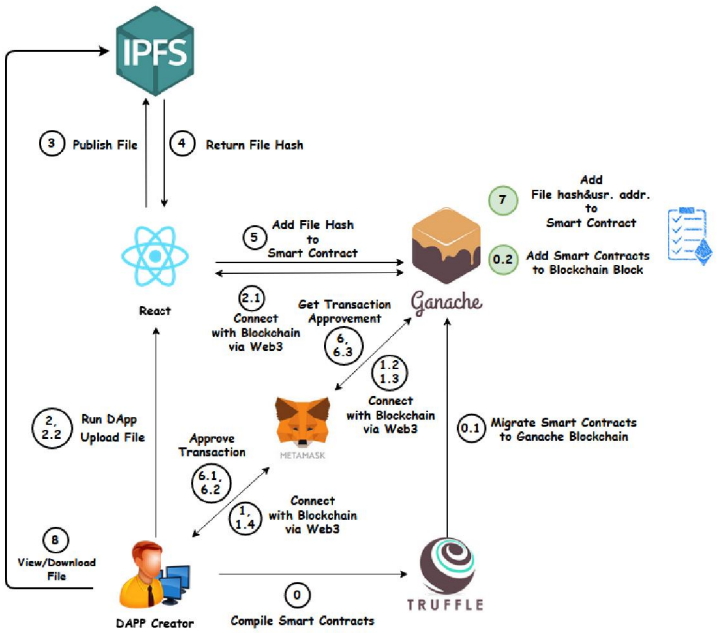

Fig.1. Architecture of HER

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1) System Layer: -React is used to build the system's UI layer. The UI layer's goal is to make the process easier for users and to retrieve the arguments required for the system's essential tasks. Moreover, MetaMask is integrated into the UI layer, allowing each node assigned to the system to carry out different tasks according to the user's role.

2)Blockchain Layer: -The proposed method makes use of Ganache, which enables the creation of a test blockchain network that is similar to Ethereum Mainnet. In the blockchain layer, every transaction that takes place between two peers is monitored and recorded. Furthermore, the implemented smart contracts are stored on the blockchain layer.

3) System Implementation Layer: -The blockchain is where each smart contract is deployed. The primary role of smart contracts is to perform transactions between two peers on the blockchain where specific conditions must be satisfied in order for the functions to be properly executed. In order to prevent unwanted access, the smart contracts' logic is designed to define granular access control to the system's numerous transactions.

V. METHODOLOGY

1) Login: -A plug-in called an authentication module collects user information from users, such as their user ID and password, and then compares that information to entries in a database. If the user's information does not meet the requirements for authentication, it is not verified and access to the requested resource is denied.

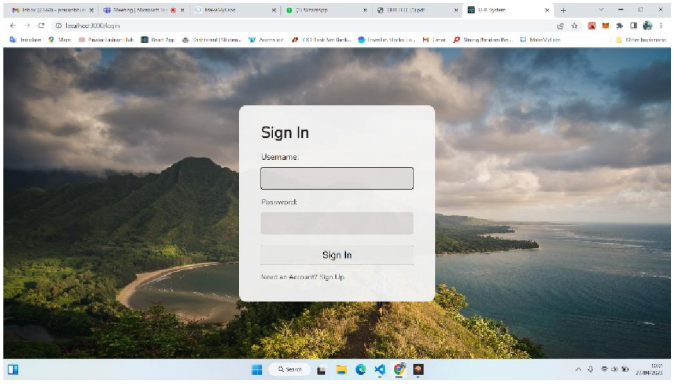

Fig.2. User Login

2) EHR: - EHR is a group of various medical records that are compiled after clinical interactions or other clinical events. Self-care and homecare systems and technology will result in the production of significant healthcare data that will be pertinent for clinical practice in the long run.

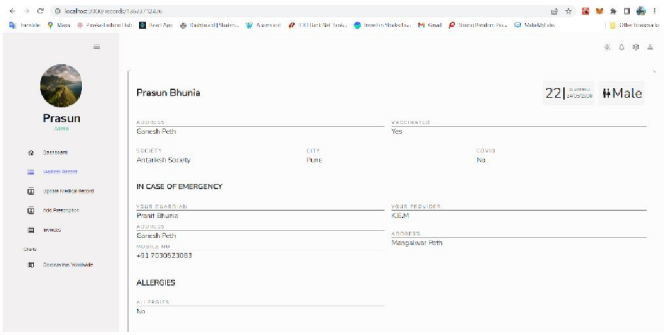

Fig.3. EHR Dashboard

3) Authentication: -Before the files are posted to the block chain data base server, they are encrypted using the Secure Hashing Algorithm-256 encryption mechanism. A 256-bit long value is produced by the cryptographic hash function SHA-256. In addition to being utilised for transaction verification, it moderates the creation and management of addresses.

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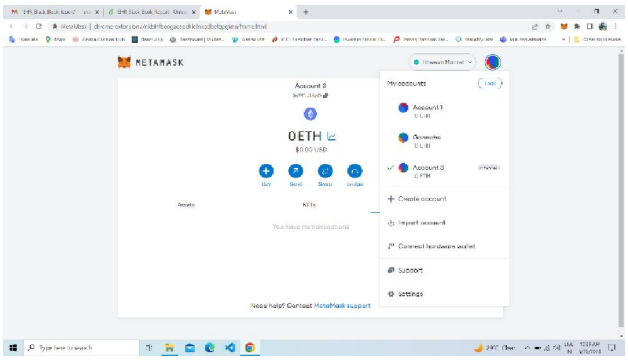

Fig.4. Meta Mask

VI. RESULT

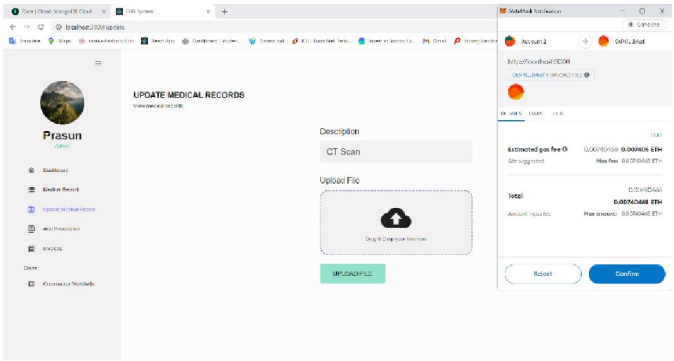

Fig.5. Meta Mask Authentication

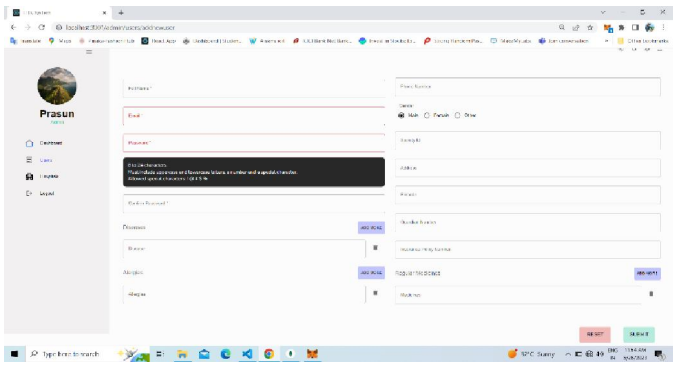

Fig. 6.User Form

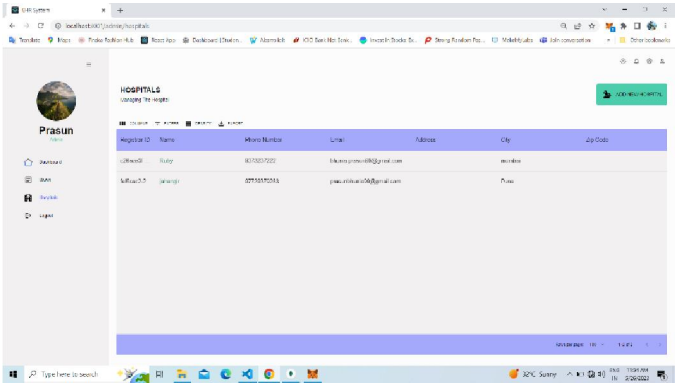

Fig.7.Hospital List

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