Securing Medical Records Using Private Blockchain Technology

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Abstract— **The term "electronic medical records" (EMRs) refers to information that is highly confidential and saved electronically. This information is associated with the diagnosis and treatment of a patient, and it must be routinely distributed among the concerned people such as doctors and nurses. The disclosure of private medical information or its alteration during an operation makes it extremely difficult for participants to exchange their medical files with one another. The most effective strategy for overcoming these obstacles is to implement an electronic medical records system that is based on blockchain technology. Within the scope of this study, we have addressed how the technology of blockchain might contribute to improved healthcare data management. Through the application of blockchain technology, the purpose of this research is to establish a connection between the health ministries and departments and both public and private hospitals in order to simplify the process of gaining access to one's medical records and transferring those records while maintaining patient confidentiality and improving safety.**

*Keywords— **blockchain, healthcare, data management, security.***

I. INTRODUCTION

To provide patients with quality care, ensure accurate and timely payment for the services provided, reduce the risk of medical malpractice, and assist healthcare providers in evaluating and planning the patient's treatment while maintaining the continuum of care, it is essential to have documentation in the patient's medical record that is clear and concise.

It is necessary of professionals working in the health care industry to keep patients' medical records in an accurate manner. In addition, these data need to be shared amongst the various health care organizations so that experts may conduct a comprehensive assessment of a patient's medical history and stay away from the risk of omitting critical information. Nowadays, medical professionals rely on electronic medical records, often known as EMRs, as a critical component in the achievement of these objectives and the provision of high-quality treatment. However, the implementation of these systems is hampered by a number of legal and technological obstacles, the most notable of which being worries over performance and concerns regarding privacy.

Possible solutions to this problem include developing a system for medical records based on block chain technology, which can be combined with existing software for electronic medical records and which can act as an all-encompassing, unified picture of a patient's record. It cannot be stressed enough that no genuine patient information is kept in a block chain. In its place, the block chain translates each new record into a one-of-a-kind hash function, a short string of letters and numbers, each block can hold data of type json, therefore we used the "value" and "key" for each record, json are used in all api. This may be anything from a doctor's note to a prescription to a test result. This is the single most crucial feature of the block chain. Each hash function is unique, and may only be decoded with the owner's express consent [1].

II. RELATED WORKS

Because of its prevalence, blockchain technology has made a significant impact on the industry by providing solutions to virtually all problems associated with centralized storage and distribution. When blockchain technology is implemented in healthcare systems, everyone involved, including patients, doctors, hospitals, and other stakeholders, comes out ahead. It is indicative of how far behind the times the healthcare industry is when it comes to innovation that it took years for the sector to acknowledge and, ultimately, incorporate these advancements. Medrec, Blochie, and Diabetes health care data and access management were some of the first initiatives in this field. The storage of data is the primary subject of this investigation. There is a concern that, despite the use of encryption methods, it may still be possible to identify a patient if sufficient information about that patient

is linked together and if criminal organizations are able to get their hands on the private keys that are used for encryption and decryption [2]. This raises concerns about both the patient's security and privacy. The primary goal of the initiative was to reduce data storage expenses by storing enormous amounts of data off-chain (IPFS: Interplanetary File system). This strategy has been proven to be effective and will result in a large reduction in the costs associated with storage. Even while there are still challenges to solve before blockchain technology can be fully implemented, it presents a potential solution to a significant number of the problems that plague the healthcare system.

Blockchain is a modern technology that can offer creative solutions in many industries, including healthcare. It is always meant to access the data more quickly and securely in a healthcare emergency. The proposed research activity has created a study about the use of blockchain in the healthcare sector to achieve this. Data is stored in the blockchain architecture using patient Electronic Medical Records (EMRs) [3]. These EMRs are extremely sensitive since they contain patient personal information. From now on, using records must be done so in a secure manner to prevent data breaches. If medical records are readily available, it will be much easier to diagnose illnesses and treat patients more effectively when they reach crucial phases like coma and unconsciousness. Major changes are taking place in access, data management, control, and illness treatment within the global healthcare systems. The amount of healthcare data is anticipated to reach roughly 2314 exabytes in 2020 thanks to developments in data capture and connected technology. Cybercriminals are investing a lot of time, effort, and money into utilizing and profiting from healthcare data. Due to this threat, the healthcare sector's cybersecurity market is predicted to expand to USD 27.10 billion by 2026 [4].

III. PROPOSED DESIGN

Before we can begin to develop a block chain-based system, we need to first decide on the type of block chain that will form the basis of the system. Should it be a permission less blockchain or a permissioned blockchain? The Ethereum blockchain, which is a permission less blockchain platform, has been utilized in virtually all the studies that we have reviewed in the work that is linked to this topic. In contrast to them, we have developed our electronic medical records system using Hyperledger, which is a permissioned blockchain platform. This allows only authorized users to access the ledger. The following are some of the reasons why we believe Hyperledger, which is a permissioned block chain, is superior then Ethereum, which is a permission less blockchain [5]. Because anybody may join the network anonymously and without permission in a permission less blockchain, this might present certain difficulties. When dealing with an electronic medical records system, it is imperative that the identities of each network member be known. Because of this, it makes perfect sense to utilize Hyperledger, which is a block chain platform with permissions and in which the identities of every participant are known.

We have built a system for the efficient storing and exchange of electronic medical records (EMRs) that is based on permissioned blockchain technology, each block can hold data of type Json, therefore we used the "value" and "key" for each record, Json are used in all API. This system offers

improved data security and privacy than previous methods. The following figure outlines the general layout of the system that we have presented. The program is geared toward three distinct types of users: patients, healthcare providers, and administrative personnel in the healthcare system. Registration of both patients and medical professionals will fall within the purview of the Health Administration [6]. The application architecture is comprised of Membership Management, user interfaces that let users to engage with the program, nodes for a consensus mechanism that also house smart contracts (business logic), the Chain database, and the World-State database. OmniPHR is a Blockchain-based system that gives patients complete control over their electronic medical records. To facilitate sharing of health data between cloud services and service providers connected on the same blockchain, Ethereum uses the Medshare architecture [7]. They proposed utilizing chart frameworks to expel contact between Energetic Information Quality and inactive blockchains by advancing their arrangement through disseminated chart capacity and queries. They backed this by characterizing fundamental blockchain, showing the likenesses of fundamental blockchain to charts, and pointing out how chart inquiries and outlines can be utilized to enhance measures of availability and representation [8].
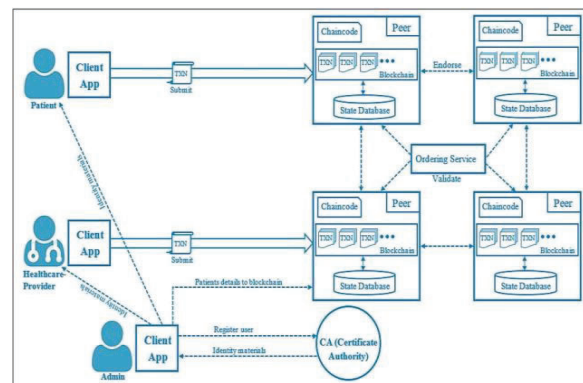

Figure 1. Architecture of proposed system

IV. METHODOLOY

In order to implement the proposed system, we used Python programming language. As we can see in Figure 3, a block diagram of the system is provided presenting the overview of the proposed system. Similarly, various operations such as registering new user and entering the records of the patients is shown in Figure 4 and 5.

Further, we developed our system using HTML and Python. The system was tested with 30 users and was fast and runs without any bugs or errors. We found that the system responds very quickly when hosted on a Linux server with a good internet connection. The system can handle up to 1000 users simultaneously without hanging, but it can be scaled up to accommodate more users if needed. The following Figure 2 shows a simple block structure of the proposed design. As we can see the proposed design will be consistent with four main modules. These modules include the patient, doctor, hospital, and ministry of health. As can be seen, a patient can register in the system and later can use the rest of the modules. As soon as a doctor generate a record for a patient, the record will be sent to the main system. The main system is organized and managed by the administrator. For istance, if the patient want to check its record they must need a private key to search

for a record. These keys are provided to each participant using the Public Key Cryptography (PKI).

Figure 3. Signup options for the new users.

V. CONCLUSION

The team succeeded in designing an electronic medical records management system that is based on block chain technology for the purpose of storing and exchanging medical information in an effective manner. By utilizing a permissioned block chain network, this solution protects both the confidentiality of patients' medical information as well as their security. We have presented evidence to support the utilization of permissioned block chain technology in our proposed system. Patients could take an active part in the administration of their own medical records using this system. Patients also can regulate who may read their medical history and who can add new data. Both the architecture of the system and a prototype built with Hyperledger have been demonstrated by us at this point. As a part of the work that we want to do in the future, we are going to test the system in its actual setting using the data of actual patients. In addition to this, we will check the system's functionality and performance.

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