

Implementation of Healthcare Record System Powered by Blockchain

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Abstract: *Blockchain as a technology was created to speed up financial exchanges, do away with the requirement for a reliable third party to notarize and verify transactions, and safeguard data confidentiality and privacy. The blockchain's new organisational structure has been created to meet the demand for this technology in other industries, including e-health, tourism, and energy. In order to improve interoperability and enable patients, hospitals, clinics, and other medical stakeholders to communicate data among themselves, this paper is concentrating on using Blockchain to manage and distribute electronic health and medical records. The entities taking part in the built-in chain network determine which Blockchain architecture is employed. Although the implementation of blockchain technology may eliminate duplication and offer carers reliable patient records, it still comes with few challenges which could infringe patients' privacy, or potentially compromise the whole network of stake holders.*

Keywords: Medical information sharing, Blockchain-based EHR, Consent based Health data sharing, Healthcare Record Management

I. INTRODUCTION

Better health is important to human happiness and the welfare of society. It plays a vital role in the economic progress of the nation. A health record is a collection of clinical data related to the patient's mental and physical health, gathered from different sources. Health record consists of a patient's medical history, examination, diagnosis, treatment, results of lab investigation, scanning reports, alerts like allergic to etc. These health records can be managed both manually and digitally. The traditional method which is followed in most of the hospitals for maintaining records is the manual method which includes papers and books. These problems can be solved by developing a decentralized digital health infrastructure that is by integrating Blockchain technology into the healthcare system. Blockchain technology has the capability to rebuild the modern economy by maintaining and updating record. One possible technology to enhance integrity, authenticity, and consistency of stored and exchanged medical records is Blockchain. Blockchain can guarantee security of sensitive data by tracking access to confidential medical records and ensuring authorized access. Blockchain can serve as a distributed database that hardens medical reports against tampering. Blockchain as a technology relies on public key cryptography and hashing mechanisms as a mean to keep track of historical transactions pertained to distributed patients' records while preserving confidentiality, integrity and availability. This will ensure that records are not lost or being wrongly modified, falsified or accessed by unauthorized users.

The EHR systems have been implemented in a number of hospitals around the world due the benefits it provides, mainly the improvement in security and its cost effectiveness. They are considered a vital part of healthcare sector as it provides much functionality to the healthcare. The basic focus is to provide secure, temper-proof, and shareable medical records across different platforms. The main objective is to produce confidentiality to patient medical records victimization "Blockchain Technology". Patient information secrecy or confidentiality is one amongst the fore most necessary pillars of drugs. Protecting the personal details of a patient isn't simply a matter of ethical respect, it's essential to bond trust between the doctor and also the patient.

II. LITERATURE REVIEW

X. Yue, H. Wang Sharing medical data is an important step to make the medical system more intelligent and improve the quality of medical service. However, the sharing of patient data among institutions is not yet fully realized, and the blockchain is a great way to solve this problem right now.[1]

According to data collected by the security firm, the rate of cyberattacks on hospitals increased during the COVID-19 pandemic. During the COVID-19 pandemic, shortages of critical medical equipment and supplies revealed how vulnerable healthcare professionals are to supply chain interruptions.[2]

A. Azaria, A. Ekblaw, T. Vieira, and A. Lippman, have proposed MedRec. It is a blockchain-based healthcare record sharing system developed by researchers at the Massachusetts Institute of Technology (MIT). MedRec uses a blockchain-based platform to enable the secure and seamless exchange of patient health information between different healthcare providers and organizations. Implementation of MedRecblockchain addresses the four major issues highlighted here: fragmented, slow access to medical data; system interoperability; patient agency; improved data quality and quantity for medical research. We assemble references to disparate medical data and encode these onto a blockchain ledger.[3]

Physicians are faced with a large amount of information that is so hard to deal with them. A blockchain solution can facilitate this responsibility and also engaging the patient in their care. Medicalchain is a blockchain-based healthcare record sharing system that uses blockchain technology to provide patients with more control over their health information. Medicalchain enables patients to grant access to their health information to specific healthcare providers or organizations, and they can also revoke access at any time. It uses blockchain to make a user-centralized electronic health record and keep a single real report of the user's data. As a prime, Medicalchain has coped with summaries of hospital discharge, which contains a summary of cure and essential follow up care.[4]

In healthcare, suitable interoperable EHR systems provide greater efficiency, lower operating costs and save time in service delivery. Interoperability is the process of communication, data exchange, and the use of data exchange between different information technology systems and software applications. The data exchange scheme and standards allow data to be shared among different stakeholders, such as a clinician, laboratory, hospital, pharmacy, and patient, regardless of application or application vendor. In health systems, interoperability is the ability of health information systems to work together, both inside and outside the organization.[5]

S. Khezzr, M. Moniruzzaman, A. Yassine, and R. Benlamri have discussed about adopting Blockchain technology in healthcare. This comprehensive review paper provides a detailed analysis of the current state of blockchain applications in healthcare. In the last couple of years, the upsurge in blockchain technology has obliged scholars and specialists to scrutinize new ways to apply blockchain technology with a wide range of domains. The dramatic increase in blockchain technology has provided many new application opportunities, including healthcare applications. This survey provides a comprehensive review of emerging blockchain-based healthcare technologies and related applications. The authors identify the various use cases of blockchain technology in healthcare, including health record management, drug supply chain management, and clinical trials. They also discuss the challenges and limitations of blockchain technology in healthcare and explore potential solutions to overcome these barriers.[6]

III. ANALYSIS OF PROBLEM

Medical information can be both medical records such as patient files as well as medical data that is retrieved from body sensors and other applications. As medical records are being transferred from paper to digital mediums, it requires additional security and role based privileges to be put in place to protect information and security of the healthcare records. Current methods to protect and secure records have proven not to be as efficient as they should be, and dissemination of a patient's medical records can have real-world consequences (e.g. risks to patients' privacy in the form of malicious attacks, which can damage the reputation and finances related to those records) Data sharing and access is both a security problem and an inherent problem with civilian health records. Different healthcare providers used different electronic health record (EHR) systems, which made it challenging to share medical data across systems. Traditional EHR systems were vulnerable to data breaches and cyber-attacks, which could compromise patient data and put patient privacy at risk. Patients often had limited control over their health data, and healthcare providers may have

been hesitant to share medical data without patient consent. Sharing health records was often a slow and inefficient process, which could result in delays in patient care and treatment.

IV. PROPOSED WORK

We have proposed a system which will aim to solve the health care sector's current problems by designing a prototype for a simple blockchain based application for EHRs that satisfies some requirements like information privacy, avoiding the third party accessing it without permission, secure information access and sharing .The patient can be access his medical report directly and can view or use the digitalized report with anytime. The hospitals will have to request permission to access a patient's history and can add records.

EHR Framework uses blockchain technology to securely store the records. The block chain is managed by a network of computers where there is no single computer is responsible for maintaining or storing the data. Using Blockchain for records can make the whole process End to End verifiable and transparent. The stored data will be transactions, from which we can create a blockchain that will keep track of the database of the patient records. Using this approach, all the patients can make use of the records by themselves, and because of the blockchain they can use these records without any permission request from the organization directly by using the secret key given to them. This solution centered on the blockchain, will allow large-scale availability, data confidentiality and cost-effectiveness.

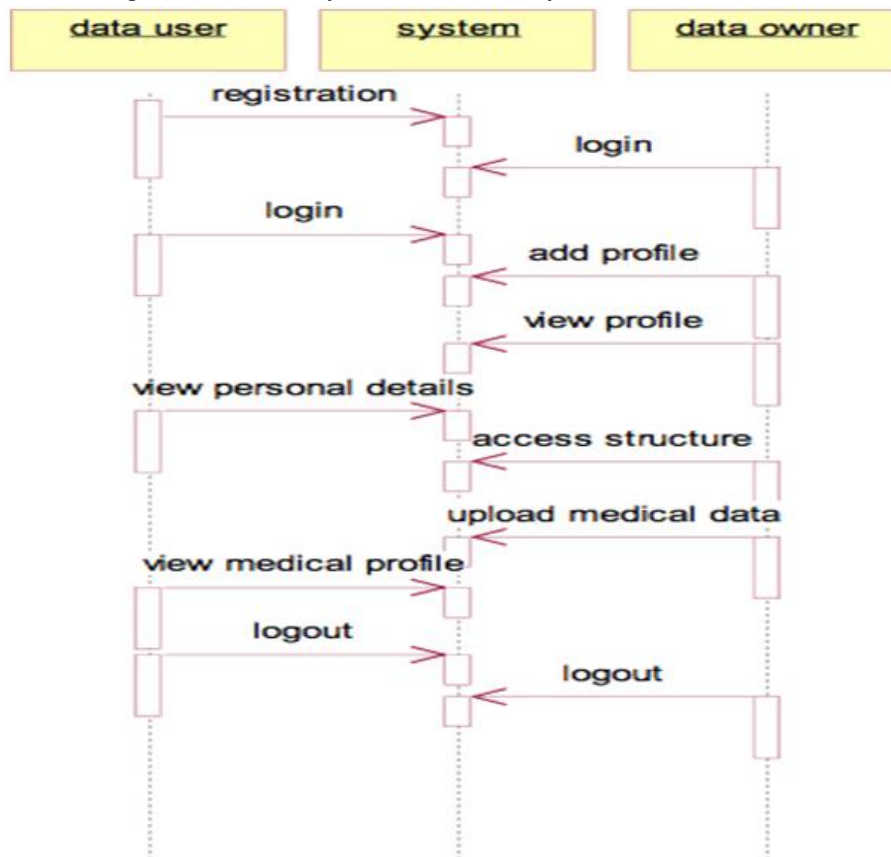


Fig: Collaboration Diagram

V. OBJECTIVE

The traditional method which is followed in most of the hospitals for maintaining records is the manual method which includes papers and books. This method has serious limitations such as a need for large storage areas and retrieval of records is difficult. We aim to provide a digital solution to this problem so that next time when you visit your doctor, you don't need to carry your medical file. We will be using Blockchain technology to store the patient records. This will ensure that the information remains secure while being decentralized across different peers.

An Electronic Health Record (EHR) is a system collection of patient personal information and health records that are stored electronically in a digital format. It helps to improve the quality of care.

5.1 System Analysis

System design is the most important and vital part of any framework as it is used for the development of the system from its theory. This section includes the modules and various elements that are combined together to form the whole systems framework.

The purpose behind this proposed framework is to create such a decentralized system that is temper- proof, secure and confidential blockchain based system for electronic health records.

This framework consists of four modules that include Patient, Hospital, Admin and Miners.

1st Module: Patient

The patients can login, they can view profile and medical record as well as accept the request if it’s necessary. The patient is an actor in first use case diagram and their functions are like new patient registration, existing patient authentication, enter personal health information. Enter patient’s personal health information and send request to doctor.

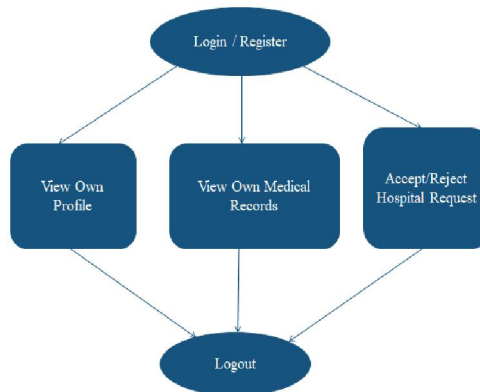


Fig: Data Flow Diagram of Patient Module

2nd Module: Hospital

The administrator staff from hospitals who can create profile and request patient’s and then view their history if any and if required create new case.

The doctor is an actor and their functions are like new doctor registration, existing doctor Authentication, accept patient request, Collect patient’s health problem and give Prescription to Patient according to health Problem.

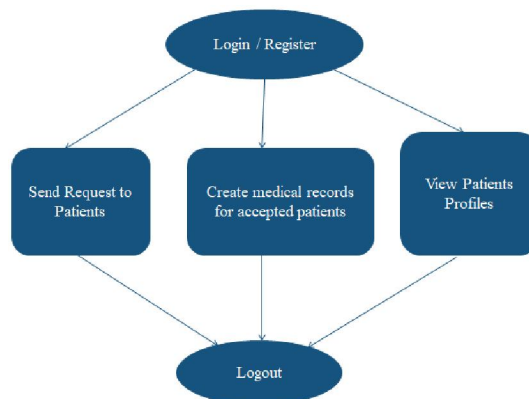


Fig .: Data Flow Diagram of Hospital Module

3rd Module: Admin

- Can view Hospital Profile
- Can View Patient Profile
- Can View Medical Records

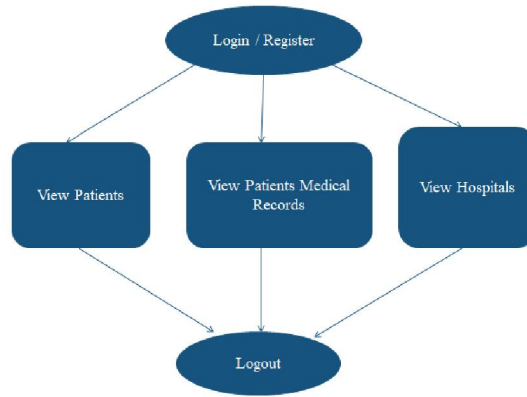


Fig: Data Flow Diagram of Admin Module

4th Module: Miners

Miners play a critical role in maintaining the overall security and integrity of the blockchain network. By verifying transactions and adding them to the blockchain, miners help prevent double-spending, fraud, and other malicious activities.

Miners are essential to the functioning of a blockchain-based EHR system as they provide the computing power needed to validate transactions, ensure data accuracy and security, and maintain the integrity of the network.

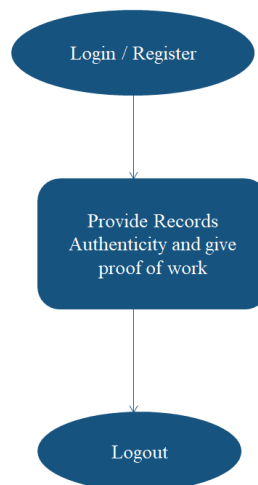


Fig: Data Flow Diagram of Miners Module

5.2 Implementation

Implementation is the stage where the theoretical design is turned out into a working system. Thus, it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and its constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods. The system has four modules. These modules when combined together would keep our system working.

Firstly the new patient will follow the registration process and by this id and password will be generated which will be further use for login. Registration details include patient personal information like name, age, height, gender, blood group and contact number. Patient can also add his profile picture. In this way patient's profile will be created.

The administrative staff from the hospital will register into the system and their account will be created. By searching patient's name, hospital can send request to the particular patient for accessing their data. Patient can accept or reject the hospital's request as per their need. Once patient accept the request it gives complete authority to hospital to create a case under the patient's name.

Primary data is generated by the interaction between a patient and their doctors. This data consists of medical history, current problem and other physiological information. An Electronic Healthcare Record is created for each patient using the data collected by the hospital and creates case of every patient.

Each patient who has the ownership of EHR can view their profile anytime they want database and cloud storage store the records in a distributed manner and miners are responsible for verifying the authenticity and accuracy of patient data, such as medical history and treatment information. This involves ensuring that the information is encrypted, securely stored, and can only be accessed by authorized parties. Healthcare providers such as clinics, community care center, hospitals are the end user who wants to get access for a safe and sound care delivery. No matter where you are treated in the globe, your health record will be available and accessible on web and validated through a distributed ledger such as blockchain, to which healthcare providers would continue to add to over time. Admin can view both patient's and hospital's profile.

There is a separate login page for miner and after login it shows mine dashboard where all the transactions are visible. For every transaction unique hash value will be generated using SHA1 algorithm. For every true transaction the hash color will be green. If anyone tries to alter the data unethically then the hash value will be changed and its color will change into red this shows that the data is manipulated. Miners play a critical role in maintaining the overall security and integrity of the blockchain network.

5.3 Limitations

Despite the potential advantages of blockchain-based healthcare record systems, a number of issues and restrictions need to be resolved. The lack of standardisation and compatibility of blockchain platforms is one of the major issues. distinct blockchain platforms have distinct technological requirements and protocols, which can make it difficult for healthcare record systems powered by blockchain to be adopted and interoperable. Additionally, the adoption of blockchain-powered healthcare record systems can be hampered by the need for considerable infrastructure, training, and maintenance investments. This is especially true for smaller healthcare providers and organisations.

VI. CONCLUSION AND FUTURE SCOPE

This paper deals with adoption of the Blockchain to deploy the EHR which solves the significant issues of accessibility and authority. The Blockchain allows ease of access to the records as it is available to any personnel authorized to access them. The goal is to provide secure access to patient data, avoiding the third party accessing it without permission. A solution centered on the blockchain, can permit large-scale availability, data confidentiality, cost-effectiveness, and belief in the information system. Blockchain-based EHRs can facilitate research and clinical trials by enabling secure and transparent sharing of data across multiple stakeholders. This can help to accelerate the discovery of new treatments and therapies. The use of blockchain-based EHRs can enable healthcare providers to have a complete view of a patient's health history, including past treatments, allergies, and other critical information. This can help providers make more informed decisions, leading to better patient outcomes

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