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MediChain: Medical Record Management System

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Abstract: ***Currently, Electronic Health Records are managed using a client-server architecture by which healthcare providers retain data stewardship. But this strategy has problems with security and privacy, a single point of failure, fragmented data, and susceptibility. Blockchain is a brand-new, developing technology for distributed databases that uses cryptography to ensure the security, incorruptibility, and integrity of data. These characteristics allow secure and reliable data storage. Blockchain-based record management system uses smart contracts to ensure the privacy of patients. This health record management platform will store the user's hospital, lab, pharmacy, and insurer records. It will increase the speed of information storing and exchange So that all patients can easily access individual medical records in different hospitals and clinics. This will help doctors and patients with diagnoses and also various insurance companies to check the medical records by getting access to records from the platform and also this will help the researchers and scientists.***
Keywords: Blockchain, Record Management, Access to records, Cryptography.

I. INTRODUCTION

The conventional medical record system uses a complicated administration procedure for verifying the patient. This current architecture is inefficient for information exchange. The cryptographic property helps in ensuring privacy. In this project, the users will have their Aadhar id as their personal login and another login is for admins (doctors, laboratories, and pharmacists) each will have their own login credentials. Access to the records is also different for admins and users. Only admins will be able to insert the records over the platform and users will have no access to change the records but users can read their own records only and admins can see the records of only the patients who are under them. Also, by linking the records to Aadhar number they are easily accessible anywhere, anytime. A person's health information can be found in electronic health records (EHRs), which are kept digitally. Since EHRs are frequently shared across healthcare stakeholders, they are vulnerable to a variety of issues, including power outages, data abuse, a lack of privacy and security, and a lack of an audit trail. Blockchain, is a ground-breaking technology, on the other hand, that offers a distributed and decentralized environment in which nodes in a list of networks can link to one another without the need for a central authority. It could be able to get over the limitations of EHR administration and establish a more safe, more secure, and more decentralized environment for transferring EHR data. Additionally, blockchain is a distributed ledger that allows for the storage and exchange of data in a mutually verified, cryptographically secure manner.

II. BACKGROUND

A. Blockchain Technology

A blockchain is a continuously expanding list of transactions that is decentralized, distributed, immutable, shareable, and tamper-proof.

Consider Blockchain as a register with transaction records organized into blocks with timestamps. Cryptographic hashes, which uniquely identify each block, are used. The hash value of the block before it is given for each block. As a result, a link is built between the blocks, resulting in the formation of a chain of blocks. Only when we investigate how a Blockchain network functions can we obtain a clear idea of how it operates. Each node in the peer-to-peer network keeps a record of every transaction that has ever taken place on it. Every node has its own wallet that it uses to conduct transactions. With a set of private and public keys, the user and the network communicate with one another (Cryptographic keys). Whereas a public key is visible to every node in the network, a private key is only used to sign one's own transactions. Sending a message containing a transaction requires the sender to sign it using their private key, which when combined with their public key creates a digital signature. This transaction is published on the Blockchain network, where the miners confirm it. The high-performance nodes in the Blockchain are known as miners. Using a consensus mechanism called Proof of work, miners make the transaction unmodified and irrevocable. The task of producing a legitimate block is one in which miners compete, and the successful one gets rewarded. A block containing a transaction is only authorised once it has been checked by every miner on the network, and if more than 50% of the miners do so, the block is deemed genuine and is added to the longest Blockchain.

B. Literature Survey

In [1], the paper gives an overview of the problems, benefits, and use of the blockchain-based decentralized autonomous organization. Currently existing DAO such as ARAGON, COLONY, DAOSTACK. It also gives an overview of scalability and threats and enhancement solution in the blockchain. Paper [2] consist the important concepts and considerations when dealing with blockchain technology for storage and sharing. It consists of architecture layers and properties of the blockchain. Data transaction, blockchain types such as public blockchain, private, consortium, etc. are discussed by Abdullah Al Mamun [3]. How to deploy blockchain to achieve high performance, security, privacy, etc [3]. The Electronic Health Record (EHR) are the records where information is stored in the digital format. So, using blockchain for the decentralized and distributed among the setting to communicate among the nodes. They have proposed three different methods for managing Electronic Health Records [4]. According to Marcela Tuler De Oliviera [5], for the cross-organization data sharing there must be transparency and trust in the organization. Smart Access provides joint agreement for getting access to the policies and provide a dynamic control over the transparency and auditability [5]. It consists of threat model and the analysis of the Smart Access system by comparing with opensource solidity implemented smart contracts.

It represents the performance, results, measuring the latency and also transaction throughput for the different blockchain network consensus setups [5]. In [6], patient medical data is stored over the decentralized storage using blockchain technology by multiple hospitals. It uses software agents and accessed using Message Queuing Telemetry Transport protocol. [6] It can handle potentially thousands of participating local systems without loss of network timelines. This system can be implemented in mobile devices apps can give direct access to patients' data by using central blockchain. Access control is managed by using amazon web services by using permission from key management system [6].

III. METHODOLOGY

A. Ethereum

A decentralised network based on blockchain technology, Ethereum. It was initially put into use on the well-known cryptocurrency Blockchain. The purpose of Ethereum was to develop an open-source platform for smart contracts with blockchain capabilities. Peer-to-peer networking is another method this technology uses to spread itself. This network also employs Ethers, which are its own cryptocurrency. Ethereum also gives programmers with a language called Solidity that allows them to construct their own blockchain. It was developed for Ethereum's ultimate feature, smart contracts. Transactions are the way by which external entities connect with Ethereum. External users can use it to change the status of a document or set of data on the Ethereum blockchain network.

B. A Smart Contract

A smart contract is a set of commands that can be used to carry out any transaction on the blockchain. This piece of code is executed when users send transactions. They work directly on the blockchain, rendering them immune to manipulation and change. Smart contracts employ the Solidity programming language to program any sort of activity on the blockchain. The programmers can compile the required operations after they have been programmed. These could then be run and deployed on the Ethereum blockchain after being compiled. The smart contract code is written using JavaScript, which implements Ethereum's Solidity language.

C. System Architecture

In this project (HealthCare Record Management System) we are going to store the medical data of patients with help of a blockchain system. The application layer consists of 2 different users, a patient, and an admin. Depending upon the authentication, access control is given to the respective user. We are using blockchain so that the data cannot be changed. Only the authorized admin has right to change and update the data in the blockchain. Patients can only see their medical history.

The user can see their medical history from their birth if it is uploaded to the database of the blockchain by the authorized doctors or authorized entities. This will help doctors and patients with diagnoses and also various insurance companies to check the medical records by getting access to records from the platform and also this will help the researchers and scientists. The same concept can be expanded to include medical document authentication and verification for government services using Aadhar cards, as well as for pension applicants so they will not need to produce their life certificates in person. This health record management platform will store the user's hospital, lab, pharmacy, and insurer records. It will increase the speed of information storing and exchanging. So that all patients can easily access the individual medical records in different hospitals and clinics.

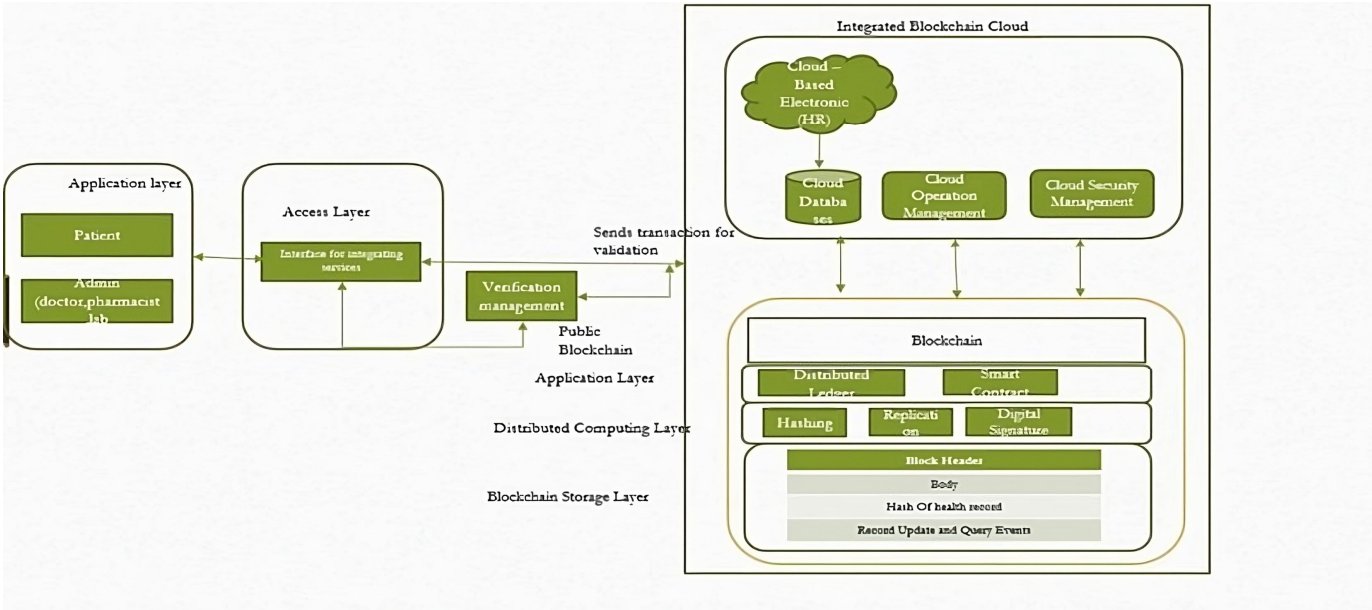

Fig. 1. System Architecture

D. Privacy and Data Access Control

The suggested access model guarantees that patients own and control their medical records. However, the issue lies in the size of the blocks. Storing all of the patient's medical records on a blockchain would dramatically increase the blockchain's size, requiring much more storage at each node. Vora et al. [8] proposed a framework based on several contracts to enable secure Electronic Health Records (EHR) access control and protect the privacy of patients through the consensus protocol Proof of Vote (POV). Kumar et al. built dynamic access control policies using smart contracts. A blockchain enables access to medical records by patients and other parties [4]. It uses advanced cryptographic methods for security and smart contracts-based blockchain to provide better access control models.

E. User Authentication

The identification and authentication perform a significant role in security controls. The research paper [3] consists of the methodology to perform automated authentication and verification which overcomes the drawback of manual authentication and verification as it consumes lots of time. Here we use 12-digit user-id for authentication and verification. The people register their data for authentication on the site which is confirmed by admins. Here verification process is done by the owners of the contract and admins. The safety and security of this method are validated using formal verification technique. After getting the users data it is stored over the blockchain network in the form of blocks. Using this data over blockchain network we can verify the user from his Aadhar number and get its detail.

IV. CONCLUSIONS

The blockchain based healthcare record management system is implemented with the help smart contract on Ethereum virtual machine (EVM). Medi-Chain will help the users to get the provisional access to their medical records where only doctors, pharmacists, lab experts will have access control to add the medical details of a patient. These records will be secured and protected as a decentralized system as well as smart contracts are used. In the future the drug traceability can be carried out in the blockchain.

V. FUTURE SCOPE

The same project can be further extended for the medical document verification and authentication for the government services in the same way we use Aadhar card and also for the pension taking persons so that they don't need to submit the life certificate in offline way and also for in different medical applications like tracking the patients report in online way so the patients don't need to visit hospitals regularly and doctors can focus on more important work so can be a revolutionary change. It will also help various life insurance companies to know the current medical details of a person in order to detect frauds and avoid irrelevant medical claims.

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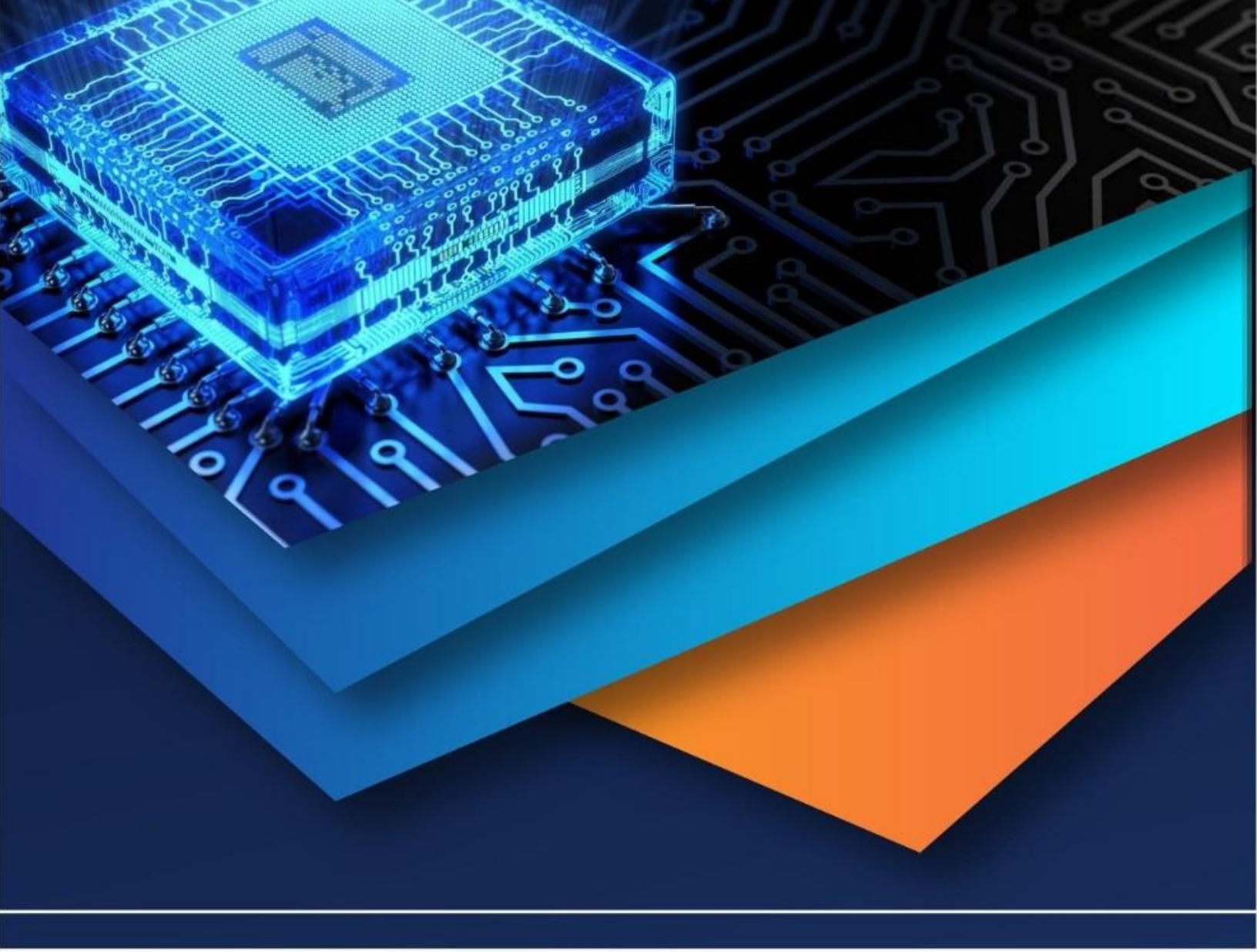

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