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A smart contract block chain based electronic health record using distributed ledger technology

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ABSTRACT

Patient privacy may be jeopardised if data from electronic health records leaks. EHR data often doesn't change after being submitted to the system, thus blockchain technology has the potential to make it easier to share this kind of information. EHRs that have been saved on the blockchain can subsequently be accessed by many participating medical organisations and individuals with more confidence. Here, a searchable encryption method for EHRs based on blockchain is suggested. Complex logic expressions are used to build the index for EHRs, which is then recorded in the blockchain so that a data user can use the expressions to search the index. The owners of the data have complete control over who can access their EHRs data because just the index is moved to the blockchain to speed up dissemination. The integrity, anti-tampering, and traceability of the EHRs' index are all guaranteed by the usage of blockchain technology. Finally, the effectiveness of the suggested system is assessed from two perspectives: the cost of extracting the document IDs from EHRs and the cost of executing transactions on Ethereum's smart contracts using industry-standard light encryption.

Keywords: Block chain, Interplanetary File system, Electronic Health Record.

INTRODUCTION

A number of research studies have underlined the potential of blockchain technology for the healthcare ecosystem, and it has recently emerged as a crucial technology in the digital revolution of the healthcare industry. It is prepared to change the way conventional medical institutions and companies have operated in the healthcare industry for the past few decades. Blockchain and information and communication technologies (ICTs) are important enabling technologies for the decentralisation and digitization of healthcare institutions, and they provide patients and service providers a modern and digitalized healthcare environment.

In the areas of patient record access and control, claims and payments management, management of medical IoT security, and research data verification and exchange for financial auditing and transparency, blockchain applications for healthcare data management create services for patients, doctors, and healthcare institutions. In these applications, real-time updates to a decentralised, encrypted block-chain ledger are made in order to comprehend, supervise, and manage medical data. Additionally, it makes it easier for healthcare organisations to prevent unauthorised individuals from accessing private data.

METHODOLOGY

To create a blockchain-IoT architecture with role-based permissioned access management that can be used in EHR systems. To develop a light-weight encryption model for anonymous and privacy-preserving block encryption in blockchain architecture, such as attribute-based signature or re-encryption (also known as revocation attribute-based lightweight signature).

For greater scalability and interoperability, the proposed blockchain architecture with decentralised ledger should be strategically interfaced with decentralised storage systems like the Interplanetary File Systems (IPFS) and Web3 (or Ethereum Swarm, the native base layer service of the Ethereum Web3 stack).To model the proposed blockchain-IoT system as a whole, with IoT representing nodes or users with different access levels and roles.

To implement the whole blockchain-based EHR/PHR solution that has been presented, using a blockchain platform or Ethereum service with flawless Smart Contract support, and to assess performance in terms of security, interoperability, scalability, etc.

BLOCK DIAGRAM

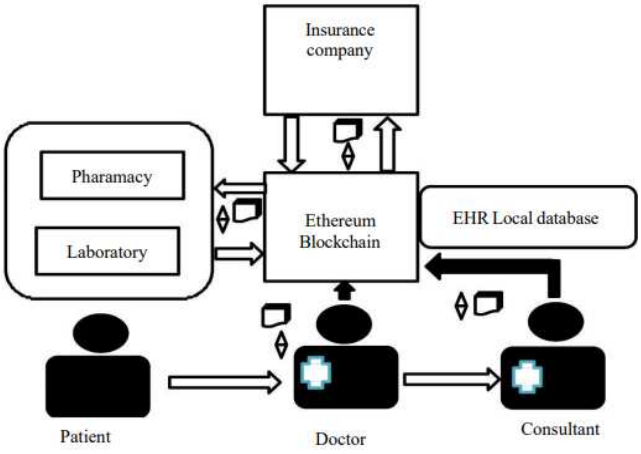

Figure 1: Block Diagram

Figure illustrates the handling of medical prescriptions by doing away with the lengthy waiting period process, eliminating the fraud component from the system, and lowering the error rate brought on by doctor misinterpretations. A prescription is written by a doctor for a patient and added to the patient's medical records using a smart contract. Once the primary physician and a patient have given authorization, the pharmacy can access this prescription via the Ethereumblockchain smart contract. After gaining access to the prescription, the pharmacy issues the medication along with its expiration date and dosage use, which are then added to the patient's medical records via smart contracts, and the medication is then ready for the patient to pick up. In general, the smart contract features organize patient happiness.A patient can avoid carrying the laboratory findings on their own or making arrangements for records to be transmitted to other healthcare providers by allowing their medical records to be put on the healthcare blockchain.

In order to give his patients the finest care possible, he also makes sure that all of his medical professionals have the information they need. The cost of printing, mailing, or faxing each test result to a single provider is reduced by laboratories.Additionally, labs and patients can access the healthcare blockchain and receive payments from insurance companies who advise the transferred information to process claims or from pharmaceutical companies that choose the information for use in considerations. Specialists and urgent care facilities have free access to comprehensive patient information, which reduces authoritative work and expenses.

Blockchain transactions in the system contain cryptographically signed management instructions for certain attributes. Only legal transactions that enforce data alternation are used by the state-transition functionalities of the contract to implement policies. As long as it can be computationally represented, these laws can be set up to enforce any set of guidelines governing a particular medical record. For instance, a policy can require receiving separate consent forms from patients and medical professionals before allowing a third party to examine information.

SOFTWARE REQUIREMENTS

Front end:

- React JS: React is a free and open-source front-end JavaScript library for building user interfaces based on UI components. It is maintained by Meta and a community of individual developers and companies.
- HTML: The HyperText Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets and scripting languages such as JavaScript.
- CSS: Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language such as HTML or XML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.

Back end:

- Node JS:Node.js is an open-source, cross-platform, back-end JavaScript runtime environment that runs on the V8 engine and executes JavaScript code outside a web browser, which was designed to build scalable network applications.
- Ganache :Ganache is a personal blockchain for rapid Ethereum and Corda distributed application development. You can use Ganache across the entire development cycle; enabling you to develop, deploy, and test your dApps in a safe and deterministic environment. Ganache comes in two flavors: a UI and CLI.
- Truffle frame work :Truffle is a world-class development environment, testing framework and asset pipeline for blockchains using the Ethereum Virtual Machine (EVM), aiming to make life as a developer easier. Truffle is widely considered the most popular tool for blockchain application development with over 1.5 million lifetime downloads.
- Metamask browser: MetaMask is a software cryptocurrency wallet used to interact with the Ethereumblockchain. It allows users to access their Ethereum wallet through a browser extension or mobile app, which can then be used to interact with decentralized applications.
- Node JS Libraries:Node. js is a single-threaded, open-source, cross-platform runtime environment for building fast and scalable server-side and networking applications. It runs on the V8 JavaScript runtime engine, and it uses event-driven, non-blocking I/O architecture, which makes it efficient and suitable for real-time applications.

IDE:

- VS Code :Visual Studio Code, also commonly referred to as VS Code, is a source-code editor made by Microsoft for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git.

WORK FLOW:

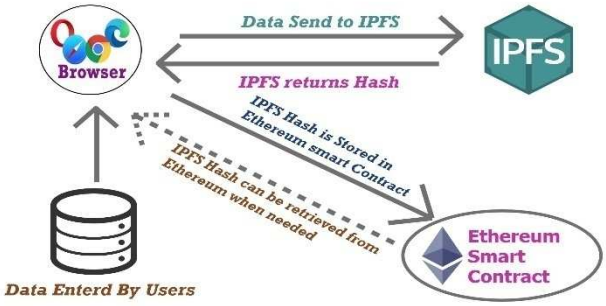

Figure 2 : Work Flow of D app

The administrator's role assignment would be the first activity, and it would include the role name and account address of the user to whom it was being assigned. For using the system, each user of the proposed system would have a role name and account address. Therefore, after the administrator assigns this demanding role, the name of the role and the account address are preserved in the roles list for further validation needs.The Admin function can only be if any others try to Access the function it throws a Error.!! Message.

The waiting lists for each specialty at each hospital are listed in each individual report. Where there are about five patients, individual confidentiality must be maintained.The figures have been combined under the title "Small Volume" for patients waiting in a specific speciality or facility. Data from a year's worth of monthly reports make up the entire document. speciality. Where there are less than five patients waiting in a particular speciality or hospital, the numbers have been combined under the category "Small Volume" to protect individual confidentiality.

ADVANTAGES

- Due to the decentralised nature of the ledger, it is impossible to commit a cyber crime against it because it requires simultaneous attacks on all copies kept throughout the network.
- The entire process is more quicker, more efficient, and less expensive owing to the simultaneous (peer-to-peer) sharing and updating of records.
- Light weight which uses less storage space and provide security using double encryption.

APPLICATIONS

- Security Secure patient data has both financial and legal ramifications, thus data privacy is particularly important.
- Infrastructure: Sharing data require a centralized data source which increases the security risk and requires trust to a single centralized authority.

RESULTS

All residents must get health and personal social services paid for by the public through the Health Service Executive. The usage of all the outpatient and inpatient waiting lists from various hospitals and departments in Ireland has been taken into consideration. The National Treatment Purchase Fund (NTPF), which oversees data collection through validation, manages the waiting lists for outpatient, inpatient, and day cases. The total number of people waiting for a first appointment at a consultant-led outpatient clinic across all time bands is listed in the waiting list report for OP. The waiting lists for each specialty at each hospital are listed in each individual report.

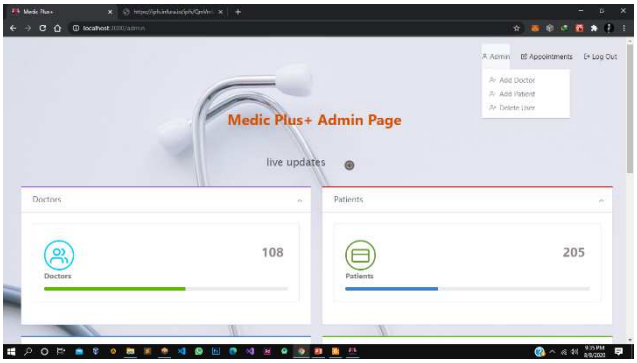

Figure 3: Home page of Dapp

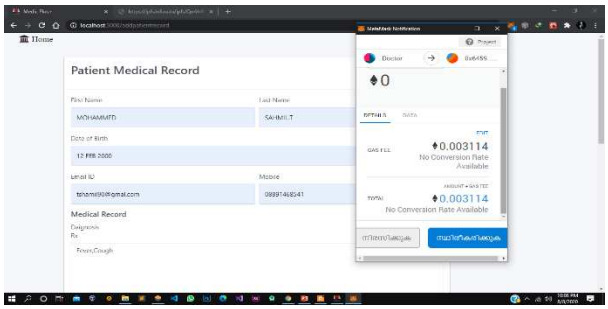

Figure 4 : Adding of data

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