ELECTRONIC HEALTH RECORD SYSTEM BY ADOPTING BLOCKCHAIN

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Abstract - *In today's world technology had vastly expanded and very improved in the almost overall possible working sector. Computers had taken place of paper works in offices, there more effective trained Artificial Intelligence to help humans work more effectively & made decision making a lot easier, clouds & centralized database systems had overtaken paper-based filing systems but the medical sector has lacked behinds in implementation of technology to hospitals & clinic.*

Even today hospitals keep paper-based health transcripts.

This corona pandemic had been very tough on all of us. Hospitals were crowed with covid parties and social distancing was an utmost priority the non-covid patients with chronic diseases like diabetes, heart problem, kidney problem, lungs disease, pregnant women were at a high risk towards Covid-19 virus as there were no available facilities of sharing their paper-based health transcript record without physical contact developing more chances of getting infected with Covid-19 virus.

Considering these crises and observing an urgent exigency for getting treatment without coming in contact with hospitals, we have designed an Electronic Health Record (EHR) accessing system. This EHR system will help patients to share their health care data with various different multiple healthcare facilities & with those health care data medical practitioners can do a thorough analysis and can write the medical check-up & prescriptions to the patients and even to those patients belonging to remote areas.

***Key Words*:- EHR, EMR, eHIE, MOH, Blockchain, Data sharing, Hashing Function, security.**

1. INTRODUCTION

EHR stands for "Electronic Health Record". EHR is nothing but an individual's real-time and patient-centered digital version of health record data. EHRs totally keep their focus towards patients' health, it is designed to collect and share health data with various health care providers, like medical laboratories, medical clinics, and specialists that means the EHR of a patient contains all the health information related to the patient from all different medical institutes involved in that patient's health care. EHRs are patient-centered rather than individual medical institute's health records it means that medical reports stored in a person's EHR can be shared with different hospitals, medical research institute, different doctors, nursing homes, even in other states or countries. EHRs contain patients' prospective, actual, meaningful data like patients' demography, medical histories, diagnoses, medication prescription, medical bills, administrative bills.

EHRs have proven more benefits over normal paper-based health records. For example,

I. In a fully functional EHRs, the patient can directly log in to their EHR and can access their medical report data from anywhere.

II. Maintaining paper-based health records is time-consuming, and in event of misplacement of paper medical records health checkups are to be done again, which will cost patients extra money. EHRs helps in the keeping of entire medical test records, bills, medication list, health checkup lists at one place and can be accessed by patient anytime.

III. Data stored in EHRs can be shared with different clinical research institutes, health care institutes for research purposes for training and developing decision-making support tools that will be helping in suggesting more precise medical tests, treatment, and effective medicines.

IV. EHRs have been proven to lower healthcare costs by preventing repeat testing and also proven to improve the institute's revenues.

V. Ease of workflow: with EHRs time taken in doing the paperwork can be reduced, filling out medical forms, processing/requesting of medical bills, by providing easier medical data documentation. Henceforth EHRs ultimately increase working efficiencies by saving a lot of valuable time for both patients as well as for doctors.

So we are making a patient-centric EHR system to counter the problem that emerged by paper-based health records. In this system, we will be using blockchain technology and hashing function for the faster and secure method for data retrieval and access.

2. BLOCKCHAIN & HASHING FUNCTION

2.1 Blockchain

The blockchain is a type of peer-to-peer, system that is used for recording information, it is a shared database that is different from the typical database. Blockchain is decentralized, most of the time open free platform for public and distributed

A blockchain is typically a form of digital ledger made of transactions that are duplicated and distributed throughout the entire blockchain's computer network system, which makes it nearly impossible to alter with stored data, hacking it, or cheating with the blockchain system.

For every occurring transaction, the blockchain records it as a "block", not like the typical database which usually stores data in tables. Each block is chained with its previous block, which makes data in blockchain to be chained together this securely linking of blocks is done to prevent any altering with data or any block to be added between two existing blocks. Each individual block in blockchain strengthens the verification of its previous block and ultimately the entire blockchain. It is also known as distributed ledger technology for its non-altering availability of data, once data is stored it can't be changed or deleted.

Thus, making blockchain trustful, secured, and time-efficient.

2.2 Type of Blockchain platform

2.2.1 IBM blockchain

The IBM blockchain platform is a very powerful open-source platform for blockchain development that supports 24x7x365 days of service level agreements (SLAs) solutions to the users. IBM is a commercial distributor of Hyperledger fabric, IBM creates a neutral terrain by using blockchain for multi-party integration hub. This blockchain system allows each user member to connect to the system and allow them to share data with complete transparency of what everyone had shared into the blockchain network.

2.2.2 Ethereum platform

Ethereum is a peer-to-peer, decentralized blockchain platform it is very best known for its native cryptocurrency known as "Ether", "Ethereum" or "ETH". Ethereum uses smart contracts in conjunction with blockchain chain technology that makes Ethereum more secure. Smart contracts are application code that is securely executed and verified by the network.

To use the Ethereum platform user have to sign transactions and must spend ether for the cost of processing transactions on the Ethereum network.

2.2.3 Hyperledger Fabric

Hyperledger Fabric is Linux's open-source blockchain platform. Linux Foundation started an umbrella project in December 2015 for open-source blockchains and related tools. Hyperledger project has received contributions from various tech giants like IBM, Intel, and SAP Ariba, these tech giants have supported the collaborative development of the Hyperledger project for the blockchain-based distributed ledger.

It consists of a set or group of nodes that all-together form a network, all nodes taking part in the formation of the network have their own identity. Hyperledger Fabric Certificate Authority (CA) is responsible for offering features for registering identities, Enrollment Certificates, and certificate renewal. Hyperledger is written in Go, Nodes.js, Java language to create transactions. The smart contract is also known as chaincode are there to perform managing task for the blockchain system. It uses an endorsement policy which is used for defining and designating the peers that will execute the transaction.

3. METHODOLOGY

We have used the Hyperledger fabric framework for creating our proposed EHR system application.

- Setting up Hyperledger fabric network framework will be our first step towards our proposed EHR system application.
- Hyperledger fabric will be going to work as the backend of our system application.
- With help of certain specific commands, the network will be set as" UP" which means now the network is ready to interact.
- Wallet, CA, channels, and gateways will be set up.
- A wallet is known as the set of user identities and with the help of MSP, both combined will help adding users to the system.
- On adding users to the system, CA will issue an 'X.509' type of certificate and the private key for interaction with the network.
- All uploaded data will be going to store in the wallet folder, hence after creating a file for registered users.
- EnrollAdmin(), RegisterPatient(), RegisterDoctor() function will be used for registering Admin, Patient and Doctor into the system application.

This proposed EHRs system application will help in solving paper-based health record problems by the establishment of

a smart contactless blockchain-based electronic health report.

An EHR framework solution centered on blockchain technology will be going to help the system store health records more securely and accessing of data more efficiently fast. Stakeholders such as: Patients, Doctors, Hospitals, Researchers institutes will have to request permission for accessing patient's electronic medical records.

4. IMPLEMENTATION

- We have made a responsive EHR website for registering patients and doctors.
- Every user (patient or doctor) will have to register themselves by filling in asked details and then hitting submit button.
- Private key and certificate generated by Certification Authority will be going to be stored in the individual wallet for each individual user.
- The user registration will be secured by email OTP verification. Each user will have to verify email OTP.
- After successful registration of patients and doctors, they both will be able to upload the medical document to the EHR system in PDF or PNG format.
- Doctors will have to ask for accessing permission from patients in case of emergency
- Our electronic health system application will be having mainly three participants: patients, doctors, and admin.

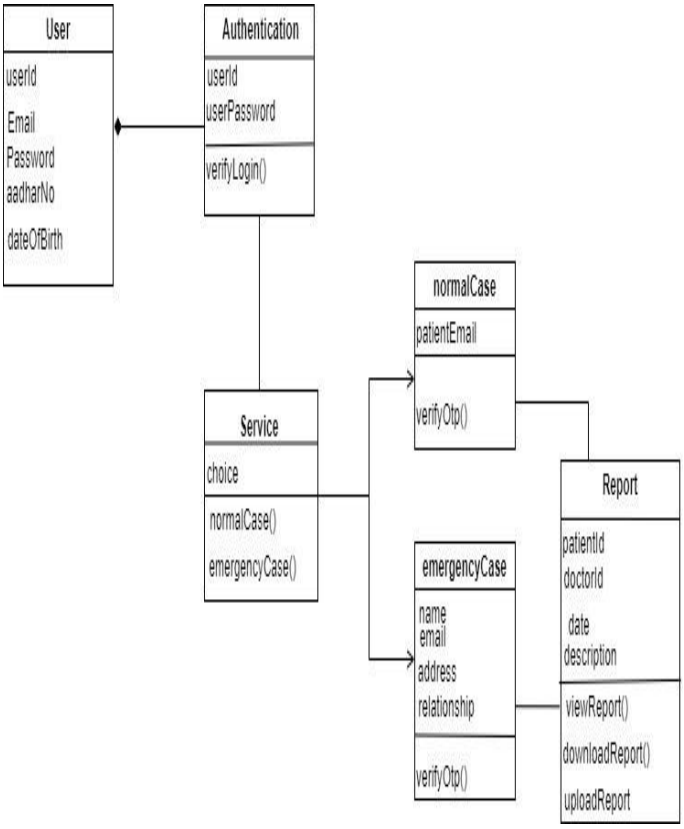

Fig -1: Case Diagram of working EHR system

5. CONCLUSION

We can conclude that adopting electronic health records over a paper-based medical record system is more effective, time-saving, cost-efficient, better patient care, on-time health transcript data sharing, helps in effectively tracking of a patient's clinical health record and electronic health record data had helped clinical research institute developing and training of effective decision-making tools, which ultimately enhance the patient's care by saving their time and money.

Using blockchain technology as a backend framework for electronic health record system application has ultimately made EHRs more secure and private. Blockchain framework gives high-integrity tracking of blocks which are very helpful in retrieving and validating medical bills.

6. FUTURE WORK

Electronic health record system has very great hope for the future, as everything is going digital electronic health record will be going to be very helpful to the medical sector by providing great oversights.

Our electronic health record system can be turned into a fully functional sophisticated electronic health care system, which will include stakeholders such as: laboratories, Insurance service providers, Pharmacies, and drug control departments for maintaining an undisturbed and trackable supply of medical goods.

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