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Blockchain-based security & privacy for biomedical and healthcare information exchange systems

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Abstract

Blockchain has become one of the most developing technologies in our country. Blockchain technology is a decentralized, distributed ledger that records the sources of digital assets. Electronic Medical Record (EMR) accommodates patient's medical history, which has been carried out by a Physician or Doctor in a particular clinic or hospital or Healthcare center. Whereas, Electronic Health Record (EHR) holds patient's entire health history, including immunization plans, diagnosis, lab reports, inoculation schedule, etc.,. This feature empowers the usage of Health IT in a more secure way with the amendment of blockchain technology. These records are maintained smart contract between the patient and the healthcare sector. In both EMR and EHR, the patient is the owner of his own data. This paper incorporates the features of blockchain technology to provide a collaborative work on Electronic Medical Records (EMRs) and Electronic Health Records (EHRs) and it concentrates highly in diabetes as it has a sharp magnification in current world. Though it is tedious to implement this EHR all over the country, this paper works for its implementation especially in the domain of diabetes.

Introduction

The significance of using EMR and EHR in today's health care system is to provide ownership to every patient for his/her medical data. EHR is an assimilated information model which can provide communication among different health care providers [1]. Basically, National health professionals will be working in different healthcare centers, which can be located in various locations. There is a possibility for them to share their patient's data with each other which leads to lack of security [2]. Current health care systems are using the ICT (Information and Communication System) mostly for registration and billing only. This traditional method must get overridden by the techniques developed method [3]. As we all know, blockchain technology provides robustness against data exposure and failure [4]. In blockchain, the basic way to provide security is through cryptographic techniques like encryption and decryption. Also, we have many features for data security and privacy of this technology. It is possible to merge blockchain technology with IoT and Machine Learning [5] to enlarge its functionalities to reach the peak of success. Generating an integrated

EMR and EHR facilitates an effective communication between patients and healthcare professionals. Additionally, there is no need for the patients to carry their health reports physically to hospitals whenever they go for checkups. Every report will be electronically documented under the patient's ID which can be utilized and updated during every visit [6]. Every system in a blockchain network will be termed as node. The data captured by a single node will be shared immediately with all the other nodes in the network along with the timestamp in order to preserve its security [7]. If a data in a single node is being modified, it seeks permission from all other nodes as per consensus mechanism, only then that corresponding change will be implemented or else it will be ignored [8]. These Electronic Medical Records and Electronic Health Records can be utilized for various purposes like storing, managing, transmitting, reproducing etc., with the acknowledgement of patients [9]. In paper [10], the author concentrated in an implementation of Electronic Health Records and interoperability confronts. Few papers focused on the concept of FAIR which defines findable, accessible, interoperable and re-usable to provoke health care's efficiency. Certain researchers have concentrated effectively on data protection and security, user support and citizen's adoption to use [11] in the real world in order to increase its familiarity among people. This collaboration in EMR and EHR brings out a tremendous improvement in our traditional health care system. It will be more tedious to implement these kinds of combinations in all the medical fields at a single instance. Hence this paper works on implementing EMR and EHR in the domain of diabetes. EMR integrated datasets have also been devised to surveillance the typical health condition of the victims with neuro-inflammatory demyelinating diseases, diabetic retinopathy (engendered from Diabetes), Cerebro-vascular diseases etc., [12]. By neglecting this diabetes, people will be prompted to the risk of getting affected by certain kind of diseases (Table 1).

Certain kind of diseases which can occur due to the ignorance of diabetes has been represented diagrammatically in Fig. 1. This paper synthesizes the features of Electronic Medical Record and Electronic Health Record in the domain of diabetes. EMR is the medical record of patients which will be available in a particular healthcare center. As we all know, EHR is collected from various EMRs. We can merge them together to make use of these data in a more beneficial way. Therefore, this database can hold all the information about the patients like his person details (like name, ID, height, weight, etc.), medical history, medication, allergies, immunization, inoculation schedule, diagnoses, laboratory test reports, along with the details of Clinician / Doctor and the healthcare center (Clinic or Hospital).

Section snippets

Materials and methods

This paper illustrates the review of various other research works carried out in healthcare sector. Through the information collected from the patients while consulting a Doctor at healthcare center, an EMR and EHR can be generated with an assistance of Blockchain technology. This technology uses certain consensus mechanisms like proof of stake, proof of work, proof of burn, smart contracts, byzantine fault tolerance, etc., which can be seen a little deeper.

(i) Proof of work (PoW)...

It is one of the...

Result

Swapping of anything between any mark-able parties can be administered with an assistance of Blockchain technology. It has extended its wings in all the fields. The transactions will be transparent, traceable, efficient and also effective to get investigated. Blockchain has variety of platforms like ethereum, hyperledger, ripple, hydrachain, etc., For example, hyperledger maintains certain features like privacy, confidentiality, chaincode functionality, modular design, and so on [17]. Few kinds ...

Discussion

In this paper, we have discussed about the integration of EMR and EHR with the help of blockchain technology with which the medical data can be kept more reliable and secure. This paper focuses particularly in the branch of Diabetes

as its cases are rapidly increasing throughout the world. Blockchain provides data transparency, immutability, reduces complexity, effective usage of resources, interoperability, etc., [22].

Every data in the blockchain will be kept encrypted, once after the storage...

Conclusion

With an insight to the digital health technologies, I have designed a blockchain based platform to overcome the difficulties of maintaining the health records securely. This integration of EMR and EHR using blockchain technology enriches our healthcare sector. We can also implement the collaboration of Internet of Things and Artificial Intelligence into blockchain technology for the betterment of healthcare sector in our country. With this collaboration, we can uplift the facilities of the...


Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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