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Towards A Secure Electronic Health Record System Using Blockchain

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Abstract: *Blockchain has emerged as a key technology for ensuring reliability and security in several application areas primarily including the healthcare sector. Blockchain is a distributed ledger where blocks of transactions are connected in a chain using the cryptographic hash function of the previous block, making it an append-only structure. Any modification on any of the blocks will generate different hash values in other blocks in a cascading manner and different link relations. In this way the blockchain achieves immutability and security. Blockchain also involves consensus mechanisms in order to ensure synchronization among blocks and agreement between existing nodes to add a new transaction in the chain. Healthcare data is highly sensitive in nature, which consists of private information related to the diagnosis and treatment of patients. In traditional approach these data are stored by each hospital separately where sharing data is very time consuming. Also, health data is very limited to access due to the risk of disclosure of sensitive information. In order to address these issues, the objective of this paper is to integrate blockchain technology with healthcare records/data in order to provide better sharing of data without the fear of data tampering or security breach*

Key Word*: Blockchain. Truffle Ethereum, Solidity.*

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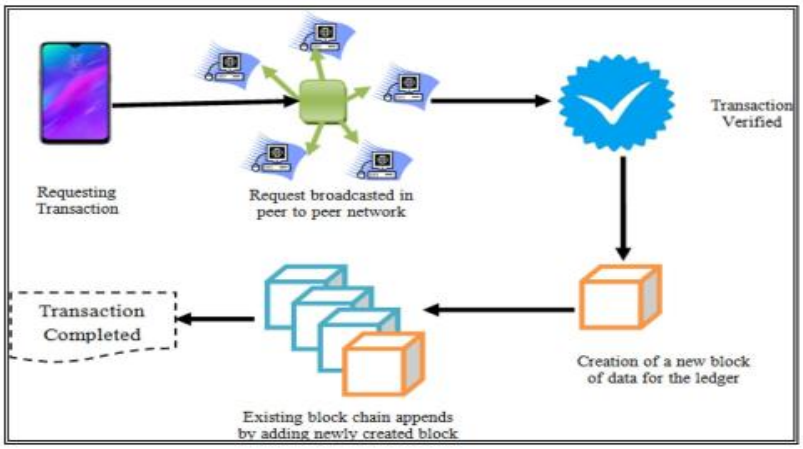
I. Introduction

The ongoing popularity of Blockchain technology is increasing day by day and the diversity associated with its application, helps in advancement of research in different scientific fields with social relevance. In Spite of being new and still in the experimental stage, the Blockchain is being considered as a pathbreaking solution, which addresses several modern concerns in the technological field like identity management, decentralization, data ownership, decisions driven by trust and data. Blockchain works on a distributed peer-to-peer system where every participating node receives a copy of the same data and acts upon the same set of rules. Blockchain is a distributed ledger in which new data is appended as a chain of blocks and it grows continuously. Protection of user security and maintenance of ledger consistency are taken care of by cryptographic functions and distributed consensus mechanisms. Big data refers to massive volumes of structured and unstructured data so large that it is difficult to process using traditional database or software techniques. Big data has 7 ‘V’ properties , that are Volume, Variety, Velocity, Variability, Veracity, Visualization and Value. Volume is about how large is the data in size. Velocity is the speed of accessing data. Variety is about heterogeneous sources and unstructured nature of the data. Variability says that the same data can have different meanings. Veracity is about the quality of data. Visualization consists of graphics, charts and other plots that help to understand the meaning of data and retrieve more details. And finally Value is about how data processing can be done to produce a meaningful outcome. Blockchain Technology can be used in several big data use cases like management of private/personal data, intellectual property resolution, supply chain management, IOT communication, healthcare etc.

II. Methodology



Blockchain gaining its popularity in almost all fields due to its inbuilt support for data integrity, reliability and data security. Healthcare records often contains sensitive information such as family diseases and if attackers hack this data then patient sensitive disease information will be leak/alter as existing application maintaining data in single centralized server and if this server hack or attack then server will not give any information.

To overcome from this issue author of this paper introducing Blockchain technology to manage healthcare records as this Blockchain will store all records as Blocks/transaction and then associate each block with unique Hashcode and maintain this information at multiple nodes or Blockchain Server.

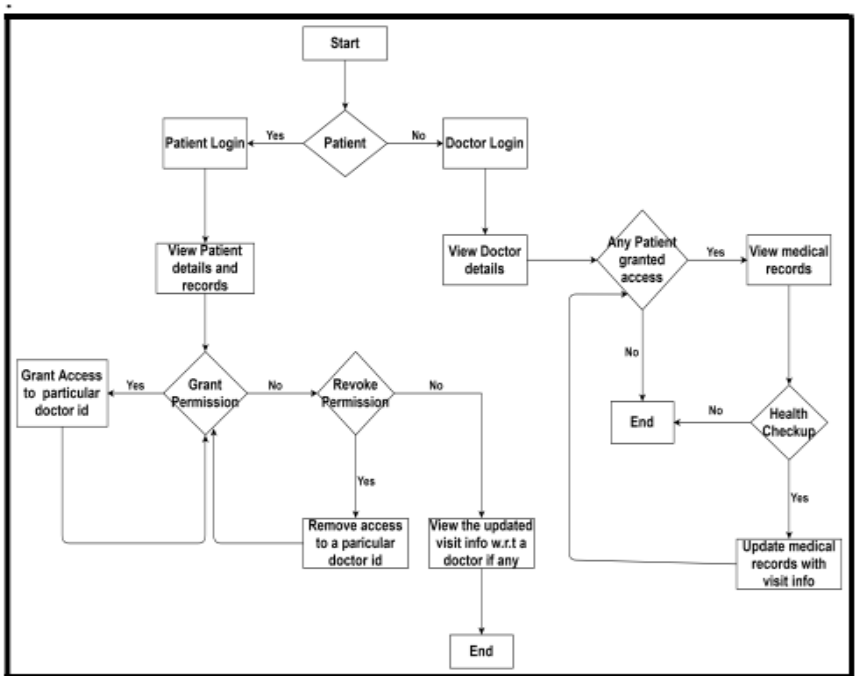
Modules

Admin Module: Admin can login to application by using username and password as 'admin'. After login admin can add new hospital and doctor details.

Doctor Module: Using this module doctors from various hospitals can login to application and then can view all patients reports who has given permission to access their reports who has given permission to access their reports. Admin will give login details to doctors.

Patient Module: Patient can signup and login to application and then can add their health report and disease details. They can select multiple hospitals to share their reports with those hospitals doctors

Flowchart



III. Result

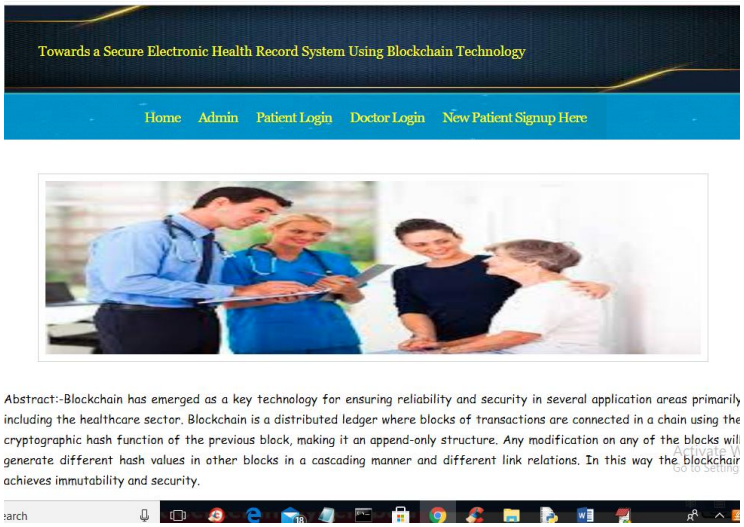


Figure 3.1 In above screen click on 'Admin' link to get below admin login scree

Figure 3.2 In above screen admin will add doctor and hospital details and then press submit button to save those details in Blockchain and get below output

Doctor Name	Password	Contact No	Email ID	Address	Qualification	Experience Details	Hospital Details
kartik	kartik	8887779198	kartik@gmail.com	hyd	MMBS Neuro Surgeon	10 years	Olive Hospitals
bansal	bansal	55556667776	bansal@gmail.com	Banjara Hills	MBBS Chest Physician	20 years	Appollo Hospital
srikanth	srikanth	6667775566	sri@gmail.com	hyd	MBBS Kidney Specialist	6 years	Krishna Hospitals

Figure 3.3 In above screen admin can view all doctor with hospital details and now logout and signup one patient

Figure 3.4 .In above screen patient signup completed and now click on 'Patient Login' to login as patient

Figure 3.5 In above screen you can see we are displaying "Prescription Details and Prescribed Doctor" and doctors has not given any prescription so its displaying 'Pending' and now doctor can click on 'Click Here' link to give prescription like below screen

IV. Discussion

The future work consists of two aspects. Basically the proposed system is a prototype to get a idea of functioning of blockchain while it is integrated with EHR. First thing is to add more participants like hospital, insurance service provider etc. Next thing is to scale up the system and maintain off-chain database so that the real prescription in the form of image etc. can be stored. Also search will be continued for a better blockchain like hybrid or layered to get leverage from it.

V. Conclusion

In this work an architecture and a methodology based to create an EMR system based on blockchain is proposed. Also the blockchain type that can be used for this purpose is identified with justification. And the proposed methodology is implemented using Hyperledger fabric and Hyperledger composer tools. Here patients can actively control his medical record. Also the security and privacy issues have been taken care of. The patient decides on who gets access to his/her medical records via doctorId and may revoke access permission for the same. On the other hand, the doctor may access the patient's medical history to read and analyse the patient's situation better, given all medical history logs are updated timely on the blockchain network. The doctor may update the current visit with prescriptions and medical procedures, if any, on blockchain. The limitations of the paper can be divided into three aspects mainly. Firstly the system is not scalable. Secondly the participants are limited to doctors and patients only. And finally the information to be stored by the database is very limited. Only some basic diagnosis information is considered and that also is only text based. The future work consists

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