KLE Society's
KLE Technological University

Blockchain and Distributed Ledgers Course Project Report

On

BLOCKCHAIN TECHNOLOGY IN HEALTH CARE MANAGEMENT SYSTEM

Submitted By

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ABSTRACT

Blockchain Technology has seen adoption to infinite domains, the health care sector is one of the major domains where there is a greater opportunity and advantage to leverage the benefits of distributed ledgers in storing and securing patient medical records. The Government of India (GoI) is also very keen on digitization in addition to their wider adoption of blockchain technology to serve the citizens by ensuring their privacy and security of personally sensitive information.

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1. INTRODUCTION

In this project, we propose a framework for the secure management of patient medical records (PMR) based on the Ethereum blockchain. To ensure a higher level of security and non-redundancy, the medical records are stored and maintained in distributed storage like InterPlanetary File System (IPFS); to ensure privacy, the patient's sensitive information is anonymized through a privacy-preserving scheme.

Major problem in India’s health care system is its very poor and sub-standard operations, management and implementation of medical facilities. A lack of proper health logs/record system of patients, a track of drugs and medication given, portability and security of data and inefficient implementation of govt schemes lead to higher health care cost and affects public health as a whole.

We address the problem by bringing blockchain into the picture. A digital health id system, which tracks and stores all the health care data of a citizen into the blockchain network.

PROBLEM STATEMENT

To Build a Blockchain Based Health Care Management System to Store Electronic Health Records and Validate Health records.

OBJECTIVES

- Configuring Ethereum blockchain and Ethereum wallet for transactions.
- Setting up IPFS to store documents and to generate Hash id.
- Writing smart contracts to store and manage Hash Id generated for healthcare records in Blockchain.
- Building a user interface to upload medical record files.
- Pushing the uploaded files to the IPFS server which generates the Hash Id.
- Deploy smart contracts.
- Verifying the documents.

2. LITERATURE SURVEY

[1] Kumar, Shivansh & Bharti, Aman & Amin, Ruhul. (2021). Decentralized secure storage of medical records using Blockchain and IPFS: A comparative analysis with future directions. Security and Privacy. 4. 10.1002/spy2.162.

As the patient's data is stored locally it is susceptible to denial of service attacks hence Blockchain and IPFS can help in storing data more securely. Since blockchain is a list of records governed by cryptography and are distributed ledgers Its advantages is it is immutable and uses digital signatures to authenticate users it also guarantees anonymity to real life identity. IPFS is used to store versioned file data in decentralized manner. Hence they provide secure healthcare storage solutions.

[2] Khatoon, Asma. 2020. "A Blockchain-Based Smart Contract System for Healthcare Management" *Electronics* 9, no. 1: 94. https://doi.org/10.3390/electronics9010094

Different medical workflows have been designed and implemented using the Ethereum blockchain platform which involves complex medical procedures like surgery and clinical trials. This also includes accessing and managing a large amount of medical data. Using blockchain technology, this smart-contract based health care management system has shown how decentralization principles can be applied in medical ecosystem for large-scale data management and to streamline complex medical procedures.

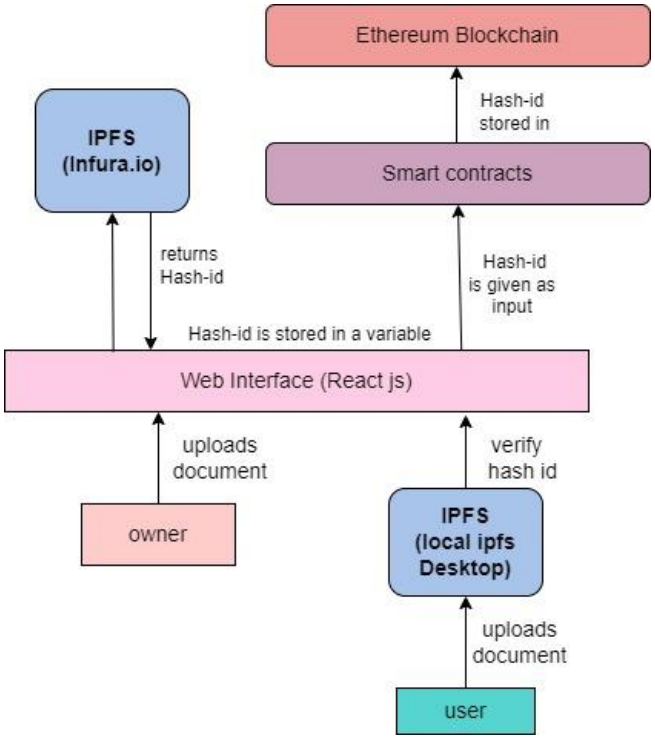
[3] Harshit Sunilkumar Singh et.al Health Monitoring and Analysis using IPFS and Blockchain.https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9318651&isnumber=9318603&tag=1

The highlight of this research is the use of two emerging paradigm changing technologies in the medical domain, which are Blockchain and IPFS. The use of these two technologies along with the architecture model suggested in this paper can efficiently reduce the problem of security breaches faced by most of the health record systems maintained by other countries.

[4] Gaganjeet Singh Reen et.al. Decentralized Patient Centric e-Health Record Management System using Blockchain and IPFS. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9066212&isnumber=9066105

The paper has proposed a mechanism which provides a solution to most of these problems. Using a permissioned Ethereum blockchain allows the hospitals and patients across the world to be connected to each other. This mechanism uses a combination of symmetric and asymmetric key cryptography to ensure the secure storage and selective access of records. It gives patients full control over their health records and also allows them to grant or revoke a hospital's access to his/her records. They have used IPFS(inter planetary file system) to store records which has the advantage of being distributed and ensures immutability of records. The proposed model also maintains the statistics of diseases without violating the privacy of any patient.

3. PROPOSED WORK



A simple App to upload a document to IPFS and then store the IPFS hash on the Ethereum blockchain. Once the IPFS hash number is sent to the Ethereum blockchain, the user will receive a transaction receipt. We will use the Create-React-App framework to make a front-end. This app works with any user that has Metamask installed in their browser.

The owner uploads the image on the web page. On submitting the image, the IPFS http client sends the image to the IPFS (The IPFS node being used is provided by infura.io). It returns the IPFS hash of the submitted image to the web page. This hash is then stored on the Ethereum Blockchain using web3 through smart contracts. The Block and transaction details can be viewed on Ganache (Ethereum Blockchain). Metamask is the Ethereum wallet which used to perform transaction i.e., storing the hash in Blockchain.

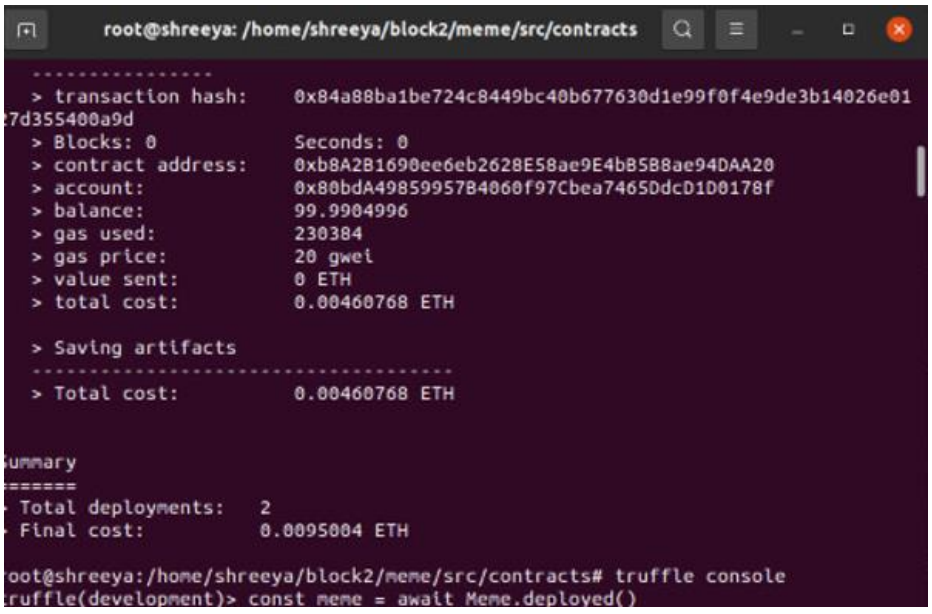
The user uploads the image which he wants to verify to IPFS desktop. And can compare the hash generated with the hash returned by the IPFS node in the web application.

4. RESULTS AND DISCUSSION

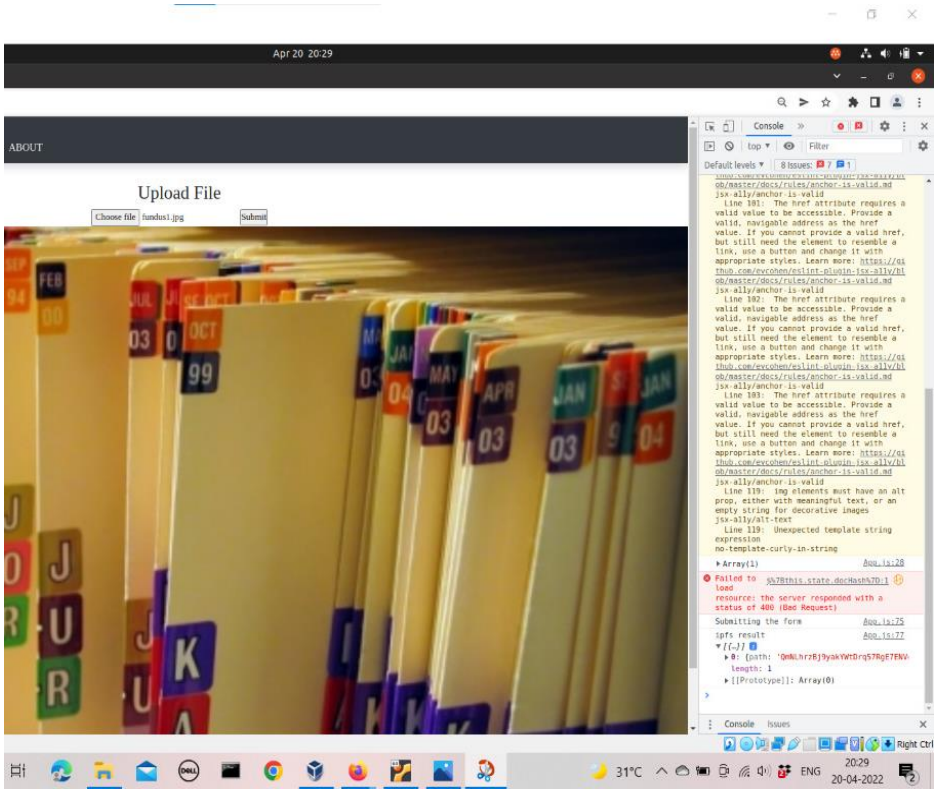
TOOLS USED

- Truffle: used to compile and migrate smart contracts.
- Ganache: is a personal blockchain for rapid Ethereum application development. Ganache enables us to develop and deploy DApps in a safe environment. It can be used to view the deployed contracts, transactions and account details.
- IPFS: The InterPlanetary File System (IPFS) is a distributed file system protocol and peer-to-peer network for storing and sharing data. In a global namespace linking all computing devices, IPFS uses content-addressing to uniquely define each file.
- React. js: is an open-source JavaScript library that is used for building user interfaces specifically for single-page applications.
- Metamask: MetaMask is a free web and mobile crypto wallet that allows users to store and swap cryptocurrencies, interact with the Ethereum blockchain ecosystem, and host a growing array of decentralized applications (dApps).

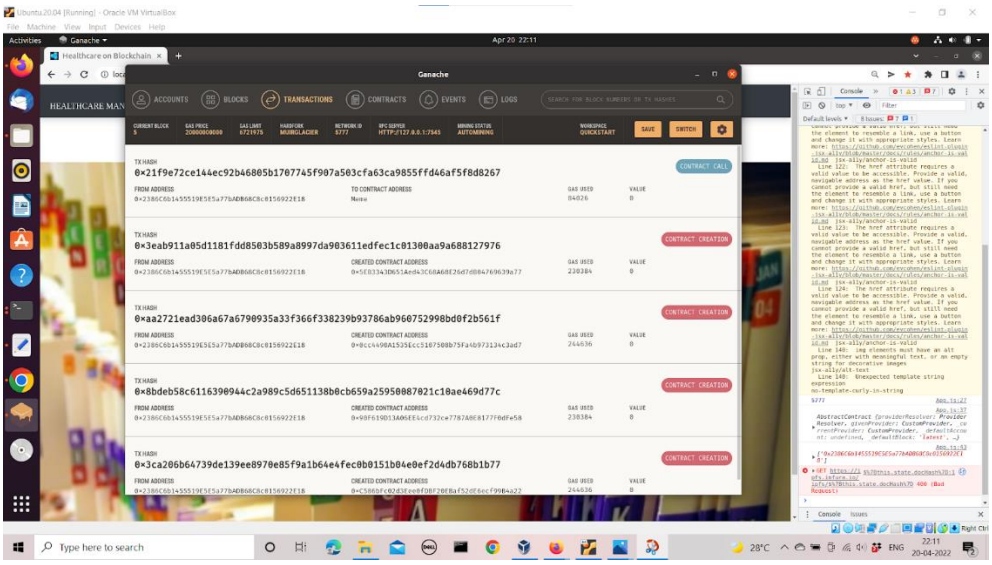
Configuring Ethereum blockchain and Ethereum wallet for transactions



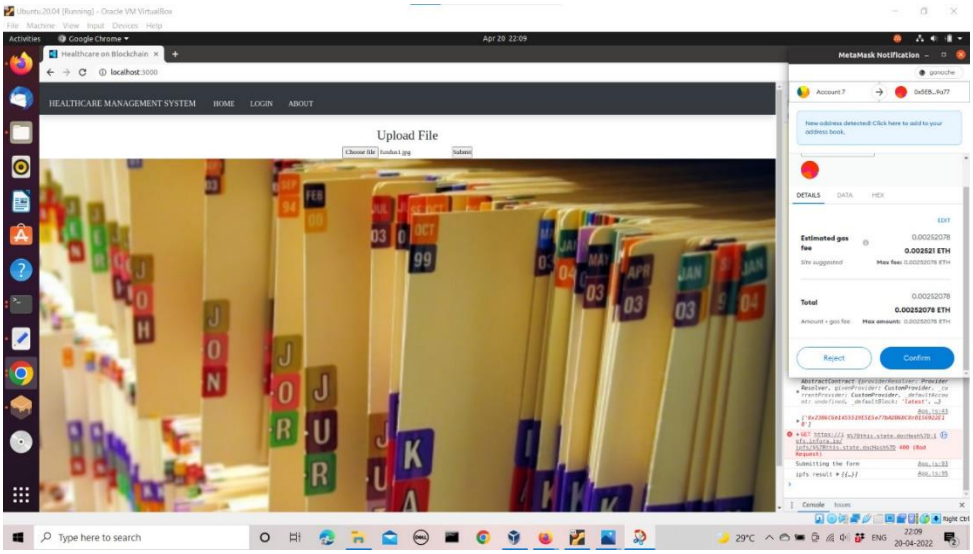
IPFS hash generated after submission of file.



Blocks created in Blockchain



Performing transaction in Metamask



5. CONCLUSION

Blockchain gives upmost security and privacy to the patient’s data. Patients should not have to be worried about carrying whole set of documents or no one including patient alters the data or deletes it once uploaded. Blockchain is replicated on several nodes. IPFS is a file sharing system that can be used to store and transfer large files more effectively. It is based on cryptographic hashes, which can be stored easily on a blockchain. Cost can be reduced by this technique and hence provide security to the files. Proposed system is developed with the help of Ethereum blockchain which stores patient‘s related data on IPFS. Use of IPFS increases its capability to store large amount of data. In future system can also arrange appointments, bookings, payments and insurance.

6. REFERENCES

[1] Dimitrov DV. Blockchain Applications for Healthcare Data Management. *Healthc Inform Res*. 2019;25(1):51-56. doi:10.4258/hir.2019.25.1.51

[2] G. S. Reen, M. Mohandas and S. Venkatesan, "Decentralized Patient Centric e- Health Record Management System using Blockchain and IPFS," *2019 IEEE Conference on Information* and *Communication Technology*, 2019, pp. 1-7, doi: 10.1109/CICT48419.2019.9066212

[3] Kumar, Shivansh & Bharti, Aman & Amin, Ruhul. (2021). Decentralized secure storage of medical records using Blockchain and IPFS: A comparative analysis with future directions. Security and Privacy. 4. 10.1002/spy2.162.

[4]https://www.ijiccn.com/images/files/vol2-issue1/Implementation-of-Ethereum-Blockchain-in-Healthcare-Using-IPFS.pdf

[5] https://www.mdpi.com/2227-9032/9/6/712/pdf