DAYANANDA SAGAR UNIVERSITY

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Bachelor of Technology
in
COMPUTER SCIENCE AND ENGINEERING

Major Project Phase-I Report

(Secured Patient Diagnostic Reports Storage and Access in Healthcare System using IPFS and Blockchain)

Batch:

By

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(2023-2024)

DAYANANDA SAGAR UNIVERSITY

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CERTIFICATE

This is to certify that the Major Project Stage-I work titled **"Secured Patient Diagnostic Reports Storage and Access in Healthcare System using IPFS and Blockchain "** is carried out by **Ujjwal (ENG20CS0391), U V Nikhil kumar reddy(ENG20CS0392),** V V N **Vignesh (ENG20CS0394), Y Ikshwak varma (ENG20CS0415),** bonafide students seventh semester of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering, during the year **2023-2024**.

Ms. Navya Damodar	**Dr. Girisha G S**	**Dr. Udaya Kumar Reddy K R**
Assistant/Associate/ Professor Dept. of CS&E, School of Engineering Dayananda Sagar University Date:	Chairman CSE School of Engineering Dayananda Sagar University Date:	Dean School of Engineering Dayananda Sagar University Date:

Name of the Examiner **Signature of Examiner**

1.

2.

DECLARATION

We **Ujjwal (ENG20CS0391), U V Nikhil kumar reddy(ENG20CS0392),** V V N Vignesh **(ENG20CS0394), Y Ikshwak varma (ENG20CS0415)** are students of eighth semester B. Tech in **Computer Science and Engineering**, at School of Engineering, **Dayananda Sagar University**, hereby declare that the Major Project Stage-I titled **"Secured Patient Diagnostic Reports Storage and Access in Healthcare System using IPFS and Blockchain"** has been carried out by us and submitted in partial fulfilment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2023-2024.**

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Abstract

The proposed healthcare framework seeks to overcome privacy challenges associated with the centralized storage of medical data by introducing a distributed off-chain model using IPFS (Interplanetary File System) and blockchain technology. In the current centralized system, storing sensitive patient information poses risks of unauthorized access and data misuse. The suggested solution involves decentralizing data storage across a network of nodes using IPFS, enhancing security and accessibility.

The integration of blockchain ensures a tamper-resistant and transparent ledger for recording medical transactions, providing an immutable record of patient data. Smart contracts are employed to manage access control, allowing only authorized entities such as healthcare providers access to specific information. This framework not only addresses privacy concerns but also ensures consistency, integrity, and availability of medical data, ultimately fostering a more secure and efficient healthcare information management system.

CHAPTER 1

INTRODUCTION

The healthcare industry generates large volumes of medical data that need to be stored, disseminated, and accessed daily. For instance, medical data gets created when a patient undergoes medical tests such as computerized tomography, CT-SCAN, and X-Ray. Another source of these data is when a doctor issues a prescription. A patient’s medical information must be stored in such a way that it is accessible by the physicians in other hospitals within the network when the need arises. However, this information must be kept private. Moreover, it should be immutable.

The requirement of transparent process for storing medical records demands a structure where data can be easily maintained and accessed. The blockchain technology provides a decentralized storage scheme, wherein a patient's medical record (viz., diagnostic report, patient personal information, doctor's prescription and so on) can be shared easily among the peers (hospitals or doctors) in a healthcare system. This technology ensures various features such as privacy, immutability, integrity, and consistency which are important requirements in a modern healthcare system. A blockchain consists of a list of blocks of transactions which are linked with the help of cryptographic hash thereby ensuring the immutability of the transactions (medical records). The details of medical records of a patient including past and present ailments can be efficiently stored in the blockchain network and can be disseminated among the peers. The structure of the blockchain network makes every record transferable, permanent and easily accessible. However, in order to maintain these large volumes of medical records, there is a need of a distributed storage (off-chain) system with a peer-to-peer structure. Moreover, the system must provide persistent storage of records.

1.1. Overview:

The proposed healthcare framework presents a solution to the privacy challenges inherent in the centralized storage of medical data. Currently, with a centralized model, there are significant concerns about unauthorized access and potential misuse of patients' sensitive information. In response to these issues, the framework advocates for a decentralized off-chain storage approach utilizing two key technologies: IPFS and blockchain.

IPFS Integration:

The adoption of IPFS introduces a decentralized and distributed file system. Unlike traditional centralized models, where data is stored on a single server, IPFS distributes medical data across a network of nodes. This decentralization enhances data security by minimizing the risk of a single point of failure. Additionally, IPFS employs content-based addressing, ensuring efficient data retrieval. This means that medical information can be easily accessed while maintaining a robust and secure storage structure.

Blockchain Technology:

Blockchain is employed as a foundational technology to establish a tamper-resistant ledger for recording transactions related to medical data. Each transaction, encompassing activities such as updates to diagnostic reports or prescriptions, is securely recorded as a block within the blockchain. The immutability of the blockchain ensures data integrity, reducing the risk of unauthorized alterations or data manipulation.

1.2. AIM

The aim of the proposed healthcare project is to enhance the security, privacy, and efficiency of medical data management by transitioning from a centralized storage model to a decentralized one.

1.3. SCOPE

The project's scope involves a comprehensive transformation of medical data management, transitioning from a centralized to a decentralized model using IPFS for distributed storage. Blockchain technology is integrated to establish a tamper-resistant ledger, ensuring the integrity of medical transactions, while smart contracts manage access control for authorized entities. The scope encompasses robust user authentication, interoperability with existing systems, scalability to accommodate growing data and users, and stringent security measures. Additionally, the project includes training programs for healthcare professionals, adherence to regulatory compliance, thorough testing procedures, continuous monitoring, and a structured maintenance plan. Comprehensive documentation will be provided to facilitate effective system management and troubleshooting, ensuring a holistic approach to enhancing security, privacy, and efficiency in healthcare information management.

CHAPTER 2
PROBLEM DEFINITION

The healthcare industry electronically maintains medical data which includes patients' information such as patients' personal information, diagnostic reports, and doctor prescriptions. However, the centralized storage model is currently used for storing such sensitive information. One main disadvantage of the centralized model is the difficulty in preserving user privacy. Threats relating to user (patient) privacy include unauthorized access of critical information such as identity details and diseases from which a patient is suffering, and misuse of patients' data and their medical reports.

CHAPTER 3
LITERATURE REVIEW

1. Implementation of Ethereum Blockchain in **Healthcare** Using IPFS

Author: Neha Rauta, Dr. Kamal Shah

The authors propose a system for storing and sharing patient health records using Ethereum blockchain and IPFS. The system uses Ethereum smart contracts to manage access to the patient records, and IPFS to store the records themselves.

The proposed system provides a number of advantages over traditional methods of storing and sharing patient health records, including, Increased security, privacy and Enhanced efficiency

2. Decentralized secure storage of medical records using Blockchain and IPFS: A comparative analysis with future directions

Author: Ruhul Amin, Aman Kumar Bharti

The author presents a detailed study of IPFS and blockchain-based healthcare secure storage solutions. The study analyzes the existing solutions and their architecture, which will further facilitate the future research and development of emerging IPFS and blockchain technologies.

This paper provides a comprehensive overview of the current state of the art in using IPFS and blockchain to secure medical records storage.

3. A survey: medical health record data security based on interplanetary file system and blockchain technologies

Author: Alkaabi, Rana Abbas

The author surveys existing research on the use of IPFS and blockchain technologies to secure medical health record data. The survey highlights the benefits of using these technologies, such as improved security, privacy, and integrity.

This survey provides a comprehensive overview of the current state of the art in using IPFS and blockchain to secure medical health record data.

4. Distributed Off-Chain Storage of Patient Diagnostic Reports in Healthcare System Using IPFS and Blockchain

Author: Randhir Kumar and Marchang

The authors propose a framework for distributed off-chain storage of medical data using IPFS and blockchain technology. The framework preserves patient privacy while facilitating easy access of medical data by authorized entities such as healthcare providers..

This framework provides a secure and efficient way to store and share patient diagnostic reports.

CHAPTER 4
PROJECT DESCRIPTION

4.1 Design Consideration

In the project design utilizing Ganache, Ethereum smart contracts are developed in Solidity and deployed to the local blockchain provided by Ganache for testing and development. A user interface is designed using HTML, CSS, and JavaScript to interact with these smart contracts. Web3.js is integrated to facilitate communication between the user interface and the Ganache blockchain. Ganache is configured to meet project requirements, and comprehensive unit tests are written and executed on the local blockchain. The final smart contracts can be deployed to the live Ethereum network, but ongoing development and testing can continue leveraging Ganache's controlled environment. Security considerations, including best practices for smart contract development, are implemented, and documentation is maintained to ensure clarity and continuity in the project.

4.2 System Architecture

The architectural configuration procedure is concerned with building up a fundamental basic system for a framework. It includes recognizing the real parts of the framework and interchanges between these segments. The beginning configuration procedure of recognizing these subsystems and building up a structure for subsystem control and correspondence is called construction modeling outline and the yield of this outline procedure is a portrayal of the product structural planning. The proposed architecture for this system is given below. It shows the way this system is designed and brief working of the system.

4.3 Flow diagram

A flow diagram is a way of representing a flow of data through a process or a system (usually an information system). The FD also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow, there are no decision rules and no loops.

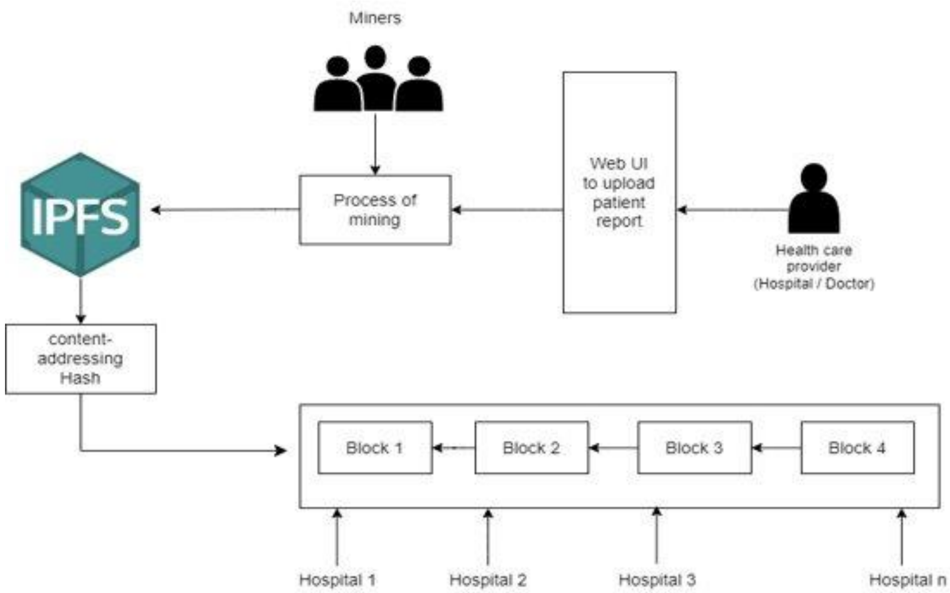

Figure 1 Level 0 High level design

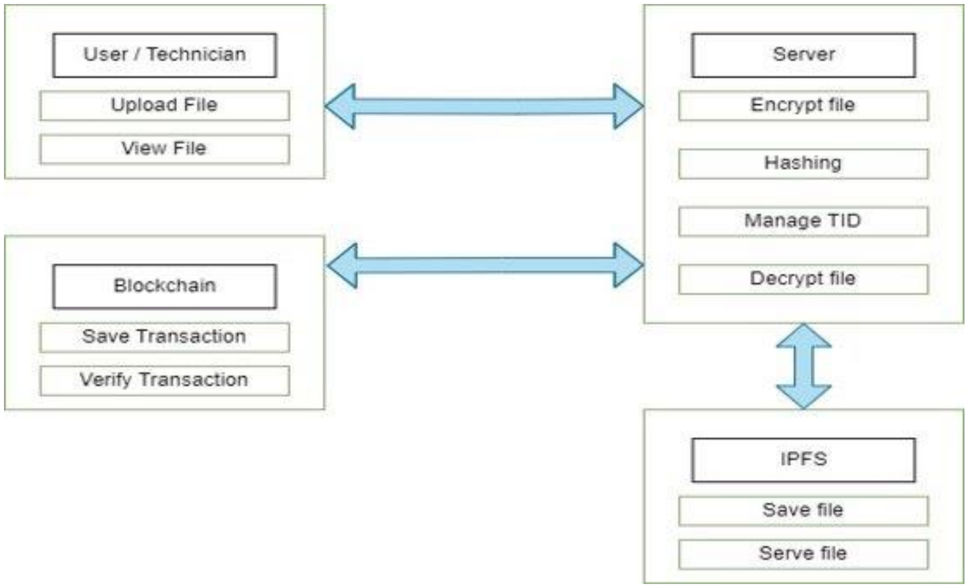

Figure 2 Level 1 Architecture

4.4 Sequence diagram

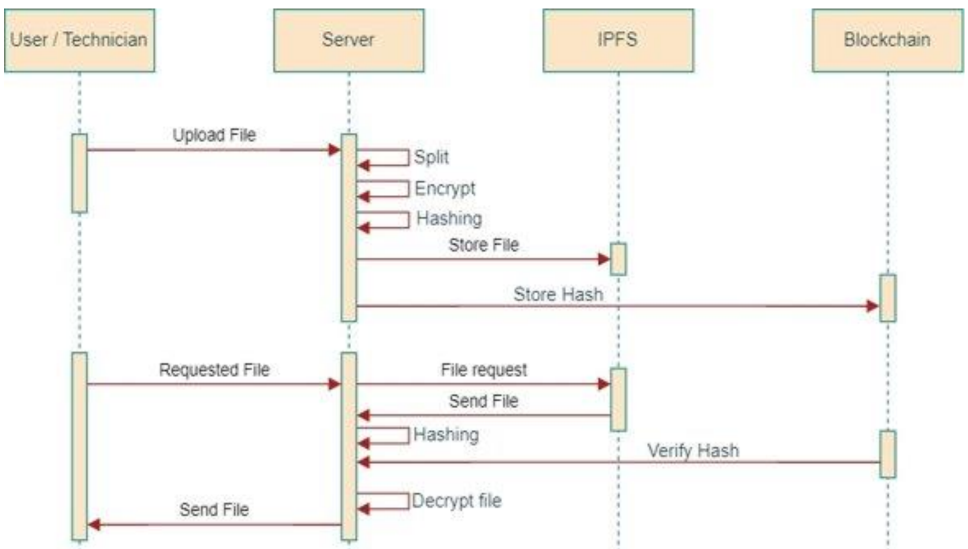

Figure 3 The working

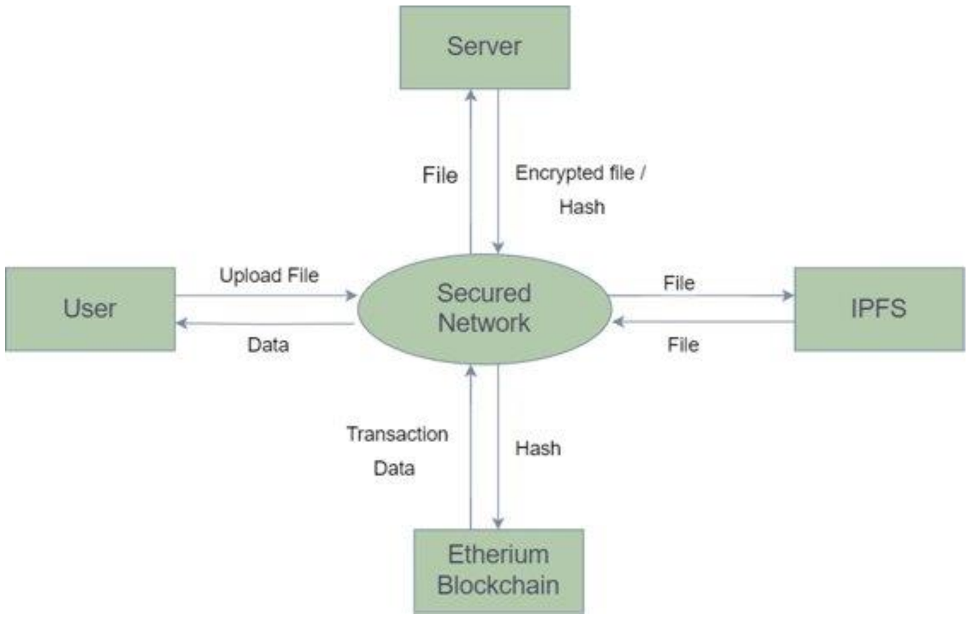

Figure 4 Data flow diagram

CHAPTER 5
REQUIREMENTS

5.1 Requirement Specification

5.1.1 Hardware Requirements

1. Processor: i5
2. RAM: 8 GB
3. Hard Disk: 400GB
4. Processor Speed: 2.4GHZ
5. System Type: 64-bit
6. Node MCU
7. DC Motor
8. H-Bridge L298 Driver
9. Ultrasonic Sensor
10. Battery

5.2 System Requirements

5.2.1 Functional Requirement

- **User Registration and Authentication**
    - User Registration: Healthcare providers (e.g., hospitals, doctors) must be able to register on the consortium network to obtain a Proof-of-Identity (PoI) or Registration-ID.
- **Data Upload**.
    - Healthcare providers should have the capability to upload patient diagnostic reports using a web user interface.
- **Mining Process**

- The system should implement a mining process using proof-of-work (PoW) to validate transactions and maintain network consistency.

- **Transaction Verification and Block Creation**
  - Miners should be able to verify transactions by comparing them with their local copies
- **IPFS Integration**
  - The system must integrate with the Interplanetary File System (IPFS) for distributed off-chain storage.
-

CHAPTER 6
DELIVERABLES

The deliverables for the blockchain project encompass the development and testing of smart contracts, creation of a user-friendly frontend application, successful integration of IPFS for decentralized off-chain storage, configuration of Ganache settings for local testing, comprehensive documentation covering functionalities and deployment procedures, implementation of robust testing artifacts, and the application of security measures throughout the system to ensure the confidentiality and integrity of healthcare information.

Conclusion:

In conclusion, the blockchain project, centered around decentralized healthcare information management, presents a holistic solution leveraging Ethereum, IPFS, and smart contracts. The implementation of Ethereum smart contracts ensures tamper-resistant and secure record-keeping, while IPFS integration enhances data distribution and accessibility. The local testing environment provided by Ganache facilitates rigorous testing, ensuring the reliability of the system. The user-friendly frontend application streamlines interactions, making healthcare data management more efficient. Comprehensive documentation and robust security measures contribute to the project's transparency and data integrity. This innovative approach not only addresses privacy concerns associated with centralized models but also establishes a secure, transparent, and efficient system for healthcare information management. .

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