BLOCKCHAIN BASED MEDICAL RECORD

SHRAWANI RAVINDRA BAMBLE, TANVI RAJESH TANGADE, PRANITA SUNIL DIXIT

JSPM's Jayawantrao Sawant Polytechnic, Pune Survey No. 58, Indrayani Nagar, Handewadi Road, Hadapsar, Satav Nagar, Hadapsar, Pune, 411028, Maharashtra , India.

Email id :- bambleshrawani@gmail.com, tanvi.tangade@gmail.com , pranitadixit3@gmail.com , stdeokate_comp@jspmjspoly.edu.in

Guide Name :- MS.P.A.Garad

HOD Name :- Ms.Z..S.Sajjade

ABSTRACT: *In traditional healthcare systems, medical records are stored in centralized databases which are vulnerable to data breaches, unauthorized access, and data manipulation. Patients often face difficulty in accessing and sharing their medical history across hospitals. To overcome these challenges, this paper presents a Blockchain Based Medical Record.*

The proposed system uses blockchain technology to securely store and manage patient medical records in a decentralized manner. Each medical record is stored as a block containing encrypted patient data and a unique hash value. Only authorized users such as doctors and hospitals can access the records using proper authentication.

The system ensures data integrity, transparency, and security while giving patients control over their medical information. This solution improves trust, reduces fraud, and enhances healthcare data management.

KEYWORDS: Blockchain, Medical Records, Decentralization, Data Security, Hashing, Healthcare System, Smart Contracts

1. INTRODUCTION

With the rapid growth of digital healthcare systems, secure storage and sharing of medical records has become a major concern. Traditional centralized databases are prone to hacking, data tampering, and single-point failure issues.

Blockchain technology provides a decentralized and tamper-proof solution where data is stored in blocks connected through cryptographic hashes. Once data is added to the blockchain, it cannot be modified without altering the entire chain, making it highly secure.

This project proposes a Blockchain Based Medical Record System where patient records are securely stored, verified, and accessed through blockchain technology. The system improves data privacy, integrity, and transparency in healthcare management.

2. FIRST-ORDER HEADING

System Architecture Overview :-

The Blockchain Based Medical Record Management System consists of four major modules: User Module, Record Management Module, Blockchain Module, and Security & Authentication Module. These modules work together to securely store, manage, and verify patient medical records.

The system allows patients and doctors to interact through a web interface. Medical records entered into the system are converted into blocks and linked together using cryptographic hashing. Each block contains patient data, timestamp, and the hash of the previous block. This ensures data integrity and prevents unauthorized modification. When a new record is added, it is verified and appended to the blockchain.

2.1 SECOND-ORDER HEADING
User Module

The User Module is responsible for handling patient and doctor interactions with the system. It includes user registration, login authentication, and role-based access control.

Patients can create accounts and upload their medical records. Doctors can log in and access patient records only if they are authorized. This module ensures that only verified users can interact with the medical data stored in the system.

2.2.1. THIRD-ORDER HEADING
Blockchain and Data Processing

The Blockchain Module acts as the core processing unit of the system. When a medical record is entered, the system processes the data and generates a cryptographic hash using the SHA-256 algorithm.

Each block contains:

- *Patient medical record details*
- *Timestamp*
- *Previous block hash*
- *Current block hash*

The system compares and verifies hash values before adding a new block to the chain. If any data is altered, the hash changes, making tampering easily detectable. This ensures data immutability and transparency.

FOURTH-ORDER HEADING
Security and Access Control System

The Security and Access Control Module enables secure communication and protection of medical records. Technologies such as encrypted passwords, secure login sessions, and role-based permissions are used to safeguard data.

The system ensures:

- Only authorized users can view records
- No previous medical record can be modified
- Data integrity is maintained through blockchain validation

Users can access the system through a web-based interface, and secure communication protocols ensure safe data transmission between client and server.

3. METHODOLOGY

The development of the Blockchain Based Medical Record Management System follows a structured methodology. Initially, a secure web-based platform is developed where

patients and doctors can register and log in. The system allows patients to enter medical details such as diagnosis, prescription, and treatment history.

When a new medical record is added, the system generates a cryptographic hash using the SHA-256 algorithm. Each record is converted into a block containing the medical data, timestamp, and the hash of the previous block. This ensures that all records are linked together securely.

The generated block is verified and then appended to the blockchain. If any attempt is made to modify previously stored data, the hash value changes, immediately indicating tampering. The entire system operates in a decentralized and secure manner, ensuring data integrity, transparency, and patient privacy.

4. MATERIALS AND METHODS

Materials

• **Node.js (Backend development)**
• **Express.js (Server framework)**
• **MongoDB (Database storage)**
• **SHA-256 Hashing Algorithm**
• **Web Browser (User interface access)**
• **Computer System (Development & Testing)**

Methods

1. The working of the system includes the following steps:
2. User (patient/doctor) registers and logs into the system.
3. Patient enters medical record details through the web interface.
4. The system processes the data and generates a SHA-256 hash value.
5. A new block is created containing:
    o Medical record data
    o Timestamp
    o Previous hash
    o Current hash
6. The block is added to the blockchain database after verification.
7. Authorized doctors can view records, but previous data cannot be modified.

Module Name	Input	Output	Processing Method & Technology Used	Real-Time Support
User Module	User details	Login access	Express.js Authentication	Yes
Record Module	Medical data	Record entry	Node.js Backend Logic	Yes
Blockchain Module	Record data	Hashed block	SHA-256 Algorithm	Yes
Database Module	Block data	Stored blockchain	MongoDB	Yes

Material Type	Tools / Components	Purpose
Software	Node.js / Express.js	Backend server processing
Database	MongoDB	Stores blockchain records
Security	SHA-256 Algorithm	Generates unique hash for each block
Interface	Web Browser	User interaction and record access
Development Tool	VS Code	Coding and system development

How the system works
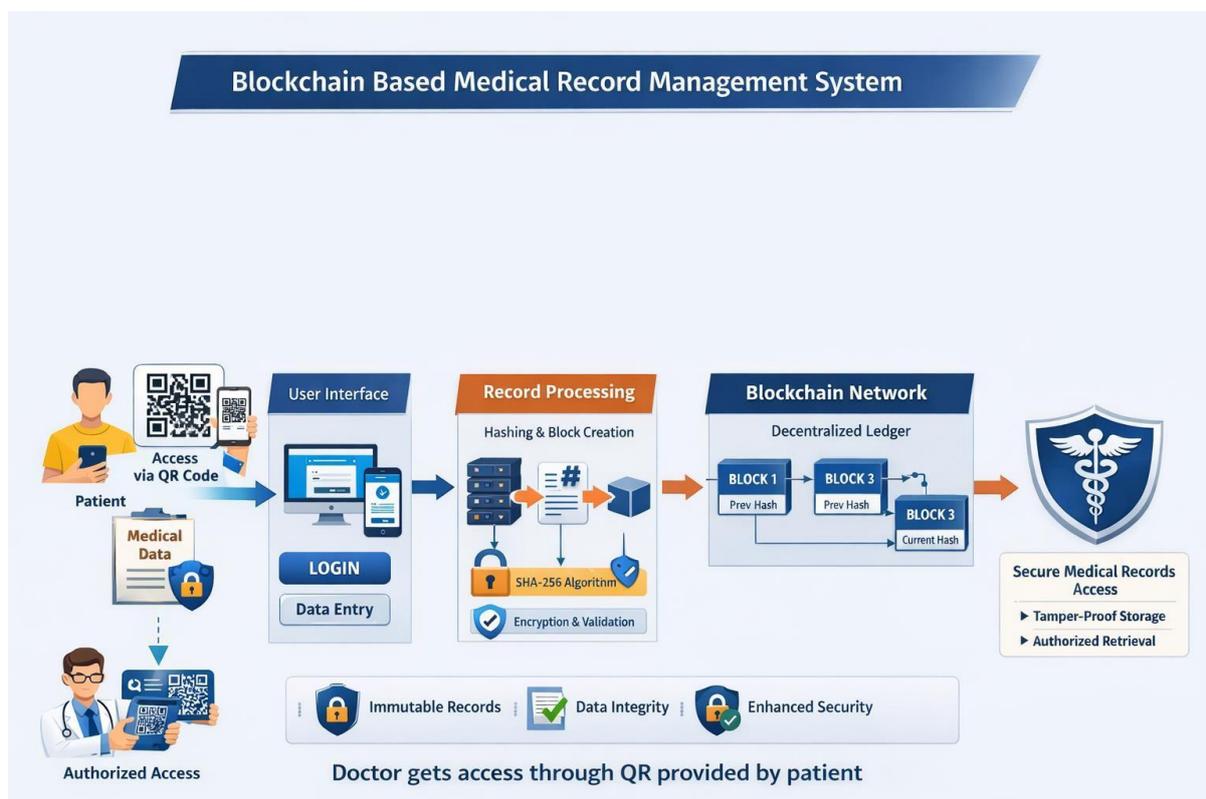
5. RESULT AND DISCUSSION

The Blockchain Based Medical Record Management System was successfully tested under various operational conditions. The system accurately stored patient medical records as individual blocks within the blockchain. Each newly added record generated a unique SHA-256 hash value, ensuring data integrity and immutability.

During testing, attempts were made to modify previously stored records. The system successfully detected tampering through hash mismatch, proving the reliability and security of the blockchain mechanism. Record retrieval by authorized doctors was performed efficiently without affecting previous blocks.

The results demonstrate that the system effectively enhances medical data security, prevents unauthorized modification, and ensures transparency. Compared to traditional centralized database systems, the blockchain-based solution offers improved trust, stronger data protection, and better control for patients over their medical records. The system is reliable, secure, and scalable for integration with larger hospital networks in the future.

6. CONCLUSION

The Blockchain Based Medical Record Management System provides a secure and decentralized solution for storing and managing healthcare data. By integrating blockchain technology, cryptographic hashing (SHA-256), and role-based authentication, the system ensures data integrity, privacy, and transparency.

Unlike traditional systems where data can be altered or hacked, blockchain ensures immutability of records. This enhances trust between patients, doctors, and healthcare institutions. The proposed system reduces the risk of data breaches and improves the efficiency of medical data sharing.

Future enhancements may include:

- *Smart contract integration for automated access control*
- *Cloud-based blockchain deployment*
- *Mobile application integration*
- *AI-based medical record analytics*
- *Integration with national healthcare databases*

The system represents a modern, secure, and scalable approach to digital healthcare management.

7. REFERENCE

1. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System", 2008.

2. IEEE, "Blockchain Technology for Healthcare Applications", IEEE Access Journal.

3. MIT Media Lab, "MedRec: Using Blockchain for Medical Data Access and Permission Management."

4. Xia, Q., Sifah, E.B., et al., "MeDShare: Trust-Less Medical Data Sharing Among Cloud Service Providers via Blockchain."

5. Kuo, T.T., Kim, H.E., Ohno-Machado, L., "Blockchain Distributed Ledger Technologies for Biomedical and Healthcare Applications."

6. IBM, "Blockchain in Healthcare: Secure Medical Data Management."