MediChain-Empowering Healthcare with Secure, Transparent, and Patient-Controlled Data.

PHASE 3- Final Report & Submission

College Name: VIT BHOPAL UNIVERSITY

Name: Hardik Gupta(22BCE11278)

Objective of the Project:

The objective is to finalize and deploy a secure, decentralized medical record management system using blockchain. This phase focuses on ensuring data integrity, enabling transparent access control through smart contracts, and giving patients full authority over their health records. The aim is to demonstrate a working solution that improves trust, privacy, and efficiency in healthcare data handling.

Tools & Technologies Used

Technology/Tool	Purpose
Ethereum Blockchain	To store medical record references securely and immutably.
Smart Contracts (Solidity)	To manage access control and permissions for medical records.
IPFS (InterPlanetary File System)	For decentralized off-chain storage of large medical files.
React.js	To build the frontend user interface for patients and doctors.
Node.js	To handle backend logic and interact with blockchain and storage services.

Summary of Work Done

- **Phase 1:** Defined the problem, proposed a blockchain-based solution, and outlined objectives, innovation, and technologies.
- **Phase 2:** Designed the system architecture, implemented core modules, and developed key functionalities like smart contracts and IPFS integration.

- **Phase 3:** Finalized the system, tested functionalities, deployed the platform, and documented tools, outcomes, and future scope.

Features Implemented

- Secure creation and storage of medical records using IPFS and blockchain.
- Patient-controlled access management via smart contracts.
- Role-based access for doctors and healthcare providers.
- Blockchain-based authentication using MetaMask wallet.
- Immutable audit trail for all record access and modifications.

Sample Block Structure


```
{
  "blockNumber": 1023,
  "timestamp": "2025-04-20T10:32:45Z",
  "previousHash": "0xabc123def456...",
  "recordHash": "QmXkYzP9RmJhG9vN8kP7qH1Y3i9Cm...",
  "patientID": "0xF1A2B3C4D5E6F7...",
  "doctorID": "0xA7B6C5D4E3F2A1...",
  "permissionStatus": "Granted",
  "smartContractID": "0x1234567890abcdef...",
  "transactionHash": "0x9a8b7c6d5e4f3g2h1i0j...",
  "digitalSignature": "0xSIG09876ABCDEF..."
}
```

Results & Testing:

Test Case	Input	Expected Result	Status
Add Medical Record	Valid patient data (e.g., records)	Block mined successfully, record added to blockchain	✅ Passed
Verify Medical Record	Existing record ID	Success message, record found and accessible	✅ Passed
Verify Medical Record	Invalid record ID	"Record Not Found" message	✅ Passed
Chain Integrity	Tampered block (changed record)	Blockchain invalid, tampering detected	✅ Passed
Grant Access	Valid patient and doctor IDs	Access granted successfully to authorized doctor	✅ Passed

---

Key Learnings

- **Blockchain can provide a highly secure and transparent way to manage medical records.**
- **Smart contracts enable efficient access control and automation in healthcare data management.**
- **Decentralized storage solutions like IPFS offer scalability and integrity for large medical files.**
- **Blockchain's immutability ensures data integrity, preventing unauthorized changes or tampering.**

Highlights of the Project

- Blockchain ensures secure and immutable medical record storage.
- Smart contracts automate access control and permissions.
- Decentralized storage via IPFS for large medical files.
- Patient-controlled access with transparent audit trails.
- Seamless integration with Ethereum and MetaMask for authentication.

Future Scope

- Integration with global healthcare systems.
- AI-driven health predictions and insights.
- Real-time data sync from wearable devices.
- Decentralized marketplace for medical data.
- Mobile app for easy access and consultation.

Conclusion

The MediChain project successfully demonstrates the power of blockchain technology in securing medical records, ensuring transparency, and giving patients control over their data. By leveraging smart contracts and decentralized storage, the system addresses key challenges in healthcare data management, offering a scalable and efficient solution. With its potential for future enhancements, MediChain paves the way for more secure, accessible, and trustworthy healthcare systems

---