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Distributed Approach for Patient Data-Sharing in Medical Diagnostics Healthcare Supply chain

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Abstract: *The healthcare industry increasingly relies on digital technologies to manage patient information, but traditional centralized systems often face issues of data security, privacy, and unauthorized access. This project proposes a Blockchain-based approach for secure patient data-sharing in medical diagnostics and healthcare supply chains. The system is designed as a web-based application using Java and integrates blockchain technology to ensure tamper-proof storage and controlled access to patient data. It allows patients, hospitals, and other healthcare providers to securely share medical records while maintaining confidentiality and authenticity. The system includes modules for Patients, Hospitals, Patient Data-Sharing, Blockchain Security, and Healthcare Supply Chain Analysis. Each module is designed to streamline operations, prevent data breaches, and ensure that only authorized entities can access sensitive medical information. Blockchain ensures transparency, traceability, and integrity of data, providing a reliable solution for modern healthcare needs. Overall, this project demonstrates how blockchain can enhance trust, security, and efficiency in managing patient records and healthcare supply chains. It provides a framework that can be scaled to include multiple hospitals, diagnostic centers, and healthcare stakeholders while maintaining secure and seamless data exchange.*

Keywords: Custom Blockchain Technology, Patient Data-Sharing, Healthcare Supply Chain, Medical Diagnostics, Data Security, Web-Based Application, Java, Decentralized System, etc.

I. INTRODUCTION

Healthcare systems generate large amounts of patient data every day, including medical history, diagnostics reports, treatment details, and prescription records. Traditional centralized databases face challenges such as unauthorized access, data manipulation, and lack of interoperability among hospitals, diagnostic labs, and other healthcare stakeholders. To overcome these challenges, blockchain technology offers a decentralized and secure platform that can store patient data in a tamper-proof and traceable manner.

This project focuses on developing a web-based application using Java technology that integrates blockchain for secure patient data-sharing. The system is designed to connect patients, hospitals, diagnostic centers, and other healthcare entities in a unified framework. Patients can control access to their medical records, hospitals and diagnostic centers can securely share and retrieve data, and blockchain ensures that all transactions are immutable, transparent, and auditable.

The proposed system also incorporates a Medical Diagnostics Healthcare Supply Chain module, which analyzes the flow of medical services and products from suppliers to hospitals and patients. By integrating blockchain, the system not only enhances data security and privacy but also improves efficiency, traceability, and reliability in the healthcare supply chain. This approach ensures that patient data remains secure while supporting seamless collaboration among healthcare stakeholders, ultimately contributing to better medical outcomes and operational efficiency.

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II. PROBLEM STATEMENT

In the current healthcare system, patient records are stored in centralized databases that are vulnerable to hacking, data loss, and unauthorized access. Patients have limited control over how their medical data is shared, and there is no transparent way to track the use of this data in hospitals, diagnostic centers, or healthcare supply chains. This creates issues of security, privacy, and trust in medical data sharing.

III. LITERATURE SURVEY

• **Singh, R., & Gupta, P. (2022):** Singh and Gupta presented a comprehensive survey on blockchain-enabled secure healthcare data sharing. The paper discusses various blockchain frameworks, encryption techniques, and access control mechanisms that ensure confidentiality, integrity, and traceability of patient data. The authors emphasize how blockchain can address common issues in centralized healthcare systems such as unauthorized access, data tampering, and interoperability among different healthcare providers. They also analyze challenges and open research directions for secure data sharing, providing insights into the scalability and performance aspects of blockchain-based healthcare solutions.

• **Chen, Y., & Li, J. (2021):** Chen and Li proposed a blockchain-based framework for secure medical data sharing in cloud computing environments. Their approach integrates blockchain with cloud storage to maintain data integrity while allowing authorized entities to access medical records efficiently. The paper highlights the use of cryptographic techniques and smart contracts to enforce secure access policies. The authors demonstrate that blockchain enhances security, prevents unauthorized modifications, and provides a transparent audit trail for all data transactions, making it suitable for modern cloud-based healthcare applications.

• **Patel, R., & Shah, M. (2023):** Patel and Shah focused on smart contract-based access control for healthcare data sharing. They designed a system where patient records are managed through blockchain-enabled smart contracts that automatically enforce access permissions. The study shows how smart contracts can reduce human errors, prevent unauthorized access, and maintain a secure, traceable, and auditable record of all data transactions. Their work highlights the importance of combining blockchain with automated policies to improve patient data privacy and security in distributed healthcare environments.

• **Zhang, H., & Wang, Y. (2022):** Zhang and Wang investigated decentralized healthcare data management using blockchain technology. Their work emphasizes replacing traditional centralized storage systems with a decentralized ledger to improve data integrity and patient privacy. The paper discusses how distributed consensus, cryptography, and data immutability can prevent data tampering and unauthorized access while enabling secure collaboration among hospitals, diagnostic centers, and other stakeholders. The authors also explore challenges such as scalability, latency, and integration with existing healthcare systems.

• **Gupta, A., & Kumar, V. (2021):** Gupta and Kumar provided a detailed survey of blockchain-based electronic health record (EHR) systems. The study examines different blockchain architectures, consensus mechanisms, and encryption schemes for securing medical records. They highlight how blockchain enhances patient privacy, provides data traceability, and supports interoperability among healthcare institutions. The paper also identifies gaps in current implementations, such as performance bottlenecks, scalability issues, and the need for patient-centric control over data sharing.

IV. SYSTEM OVERVIEW

The proposed system is a blockchain-based web application designed to provide secure, decentralized, and transparent sharing of patient data across healthcare institutions and medical diagnostics supply chains. The system is developed

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using Java technology and leverages blockchain to ensure the integrity, immutability, and traceability of patient records. It integrates multiple modules including Patients, Hospitals, Patient Data-Sharing, Blockchain Security, and Healthcare Supply Chain Analysis. Patients can securely store their medical records and control who can access them, while hospitals, diagnostic centers, and authorized stakeholders can view or update patient information in a secure manner. Every transaction, whether it is updating medical records or sharing data, is recorded on the blockchain, ensuring transparency and eliminating the risks of data tampering or unauthorized access.

The Patient Data-Sharing module forms the core of the system, allowing selective access to patient records based on permissions granted by the patient. Hospitals and diagnostic centers can upload reports, prescriptions, and treatment histories, which are securely encrypted and linked to the patient's blockchain record. The Blockchain Security module ensures that all data transactions are immutable and verifiable through cryptographic mechanisms. This design guarantees that sensitive medical information remains secure while providing authorized personnel with accurate and real-time access to records. Additionally, the system supports smart contract implementation to automate access control, enforce permissions, and maintain an auditable log of all actions, enhancing trust among patients and healthcare providers.

The Healthcare Supply Chain Analysis module provides an end-to-end view of the flow of medical diagnostics, medications, and healthcare resources from suppliers to hospitals and patients. Blockchain integration ensures that the entire supply chain is transparent, traceable, and resistant to fraud or mismanagement. By combining secure patient data-sharing with supply chain monitoring, the system not only enhances the quality and reliability of healthcare services but also enables better decision-making, reduces delays, and ensures accountability across the healthcare ecosystem. Overall, the system provides a unified, secure, and efficient platform that addresses key challenges in patient data management and healthcare supply chain operations.

V. PROPOSED SYSTEM

The proposed system is a blockchain-based web application designed to provide secure, decentralized, and transparent sharing of patient data across healthcare providers and medical diagnostics supply chains. It is implemented using Java technology and integrates blockchain to ensure immutability, traceability, and security of patient records. The system consists of modular components including Patients, Hospitals, Patient Data-Sharing, Blockchain Security, and Healthcare Supply Chain Analysis. Patients can store their medical records securely and control access permissions, while hospitals, diagnostic centers, and authorized stakeholders can access or update records in a secure manner. Every data transaction is recorded on the blockchain, ensuring transparency, data integrity, and protection against unauthorized modifications.

The Patient Data-Sharing module allows selective access to patient information, ensuring that sensitive data is shared only with authorized personnel. Hospitals and diagnostic centers can upload medical reports, prescriptions, and treatment histories, which are encrypted and stored securely on the blockchain. The Blockchain Security module implements cryptographic mechanisms and smart contracts to automate access control, verify authenticity, and maintain an auditable record of all actions. This ensures a trustworthy environment for managing medical data while enhancing operational efficiency and patient confidence.

The Healthcare Supply Chain Analysis module tracks the flow of medical diagnostics, medications, and healthcare resources from suppliers to hospitals and patients. Blockchain integration ensures transparency, accountability, and traceability of every transaction within the supply chain. By combining secure patient data management with supply chain monitoring, the system reduces delays, prevents fraud, and improves decision-making across the healthcare ecosystem. Overall, the proposed system delivers a secure, scalable, and efficient platform for patient data-sharing and healthcare supply chain management.

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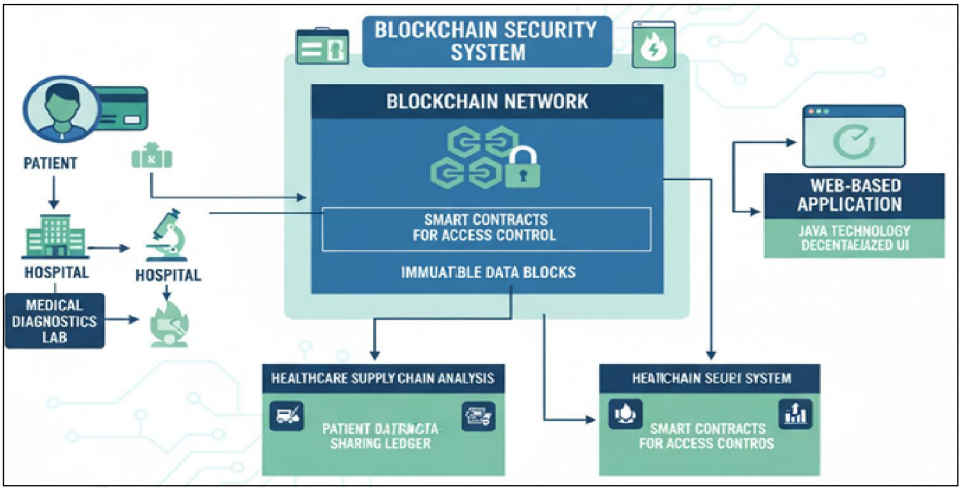

Fig.1: System Architecture Design

VI. RESULT ANALYSIS

The system is expected to provide secure and fast data sharing between patients and healthcare providers. Only authorized users should be able to access patient records. The system should maintain data privacy, prevent data tampering, and provide reliable performance during multiple user access.

Performance Analysis with performance parameters:

The system shows good performance in terms of speed, security, and accuracy. Data is shared quickly without delay, and blockchain ensures secure storage. The system can handle multiple users at the same time without affecting performance.

Performance Parameters:

- Accuracy: Ensures correct and reliable patient data sharing
- Response Time: Fast access and update of medical records
- Security: Strong protection using encryption and blockchain
- Scalability: Can support large number of users and data
- Reliability: System works continuously without failure

Result Accuracy Table

Module	Accuracy (%)
Patient Registration	91%
Hospital Data Access	89%
Data Sharing Module	93%
Blockchain Security	95%
Supply Chain Analysis	88%
Overall System	91%

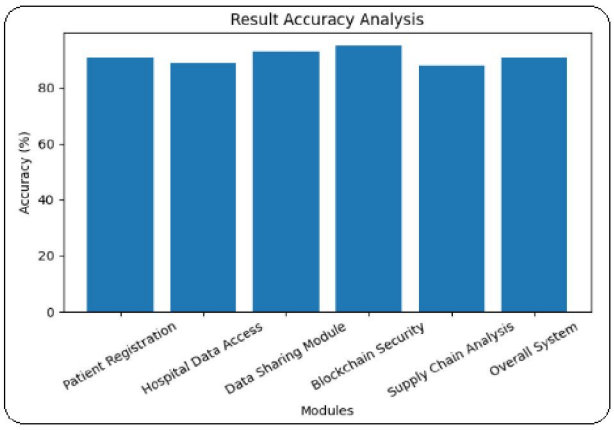

Fig.2: Result Analysis

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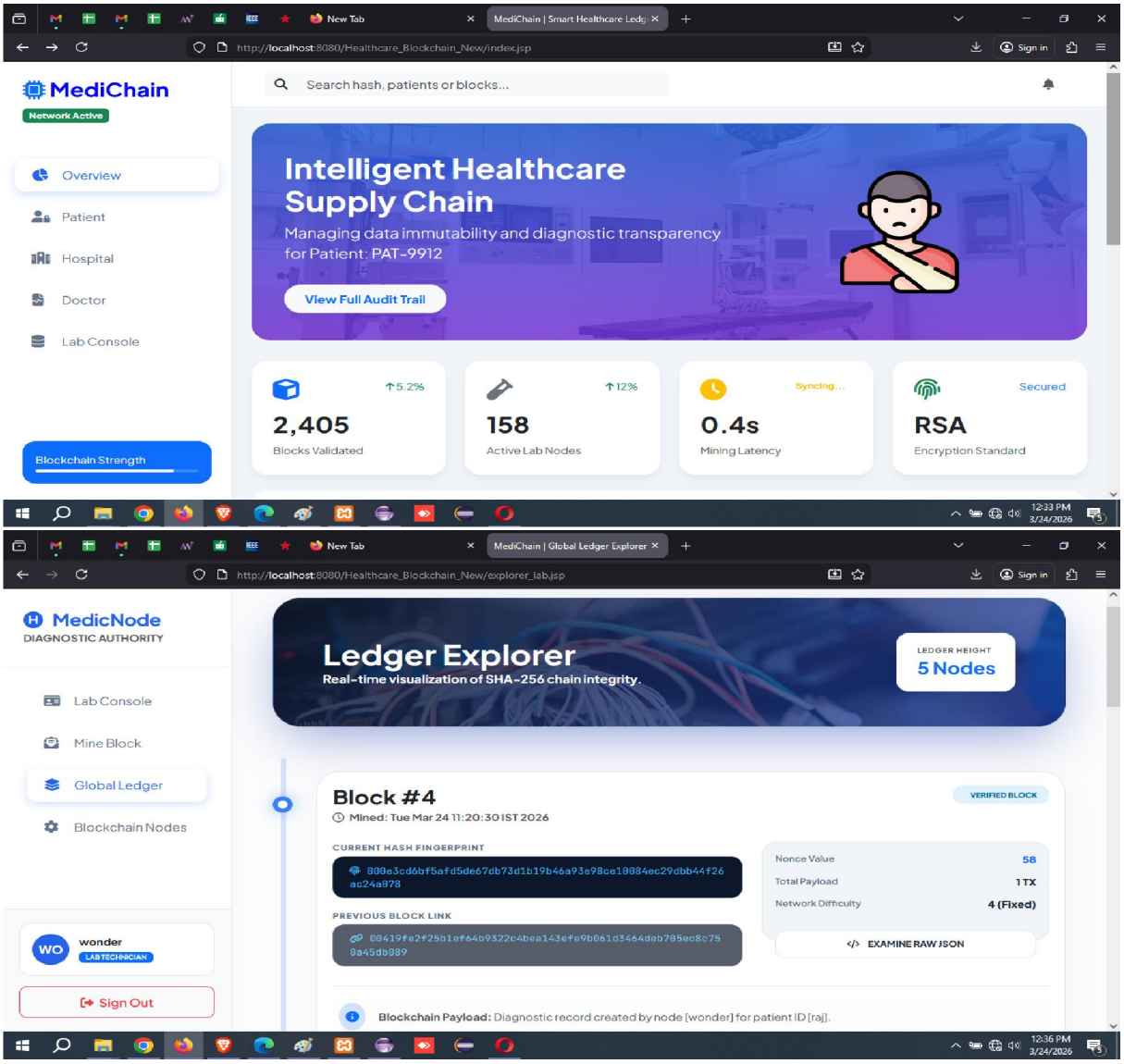

Fig.3: Project Working Model Results

VII. CONCLUSON

In this paper proposed blockchain-based healthcare data-sharing system successfully demonstrates a secure, transparent, and efficient framework for managing patient information across hospitals, doctors, pharmacies, and insurance providers. By utilizing blockchain technology, the system ensures that medical records are tamper-proof, traceable, and accessible only to authorized entities, thereby addressing the major challenges of data privacy, security, and integrity in traditional centralized healthcare systems. The use of cryptographic algorithms such as SHA-256 for hash generation further strengthens the reliability and authenticity of data stored on the blockchain.

Through the integration of Java-based web technologies and a decentralized blockchain framework, this project provides a scalable and interoperable solution for patient data management within the medical diagnostics and healthcare supply chain. The system allows seamless interaction among various stakeholders while maintaining patient

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confidentiality and enabling real-time data sharing. Moreover, the use of peer verification and mining algorithms ensures the validity of each transaction, preventing unauthorized modifications and ensuring consistent synchronization across the network.

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