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Blockchain-Based Decentralised Transaction Settlement System

P. D. Kale[1], Sanika Lawande[2], Harshada Mache[3] , Komal Malekar[4], Harshit Pawar[5]
Professor, Department of Computer Engineering[1]
Students, Department of Computer Engineering[2-5]
NBN Sinhgad Technical Institute Campus, Pune, India

Abstract: *The Blockchain-Based Decentralized Transaction Settlement System offers a secure and transparent method for conducting financial transactions without relying on a central authority. It uses blockchain technology to maintain a distributed ledger, where each transaction is recorded across multiple nodes in a peer-to-peer network. The SHA-256 hashing algorithm ensures data integrity and security by generating unique, tamper-proof hashes for each transaction. Transactions are grouped into blocks and verified through a mining process, which involves solving computational puzzles to achieve consensus across the network. This prevents fraud, double-spending, and unauthorized changes. By eliminating intermediaries, the system reduces transaction costs, increases processing speed, and enhances trust. It is particularly suitable for secure digital payments, asset transfers, and financial settlements.*

Keywords: Blockchain, Decentralized, Transaction Settlement, Distributed Ledger, Cryptographic Algorithms, Peer-to-Peer Network

I. INTRODUCTION

In the modern digital era, financial transactions are expected to be fast, secure, and transparent. However, traditional transaction systems rely heavily on centralized authorities such as banks, clearing houses, and financial institutions, which can introduce several challenges including high operational costs, slow processing times, lack of transparency, and vulnerability to fraud or single points of failure. To overcome these limitations, blockchain technology has emerged as a powerful alternative by enabling decentralized systems that enhance the security and efficiency of digital transactions.

Blockchain-Based Decentralized Transaction Settlement System, aims to develop a platform that eliminates the need for intermediaries by leveraging blockchain's distributed ledger mechanism. In this system, each transaction is securely recorded and shared across a peer-to-peer network, ensuring complete transparency and resistance to tampering. To maintain data integrity and authenticity, the system employs the SHA-256 cryptographic hashing algorithm, which generates unique, irreversible hashes for each transaction, making unauthorized changes virtually impossible.

Moreover, to verify and add transactions to the blockchain, the system uses a mining algorithm. This involves solving complex computational puzzles through a process known as Proof of Work, ensuring that only legitimate transactions are added to the chain. This not only secures the network against fraud and double-spending but also achieves consensus among distributed nodes without the need for a central validating body.

By decentralizing the transaction settlement process, this system offers significant advantages such as reduced costs, faster processing times, improved trust, and enhanced security. It can be effectively applied in domains like digital payments, asset management, supply chain tracking, and other financial services where data integrity, accuracy, and transparency are critical.

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II. RESEARCH METHODOLOGY AND SYSTEM ARCHITECTURE

2.1 RESEARCH METHODOLOGY

Requirement Analysis: Identified the need for a secure, transparent, and decentralized platform for financial transactions. Analyzed existing centralized systems and their limitations, such as single point of failure, high transaction fees, and lack of transparency. Defined the core functionalities: user registration, transaction creation, block validation, and ledger maintenance.

System Design: Designed a peer-to-peer architecture where each node maintains a copy of the blockchain. Used UML diagrams to visualize system flow, including transaction flow, block structure, and mining process. Ensured the design followed modular principles for scalability and ease of testing.

Module Development: User Module: Handles user interaction and input of transaction details.

Transaction Module: Validates and stores transactions before block formation.

Block Creation Module: Groups validated transactions and creates new blocks.

Mining Module: Implements the Proof of Work algorithm to validate and add blocks to the chain.

Ledger Module: Maintains and updates the distributed ledger across all nodes.

Technology Stack: Language: Java – for building the core logic and algorithms.

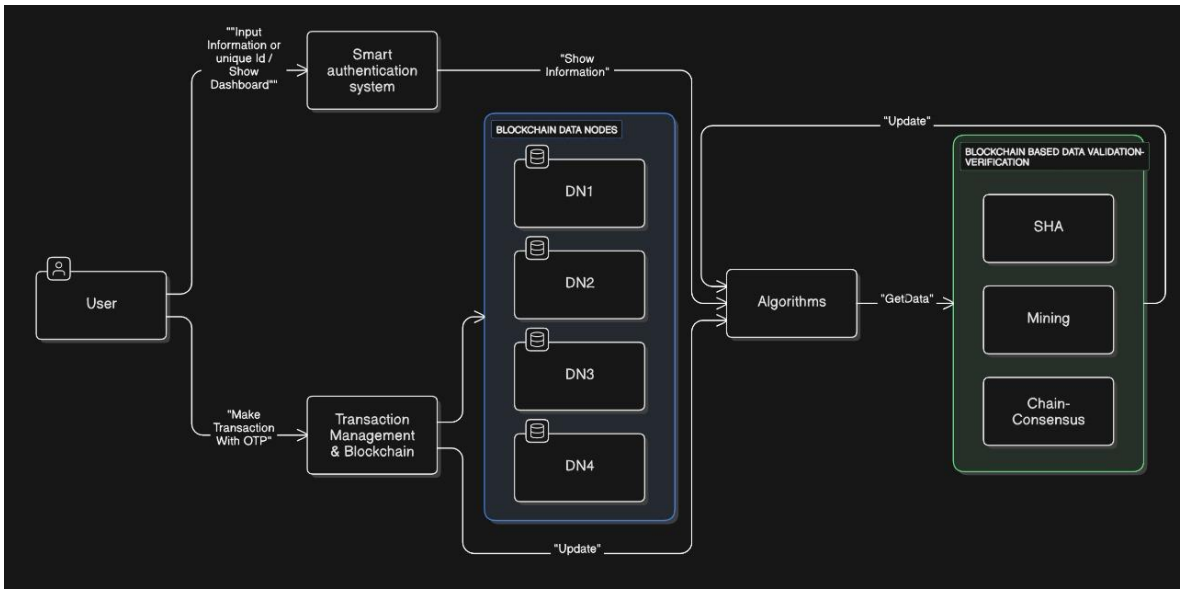
Database: MySQL – for storing user data and auxiliary information.

Frontend: HTML and CSS – for the basic user interface.

Security: SHA-256 – for hashing transactions and ensuring data integrity.

Blockchain Mechanism: Custom implementation of block creation, hashing, and mining logic.

2.2 SYSTEM ARCHITECTURE



III. RESULTS

The blockchain-based decentralized transaction settlement system was successfully developed and tested, demonstrating its ability to process transactions securely without relying on a central authority. Using SHA-256 hashing, each transaction was converted into a tamper-proof hash, ensuring data integrity. Transactions were grouped into blocks and added to the chain only after being verified through a Proof of Work mining process. The system maintained a synchronized distributed ledger across all participating nodes, enabling transparent and fraud-resistant record-keeping. Unauthorized modifications were effectively detected, and the consensus mechanism ensured that only legitimate transactions were accepted, preventing double-spending and ensuring high security and reliability.

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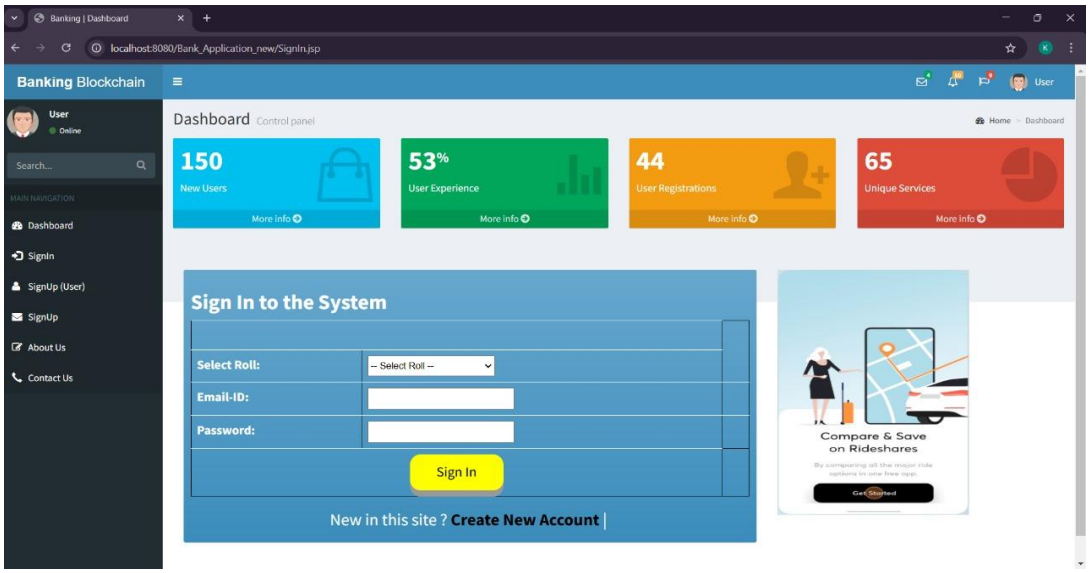

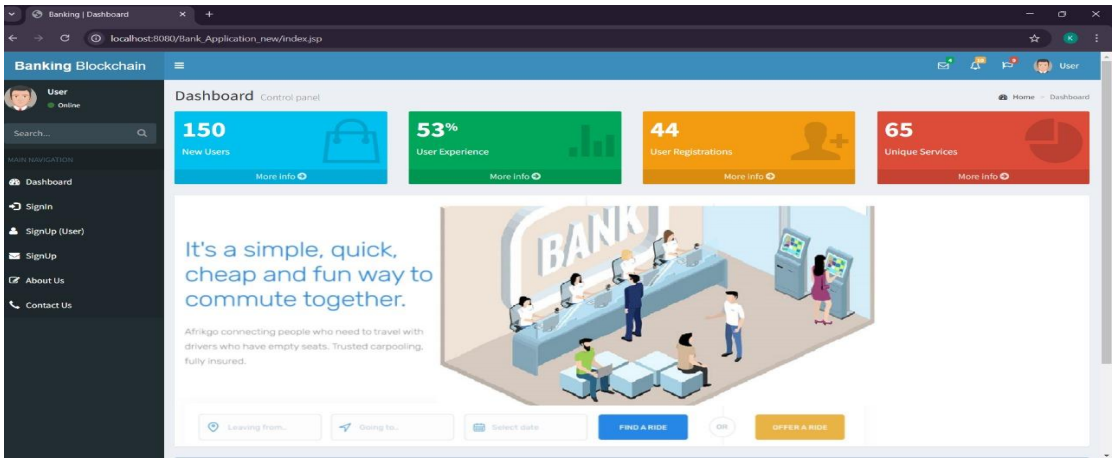

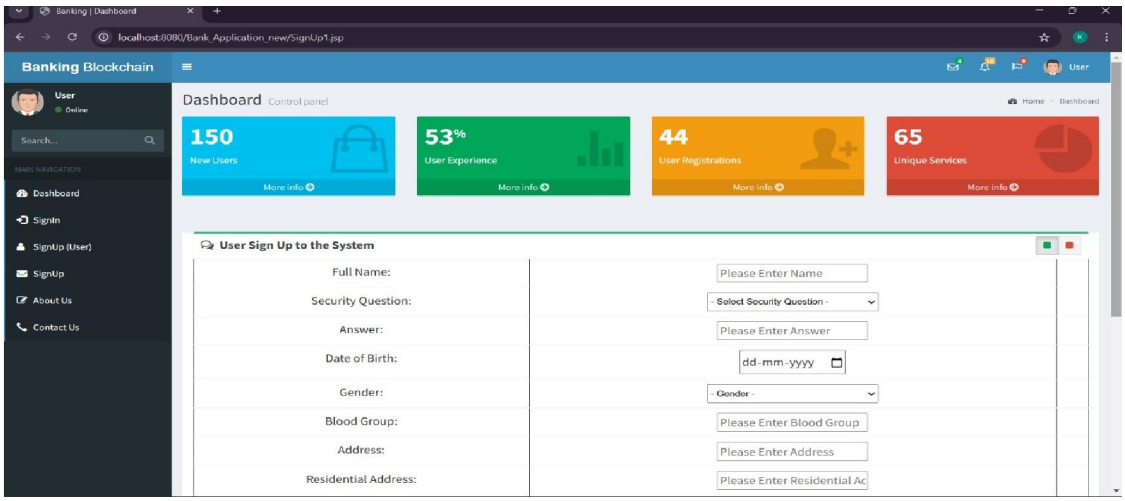

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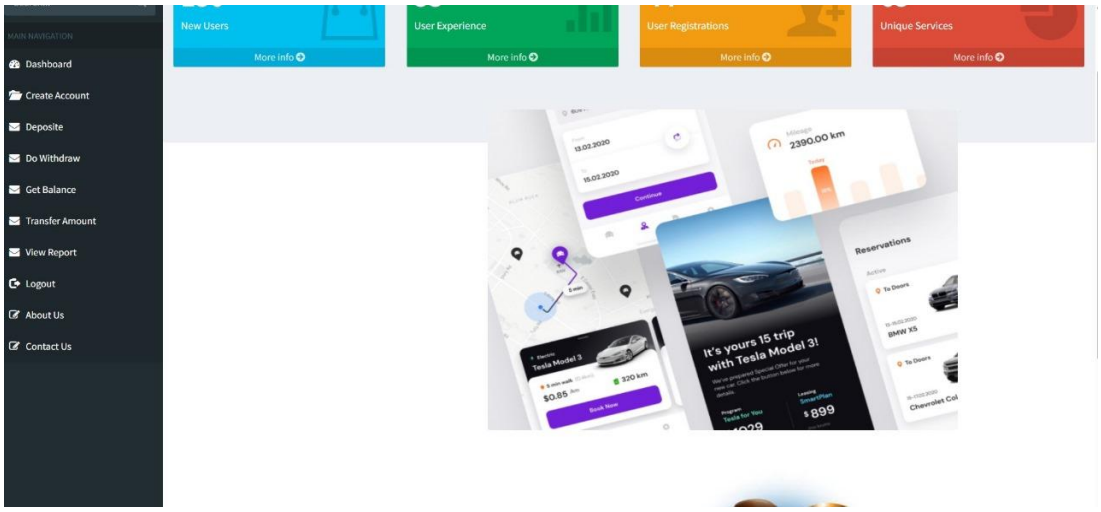

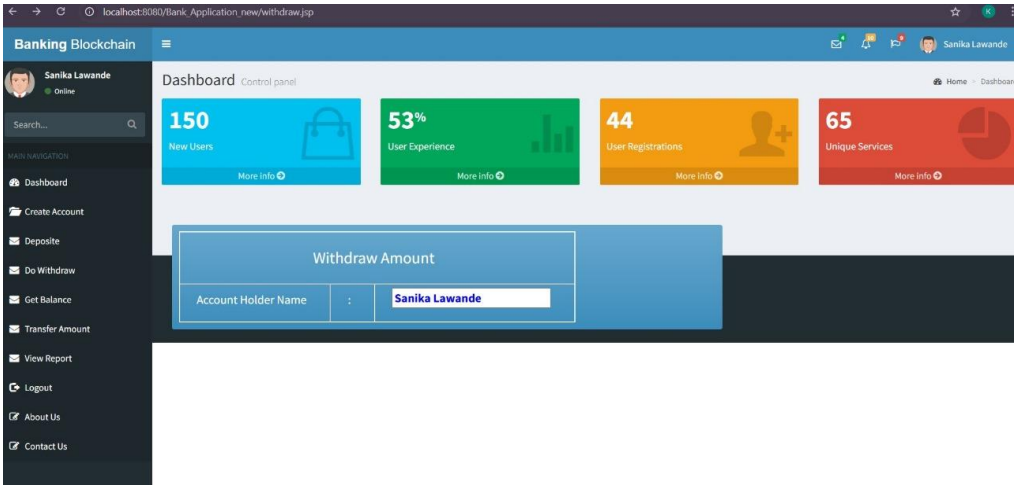

IV. CONCLUSION

The blockchain-based decentralized transaction settlement system offers a transformative approach to addressing the limitations of traditional financial infrastructures. By removing the need for intermediaries and enabling direct peer-to-peer transactions, the system ensures faster, more cost-effective, and transparent exchanges. The integration of SHA-256 cryptographic hashing guarantees that each transaction is secure, tamper-proof, and uniquely identifiable. The use of a mining algorithm and the Proof of Work consensus mechanism further strengthens the system's integrity by validating transactions through a decentralized process.

This distributed ledger model enhances reliability by eliminating single points of failure and ensures that all nodes maintain synchronized, immutable records. Such resilience makes the system ideal for critical financial operations such as digital payments, asset transfers, and secure settlements. Overall, the project effectively demonstrates how blockchain technology can be harnessed to build secure, transparent, and decentralized systems that redefine the way digital transactions are verified and settled.

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the concept to the final execution. Her encouragement and clarity of guidance gave us the confidence to explore and build this project successfully.

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