Project Report: Blockchain Transaction Simulator

1. Objective

To simulate a basic blockchain system in Java that demonstrates core blockchain concepts — including transactions, hashing, proof-of-work, mining, and chain verification — using a console-based application.

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2. Tools and Technologies Used

- Programming Language: Java
- Build Tool: Gradle
- Library: Gson (for JSON representation)
- Hashing Algorithm: SHA-256
- IDE: VS Code / IntelliJ IDEA

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3. Introduction

This project is a simplified simulation of blockchain technology designed to help understand how blockchain works internally.
It models the basic structure of a blockchain, performs mining using proof-of-work, and maintains data integrity through cryptographic hashing.
Transactions are added to blocks, which are then mined and appended to the blockchain.

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4. Key Features

- Implementation of SHA-256 hashing for block security
- Proof-of-Work mining mechanism simulation
- Transaction management system

- Blockchain integrity verification
- JSON visualization of the entire blockchain using Gson

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5. Results

The simulation successfully demonstrates how:

- Transactions are added and verified.
- Each block is mined through proof-of-work.
- Blockchain integrity is maintained through hash verification.
- The blockchain data can be viewed in a structured JSON format.

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6. Conclusion

The project effectively models the working of blockchain technology at a conceptual level.
It provides hands-on experience with hashing, proof-of-work, mining, and JSON data management in Java.
This implementation can be extended further to include peer-to-peer networking, digital signatures, and smart contract simulation.

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7. Future Scope

- Integration with GUI or web-based frontend
- Real-time transaction addition
- Digital signatures for secure transactions
- Networking to simulate distributed ledgers
- Integration with databases for block storage
