

Implementation of a Blockchain Based Supply Chain Management System

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Abstract -

This project proposes the implementation of a blockchain-based supply chain management system to enhance transparency, security, and efficiency in the tracking and management of goods and services. The system utilizes a decentralized network of nodes to record and verify transactions, ensuring the integrity and authenticity of supply chain data. By leveraging blockchain technology and smart contracts, this system aims to improve collaboration, reduce counterfeiting, and increase trust among stakeholders. The proposed system is designed to be scalable, interoperable, and adaptable to various industries, with potential applications in product tracking, inventory management.

Key Words: Tracking of Goods Ganache , Ethereum , Python 3.x , HTML and CSS

1.INTRODUCTION

The project “**Blockchain Based Supply Chain Management System**” focuses on building a secure, transparent, and trustworthy platform to track products from their origin to the end consumer. In traditional supply chains, information is often stored in centralized databases maintained separately by suppliers, retailers, and logistics partners. This fragmented approach makes it difficult to verify authenticity, trace product history, and detect tampering or counterfeits. By integrating blockchain technology into the supply chain process, this project ensures that every transaction and update related to a product is recorded in an immutable ledger, which cannot be altered or deleted once stored. This brings a higher level of trust, as all stakeholders can rely on a single, shared source of truth.

In this system, each product is registered with detailed information such as product ID, name, batch details, manufacturing and expiry dates, price, and other relevant attributes. A unique QR code is generated for every product, linking it to its blockchain-backed record. At any stage of the supply chain, stakeholders such as suppliers, retailers, and consumers can scan this QR code to verify the product’s details and check whether it has been tampered with or replaced. This helps in combating issues like counterfeit products, duplicate entries, or unauthorized modifications in the product journey, which are common challenges in many industries such as pharmaceuticals, food, electronics, and luxury goods.

2. PROPOSED METHODOLOGY

Implementing a blockchain-based supply-chain management system begins with a clear definition of business objectives and the specific pain points—such as traceability, fraud prevention, or paperwork reduction—that the solution must address. Stakeholders from each segment of the chain (manufacturers, logistics providers, distributors, and auditors) are then engaged to map end-to-end processes and identify the data elements (product IDs, batch numbers, sensor readings, etc.) that will be recorded on-chain. Next, a permissioned blockchain platform (e.g., Hyperledger Fabric or Quorum) is selected for its privacy, scalability, and consensus requirements, and a data model is designed that stores only cryptographic hashes of critical documents while keeping large files off-chain in IPFS or a secure cloud store. Smart contracts are drafted to enforce role-based access, automate asset transfers, and capture provenance events such as “create,” “transfer,” and “quality-check,” with each transaction timestamped and linked to the previous block for immutability. A modular backend integrates IoT sensors, enterprise APIs, and a relational database for fast queries,

exposing RESTful endpoints that the front-end—built with React or a similar framework—calls to query history, register new items, or update status. The system is first deployed on a controlled test network for functional, security, and performance testing, then piloted with a limited partner set to gather feedback, before full rollout across the supply chain, accompanied by training and governance mechanisms to manage upgrades and participant permissions over time.

3. IMPLEMENTATION

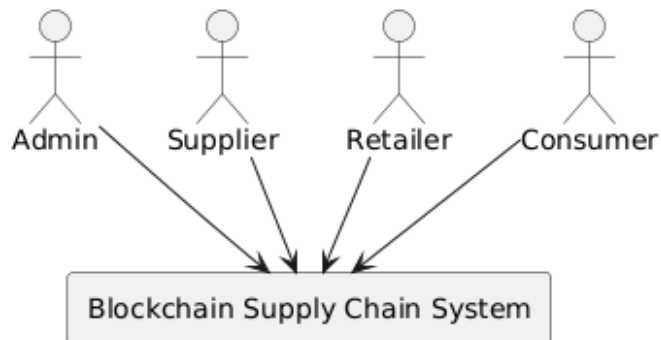


Fig : DFD Level 0

Level 0 DFD presents the entire system as one process. It shows how all external entities send and receive data from the Blockchain Supply Chain System. It gives a high-level overview without showing internal processing.

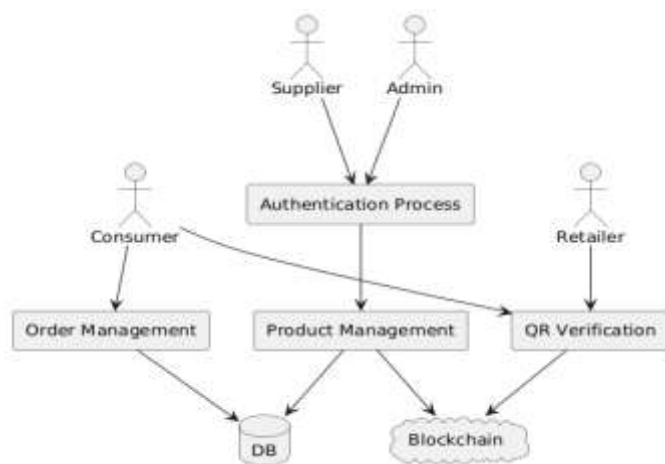


Fig : DFD Level 1

Level 1 explains the main functional blocks inside the system. Authentication verifies users. Suppliers add products which are stored in both blockchain and database. Consumers and retailers verify using QR scanning. Orders are stored and status managed. Blockchain guarantees trust.

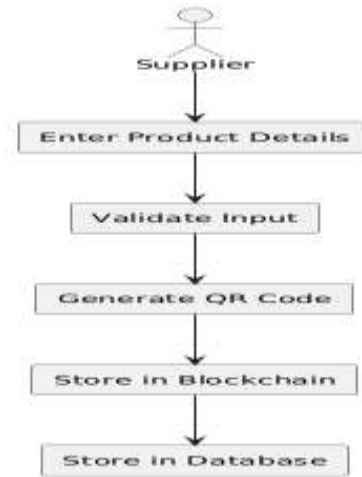


Fig : DFD Level 2

Level 2 details the internal process of product registration. The supplier inputs product data, which is validated, converted into a QR code, written to blockchain for immutability, and stored in the database for operational use.

4.RESULTS AND DISCUSSION



Fig : Home page

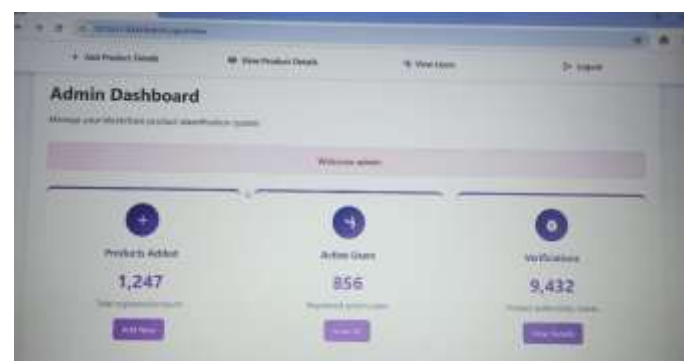


Fig : Admin Dashboard Output

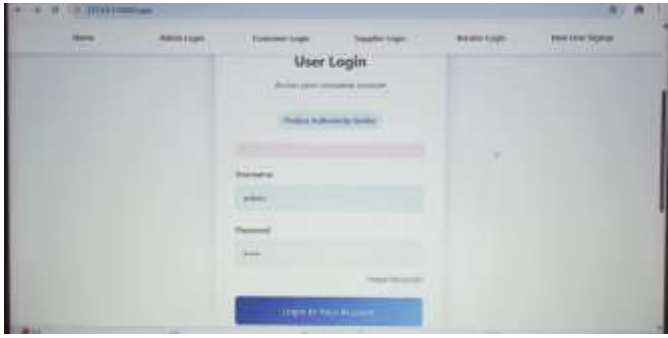


Fig : User Login Output

CONCLUSIONS

The project “Blockchain Based Supply Chain Management System” was designed and implemented to address key issues in traditional supply chains such as lack of transparency, difficulty in verifying product authenticity, and dependence on centralized databases. A role-based web application using Flask was developed, supporting different stakeholders like Admin, Supplier, Retailer, and Consumer. Suppliers can register products, generate QR codes, and push essential details to a blockchain-backed ledger. Retailers and consumers can scan QR codes to verify product details and trace the journey of the item from origin to destination.

The system integrates multiple components: a web-based user interface, a backend application layer, a local or private blockchain network for immutable record-keeping, a relational database for operational data, and QR modules for code generation and scanning. End-to-end flows such as product registration, QR code generation, order booking, status updates, and authenticity verification were implemented and tested. Unit, integration, and system testing were carried out to verify that modules function correctly both in isolation and as a complete system, demonstrating the practical feasibility of using blockchain for secure and transparent supply chain management.

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