

# Supply Chain Traceability using Blockchain

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**Abstract:** *This project is an innovative and revolutionary blockchain-based traceability system that utilizes QR code technology to improve the transparency, efficiency, and safety of the supply chain. The primary aim of this project is to develop a system that can accurately and effectively track goods in real-time and provide reliable information on their origin, movement, and authenticity. The proposed system uses advanced blockchain technology to record transactions and track the movement of goods from the point of production to the end consumer. In today's global marketplace, the importance of supply chain transparency and accountability cannot be overemphasized. Any weak link in the supply chain can result in significant negative consequences, such as recalls, product shortages, and legal liability. The proposed system aims to address these challenges by improving supply chain transparency, efficiency, and safety. The system is designed to lower supply chain management costs by streamlining operations, reducing the likelihood of a recall, and improving customer trust. The project's outcomes demonstrate the advantages of the system and successful implementation. The proposed system has significant potential to transform the supply chain industry and set new standards for transparency, efficiency, and safety*

**Keywords:** Block chain, Transparency, Supply Chain, Compliance, Cost Reduction, Efficiency, QR code.

## I. INTRODUCTION

Supply chain traceability is becoming increasingly vital in today's global marketplace. Consumers are expecting more transparency in the things they purchase, wanting to know where their commodities come from, how they are created, and if they are safe to consume. In addition, regulatory bodies are imposing stricter rules and regulations on businesses to ensure that their products are safe and comply with industry standards.

In response to these demands, businesses are turning to digital solutions to help them manage their supply chains more effectively. Blockchain-based traceability systems that use QR technology to track and record transactions as goods move through the supply chain are one example of a solution to this problem. By implementing such systems, businesses can improve supply chain transparency, reduce the risk of fraud and contamination, and gain a competitive edge in the marketplace. In order to give real-time access to accurate and current information on the origin, movement, and authenticity of items, this project aims to investigate the deployment of a blockchain based traceability system that employs QR technology.

## II. LITERATURE SURVEY

H. Chen, Z. Chen [1], F. Lin[1] and P. Zhuang discusses the challenges faced by agri-food supply chains and proposes a framework for improving their management using deep reinforcement learning and blockchain technology. The proposed framework provides product traceability and decentralized security for agri-food tracing data in agri-food supply chains. The Deep Reinforcement learning based Supply Chain Management (DR-SCM) method is proposed to make effective decisions on the production and storage of agri-food products for profit optimization. The paper describes the detailed settings of different ASC scenarios, including a simple scenario with a single retailer. Extensive simulation experiments are conducted to demonstrate the effectiveness of the proposed blockchain-based framework and DR-SCM method under different ASC environments. The results show that reliable product traceability is well guaranteed by using the proposed blockchain-based ASC framework, and DR-SCM can achieve higher product profits than heuristic and Q-learning methods. This paper provides valuable insights into how deep reinforcement learning and

blockchain technology can be used to improve the management of agri-food supply chains, ensuring agri- food safety for consumers and increased profits for farmers

S. E. Chang[2] and Y. Chen[2] examines the state, potential uses, and future directions of blockchain technology in supply chain management. It is an organized review of the literature. For the purpose of giving a general overview of the application of blockchain and smart contracts in supply chain management, the authors conducted a literature study and analytical review of 106 chosen publications. The blockchain-supply- chain paradigm's advantages, problems, and challenges are discussed in the paper. They concluded that blockchain technology has considerable potential to improve supply chain management by boosting transparency, traceability, security, efficiency, and collaboration among stakeholders

U. Agarwal[3] examines the potential of blockchain technology for secure supply chain management. The authors provide an overview of the current state of the art in industrial blockchain and provide an overview of the current literature on the subject. They identify Overall, the project aims to improve customer trust and reduce the risk of recall and liability for food safety key challenges and opportunities for implementing blockchain technology in supply chain management, including increased transparency, traceability and security. The whitepaper also explores various use cases for blockchain in supply chain management. B. Product Tracking, Inventory Management, and Payment Processing. The authors believe that while there are still some technical and regulatory challenges to overcome, blockchain technology has the potential to improve supply chain management by increasing efficiency, reducing costs, and increasing trust among stakeholders. have the potential to revolutionize Overall, this paper is a valuable resource for researchers and practitioners interested in exploring the potential of blockchain technology in supply chain management.

### **III. OBJECTIVE**

The objective of the project is to enhance supply chain transparency, efficiency, and safety by implementing a blockchain-based traceability system that uses QR technology. The proposed system aims to provide real- time access to accurate and up-to-date information about the origin, movement, and authenticity of goods. By automating tracking and traceability of goods through QR technology, the system can reduce manual processes and errors while meeting government regulations and compliance.

### **IV. PROPOSED SYSTEM**

The suggested method uses blockchain and QR technology to revolutionize supply chain traceability. The supply chain's ability to access accurate and current information about the origin, transportation, and authenticity of commodities is made possible through the usage of blockchain technology. The system improves efficiency and speed by automating tracking and reducing human operations through the integration of QR technology. The technology is unique in that it offers a complete solution that improves supply chain efficiency, transparency, and safety. It gives businesses a means of proving compliance with rules, avoiding fines, and lessening the effects of recalls on both customers and businesses. This solution is exceptional and strong in terms of supply chain traceability due to the integration of blockchain technology with QR technology. Overall, the suggested approach has the potential to increase supply chain management, decrease the likelihood of recalls, and lower liability for food safety.

System Architecture

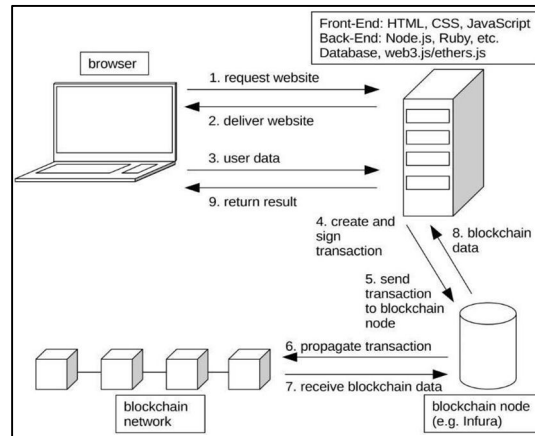


Fig 1: Architecture of Supply Chain Management using Blockchain system

- The browser asks the server to deliver a website.
- The browser receives the website from the server.
- User data is sent to the server by the user interface.
- The server generates a transaction and uses a private key to sign it.
- A blockchain node receives the transaction from the server.
- The blockchain node spreads the transaction throughout the network of blockchains.
- Information is received by the blockchain node from the blockchain network.
- The server receives information from the blockchain node.
- The browser receives information from the server

**V. MODULES AND IMPLEMENTATION**

The modules to be discussed are:

- Registration and Authentication Module
- Product Information Module
- Permission Management Module
- Product Tracking Module
- Transaction information module

**Registration and Authentication Module**

Manufactures, Farmers and retailer can register their account on Registration Authentication Module, a critical part of the supply chain traceability system. Only individuals who have been given permission to access and manage the system can do so thanks to this module's simplified registration procedure. Users can access a variety of features, including product information, transaction records, and supply chain analytics, by logging in with their credentials. The authentication procedure is secure, preventing unauthorized users from accessing user data and ensuring that only authorized users can view or change the data. The module's ease of use, Scalability, and security features make it an essential tool for managing supply chain traceability.

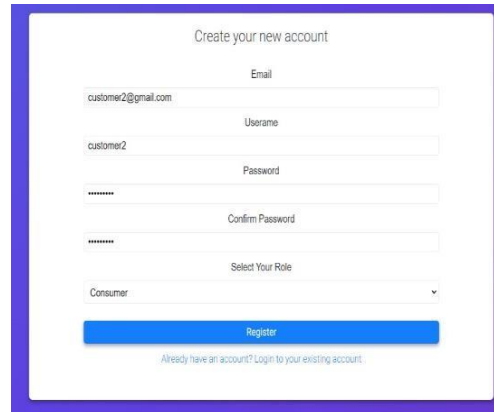


Fig 2: Registration and Authentication Module

### Product Information Module

Accurate and current information about the goods being tracked on the platform is crucially maintained by the Product Information Module. The module enables registered users to add crucial product information, such as name, description, picture, and QR or QR code, in order to create and manage their product listings. As the product moves from one step of the supply chain to another, other supply chain participants can view these product listings, which act as a central repository of information about the products. The module also enables users to update the product specifics as necessary, guaranteeing that they are always up-to-date and pertinent. By doing this, confusion and mistakes that may occur when using out-of-date product details are reduced. Overall, the Product Information Module serves as a key component of the supply chain traceability system, providing a comprehensive and reliable database of product information that is accessible to all authorized users.

### Permission Management Module

The platform's database's security and stability are crucially supported by the Permission Management module. Users will only have access to the data that they are permitted to view or change thanks to administrators' ability to control user access rights and permissions to various sections of the database. Administrators can establish and handle a variety of user roles using this module, including administrators, data analysts, and data entry staff. The degree of access that each role has to the database can be controlled by assigning each role a set of permissions, such as read-only access, write access, or complete control over a set of tables or fields. The module aids in preventing unauthorized data entry or modification, which is a crucial problem in supply chain management, by limiting user access to the database. Additionally, it assists in ensuring that only authorized personnel have access to data, which is crucial for abiding by privacy and data security laws.

The platform's database administration system relies heavily on the Permission administration module to keep data safe, accessible, and restricted to authorized personnel

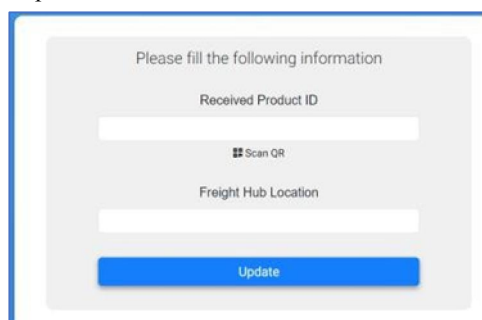
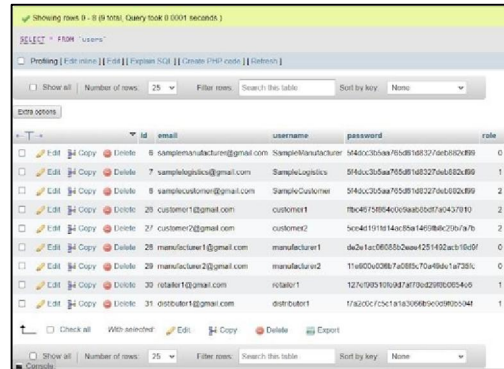


Fig 3: Product Information Module

distribution of the product. By simply scanning the QR or QR code on the item they buy, users can quickly obtain this data Overall, the Product Tracking Module is a crucial instrument for guaranteeing the efficiency, transparency, and safety of the supply chain. The module raises customer confidence, reduces supply chain management expenses, and boosts supply chain performance by enabling real-time tracking and monitoring of products.



ID	email	username	password	role
6	samplemanufacturer@gmail.com	sampleManufacturer	5440c3b5aa76d8168327aeb810c499	0
7	samplelogistics@gmail.com	SampleLogistics	5440c3b5aa76d8168327aeb810c499	1
8	samplecustomer@gmail.com	SampleCustomer	5440c3b5aa76d8168327aeb810c499	2
25	customer1@gmail.com	customer1	7bc4d75894c009a0c087a0437910	2
27	customer2@gmail.com	customer2	50c4d1918144c8ba14698a62067a7b	2
28	manufacturer1@gmail.com	manufacturer1	da2e1a0605520aee4251402ac310a0f	0
29	manufacturer2@gmail.com	manufacturer2	11e600c0867a085c70a8da1e7381c	0
30	retailer1@gmail.com	retailer1	127e79d3109a947a79a2d2880805406	1
31	distributor1@gmail.com	distributor1	17a200c7c5c1a1a30685c00c0803044	1

Fig 4: Permission Management Module

**Product Tracking Module**

A crucial part of the supply chain management system, the product tracking module allows real-time tracking of products from their point of origin to their destination. The module enables effective tracking and monitoring of product movement throughout the complete supply chain network using QR or QR code scanning technology. The tracking procedure starts when goods are first registered on the platform and continues as they move through different supply chain stages. Users will receive accurate and current information on the product's location, origin, and authenticity from the monitoring system. Each transaction that occurs as the product moves through the supply chain is tracked and saved on the blockchain, making it nearly impossible to alter or manipulate the data. This ensures that the information provided to users is trustworthy and reliable. The Product Tracking Module offers a thorough view of the product voyage, including details on the production and processing, transportation, storage, and

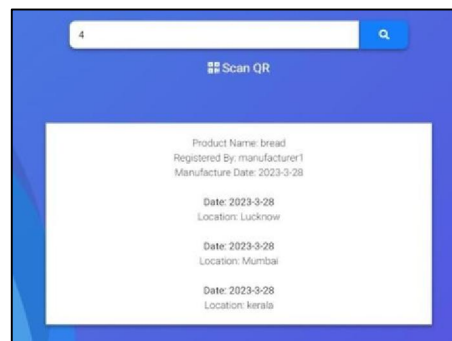


Fig 5: Product Tracking Module

**Transaction Information Module**

An essential part of the blockchain-based supply chain traceability system is the Transaction Information Module. This module records and presents data on all platform transactions, including updates to product details and the flow of items through the supply chain. A new transaction is produced and added to the blockchain whenever a user modifies a product's information or scans its QR or QR code. This module makes sure that every transaction is precisely recorded, saved, and shown on the platform. The amount of modifications made to the product details and the flow of goods may be clearly seen and studied in the prototype Ganache test environment. This provides valuable insights into the supply chain operations and helps identify areas where improvements can be made. All transactions are encrypted and impenetrable thanks to the high level of data security and integrity offered by the Transaction Information Module. This

increases supply chain transparency and confidence because all stakeholders can rely on the transaction data's accuracy and validity. Overall, the Transaction Information Module is an essential part of the supply chain traceability system because it makes sure that all transactions are accurately recorded, safely preserved, and readily available for examination and analysis.

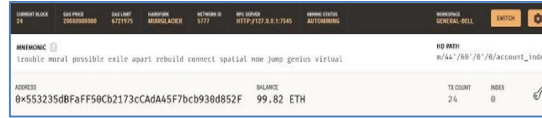


Fig 6: Transaction Information Module

## VI. CONCLUSION AND FUTURE WORK

In conclusion, our suggested supply chain tracking website provides a safe, effective, and open method of controlling the flow of commodities. Our approach offers increased transparency, accuracy, and integrity of supply chain data by utilizing blockchain technology, QR scanning, and realtime data tracking. This improves the ability of producers, retailers, and farmers to follow the progress of their goods, guarantee legal compliance, and spot and quickly fix supply chain problems. Asset management, identity management, permission management, consensus, smart contract, data storage, and API modules are just a few of the many modules that offer thorough assistance for managing the various elements of the supply chain process. Our solution has the ability to completely transform how companies manage their supply chains because it provides a huge improvement over current methods

### A. Future Work:

- Deploying the project in the cloud.
- To implement in the IOT system

## REFERENCES

- [1] H. Chen, Z. Chen, F. Lin and P. Zhuang, "Effective Management for Blockchain-Based Agri-Food Supply Chains Using Deep Reinforcement Learning," in *IEEE Access*, vol. 9, pp. 36008-36018, 2021, doi:10.1109/ACCESS.2021.3062410.
- [2] S. E. Chang and Y. Chen, "When Blockchain Meets Supply Chain: A Systematic Literature Review on Current Development and Potential Applications," in *IEEE Access*, vol. 8, pp. 62478-62494, 2020, doi:10.1109/ACCESS.2020.2983601.
- [3] U. Agarwal et al., "Blockchain Technology for Secure Supply Chain Management: A Comprehensive Review," in *IEEE Access*, vol. 10, pp. 85493-85517, 2022, doi: 10.1109/ACCESS.2022.3194319.
- [4] I. A. Omar, R. Jayaraman, M. S. Debe, H. R. Hasan, K. Salah and M. Omar, "Supply Chain Inventory Sharing Using Ethereum Blockchain and Smart Contracts," in *IEEE Access*, vol. 10, pp. 2345-2356, 2022, doi:10.1109/ACCESS.2021.3139829.
- [5] R. W. Ahmad, K. Salah, R. Jayaraman, I. Yaqoob, M. Omar and S. Ellahham, "Blockchain-Based ForwardSupply Chain and Waste Management for COVID-19 Medical Equipment and Supplies," in *IEEE Access*, vol.9, pp. 44905-44927, 2021, doi:10.1109/ACCESS.2021.3066503.
- [6] Y. Madhwal, Y. Borbon-Galvez, N. Etemadi, Y. Yanovich and A. Creazza, "Proof of Delivery Smart Contract for Performance Measurements," in *IEEE Access*, vol. 10, pp. 69147-69159, 2022, doi: 10.1109/ACCESS.2022.3185634.
- [7] I. A. Omar, R. Jayaraman, K. Salah, M. Debe and M. Omar, "Enhancing Vendor Managed Inventory Supply Chain Operations Using Blockchain Smart Contracts," in *IEEE Access*, vol. 8, pp. 182704-182719, 2020, doi: 10.1109/ACCESS.2020.3028031.
- [8] D. Shakhbulatov, J. Medina, Z. Dong and R. RojasCessa, "How Blockchain Enhances Supply Chain Management: A Survey," in *IEEE Open Journal of the Computer Society*, vol. 1, pp. 230- 249, 2020, doi:10.1109/OJCS.2020.3025313.

- [9] M. N. M. Bhutta and M. Ahmad, "Secure Identification, Traceability and Real-Time Tracking of Agricultural Food Supply During Transportation Using Internet of Things," in IEEE Access, vol. 9, pp. 65660-65675, 2021, doi: 10.1109/ACCESS.2021.3076373.
- [10] F. M. Benčić, P. Skočir and I. P. Žarko, "DL-Tags: DLT and Smart Tags for Decentralized, Privacy-Preserving, and Verifiable Supply Chain Management," in IEEE Access, vol. 7, pp. 46198-46209, 2019, doi:10.1109/ACCESS.2019.2909170.