Product Authentication and Traceability Using Blockchain

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ABSTRACT
This article provides a comprehensive review on the use of blockchain technology in supply chain management, with a focus on product authentication and traceability. It then reviews the existing literature on the use of blockchain technology in supply chain management, including case studies and surveys. The product supply chain is a complex process that involves multiple stakeholders, including suppliers, manufacturers, distributors, retailers, and customers. Ensuring transparency, efficiency, and security throughout the supply chain is a challenging task.
This paper proposes a decentralized blockchain-based product supply chain management system with QR code verification that can improve transparency, efficiency, and security. The system allows manufacturers to enter product details, including brand name, logo and generates a unique QR code for each product. The QR code can be used by buyers to verify the authenticity of the product and track its movement through the supply chain. The methodology used includes Ganache, IPFS, Blockchain, Ethereum and Truffle.
Keywords— QR codes, Ganache, IPFS, Truffle, Node.js, Smart contracts.

1. Introduction

In recent years, several blockchain-based supply chain management systems have been proposed, but they often suffer from issues such as scalability, interoperability, and usability. These challenges have limited the adoption of blockchain technology in real-world supply chain applications.

In this paper, we propose a methodology that uses Next.js framework, Ganache, Truffle, Meta Mask, IPFS, and QR code verification to implement a secure and efficient product authentication and supply chain management system using blockchain. The proposed methodology addresses the limitations of existing blockchain-based supply chain management systems and provides several advantages over traditional supply chain management systems.

The proposed methodology offers a secure and transparent way of tracking the product from its production to its delivery to customers. The use of QR code verification system that allows customers to easily verify the authenticity of a product using their mobile device. This makes it easier for customers to make informed purchasing decisions and reduces the risk of fraud and counterfeiting.
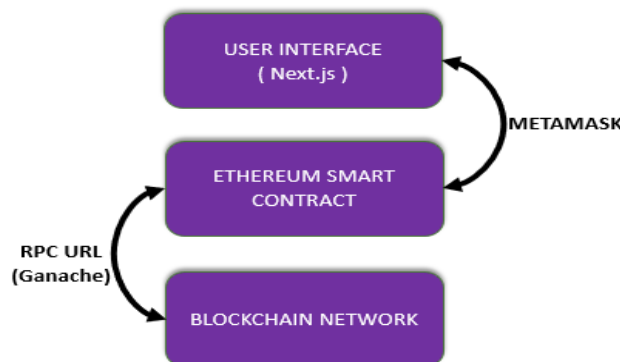
2. Experimental Methods or Methodology

Fig.1. Methodology

Firstly, let's talk about QR codes. QR codes, or Quick Response codes, are two-dimensional barcodes that can be scanned using a smartphone camera to access information or content related to the product. QR codes are increasingly being used for product authentication, as they can be used to verify the authenticity of the product at any point in the supply chain.

Ganache[1] To implement QR codes for product authentication and supply chain management using blockchain, we used several different technologies and tools. One of these was Ganache, a personal blockchain for Ethereum development, which allows us to test and develop our blockchain applications locally.

IPFS[2] Another technology used was IPFS, or Inter Planetary File System, which is a peer-to-peer network for storing and sharing files in a decentralized manner. We used IPFS to store the logo and brand name associated with each product, which can be accessed via the QR code to verify its authenticity.

Truffle[3] Truffle, a popular development framework for Ethereum-based blockchain applications, was also used to streamline the development process. Truffle provides a suite of tools and utilities for building, testing, and deploying smart contracts on the Ethereum blockchain.

Next.js[4] Finally, we used Next.js, a JavaScript runtime environment, to create a server that could communicate with our blockchain network and the IPFS network. This allowed us to create a user interface that could interact with the blockchain and provide users with information about the product's authenticity and supply chain journey.

3. Results and Discussion
3.1 User Interface

The manufacturer must create the brand initially. They must enter the brand and logo that creates unique brand.
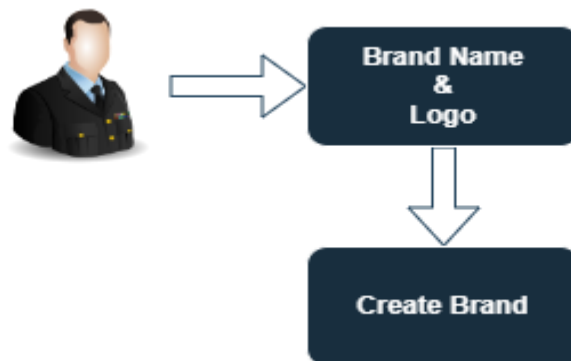

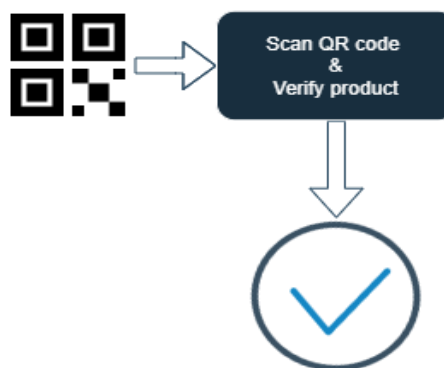**Fig.2. Creating Brand**

3.2 Create Product

Fig. 3. Create Product

After creating a brand, the manufacturer can update the new product for the brand. After entering the product details, the unique QR code had generated for each product. The QR code has used to verify the product and its traceability.

3.3 Product Verification

When the customer or seller buys the product then they verify the product by scanning the QR code it shows complete transaction history of the product. After that ownership moves to the customer or seller completely these transaction details completely stored in the blockchain network.
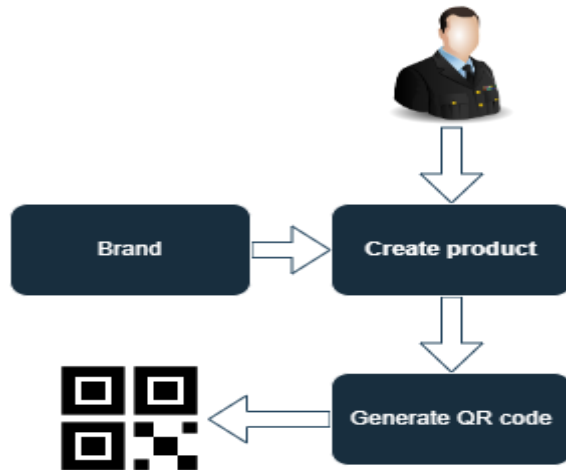

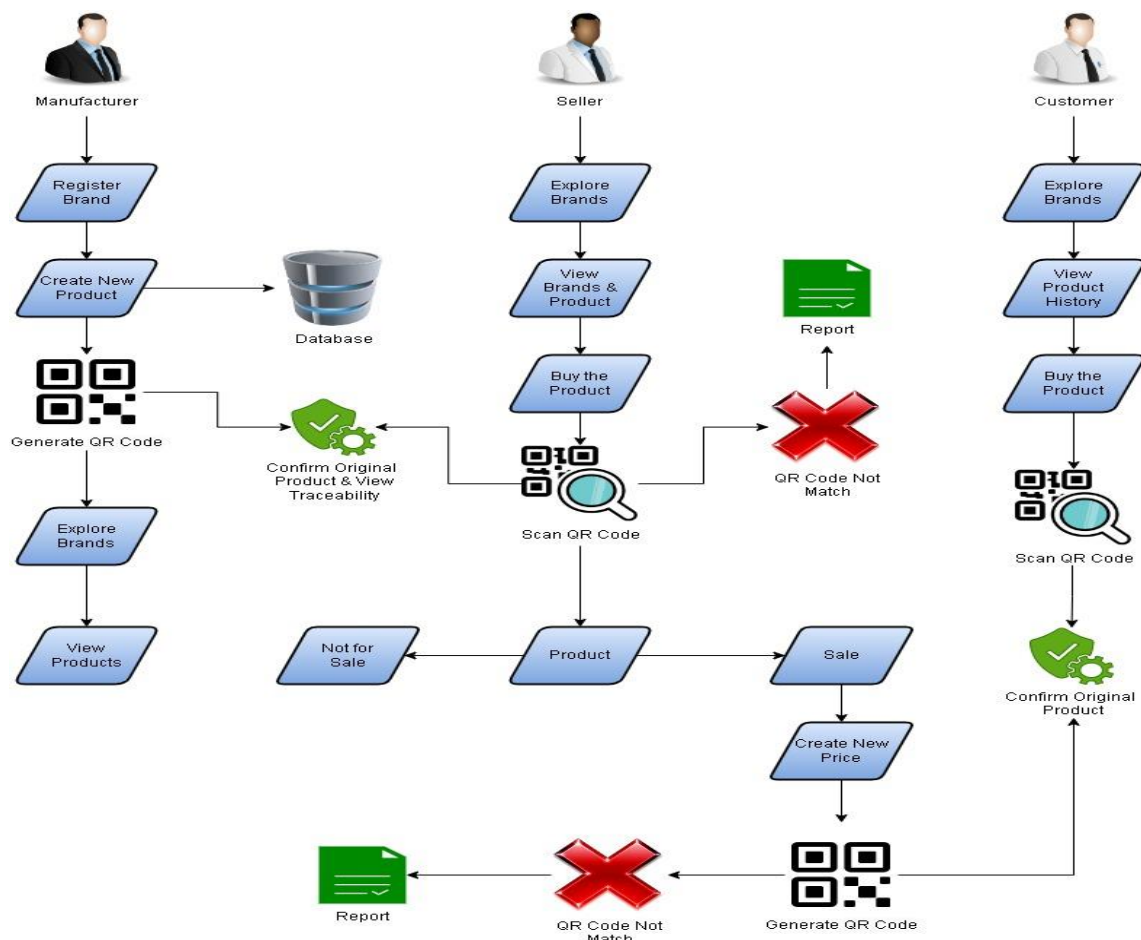**Fig. 4. Product Verification**

3.4 Process Flow

Fig. 5. Process flow

CONCLUSION

In conclusion, the proposed solution for product authentication and traceability using blockchain technology and QR code verification provides a secure, transparent, and user-friendly way to manage the supply chain and authenticate products. The system utilizes a decentralized network and stores all product data on the blockchain network, ensuring transparency and accountability throughout the supply chain. The QR code verification system provides consumers with a simple and effective way to verify the authenticity of products, enhancing consumer trust and confidence in the products they purchase.

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