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Blockchain Based Fake Product Identification Using QR Code

G V Sowmya[1],Harsha R[2],Usha R[2],Vanishree TS[2],Yuvashree P[2]

[2]Assistant Professor.,Dept of ISE,JNNCE,Shivamogga,India.

[2]UG Students,Dept of ISE,JNNCE,Shivamogga,India.

Abstract-In today's supply chain, problems like repeated work, poor coordination, and lack of transparency make it hard to stop fake products. Counterfeit items look very similar to original ones, so identifying them has become a big challenge. This affects both companies and customers. Earlier methods such as RFID, AI models, and simple QR codes were used, but they all have limitations. For example, QR codes can be copied easily, and AI systems need high computing power. In this project, we use Blockchain to check the complete product history and confirm if a product is real or not. Since Blockchain is decentralized and its data cannot be changed once stored, it is safer for keeping product details. This work mainly aims to create a simple and secure system using Blockchain to help detect and prevent fake products.

1. Introduction

Product counterfeiting happens when a duplicate item is sold as if it were the original one. This is a form of fraud and leads to financial loss and safety risks for customers. According to the Authentication Solution Providers' Association, fake products cause nearly 1 trillion rupees loss to the Indian economy every year, and such cases have been rising steadily.

Fake items such as cosmetics, clothes, electronics, and accessories not only harm the economy but can also affect people's health and daily use. For example, low-quality cosmetics may cause skin issues, and fake electronic parts can damage devices or create unsafe situations. Because of this, finding a proper way to stop counterfeit products has become very important.

Counterfeiting also damages a company's reputation. Many customers unknowingly buy fake items and later blame the original brand when the product fails. This creates unnecessary complaints and losses for genuine companies and affects their relationships with suppliers and retailers.

To reduce these problems, supply chain transparency and proper tracking are needed. In this paper, we propose a Blockchain-based system that helps track the complete journey of a product and verify its originality. The system aims to prevent fake branding and allow customers and suppliers to check product authenticity in a secure and clear way.

The remaining sections of the paper are organized as follows: Section 2 explains Blockchain technology, Section 3 discusses related work, Section 4 describes the proposed model, Section 5 shows the results, and Section 6 concludes the paper.

Blockchain is a system where information is stored in a series of blocks that are linked to each other. Each block has details like the time it was created, some transaction data, its own hash, and the hash of the block before it. Because the blocks are connected in this way, changing any data in the chain becomes very difficult.

2. Literature Survey

In the study by **Shaik et al. [9]**, a cryptographic method was integrated with Quick Response (QR) codes to verify the authenticity of manufactured goods. Each product was encoded with both public and private keys that could be decrypted by a mobile application. The application communicated with the manufacturer's database to confirm whether a product was genuine. This approach was relatively simple for consumers to use and provided a clear verification trail. Nevertheless, the system required continuous network access and relied heavily on cryptographic processing on both the client and server sides, which increased cost and complexity.

Benatia and Baudry et al. [10] designed a cyber-physical traceability system to improve transparency throughout the supply chain. Their model collected transaction data and analyzed it to detect irregular product movements that might indicate counterfeiting. The proposed architecture effectively strengthened traceability and offered detailed analytics. However, it depended on high-quality, real-time data and required substantial computational power and infrastructure investment to maintain accuracy.

An RFID-based authentication scheme was proposed by **Khalil and Doss et al. [11]**, enabling customers to scan tagged products in stores to verify their legitimacy. The system was lightweight and well suited for large retail networks because of its low implementation cost. Its major limitation, however, was the possibility of RFID tag duplication and the risk of physical tampering, which could compromise data integrity. Although efficient, the technique alone could not ensure complete protection against cloning attacks.

Habib and Sardar et al. [12] explored how blockchain could automate and secure supply-chain transactions. Their model emphasized the immutability of blockchain ledgers, allowing participants to exchange data without intermediaries. This structure reduced fraud and provided a transparent record of every transaction. Even so, issues of scalability and high transaction fees posed practical barriers to real-time adoption, particularly in large-volume industrial contexts.

A different approach was presented by **Daoud and Vu et al. [13]**, who applied artificial intelligence for counterfeit detection through image analysis. Using a Faster R-CNN network, their system identified fake logos and product features with high accuracy. The design performed well under controlled conditions but required extensive labeled datasets and significant computational resources for training. Furthermore, AI systems could not prevent fraudulent reuse of legitimate tags once items left the production environment.

Chen and Shi et al. [14] developed a Supply-Chain Quality Information (SCQI) framework combining blockchain with RFID and smart-contract technologies. Each transaction and quality check was recorded on a blockchain, allowing for automatic and transparent quality verification. The use of smart contracts minimized manual errors and strengthened trust between trading partners. However, consensus delays and the irreversible nature of smart-contract execution meant

that errors could not easily be corrected after deployment.

In the work of **Toyoda and Mathiopoulos et al. [15]**, a hybrid blockchain-QR code system was introduced for tracking and validating goods. Consumers could scan a product's code to access its complete history—from manufacturing to retail sale—recorded in a distributed ledger. The method successfully improved supply-chain visibility and consumer confidence. Still, QR codes could be copied or reused unless they were protected by encryption or designed for one-time use only.

Nakasumi [16] proposed a decentralized data-sharing framework using blockchain to allow supply-chain entities to exchange sensitive information securely without external mediators. The decentralized design preserved data ownership and ensured tamper resistance. Its main drawback was the increased computational demand and energy consumption caused by blockchain's consensus process, which made it less viable for small-scale operations.

A broader overview by **Ghadge and Adrew et al. [18]** examined counterfeit trends in international supply chains. Their analysis highlighted the vulnerability of markets such as pharmaceuticals, consumer electronics, and spare-parts manufacturing. They suggested that blockchain and traceability technologies could reduce these risks by improving transparency. The study, however, was largely survey-based and did not include experimental validation, leaving its conclusions mostly conceptual.

Overall, existing anti-counterfeit strategies—ranging from QR-based systems and RFID tagging to AI-driven recognition and blockchain solutions—address different aspects of product authentication. Each has notable strengths but also persistent weaknesses: QR codes are easy to duplicate, RFID tags can be cloned, and AI models demand heavy computation and extensive data. Among these methods, **blockchain technology offers the most reliable foundation**, as its decentralized and tamper-resistant structure provides transparent record-keeping and secure traceability. Incorporating blockchain into supply-chain verification can thus strengthen product integrity, enhance brand trust, and minimize the circulation of counterfeit goods in global markets.

3. Proposed System

Fake products have become a serious problem worldwide, and they affect everyone—from companies and manufacturers to regular customers. These counterfeit items reduce trust in brands and may even put consumers at risk. India is also experiencing this issue on a large scale.

The system proposed in this work focuses on consumer products and helps track them throughout the entire supply chain. Blockchain technology is used to keep product information accurate and secure at every stage. With this system, a customer can view the full history of a product, starting from the manufacturer up to the final point of sale.

To make the process simple, the system uses QR codes along with Blockchain. Every product gets a QR code, and when customers scan it, they can see all the steps the product has passed through. Since Blockchain data cannot be changed once stored, the information remains safe and trustworthy. This helps customers easily verify whether a product is original or fake.

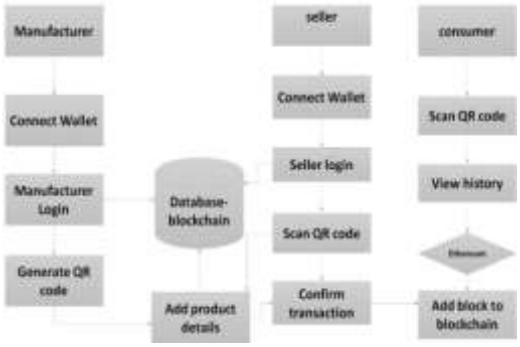


Figure 3.1 : Proposed System architecture

4. Results and Discussion

The project results show how effectively the system performs after implementation and testing. They highlight how well it meets its goals, functions accurately, and addresses the identified problem. The outcomes include observations, metrics, screenshots, and system responses that confirm the solution's functionality.

Figure. 4.1 : Home Page

Figure 4.1 shows the web interface of the project "Blockchain-Based Fake Product Identification Using QR Code," which serves as the consumer dashboard for verifying product authenticity. The page displays the project title at the top, highlighting the use of blockchain and QR codes to detect counterfeit items. A simple navigation bar with options like Home, Consumer Product History, and Product Verification allows users to access different features. The main section guides consumers on using these options for verification and tracking. Through this interface, users can scan or upload a QR code to confirm whether a product is genuine, while blockchain ensures secure, transparent, and tamper-proof data storage. Overall, the design makes authenticity checks quick, reliable, and user-friendly.

Figure 4.2 : Connecting to Ethereum using Metamask wallet

The system includes three user roles—manufacturer, supplier, and customer—as shown in Figure 4.2. Manufacturers connect to the platform through their Ethereum account using the MetaMask wallet (Figure 3). Both manufacturers and suppliers must approve each blockchain transaction through MetaMask via Web3.js when adding product information. Customers, on the other hand, verify product authenticity by scanning the QR code, which reveals the complete blockchain-recorded supply-chain history. This allows them to confirm the product's genuineness and integrity.

Figure 4.3 : Manufacturer Login Page Figure 4.3 shows the Manufacturer Login Page of the project “Blockchain-Based Fake Product Identification Using QR Code.” This page allows authorized manufacturers to sign in using their email and password to access their production dashboard. After authentication, they can add products, generate QR codes, and update inventory on the blockchain. The secure password field and option to switch to the seller login help enforce proper access control and prevent unauthorized access. Overall, this login page ensures that only verified manufacturers can upload product data to the blockchain, maintaining system integrity.

Figure 4.4 : Manufacturer Dashboard

Figure 4.4 shows the Manufacturer Dashboard of the project “Blockchain-Based Fake Product Identification Using QR Code.” After logging in, manufacturers are directed to this dashboard, which serves as their main workspace for managing production activities. The page displays the project title at the top, followed by a navigation bar with options such as Home, Add Product, Add Seller, Sell Product to Seller, and Query Seller. These features allow manufacturers to add products, register sellers, and transfer items into the supply chain, with every action securely recorded on the blockchain for transparency and tamper-proof tracking.

The central area provides a brief instruction encouraging users to navigate through the menu to perform tasks. The clean and user-friendly design helps manufacturers manage inventory and maintain authenticity records that consumers will later verify using QR codes. Overall, this dashboard supports counterfeit prevention by ensuring all product movements are accurately logged on the blockchain.

Figure 4.5 : Adding Product and Generating QR Code

Figure 4.5 shows the Add Product interface used by manufacturers in the blockchain-based fake product identification system. This page allows manufacturers to enter key product details such as Manufacturer ID, Product Serial Number, Price, Name, and Brand. After submitting the form, clicking "Add the Product" sends a blockchain transaction request, which is confirmed through a MetaMask popup. This step ensures that the product is securely registered and tamper-proof on the blockchain.

Once the transaction is approved, the system generates a unique QR code linked to the product's blockchain record. The QR code can be downloaded and later scanned by consumers to verify the product's authenticity. This interface is essential for maintaining transparency, as each product added becomes a permanent, verifiable blockchain entry that helps prevent counterfeit items from entering the supply chain.

Figure 4.6: Adding Seller

Figure 4.6 shows the interface used to add seller information, where manufacturers or authorized users enter details such as seller name, seller code, manager name, manufacturer ID, brand, phone number, and address. The structured form ensures that each seller is registered with complete and verified data, preventing unauthorized or duplicate entries.

With blockchain integration, all seller records become secure, tamper-proof, and easily traceable, reducing the risk of fake seller identities entering the system. These authenticated seller details later help consumers verify product origin and legitimacy through QR code scanning, supporting a transparent and trustworthy product verification process.

Figure 4.7 : Sell Product to Seller

Figure 4.7 shows the Sell Product to Seller module, which allows manufacturers to securely transfer product ownership to registered sellers. The interface includes a QR scanning feature that lets manufacturers scan or upload a product's QR code to automatically retrieve its Serial Number (SN). After the SN is fetched, the

manufacturer enters the seller code to identify the intended recipient, ensuring that each transfer is authenticated.

When the transaction is submitted, it is recorded on the blockchain, providing full transparency and preventing unauthorized changes. This immutable record makes it easy to verify product movement and authenticity at any stage. By documenting each transfer, the system strengthens traceability, minimizes counterfeit risks, and ensures that only verified sellers receive genuine products, thereby maintaining trust throughout the distribution chain.

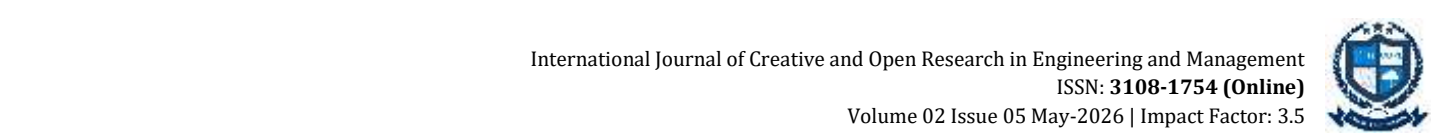
Figure 4.8: Query Seller

Figure 4.8 shows the Query Sellers module, which allows manufacturers or authorized users to view all sellers registered under a specific manufacturer in the blockchain network. By entering the manufacturer code, the system retrieves seller details—such as seller ID, name, brand, code, contact number, manager, and address—directly from the blockchain. This ensures that the displayed information is authentic, accurate, and free from tampering. The simple interface makes it easy for manufacturers to monitor and verify their associated sellers.

Since all data comes from the blockchain, each seller record is immutable, transparent, and fully traceable. This strengthens supply-chain reliability by confirming that only authorized sellers are part of the network. The module also supports auditing and verification, preventing unauthorized sellers from entering the system and enhancing overall accountability and visibility.

Figure 4.9 : Seller Login Page

Figure 4.9 presents the Seller Login Dashboard, which serves as the secure access point for sellers in the blockchain-based fake product identification system. Registered sellers can log in using their username and password through a simple, user-friendly form that also includes a “keep me logged in” option. After authentication, sellers can view products transferred to them by manufacturers, manage listings, update product status, and handle customer orders.



The login page ensures that only authorized sellers can access or modify product-related data, protecting the integrity of the blockchain records. It also provides a link to switch to the manufacturer login for easy role navigation. Overall, this dashboard offers a secure and efficient interface for sellers to perform their responsibilities and help maintain a counterfeit-free supply chain.

Figure 4.10 : Seller Dashboard

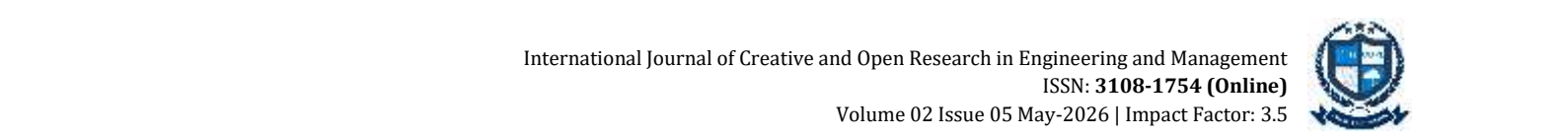
Figure 4.10 shows the Sell Product to Seller module, which enables manufacturers to securely transfer product ownership to registered sellers. The interface includes a QR scanning feature that lets manufacturers scan or upload a product's QR code to automatically retrieve its Serial Number (SN). After the SN is detected, the manufacturer enters the seller code to identify the intended recipient, ensuring each transfer is authenticated.

Once the details are submitted, the transaction is recorded on the blockchain, providing full transparency and preventing unauthorized changes. This immutable record allows stakeholders to verify product movement and authenticity at any time. By documenting every transfer, the system strengthens traceability, minimizes counterfeit risks, and ensures that only verified sellers receive genuine products, supporting trust and accountability across the supply chain.

Figure 4.11 : Sell Product to Consumer

Figure 4.11 shows the Sell Product to Consumer interface of a blockchain-based product verification system. A QR code is displayed in the center, with options to upload or scan it directly. The Product Serial Number (SN) is auto-filled from the scan, and the user enters the Consumer Code before clicking the *Sell to Consumer* button to proceed.

On the right, a MetaMask transaction request appears, asking the user to confirm the blockchain transaction. This step securely records the transfer of product ownership on the blockchain, ensuring



authenticity, preventing tampering, and maintaining transparent product movement.

Figure 4.12 : Products for Sale

Figure 4.12 shows the "Products for Sale with the Seller" interface, an essential part of the seller module in the blockchain-based fake product identification system. Sellers enter their unique Seller Code to view all products transferred to them by the manufacturer. After submitting the code, the system retrieves product details from the blockchain and displays information such as Product ID, Serial Number, Name, Brand, Price, and current Status. This provides sellers with a transparent and tamper-proof record of all products in their possession.

On the right side, a MetaMask transaction request appears whenever the seller performs an action that requires blockchain confirmation, such as updating product status or acknowledging product receipt. This ensures that every step is securely recorded on the blockchain, enabling full traceability and preventing unauthorized modifications. Overall, the interface supports secure, real-time tracking of product ownership and helps keep counterfeit products out of the supply chain.

Figure 4.13 : Consumer Dashboard

Figure 4.13 shows the consumer dashboard, which allows users to easily verify and track product authenticity. The project title at the top highlights the use of blockchain and QR codes for fake product detection. A navigation bar with options like Home, Consumer Product History, and Product Verification lets users access different features. The main section guides consumers on how to use these options for verification. By scanning a product's QR code, users can check whether it is genuine, while blockchain provides secure, transparent, and tamper-proof data storage.

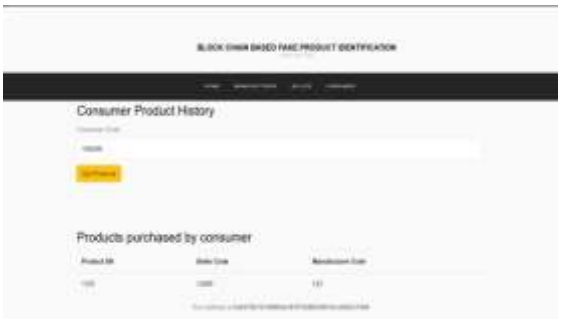


Figure 4.14 : Consumer Product History

Figure 4.14 displays the interface that allows consumers to view the complete purchase history of products linked to their unique Consumer Code. Users enter their Consumer Code and click “Get Products” to retrieve all associated records. The system then shows a structured list with details such as Product Serial Number (SN), Seller Code, and Manufacturer Code. Since this data is stored on the blockchain, every transaction is immutable and transparent, ensuring accurate and tamper-proof information.

This feature enables consumers to trace a product’s entire journey—from manufacturer to seller and finally to themselves—making it easier to verify authenticity and identify any suspicious activity. By providing clear visibility into a product’s background, the system strengthens trust and supports reliable product verification.

the interface empowers consumers to make informed decisions and confidently confirm that the items they purchase are genuine, safe, and tamper-free.

Figure 4.15 : Product Verified as Genuine Product

Figure 4.15 shows the interface designed to help consumers quickly and reliably verify the authenticity of a purchased product. It includes two input fields—one for the Product Serial Number (SN) and another for the Consumer Code—to confirm that the product matches the intended buyer. For convenience, the page also offers a QR code scanning option, allowing users to scan with their device’s camera or upload a QR code image, reducing manual entry and errors.

After entering the details or scanning the QR code, users click “Get Product Status,” which sends a verification request to the blockchain. The system then retrieves the corresponding record and displays whether the product is genuine or fake. Because the blockchain stores immutable, tamper-proof data, users can trust that the results are accurate and secure. This interface protects

consumers from counterfeit goods and promotes transparency by enabling easy and reliable product authentication

5. Conclusion

The proposed blockchain-based system provides a secure and transparent solution for detecting counterfeit products. Because blockchain is decentralized, no local supplier or external party can tamper with the product information stored on the network. Manufacturers and suppliers can safely record product details, while customers can easily check the entire supply chain history to confirm a product's authenticity. This increases customer trust and ensures that the goods they purchase are genuine. By reducing the chances of duplication and fraud, the system helps brands protect their reputation and supports a healthier market environment. In the future, this approach can be expanded to various sectors like banking, healthcare, online shopping, and voting systems to further improve security and reduce corruption.

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