

# Fake Product Detection System Using Blockchain

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**Abstract-** The increasing presence of counterfeit goods across industries threatens consumer safety, brand trust, and supply chain transparency. Traditional anti-counterfeiting methods are prone to duplication and lack unified traceability. This paper presents an implemented blockchain-based system for fake product detection that ensures secure and tamper-evident product provenance. Each product is assigned a unique on-chain identity on a permissioned blockchain, with smart contracts managing lifecycle events such as manufacturing, transfer, and sale. Consumers can verify authenticity through QR/NFC-based access. Additionally, an image recognition module compares product visuals with verified references to detect anomalies. The system, developed using React and Solidity, is evaluated through simulated supply chain scenarios and image datasets. Results demonstrate low-latency verification, improved traceability, and robustness against common threats such as cloning and replay attacks. The approach provides a scalable and practical solution for enhancing trust in modern supply chains.

**Keywords-** Blockchain, Fake Product Detection, Supply Chain Security, Smart Contracts, Product Provenance, Image Recognition, QR Code Verification

## I. INTRODUCTION

Counterfeit products pose a significant threat to modern supply chains, affecting industries such as pharmaceuticals, electronics, and luxury goods. The increasing complexity of multi-party logistics and the lack of transparent record-keeping create opportunities for product substitution, duplication, and unauthorized distribution. Traditional anti-counterfeiting mechanisms, including holograms, barcodes, and RFID tags, are limited in effectiveness due to their susceptibility to replication and reliance on centralized systems.

Blockchain technology offers a decentralized and tamper-evident approach to supply chain management. By maintaining an immutable ledger shared across stakeholders, it ensures transparency and traceability of product lifecycle events. Smart contracts further enhance this system by automating state transitions such as manufacturing, distribution, and sale while enforcing predefined rules.

In this work, a blockchain-based product authentication system is implemented, integrating QR/NFC-based consumer verification and an image recognition module for detecting visual inconsistencies. The proposed approach enables secure provenance tracking, real-time verification, and improved trust across the supply chain ecosystem.

## II. PROBLEM STATEMENT

Despite advancements in product labeling and tracking technologies, several critical challenges remain:

- **Data Integrity:** Centralized systems allow unauthorized modifications, enabling counterfeit insertion without detection.
- **Consumer Verifiability:** End users lack a simple and reliable mechanism to verify product authenticity.
- **Visual Counterfeiting:** Cloned packaging can bypass identifier-based checks without deeper inspection.

### Problem Definition

Design and implement a system that ensures tamper-evident product lifecycle tracking, enables real-time consumer verification, and enhances counterfeit detection through both metadata validation and visual analysis.

### Proposed Approach

- Assign a unique blockchain-based identity to each product with manufacturer authentication.
- Use smart contracts to control lifecycle events and prevent invalid transitions.
- Enable QR/NFC-based verification for consumers and auditors.
- Integrate image recognition to detect packaging anomalies.
- Implement using React (frontend) and Solidity (smart contracts) with security measures against cloning and replay attacks.

## III. CONCLUSION

The widespread presence of counterfeit goods necessitates more reliable and transparent authentication mechanisms. Traditional approaches are increasingly ineffective due to their vulnerability to duplication and lack of traceability. The implemented blockchain-based system addresses these challenges by providing a secure, decentralized, and tamper-proof infrastructure for tracking product provenance.

By combining blockchain with smart contracts, the system ensures automated and trustworthy lifecycle management. The addition of an image recognition module enhances detection by identifying visual discrepancies in products and packaging. This multi-layered approach improves consumer confidence, strengthens supply chain accountability, and reduces the risk of counterfeit distribution.

Future enhancements may focus on improving scalability, integrating advanced machine learning models, and aligning with global supply chain standards for broader adoption.

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