

## A SURVEY ON BLOCKCHAIN BASED DETECTION SYSTEM FOR UNVEILING COUNTERFEIT PRODUCTS

Mr. V. Chandra Sekhar Reddy<sup>1</sup>, Shainaz Farheen<sup>2</sup>, Nattala Hemanth Reddy<sup>3</sup>,  
Rohith Kumar Thaduri<sup>4</sup>, Vemula SaiRam Goud<sup>5</sup>

<sup>1</sup>Assistant Professor, Computer Science and Engineering, ACE Engineering College, India.

<sup>2,3,4,5</sup>Student, Computer Science and Engineering, ACE Engineering College, India.

### ABSTRACT

In recent years, Counterfeit products play an important role in Product Manufacturing Industry. This affects the company's name, sales, and profit of the companies. Blockchain technology helps to solve the problem of counterfeiting a product. Once the product is stored on the network, hash code of that product is generated and it is possible to maintain all transaction records of the product and its current owner will be created for that product transactions as a chain. In this project we are assigning a generated QR code to a particular product and the end customer can scan that QR code to get all information about that product. After scanning the QR code we can identify that the product is real or fake. Quick Response (QR) codes provide a robust technique to fight the practice of counterfeiting the products. Counterfeit products are detected using a QR code scanner, where a QR code of the product is linked to a Blockchain. This system is used to store product details and generated unique code of that product as blocks in the database. It collects the unique code from the user and compares the code against entries in the Blockchain database. If the code matches, it will give a notification to the customer that product is verified.

**Keywords:** Blockchain, Counterfeit detection, Supply chain management, Product authentication, QR codes.

### 1. INTRODUCTION

Counterfeit products have become a widespread issue, posing significant risks to consumer safety and brand reputation. Detecting and preventing the circulation of fake products has become a crucial concern for businesses and consumers alike. To address this problem, innovative technologies are being leveraged to develop effective solutions for counterfeit product detection. One such technology is Quick Response (QR) code generation, coupled with block chain technology. QR codes are matrix bar-codes that can be scanned using smartphones, providing users with quick access to product information. By integrating QR code generation with block chain, a decentralized and transparent ledger, the authenticity of products can be verified and counterfeiting can be combated. The aim of this project is to develop a system that utilizes QR code generation and block chain technology for counterfeit product detection. QR codes are assigned to each product during the manufacturing process, containing encrypted information about the product's origin, manufacturing details, and other relevant identifiers. Consumers can scan the QR code to access this information and determine the authenticity of the product. The integration of block chain technology ensures the integrity and security of the product data. Block chain's decentralized nature eliminates the possibility of data manipulation and provides a transparent record of the product's life cycle. This allows consumers to trace the product's journey from production to distribution, instilling trust and confidence in the authenticity of the product. By utilizing QR code generation and block chain technology, this system offers a reliable and user-friendly solution to combat counterfeiting. It empowers consumers to make informed purchasing decisions and enables manufacturers to protect their brand reputation. Ultimately, the goal is to create a marketplace that is free from counterfeit products, ensuring consumer safety and promoting brand integrity.

**Retail and E-commerce:** Integrating blockchain-based solutions into retail and e-commerce platforms can verify the authenticity of products sold online, providing consumers with confidence in their purchases and protecting them from counterfeit goods.

**Luxury Goods:** Blockchain technology can revolutionize the luxury goods industry by providing a transparent and immutable ledger of product authenticity. This ensures that consumers purchasing high-end items such as watches, handbags, and jewelry can verify the genuineness of their purchases, protecting both consumers and brand reputation.

**Pharmaceuticals and Healthcare:** Counterfeit drugs endanger public health and undermine trust in the healthcare system. Implementing blockchain in pharmaceutical supply chains allows for tracking and tracing medications from production to distribution, enabling consumers and healthcare professionals to verify the authenticity and integrity of pharmaceutical products, thus ensuring patient safety.

**Food and Agriculture:** With the rise of counterfeit food products and fraudulent labeling, blockchain offers a solution for creating transparent supply chains in the food industry. By recording every step of the food supply chain on a

decentralized ledger, consumers can trace the origins of their food products, verify their authenticity, and ensure food safety and quality.

**Electronics and Technology:** Counterfeit electronic products pose safety risks and damage brand reputation. Blockchain technology can be utilized to verify the authenticity of electronic components and devices by recording their manufacturing processes and supply chain journey, ensuring that consumers receive genuine and safe products.

**Automotive Industry:** Counterfeit automotive parts compromise vehicle safety and reliability. By tracking the provenance of automotive parts on a blockchain ledger, manufacturers and consumers can ensure the authenticity of parts used in vehicle manufacturing and repairs, reducing the risk of accidents and mechanical failures.

**Cosmetics and Beauty Products:** Counterfeit beauty products can contain harmful ingredients, posing health risks to consumers. Blockchain enables transparency in the cosmetics supply chain, allowing consumers to verify the authenticity of beauty products and ensure that they meet safety standards.

**Gaming and Entertainment:** Counterfeit gaming consoles, software, and merchandise are prevalent in the gaming and entertainment industry. Blockchain can authenticate gaming products and merchandise, ensuring that consumers receive genuine and authorized products.

**Jewelry and Gemstones:** The jewelry industry faces challenges with counterfeit gemstones and jewelry. Blockchain can provide a secure and transparent record of gemstone provenance and jewelry manufacturing, ensuring the authenticity and quality of jewelry products.

In domains such as luxury goods, pharmaceuticals, food, fashion, electronics, automotive, cosmetics, art, documents, retail, and many others, blockchain technology can be integrated into existing supply chain systems to enhance transparency and security.

By implementing blockchain-based authentication solutions, consumers can verify the authenticity of products using simple tools such as smartphone apps or dedicated verification platforms. Furthermore, blockchain technology fosters collaboration among industry stakeholders, including manufacturers, distributors, retailers, and consumers, by providing a shared and trusted platform for verifying product authenticity.

This collaborative approach ensures that everyone involved in the supply chain benefits from increased transparency and reduced risks associated with counterfeit product.

## 2. LITERATURE SURVEY

As part of the Literature Survey, we have referred few project papers and the findings from them are:

Product Identification in Retail Stores by Combining Faster R-CNN And Recurrent Neural Network by Rajib Ghosh (June 2023) [1].

This article presents a method for identifying products on supermarket shelves using computer vision. The approach involves detecting text blocks in product labels through Faster R-CNN with multiple region proposal networks (RPNs) and then recognizing the text with a Recurrent Neural Network (RNN) classifier.

The innovation lies in using diverse-sized RPNs to accurately detect varying text block sizes in labels, a departure from the traditional Faster R-CNN. The proposed system outperforms existing methods on text block detection, achieving high recognition accuracies of 99.18%, 99.21%, and 99.12% on three different public datasets—GroZi-120, Grocery Products, and Grocery Dataset, respectively.

Fake Product Identification System Using Blockchain by Anil Pawar, A. Quadri, meenaz Kolyal (2022) [2].

This paper uses blockchain technology to combat the sale of counterfeit products. We use blockchain to allow manufacturers to add authentic product serial numbers onto the ledger; consumers can then use the serial number to verify the authenticity of a product before purchasing it.

Blockchain plays a pivotal role in ensuring that data was not tampered with - creating a trusted environment.

Combining External Attention Gan with Deep Convolutional Neural Networks for Real-Fake Identification of Luxury Handbags by Jianbiao Peng, Beiji Zou (2022) [3].

This paper introduces an innovative hybrid framework for detecting fake luxury handbags using a combination of External Attention Generative Adversarial Networks (EAGANs) and Deep Convolutional Neural Networks (DCNNs). The proposed method addresses limitations in existing approaches, such as the lack of attention to external attention optimization and class imbalance in datasets.

The improvements include using transformers in EAGAN for better local feature representation, introducing a new attention module based on external attention mechanism, incorporating a simple CNN auxiliary classifier for efficient feature learning, and implementing a three-stage weighted loss for training the EAGAN model.

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Fraud Detection: A Review on Blockchain by Anuska Rakshit, Shriya Kumar (2022) [4].

This study explores blockchain's role in detecting and preventing common types of fraud, including rating fraud, insurance fraud, and employment history fraud. Its permanence and resistance to hacking make it a robust solution against identity theft and network intrusions. While challenges persist, blockchain technology stands as a potent tool in safeguarding transactions and assets across industries. Blockchain technology functions as a distributed database, commonly referred to as a public ledger, where records of transactions or digital events are permanently stored and shared among participants. Its inherent features of decentralization, immutability, and transparency make it an effective tool for detecting and preventing various forms of information fraud, including identity theft, rating fraud, insurance fraud, employment history fraud, and other fraudulent schemes across industries. While not completely eliminating the possibility of fraud, blockchain significantly enhances security and trustworthiness by providing a transparent and tamper-proof platform for conducting transactions, thereby mitigating fraudulent activities effectively.

Counterfeit Drug Detection in Pharmaceutical Industry Using Blockchain by Lokesh M R (September 2022) [5].

This paper presents a comprehensive exploration of blockchain technology's application in combating counterfeit products within the pharmaceutical industry, which has been plagued by challenges in tracking products throughout the supply chain process. Counterfeit drugs pose a significant threat, resulting in substantial financial losses for pharmaceutical companies and endangering patient safety due to ineffective or harmful medications. The paper highlights the urgency of implementing a robust system to trace and monitor drug delivery at every stage of the supply chain. Leveraging the capabilities of blockchain, the proposed system aims to address this issue by deploying a blockchain-based drug supply chain management solution using Hyperledger Fabric. The system's efficacy and usability are validated through various tests, demonstrating its potential to effectively combat counterfeiting and ensure the integrity of pharmaceutical products for consumers.

Fake Product Monitoring System Using Artificial Intelligence by Reema Roy, Sunita Patil (2021) [6].

The paper addresses the risks of counterfeit products, particularly in the medical sector, emphasizing the vulnerability of logos. It outlines challenges in logo detection, proposing a two-phase mobile application. The first phase employs spelling detection, while the second utilizes color recognition through color moments, both supported by Artificial Intelligence algorithms. The proposed system combines Naïve Bayes Classifier and Convolutional Neural Network for training and detecting fake or original logos. The comprehensive approach involves logo scanning, image/text detection, feature extraction, and CNN application. The primary emphasis lies in employing AI algorithms to detect both image and textual representations of logos, facilitating quick and accurate identification of fake or original products.

Deep Learning Approach for Cosmetic Product Detection and Classification by Se-Won Kim, Sang-Woong Lee (January 2021) [7].

This paper proposes a novel approach for the identification of cosmetic products in online video content using deep learning techniques. The method consists of a two-stage process involving detection and classification, where variants of the YOLO network are employed for product detection, and subsequently, the detected products are classified using four state-of-the-art classification networks. The inclusion of dilated convolution in these networks enhances feature representations, leading to improved performance. Through extensive experiments, it is demonstrated that YOLOv3 and its tiny version achieve superior speed and accuracy in product detection. Additionally, the dilated networks exhibit slightly better performance compared to the base models, or at least achieve comparable results. Overall, the proposed method proves to be effective in accurately detecting and classifying cosmetic products in online videos, thus contributing to the identification of current commercial trends in the cosmetics industry.

Blockchain Applications in Supply Chain Transactions by Christian F. Durach, Till Blesik, Maximilian Von Diring, Markus Bick (March 2020) [8].

This study addresses the gap in understanding the application areas of blockchain technology in supply chain transactions, emphasizing the importance of clarifying its relevance for businesses. Through a comprehensive approach involving literature review, a Delphi study, and a survey of German machinery and equipment sector managers, the research identifies key blockchain application areas (BAAs) and extends existing frameworks. Notably, verified customer reviews and product quality certification emerge as the most significant blockchain usages in supply chain transactions, while traditional applications such as document-signing processes are expected to see limited adoption. Additionally, logistics and delivery systems, along with token-curated registries, are highlighted as emerging BAAs with substantial relevance. These findings not only contribute to advancing theoretical understanding but also offer practical insights for businesses, guiding strategic decisions on participation in blockchain networks based on their potential benefits and relevance in supply chain operations.

Improving Fake Product Detection Using Ai- Based Technology by Eduard Daoud, Dang Vu Nguyen Hai, Hung Nguyen (April 2020) [9].

This paper addresses the increasing global issue of counterfeit goods, with up to \$1.2 trillion estimated in 2017 and a projected damage of \$1.82 trillion in 2020. Focusing on technological prevention rather than legal aspects, the research explores the rising presence of counterfeit products in the European market. Recognizing that intervention by inspection bodies and authorities alone is insufficient, the paper advocates for consumer involvement in combating counterfeiting. The study investigates the potential of machine learning-based technology, specifically image and text recognition and classification, as a key tool in the fight against counterfeiting. By developing easy-to-use applications, the goal is to empower end-users to identify counterfeit products quickly and precisely, contributing to the broader effort against product piracy.

Fake Product Detection Using Deep Learning Object Detection Models Eduard Daoud, Dang Vu, Hung Nguyen and Martin Gaedke (October 2020) [10].

The detection of counterfeit products poses significant challenges for consumers, particularly in industries such as medical products and children's toys. Despite efforts by inspection bodies and authorities, the presence of counterfeit goods in markets, particularly in Europe and the US, continues to increase. Counterfeiters take advantage of low production costs and the accessibility of e-commerce platforms to sell counterfeit and pirated goods, often bypassing regulatory standards and certifications.

This paper proposes a solution focusing on products with falsified certification or quality marks, recognizing the importance of certification in influencing consumer purchasing decisions.

The study aims to explore how IT technology can contribute to combating counterfeiting, highlighting related works, presenting a solution concept and technical architecture, and addressing implementation challenges and evaluation. Ultimately, the paper aims to provide insights into addressing the growing issue of counterfeit products and outline future directions for research and action.

### 3. COMPARISION ANALYSIS

S.No	Paper Title	Work done on paper	Future work	Drawbacks
1	Rajib Ghosh “Product Identification in Retail Stores by Combining Faster R-CNN And Recurrent Neural Network” June 2023	The article proposes a method for identifying various products on the racks of supermarkets using computer vision-based systems.	Robustness Enhancement, Real-time Implementation, Integration with Inventory Management Systems, Scale-up to Larger Datasets.	Dependency on Data Quality, Computational Complexity, Generalization Limitations
2	Anil Pawa, A. Quadri meenaz Koyal “Fake Product Identification System Using Blockchain” 2022.	The implemented system focuses on countering the issue of counterfeit products through the integration of blockchain technology and QR code identification.	User Interface Improvement, API-Based Data Extraction, Security Measures Exploration.	User Adoption Challenges, Cost Implications, Information Copying Risk.
3	Jianbiao Peng, Beiji Zou “Combining External Attention Gan with Deep Convolutional Neural Networks for Real–Fake Identification of Luxury Handbags” 2022.	The paper proposes an innovative hybrid framework for identifying fake luxury handbags using a combination of External Attention Generative Adversarial Networks and Deep Convolutional Neural Networks.	Further exploration of attention mechanisms, Dataset expansion, Real-world deployment, Model interpretability.	Computational complexity, Data imbalance, Dependency on synthetic data, Model complexity.
4	Anuska Rakshit, Shriya Kumar “Fraud	The study explores the application of blockchain technology in detecting fraud	Enhancing Scalability, Integration with AI and Machine Learning,	Scalability Issues, Regulatory Compliance,

	Detection: A Review on Blockchain” 2022.	across various domains such as rating fraud, insurance fraud, employment history fraud, fraudulent acquisitions, and other fraudulent activities.	Industry-Specific Solutions	Integration Complexity.
5	Lokesh M R “Counterfeit Drug Detection in Pharmaceutical Industry Using Blockchain” Sept 2022.	Recognizing the significant challenges posed by counterfeit drugs, the paper highlights the urgent need for a foolproof system to track and trace products throughout the supply chain process.	Enhancing Interoperability, Integration with IoT, Data Analytics, Regulatory Compliance.	Integration Challenges, Cost, Privacy Concerns.
6	Reema Roy, Sunita Patil “Fake Product Monitoring System Using Artificial Intelligence” 2021.	The paper addresses the risks of counterfeit products, particularly in the medical sector, emphasizing the vulnerability of logos. It outlines challenges in logo detection, proposing a two-phase mobile application.	Enhanced Spelling Detection, Expand Feature Extraction, Integration of Blockchain.	Limited Dataset Information, Sensitivity to Image Variations, Evaluation Metrics.
7	Se-Won Kim, Sang-Woong Lee “Deep Learning Approach for Cosmetic Product Detection and Classification” January 2021.	It includes a two-stage deep-learning method for detecting and classifying cosmetic products in online videos. It utilizes variants of the YOLO network for product detection, followed by classification.	Data Augmentation, Real-time Implementation, Domain Adaptation.	Data Availability, Algorithm Complexity, Interpretability
8	Christian F. Durach, Till Blesik, Maximilian Von Diring, Markus Bick “Blockchain Applications in Supply Chain Transactions” March 2020	It involves understanding of blockchain's business opportunities in SC transactions and verify and extend existing frameworks for blockchain adoption.	Technological Developments, Cross-Industry Comparisons, Qualitative Analysis.	Limited Scope, Dynamic Nature of Technology.

#### 4. FUTURE SCOPE

Blockchain technology holds immense potential for revolutionizing product authentication and addressing issues such as counterfeiting and supply chain transparency. Integration with emerging technologies like the Internet of Things (IoT) and Artificial Intelligence (AI) promises to enhance the reliability and efficiency of product tracking and verification processes.

Through IoT devices, realtime data regarding product movements and conditions can be securely recorded on the blockchain, enabling more accurate authentication. AI algorithms can analyze this data to detect patterns indicative of counterfeit or tampered products, streamlining the verification process and bolstering security measures.

#### 5. CONCLUSION

In conclusion, the proposed blockchain-based anti-counterfeiting system offers a secure, transparent, and user-friendly solution for product authentication.

By leveraging blockchain technology, businesses can protect their products and brand reputation, while consumers can make informed purchasing decisions with confidence.

The system has the potential to disrupt the counterfeit market and create a safer and more trustworthy environment for both businesses and consumers.

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