Product Originality Detector using Blockchain: A review

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Abstract The existence of counterfeit products in the current world market is a big issue to brand image, consumer well-being and economic integrity. The paper includes a comprehensive literature review of how the use of blockchain and the associated digital technologies can be applied to guarantee the authenticity of the products and enhance the transparency of the supply chain. Product information visualize origin, manufacturer information, batch number, and Timestamp are registered in the blockchain at the time of production. The QR code can be scanned by a smartphone application to help a consumer or a stakeholder instantly check the originality of the product and see the entire history of the product. The blockchain ensures the immutability and transparency of data, QR codes offer a convenient and cost-effective interface that will allow to verify data in real-time. The literature review helps devise a mechanism to fight counterfeiting, boost consumer confidence, and enhance supply chain visibility in different sectors.

Keywords: Blockchain, Anti-counterfeiting, Product authentication, Immutability, Smart Contracts.

1 Introduction

Over the past few years, the spread of fake goods has become one of the burning issues on an international scale, negatively affecting consumer safety, a company's income, and brand image. With counterfeit products finding their way into industries as diverse as pharmaceuticals and electronics, as well as the luxury goods industry, even conventional verification processes have failed to offer any meaningful resolutions. As a way of combating this rising menace, researchers and technologists have looked to blockchain technology, in growing numbers, as an immutable, decentralized ledger that could store product authentication and supply chain transparency information.

Blockchain is a revolutionary way of allowing immutable data recording and traceability, where it is close to impossible to change the history of a product without the agreement of the whole network. That immutability has prompted an array of systems that combine QR codes, smart contracts, and cryptographic hashing to verify product authenticity. As an illustration, a Blockchain-Based Management System (BCBM) [1] may associate the barcode or QR code of each item with an unchangeable record on the blockchain, allowing customers to confirm the authenticity of their purchase by themselves.

This idea has been developed by a number of studies. The Blockchain and QR-based Product Analyzer (BQRPA) is efficient in cross-validating the authenticity of products with the aid of a distinct code attached to every item [2]. Similarly, the combination of one-time printable QR codes and GPS (Global Positioning System) tracking, most recently suggested in an anti-counterfeiting solution, offers manufacturers a highly secure system to guarantee brand authenticity, and safeguard consumer confidence [3]. This framework is also strengthened by using the Ethereum blockchain and smart contracts, which provide product verification, transparency, and automation [4].

These innovations do not confine their existence to theoretical discourses. Field tests have shown that blockchain-based anti-counterfeiting systems are possible and accurate. An outstanding implementation is the use of encrypted QR codes and secure manufacturer-consumer interfaces to generate an immutable product journey, between production and point of sale [5]. In a different approach, QR codes are created through computational algorithms and cryptographic hashing, which offer quick and secure counterfeit identification using mobile applications [6].

Also, blockchain-based systems, in addition to detecting fake products, seek to enhance overall supply chain processes through traceability, reduced losses in the grey market, and responsible manufacturing [7]. The systems can decentralize control and bring transparency [8], which will allow all stakeholders, including manufacturers, distributors, retailers, and end-users, to take an active role in enforcing product integrity.

To sum up, blockchain technology and product authentication systems (such as QR codes and smart contracts) have a synergistic effect and can be considered a new paradigm in the fight against counterfeit products. These technologies are still developing and being adopted, but they have considerable potential to change the situation in the area of safe and clear worldwide trading.

2 Literature Survey

Blockchain can improve product identification by creating open, safe and unalterable tracking. This survey treats the current researches to have a glimpse of the role they play in enhancing traceability in production systems.

In [9], the product tracking and counterfeiting are improved with the help of a blockchain and QR code-based solution. The QR code of each product is unique and points to the production data of the product on an unmodifiable blockchain. These codes can be verified by the stakeholders, enforced by smart contracts which enable the procedure with the least degree of error. A mobile application enables the consumer to find out immediately whether it is genuine, which enhances trust and transparency. The system is removing the power imbalance between manufacturers, retailers, and consumers because it is built on Ethereum using smart contracts and role-based access. Nevertheless, set-up can be expensive, it is technical, QR codes are vulnerable, it is not scalable, and there are privacy concerns.

In [10], a decentralized system, built on Ethereum and utilizing smart contracts, is proposed in n to increase the visibility of the supply chain and fight counterfeiting. With the help of a Dapp (Decentralized app), manufacturers, suppliers, and customers cooperate to write and verify product information on the blockchain with QR codes. The platform is supported by technologies such as Ganache, Truffle, Web3.js, React and MetaMask. The product reliability, clear records, independent supply chain management, and consumer verification are its important advantages. Nonetheless, technical dependency, intensive computation expenses, a possible duplication of QR codes, and the necessity to be accepted by the vast majority of the market are among the challenges.

In [11], the system provides with single-use QR codes and Firebase to verify product authenticity, disabling codes after the first scan. It can be accessed through a React.js interface and provides real-time information, SHA (Secure Hash Algorithm) security, and convenience. Efficient as it is, it is not as secure as blockchain, requires network connection and could be subject to customer reluctance. Its capabilities may be improved with integration to blockchain and IoT.

In [12], a system based on blockchain with Hyperledger Fabric and Scratchable-QR codes is described where the products are authenticated and their ownership is traced through smart contracts and REST (Representational State Transfer) APIs. With the help of “Hyper Supply,” stakeholders track the real-time supply chain. It increases security, transparency and consumer confidence, and has disadvantages such as being costly, relying on experts, low user acceptance, and scalability to small business.

The authors [13] have proposed a blockchain-based system which allows preventing counterfeiting and verifying products with the help of Ethereum smart contracts and special QR codes. It provides hash chains to secure it and KPI (Key Performance Indicator) tools to monitor it. Despite the confronted issues, such as low transaction throughput and usage, it improves data security, transparency, and brand protection, and can be prospective in regards to AI and IoT integration.

In [14], a POMS (Production and Operation Management Society) using blockchain that is implemented on the Ethereum platform tackles the problem of post-supply chain counterfeiting and RFID duplication. It attaches exclusive EPCs (Engineering Procurement Construction) to goods and applies smart contracts on RFID (Radio Frequency Identification tags), QR, or NFC (Near Field Communication) tags to ensure safe tracking. Although POMS some drawbacks, such as dependence on Ethereum, privacy, and brittle protocols, it has secure ownership transfer, consumer verification, and low operation costs.

In [15], the authors look at fraud in blockchain-based reputation systems and differentiate between fact-based and opinion-based fraud. Blockchain and cryptographic measures can minimise factual fraud, but not opinion-based fraud such as fake ratings on real transactions. Therefore, even with enhanced trust and security, extra verifications are necessary.

In [16], a product and customer data are secured in a private blockchain system with the signature of SHA-256 and barcode recovery allowing efficient verification with a QR code. It can provide trusted, cost-effective authentication and consumer confidence by allowing no alteration of records. Although it is scalable through cloud and key-based access, it has a product limit of 1,000 and requires QR readers, as well as depends on cloud performance.

In [17], the system described allows SMEs (Small and Medium Enterprises) to fight counterfeiting: it consists of a low-cost web-based system with hashing and QR codes, a MySQL database. Products are assigned an ID and a password, which are checked through the manufacture site, and the records are disabled once utilized. It is developed using PHP (Hypertext Preprocessor), HTML (Hyper Text Markup Language), and JavaScript and is quick, convenient, and cheap to verify, but it is centralized, which creates vulnerability and network connectivity issues.

The authors [18] have proposed a decentralized system based on Ethereum and smart contracts and web3.js to realize safe product authentication through QR codes. It is transparent and verifiable at low costs, since it is encrypted with ECDSA (Elliptic Curve Digital Signature Algorithm), has a PoW (Proof of Work) consensus mechanism, and ownership tracking modules. Although it is secure and decentralized, high-energy consumption, a limit on scalability, and the cost of entry are difficulties.

The authors [19], have proposed a blockchain-based system that involves QR codes to trace and authenticate the products safely. It has advantages like tamper evident records, real time verification and enhanced trust. Smart contracts guarantee the authorized individuals access the information. Nonetheless, external storage of the images is prone to tampering of the data, and QR code can be duplicated without further security implementation.

In [20], methodology entails permissioned blockchain, smart contracts to track, verify and to secure pharmaceutical supply chains. It provides immutability of data and verifies in real time. Benefits are in terms of enhanced traceability, security, and curtailing of counterfeiting. Drawbacks include expensive set up and difficulty of integration.

In [21], a modified UTAUT2 (Unified theory of acceptance and use of technology) model applied in the research and analysed in SMART PLS (Partial Least Squares) allowed evaluating consumer preparedness towards blockchain-authenticated fashion. Its advantage is seen in the determination of the major drivers of adoption such as effort expectancy and social influence. But it is restricted by a thin and youthful sample and certain statistically inconsiderable variables.

The survey demonstrates that blockchain has the ability to improve product identification, bringing more transparency and preventing counterfeiting. The prospects are promising but such challenges as scalability and integration remain to be solved.

Table 2.1 Taxonomy of Literature Review on QR Code authenticity using Blockchain.

No.	Title (Authors, Year)	Methodology	Advantages	Disadvantages	Remarks
1	Keerthy G., et al. 2023 [9]	QR code, Blockchain in product authentication.	Traceability that is safe, open and invulnerable.	Expensive, not measurable, technological dependency.	Optimal solution, suitable with high value goods.
2	Wasnik., et al. 2022 [10]	Ethereum blockchain and smart contract with QR code.	Decentralized, impossible to tamper with, transparent tracking of supply chain.	It needs blockchain infrastructure, technical skills, and it is costly in transactions.	Offers the safest and most scalable system to detect frauds.
3	Devi., et al. 2023 [11]	QR,Firebase, SHA(Secure Hash Algorithm) to authenticate the product.	It is a real time, secure and user friendly.	Requires the internet, poor QR and scale restrictions.	Now Practical, more powerful with blockchain/IoT (Internet of Things)
4	Muzafar., et al. 2023 [12]	Blockchain (Hyperledger) and smart contracts, REST APIs, and scratch-protected QR codes to obtain an authentic product.	It is tamper-resistant, auditable, automated and effective.	It is expensive, complicated and lack of interoperability scale.	Works now against counterfeiting, but more with the IoT, AI, and regulatory integratio n.
5	Dileep M. R., et al. 2024 [13]	QR codes , Blockchain (product verification).	It is open, Safe and reputed.	It is expensive, scale related problems.	Upgrading AI (Artificial Intelligence)/IoT pro mising.
6	Toyoda ., et al. 2017 [14]	Blockchain RFID/QR/NFC (Near Field Communication) to verify the ownership of products.	It is open, non-resistant, cheap, customer confidence.	Trading costs, level of scalability, semi centralization.	Suited to products of high value, which have a future with AI/IoT integration.
7	Cai., et al. 2016 [15]	Reputation fraud analysis on blockchain.	Permanent, open, does not want bad-mouthing/whitewa shing.	Weak against subjective fraud (ballot-stuffing, sybil).	Good on objective fraud, poor in subjective cases.
8	Gupta., et al. 2024 [16]	Blockchain, AES (Advanced Encryption Standard), QR-code with bit-reconstruction.	It is Safe, quick, decreases counterfeit and wait.	Increased encryption latency, small size.	SMBs (Small and Medium Based Business) practice, should scale up later.
9	Hossain., et al. 2024 [17]	RFID that has secured tags and unique codes that are read by scanners.	Real-time authentication, brand protection.	It is expensive per tag, Cloning threat.	Not ideal for SMBs.

10	Mhatre., et al. 2023 [18]	Blockchain and QR and smart contract.	Secured, transparent, decentralized.	Expensive, complicated, inability to be scaled.	Viable solution, needs further enhancement.
11	Maheshwari M., et al. 2025 [19]	Supply chain traceability blockchain ledger.	With impregnable records.	Implementation cost is high and energy cost is high.	Guarantees long term trust and transparency.
12	Shukla., et al. 2025 [20]	Product registration, transfer and verification with a smart contract.	It automates and eliminates human error.	Once it is deployed, it is hard to change; any coding mistakes can break down the operations.	Provides the foundation of the secure automation of supply chains.
13	Sovtic,et al.2025 [21]	Supply chain traceability based on blockchain ledger.	Immutable records that have a decentralized nature.	It is costly implementation and cost of energy.	Guarantees long term trust and transparency.

3 Open Challenges

There are a number of challenges that are open to the adoption of blockchain as a product identification that limit its application on a large scale. Scalability and speed of transaction is ever a problem, with existing blockchain networks not being able to efficiently handle the large amount of supply chain data. It is also expensive in the development of infrastructure, integration and transaction charges, which makes it hard to implement, particularly in the case of small and medium enterprises. Another concern is the interoperability with the current technologies like RFID, QR codes, and the ERP systems, as the industries use the old systems that are not readily compatible with blockchain systems. Moreover, blockchain transparency contributes to a higher level of trust but introduces the issue of privacy of the sensitive company and consumer data, which can be addressed by ensuring a secure system of access control. Consensus mechanisms such as Proof of Work also come with energy usage issues, but more recent options are yet to be validated. Above all, blockchain cannot have any inherent mechanism to verify the authenticity of the data being inputted; once fake information is recorded as legitimate, it can never be changed, and the issue of garbage in, garbage out stays a thorn in the side of the system.

4 Summary

Blockchain technology is presently seen as a safe and autonomous tool to help find original products and fight counterfeiting. Barcodes and RFID can be changed, but blockchain keeps tracking of each step of a product's journey from start to finish, so nothing is changed. Some researchers use platforms including Ethereum and Hyperledger and combine smart contracts and QR codes to ensure instant verification. Still, these systems do not work well for large volumes, with the IoT (Internet of Things) or when the costs are too high.

5 Conclusions

Applications of blockchain in originality detection of products offers a transparent and safe way of authenticating products, which can help in the fight against counterfeit products. According to the literature, blockchain offers tamper-proof records because of its decentralized nature, which makes it a suitable solution for tracking the origin of products. The technology demonstrates excellent promise; however, the practical issues, such as the cost of implementation and integrating the system, are subjects of ongoing research and development.

References

[1] Jayaprasanna, M. C., Soundharya, V. A., Suhana, M., & Sujatha, S. (2021, February). A block chain based management system for detecting counterfeit product in supply chain. In 2021 Third international conference on intelligent communication technologies and virtual mobile networks (ICICV) (pp. 253-257). IEEE.

[2] Geetha, R., Jayakumar, D., Prabakaran, P., Nivedha, S., Sindhu, M., & Thivyarathi, R. C. (2024, May). An Experimental Evaluation of an Effective QR Code Based Duplicate Product Detection Using Blockchain Technology. In 2024 International Conference on Intelligent Systems for Cybersecurity (ISCS) (pp. 1-7). IEEE.

[3] Pragadeesh, M., Vignesh, B. K., Ashraf, S. M., & Kumar, R. D. (2024, February). Anti Counterfeiting Solution For Product Authentication Using Blockchain. In 2024 Second International Conference on Emerging Trends in Information Technology and Engineering (ICETITE) (pp. 1-4). IEEE.

[4] Dhore, M. L., Loya, R., Sasne, R., Rokade, T., & Chandak, R. (2024, August). Anti-Counterfeit Product Identification System: A Paradigm Shift in Supply Chain Integrity. In 2024 8th International Conference on Computing, Communication, Control and Automation (ICCUBEA) (pp. 1-6). IEEE.

[5] Singhal, I., Bisht, H. S., & Sharma, Y. (2021). Anti-counterfeit product system using blockchain technology. Int. J. Res. Appl. Sci. Eng. Technol, 9(12), 291-295.

[6] Shankar, B. P., Rajkumar, N., Viji, C., Kumar, K. D., Saravanakumar, S., & Mohanraj, A. (2024, September). Approach to Identifying Counterfeit Products with QR Codes and Computational Algorithms. In 2024 5th International Conference on Smart Electronics and Communication (ICOSEC) (pp. 1203-1209). IEEE.

[7] Prathipa, S., Harish, K., & Thashanmouli, N. (2022, November). Counterfeit product detection in supply chain management with blockchain. In 2022 1st International Conference on Computational Science and Technology (ICCST) (pp. 841-844). IEEE.

[8] Mane, V., Patil, R., Pawar, S., & Pujari, N. (2024, August). Detection of Counterfeit Products with QR Codes using Blockchain Technology. In 2024 7th International Conference on Circuit Power and Computing Technologies (ICCPCT) (Vol. 1, pp. 545-550). IEEE.

[9] Keerthy, G., Rohith, N., Bg, H., Nayak, A. D., & Srinivas, D. B. (2023, July). Enhancing product authentication and counterfeit detection using qr codes and blockchain technology. In 2023 2nd International Conference on Edge Computing and Applications (ICECAA) (pp. 262-267). IEEE.

[10] Wasnik, K., Sondawle, I., Wani, R., & Pulgam, N. (2022). Detection of counterfeit products using blockchain. In ITM Web of conferences (Vol. 44, p. 03015). EDP Sciences.

[11] Devi, P. J., Dutta, M. S., Damerakonda, M., Gutti, D. N., & Domakuntla, S. K. (2023, August). One Time QR-Code for Fake Product Identification. In 2023 5th International Conference on Inventive Research in Computing Applications (ICIRCA) (pp. 583-588). IEEE.

[12] Muzafar, M. A., Bhargava, A., Jha, A., & Nand, P. (2023). Securing the supply chain: a comprehensive solution with blockchain technology and QR-based

anti-counterfeit mechanism. International Journal of Performability Engineering, 19(5), 312.

[13] Dileep, M. R., & Sathvic, A. (2024, November). Securing Authenticity: A Frontier Block Chain-Powered Fake Product Detection via QR Codes. In 2024 Second International Conference on Advanced Computing & Communication Technologies (ICACCTech) (pp. 188-194). IEEE.

[14] Toyoda, K., Mathiopoulos, P. T., Sasase, I., & Ohtsuki, T. (2017). A novel blockchain-based product ownership management system (POMS) for anti-counterfeits in the post supply chain. IEEE access, 5, 17465-17477.

[15] Cai, Y., & Zhu, D. (2016). Fraud detections for online businesses: a perspective from blockchain technology. Financial Innovation, 2(1), 20.

[16] Gupta, S., Kuchipudi, R., Sohail, M., Singh, K., Mahalakshmi, J., & Sarabu, A. (2024). Fake product identification for small and medium firms (FPISMF) using blockchain technology. Measurement: Sensors, 33, 101164.

[17] Hossain, M., Begum, M., Das, B. C., & Uddin, J. (2024). A cost-effective counterfeiting prevention method using hashing, QR code, and website. International Journal of Advances in Applied Sciences, 13(2), 351-359.

[18] Mhatre, M., Kashid, H., Jain, T., & Chavan, P. (2023). BCPIS: Blockchain-based counterfeit product identification system. Journal of applied security research, 18(4), 740-765.

[19] Maheswari, M., Somasundaram, V., Kumar, S. M. J., & Suryanarayanan, S. (2025). Product Identification System Utilizing Blockchain to Combat Counterfeiting. International Journal of Advanced Scientific Multidisciplinary Research, 2(3), 46-53.

[20] Shukla, P., & Patel, S. (2025, May). Securing Medicine Supply Chains Through Blockchain Based Trustworthy Certification. In International Conference on Recent Advancements and Modernisations in Sustainable Intelligent Technologies and Applications (RAMSITA 2025) (pp. 765-788). Atlantis Press.

[21] Sovtić, D., Trpkov, A., Radenković, M., Popović, S., & Labus, A. (2025). Examining Readiness to Buy Fashion Products Authenticated with Blockchain. Journal of Theoretical and Applied Electronic Commerce Research, 20(2), 119.