

Innovative Approaches to Fake Product Detection: Blockchain and QR Code Synergy

Apeksha Vatte^{1,*}, Giridhar Chinchakar², Akshay Kamble³, Rohit Vishwakarma⁴

Abstract

For consumers, corporations, and regulatory agencies, the worldwide market's rise of counterfeit goods presents serious issues. Maintaining consumer confidence, guaranteeing product safety, and preserving brand reputation all depend on the ability to identify counterfeit goods. An overview of the different approaches and difficulties associated with spotting counterfeit goods is given in this abstract. First off, the ability to identify sophisticated counterfeit goods is limited by the use of conventional techniques like eye inspection and authenticity labels. Two innovative technologies that have emerged as viable tools for combating counterfeit identification are machine learning algorithms and blockchain technology. Large-scale data analysis using machine learning models can spot trends that point to fake goods, while blockchain technology allows safe product identification and traceability. The ability of counterfeiters to evade detection techniques, the absence of standardised authentication standards, and the complexity of international supply chains are obstacles in the identification of fake products. Furthermore, the sale of counterfeit goods has been made easier by the quick expansion of online marketplaces, making it difficult for customers to tell the difference between real and imitation goods.

Keywords: Blockchain, Ethereum, counterfeit, QR code, blockchain, counterfeit, supply chain

INTRODUCTION

Products that are counterfeit seriously jeopardise customer security, brand equity, and financial stability. In addition to misleading customers, the market's overabundance of counterfeit goods undermines the reputation of respectable companies. A Fake Product Identification System that makes use of QR codes and Blockchain technology has evolved as a potent and inventive answer to this

expanding issue. Through the provision of transparency, traceability, and a trustless environment, technology improves supply chain security. To guarantee the accuracy of product information, it makes use of decentralised ledger technology, smart contracts, and cryptographic hashing. By scanning the QR code, customers can expeditiously verify the authenticity of a product and initiate a secure authentication process.

Motivation

Fake products often fail to meet safety standards and may contain harmful materials or substances. When inferior imitations dilute the image of authentic brands, counterfeit goods have the potential to harm those businesses' integrity and reputation. By detecting fake products, businesses can safeguard their market share and revenue streams, thereby supporting their sustainability and growth.

*Author for Correspondence

Apeksha Vatte

E-mail: apekshavatte@gmail.com

¹Student, Department of computer Engineering RD' Shri Chhatrapati Shivajiraje College of Engineering, Dhangwadi, Bhor, Pune, Maharashtra, India

²Department of computer Engineering RD' Shri Chhatrapati Shivajiraje College of Engineering, Dhangwadi, Bhor, Pune, Maharashtra, India

³Department of computer Engineering RD' Shri Chhatrapati Shivajiraje College of Engineering, Dhangwadi, Bhor, Pune, Maharashtra, India

⁴Department of computer Engineering RD' Shri Chhatrapati Shivajiraje College of Engineering, Dhangwadi, Bhor, Pune, Maharashtra, India

Received Date: May 26, 2024

Accepted Date: June 27, 2024

Published Date: July 01, 2024

Citation: Apeksha Vatte, Giridhar Chinchakar, Akshay Kamble, Rohit Vishwakarma. Innovative Approaches to Fake Product Detection: Blockchain and QR Code Synergy. International Journal of Radio Frequency Innovations. 2024; 2(1): 21–27p.

Recognising counterfeit goods ensures that inventors and artists' intellectual property is protected and that they are fairly acknowledged and compensated for their contributions. The fake products helps maintain supply chain integrity by identifying and eliminating unauthorized or counterfeit goods, ensuring that products meet established quality and ethical standards

LITERATURE SURVEY

There are many fake products in the existing supply chain. In order for customers to determine whether or not the goods they are purchasing is authentic, a system that allows them to review every aspect about it is required. Counterfeit products have become a significant factor in the product manufacturing industry in recent times. This has an impact on the businesses' sales, profits, and brand. Block technology is used to identify real products and detect fake products. Blockchain technology is a distributed, decentralised, digital ledger that is connected to numerous database/node-computers that maintains transactional data in the form of blocks. Because data recorded in a blockchain is immutable, any block in the chain cannot be altered or compromised, making blockchain technology secure [1–4]. Through the utilisation of Blockchain technology, consumers or users can verify the validity and safety of products without depending on other users. Quick Response (QR) codes, an innovative technology used in our system, offer a powerful method of combating the practice of product counter feiting [5–9]. By connecting the product's QR code to Blockchain, counterfeit goods can be identified with a QR code scanner. Thus, this method might be used to generate a product's unique code as database blocks and record product details [10–13].

Existing System

Customers can obtain comprehensive details regarding the product's provenance, legitimacy, and supply chain path by scanning the QR codes. IBM Food Trust tracks and traces food products from farm to table using blockchain technology and QR codes, but it was initially concentrated on the food business. The supply chain management of pharmaceuticals is the focus of this blockchain-based technology. Buyers can use QR codes to make safe transactions, while sellers can use them to offer payment information and product data.

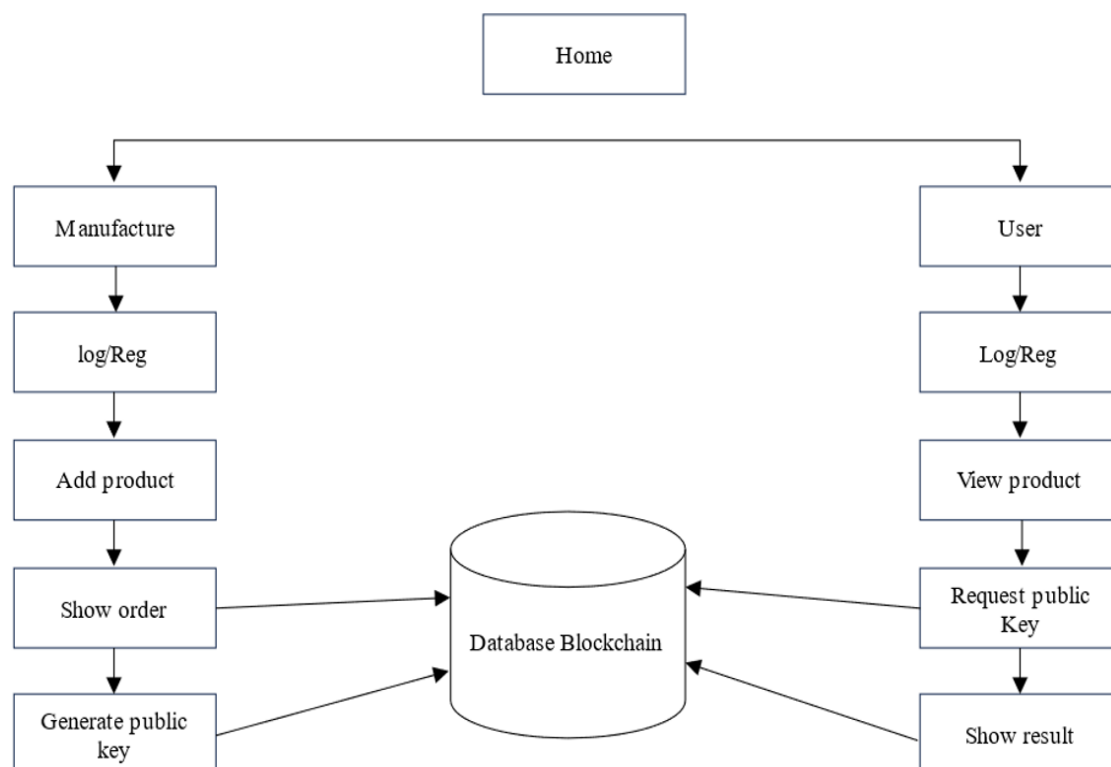


Figure 1. Supply chain management using blockchain.

Problem Statement

To spread of fake products not only results in financial losses but also endangers consumer safety and trust.

METHODOLOGY

Check the goods for any differences in terms of quality overall, packaging, labelling, typefaces, colours, and logos. For the aim of authentication, a lot of products come with unique security features like holograms, serial numbers, QR codes, or RFID tags. Purchase solely from licenced stores and trustworthy sources to lower the likelihood of purchasing counterfeit goods. A few examples of the features are holograms, unique tags, QR codes, and serial numbers. Learn about these features and use the manufacturer's instructions to confirm their legitimacy. By employing these techniques and staying watchful, you can strengthen your capacity to spot phoney goods and safeguard yourself against buying or utilising them.

Manufacturer and consumer part applications make up the system: *Manufacture End:* For membership and authentication reasons, the company is utilising mail ID verification. Using the QR code that the programme generates to capture all of the product details, users can upload product information, add new items or products, and log in to the system. Serialising the QR code is also advised to improve security and keep an eye on the goods. Product data will be stored in a database, and a secure graphic technique will make the QR code tamper-proof and copy-sensitive—that is, once copied, information is lost, and printing cannot be undone.

Customer End: Using their email address and password, customers must register or log in. The product starts with a scan button to scan its QR code once user authentication is complete. Here, the user is a customer who wishes to verify if the goods are authentic or not. The customer's distinct scanned code and the code generated by the manufacturer will be compared block by block. The user will thereafter receive notification regarding the product's validity. Customers can view information about the product, including its name, manufacturing year, price, overall quality, product quality, and manufacturer data.

Working: The framework may detect counterfeit items by using QR (Quick Response) codes, which are linked to specific products and enable people to scan the codes using smartphones or other scanning devices. This will show whether the products are real or fake.

After completing the registration process and having their mail ID validated, a corporation can upload product details via a QR code generated by the system.

The product data comprise the name and brand of the product together with the year of manufacture, price, total amount, product quality, and manufacturer information. This will be stored in a Firebase database, and the image of the QR code will be stored in a decentralised block using blockchain technology.

PROJECT ESTIMATES

The waterfall model is what we use to estimate the project.

1. *Requirement collecting and analysis:* In this waterfall phase, we determine what kinds of requirements, such as database management and interfaces, software and hardware needs, are necessary for our project.
2. *System Design:* In this phase, we design a system that is easy for the end user to use and comprehend.
3. We create some data flow diagrams and UML diagrams to comprehend the system flow, system module, and execution order.
4. *Implementation:* During the implementation stage of the project, we succeeded in implementing the various modules required to produce the intended results at the various module levels. The

system is first developed as units, or tiny programmes, using inputs from the system design. These modules are then integrated in the subsequent phase. The process of creating and assessing each unit for functionality is known as unit testing.

5. *Testing*: A variety of test cases are conducted to determine whether the project modules are delivering the required outcomes within the projected time frame. All of the components developed during the implementation phase are integrated into a single system once each unit has undergone testing. After integration, the system is checked for flaws and defects throughout.
6. *System Deployment*: The product is either put on the market or put into a customer environment after functional and non-functional testing is finished.
7. *Maintenance*: There are sporadic issues with the client environment. Patches are released to fix specific issues. Additionally, updated versions of the product are provided to enhance it. To bring about these modifications in the client environment, maintenance is carried out.

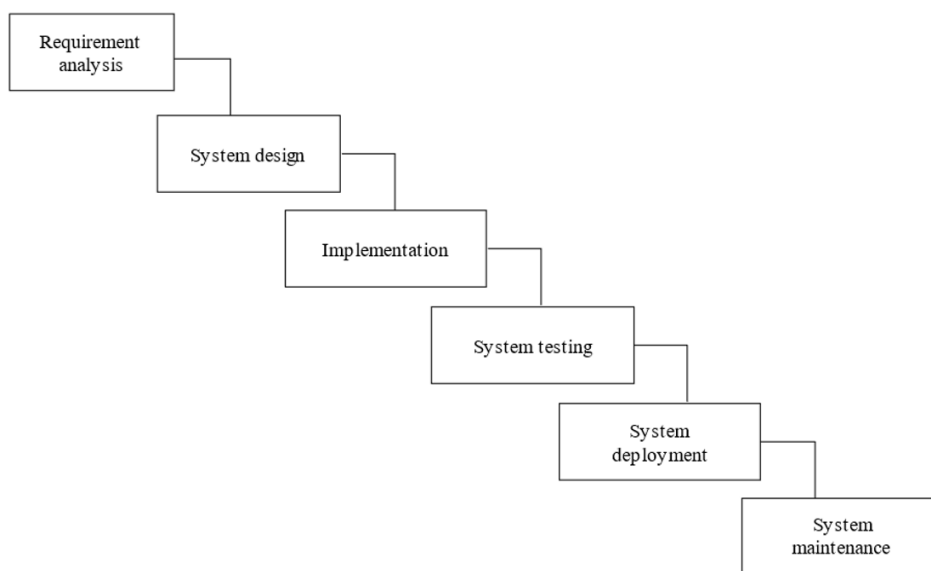


Figure 2. Steps involved in the waterfall model.

Analysis Model: SDLC Model To Be Applied

The steps of the software development cycle, which include project design, implementation, and deployment, are combined. This section describes the many stages of the software development model. The following figure can be used to understand the project development SDLC model. The waterfall model of the SDLC was selected since it is the most user-friendly and suitable for this project's implementation.

Requirements Analysis: During this phase, the use case definitions, business requirements, and related documentation are examined and produced. *Design*: Various data preparation and analysis tasks as well as the definition of data model designs will be completed during this phase.

Implementation: At this point, the model's actual development will take place. The back end and front-end components of the agent will be developed using suitable algorithms, mathematical models, and design patterns based on the requirements and data model designs from earlier stages.

Testing: In this step, the developed model built on the earlier stages will be put to the test. We'll run a number of validation tests on the trained model. *Deployment*: The model can be utilised in simulated scenarios or deployed once its accuracy scores have been verified.

Maintenance: The model will be subjected to a variety of inputs and scenarios when using the produced solution, which may have an impact on the model's overall correctness. Alternatively, as time

goes on, the model might not meet the updated company needs. Therefore, regular maintenance is required to maintain the model functioning as intended.

Proposed System

Establish a blockchain network where product-related data will be recorded in a tamper-proof and transparent manner. Generate unique QR codes for each product in the manufacturing or packaging phase. When a product is manufactured or enters the supply chain, its information is recorded on the blockchain. The system checks the blockchain data to confirm the product's authenticity. If the system detects any discrepancies or suspicious activity in the supply chain, it can trigger alerts to relevant parties, such as manufacturers or regulatory authorities.

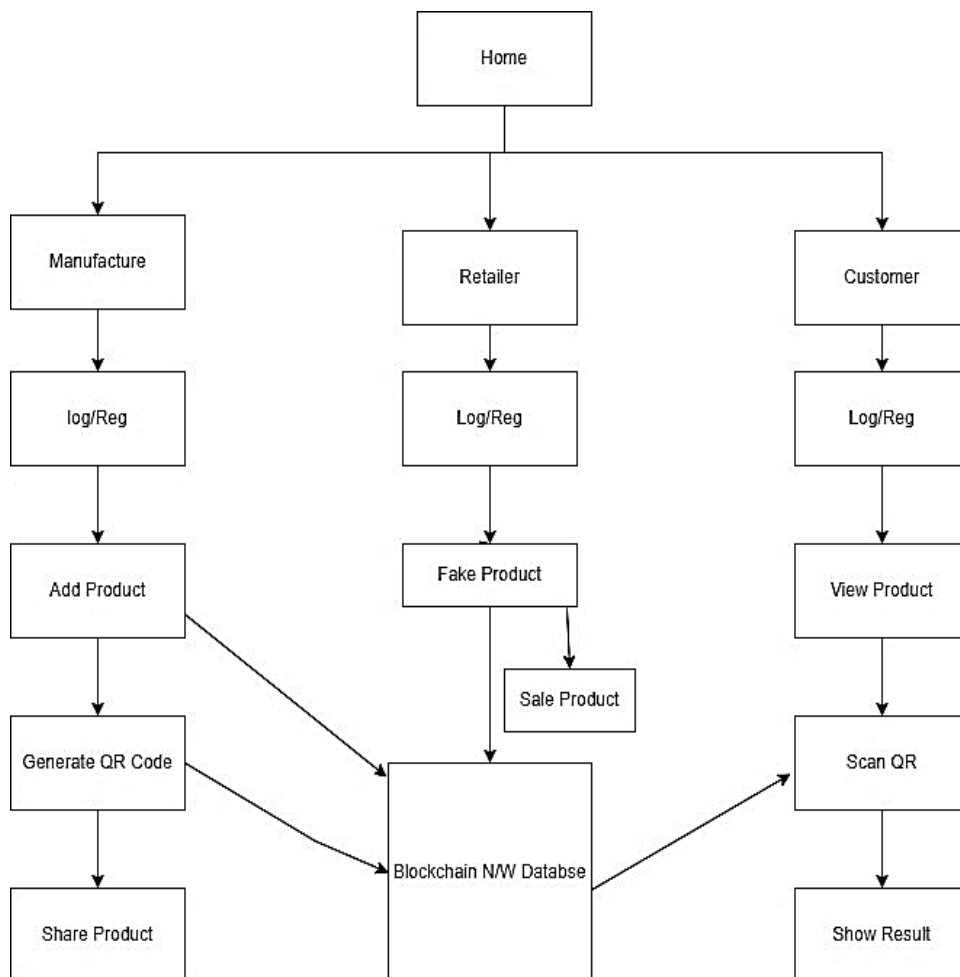


Figure 3. Proposed system algorithm.

WHAT IS BLOCKCHAIN TECHNOLOGY?

Create a blockchain network where transparent and tamper-proof data pertaining to products is recorded. Create distinct QR codes for every product while it's being manufactured or packaged. A product's details are entered onto the blockchain at the time of manufacturing or supply chain entry. The technology validates the blockchain data to confirm the product's validity. The system can notify the appropriate parties, such as manufacturers or regulatory agencies, if it finds any anomalies or questionable activities in the supply chain. The manufacturer will not be able to utilise the unique QR code for any other product after it is generated for each block transaction. Manufacturers who employ serialised QR codes to display product information, interact with customers, and boost sales can improve the security and dependability of the tracing and identification process.

Prior to scanning the product's barcode or QR code, the customer must register or log in to the system. Following user authentication, the manufacturer's code generated in smart contract blocks will be compared with the customer's unique scanned code.

If the code matches, the user will be notified that the product is real, complete with all of its details and an authentic certificate from the database. If the code does not match, the user will be told that the items are phoney, which can prevent them from purchasing a phoney item that could result in major health issues or financial losses.

If the product is phoney, the manufacturer stands to gain as well. The manufacturer will receive notification of the user's location with consent, enabling them to take legal action against the distributor, retailer, and black-market maker. This safeguards customers' trust in merchants, increases user pleasure, and can assist manufacturers in avoiding wasting time or resources battling against sales and reputational damage brought on by forgeries.

Advantages of Blockchain

Enhanced security: Blockchain can drastically alter how you view important information that is sensitive to you. By creating an irreversible, end-to-end encrypted record, the blockchain helps to stop fraud and unlawful activity. Blockchain privacy issues can be resolved by using permissions to limit access and anonymizing personal information. Since data is kept over a network of computers rather than on a single server, hackers have a harder time accessing it.

Enhanced transparency: In the absence of blockchain, each company needs to keep a separate database up to date. Because blockchain uses a distributed ledger, it preserves data and transactions in several locations in an identical way. Since everyone with permitted access to the network views the same data at the same time, complete transparency is guaranteed. Every transaction is permanently recorded, time- and date-stamped. This tool allows members to view the entire transaction history and virtually eliminates the risk of fraud.

Instant traceability: An asset's origin is tracked at every stage of its travel thanks to an audit trail created by blockchain technology. This provides evidence in industries where fraud and counterfeiting are issues, or where customers are concerned about a product's effect on human rights or the environment. Blockchain enables direct data sharing of provenance with customers. Furthermore, any supply chain's weak points, like goods left on a loading dock awaiting delivery, can be identified using traceability data.

Enhanced speed and efficiency: Time-consuming, prone to human error, and frequently requiring third-party mediation are the drawbacks of traditional paper-heavy operations. Blockchain simplifies these procedures, allowing for quicker and more effective transaction completion. The blockchain can be used to record transaction and documentation data, eliminating the need for paper exchange. Because there is no need to reconcile several ledgers, clearing and settlement can occur much faster.

APPLICATION OF BLOCKCHAIN

Money transfers: This is still a fantastic use case for the initial idea that led to the development of blockchain technology. When compared to using current money transfer services, money transactions made using blockchain can be quicker and less expensive. This is especially true for transactions across borders that are expensive and time-consuming. Money transfers between accounts can take days, even in the current American banking system; in contrast, a blockchain transaction only takes minutes.

Exchanges of money Over the past few years, a large number of businesses have emerged offering decentralised bitcoin exchanges. Blockchain exchanges enable cheaper and faster transaction times. Additionally, investors have more autonomy and security because a decentralised exchange does not oblige them to deposit their assets with the centralised authority. Although blockchain-based exchanges mainly deal with cryptocurrencies, traditional assets could also benefit from the technology.

Protect private information Your Social Security number, birthdate, and other identifying information might be safer to keep on a public ledger (like a blockchain) than they are right now on more insecure platforms. Blockchain technology can be applied to the travel, healthcare, finance, and education sectors to secure access to information while also improving accessibility for people who require identification.

CONCLUSION

The implementation of a Fake Product Identification System utilising Blockchain and QR Code has great potential to tackle the widespread issue of counterfeit goods in the marketplace. This creative approach uses blockchain technology and QR codes to give manufacturers, authorities, and customers transparency, confidence, and security.

Future Scope

Marketing efforts can make inventive use of fake goods to draw attention, create buzz, or deliver a message. In a variety of disciplines, such as business studies, marketing, engineering, and design, counterfeit goods can be used as teaching aids. These works can be shown in galleries, shows, or online venues that support artistic expression. This method ultimately results in more reliable end products by enabling developers to iterate quickly, polish concepts, and spot possible problems or enhancements early in the development cycle.

REFERENCES

1. Si Chen, Rui Shi, Zhuangyu Ren, Jiaqi Yan, Yani Shi, Jinyu Zhang, "A Blockchain-based Supply Chain Quality Management Framework", 14th, IEEE International Conference on e-Business Engineering, 2021
2. Mitsunaki Nakasumi, "Information Sharing for Supply Chain Management based on Block Chain Technology", 19th Conference on Business Informatic, IEEE, 2020
3. V. Srivastava and A. D. Kalro, "Enhancing the helpfulness of online consumer reviews: The role of latent (content) factors", J. Interact. Marketing, Nov2020.
4. RUIGUO YU et al, "Authentication With Block-Chain Algorithm and Text Encryption Protocol in Calculation of Social Network, IEEE Access November 28,2021.
5. Counterfeit Product Detection IOSR Journal of Engineering (Sandeep Hembade, Mayur Patil, Anmol Gandhi, Prof. Krishnanjali Shinde, 2022
6. Haq, Ijazul & Muselemu, Olivier. (2018). Blockchain Technology in Pharmaceutical Industry to Prevent Counterfeit Drugs. International Journal of Computer Applications. 180. 8-12. 10.5120/ijca2018916579.
7. Feng Tian, "An agri-food supply chain traceability system for China based on RFID & blockchain technology," 2020 13th International Conference on Service Systems and Service Management (ICSSSM), 2016, pp. 1–6, doi: 10.1109/ICSSSM.2016.7538424.
8. P. William, P. Kumar, G. S. Chhabra and K. Vengatesan, "Task Allocation in Distributed Agile Software Development using Machine Learning Approach," 2021 International Conference on Disruptive Technologies for Multi-Disciplinary Research and Applications (CENTCON), 2021, pp. 168–172, doi: 10.1109/CENTCON52345.2021.9688114.
9. Ahamed NN, Vignesh R, Alam T. Tracking and tracing the halal food supply chain management using blockchain, RFID, and QR code. Multimedia Tools and Applications. 2023 Nov 3;1–26.
10. Bandyopadhyay A, Karmakar J, Raj K, Swain S. Fake Medicine Detection Using Blockchain in Metaverse Domain. In Healthcare Services in the Metaverse 2024 May 2 (pp. 154–169). CRC Press.
11. Kamišalić A, Kramberger R, Fister Jr I. Synergy of blockchain technology and data mining techniques for anomaly detection. Applied Sciences. 2021 Aug 29;11(17):7987.
12. Liu X, Shah R, Shandilya A, Shah M, Pandya A. A systematic study on integrating blockchain in healthcare for electronic health record management and tracking medical supplies. Journal of Cleaner Production. 2024 Apr 1;447:141371.
13. Islam I, Islam MN. A blockchain based medicine production and distribution framework to prevent medicine counterfeit. Journal of King Saud University-Computer and Information Sciences. 2024 Jan 1;36(1):101851.