Fake Product Identification System Using Blockchain

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***Abstract*—**Fake product identification is a growing concern in today's global market. The use of blockchain technology can help address this issue by providing a secure and transparent way to track the provenance of products. This paper proposes a system for fake product identification using blockchain, which involves assigning a unique identifier to each product at the time of manufacture and storing its transaction history on the blockchain. By leveraging the decentralized nature of blockchain, this system ensures the authenticity and integrity of product information, making it virtually impossible to tamper with. This paper also discusses the benefits and challenges of implementing such a system and highlights the potential impact it could have on supply chain management and consumer trust. Overall, this paper provides insights into the potential of blockchain technology to tackle the issue of fake products in a secure and efficient manner. Moreover, blockchain-based solutions for fake product identification enable stakeholders to trace the source of counterfeit products. The technology allows them to follow the product's journey from the manufacturing facility to the point of sale, identifying where the counterfeit entered the supply chain. This enables them to take appropriate measures to prevent further counterfeiting and safeguard their brand reputation. In conclusion, blockchain-based solutions for fake product identification offer a secure and transparent way to combat counterfeiting and protect consumers from potentially harmful products. By creating an immutable record of a prod- uct's journey through the supply chain, blockchain technology can enable manufacturers, retailers, and consumers to verify the authenticity of products and prevent counterfeiting.

***Index Terms*—**Fake product, Blockchain, Decentralized

I. Introduction

Fake product identification has become a pressing concern in today's global market due to the rise in counterfeit goods, which not only deceive consumers but also damage brand reputation and revenue. In response to this, various methods have been developed to identify and prevent counterfeit products, such as using anti-counterfeit labels, serial numbers, or QR codes. However, these methods are vulnerable to fraud and can be easily replicated by counterfeiters.

Blockchain technology has emerged as a potential solution to the problem of fake product identification. By leveraging its decentralized and transparent nature, blockchain can provide a secure and tamper-proof way to track the provenance of products throughout the supply chain. This enables consumers to verify the authenticity of products, and companies to ensure the integrity of their brand.

This paper proposes a system for fake product identification using blockchain, which involves assigning a unique identifier to each product at the time of manufacture and storing its transaction history on the blockchain. The system allows for easy tracking of a product's journey from manufacturer to end-user, providing transparency and accountability in the supply chain.

This paper aims to explore the benefits and challenges of implementing such a system, and to discuss its potential impact on supply chain management and consumer trust. The following sections will provide a detailed description of the proposed system, along with its benefits and limitations.

II. Literature Survey

The related anti-counterfeiting technology has already been proposed but not yet perfected. Nowadays, Small and medium-sized enterprises (SMEs) often have financial burdens, which cannot be compared with large companies with strong financial resources. In the brand management sector, SMEs will inevitably need to reduce costs and will be most likely unable to implement traditional methods of preventing counterfeited goods [1].In order to improve supply chain quality management with the blockchain technology, this study proposes the framework and system architecture for blockchain-based supply chain quality management.Blockchain technology adopts the governance model of human society in IT systems, and further develops the traditional centralized system to a multi-centered or decentralized system that enables different interest groups to share power in the same IT system. This system also improves the qualities of products and services in supply chains by contracts. These two aspects of IT and management mechanisms are exactly the two domains in which management science and information management

systems are exploring in supply chain quality management, and also interprets the value of blockchain in the research of this field [2]. Several solutions for anti-counterfeiting and brand protection have been proposed based on QR code watermarking, RFID (Radio Frequency Identification) tags or similar hardware which is, in most cases, too expensive to be applied on bottles since price of the tag exceeds price of the actual wine product. The proposed smart tag design, based on QR codes and functional ink, will make assigning the unique identifier to each bottle possible and viable[3]. Paul (2019) proposed [5] a blockchain-based system for detecting fake news in social media. The system verifies the authenticity of news sources and records the entire lifecycle of news on the blockchain, making it difficult to manipulate. Tambe et al. (2021) presented [7] a blockchain-based fake product detection system that utilizes QR codes to enable consumers to verify the authenticity of products. The system records the entire supply chain process on the blockchain, providing transparency and traceability. Sandi et al. (2018) proposed smart tags for brand protection and anticounterfeiting in the wine industry. The tags contain NFC chips that record the product's information on the blockchain, enabling consumers to verify the authenticity of the wine[8]. Tse et al. (2017) proposed[8] a blockchain application in food supply information security that addresses the challenges of food safety and quality control. The system records the entire food supply chain on the blockchain, providing transparency and traceability. Tian (2017) presented[9] a supply chain traceability system for food safety based on HACCP, blockchain, and the Internet of Things. The system records the entire supply chain process on the blockchain, providing transparency and traceability. Sanghi et al. (2021) proposed[10] a blockchain-based system for detecting fake drugs. The system records the entire drug supply chain on the blockchain, enabling consumers to verify the authenticity of the drugs. Lakshmi et al. (2021) presented a blockchain-based system for detecting fake drugs. The system records the entire drug supply chain on the blockchain, enabling consumers to verify the authenticity of the drugs. Lakshmi et al. (2021) presented[11] a blockchain based inventory management system that utilizes QR codes to track inventory. The system records the entire inventory process on the blockchain, providing transparency and traceability. Jambhulkar et al. (2022) proposed[12] a blockchain based fake product identification system that utilises QR codes to enable consumers to verify the authenticity of products. The system records the entire supply chain process on the blockchain, providing transparency and traceability. Shastri et al. (2022) proposed [13] a blockchain-based system for detecting fake products. The system records the entire supply chain process on the blockchain, enabling consumers to verify the authenticity of the products. Sure, here are some additional points that can be included in the literature review on fake product identification using blockchain: The role of blockchain in preventing counterfeiting is not limited to product identification alone. Blockchain technology can be used to track the entire supply chain of a product, including its origin, transportation, storage, and distribution, thus making it difficult for counterfeit products to enter the market. Several studies have focused on the application of blockchain in specific industries such as healthcare, wine, and food. For instance, a study [14]by K.A. Clauson (2018) explored the use of blockchain to enhance supply chain management in health-care. The use of smart contracts in blockchain technology can enable automatic verification and authentication of products.

III. PROBLEM STATEMENT

Counterfeit products pose a serious threat to both consumers and manufacturers alike, as they are often of subpar quality and can pose health and safety risks. The current methods of identifying and tracking products are not always effective, leading to a proliferation of fake products in the market. This is particularly problematic in industries such as luxury goods, pharmaceuticals, and electronics. To combat this issue, there is a need for a secure and efficient system for identifying and tracking genuine products throughout the supply chain. Therefore, the goal of this project is to design and develop a fake product identification system using blockchain technology that can authenticate and track products in real time, giving consumers the confidence that the products they purchase are genuine.

IV. BACKGROUND RESEARCH

A. Ethereum

Ethereum is an open-source blockchain platform that was proposed by programmer Vitalik Buterin in 2013. The platform allows developers to build decentralized applications on its blockchain, which can serve various purposes, such as creating digital currencies and enabling decentralized marketplaces. One of the main features of Ethereum is its use of smart contracts, which are self-executing programs that automatically execute contract terms when specific conditions are met. These smart contracts enable developers to create decentralized applications that are secure, transparent, and verifiable. Ethereum has its native cryptocurrency called Ether (ETH), which is used to pay transaction fees and incentivize miners to process transactions. The platform also has its own programming language called Solidity, which is used to write smart contracts. Overall, Ethereum offers a platform for building decentralized applications that operate transparently and securely without intermediaries like banks or financial institutions.

B. Smart Contract

Smart contracts are simply programs stored on a blockchain that run when predetermined conditions are met. They are typically used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss.

C. Solidity

Solidity is a programming language used to create smart contracts on the Ethereum blockchain. It was developed specifically for Ethereum and is designed to be similar to

popular programming languages like C++ and JavaScript. Smart contracts are self-executing agreements with the terms of the contract written in code. They enable the creation of decentralized applications (dApps) that run on the blockchain and have a wide range of use cases, such as digital identity verification, asset ownership, and voting systems. Solidity is the most widely used language for creating smart contracts on Ethereum, and it has a large and active community of developers constantly working to improve its capabilities. It is open-source and available for free to anyone who wishes to use it.

D. Distributed Ledger

A distributed ledger is a database that is shared and synchronized across a network of computers in the context of blockchain. It records all transactions that have occurred on the blockchain network, and each new transaction is verified and added to the ledger in a secure and transparent way. This ledger is decentralized, which means that no central authority manages the database, and all participants in the network have access to the same information. Transactions are validated and verified through a consensus mechanism, such as Proof of Work or Proof of Stake. Using a distributed ledger in blockchain technology ensures that all participants have a shared, tamper-proof record of all transactions, making it difficult for anyone to modify or delete records, and ensuring that the ledger is transparent and secure.

V. System Design

The use of blockchain technology can enhance the authenticity of product identification by providing a tamper-proof and transparent record of the product's history.

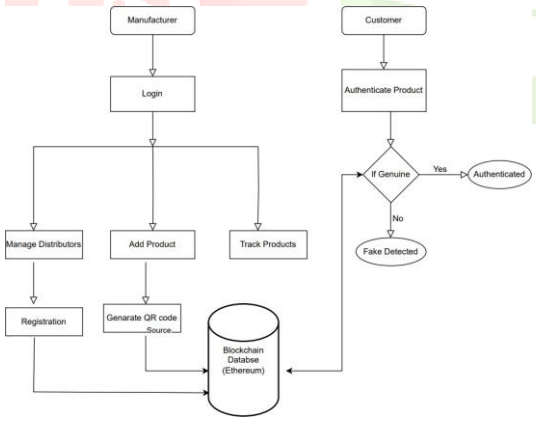

Fig. 1. System Architecure.

This system architecture Fig.(1) enables users to input product information, initiates verification processes, securely stores verification results on the blockchain, and provides real-time authentication feedback. The components work together to ensure smooth data flow and interactions, fulfilling the objectives of the fake product identification system. The system architecture for a fake product identification system using blockchain comprises several key components.

Adding the product: The role of adding the product within a fake product identification system using blockchain is essential to establish a reliable and verifiable record of the product's authenticity.

Access to Product Information: Scanning the QR code allows users to retrieve detailed product information, including origin, manufacturing date, authentication records, or additional data provided by the manufacturer.

Supply Chain Transparency: Each scan of the QR code can be recorded on the blockchain, creating an auditable and transparent trail of the product's movement.

Verification Process: Once the product is added to the system, it becomes part of the verification process. When customers or other stakeholders interact with the product and attempt to verify its authenticity, the system relies on the registered data and unique identifiers to determine its genuineness. Authenticity Check: The verification system compares the retrieved data with the expected information associated with a genuine product.

Traceability: By adding the product to the system, the manufacturer enables traceability throughout its lifecycle. The immutable nature of the blockchain allows for a transparent and auditable record of the product's journey from production to consumption.

Data Validation by Users: Users contribute to the validation of product data recorded on the blockchain. Through their active participation in the verification process, users help ensure the accuracy and integrity of the information stored in the system.

Feedback and Reporting: Users have the responsibility to provide feedback and report any suspicious incidents they encounter during the verification process. This feedback is valuable in identifying potential vulnerabilities or areas of improvement within the system.

Data Privacy and Security: Users must prioritize the privacy and security of their personal data while interacting with the system. Following best practices and adhering to the security guidelines provided by the system helps users safeguard their information and maintain the overall security of the system.

Verification Result: Based on the comparison and consensus mechanism, the verification system generates a result indicating whether the product is genuine or not. If the retrieved data matches the expected information and passes the consensus validation, the product is considered genuine.

VI. Proposed System

In this system, there are three types of individuals namely Manufacturer, Distributor and Customer are present. The terms are explained below.

Manufacturer: They are the ones who will look at creating the distributors. As well as Add and Tracks the product.

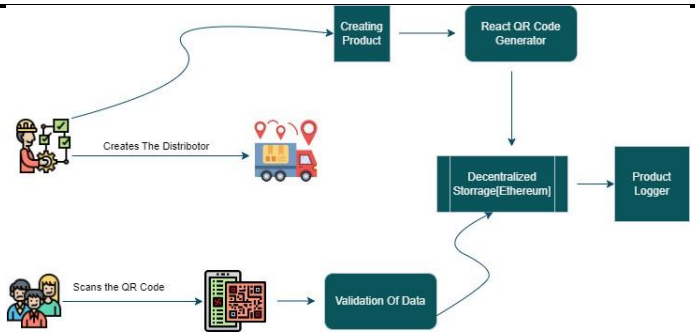

Fig. 2. System Flow.

Distributor: These are the intermediate person who provides the product to the customer.

Customer: The Customer is the person who buys the product. He is the end user who checks the authenticity of the product by scanning the QR code.

Fig.(2) Shows the working of the system using Ethereum Blockchain. The manufacturer creates the product as well as assigns the product to the Registered Distributors. Using the appropriate details QR code is generated and stored in the blockchain ledger. The customer can access the scanner which scans the QR code listed on the product. After validating the QR code data on the Ethereum blockchain, a message will be displayed on the screen showing whether the product is authentic or not.

VII. Tools Of Implementation

The system front end is built with reactJs which is a Javascript library. Smart contracts are written using solidity language which uses the blockchain technology. if the manufacturer is genuine i.e. if he has an account on Metamask, then he can log in and then access various features like adding products, adding distributors, track products. The customer should log in for verifying the product. the customer uses a QR code for scanning and verifying the product. For reading the QR code author used the QR react-QR-reader library. We have utilized VS code for the actual coding and programming part, ReactJS for front-end development, Ethereum blockchain ,Etherscan Explorer and Metamask: Goerli Test Network for testing.

VIII. Result

This real-time system is used to verify the authenticity of the product by scanning the QR code. The manufacturer generates the QR code using qrcode.react library by adding the product to the blockchain. The following images show the results after scanning the real QR code and Fake Qr Code. Following Figures show the result after scanning the original and fake QR codes of the product.

Given System is generating correct results after scanning the QR code.

Fig. 3. QR Code.

After scanning the above QR code the following results were displayed on the screen which shows the product is authenticated and if no message appears then the product is fake.

Fig. 4. Result After Authentification

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X. Conclusion

In this research, we are implementing a decentralised fake product identification system using the Ethereum blockchain. Using the Etherscan API we have built a system where customers can check the authenticity of the product. Blockchain-based product identification has the potential to increase consumer trust in products and brands, as customers can easily verify the authenticity of what they buy. In summary, using blockchain for fake product identification has great potential to improve product safety, reduce counterfeiting, and enhance supply chain efficiency.

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