

Fake Product Identification using Blockchain

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Abstract— The increase in fake goods is severely affecting the industrial sector and consumers. According to the survey, incidences involving fake products have increased in recent years, which have had a negative impact on sales, profits, and brand recognition. Far from reducing the ability of a company to make money, this counterfeiting also affects the consumer's ability to trust their goods in open market. Without proper tracking and security measures, consumers gradually stop trusting brands to keep their consumers safe from theft. This is happening because the manufacturing and distribution processes are hidden to consumers and this information is easily manipulated or falsified by others. So, users must have a method to determine if a product is genuine or not. This study proposes a blockchain based anti-counterfeiting system for product traceability throughout the supply chain. By using public or permissionless blockchain all the information throughout the supply chain will be recorded in the blockchain network in the form of blocks that are immutable, transparent, secure, tamper-proof, and trusted. This proposed method uses QR code for making the system further secure.

Keywords— Fake product, QR code, Blockchain, Supply Chain.

innovation in a variety of enterprises and sectors. The sale of counterfeit products interferes with the sale of legitimate goods and deters creators. According to the report of Authentication Solution Providers Association (ASPA) almost 25-30% of all products sold in the country are spurious with counterfeiting and almost 27% of consumers are not aware that the products are counterfeit at the time of purchase.

This study proposes an anti-counterfeiting system to track the product along the supply chain, allowing any customer to check if the product bought is authentic or not by scanning the QR code that is printed on it.[2][3] For this, blockchain is used which is a distributed, decentralised network that makes the whole system trustworthy and

transparent.[4] Blockchain ensures that once the data is stored in the blockchain network it cannot be altered or changed, a unique identity can be given to each product making every product in the supply chain unique and it also provides the feature of verifying and testing the authenticity of products.[5] Every product can be easily traced back to ensure the product is authentic or not. [6]

BLOCKCHAIN OVERVIEW

I. INTRODUCTION

A type of consumer fraud called product counterfeiting occurs when a product is sold while falsely claiming to be something else. It is a growing worldwide issue that is having an impact on numerous businesses. It is most common in the garment, FMCG, and automotive industries, then in the pharmaceutical, durable, and agrochemical industries.[1] Additionally, counterfeiting stifles

A decentralized Blockchain technology for product identification and counterfeit protection, the suggested system makes use of a blockchain-based platform. Product authentication, counterfeit prevention, traceability, and data analysis are its four key parts.[7] Each product in the blockchain network can be given a special identification, by creating a digital identity for it. This unique identity can be linked with the product details and it becomes very easy for tracing back

the originality of the product. And this provides a real-time visibility into the movement of goods.[8]

Blockchain can include several authentication mechanisms, such as digital signatures, unique identifiers like QR code, barcodes into the product's blockchain record and it can be integrated with IOT devices [9] as well.

It promotes cooperation and trust among those who are involved in anticounterfeiting. Using a shared blockchain network allows all participants real-time data sharing. this cooperative and collaborative approach enables faster identification and response to counterfeit instances, resulting in more enhanced enforcement actions. [2] By keeping track of copyrights, ownership, and trademarks on

the blockchain, intellectual property rights can be protected. In addition to preventing the unauthorized use of intellectual property and the production of counterfeit goods, this creates a verifiable and tamper-proof record of ownership. [10] And thus, blockchain can be the best solution for anticounterfeiting systems.

III. RELATED WORK

Blockchain based classification is a new approach to fake product identification that uses blockchain technology. Blockchain is a distributed ledger technology that makes it possible to store data in a way that is safe, transparent, and impenetrable. In the context of fake product identification, blockchain is used to trace the provenance of goods along the supply chain.[11]

Traditional fake product identification techniques frequently use text or image analysis to spot fraudulent goods. On a dataset containing pictures of real and fake goods, image recognition algorithms are trained. Based on how closely an image resembles those in the training dataset, the model determines whether it is real or fake when it is presented with a new image. On a dataset containing text descriptions of real and fake products, text analysis models are trained. The model determines if a new text description is real or fake based on how closely it resembles the text descriptions in the training dataset.

Comparing blockchain-based classification to traditional phony product identification models reveals various advantages. First, classification

based on blockchain is safer. Since blockchain is a tamper-proof technology, no changes can be made to the data that is stored there. As a result, it is more challenging for counterfeiters to produce phony goods that seem to have a legitimate provenance. Second, classification based on BC is more scalable. Millions or even billions of products can have their provenance traced using blockchain technology. It can therefore be used in extensive supply chains. Third, classification based on blockchain is more accurate. By being able to produce goods that closely resemble real things, counterfeiting organizations can trick image recognition and text analysis models. Due to its reliance on data, blockchain based classification is less vulnerable to this kind of deception.[12]

There are drawbacks to blockchain based product authentication that must be taken into account. As the blockchain expands, scalability issues occur, resulting in slower processing times and more expensive transactions. High implementation costs might further discourage adoption. Due to diverse protocols and standards, interoperability between various blockchain networks is difficult. Risks are posed by security flaws because hackers can alter or erase data on the blockchain. [13] A further barrier to adoption is complexity, which calls for specialized knowledge and expertise. Despite these drawbacks, research is being done to overcome them and improve how well blockchain works to stop counterfeiting

IV. METHODOLOGY

a. System Architecture

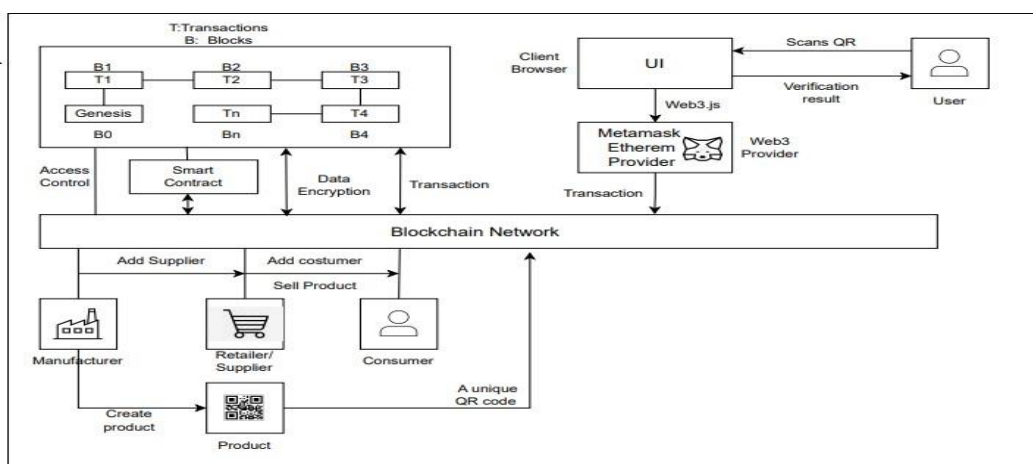


Fig. System architecture

The suggested blockchain-based method for identifying fake products consists

of several parts that work together to guarantee a product's authenticity. These

components include the product manufacturer, blockchain network, nodes, smart contracts, retailer, and customer. [14]

The ledgers for the proposed work on blockchain-based fake product identification are designed in a way that makes it possible to follow the movement of products along the supply chain. By doing so, it will be easier to spot fake goods and stop them from reaching the market.

Ledgers are formulated by Product information which includes the product's name, serial number, batch number, manufacturing date, expiration date, and other relevant information. The movement of products is tracked on the ledger. product's origin, destination, and any intermediate stops along the way. Manufacturers can create unique identifiers for their products, these identifiers can then be used to track the movement of products throughout the supply chain.

When the product is manufactured, a unique QR code is generated using the product's unique identification code and then the product details such as its unique identifying code, price details and manufacturer's information, and transaction history are all stored in the decentralized ledger that the blockchain network acts as. A copy of the blockchain is stored on nodes, which are individual computers or gadgets that take part in the blockchain network and verify transactions.

A smart contract is used to examine a product's unique identifying number and transaction history in order to confirm its legitimacy.[15] Retailers can do this by scanning the product's unique identifying number and looking up its transaction history on the blockchain or by looking up the ledgers. [16] Retailers are in charge of confirming the legitimacy of the product before selling it to a client. Customers, who are the product's final users, can confirm the product's legitimacy by scanning its distinctive identification code and looking up its transaction history on the blockchain.

The below table shows all the types of events and transactions that invokes smart contract.

Add new seller	Transaction	Add new seller with details. e.g. Seller name, seller code, seller manager, manufacturer ID, seller Brand, Seller phone no., seller address
Sell product to seller	Transaction	Scan an image file of QR code, enter seller code
Sell product to consumer	Transaction	Scan an image file of QR code, enter consumer code
Verify products	Transaction	Scan an image file of QR code, enter consumer code
Share product verification result	Event	Share verification result, that the product is authentic or not.

TABLE I. Types of events and transactions

b. Smart contract

The first function, addProduct, adds a new product to the blockchain and saves its information in the productItems mapping, including the product name, serial number, brand, price, and availability status.

```
function addProduct(bytes32 _manufacturerID, bytes32 _productName, bytes32 _productSN, bytes32
    _productBrand, uint256
    _productPrice) public {
    productItem memory newProductItem = productItem(productCount, _productSN,
    _productName, _productBrand, _productPrice, "Available");
    productItems array productMap[_productSN] = productCount;}
```

The second function, addSeller, adds a new seller to the blockchain and stores their details in the sellers mapping. In the sellersWithManufacturer mapping, the seller code is also added to the list of sellers for the specified manufacturer ID. The third function, manufacturerSellProduct, enables the manufacturer to sell a product to a particular seller by including the product serial number on the seller's list of goods sold and designating the seller code as the product's current owner.

sellersWithManufacturer[_manufacturerId].push({_sellerCode});

The fourth function, sellerSellProduct, is used to sell a product to a consumer.

Name of Component	Type	Job
New product is added	Transaction	Add new product with details such as manufacturer id, Product SN, Product Price, Product name, Product Brand

productsWithSeller[_sellerCode].push({_productSN});

c. Backend Technologies

Solidity is a programming language used for developing smart contracts on the Ethereum

blockchain. [17] It was used in the development of the fake product identification system. JavaScript is used for the front-end development of the web application that interacts with the blockchain that inputs data from user and displays the results of the product verification process. HTML and CSS for the design and layout of the web application interface. Web3.js is a JavaScript library that provides an interface

Smart contracts are tested and debugged using Ganache, a local blockchain development environment. Before uploading their smart contracts on the Ethereum blockchain, developers can test them in a simulated environment using Ganache's local blockchain environment.

V. RESULTS

Table II. Transaction and execution costs per function

Function	transaction cost	execution cost
addSeller	401586	323162
viewSellers	646893	550581
addProduct	398742	320762
viewProductItems	510143	510143
sellerSellProduct	404334	326362

These results Table 2. represent the costs associated with executing each function or the entire program on the blockchain. The transaction cost refers to the cost of executing the function in terms of gas consumed in the blockchain network. The

for interacting with the Ethereum blockchain. And Node.js which is an open-source, cross-platform JavaScript runtime environment that enables one to build scalable and high-performance applications on the server-side.

d. Development environment

To store transaction and product data, the Ethereum blockchain is used which offers a secure transparent ledger. MetaMask, a browser extension, is used to interact with the Ethereum blockchain and manage user accounts. Users can store, manage, and transfer Ethereum and other ERC-20 tokens using MetaMask as a wallet. It gives users safe access to the network

On the Ethereum blockchain, smart contracts are created, tested, and deployed using the Truffle suite. Truffle is a development framework that offers tools for creating, testing, and deploying smart contracts, streamlining the development of Ethereum-based applications.

execution cost indicates the computational resources used during the function execution. And transaction cost for the entire program is 2000809, and execution cost is 1808105.

VI. CONCLUSION

The implementation of a fake product identification system is an important step towards ensuring consumer safety and protecting the reputation of businesses. The use of advanced technologies such as blockchain, QR codes can greatly enhance the accuracy and efficiency of such a system. It is more difficult for counterfeiters to create fake products that can mislead consumers when there are several layers of authentication and verification. The system can also assist companies in tracking their goods along the supply chain, helping them to see and resolve any potential problems. Overall, implementing a fake product

identification system can be advantageous for both consumers and businesses and should be seen as an essential investment in the current global marketplace. Additionally, the system could be extended to incorporate digital signatures involves using cryptographic techniques for the QR code to create a more secure and tamper-proof QR code authentication system. It would be possible to develop a system that gives even greater transparency and accountability by utilising the immutable characteristics of blockchain technology, making it increasingly harder for counterfeiters to produce fake goods

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