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Fake Product Detection Using Blockchain Technology

Kishan Tiwari[1], Nikita Patil[2], Akshay Gupta[3], Akash Sabale[4], Vina Lomte[5]

[1,2,3,4] *(Students, Department of Computer Engineering), R.M.D Sinhgad School of Engineering, Pune, India*
[5] *(HOD, Dept. of Computer Engineering), R.M.D Sinhgad School of Engineering, Pune, India*

Abstract - *The rise of counterfeit products is a growing concern for businesses and consumers alike. The proliferation of fake products poses a significant threat to the reputation and financial stability of companies, as well as the health and safety of consumers. Blockchain offers a decentralized and secure platform for tracking and verifying the authenticity of products, enabling consumers to easily identify and avoid counterfeit goods.*

This paper explores the use of blockchain technology in the identification of fake products. We examine the key features of blockchain technology and how it can be used to create a secure and transparent system for product identification.

We propose a blockchain-based system for product identification that utilizes smart contracts to automate the verification process. The system would allow manufacturers to register their products on the blockchain and generate a unique digital identity for each item. Consumers would be able to scan the product's QR code to access the product's digital identity and verify its authenticity.

We also discuss the potential benefits of using blockchain technology for product identification, including increased transparency, reduced fraud, and improved consumer trust. Finally, we examine the challenges and limitations of implementing blockchain-based product identification systems, such as scalability and interoperability issues.

Overall, we conclude that blockchain technology offers a promising solution for identifying and combatting fake products. Its decentralized and secure nature provides a transparent and reliable platform for verifying the authenticity of products, protecting businesses and consumers from the harmful effects of counterfeit goods.

Key Words: **Blockchain, Decentralized, Ethereum, Smart Contract, Counterfeited Product, QR Code.**

1. INTRODUCTION

Fake product detection in blockchain refers to the process of identifying counterfeit products by leveraging blockchain technology. Blockchain is a decentralized and immutable digital ledger that provides transparency and security for transactions. By using blockchain, businesses can ensure that their products are genuine, and customers can have confidence in the authenticity of the products they purchase. It works by creating a digital record of the product's origin and tracking its journey through the supply chain. Each time the product changes hands, the transaction is recorded on the blockchain, creating an immutable and transparent record of the product's history. This record used to verify the product's authenticity and prevent fraud.

This paper proposes a novel approach to counterfeit goods identification using blockchain technology that authenticates products and maintains a transparent record of all product-related transactions. By registering each product on the blockchain and assigning a unique digital identity to it, manufacturers can ensure that their products are authentic and genuine. This allows consumers to verify the authenticity of the product before purchasing it, ensuring that they are buying the real thing.

The main objectives of this system are:

1) Protect consumers, brands

2) Company revenue

3) Ensuring regulatory compliance

4) Supporting ethical practices

Blockchain can help streamline the verification process, ensuring that products are genuine and reducing the risk of counterfeits entering the supply chain. The Paper will also Discuss the potential benefits of this system, including increased transparency, supply chain traceability, and consumer protection. for example, the platform creates a digital record for each cosmetic item, containing details such as its origin, the date of production, and the supply chain information. When a cosmetic

item is scanned at any point in the supply chain, its information is updated on the blockchain, creating a tamper-proof record of the item's journey from farm to table. Consumers can also access this information by scanning a QR code on the packaging or label of the cosmetic item. The blockchain record provides an immutable and transparent record of the cosmetic item's journey, enabling businesses to quickly identify any discrepancies or anomalies in the supply chain that may indicate the presence of counterfeit or fake products. For example, if an item's record shows that it has been produced in a different location than the one mentioned on the packaging, it will indicate that the product is fake or counterfeit.

Moreover, this paper aims to provide a critical evaluation of the proposed system, including its limitations and challenges. It will examine how the proposed system compares to existing anti-counterfeiting technologies and explore potential future developments. Finally, this paper will conclude with recommendation for future research in this area and its potential impact on businesses and consumers. Overall, fake product detection in blockchain has the potential to revolutionize the way businesses authenticate products and prevent fraud, providing benefits for both businesses and consumers alike.

2. WORKING MODEL

2.1 Proposed System:

Counterfeit has spread worldwide and has huge effects on organizations, manufacturers, and consumers. Manufacturers would create a unique identifier for each product they produce and record it on the blockchain. This identifier is Unique Aadhaar Card 16-digit number.

As the product moves through the supply chain, each party (e.g., distributors, retailers, etc.) would add their own digital record to the blockchain, including information about the product's location, who it was sold to, price of the product, brand and seller details.

Consumers could scan the product's unique identifier with their smartphone to verify its authenticity. They would be able to see all the digital records associated with the product on the blockchain, which would include the manufacturer's record and all the subsequent records added by the supply chain parties. If a fake product were to be introduced into the supply chain, it would not have a valid record on the blockchain. Consumers could easily identify the fake product by scanning its unique identifier (QR CODE) and seeing that there are no valid records associated with the product.

The purpose of this model is to use blockchain technology to prevent counterfeit products from entering the market and to increase transparency, traceability, and accountability in supply chains.

Thus, ensuring that the Counterfeits products does not harm manufacturer reputation and economic losses and also helps in maintaining customer satisfaction by providing authentic products.

2.2 System Model:

The proposed system will be a decentralized application (Dapp) that will be implemented using Ethereum as the main blockchain for keeping all the records and managing the transactions regarding the products of the companies listed on Dapp. The basic system architecture is shown in the figure below-

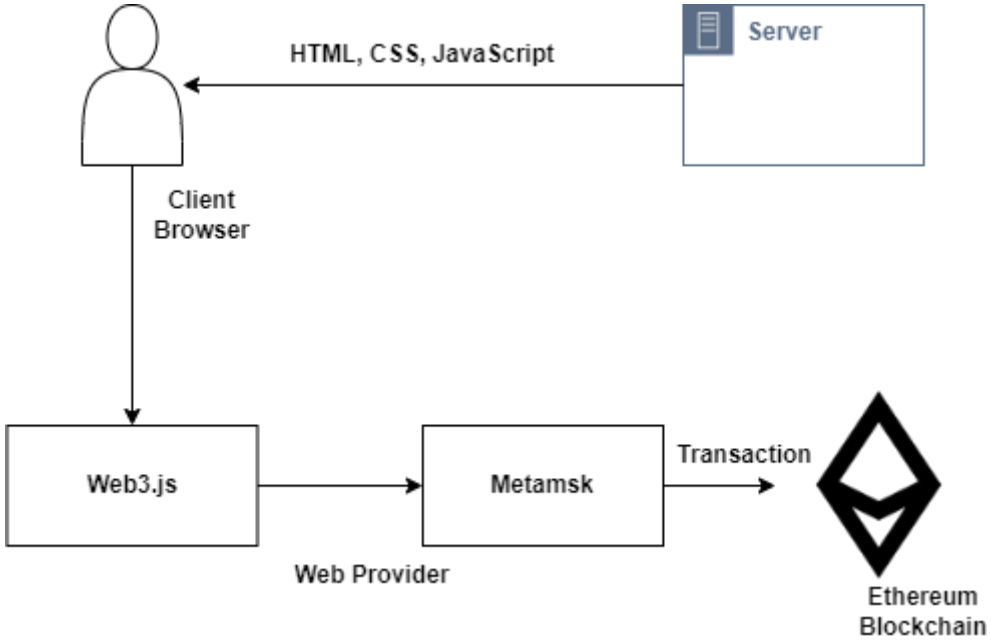

Fig1.1 System Model

The actual role of Ethereum in detecting fake products using smart contracts involves creating a decentralized system for verifying the authenticity of products throughout the supply chain. This system can be built using Ethereum's smart contract functionality, which enables the creation of self-executing contracts with pre-defined rules and conditions.

Here's an example of how this system works:

1. A manufacturer assigns a unique identifier to a product and records it on the Ethereum blockchain.
2. As the product moves through the supply chain, each party involved (e.g., distributors, retailers, etc.) records their involvement with the product on the blockchain. This creates an immutable record of the product's journey, which can be used to verify its authenticity.
3. Smart contracts are used to automate the verification process. For example, a smart contract could be programmed to check the product's unique identifier against the blockchain record to ensure that it is genuine. If the product passes the verification process, the smart contract could automatically trigger a payment to the manufacturer or distributor.
4. If a fake product is detected, the smart contract shows verification status as fake product.

This is because the blockchain record is immutable, meaning that it cannot be altered or tampered with. In addition, the use of smart contracts can reduce the need for intermediaries and streamline the verification process.

2.3 Flow of Proposed System:

The main aim of this proposed system is to maintain the Genuity of the goods and tracking the supply chain history of the goods. System gives power to customers for tracking the history of an entire goods from manufacturer to customer using blockchain. This system based on Blockchain is composed of three roles, the Manufacturer, the Seller, and the Consumer, as discussed and shown in figure below-

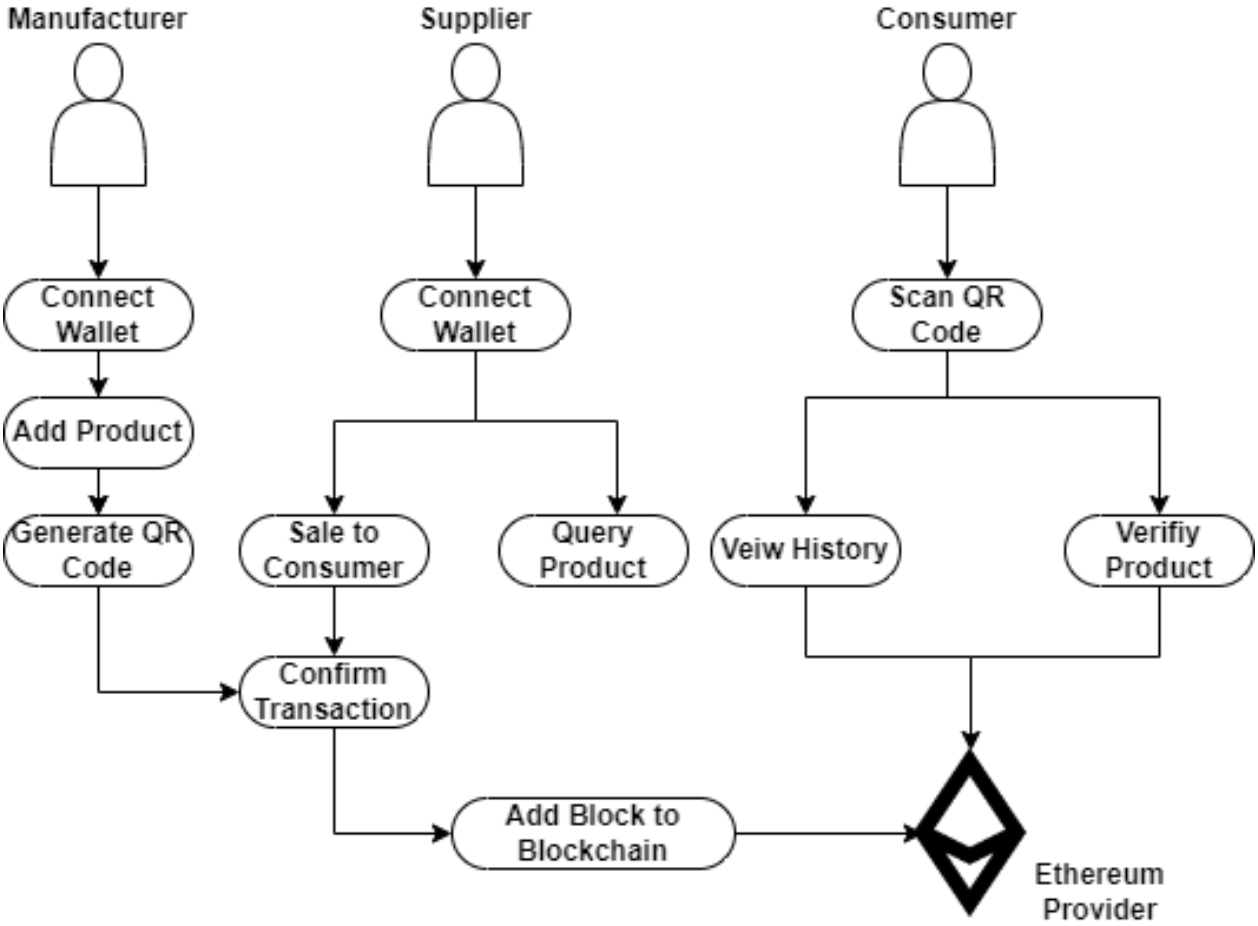

Fig1.2. System Flow

Manufacturer: Manufacturer logs into the manufacturer account and generates QR Code for Product and adds required details of the product and by using his MetaMask wallet, the manufacturer adds a block to Ethereum blockchain.

Seller: Seller scans the QR code of the product. The seller can access information about his products that the manufacturer has entered. He can sell the product to the consumer which transfers the ownership of the product.

Consumer: Consumer can check the integrity of the product by scanning QR code which will list the history of transactions and thus verifying the gentility of the product. At the time of consumer verifying the Genuity of the product it will show the status. If product is fake then he concludes that the QR code was copied and the customer becomes aware of counterfeiting.

3. LITERATURE SURVEY:

3.1 Literature Survey

Table -3.1: Deep Literature Survey of Blockchain Based Systems

Sr No.	Paper Title	Publication Details	Author Name	Limitations	Challenges
1	Fake Product Detection using Blockchain	IEEE-Access 2020	Tejaswi Tambe, Sonali Chitkala	Limited Coverage	Data Accuracy
2	Detection of Counterfeit Products using Blockchain	IRJMETS 2022	Kunal Won-Shik, Isha Sondawale	Cost	Privacy and confidentiality

3	Identifying Counterfeit Products using Blockchain Technology in Supply Chain System	IJARIIE 2022	Pramit Dutta	Technical Complexity	Scalability
5	Fake Product Detection Using Blockchain Technology	IJARCE 2022	Sri Krishna Shastri C, Vishal K	Lack of Standardization	Efficiency
6	Blockchain based product identification system.	ITM Web of Conference 2022	M.Suhana S. Sujatha	Less Secure	Privacy and confidentiality
7	Anti-Counterfeiting Blockchain Using a Truly Decentralized, Dynamic Consensus Protocol	PDX Scholar	Naif Alzahrani, Nirupama Bulusu	Technical Complexity	Complexity of algorithm
8	Fake Product Identification System Using Blockchain	IEEE 2022	Anita Kanavalii, Kushagara Gupta	Technical Complexity	Data Accuracy
9	A Blockchain-Based Fake Product Identification System	IEEE 2022	Yasmeen Dabbagh, Reem Khoja	Cost	Efficiency

3.2 ALGORITHMIC SURVEY

Table -3.2: Algorithmic Survey of Research Studies

Sr No.	Algorithm Used	Time Complexity	Space Complexity	Advantages	Disadvantages
1	Secure Hash Algorithm (SHA)	O(n)	O (1)	Strong Security, Large key space.	Deterministic.
2	Proof of Work (PoW)	Slower than Proof of Stake	Slower than Proof of Stake	Decentralized, Simple Design.	Consumes large amount of energy,
3	Proof of Stake (PoS)	Faster than Proof of Work	Depends upon network size and traffic	Consume less amount of energy.	Security risk.

3.3 LIVE SURVEY

Table -3.3: Live Survey of Recent Blockchain Based Systems on Various Organizations

Sr No.	Organization Name	Year Established	Stated Word	Algorithm used	Time & Space Complexity
1	Real Items Foundation	2017	REAL Items are verifiable products with a blockchain smart labels each with a digital identity stored on blockchain with Non-Fungible Tokens.	NFT Standard Algorithms	Directly dependent on number of input n and network size.

2	IBM Research	2018	Developed supply chain system for tracking specific goods and medicine tracking system help developing countries.	Proof of Work, SHA algorithms for Security	Lesser as compared to standard system due to limited network size.

4. RESULT AND DISCUSSION:

The proposed system allows both manufacturers and suppliers to interact with the system to add their respective blocks containing the transaction details to the blockchain without modifying the other's block. Since the code is running on a local network ganache has been used for local testing. The contracts are then compiled and deployed using truffle. The interface is created using HTML, CSS, and JavaScript. To allow interaction with the Ethereum blockchain Web3.js library is used which is used to perform actions like reading, and writing data from smart contracts. MetaMask is installed on a browser which is a wallet to interact with the Ethereum blockchain. Accounts from ganache are imported into the MetaMask. To add supplier and manufacturer blocks they must confirm the transactions using their account MetaMask wallet which is connected using Web3.js. The end-user can then check the supply chain by scanning the QR code to check the integrity of the goods.

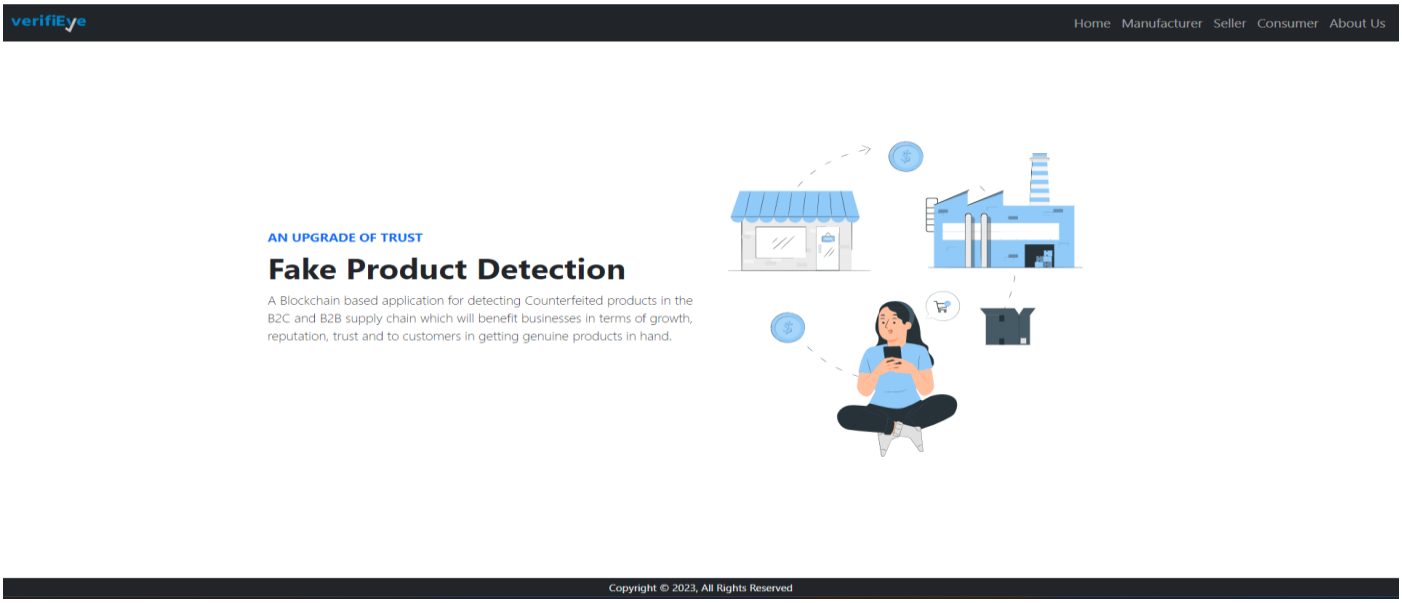

Fig 4.1: Accounts can be categorized into manufacturer, supplier, and customer.

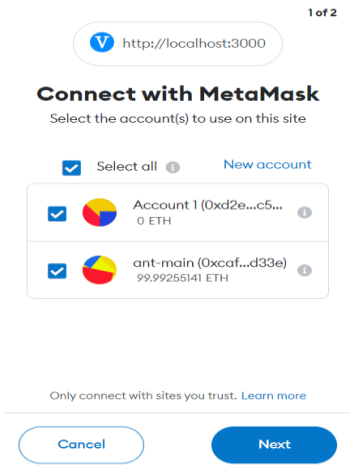

Fig 4.2: Connecting Ethereum using meta mask wallet.

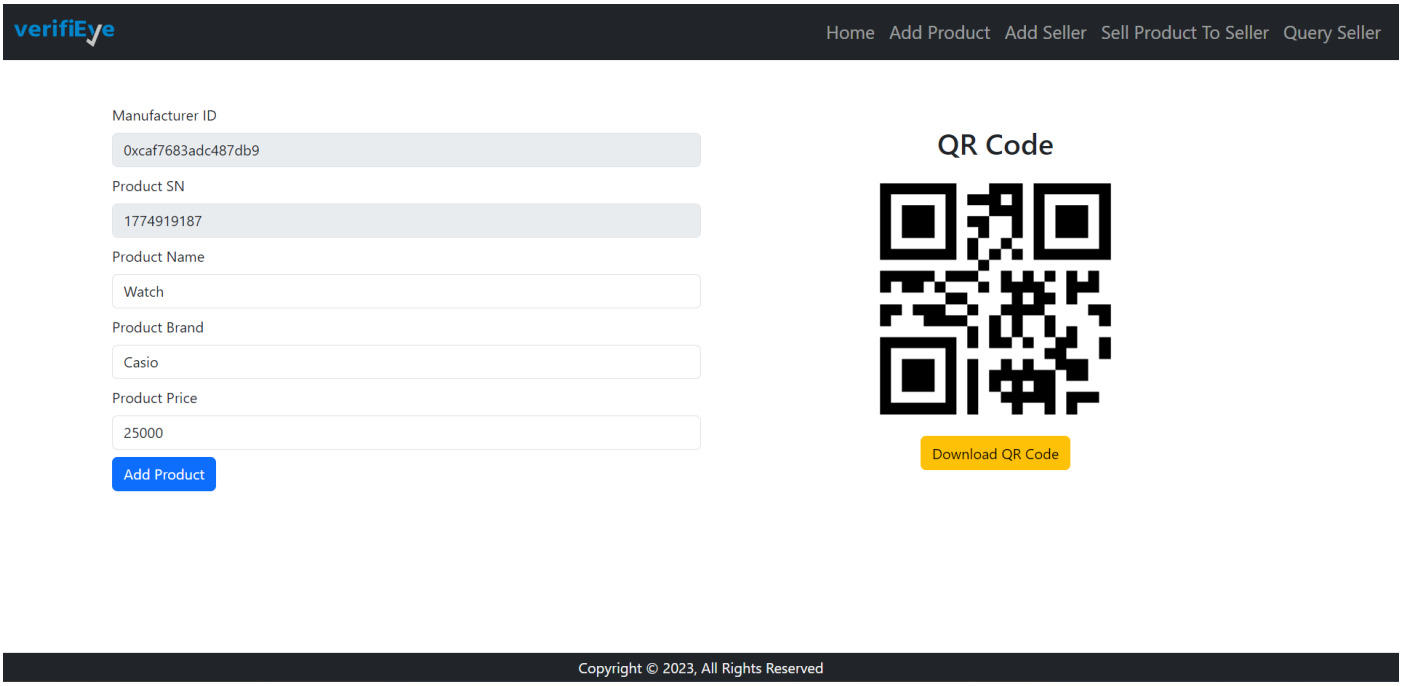

Fig 4.3: Manufacturer adds product details using the MetaMask Wallet.

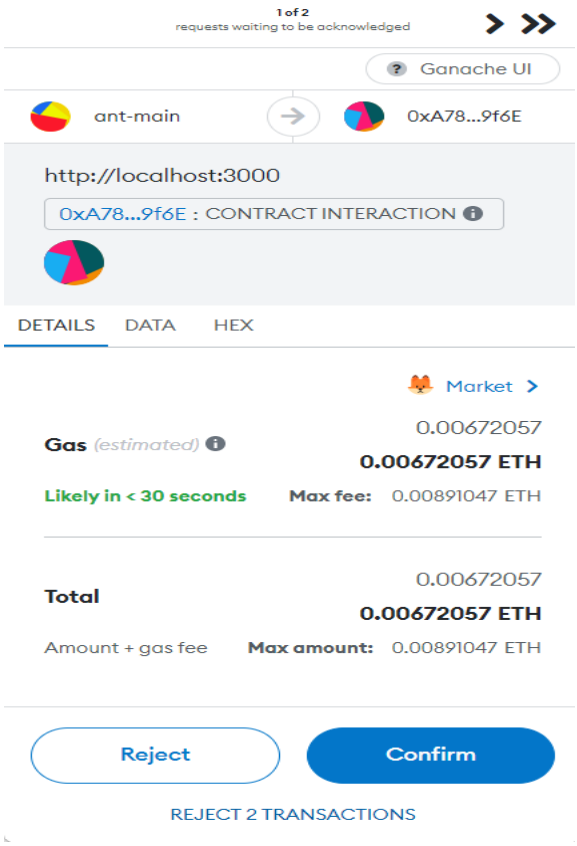

Fig 4.4: A MetaMask confirmation popup is displayed which asks for the confirmation.

This real-time system can be implemented to check the received product is a counterfeit product or original product.

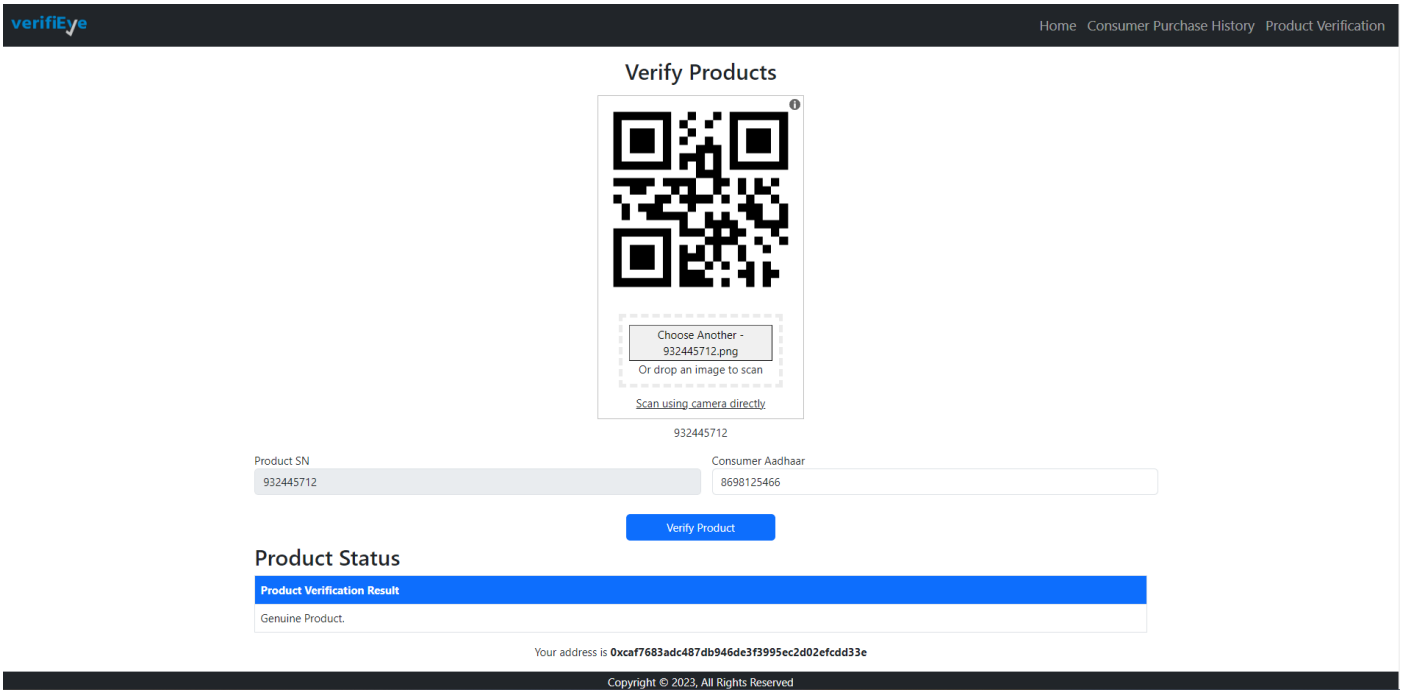

Fig 4.5: Product Verification by Consumer.

5. CONCLUSIONS

Using blockchain, manufacturers can create a unique and immutable digital identity for each product, enabling the traceability and verification of product information throughout the supply chain. This allows consumers to easily verify the authenticity of a product, reducing the risk of purchasing counterfeit or fake products.

Manufacturers and Suppliers can use the system to store product details in Blockchain which offers certain properties such as security and privacy of the data on the network. The customer views the good's supply chain history and verifies if the goods are genuine. Customers can be sure about the integrity of the goods they purchase. This system helps to lower the rate of counterfeiting and boost the economy. Further system can be extended to avoid frauds done in healthcare, voting system, online shopping, banking, and so on.

Moreover, these real-time systems can enable the creation of decentralized marketplaces that prioritize authenticity and transparency, reducing the risk of fraud and counterfeiting in online transactions.

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7. BIOGRAPHIES

Mr. KISHAN TIWARI
Pursuing B.Tech (CSE)
R.M.D Sinhgad School of Engineering,
Pune, India

Ms. NIKITA PATIL
Pursuing B.Tech (CSE)
R.M.D Sinhgad School of Engineering,
Pune, India

Mr. AKSHAY GUPTA
Pursuing B.Tech (CSE)
R.M.D Sinhgad School of Engineering,
Pune, India

Mr. AKASH SABALE
Pursuing B.Tech (CSE)
R.M.D Sinhgad School of Engineering,
Pune, India

Prof. VINA LOMTE
HOD, Dept. of Computer Engineering,
R.M.D Sinhgad School of Engineering,
Pune, India