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A RELIABLE SYSTEM FOR IDENTIFICATION OF FRAUDULENT COMMODITIES

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Abstract

Fraudulent or Counterfeit commodities are imitation of the original products with malicious intent to mislead people and generating profit. The counterfeit product problem is a global issue that has several negative effects. From the perspective of business, it may result in decline of sales and revenue. It might undermine consumer and business confidence. Fake goods can have negative, and even fatal, effects on the unwary consumer in addition to directly compromise the reputation and worth of a well-known company. There has been a considerable research in this area to avoid fake product, although not completely successful.

The application of blockchain technology has reached numerous sectors including healthcare, supply chain management, Transfer of wills etc.In this paper, a ”Fake Product Identification System using Blockchain Technology” is proposed. The proposed system will leverage blockchain technology to achieve product traceability, reduce the impact of counterfeiting, and enhance the security of the system. This will help business and clients to identify faulty products in the manufacturing process and take necessary measures to prevent them from entering the market.

Keywords: BlockChain, Authentication, D-App, Etherium, Smart Contract.

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1. INTRODUCTION

The advent of ingenious technologies are advantageous, however it can harm us in several ways. This is best illustrated in the struggle against fraudulent and counterfeiting. As technology advances, the propensity to steal and sell counterfeit commodities has increased. It has become essential to find new ways for businesses to protect their brand and products from theft. Some

From the economic perspective, counterfeiting is a global issue. Some of its adverse effects are:

Consumers begin to lose faith and credibility in the brand's merchandise, Loss of revenue and sales, as well as reputational damage, Usage and disposal of low quality raw materials may damage the ecosystem and may cause negative and allergic effect on the customer. It is therefore the responsibility of brands to safeguard their goods and their reputation against fraud and theft. There has been considerable research carried out in this area, although not completely successful [12].

Blockchain technology is transforming how businesses and users engage with one another. It provides a safe, transparent, and immutable data storage and verification platform. Businesses may now build immutable and secure records of products and services thanks to the arrival of blockchain technology. This enables the identification and authentication of product authenticity, which is becoming increasingly crucial in the digital era.. This is where the blockchain-based phoney product identification system comes into play. This solution uses blockchain technology to produce a secure and unchangeable record of product origin and validity.

The blockchain is used to track and verify the legitimacy of items while keeping data secure and confidential. Businesses may use this system to verify the validity and origin of items, and users can use it to confirm that the things they buy are real [15]. A ground-breaking method to ensure the authenticity of goods and services is the blockchain-based fake product detection system. It provides a safe and immutable platform for data storage and verification, allowing companies and customers to have confidence in the product's legitimacy. This technique is the future of product authentication since it gives both businesses and consumers assurance about the product.

There has been the introduction of an application created with Ethereum blockchain technology. This mimics a real-world supply chain and assures that product ownership is transferred and documented on the blockchain network. Furthermore, the approach suggested here may be utilised in retail sites, significantly increasing openness in virtual platforms for all users.

A Quick Response Code technology, the name suggests provides a secure quick access to online content. It contains data in encoded form that can be used for unique identification. QR code technology, in combination with Blockchain technology is proposed to identify fraudulent products and to protect the business and maintain trust of the consumers [14][16].

2. Literature Survey:

In a paper [1] “Udhaya Nila” and “Abalin Luther” “Aathi Vignesh” proposed a “Fake product identification system using a QR code”.A QR code manages product data and can be used to spot counterfeit goods. Python and My SQL were used to create this system.. This web application educates the user about counterfeit medications. This model's performance has improved by 70%.

In paper [2] “Randhir Kumar” and “Rakesh Tripathi” proposed a model that aims in addressing the issue of drug safety using blockchain and encrypted QR code security[18]. They proposed a framework

for storing transaction data. This structure uses the sender's cryptographic signature to guarantee non-repudiation verification. Because of the QR code, the given structure also prevents the problem of double spending.

In paper [3]Deep learning and machine learning algorithms have been used to identify fake products, including logos [25]. These technologies have shown increasing success in identifying fake goods and confirming the veracity of logos and other brand assets as they have become more sophisticated. Deep learning and machine learning algorithms can assist identify fraudulent goods by spotting trends and abnormalities in items [23]. Therefore, creating effective methods to identify fake logos and goods is essential for both customer protection and preserving the integrity of brand assets.In conclusion, logos must be protected by IPR laws since they are so important in raising brand awareness and promoting public recognition. In addition to preserving a product's conformance with norms and regulations, deep learning and ML algorithms[19] may be used to identify and get rid of counterfeit items, including phoney logos.

In paper [4] emphasises the benefits of using IPFS as a storage system for keeping track of product ownership. Similar to the Blockchain protocol, IPFS operates as a distributed file system that can store enormous amounts of data in a variety of formats. IPFS can easily transfer a large volume of data via its network, resulting in greater efficiency, in contrast to http, which depends on a single device. In addition, IPFS ensures that each item saved on the network has a distinct hash code, eliminating data duplication. This feature enables thorough maintenance of product transaction records and current ownership as a chain, providing a full answer for supply chain authenticity verification.

In paper [5] demonstrates the advantages of using blockchain technology to supply chain issues like product counterfeiting. The authors examine the profitability of each member in two unique supply chains, one supported by blockchain technology and the other not, using business profit-driven analytical models based on Stackelberg equilibrium theory. The findings demonstrate that blockchain technology can increase profitability for genuine producers when input prices are high, despite its occasional downsides for producers, retailers, and users. Additionally, retailers in price-sensitive markets may prefer to trade on a blockchain-enabled e-commerce platform if their qualification on the platform is lower than in a traditional supply chain and the manufacturing cost of the counterfeit manufacturer on the platform is higher than in a traditional supply chain [21].

In paper [6], “Nafisa Anjum” and “Pramit Dutta” described a decentralised application system (D-App) with an architecture based on the Ethereum blockchain. The D-APP ensures that product ownership is transferred and documented in the blockchain network by simulating a real-world supply chain. The approach presented here may also be used on retail and e-commerce websites, greatly enhancing accessibility for all users of the online markets.

This research paper[7] by “Yasmeen Dabbagh”, “Reem Khoja”, “Leena AIZahrani”, “Ghada AlShowaier”, and “Nidal Nasser” has given me with insights on the design of a ‘blockchain-based Fake product identification and product flow from maker to user’. As a result, the necessity for intermediaries is eliminated, making it a secure and trusted platform.

In paper [8], authors “Kunal Wasnik”, “Isha Sondawle”, “Rushikesh Wani”, and “Namita Pulgam” suggested a system for tracking user products that uses Blockchain to preserve the integrity of the supply chain and the product [13]. Customers now have the ability to use blockchain and QR codes

to trace the history of an entire product from admin to user.

In paper [9], "Swaroop Jambhulkar", "Harsh Bhoyar", "Shantanu Dhore", "Arpita Bidkar", and "Prema Desai" presented a system that records a product's state along with the admin, present owner, and former owners, together with a QR number and a time stamp that shows when the product was modified[22].

Paper [10] emphasises the potential of machine learning-based technology to tackle counterfeit items. The survey focuses on picture and text identification and classification using machine learning as a critical technology to discover and eradicate counterfeit items.

Paper [11] explains how to utilise artificial intelligence to spot fake goods. The author employed two stages. To recognise logos, the initial step is to apply algorithms for spelling and colour identification. The second phase involves training a machine learning model to distinguish between authentic and fake logos using the Feature Extraction approach [24].

Paper [17] presents a system for detecting fake products and generating original reviews using a data mining mechanism. The authors propose a solution to identify counterfeit products by analyzing various factors and patterns through data mining techniques. Additionally, the system generates authentic reviews to provide reliable information to consumers. The paper highlights the importance of such a system in combating fake products and improving consumer trust.

In paper [20] presents a framework that combines blockchain technology and the Internet of Things (IoT) for food traceability. The authors propose a system that leverages IoT devices for data collection and blockchain for secure storage of traceability information. The integrated consensus mechanism ensures data reliability and immutability. The paper highlights the potential of this approach in enhancing food traceability, improving supply chain transparency, and ensuring the authenticity of food products.

SL. NO	PUBLICATION YEAR	TITTLE	METHODOLOGY	DRAWBACKS
1	2021	Blockchain in Fake Product Identification System using QR Code.[1]	• The study places a strong emphasis on creating and implementing a blockchain system for product verification and stopping the sale of counterfeit goods. • The advantages of utilising QR codes and blockchain for identification.	• Scalability challenges • Integration complexities.
2	2019	Traceability of counterfeit medicine supply chain through Blockchain.[2]	• The suggested methodology utilises a private Blockchain system. • A digital signature from a certificate authority, enabling	• Dependency on a trusted third party

			participants to trust the provided digital signature.	
3	2022	Fake Product Monitoring System Using Artificial Intelligence.[3]	• Fine Object grained classification • Deep Learning Model • Lexical Processing • Machine Learning • Deep Learning with Conventional Neural Network	• Need for extensive training data. • Limitations in accurately detecting sophisticated counterfeit products.
4	2019	Blockchain Based Fake Product Identification in Supply Chain.[4]	• The authors suggest using a blockchain-based system to track and check the legitimacy of products along the supply-chain.	• Manual acknowledgment • Potential human errors • Vulnerabilities to fraudulent activities,
5	2021	Managing the Product-Counterfeiting Problem with a Blockchain-Supported E-Commerce Platform.[5]	• The authors propose a blockchain platform to increase supply-chain traceability, transparency, and enforcement against fake goods.	• Limited applicability and accuracy
6	2022	Identifying Counterfeit Product Using Blockchain Technology in Supply chain System.[6]	• The authors propose a blockchain based solution for tracking and authenticating products, combating counterfeits, and ensuring authenticity. • Virtual Marketplaces	• Scalability
7	2022	A Blockchain-Based Fake Product Identification System.[7]	• The paper presents a blockchain-based system for identifying counterfeit products, utilising blockchain's immutability and transparency for reliable authentication. • Smart Contract.	• A potential drawback of the proposed system is the energy consumption associated with blockchain technology.
8	2022	Detection of Counterfeit Products using Blockchain.[8]	• The D-App utilises Ethereum Network to preserve records and manage transactions for registered companies' goods.	• Scalability challenges due to limitations in speed and network congestion.

			• Facilitating product tracking and supply-chain management. • It allows customers to trace the entire history of goods using blockchain and QR codes.	
9	2022	Blockchain-Based Fake Product Identification System.[9]	• Proposed a system that keeps track of a product's status, including the Admin, current owner, and previous owners , time stamp and a QR code.	• Inaccuracies, tampering • Counterfeit QR codes in the manual-based system
10	2020	Improving Fake Product Detection Using AI Based Technology.[10]	• Training models and detecting logos are the two processes that make up the implementation. • The first step's training model component shows how we choose the Deep Learning pre-trained detection model and prepare the dataset. • After gathering the dataset, label it using annotation tools and split it into two sets: a training set (80%) and a test set (20%). • Through an iterative process so that the machine learning model produce results that are more accurate	• The drawback is that the process of training models and dataset preparation requires significant time, resource.
11	2022	Fake product monitoring system using Artificial Intelligence.[11]	• Proposes a mobile application for logo detection that uses artificial intelligence • To distinguish between genuine products based on various forms, text, colours, and attributes • It operates in two stages.It first recognises logos using colour and second stage is spelling recognition, and then trains an ML model in the second phase.	• Limited accuracy • Reliability of AI model in logo recognition

2. METHOD

Authenticating supply chain products using Blockchain technology. The intention is to stop independent distributors from selling fake or fraudulent goods. These distributors could create cloned or fake QR codes and apply them to fake goods, causing significant financial losses. We convert all product details and QR codes into digital signatures, which are then safely kept on a Blockchain server to prevent the sale of counterfeit items.

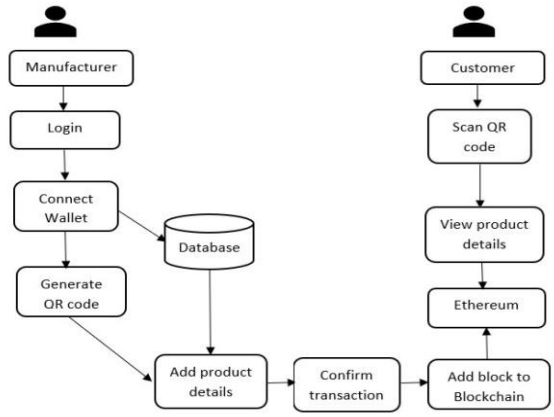

Fig 1 : System Diagram

A. System Design

Fig. 1 shows the suggested D-App's system diagram.Before logging in, each D-App user must first be verified. On a Google platform for creating interactive web apps, an authentication method was developed. The Admin can register their company to the D-App and enrol their items after successful verification. The contract address of the business is provided to the Admin and all of the business's information as well as the account address of the admin are stored on the blockchain network. A QR code is given to a product when it is put to the blockchain for verification. After enrolling, users can authenticate products directly from the producer. The transfer of ownership of the product can be tracked using the QR code.

B. Administrator

The admin connects to their wallet after logging into their account. In the beginning, Ethereum is not blocked. It creates a mnemonic code and inserts a block for each transaction after compiling the contract. A new transaction and new block are added to Ethereum when an administrator adds a new product.

C. Users

A block is added to the Ethereum blockchain when the user creates an account. The user can scan a QR code or access the product using its ID to verify its integrity. The product is authenticated successfully if it matches with the Ethereum blockchain else, it fails.

D. Blockchain

Blockchain is a distributed ledger technology that allows for safe and transparent transaction recording across several computers or nodes. It is the technology that supports cryptocurrencies such as Bitcoin, but its uses go beyond digital money.

On a blockchain, transactions are grouped into blocks, and each block is connected to the one before it using cryptographic hashes, forming a chain of blocks. This connection ensures the immutability and integrity of the blockchain data. Once a block has been added to the chain, it is exceedingly impossible to modify or tamper with the information contained inside it.

Important characteristics and concepts associated with blockchain technology include:

1. Decentralisation: Blockchain relies on a decentralised network of computers over which no single entity has total authority. Decentralisation boosts transparency, security, and resilience.

2. Security and immutability: Because blockchain is cryptographic in nature, once a transaction is added to the chain, it cannot be readily changed or erased. This impermanence improves system security and trust.

3. Smart Contracts: Smart contracts are self-executing contracts with predefined rules and circumstances. When the specified conditions are satisfied, they perform actions and transactions automatically. In a number of applications, smart contracts enable automation and eliminate the need for middlemen.

4. Transparency and auditability: Blockchain makes them possible since it allows for open access to all transactions and data kept there. It is possible to audit and hold people accountable because of this transparency.

E. Etherium

The user interface (UI) was created using the Node.js server-side JavaScript runtime environment. Web3.js is used by the decentralised application (D-App) when users want to communicate with the smart contract. Web3.js links the D-App to Ganache, a browser extension that acts as a wallet. When a user starts a transaction, Ganache uses the user's private key, which is securely stored in Ganache, to build and sign the transaction. The signed transaction is subsequently transmitted to the Ethereum network, where it is handled, verified, and eventually added to a block. The user's private keys are never recorded during this process, ensuring a trustworthy and secure connection to the network.

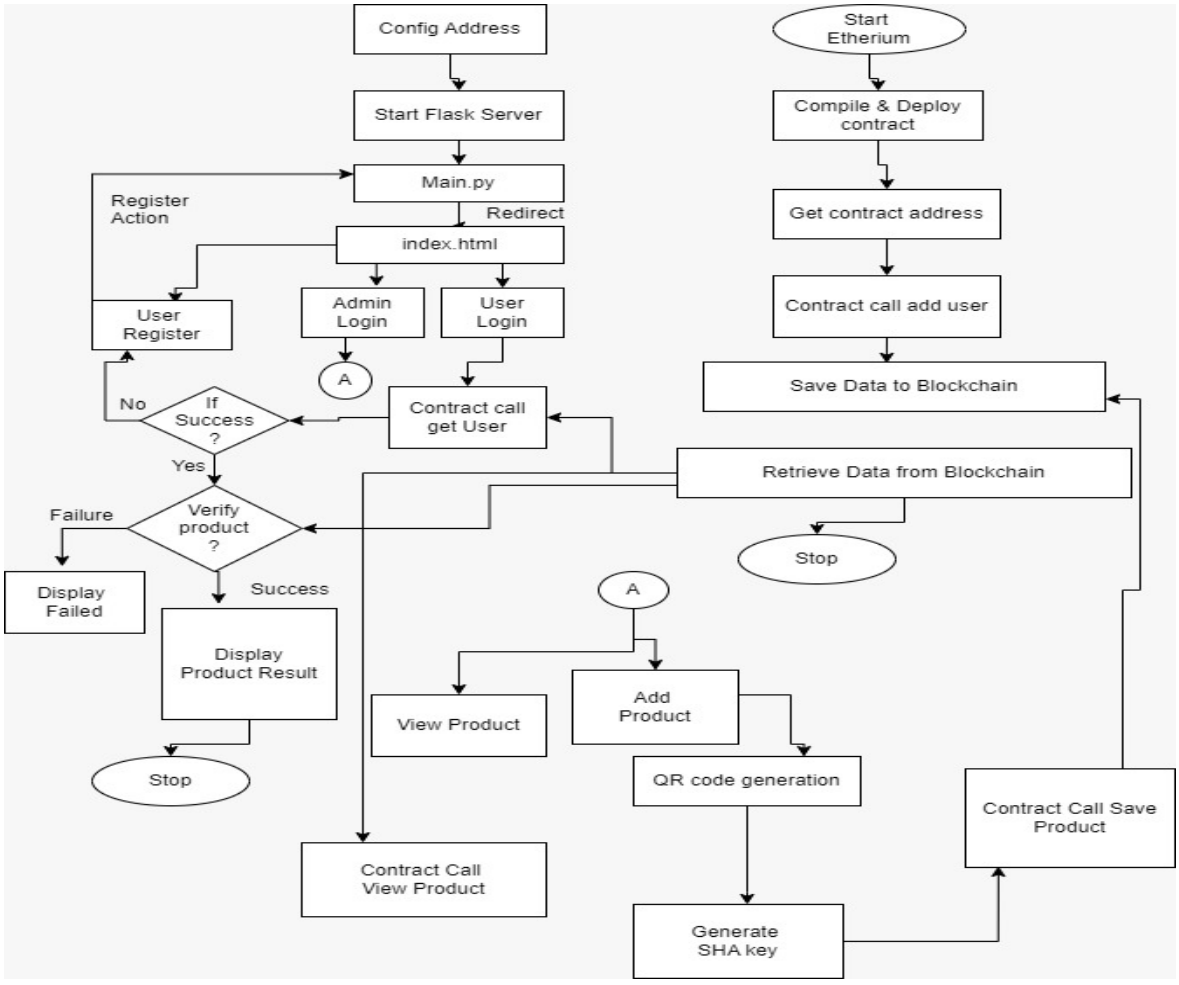

Fig.2 Implementation Flow Diagram

F. Implementation

Fig. 2 shows The administrator will use the configuration address to launch the flask server. After everything is put into place, the users and admin can log into a decentralised application.

The administrator can enter the product details once the details are uploaded, a Quick-Response code is generated for each product to maintain product authentication along with the QR code, a digital signature is generated which is unique, which make it simple to spot fake products and all of this data is stored in the block chain to prevent third parties from altering the product data.

Administrator must use the mnemonic code to create the workspace. After creating an Ethereum workspace, the administrator puts together the contract and gets the contract address. The user data are stored in the blockchain after the contract is called to add the user details. A Quick Response code is used to submit product data for verification, allowing a user to determine whether the product is authentic or not.

Admin can view users, add new products, study transaction history for the products, and examine the items after he signs in using these D-Apps.

If the user's login information matches the database, he or she will be able to scan the product's QR code or enter the product ID to find out whether the products are real or fake.

The user first registers before logging in to check the product authenticity.

The user scans the Quick Response code or enters the product ID if the information is consistent with the information that has been kept on the block chain then their details are displayed with a “Authentication Success” message. The user will get the message "Authentication Failed" if the product details they provided do not correspond to the data kept in the block chain.

3. RESULTS AND DISCUSSION

1. Authentication Successful

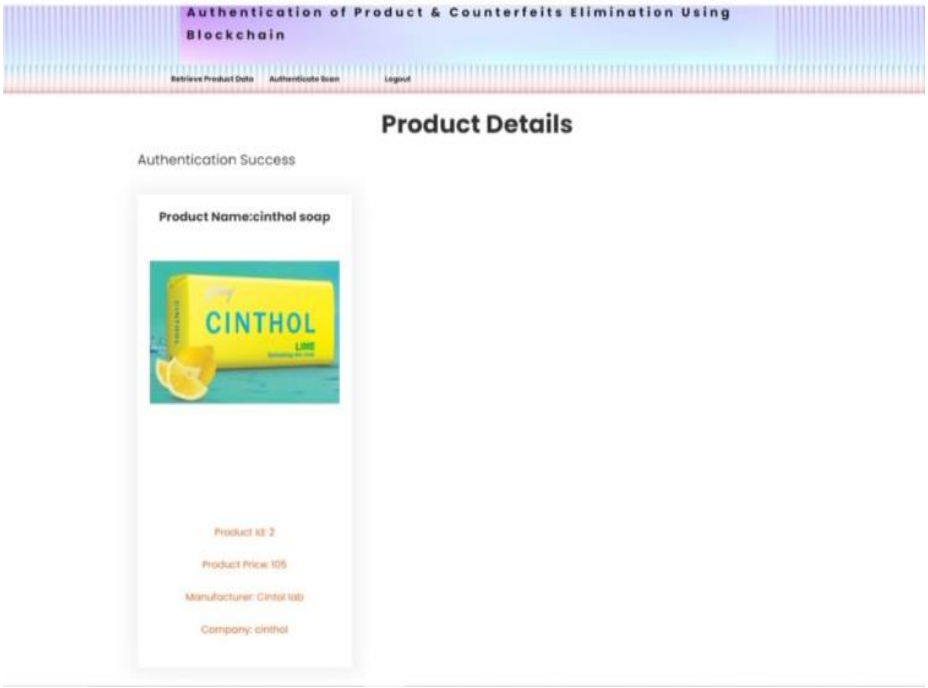

Fig.3 Authentication Successful Ethereum Wallet:

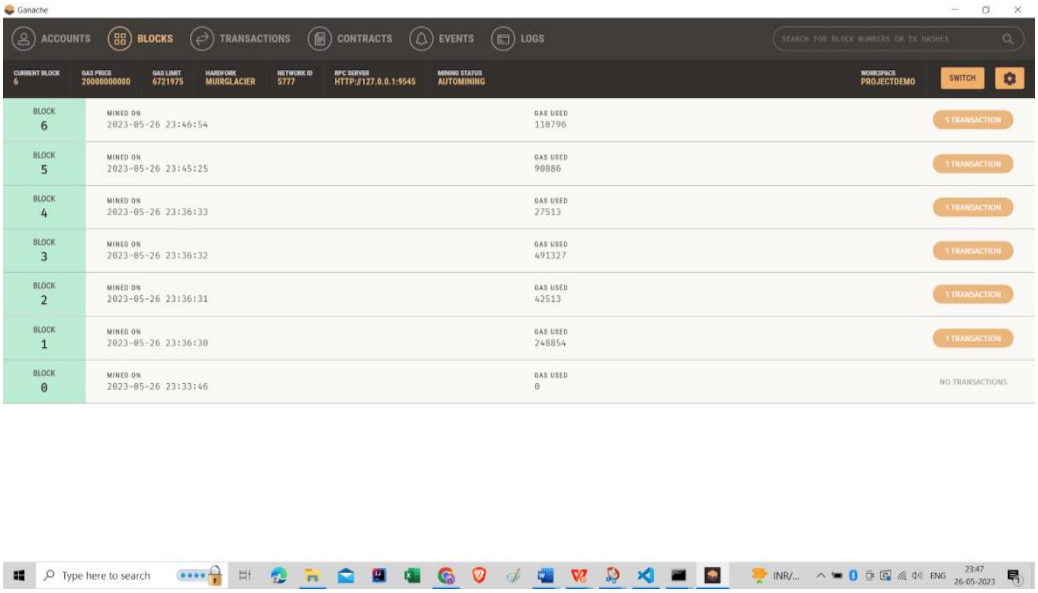

Fig.4 Etherium Wallet

The system compares the data entered by the user when they scan a QR code or enter a product ID to the data already in the database. The system will show product information, including the product ID, price, picture, manufacturer, and business names, if the product ID and the one in the database matches as shown in the Fig.3 and a block is added to the ethereum wallet as shown in Fig.4. This acknowledgment demonstrates the effectiveness of the authentication procedure.

0. Authentication Failed

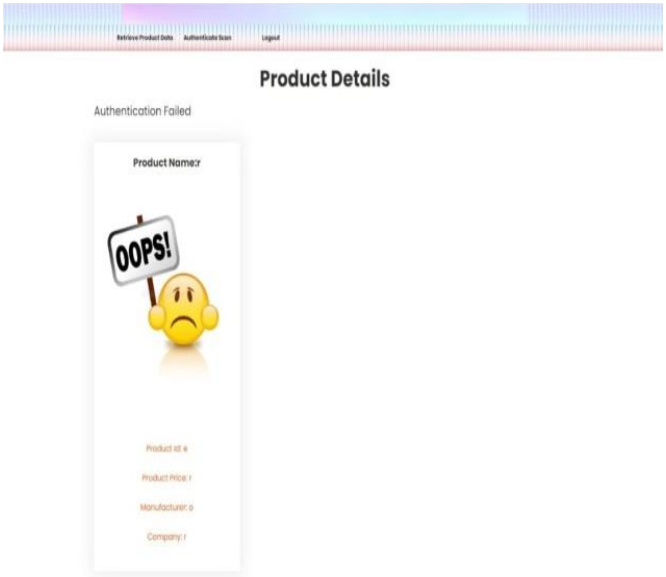

Fig.5 Authentication Failed

The system will cross-reference it with the current database after scanning the QR code or entering the product ID. The system will indicate "Authentication Failed" as shown in Fig.5.If the product ID does not match any of the database records. This message emphasises the failed authentication attempt by stating that the given product ID is invalid or cannot be found in the database.

4. CONCLUSION

Blockchain, which is a decentralised system, forbids regional suppliers from interfering with product authentication or preventing counterfeiting in the proposed system. The technology allows the administrator to enter product information into Blockchain, which has properties like tamper resistance, data consistency, and secrecy that safeguard the security and privacy of the data on the network. The reliability of the things that consumers purchase may give them comfort. The suggested technique can successfully lower the rate of branded-items counterfeiting and give businesses a simpler way to guarantee customers that they won't buy phoney goods.Between the administration and the client, this approach will help to foster trust and a strong relationship. It will also help to improve the economy and lower corruption.

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