A Block Chain Based Application System for Finding and Eliminating Fake Products and Counterfeit

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ABSTRACT

A block chain-based PoS algorithm improves supply chain transparency and security by logging every transaction and product attribute in an unchangeable ledger. PoS allows for effective validation while lessening the environmental impact, in contrast to energy-intensive mining. Because every transaction is kept on file, manufacturers, suppliers, retailers, and customers can all instantly check the history of a product. In order to provide traceability and reduce the risk of counterfeit goods, manufacturers authenticate the origins of their products, and each stakeholder—distributors, logistics companies, and retailers—adds to the record. Before stocking, shops may verify authenticity and suppliers can authenticate product sources. By looking up product history before to making a buy, consumers in turn develop trust. By dispersing validation throughout a network and minimizing malevolent influence, block chain's decentralized architecture guards against data breaches. This encourages responsibility because everyone involved can see each other. Real-time updates make monitoring easier, facilitating prompt resolution of discrepancies and bolstering the integrity of the supply chain.

Keyword: *QRcodes, Anticounterfeiting, Transparency, Smart contract, Proof of stake*

1. INTRODUCTION

This solution improves supply chain safety and transparency using steak (POS) and evidence of blockchain technology. All transactions and product information are safely recorded by irreversible laser of blockchain technology, which is a guard against fraud and unauthorized changes. At each point of the supply chain, stakeholders can confirm the authenticity of the product, promote responsibility and confidence. Consumers and brands are preserved when fake objects are immediately identified and thanks to real -time visibility in product movement are removed.[1] Customers can verify validity, follow the dealer sourcing, and the manufacturer can certify the product perfection for the system. Compared to the evidence of the work, POS provides a more affordable and durable verification technique, allowing the system to grow. By reducing fraud activity, this blockchain-based technology guarantees the integrity of goods. By dominating the acts visible and permanently, it encourages accountability among all participants. The solution simplifies the monitoring of the supply chain by streamlining product tracking. The system successfully fights forgery by fusing the security of blockchain technology with the effectiveness of the proof-of-set. This guarantees that customers get real goods, promote operational effectiveness, and strengthen confidence.[2] Supply chains that are more transparent, accountable and safe are possible with this strategy. The irreversible data of the system ensures data integrity, promoting stakeholders confidence. Finally, it helps consumers, suppliers and manufacturers to reduce fraud and increase confidence. The approach creates a cooperative environment where everyone can rely on accurate product information

BLOCKCHAIN OVERVIEW:

As seen in Figure 1, blockchain is a distributed and decentralized account book technique that safely logs to transactions in several nodes. To ensure data integrity and irreversibility, each block in the chain includes a timestamp, transaction data and a cryptographic hash of the first block. Since blocks are associated with a cryptographic hashing process, changing any previous data without changing all the following blocks is practically difficult, which will require an agreement with most networks.[3] The requirement of a central authority is away, this decentralized structure reduces the possibility of fraud, single point of failure, and unauthorized changes. Each node in the network holds a copy of full blockchain, and unanimous techniques such as proof of work (Pow) and proof of steak are used to verify the transaction. These approaches improve security by demanding computational work or stake-based verification to validate the transaction. Blockchain technology

improves transparency, to enable everyone to witness and confirm the transaction recorded in an irreversible way. It is particularly helpful in areas where trust and data security is necessary, such as supply chain management, healthcare and banking.[4] Blockchain technology guarantees a safe and verification of peer transactions in cryptocurrency applications such as atherium and bitcoin, eliminates the needs of middlemen and cuts the processing time and transaction costs. Blockchain's traceability helps businesses to supply series management to monitor products in real time and to confirm their validity
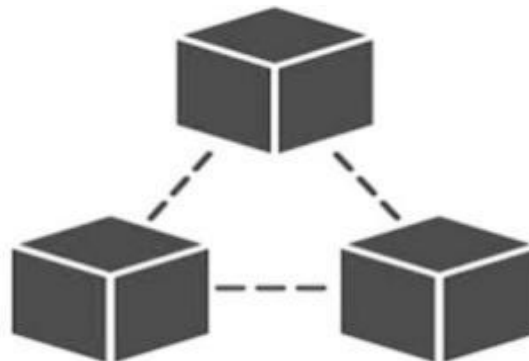

Fig 1. Block Chain

BLOCKCHAIN ASPECTS:

A. **Decentralization** - Because the blockchain is a distributed network, it does not require a central authority and reduces the possibility of data manipulation.

B. **Inaccuity**-A tampering-proof and permanent transaction history is ensured by the disability of blockchain to remove or modify the data after being recorded a time.

C. **Transparency** – All participant in blockchain networks can see transactions records, promote trusts and accountability in the system.

D. **Security** – Blockchain is extremely safe against fraud, hacking and unauthorized access that thanks to the cryptographic algorithm that protect the data.

E. **Consensus Mechanisms** – POW of work evidence and proof of steak (POS) are two examples of unanimous algorithms that use to verify blockchain transactions and preserve network integrity.

F. **Smart Contracts** – these self-exposed contracts increase the efficiency and trust by automating procedures by carrying out predetermined conditions without the need of middlemen.
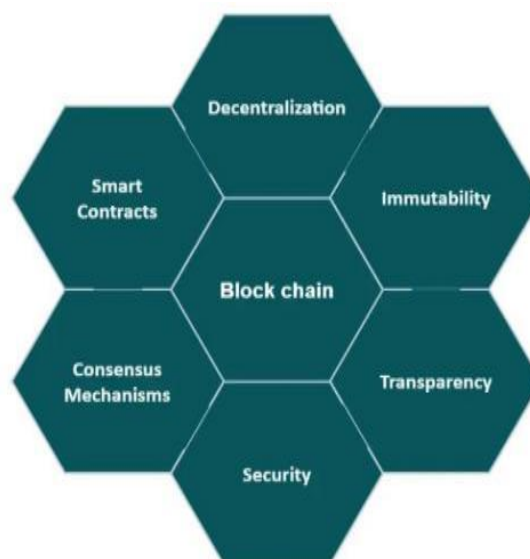

Fig 2.Block Chain Aspects

SMART CONTRACTS

There are self-performing agreements written in the smart contract code and are stored on a blockchain. They automatically apply the conditions without middlemen, ensuring transparency and safety. Once deployed, they are irreversible and triggers from pre-defined conditions, such as payment on delivery confirmation.[5] It streamlines automation processes, reduces costs, and reduces errors in industries such as finance, supply chain, and insurance. However, challenges exist, including code weaknesses, potentially flawed external data and vague legal status in some areas. Despite these obstacles, smart contracts offer security, trust and enabling decentralized applications.

2. LITERATURE SURVEY

A. RFID-based anti-counterfeiting System

Interest in RFID-based anti-counterfeiting is increasing. Instead of mimicking only current RFID product tagging systems, this study conducts a survey of the subject with emphasis on research. Wireless sensor network (WSN) and RFID are important technologies with a wide range. [19] Since RFID tag acts as actuators, they require electricity and a control signal. Unlike the RFID barcode scanner, allowing automated data in warehouses and distribution centers using radio frequencies to collect and collect data allows to collect automatic data. An RFID tag acquires radio waves from a transmitter and relays the identification information stored in its microchip to the RFID reader.

B. Ai-based technology detection of fake product:

This system provides the last user without specialist devices with machine learning-based solutions for the system product verification. User takes pictures of product packaging, including certification mark, text and logo, and submit them to processing. [2] The user is later given back the verification result. Officers can be informed about suspected fake, and they may be integrated with European Union programs such as Rapex.

C. Protection with Hallographic Barcode using computer-related holograms:

The purpose of the hologram is to prevent forgery. This technique combines barcode and hologram to increase safety. For additional protection, the unique identification code of each object is translated into a QR code, which is later converted into a 3D holographic image [3]. These holographic barcodes are made with matlab. The identification number given of the product appears by decoding the barcode from the hologram.

D. Proclaimed authentication without relying on matrix barcode based third party

A matrix barcode-based authentication system that does not depend on the third-party trust is presented in this study. This suggests a technique in which certification data is safely encoded within the barcode, guaranteeing integrity and failing to tamper. To prevent forgery and cloning, the system uses cryptographic techniques. [4]This improves safety, allowing direct verification without the need for centralized verification. The feasibility of the method in safe authentication is displayed by evaluation of its efficacy in practical applications.

E. A block chain -based management system to detect fake product in supply chain

A blockchain-based management system is presented in the study to identify fake items in the supply chain. This product uses decentralized and irreversible characteristics of blockchain technology to improve authenticity and traceability. [5] The suggested approach ensures transparency and low fraud by recording transactions at each stage of the supply chain. By automating verification processes, smart contracts prevent unwanted changes. The results of the experiments increase safety and effectiveness in detecting fake goods.

3. PROPOSED SYSTEM

To improve the supply chain safety and transparency, the proposed system includes a unanimous mechanism in blockchain technology, evidence of the steak (POS) method. This technique ensures that each transaction, product movement and expansion within the supply chain have been recorded permanently and irreversibly. [6] As a result, once the data is recorded, it can be converted, removed or tampered with as a highly safe and reliable system for product verification. Each product is assigned a unique digital identity stored on blockchain, ensuring complete traceability from production to the last consumer. This prevents fake goods from infiltrating the supply chain, as the fraud modification will be immediately noticeable for all stakeholders.In addition, blockchain technology enhances accountability and confidence among all participants. Since each transaction is recorded publicly and verified, it eliminates the possibility of fraud change by any one party. [7] Manufacturers can prove the reality of their products, distributors can track shipments in real time, and retailers can confirm that they only receive the original, unpublished items. Consumers also create confidence in the form of openness and transparency of the system. Buyers can scan the blockchain-ambed QR code to see the wide product history, including sourcing, manufacturing dates and certifications. This assures customers that they are buying legitimate goods, increasing brand reputation and customers are increasing satisfaction. Unlike the traditional supply chain tracking system, which rely on the centralized

database, the blockchain is distributed in several nodes, making it resistant to cyber threats. [8] No unit can manipulate or erase the record, ensure the integrity of data at all times. Ultimately, this approach converts the supply chain into a more secure, transparent and efficient network, which benefits all stakeholders involved.

Fig 3.System Flow Architecture

4. MODULES DESCRIPTION

1) Creation of Manufacturer Account

A manufacturer can sign up to the system, by establishing an account and entering special login credentials for their contact data, personal information and safe access. Manufacturer product certification can use this account to obtain credentials, which is required to confirm the validity of a product before being added to the blockchain. Manufacturer can reduce the risk of fake goods using this system to safely track the product movement in the supply chain. [9]The certification process improves supply chain safety from guarantee that only approved manufacture handle authentic items. The system also makes it possible to track and monitor product distribution in real time, which increases accountability and transparency. Through their accounts, manufacturer can also report any potential fraud or suspected activity, leading to rapid reactions to safety issues. Customers and retailers get from this structure as they can ensure that the goods purchased from authorized distributors are real. Additionally, the account serves as a record-capping tool, storing authentication history and transaction records for later use. Businesses can increase the trust, reduce damage from fake goods, and expedite product verification procedures by incorporating certification of distributors in the supply chain.

Algorithm 1: Creation of Manufacturer Account
Input: manufacturerInfo,address,privateKey,blockchainContract

1:	data ← concatenate manufacturerInfo
2:	dataHash ← SHA256(data)
3:	signature ← sign dataHash with privateKey
4:	call smart contract function registerManufacturer(publicKey, signature, dataHash)
5:	**if** (smart contract verifies signature using publicKey) **then**
6:	Manufacturer is registered successfully
7:	**Else**
8:	Manufacturer registration failed
9:	**end if**

2) Creation of Distributor Account

A distributor can sign up to the distributor system by establishing an account and entering their contact information, personal data and safe login credentials. They can use product verification and major certification facilities using this account. Distributors can use special product authentication credentials obtained after being registered to confirm the validity of the goods before distributing them.[16] This process reduces the possibility of fake goods by ensuring that only authentic products are added to the supply chain. Distributors can use this account to monitor the product movement, which enhances the distribution process visibility and transparency. Each transaction is recorded by the system, which facilitates location of tracking sources and products. The solution improves the integrity and AIDS of the supply chain in the fight against forgery by incorporating these security facilities.

3) Creation of Retailer Account

The first step in creating a retailer account is to enter merchant information and contact details on the platform. This registration process reduces the possibility of unauthorized sales by guarantee that only legitimate companies are provided access to the system. Retail vendors can confirm the validity of the products by scanning the authentication code involved. Through the platform, businesses can quickly report fake goods. If they are discovered, they assist in necessary action against dishonest vendors. By enabling the actual -time time of product authenticity, this process improves supply chain safety. The account also gives retailers a safe way to control their product inventions, guaranteeing the exact stock level. Businesses can reduce illegal sales and losses from fake goods using a suitable inventory control system. By ensuring that only authentic products are distributed to customers, platform also promotes consumer trusts. As a result, a more reliable and transparent markets benefit both companies and customers. All things were considered, the retailer account is required to keep fake products away from the account market and accelerate inventory control.

4) Smart Contract

A smart contract is a self-desired contract that establishes conditions, responsibilities and permissions for product tracking and movement in the supply chain. It is unchanged and impregnable, irreversible and impervious using blockchain technology, which appear among all recorded transactions, traders and distributors. Specific rights and obligations are allocated to each supply chain share, which facilitates smooth coordination and reduces the possibility of conflict. The operation is streamlined by automatic creative verification and enforcement, which reduces delays and removes middlemen with the requirement. The decentralized structure of blockchain improves security by keeping against fraud activity and illegal changes. Product information can be registered by manufacturers, the authenticity and supply chain can guarantee traceability. Retail sellers are capable of selling authentic products to customers with confidence after achieving access to verified information. Customers can also use blockchain-based records to confirm authenticity, which enhances their confidence in the goods they bought. The use of smart contracts leads to revolution in chain management, which increase productivity and protect from fake goods.

Algorithm 2: Smart Contract	
Input:accountType, accountAddress, dataHash, signature	
1:	**if** (verifySignature(accountAddress, dataHa sh, signature) == true) **then**
2:	Register Manufacturer
3:	**Else**
4:	Reject registration (Invalid Signature)
5:	**end if**
6:	**if** (verifySignature(accountAddress, dataHash, signature) == true) **then**
7:	Register Distributor
8:	**Else**
9:	Reject registration (Invalid Signature)
10:	**end if**
11:	**if** (verifySignature(accountAddress, dataHash, signature) == true) **then**
12:	Register Registered
13:	**Else**
14:	Reject registration (Invalid Signature)
15:	**end if**
16:	**Function** verifySignature(accountAddress, dataHash, signature)
17:	Compute ethSignedMessageHash from dataHash
18:	Extract r, s, v from signature
19:	Recover address using ecrecover(ethSignedMessageHash, v,r, s)
20:	**if** (recoveredAddress == accountAddress) **then**
21:	Return true
22:	**Else**
23:	Return false
24:	**End function**

5) Addition of Product

By entering comprehensive product details in the system, a manufacturer can add a product for delivery. To guarantee accuracy and clarity, it includes product name, a special identity code and complete specifications. Authorized retailers or distributors can be given distribution rights by the manufacturer after presenting product details.[17] The system creates an irreversible and impervious record for verification by storing this data on blockchain. Each product of the supply chain can be tracked from its original point to this process to its final destination. Transparency of blockchain technology makes it easy to identify and stop fake goods. At any stage of the distribution chain, stakeholders and customers can confirm the validity of a product. Unauthorized changes in the product's passage or irregularities can be found and reported for further examinations. The transparency and security of the system improves consumers, distributors and manufacturer trusts. This strategy increases the overall supply chain security and strengthens brand safety.

Algorithm 3: Addition of Product

Input: productID, productDetails, manufacturerAddress, signature	
1:	**if**(manufacturer[manufactureraddress] is not registered) **then**
2:	**Reject product addition**
3:	**else if** (verifySignature(Address, productID, signature) == false) **then**
4:	**Reject product addition (Invalid Signature)**
5:	**Else**
6:	**Store product details with** productID
7:	**Link product to** manufacturerAddress
8:	**end if**
9:	**Function** verifySignature(manufacturerAddress, productID, signature)
10:	Compute dataHash =SHA256(productID)
11:	Compute ethSignedMessageHash from dataHash
12:	Extract r, s, v from signature
13:	Recover address using ecrecover(ethSignedMessageHash,v,r, s)
14:	**if** (recoveredAddress == manufacturerAddress) **then**
15:	**Return true**
16:	**else**
17:	**Return false**
18:	**End function**

6) Transfer of Product from Manufacturer to Distributor

Products should be recorded in important transactions, including ID, batch number and receiver distributor data whenever a product is transferred from a manufacturer to distributor. At each point of the supply chain, these nuances guarantee that each item is tracked. The manufacturer moves on blockchain to improve safety and prevent illegal distribution.[18] The transaction is permanently recorded in this decentralized account, which is impervious and verified by all the parties involved. The stakes can follow the flow of goods from manufacturing to distribution by placing an open record. Customers, companies and regulators can all use the system to confirm the validity of products at any time. This reduces illegal rehabilitation and threats of fake goods. The blockchain structure helps to maintain industry standards and laws. Recorded data provides reliable evidence to effectively resolve disputes or memories. It is believed to promote accountability, safety and confidence among all parties associated with blockchain technology in the supply chain for all things.

7) Transfer of Product from Distributor to Retailer

Whenever a product is transferred from the distributor to the retailer, some information should be recorded, including the product ID, batch number and retailer details. It holds an accurate record of the path of each product through the supply chain and guarantees that each product is responsible for. An irreversible record that cannot be revenge or intervened, when the distributor log in to blockchain. The approach improves transparency and enables stakeholders to confirm the validity of the product at any point using blockchain technology. This guarantees that only authentic products are sent to customers and helps to keep fake goods out of the market. Maintaining proper inventory management reduces discrepancies and damage from fraud or theft. The retailers can feel more secure about the origin of their goods, which is thanks to the recorded data, which enhances mutual trust. Additionally, consumers have access to relevant product information, which improves their ability to make intelligent shopping.[17] The overall efficiency for the supply chain players increases in real -time tracking capabilities and simplified processes. This method offers regulatory compliance by offering product movements and verification of transactions.

8) User Verify the Product

The retailers can feel more secure about the origin of their goods, which is thanks to the recorded data, which enhances mutual trust. Additionally, consumers have access to relevant product information, which improves their ability to make intelligent shopping. The overall efficiency for the supply chain players increases in real -time tracking capabilities and simplified processes. This method offers regulatory compliance by offering product movements and verification of transactions. This method can also be used by officers and regulatory agencies for monitoring and management of fraud activity.[16] Because blockchain technology is decentralized, centralized data is not a chance to manipulate. By using this method, the system product strengthens the integrity of authentication, increases security, and promotes consumer trusts.

5. IMPLEMENTATION AND ANALYSIS:

To guarantee the product authenticity and prevent forgery, the fake product identification system must be applied using several important processes. Initially, a hash code is manufactured through the HMAC-Sha256 method, which requires a secret key and product details in the form of input. [10]This guarantees that the produced is the different, impregnable and challenging to make forged. After that, a QR code that is printed on the product packaging contains the hash code. A safe and scanable identifier who can be used for verification is the QR code.

$$HMAC(K,M)=H(K \oplus opad) \| H((K \oplus ipad)\|M))$$

Where:

- H is the SHA-256 hash function
- K is the secret key (padded or truncated to block size)
- M is the message (product information in this case)
- opad is the outer padding (0x5c repeated to block size)
- ipad is the inner padding (0x36 repeated to block size)
- $\|$ denotes concatenation
- $\oplus$ is the XOR operation

The product ID, batch number and haveh code is then collected safely by the system in the SQLite database. This makes it possible to quickly compare and recover information during the verification process.[11] The recovered ish ish is compared to the database's stored ish when someone scans the client or Inspector QR code. If the scan is the wash corresponds to the approximate ish, the product is verified as authentic. The system informs the user and marks the product as fake in the form of an anomaly.

$$V=\begin{cases} \text{Genuine,} & \text{If } (QR_{scan} = QR_{db})^\wedge(l_{scan} = L_{db}) \\ \text{Fake,} & \text{Otherwise} \end{cases}$$

Where:

- QR_{scan} = Scanned QR code data
- QR_{db} = QR code data stored in the database
- L_{scan} = Location of the scan
- L_{db} = Expected location from the database

The amount of ETH required to complete blockchain operation is shown by the transaction cost. The table below shows a certain computing effort, as the gas used remains stable at 366,119 in all transactions.[12] Each transaction has a separate gas value, which affects the total transaction costs due to the rush of the network. The cost of product transfer is slightly lower than deploying smart contracts. A blockchain simulator Ganache is used to create these data for ethereum growth and testing.

Transactions	Transaction Cost	GasPrice	Gas Used
Deloy the contract for Manufacturer	99.99 ETH	25860731986	366119
Deploy the contract for Distributor	99.99 ETH	28442131642	366119
Adding Product to the BlockChain	99.98 ETH	28041921708	366119

Manufacturer send the product to distributor	99.97 ETH	29111189512	366119
Distributor send the product to Retailer	99.98 ETH	22189097901	366119

Web-based platforms that provide real-time verification, as seen in Figure 5 below, can be used to apply the QR code scanning process. To have an innocent experience for businesses and customers, the verification system must be quick and easy to use. As seen in Figure 7, recording unsuccessful scan efforts and monitoring verification data can give important information about fake activity to firms and assist them in taking appropriate action. [13] Regular safety patches and updates are required to maintain the system's strength and dependence.
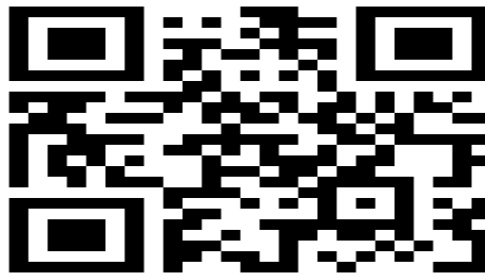

Fig 4.Generated QR

Major elements such as supply chain transparency, consumer trust, security, certification accuracy and tampering resistance are compared with the current system using a performance metric graph.[14] These measurements are represented on X-axis, and their respective scores are displayed on the Y-axis. As seen in Figure 6 below, the blockchain system suggested on the QR code works better in all ways, guarantees enlarged safety and transparency. Better product is indicated by authenticity tampering resistance and high ratings in fake avoidance. This comparison shows how well blockchain works to secure the supply chain.
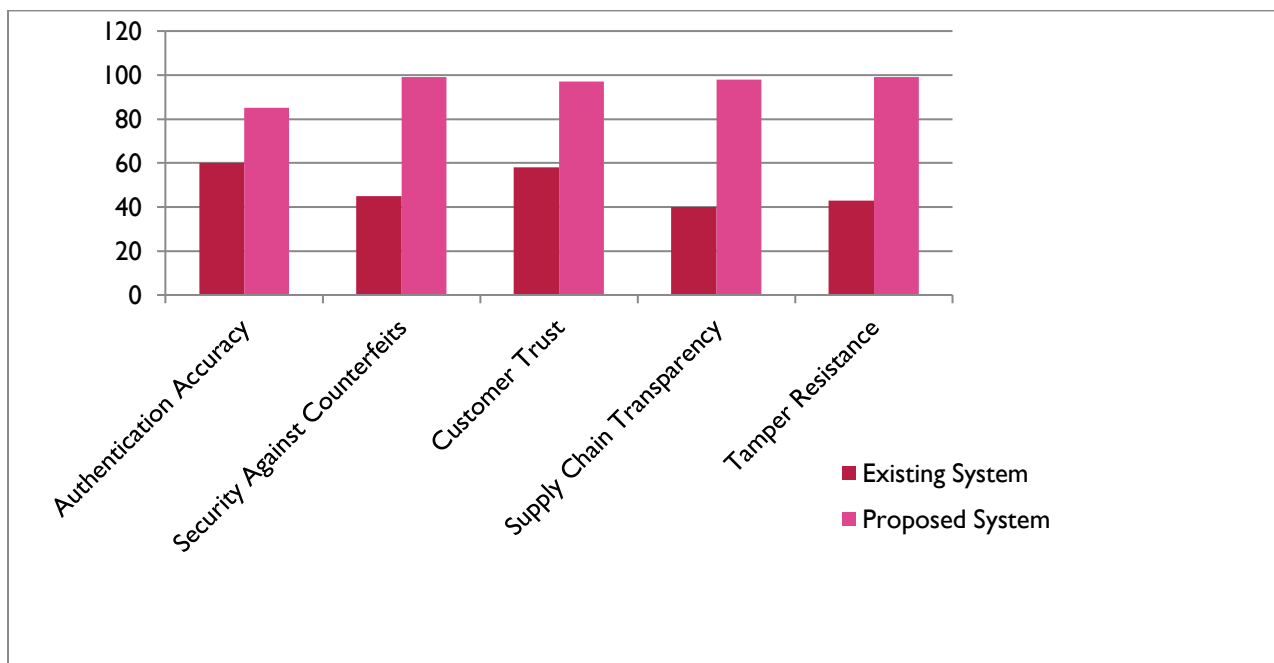

Fig 5.Performance Metrics

The fake product identification system provides a complete and safe defense against fake goods by putting these elements

into practice. This strategy not only molds companies with monetary damage, but also prevents customers from purchasing potentially dangerous fake goods. It is a very powerful anti-counterfeiting system that combines database verification, QR code certification and cryptographic hashing[15]. Detection of AI-powered discrepancy, which automatically flagged the suspected verification pattern for examination, is an example of future improvement. Such a system supply chain guarantees transparency and confidence, which benefits retail vendors, producers and final customers.

Data

Home

It is a Genuine Product

id	hash	date	from_name	to_name	product_name
122	464F62895FE6AA5815DB28326B93A819F11A38D055A7C3DE77E2A9BA0318AD6F	2025-03-27 18:44:47	Not Found	Manufacturer1	paste
123	04961EE99F82177172D6E59533EF3534047B82341C4C9D2317FE3B0BCC92A1D7	2025-03-27 18:44:56	Manufacturer1	Distributor1	paste
124	D660F5B4BE3E6FEEA6EADE572B1A7B6D34E5DE8C28C29333B9734D3D9A7C29EF	2025-03-27 18:45:37	Distributor1	retailer1	paste

Fig 6.Result

6. CONCLUSION

The use of proof of proof (POS) algorithm proof of Steak (POS) algorithm in the blockchain system greatly increases security and transparency, especially in supply chains, safety and transparency improves significantly. POS reduces members' possibility of attacks interested in network, which serves as a disinfectant and a preventive for harmful activities for dishonest behavior. By using blockchain technology, the system maintains the irreversible records of each transaction, making it more difficult to tamper with product traceability. This transparency increases the stakeholder trust by enabled to verify the authenticity of objects at each stage of the supply chain. POS increases the reliability and efficiency of the blockchain by having a decentralized structure that consumes less energy than the evidence of the work. POS allows rapid transaction processing, making it a scalable option for large businesses. Generally, the use of POS in blockchain-based supply chain systems ensures increased safety, efficacy and authenticity verification

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