

Fake Product Identification Using Blockchain

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ABSTRACT

Counterfeit goods have been a significant factor in the manufacturing of goods in recent years. This has an impact on a company's brand, revenue, and profitability. With blockchain technology, real-product identification and fake-product detection are possible. Blockchain technology is a distributed, decentralized, and digital ledger that keeps track of transactions in a number of databases that are linked together through chains. As blockchain technology is secure, no block can be altered or compromised. Customers or consumers can certify the safety of a product without relying on a third party by using blockchain technology. In this study, Quick Response (QR) codes are used as a powerful approach to combat the practice of product counterfeit blockchain. QR codes are rising trends in wireless and mobile technologies. By linking a product's QR code to a blockchain, a QR code scanner can identify counterfeit goods. In order to record product information and its produced unique code as database blocks, this system may be employed. It obtains the customer's unique code, then checks it against entries in the blockchain database. If the code matches, the customer will receive notified; if not, the consumer will be informed that the product is a fake. Index Terms—Keywords:

Keyword - Counterfeit product, QR code and Blockchain etc

1. INTRODUCTION

A product's or technology's global development is always accompanied by risk elements such as copying and forging, which can harm the brand, business profits, and client health. There are a lot of products in the supply chain to confirm whether the product is genuine or not. The main issue and significant costs for manufacturers are caused by counterfeit or fraudulent goods. We can employ blockchain technology to risk the product's falsity. Blockchain is a method for storing data that makes it difficult or impossible to alter, hack, or defraud the system. A blockchain is essentially a digital ledger of transactions that is duplicated and dispersed among the network of computers involved in the blockchain. Each block on the chain comprises a number of transactions, and each party's account is updated with a record of each transaction whenever a new transaction takes place on the blockchain. Distributed Ledger Technology refers to the decentralized database that is governed by numerous parties (DLT). A hash is a rigid cryptographic hand used in blockchain, a type of DLT, to record transactions. Blockchain technology aids in eradicating the issue of product counterfeiting. Using blockchain technology increases security. Once the product is stored on the network, a chain will be formed for that product's transactions that allows you to keep track of all of its past sales and those of its present owner. The blockchain will be used to store every sale record as a block. In the proposed system, we associate a produced QR code with a specific product, which the end user can scan to access all the product's details. After scanning the QR code, we can determine whether the goods are genuine or not.

2. MOTIVATION

In recent years, the distribution of fake goods has increased on a global scale. There are many fake commodities in the current supply chain. According to the study, there have been more instances of fabricated products recently. A system that enables customers or users to confirm all the product's specifications is necessary, so they can decide whether the item is authentic or not. India currently lacks a framework for identifying bogus goods. So, the answer calls for a simple QR code-based identification that can help the consumer or end-user scan and confirm the product's validity using a smartphone.

3. OBJECTIVE

This project's concept originated as a result of the rise in fake products. The following are the project's goals:

- Create a blockchain-based anti-counterfeit system.
- To use a QR code to protect product information.
- By making data accessible to clients, you can give them security.
- The immutable property of the blockchain increases the security and transparency of the proposed system's transactions.
- To stop the production of fraudulent goods by bringing customer awareness of the items' transparency products to the notice of the consumers.
- To raise performance and increase awareness of imitations of the main product sold in the market.

4. LITERATURE SURVEY

- 1) JINHUA MA , SHIH-YA LIN , XIN CHEN , HUNG MIN SUN YEH-CHENG CHEN [1], In order to ensure that customers do not just rely on the merchants to evaluate whether things are authentic, this article employs the decentralized Blockchain technology approach. We outline a decentralized Blockchain system for anti-counterfeiting items, allowing producers to use it to distribute authentic goods without having to oversee directly managed outlets. This can considerably lower the cost of product quality assurance. This study introduces a fully operational anti-product forgery system as the first Blockchain system. Users of our system no longer have to be concerned about buying a fake good because they only have to pay a very small transaction charge. Manufacturers can utilize the system to maintain pertinent sales data for their products in a publicly accessible blockchain. Both the seller's maximum possible sales and the number of products she has remaining on the market are transparent. The user can use the features offered by our system to carry out vendor-side verification right away. The method uses digital signatures to offer identification verification. Other than the key owner mistakenly disclosing his key, there is no other way to decrypt the private key of the key owner.
- 2) Nruthya Ganapathy B ,Keerthan Kumar, Poojary Shreya Jaya, Rajath D Shetty, Dr. Shreekumar T[2] In this project, QR (Quick Response) codes and barcodes offer a method to reduce the practice of product counterfeiting due to the significant rising trends in wireless technology. The fraudulent products are detected using a camera scanner, and the QR or barcode of the item or items is connected to a blockchain to save the item's information and the guaranteed unique code, which are stored as database blocks. The consumer will receive a notification that the product is authentic if the code in the product matches. If the customer accepts the request made by the application, a message is sent to the manufacturer about the place of purchase and to the customer stating that the product is false or counterfeited if it does not match the code in the database. This strategy for reducing counterfeiting ensures that customers won't solely rely on retailers to judge whether things are genuine or fake.
- 3) Abdul Rawoof Khan, Aditi Sahay, Athmika BV, Lavanya MV[3] As a remedy for the current state of affairs, we advocated the blockchain technology in the proposed system. Through this technology, we make it easier for clients to communicate with various departments. On the Ethereum network, a smart contract is used to build the script. With the suggested approach, a QR code is produced for a particular product. Consumers can use a QR code scanner in their customer app or the QR code reader app on their smartphone to scan the QR code on the product or packaging. We can identify whether the product is genuine or not after scanning. Last but not least, the Blockchain system records both these product attributes and a transaction history, enabling product tracing along the supply chain.
- 4) Ishaan Singh¹ , Himanshu Singh Bisht² , Yogesh Sharma³[4] With the proposed system, users and manufacturers will be able to interact with Ethereum-based smart contracts and modify just the attributes to which they have access. Given that the Ethereum blockchain is decentralized and the suggested solution is based on it. Blockchains serve as the client's backend in the Ethereum architecture since they control the backend based data. Users' requests and transactions are recorded on the blockchain, and they receive a response in return. The system's centralized server can be used to manage frontend resources like HTML, CSS, and the user interface. Both the manufacturer and the user will be able to conduct some sort of transaction in the smart contract under the suggested system. Each company's smart contract will be unique, allowing them to add or edit product details, see things that are offered, and transfer ownership to customers. All of the company's transactions will instantly

update the smart contract, and after they have been verified, the transaction record will be transferred to the blockchain.

5. PROBLEM STATEMENT

To identify the fake/duplicate product using blockchain technology. A Fake Product Identification Systems may be prolonged overdue, A imperative factor of Failure and more than one Counterfeits of Fake Products because of Intermediaries makes it tough for the consumers to determine whether or not the product is authentic or not.

6. BACKGROUND

6.1 Blockchain Technology

Blockchain, sometimes referred to as distributed ledger technology (DLT), enables the unalterable and transparent recording of any digital asset's history via a decentralised network and cryptographic hashing. A Google Docs page and blockchain technology can be easily compared in terms of how they both operate. When a Google Doc is shared with a number of individuals, it is simply distributed rather than duplicated or transferred. As a result, a decentralised distribution network is created, enabling simultaneous access for all users to the core text. No one is kept out while waiting for changes from some other party because all edits to the document are being recorded in real-time, making some changes completely visible. A massive flaw to be aware of involves the fact that the blockchain's original data and information cannot be modified after being written, increasing its level of security.

- A blockchain is a type of digital ledger or database where encrypted blocks of data about digital assets are stored and linked together to form a single source of data that is accurate in both time and space.
- Digital assets are distributed, not copied or transferred.
- Digital assets are decentralized, allowing for real-time accessibility, transparency and governance amongst more than one party.
- Blockchain ledgers are transparent
- Blockchain ledgers are public and constructed with inherent security measures, making it a prime technology for almost every sector.

6.1.1 Block:

Each block in a chain consists of three fundamental components.

- The information in the block.
- The nonce is a "number that is only used once." In the blockchain, a nonce is a whole integer that is generated at random when a block is created and used to produce the block header hash.
- The hash—in a blockchain, a hash is a number that is always associated with the nonce. These values must begin with a large number of zeroes (i.e., be very tiny) for Bitcoin hashes. The crypto hash is generated by a nonce at the beginning of a chain. The data in the block is considered signed and permanently connected to the nonce and hash unless it is mined.

6.1.2 Miner in Blockchain:

By a process known as mining, miners add new blocks to the chain. Every block on a blockchain possesses a unique nonce and hash, however it also refers to the hash of the block before it in the chain, which makes it challenging to mine a block, particularly with long chains. Generating a nonce that produces an acceptable hash is a tremendously hard arithmetic problem, and miners need specialised software to solve it. As the hash is 256 bits but the nonce is only 32 bits, it takes around four billion nonce-hash combinations to identify the correct one. When that takes place, the miners claim to have discovered the "golden nonce," and their block is included in the chain. Every block later in the chain may only be modified by re-mining every block after it, not just the one that has the modification. So

that's why Blockchain technology is extremely tough to manipulate. As identifying golden nonces takes a lot of effort and processing resources, consider of it as "safety in math". When a block is successfully mined, the modification is recognized by all of the network's nodes, and the miner gets rewarded. The main purpose of adopting a blockchain is to enable people, especially those who don't trust one another, to share important data in an inaccessible, secure manner.

6.2 Project Scope

No one can afford to be duped when purchasing goods like pharmaceuticals and cosmetics that, if counterfeit, are harmful to health. There is an evident cost to businesses due to duplicate products, but the customer also feels tricked if the products he buys are forged or fake. The app scans the product using a barcode or QR code that is specific to each packet in order to avoid this and can reveal a lot about the item. Because it aids in identifying bogus goods in the supply chain, the suggested method is therefore very helpful to the end customer.

6.3 Assumption and Dependencies

- WindowsOS will be used to construct the end user application.
- A blockchain-based database will be used.

7. FUNCTIONAL REQUIREMENTS

- The software is easy to use.
- It gives users a simple user interface.
- The application's accessibility and response time should be quick.
- The system's performance is appropriate.

7.1 Interface

- Manufacturer
- Supplier
- Scan QR
- Seller
- Products

7.2 Hardware Interface

The hardware should have following specifications:

- Ability to exchange data over network
- Touch screen for convenience
- Keypad(in case touchpad not available)
- Continuous power supply
- Ability to connect to network
- Ability to take input from user
- Ability to validate user

7.3 Software Interface

- Operating System: Windows 10, 7, 8
- Coding Language: Javascript, Solidity, Html5 ,Css.
- Tools Required: Truffle, NodeJs, Ganache, Metamask, VS Code

7.4 Communication Interface

- Our Project belongs to web based, so connecting user at online with request and response form. For that HTTP protocol we are going to use.
- HTTP protocol: For distributed, collaborative, and hypermedia information systems, there is an application protocol called HTTP, or hypertext transfer protocol. The World Wide Web's data transmission system is built on HTTP. Text that is arranged to use logical links between nodes that contain text is known as hypertext.

8. NON-FUNCTIONAL REQUIREMENT

8.1 Performance Requirement:

- System can perform better with 4GB of RAM, according to the performance requirement.
- The primary node's peak demands can take longer • The system will always remain functional.

8.2 Safety Requirements:

- Software and plugin updates are required for safety.
- Include HTTPS as well as an SSL certificate
- Decide on a clever password.
- Employ an encrypted web host.
- Keep track of administrative and user access privileges.
- Modify the CMS's default settings.
- Get familiar with the files that control your web server.

9. SECURITY REQUIREMENTS:

The blockchain-based privacy system created in this study that protects anti-counterfeit goods complies with the following security standards.

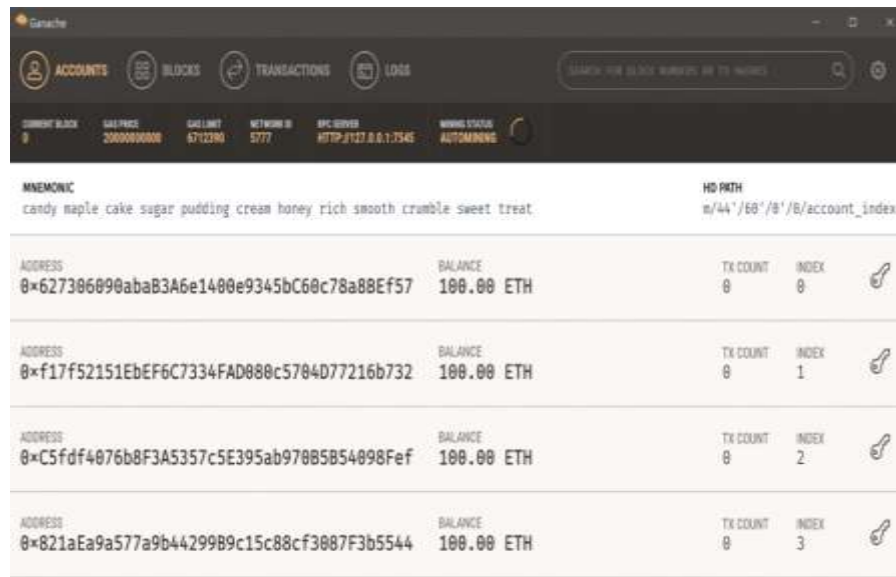
- **Immutability:** To prevent data leakage, identities and the corresponding attributes should be securely preserved. The data business owner should be the only person with access to and authority to modify the user data.
- **Transparency:** Parties can amend or inquire about the status of contracts through review transactions. The proposed program's transparency is guaranteed by the public's access to all transactions and changes to the ledger's state.
- **Availability:** In this article, smart contracts will always be published on the blockchain network to execute their functions for the participating entities. This will guarantee availability. Also, it enables all users to easily access the machine resources.

10. SYSTEM REQUIREMENT

10.1 Ganache

In order to engage with smart contracts in your own private blockchain, you can replicate the Ethereum blockchain using Ganache, a private Ethereum blockchain environment. The following are some characteristics offered by Ganache:

- Offers comprehensive mining control,
- Displays blockchain log output
- Has a built-in block explorer
- Operates in an Ethereum blockchain context.
- Both a desktop program and a command-line tool are available for Ganache. This is what the desktop version of Ganache looks like:



10.2 Truffle

For blockchains running on the Ethereum Virtual Machine (EVM), Truffle is a top-tier programming environment, testing framework, and asset pipeline that aims to simplify the life of a developer. With over 1.5 million lifetime downloads, Truffle is considered as the most well-liked tool for developing blockchain applications. Whether they choose to build on Ethereum, Hyperledger, Quorum, or one of the ever-expanding list of additional supported platforms, Truffle enables developers throughout the whole lifecycle of their projects. The whole Truffle toolkit aims to be an end-to-end dApp development platform when combined with Ganache, a personal blockchain, and Drizzle, a front-end development kit.

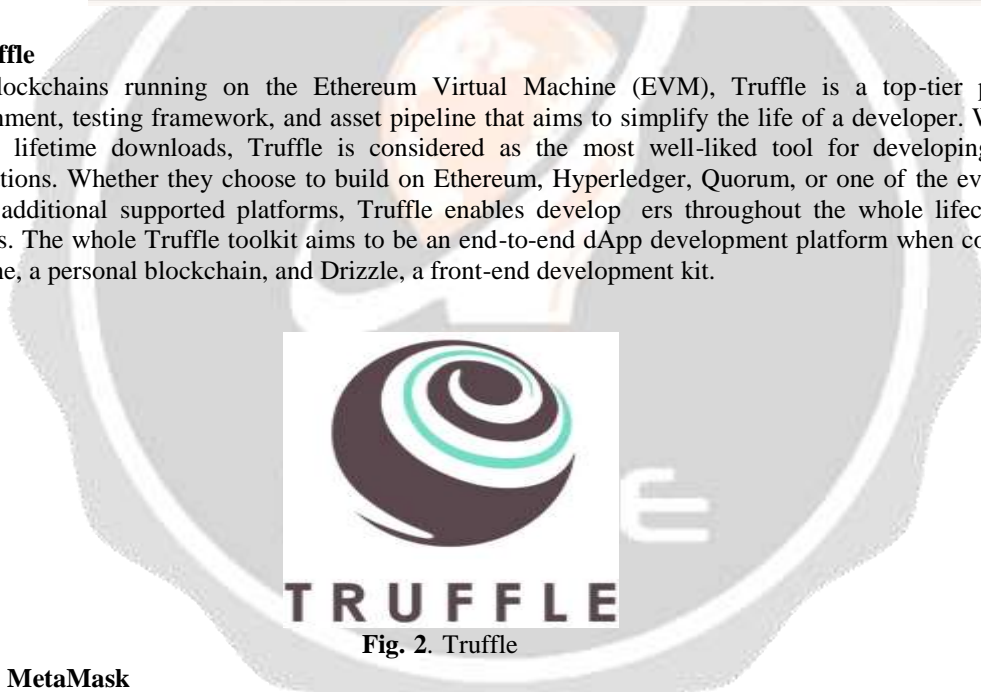


Fig. 2. Truffle

10.3 MetaMask

For non-fungible tokens (NFTs) on supported blockchains, MetaMask is a well-known cryptocurrency wallet that supports a wide variety of Ethereum-based tokens. While experienced crypto traders may value the wallet's speed and ease of use, novice traders might find it challenging to use.

Fig. 3. MetaMask



10.4 Hardware Requirement

- System Type:64-bit
- Processor: Intel core i5,2GHz
- Storage Capacity: 512GB
- RAM:4GB (Min)
- I/O Devices : Mouse and Keyboard

11. HOW BLOCKCHAIN WORKS?

A digital database called a blockchain is made up of encrypted data blocks that are linked together and protected by challenging arithmetic puzzles. The arithmetic difficulties requiring matching nonces and hashes are virtually impossible to alter later since the blockchain maintains a highly accurate and secure record of prior transactions. The blockchain is equally dispersed among various decentralised nodes, preventing ownership or control by any one entity.

11.1 Decentralization in Blockchain

Decentralization is among the most crucial ideas in blockchain technology. The chain cannot be controlled by a single computer or entity. Instead, it functions as a distributed ledger through the chain of chained nodes. Any electronic device that saves copies of the chain and maintains network functionality can act as a blockchain node. The blockchain is replicated by each node, and in order for the chain to be updated, trusted, and confirmed, the network must algorithmically approve each newly mined block. Every transaction in the ledger can be easily verified and examined since blockchains are transparent, which inherently increases blockchain security. An exclusive alphanumeric identification number that tracks their transactions is supplied to each participant. The blockchain is kept up to date by combining public information with a system of checks and balances.

11.2 Top blockchain uses applications

- Cryptocurrency
- Cybersecurity
- Accounting and record keeping
- Supply chain
- Healthcare

12. SYSTEM ARCHITECTURE

Since most individuals purchase their goods online, there is a chance that they will be counterfeit or phony. Both the buyer and the brand name of the corporation are harmed by these bogus goods. They will suffer a great loss as a result of this. There is no ideal course of action before tackling this issue. There is no guaranteed mechanism or effective way to tell fake products from authentic ones due to how easily reproduced barcodes are. The most promising new technology to emerge in recent years that can assist in resolving that kind of issue is blockchain. Blockchain technology can be used to track and monitor shipping goods to ensure that customers only receive the correct item. The project's major goal was to increase product transparency during consumer purchases and make it easier for buyers to determine if a product is genuine or a fake.

By using blockchain technology, we identify fake products in the system that is being offered. Bringing every manufacturer onto the blockchain network and gathering their key product data is the first step. Product verification is accomplished through registration and the provision of the proper login information. The primary owner of the item will be the maker. After the product is assigned a QR code, the manufacturer will ask the network manager to add it to the system. If the application is the real manufacturer, the regulator will register the product and the maker on the network. When a product is registered on the network, a smart contract is created using the product's unique QR code, which contains the product's information in encrypted text form. A Copy Sensitive digital image is embedded in the QR code to prevent it from being copied. The item will not change ownership until a request is made, at which point the manufacturer will ship the item to the distributor and establish the status as shipping. The product is then shipped from the manufacturer to the distributor, and its status is changed to "shipping"; ownership of the product does not change until a request from both parties for the purchase and sale of the product is

accepted. The ownership of a joint venture will automatically be transferred in the form of a smart contract once money has been received in the blockchain network as soon as both parties agree to it. Customers will be given the Android app at this point, and they can use it to scan the QR code that has been allocated to the object. The scanner scans the object, decrypts the encrypted text using the given technique, and obtains details about the product's current manufacturer and owner, allowing the user to decide whether or not to purchase the item.



Fig. 4. System Architecture

The major goal of this proposed system is to preserve the originality of the product by assisting the customer in following the product's supply chain history. Customers have the ability to follow a product's whole history from manufacturer to customer via the system. The Manufacturer role, the Seller role, and the Consumer role make up the three roles in this Blockchain-based system for preventing product counterfeiting.

12.1 Manufacturer:

Manufacturer signs into the manufacturer account, creates a QR code for the product, adds any other information that is needed, and then uses his Ethereum wallet to submit a block to the Ethereum blockchain. The user id of our local database and the wallet address of the entity will be mapped to one another, and only the block will be added to the digital ledger if both are present, i.e., a manufacturer checks in using his own account and uses his own wallet.

12.2 Supplier:

The supplier logs into their account as a supplier and scans the product's QR code. The manufacturer has entered information about the vendor's goods, which the seller can access. It pushes the product's additional details, such as the shop's location, into the Blockchain. The buyer can see those specifics.

12.3 Customer:

Consumers can verify the genuineness of a product by scanning a QR code that lists the history of transactions and allows them to examine its integrity. If the last location is not the same as the buy location at the time of customer purchase following the QR scan in supply chain history, the customer will be aware that the product is not authentic. The buyer learns about counterfeiting and the conclusion is that the QR code was copied.

12.4 Modules :

Type of Logins: Three different types of login. Admin, User, and Manufacturer.

Registration: In order to participate, users must first register that project.

Login: In order to access a project, a user must log in independently.

Add Product : After logging in as the manufacturer, they can add products to the blockchain

database using javascript and smart contracts.

Generate QR Code: All product information is displayed on the admin side, where the admin may validate it, create a QR code for a linked product, and add it to the blockchain database.

Scan QR Code: Using an Android application, the user scans the QR code to display all of the product's details on their mobile device.

The process of detecting a counterfeit product by the customer while purchasing.

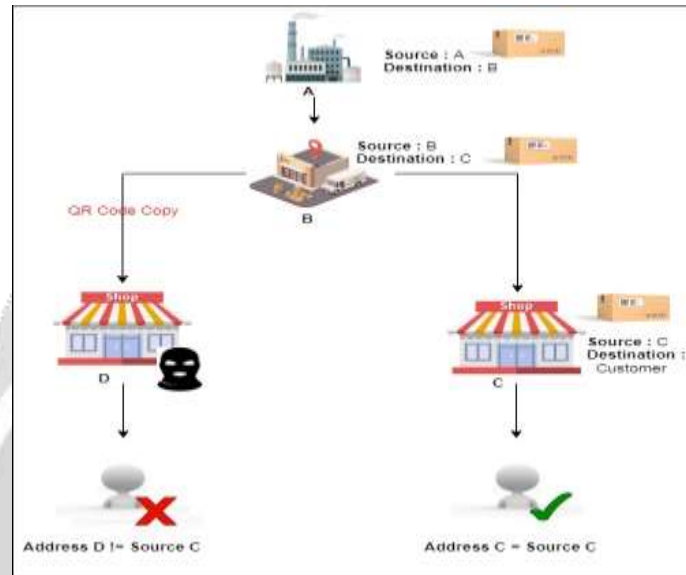


Fig. 5. Dealing with Counterfeit Product

13. WORKING

The technology will identify fake goods using QR (Quick response) codes, which are linked to smart contracts and chained to particular objects, allowing smart phones and other scanning devices to read the codes. This will indicate whether the goods are genuine or counterfeit. A company will be allowed access to upload the product details with a system generated QR code after having their mail ID and registration process verified. The product information includes the name of the brand of the product, the year it was manufactured, its price, its total quantity, its quality, and the manufacturer's information. The QR code will be saved in a decentralized block utilising Blockchain technology, and this will be maintained in a database (Firebase). Each block transaction will have a special QR code on it that the manufacturer cannot use for another product. Manufacturers can employ serialised QR codes to convey product information, engage customers, and boost sales, improving the security and dependability of the tracing and identification process. Before scanning the QR or barcode of the product, the customer must first log in or register with the system. The customer's unique scanned code will be compared to the manufacturer's code, which is kept in blocks of smart contracts, after user verification is complete. The user will be informed that the product is original with all of its details and an authentic certificate from the database if the code matches. If the codes do not match, the user will be informed that the product is counterfeit, helping to avoid purchases of counterfeit items that could cause serious harm to one's health or substantial financial losses. If the product is false, the location of the user will be accessed with permission, and a notification will be issued to the manufacturer. The manufacturer can then take additional legal action against the distributor, retailer, and black-market manufacturer. This promotes user pleasure, guarantees that buyers have faith in merchants, and can help manufacturers avoid spending time and money battling false advertising and sales caused by counterfeit goods.

14. DATA FLOW DIAGRAM

The main objective of the suggested approach is to help the client monitor the product's history in order to retain the product's originality. Customers can utilize the system to track a product's history from

manufacturer to customer using blockchain. This data flow system has three roles. They are a distributor, retailer, and manufacturer. The manufacturer and retailer either register themselves with the account or log in. The creator generates a QR code for the product using the Ethereum wallet and includes any other information that may be required. The database will hold the product information. Customers can check the legitimacy of a product and evaluate its integrity by scanning a QR code that records the history of transactions.

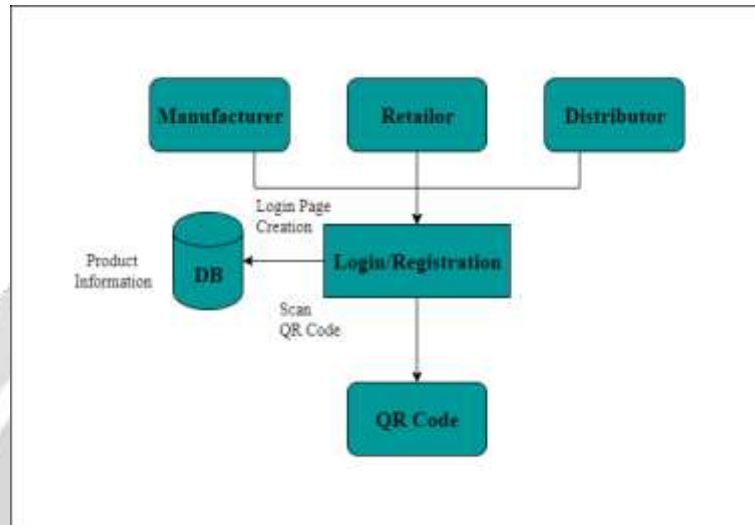


Fig. 6. Data Flow Diagram

BASIC STEPS OF SYSTEM : The system keeps track of the product’s status, current owner, and time stamp, which indicates when ownership changed.

- STAGE I: Product enrollment on the network: The product’s first owner will be the maker. At that point, a QR code will be assigned to the product once the manufacturer asks the administrator to add it to the network. If the requestor is a legitimate manufacturer, the administrator will register the product and manufacturer on the network.
- STAGE II: Ship product to Distributor: The manufacturer will ship the product to the distributor in the next step, setting the status assent ; nevertheless, the ownership of the product won’t change until the distributor acknowledges receipt of the shipment. Ownership of that goods is transferred to the distributor following receipt of ACK.
- STAGE III: Ship product to retailer: At this stage, the distributor will ship the item to the retailer, setting the status as sent. Once the retailer confirms that the item has been received, the retailer is handed ownership of the item.
- STAGE IV: End user get detail about product: Customers will be given an Android app at this stage, and they can use it to scan the QR code attached to the product to learn more about the product’s manufacturer and current owner before deciding whether or not to purchase it.

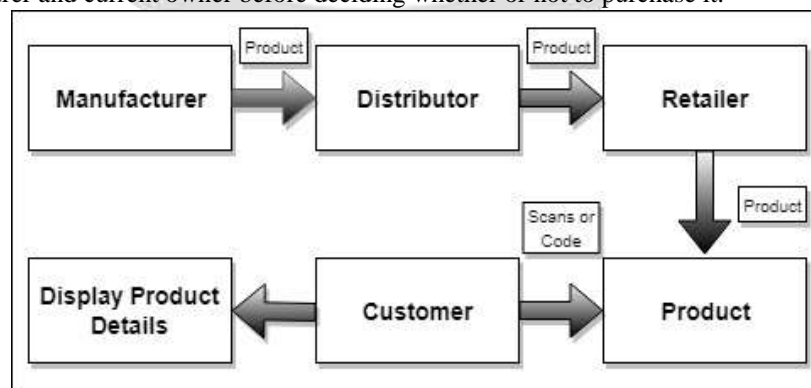


Fig. 7. Proposed Flow

15. SEQUENCE DIAGRAM

There are four parts to it: a manufacturer, a distributor, a retailer, and a customer. The manufacturer will dispatch the product and the consumer first. The goods will be added by the manufacturer and shipped to the distributor. All the information will be added to the blockchain as the distributor sends that to the store. By scanning the QR code, the client may determine whether the goods is genuine or not.

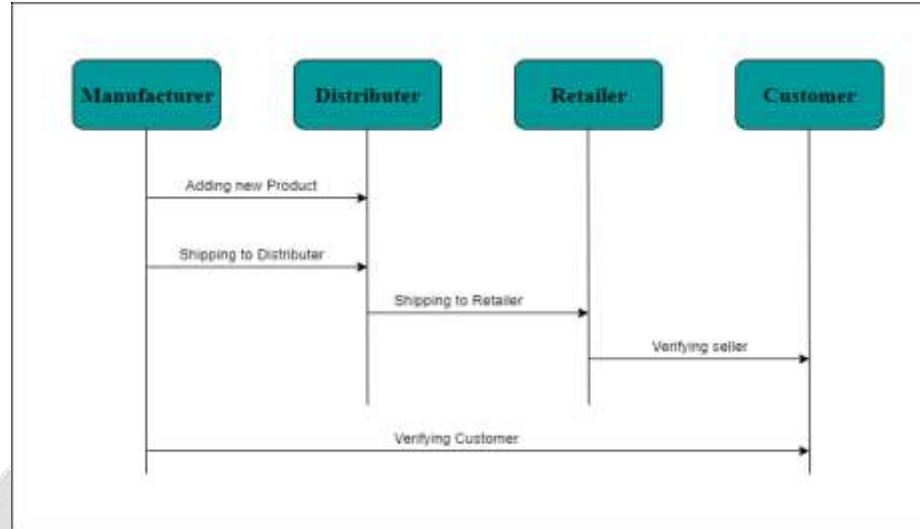


Fig. 8. Sequence Diagram

16. CONCLUSION

The anti-product forgery solution that is proposed by this Blockchain system is completely operational. Users of our system no longer have to worry about buying a fake item because they only have to pay a tiny transaction charge. Manufacturer scan utilize the system to maintain essential sales data for their products in a publicly accessible blockchain. Both the seller's maximum possible sales and the number of products she has remaining on the market are transparent. The user can use the features offered by our system to carry out vendor-side verification right away. The method uses digital signatures to offer identification verification. Other than the key owner mistakenly disclosing his key, there is no other way to decrypt the private key of the key owner.

17. FUTURE WORK

- Because distributed applications have a tendency to improve user trust, the system's future performance may serve as evidence of its ability to write simple code.
- It might be challenging for manufacturers to add all the information about the products they produce, so instead of adding the information by hand, data can be extracted via the company's API, which can boost efficiency and be helpful to manufacturers.
- Although a QR code cannot be hacked, information contained within it can be copied or used to generate a similar QR code, as well as a printout of a QR code, which works well for scanning and retrieving information. To get around this, a secure graphic QR code can be used, but if it is photocopied, the information will be lost due to ink smearing.
- These copy detection patterns, also known as secure graphics, are digital images that are specially designed to lose information when duplicated and reproduced in an irreversible manner.
- When a customer discovers a counterfeit goods, the system should be able to display identical products that are original from several websites at varying prices in order to increase the system's usability, efficiency, and effectiveness.
- The entire cost of running the distributed system on the Ethereum block blockchain is directly impacted by the unpredictable nature of the code. This system's usage in the future could show how straightforward the code is. The consumer can feel secure knowing that the distributed programme won't raise consumption due to its straightforward design and lack of unnecessary code.

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