FAKE PRODUCT IDENTIFICATION USING BLOCKCHAIN

THE FULFILLMENT OF THE TWO-WEEK INTERNSHIP PROGRAM DEGREE OF **B. TECH**

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Computer Science and Engineering/ Data Science

by

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Career Development Centre

INSTITUTE OF AERONAUTICAL ENGINEERING

DUNDIGAL

MAY 2023

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CERTIFICATE

This is to certify that the project report entitled **Fake Product Identification Using Blockchain** submitted by **Jai Indra Reddy Jonnala** to the Institute of Aeronautical Engineering, Dundigal, in partial fulfillment for the award of the degree of **B. Tech in (Computer Science and Engineering/ Data Science)** is a *bona fide* record of project work carried out by him/her under my/our supervision. The contents of the report, in full or in parts, have not been submitted to any other Institution or University for the award of any degree or diploma.

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DECLARATION

I declare that this project report titled Fake Product Detection Using Blockchain submitted in partial fulfillment of the degree of **B. Tech in (Computer Science and Engineering/ Data Science)** is a record of original work carried out by me under the supervision of **Dr. C V R Padmaja,** and has not formed the basis of the award of any other degree or diploma, in this or any other Institution or University. In keeping with the ethical practice in reporting scientific information, due to acknowledgements have been made wherever the findings of others have been cited.

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ACKNOWLEDGMENTS

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I take this opportunity to thank Sri M. Rajasekhar Reddy, Director – IARE, Dr. C. V. R. Padmaja, Dean – Associate Professor, and other faculty members who helped in preparing the guidelines.

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Jai Indra Reddy Jonnala

ABSTRACT:

Supply chain management frequently faced issues such as service redundancy, poor coordination between several departments, and lack of standardization because of the lack of transparency. Product counterfeiting is something that is very common nowadays and it's almost impossible to detect a counterfeit product just by looking at it. Counterfeiters cause significant challenges for legitimate firms, yet far too many people have no idea of the entire amount of counterfeit items' influence on brands. There are several methods devised in the past to get away with this problem of product counterfeiting. The most popular methods are using RFID tags, Artificial Intelligence, QR code-based systems, etc. But each of them had a few disadvantages such as the QR code can be copied from a genuine product and placed on a fake product, artificial intelligence uses CNN and machine learning which needs heavy computational power, and so on. The idea of this project is to improve the detection of fake products by tracking their supply chain history. This is achieved with Blockchain technology which ensures the identification and traceability of real products throughout the supply chain. A blockchain-based system makes everything decentralized that may be accessed by several parties at the same time. One of its main advantages is that the recorded data is difficult to change without the consent of all parties concerned which makes the data extremely secure and protects from all vulnerabilities. This paper presents a system designed using blockchain technology for the detection of counterfeit products.

Keywords: Counterfeit product, QR code, Blockchain

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1. INTRODUCTION

Product counterfeiting happens when a product is sold pre-tender to be another product. It is consumer fraud and commonly defined as deceptive business practices that cause consumers to super financial or other losses. According to the Authentication Solution Providers' Association reports it costs the Indian economy INR 1 trillion every year. Counterfeit incidents are increasing by 20% average in between 2018-20.[1]. Counterfeit goods include counterfeit handbags, clothing, cosmetics, and electronics. It not only has negative effects on the economy, but on citizens too. For example, poor cosmetics can affect skin and cause skin diseases and rashes, and counterfeit electronic components can cause malfunction in gadgets and can lead to unfavorable situations and mishaps. Poor quality clothes, shoes when worn can cause discomfort. Hence this issue necessitates finding some solution for the sale of counterfeit products. Another consequence of counterfeiting is that a company's reputation suffers.

Because many customers are clueless that the object, they are holding is a knock-o↵, they will accuse the genuine company if the knock-o↵ product fails to perform properly, comes apart rapidly, or fails to satisfy their expectations. Customer demand recompense, either in the form of a refund or a new product, and they seek it out directly from the legitimate company. A lot of affected businesses may find themselves in a scenario where they are dealing with an unhappy customer who is complaining about the bad quality of the item, and the customer care representative is unaware that the item in question is a counterfeit. Companies are caught between a tough situation, attempting to avoid wasting time and effort dealing with poor imitations of their goods while yet trying to keep their customers pleased. The harm caused by counterfeiters extends beyond customer relationships. Because of the behaviors of counterfeiters, distributors, retailers, and other business partners frequently lose faith in legitimate enterprises. The most successful mitigation measures for overcoming misleading counterfeit risk in global supply chains include network transparency, cost control and pre-supply evaluation approaches, and supplier relationship management. Hence the objective of this paper is to present the system designed for anti-counterfeit using Blockchain technology and to give end user and supplier power to track supply chain of product in a secured environment. In an overview of proposed system, it is aimed to solve the problem of brand counterfeiting and provide the chance to the customer, vendors and suppliers to check the integrity of the product. The paper is organized as follows: The detail explanation of Blockchain with its working and features is mentioned in section 2. The section 3 covers a comprehensive review of the literature. The proposed System in Section 4 includes the system model and the flow of the system. The simulation results for the proposed method are presented in Section 5. Section 6 is where the paper comes to a close with the conclusion.

1.1 BLOCKCHAIN

Blockchain is collection blocks that are linked together which store information. Each block has a timestamp, transaction data and hash of its own and hash of previous block, so it is difficult to tamper with data. Blockchain is a decentralized system. It ensures that every new block added to the blockchain is the one and only true version that is agreed upon by all nodes in the

Blockchain. It refers to the collective maintenance of a technical solution that maintains a continuous record file as a reliable database through decentralization [2][3][4].

1.2 WORKING OF BLOCKCHAIN

When a new transaction is entered, it is then transmitted in a network of peer-to-peer computers scattered across the world. The network of computers then solves the equations to confirm the validity of the transaction. They are called miners. Once confirmed to be legitimate transactions, they are clustered together into blocks. The miner then receives an award as a proof of work. These blocks are then chained together creating a long history of all transactions that are permanent. The transaction is complete.Whole procedure is done as shown in figure 1.[5][6]

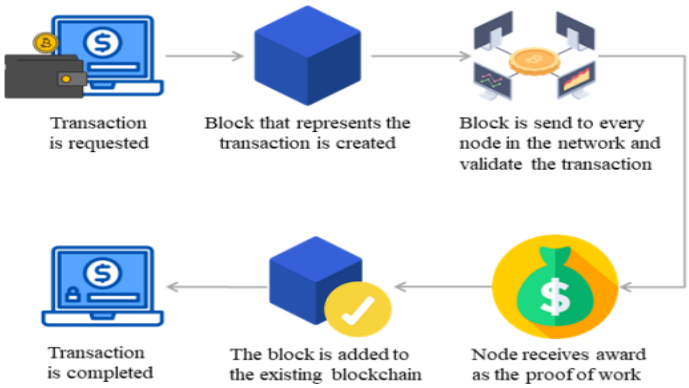


Figure 1: Working of Blockchain [6]

1.3 BLOCKCHAIN FEATURES

Blockchain can add data records to its database which does not depend on any centralized authority as a arbitrator, instead it works on its own consensus algorithms. Blockchain is openly available database and is highly reliable. The features of Blockchain technology are described in detail below. The features of Blockchain are shown in figure 2.

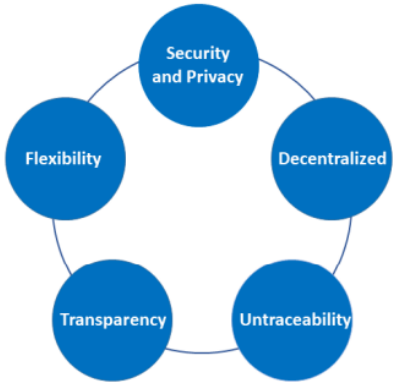


Figure 2: Features of Blockchain [7].

1. **Security and privacy:** Blockchain uses cryptography to secure its data. Private key is used to sign the data, using the public key we can verify whether the data has been tampered or not and check its genuineness. A user should protect its private key similar to bank OTP and passwords and prevent it from leaking to ensure the security of its data on blockchain [5][7][8].

2. **Decentralized:** In a decentralized blockchain network, no one has to know or trust anyone else. Each member in the network has a copy of the exact same data in the form of a distributed ledger. If a member's ledger is altered or corrupted in any way, it will be rejected by the majority of the members in the network [5][7].

3. **Untraceability :** Once the block is entered into the blockchain, it cannot be tampered. Due to this if the block in the Blockchain is altered and is immediately rejected or deleted.

4. **Transparency:** The data in Blockchain is completely public and can be viewed by the participants.

5. **Flexibility:** Being open source is one of biggest advantages of blockchain. Various public and private blockchains are available to the users, which can be used based on type of application which has to be created [5][7].

1.4 IMPORTANCE OF BLOCKCHAIN

Blockchain increases trust as we don't have to depend on any third party. The smart contracts which are basically programs on blockchain are run only when certain conditions are met. Since all the blocks store its data along with hash of previous block it becomes difficult to modify the blockchain with false information. If attacker changes information of block, its hash also changes but the hash of next block remains same. To alter chain would require the consensus of more

than half of the participants which is unlikely, since lots of resources and financial amount is required. Also, other members would come to know of this drastic change [5].

Various researchers have proposed different methods for establishing a blockchain-based supply chain management system. One of them presented a counterfeit product identification system using android application where a product can be searched in the Blockchain network. Another paper displayed a fake product detection system using blockchain where SHA-256 Algorithm was used to identify a product. A fully functional anti-product forgery system was designed by a group of researchers that uses digital signature for verification. In one of the papers, a blockchain-based Product Ownership Management System was proposed. It displayed the use of blockchain-based system over traditional RFID based system. Another paper presented a food traceability system using IoT and blockchain collectively. In this model, they used fuzzy logic to evaluate the food quality.

2. LITERATURE SURVEY

The survey focused on understanding the sources of counterfeits, impact on the society.There exist various systems of fake product detection, which use Artificial Intelligence, QR codes, Machine Learning and Blockchain. The methods discussed by Shaik included the use of providing product with public and private keys as QR code, the app used to scan the QR should have cryptographic functionality to decrypt the QR code. The manufacturer is also supposed to run server to accept request and match the buyer's name, and items code. The scanning app should have cryptographic functionality to decrypt ciphertext of the item code encoded in the QR code [9]. Benatia and Baudry et.al explains traceability-CPS based architecture for supply chain management consists of several layers that interact to form a traceability-CPS. Also, the proposed architecture allows supply chain monitoring and data analytic to enhance product. Safety and quality. The proposed algorithm con-sist on computing the most frequent item sets in the prod- uct transaction database. This item sets are then used as genuine product trajectories and can serve in detecting ab- normal product behavior [10]. Khalil and Doss et.al comes up with the solution of using RFID based system to reduce counterfeiting.

This system allows consumers to query in-store the tag attached to an item to verify its legitimacy. RFID-based anti-counterfeiting and anti-theft schemes are suitable for large scale implementation in retail environments. The proposed scheme is lightweight and suitable for implementation using low-cost passive RFID tags. Tran and Hong’s anti- counterfeiting protocol are used. This system is immune to DOS attacks [11].

Habib and Sardar et.al give explanation on SCM trends. They are examined in their work process that executives’ difficulties and transaction issues are problems featured in the SCM. Hence proposed a solution, SCM by considering the blockchain as a technological feature for solving them. Primary method for structuring new models should find the transaction process at a plan level [12]. Daoud and Vu et.al focus on the architecture of AI Application. It has three main parts: the data set, detection models, and trained model.

Anti- counterfeiting machine learning-based solution to detect fake products. Training models step and detecting logo step are the two steps required. Faster R-CNN achieves high accuracy and low training speed [13]. Chen and Shi et.al explains SCQI. Framework for blockchain based SCQI provides a theoretical basis to intelligent quality management of supply chains based on blockchain technology. RFID technology is used to record quality information, trans- action information. Smart contracts are used to execute quality control and improve the efficiency of the supply chain [14].

Toyoda, Kentaroh and Mathiopoulos, P Takis et.al Proposed system to detect fake product with the help of QR code. End users can scan the QR code assigned to product to get the product

details and transaction history, the steps involved Product enrolment, ship product to distributor, and ship product to retailer, end user gets details about the product [15].

In a Blockchain based system the data is stored on each node, then the nodes exchange information with each other over the network. Each node maintains all Blockchain data. The node verifies the received transactions and includes them in the new block based on its own Blockchain data, and tries to obtain the rights of the new block. Ethereum as the back-end Blockchain operating system. Store relevant information on product sales in Blockchain which is accessible to everyone. It is cost efficient [7]. In this blockchain technology for information sharing is proposed. Is this the information being in the control of the owner so third-party interference is difficult. Users are always aware of the data that is being collected about them and how it is used. The blockchain block contains sender, amount, receiver, transaction id, product id and metadata [16]. Ethereum is an open-source Blockchain. Ethereum is a technology that's home to digital money,global payments and applications. The process is simple as to get into the portal,pick a wallet that lets you connect to Ethereum and manage your funds, Get the ETH, use applications powered by Ethereum, start building [17]. Abhijeet and Adrew et. al. [18] discusses various findings on counterfeiting in global supply chain environments based on various papers and online surveys of professionals targeted at a national purchasing body and affiliated UK purchasing groups. It was found that counterfeiting is widely increasing in areas of low-cost spare parts and sectors like drug market. Strategies used by industries to tackle this problem include avoidance, prevention based on previous experience, destruction. The counterfeit products were difficult to identify for customers due to availability of forged certificates. The limitations in the existing systems are that brands used QR codes on products to prove the validity of the product. But the QR code can be copied and used to label counterfeit products [9]. In the RFID based system that low-Cost RFID tags can be used for auto identification of products, but due to cloning of RFID tags, this method is not suitable [14]. In AI and machine learning application, CNN takes more time and memory.It needs training and testing phase before its actual deployment. Artificial Intelligence fails to detect tag reapplication attacks, wherein a counterfeiter removes a legitimate tag from a genuine product and reapplies it to a counterfeit or expired product [13]. There is no power for the customer,suppliers and retailers to check the integrity of product.

3. PROPOSED SYSTEM

1. **Blockchain Network**: The system would utilize a blockchain network, such as Ethereum or Hyperledger, to maintain a decentralized and tamper-proof ledger of product information and transactions. The network would consist of multiple nodes operated by stakeholders involved in the supply chain, including manufacturers, distributors, retailers, and consumers.
2. **Digital Product Identifiers**: Each product would be assigned a unique digital identifier, such as a digital twin or a digital certificate, which contains relevant information about the product. This identifier could be encoded as a QR code, RFID tag, or other forms of digital markers.
3. **Product Information and Verification**: The blockchain would store detailed information about each product, including its origin, manufacturing details, batch number, and other relevant attributes. Consumers or authorized personnel could use a smartphone app or dedicated scanning device to scan the product's digital identifier and retrieve its information from the blockchain. The app would then perform real-time verification, comparing the scanned information with the records on the blockchain to confirm the product's authenticity.
4. S**upply Chain Tracking**: The blockchain would facilitate tracking the movement of products throughout the supply chain. Each time a product changes hands, the transaction would be recorded on the blockchain, creating an immutable history of its journey from the manufacturer to the end consumer. This tracking mechanism enables stakeholders to verify the product's legitimacy at any point in the supply chain.
5. **Smart Contracts**: Smart contracts, self-executing code stored on the blockchain, could be utilized to automate certain actions and enforce predefined rules. For instance, when a product is transferred from one party to another, a smart contract could trigger an automatic verification process to ensure the authenticity of the transaction.
6. **Anti-Counterfeiting Measures**: The system may incorporate additional anti-counterfeiting measures, such as the integration of IoT devices, like sensors or tamper-evident tags, to monitor product integrity and detect any signs of tampering or unauthorized access. These measures would enhance the security and reliability of the product authentication process.
7. **Consumer Feedback and Reporting**: The proposed system could include a mechanism for consumers to provide feedback and report suspicious or counterfeit products. This feedback loop would help in identifying potential counterfeiters and taking appropriate actions to mitigate the presence of counterfeit goods in the market.

The proposed system leveraging blockchain technology aims to provide a transparent, secure, and reliable solution for detecting counterfeit products. By utilizing blockchain's immutability and decentralized nature, the system can enhance supply chain transparency, establish product

authenticity, and empower consumers to make informed purchasing decisions while combating counterfeiting effectively.

4. SYSTEM MODEL

The proposed system will be a decentralized application (Dapp) which will be implemented using the Ethereum Network 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 figure 3.

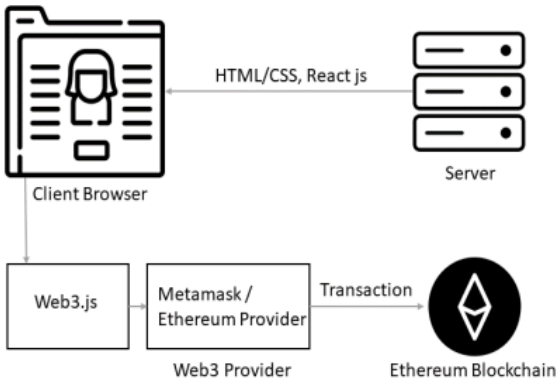


Figure 3: System Architecture [19].

4.1 Ethereum:

It is a decentralized blockchain which uses a proof-of work consensus mechanism. Proof-of-work is adding block to the blockchain by solving the mathematical expressions. Solving the puzzle “proves” that nodes have done the “work” by using computational resources. It confirms that the block is added and recorded in the blockchain. This process is known as mining. Mining is typically brute force trial and error, but successfully adding a block is rewarded in Ethereum (ETH) [17][19].

4.2 Smart contract:

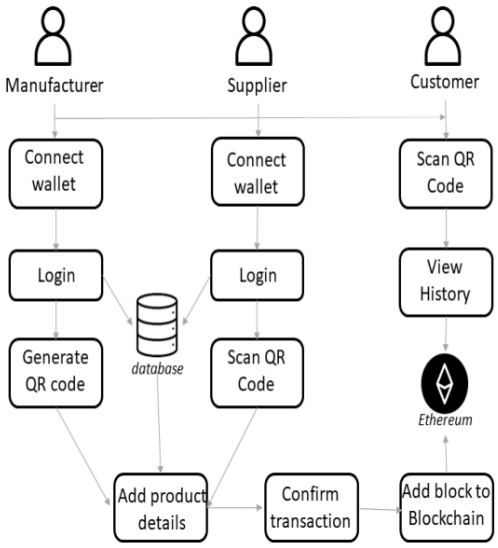
Smart contracts are programs that are stored inside Blocks. Smart contracts replace the involvement of third-party members. These are basically protocols that execute when the conditions are satisfied. They never change, that means no one can tamper with the contract [19].

4.3 FLOW OF PROPOSED SYSTEM

The proposed system for the detection of counterfeit products using blockchain would typically follow a flow that encompasses the various stages of the supply chain. Here's a general outline of the flow of the system:

- **Product Manufacturing and Tagging:** The process begins with the manufacturing of products. Each product is assigned a unique digital identifier, such as a QR code, RFID tag, or other forms of digital markers. This identifier is securely linked to the product's information and authenticity data.
- **Blockchain Integration:** The product information and authenticity data, along with the unique digital identifier, are stored on a blockchain network. The blockchain serves as a decentralized and tamper-proof ledger, accessible to all authorized participants in the supply chain.
- **Supply Chain Operations:** As the products move through the supply chain, their movements, transfers, and transactions are recorded on the blockchain. Each time a product changes hands, the relevant information, including the source, time, and location, is updated on the blockchain.
- **Product Verification:** Consumers or authorized personnel can use a smartphone app or dedicated scanning device to scan the product's digital identifier. The app retrieves the product's information from the blockchain and performs real-time verification. It compares the scanned information with the records on the blockchain to confirm the product's authenticity.
- **Anti-Counterfeiting Measures:** In addition to blockchain verification, the system may incorporate additional anti-counterfeiting measures. These may include the integration of IoT devices, such as sensors or tamper-evident tags, to monitor product integrity and detect any signs of tampering or unauthorized access.
- **Feedback and Reporting:** The system may provide a feedback mechanism for consumers to report any suspicious or counterfeit products they encounter. This feedback loop helps identify potential counterfeiters and allows appropriate actions to be taken to mitigate the presence of counterfeit goods.
- **Supply Chain Transparency:** The blockchain provides transparency and traceability throughout the supply chain. Participants can access the blockchain to verify the authenticity of products, ensuring transparency and trust in the supply chain operations.
- **Analytics and Insights:** The system can leverage data analytics to gain insights into patterns of counterfeit activities, identify potential vulnerabilities in the supply chain, and take proactive measures to prevent counterfeiting.

By following this proposed flow, the system aims to enhance product authenticity, increase transparency in the supply chain, and empower consumers to make informed purchasing decisions while effectively combating counterfeit products.



4.4 Manufacturer: Manufacturer logs into the manufacturer account and generates QR Code for Product and adds other required details of the product and by using his ethereum wallet, the manufacturer adds a block to Ethereum blockchain. The userid of our local database and the wallet address of the entity will be mapped together, if both the things are there, that is a manufacturer logs in from his own account and uses his own wallet then only the block will be added to the digital ledger.

4.5 Supplier: Supplier logs into supplier account and scans the QR code on the product. The seller can access information about his products that the manufacturer has entered. It adds its own details of the product like shop destination and pushes it into the Blockchain. Those details can be viewed by the buyer.

4.6 Customer: Customers can check the integrity of the product by scanning QR code which will list the history of transactions and thus verifying the genuinity of the product. At the time of customer purchasing the product after the QR scan in supply chain history, if the last location is not matched with the purchase location, the customer will know that the product is not genuine. It concludes that the QR code was copied and the customer becomes aware of counterfeiting.

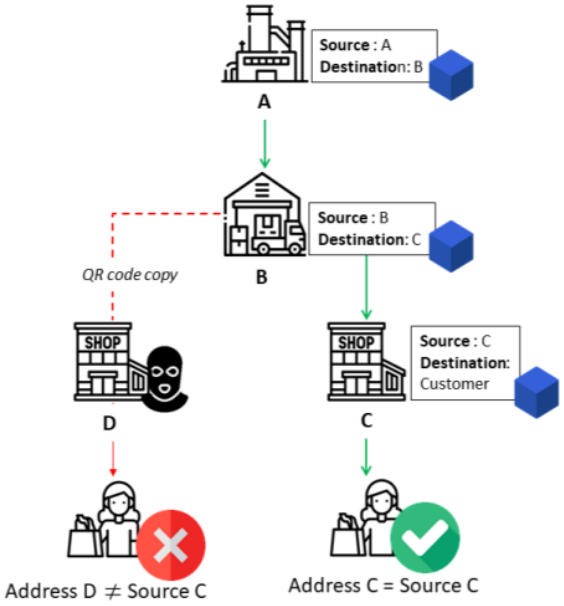


Figure 5: Dealing with Counterfeit Product.

The process of detecting a counterfeit product by the customer while purchasing is shown in figure 5.

5. IMPLEMENTATION

Implementing a complete system for the detection of counterfeit products using blockchain requires a comprehensive approach that involves various components and technologies. Here are the key steps involved in implementing such a system:

1. **Define Use Case and Requirements**: Clearly define the use case and requirements of the system. Identify the specific industry or product segment you aim to address and outline the desired functionalities, such as product verification, supply chain tracking, and anti-counterfeiting measures.
2. **Choose a Blockchain Platform**: Select a suitable blockchain platform that aligns with your requirements. Popular options include Ethereum, Hyperledger Fabric, and Corda. Consider factors such as scalability, security, consensus mechanism, and smart contract capabilities when making a decision.
3. **Design the Smart Contract:** Design and develop a smart contract that governs the logic of product verification and anti-counterfeiting measures. The smart contract should include functions for registering products, recording product movements, and verifying product authenticity.
4. **Create Digital Identifiers**: Establish a mechanism to generate and assign unique digital identifiers to products. These identifiers can be in the form of QR codes, RFID tags, or other digital markers. These identifiers will be linked to the product information and stored on the blockchain.
5. **Integrate Supply Chain Data**: Integrate the supply chain data with the blockchain. This may involve capturing data at each stage of the supply chain, such as manufacturer details, product information, shipping records, and retailer information. This data should be securely stored and synchronized with the blockchain network.
10. **Develop User Interfaces**: Build user interfaces for different stakeholders, such as manufacturers, distributors, retailers, and consumers. These interfaces should enable easy product verification by scanning the digital identifier and displaying relevant product information retrieved from the blockchain.
11. **Implement Anti-Counterfeiting Measures**: Implement additional anti-counterfeiting measures, such as tamper-evident packaging, holographic labels, or IoT devices. These measures can help detect and prevent counterfeit products from entering the supply chain.
12. **Conduct Testing and Deployment**: Test the system thoroughly to ensure its functionality, security, and scalability. Conduct pilot tests with a subset of users to gather feedback and fine-tune the system. Once the system is deemed ready, deploy it in a production environment.
13. **Monitor and Maintain the System**: Continuously monitor the system's performance, security, and user feedback. Regularly update and maintain the blockchain infrastructure and smart contracts to address any potential vulnerabilities or improvements.

14. **Collaborate and Educate Stakeholders**: Collaborate with relevant industry stakeholders, such as manufacturers, retailers, and regulatory authorities, to encourage their participation and adoption of the system. Conduct awareness campaigns and training sessions to educate stakeholders about the benefits and usage of the system.

6. RESULTS AND DISCUSSION

The proposed system allows both manufacturers and suppliers to interact with the system to add their respective block containing the transaction details to blockchain without modifying other's block. The contracts for the manufacturer and supplier block are written using solidity. Since the code is running on local network ganache has been used for local testing. The host"127.0.0.1", and port 7545 is configured in true-config.js file. The contracts are then compiled and deployed using true. Migrations files are created for deployment. Migrations are files that help us to deploy contracts on an Ethereum blockchain network.

The interface is created using React. To allow interacting with Ethereum blockchain Web3.js library is used which is used to perform actions like sending ether, confirming transactions reading and writing data from smart contracts. MetaMask is installed on a browser which is a wallet to interact with Ethereum blockchain, to allow accessing Ethereum wallet through a browser. Accounts from ganache are imported into the MetaMask. To add supplier and manufacturer blocks they must confirm the transactions using their account using 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 product integrity.

Accounts can be categorized into manufacturer, supplier and customer as shown in Figure 6. The manufacturer connects to his Ethereum account using the MetaMask Wallet as shown in Figure 7.

Figure 6: Landing page.

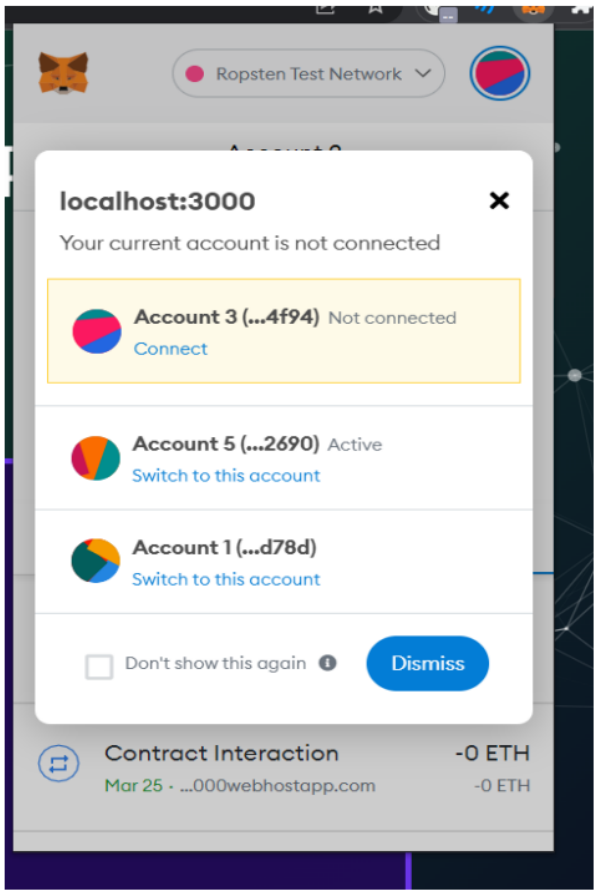


Figure 7: Connecting to Ethereum using Metamask wallet

The Manufacturer logs into his account using his credentials like username and password as seen in Figure 8

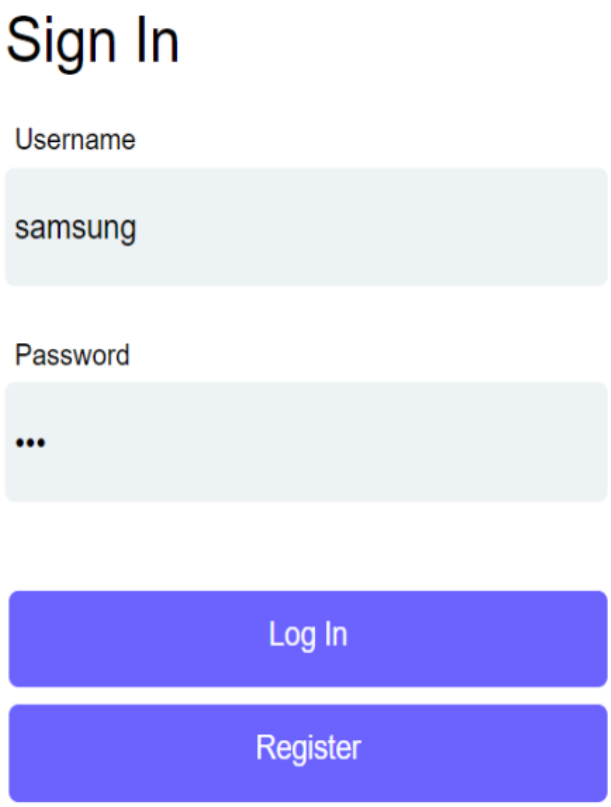


Figure 8: Manufacturer Login page

The credentials are stored in SQL server as shown in Figure 9. SQL database is used for storing manufacturer and supplier login details and their address.

id	name	uid	addr	category	password
10	samsung	26513	Samsung Electronics Huizhou Co., Ltd., Industrial ...	Electronics	202cb962ac
59	louis_vuitton	65464	116 Greene St, New York, NY 10012, United States	Fashion	df2a3e9e50

Figure 9: SQL database.

As shown in Figure 10, after logging into his account the manufacturer assigns unique serial number for the product and generates its QR Code. This QR code is placed on the product when

it is transported to other places.Along with this the manufacturer fills other details of product like its name , current address that is the source and destination where it is currently headed.Once all the details are filled the manufacturer clicks add block button which is used to add all the filled details to blockchain.

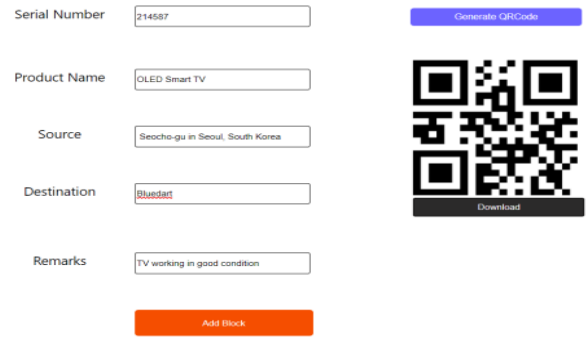


Figure 10: Manufacturer adding the details of the product.

A metamask confirmation popup is displayed which asks for the confirmation as in Figure 11.

Once confirmed the block containing all details is added to blockchain and success page is displayed as shown in Figure 12.

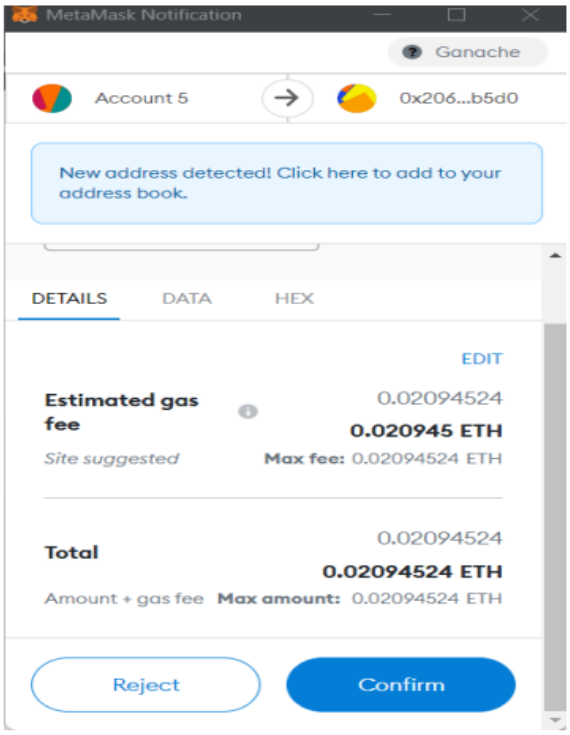


Figure 11: Completing the transaction with metamask wallet

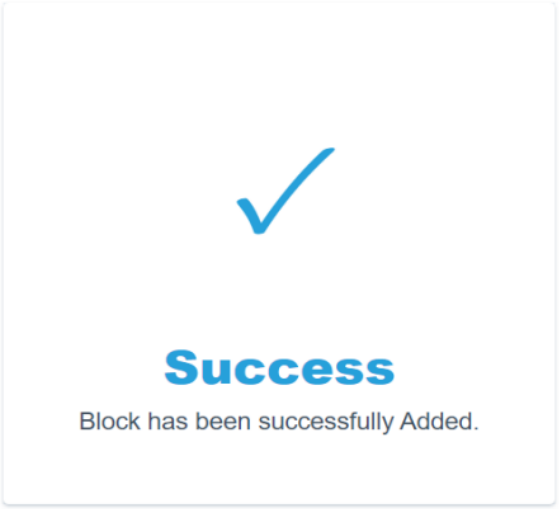


Figure 12: Message after addition of block to blockchain.

Once the product reaches the supplier destination, the supplied needs to login into his account shown in Figure 13 and connect his MetaMask wallet.

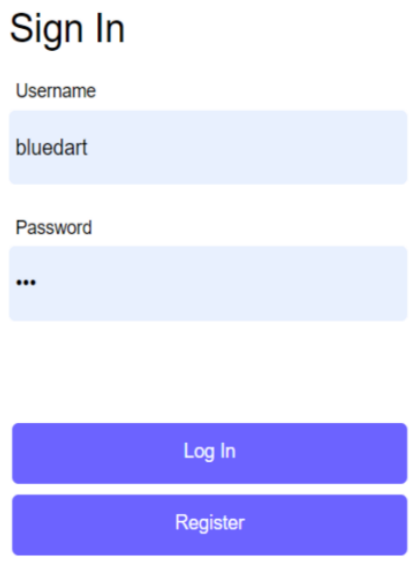


Figure 13: Supplier Login page.

Once done the supplies is presented with screen to fill in the required details of product.This time the supplier doesn't generate the QR code ,the supplier clicks on scan qr and scans the qr code.The supplier enters the required details for the product and clicks on add block as shown in Figure 14.The block gets added after the supplier confirms his transaction through the metamask wallet and logs out.

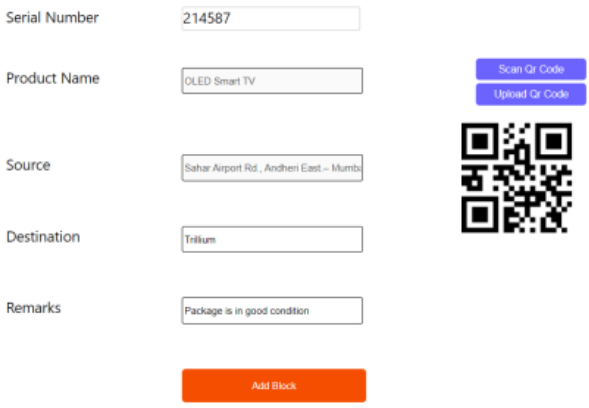


Figure 14: Supplier adding details for the product.

Other supplier involved similarly log into their account and add their respective blocks to the blockchain. After the product reaches the customer he can visit the customer page, scan the QR code as shown in Figure 15 and check the complete supply chain history of product.

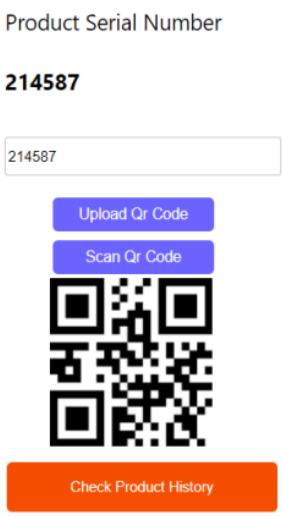


Figure 15: Customer page to check Supply chain history of the product.

The supply chain history as shown in Figure 16 and Figure 17 shows various information of like the the product id, its name, source, destination address related to the entities involved, their ethereum account address, timestamp of when the block was added, and any additional remarks if added.

Figure 16: Supply chain history - 1.

Figure 17: Supply chain history - 2.

7. TRANSACTIONS:

FIGURE 18

FIGURE 19

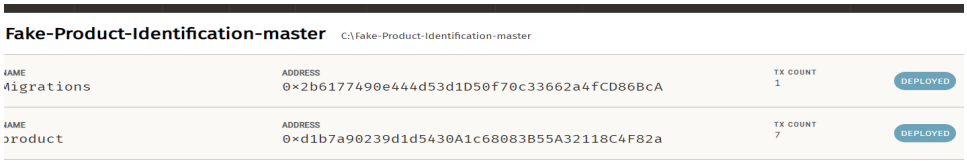
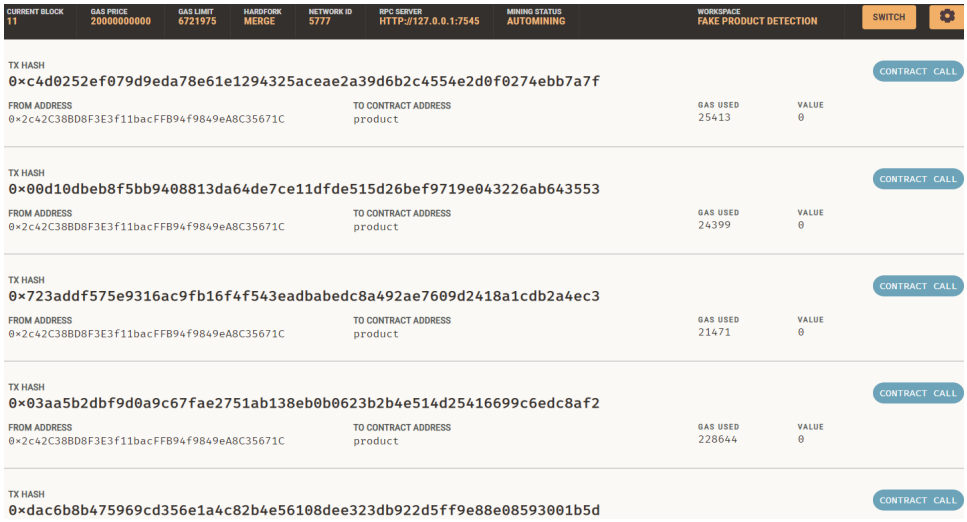


FIGURE 20



At the time of customer purchasing the product after the QR scan in supply chain history, if the last location is not matched with the purchase location, the customer will know that the product is not genuine. It concludes that the QR code was copied and the customer becomes aware of counterfeiting.

8. CONCLUSION

In conclusion, the use of blockchain technology for the detection of counterfeit products offers promising potential in enhancing supply chain transparency, product authentication, and consumer trust. By leveraging blockchain's features, such as immutability, decentralization, and transparency, the proposed system aims to combat the pervasive issue of counterfeit goods.

The proposed system's flow involves several key components, including the integration of unique digital product identifiers, blockchain networks, supply chain tracking, product verification mechanisms, and anti-counterfeiting measures. Through these components, stakeholders can track products' movement, verify their authenticity, and detect any signs of tampering or unauthorized access. The system also encourages consumer feedback and reporting, creating a feedback loop to identify counterfeiters and take appropriate actions.

While several existing systems and initiatives are already utilizing blockchain technology for counterfeit detection, the proposed system highlights the importance of transparency, trust, and real-time verification in combating counterfeiting. By empowering consumers with access to reliable product information and enabling them to make informed purchasing decisions, the proposed system aims to minimize the presence of counterfeit goods in the market.

However, it's essential to note that implementing a comprehensive system for the detection of counterfeit products using blockchain requires careful consideration of various factors, including the choice of blockchain platform, integration with existing supply chain processes, scalability, and privacy considerations. Additionally, collaboration among stakeholders, industry standards, and regulatory frameworks play a vital role in the success of such systems.

In summary, the proposed system leveraging blockchain technology offers a potential solution to address the challenges posed by counterfeit products. By combining blockchain's inherent properties with robust supply chain practices, it has the potential to increase transparency, authenticity, and trust, ultimately leading to a reduction in counterfeit goods and protection for consumers and legitimate businesses.

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