# BLOCKCHAIN BASED SYSTEM TO DETECT COUNTERFEIT PRODUCTS IN SUPPLY CHAIN

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**Abstract -** Blockchain-Based Supply Chain Management is a novel approach to enhancing the transparency, security, and trustworthiness of supply chains. In this study, we explore the design and implementation of a blockchain-based system that enables manufacturers, suppliers, and customers to collaborate seamlessly in tracking and verifying product information. The proposed system leverages blockchain's inherent features, such as decentralization, tamper-resistance, and transparency, to reduce counterfeiting and build trust in the supply chain. We discuss the architecture and key components of the system, including the role of SQL databases and Metamask wallet integration. Additionally, we highlight the process flow, from manufacturers assigning unique serial numbers to customers verifying product authenticity through QR code scans. [1]

This research presents a comprehensive solution for supply chain management, offering potential applications beyond product tracking, including in banking, healthcare, and e-commerce. Blockchain innovations have acquired interest in the course of the most recent years. One of the most talked about issues is currency exchange, but its application is not limited only to Digital currency. so it has the potential to influence different business sectors. Blockchain technology has brought greater transparency and ease in large transactions. We can detect counterfeit goods using blockchain technology. The question that arises when buying any item in today's world is whether it is fake or not. And the lack of these things has been shown a huge impact on economic progress. Therefore, in order to curb all counterfeit goods, it is important to bring transparency about the goods to the notice of the consumers. The growing presence of counterfeit and unsafe products in the world is a cause for concern and blockchain technology has taken the next step towards its complete annihilation. [2]

***Key Words*:** *Blockchain, Supply Chain Management, Counterfeiting, Transparency, Product Authentication, Fake Product Detection, Blockchain, Metamask.*

## 1.INTRODUCTION

Blockchain Guard is a pioneering project designed to revolutionize supply chain management by harnessing the power of blockchain technology to combat the rampant proliferation of counterfeit products. In today's interconnected global economy, the authenticity and integrity of products within supply chains are under constant threat, posing significant risks to businesses and consumers alike. Blockchain Guard emerges as a beacon of innovation, offering a comprehensive solution to address these pressing challenges. At its core, Blockchain Guard is founded on the principle of transparency, traceability, and trust. By leveraging blockchain technology, we aim to create a secure and immutable ledger that records every transaction and movement of products throughout the supply chain network. Unlike traditional supply chain management systems, which often suffer from opacity and inefficiencies, Blockchain Guard provides stakeholders with unparalleled visibility into the provenance and authenticity of products at every stage of their journey. [3]

Our solution is multifaceted, encompassing a range of cutting-edge technologies and methodologies to ensure the highest level of effectiveness and reliability. Through the integration of smart contracts, we automate verification processes and enforce compliance with predefined rules and standards, thereby minimizing the risk of counterfeit infiltration. Moreover, advanced data analytics and machine learning algorithms empower us to analyze vast amounts of data in real-time, enabling proactive identification and mitigation of counterfeit threats.

Central to the success of Blockchain Guard is collaboration. We recognize that the battle against counterfeit products requires collective action and shared responsibility. As such, our platform fosters collaboration and trust among supply chain participants, facilitating seamless communication and information sharing. By empowering stakeholders with the tools and insights needed to make informed decisions, Blockchain Guard drives positive change and ensures the integrity of the global supply chain ecosystem.[4]

The motivation driving BlockchainGuard stems from the critical necessity to tackle the mounting challenge posed by counterfeit products infiltrating modern supply chains. In an era of globalization and intricate trade networks, counterfeit goods not only endanger consumer safety but also erode trust in legitimate businesses. With the proliferation of these illicit products, there's an urgent need for innovative solutions that can fortify supply chain integrity and protect against the risks associated with counterfeit infiltration.

BlockchainGuard rises to meet this challenge by harnessing the transformative potential of blockchain technology. By establishing a secure, immutable ledger that tracks every step of a product's journey through the supply chain, BlockchainGuard enhances transparency and traceability. This real-time visibility empowers stakeholders to verify product authenticity with confidence, mitigating the impact of counterfeit goods and fostering a safer, more trustworthy marketplace for all involved.[5]

## 2. LITERATURE REVIEW

**PAPER 1**

**"A Blockchain-Based Framework for Supply Chain Provenance" Author: JULIE DIXON, UJJWAL GUIN Publishing Year: 2019**

Description: This paper introduces a novel blockchain-based framework aimed at addressing the complexities and security challenges inherent in the global electronics supply chain. In response to the proliferation of counterfeit and cloned electronic parts, the authors propose a non-destructive solution built upon Hyperledger Fabric, a permissioned blockchain platform. This framework enables comprehensive traceability of electronic parts, allowing stakeholders to track their origin, travel history, and bill of materials efficiently and reliably. Through detailed performance evaluations and security analyses, the authors demonstrate the feasibility and robustness of their approach, highlighting its potential to safeguard the supply chain and protect against counterfeit devices. Furthermore, the paper suggests avenues for future research, including the exploration of additional security measures such as Physical Unclonable Functions (PUF)

**PAPER 2**

**"A Blockchain-Based Framework for Supply Chain Provenance" Author:JINHUA MA, SHIH-YA LIN, XIN CHEN, HUNG-MIN SUN. Publishing Year: 2020**

Description: This paper introduces a pioneering blockchain-based system designed to combat product counterfeiting by providing consumers with a decentralized means of verifying product authenticity. Leveraging the inherent tamper-proof nature of blockchain technology, the system enables manufacturers to securely store and share product sales information transparently on the blockchain. Users can verify product authenticity directly, minimizing reliance on merchants and mitigating the risk of purchasing coun6 LGNSCOE, Department of Computer Engineering 2023-24 Blockchain Based System to Detect Counterfeit Products in Supply Chain terfeit goods. Through digital signatures and robust encryption mechanisms, the system ensures secure identity verification, enhancing trust and reliability. Cost analysis demonstrates that the system offers a cost-effective alternative to traditional anti-counterfeiting measures, significantly reducing the financial burden on manufacturers compared to operating direct-operated stores. Overall, this innovative blockchain solution offers a promising avenue for enhancing product authentication while lowering costs and increasing accessibility for consumers.

**PAPER 3**

**"A Block Chain based Management System for Detecting Counterfeit Product in Supply Chain" Author:Mrs.M.C.Jayaprasanna, Ms.V.A.Soundharya ,Ms.M.Suhana Publishing Year: 2021**

Description:This paper proposes a blockchain-based solution to combat the growing issue of counterfeit goods in product manufacturing industries. Leveraging blockchain technology's tamper-resistant nature, the proposed system utilizes barcode readers to link product barcodes with a Blockchain-Based Management (BCBM) system. This system stores product details and unique codes in a blockchain database, allowing consumers to verify product authenticity by comparing codes against blockchain entries. It also facilitates detection of counterfeit products by collecting information from consumers about their purchase sources. With counterfeit products proliferating in online and black markets,

**PAPER 4**

**"Literature Survey on Fake Product Identification System Using Blockchain" Author: Subeg Singh Kapoor, Tushar Suryawanshi, Swapnil Jadhav, rof. S. V. Shinkar Publishing Year: 2023**

Description:This literature survey explores the growing use of blockchain technology in product identification systems, focusing on its ability to enhance security and transparency in supply chains. It discusses various blockchain-based approaches, such as smart contracts and digital signatures, for verifying product authenticity and tracking throughout the supply chain. The survey highlights the benefits of blockchain technology, including increased consumer trust and improved traceability, while also addressing challenges such as implementation costs and data privacy concerns.

The paper concludes by proposing a false product detection system built on Ethereum blockchain, utilizing Solidity for smart contract development and web3.js for user interface interaction. The system employs SHA-256 hashing for secure product tracking, offering a comprehensive solution to combat counterfeit products.

## 3. METHODOLOGY

1. **System Requirements Analysis:**

- Identify the key stakeholders in the supply chain (e.g., manufacturers, distributors, retailers, consumers).
- Determine the types of products to be tracked and the specific information to be recorded (e.g., product origin, batch number, serial number, production date).
- Define the goals and objectives of the system (e.g., enhance traceability, improve consumer trust, prevent counterfeit products).

2. **Blockchain Platform Selection:**

- Choose a suitable blockchain platform (e.g., Ethereum, Hyperledger Fabric, Corda) based on the requirements of the system.
- Consider factors such as transaction throughput, scalability, data privacy, and smart contract support.

3. **System Architecture Design:**

- Design a decentralized network architecture that includes nodes representing different supply chain participants (e.g., manufacturers, distributors, retailers).
- Define the data model for storing supply chain information on the blockchain, including product details, transaction history, and ownership changes.
- Design smart contracts to handle transactions and enforce business rules (e.g., verifying product authenticity, transferring ownership).

4. **Data Collection and Integration:**

- Integrate data sources from different stages of the supply chain (e.g., manufacturing, distribution, retail) to gather product information.
- Use IoT devices (e.g., RFID tags, QR codes, sensors) to collect and verify product data in real-time.

5. **Traceability and Authentication:**

- Implement mechanisms for tracking products through the supply chain using unique identifiers (e.g., serial numbers, QR codes).
- Develop smart contracts for verifying the authenticity of products at each stage of the supply chain.
- Enable consumers to authenticate products by scanning QR codes or other identifiers.[6]

6. **Security and Privacy:**

- Ensure the security of the blockchain network through cryptographic techniques (e.g., hashing, digital signatures).
- Implement access control mechanisms to protect sensitive data and restrict access to authorized parties.
- Monitor the network for suspicious activity and potential tampering.

7. **User Interface and Interaction:**

- Design user-friendly interfaces for different stakeholders (e.g., supply chain participants, consumers) to interact with the system.
- Provide tools for users to query product information, verify authenticity, and track products.

8. **Testing and Validation:**

- Conduct testing to verify the functionality and performance of the system under different scenarios.
- Validate the accuracy and reliability of the data recorded on the blockchain.

9. **Deployment and Maintenance:**

- Deploy the system in a controlled environment to monitor its performance and identify any issues.
- Provide training and support to supply chain participants to ensure smooth adoption of the system.
- Plan for ongoing maintenance and updates to keep the system secure and efficient.

10. **Feedback and Continuous Improvement:**

- Gather feedback from users and stakeholders to identify areas for improvement.
- Continuously update the system based on new requirements, challenges, and emerging technologies.

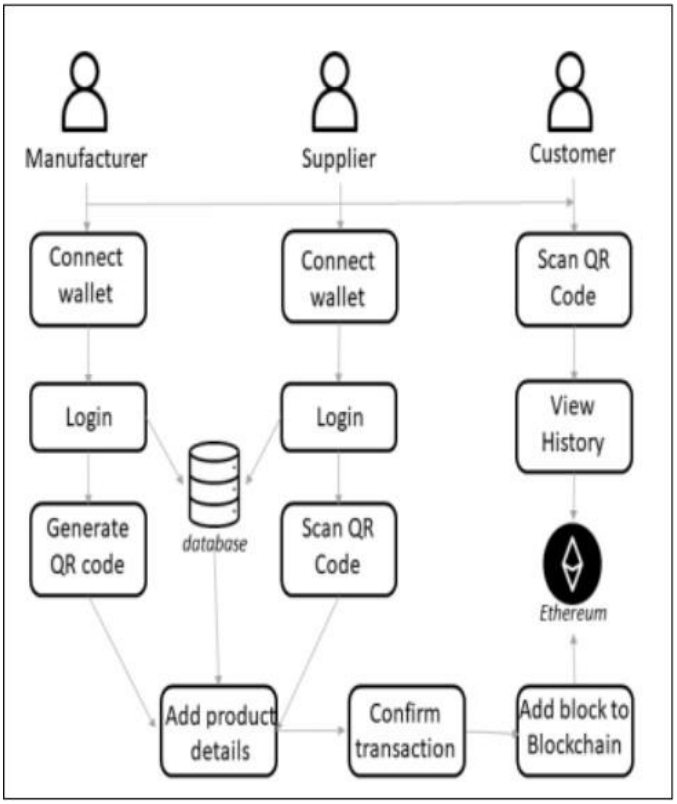


**Fig:-** System Architecture

## 4. PROCESS OF PROJECT

1. **Requirement Analysis:**
   - Understand the specific challenges and pain points in the supply chain related to counterfeit products.
   - Identify stakeholders (manufacturers, distributors, retailers, and consumers) and their needs.
   - Determine the types of products you want to track and the data points that need to be captured for each product.
2. **Design the Blockchain System:**
   - Choose the Right Blockchain Platform: Select a blockchain platform that meets your requirements in terms of scalability, consensus mechanism, and security. Options may include Ethereum, Hyperledger Fabric, or other private or permissioned blockchains.
   - Define Data Model: Design a data model that includes all necessary information about products, such as origin, components, production date, and serial numbers.
3. **Develop and Integrate the System:**
   - Create Blockchain Nodes: Set up blockchain nodes for participants in the supply chain. This includes manufacturers, distributors, retailers, and potentially consumers.
   - Integrate IoT Devices: Use Internet of Things (IoT) devices, such as RFID tags or QR codes, to capture and transmit product data to the blockchain.
   - Build Interfaces and APIs: Create user-friendly interfaces and APIs for stakeholders to interact with the system.
   - Establish Tracking and Verification Processes: Develop processes for tracking products and verifying their authenticity at each stage of the supply chain.[7]
4. **Testing:**
   - Unit Testing: Test individual components, such as smart contracts and APIs, to ensure they function as expected.
   - Integration Testing: Test the interaction between different parts of the system to verify they work seamlessly together.
   - System Testing: Test the complete system in a controlled environment to ensure it meets all requirements and works under various conditions.
5. **Deployment:**
   - Pilot Testing: Deploy the system in a limited scope, such as with a single product line or a small group of stakeholders, to identify any issues before full-scale deployment.
   - Full Deployment: Once the pilot testing is successful, deploy the system across the entire supply chain.
6. **Monitoring and Maintenance:**
   - Continuously monitor the system for performance and security issues.
   - Update smart contracts and other components as needed to address emerging threats and business needs.
7. **User Training and Support:**
   - Provide training to stakeholders on how to use the system effectively.
   - Offer ongoing support to address any issues and gather feedback for future improvements.
8. **Evaluate and Optimize:**
   - Collect data and feedback from users to evaluate the system's effectiveness.
   - Make adjustments and optimizations based on user feedback and performance data.

## 5.IMPLEMENTATION

### 1. Server Running

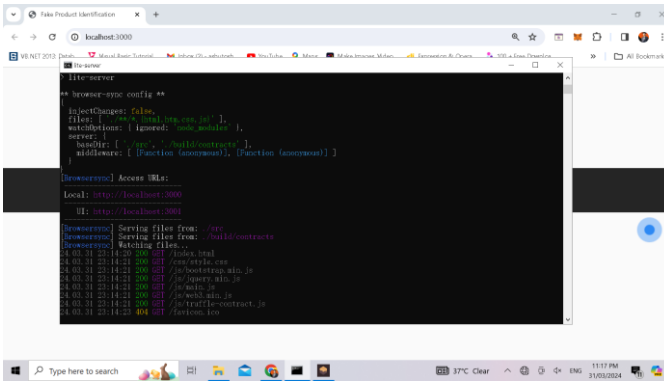

**Fig:- :** Running the Server on Local Host

### 2. Main Screen

Main screen of UI contains various section Manufacturer, Seller and Consumer.

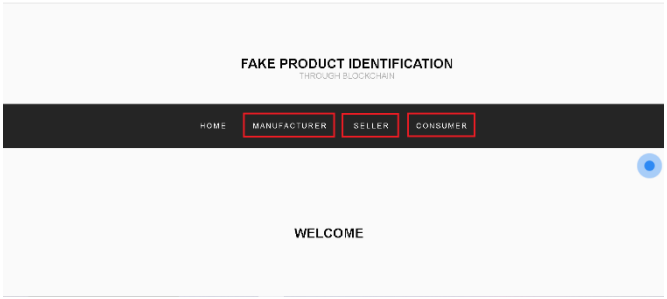


**Fig:-** Main Screen Server with Frontend Navigation

### 3. Ganache Software

Ganache is a personal blockchain for Ethereum development that you can use to deploy contracts, develop your applications, and run tests.

A "Ganache connection" typically refers to establishing a connection to a Ganache instance from your development environment or application

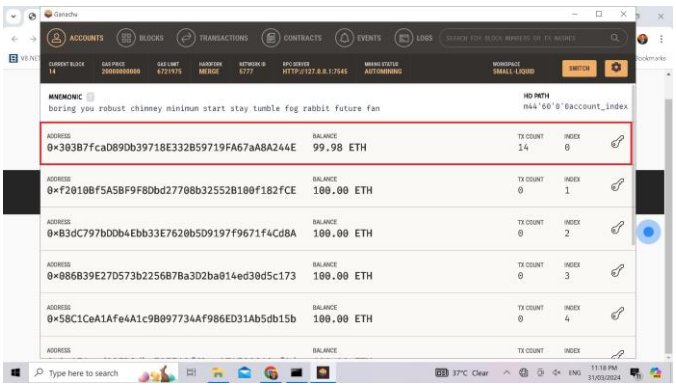


**Fig:-** Using Ganache Software for Ethereum

### 4. Manufacturer section

The manufacturer section typically refers to a specific component or aspect of the blockchain system designed to track and verify the authenticity of products manufactured by legitimate producers.

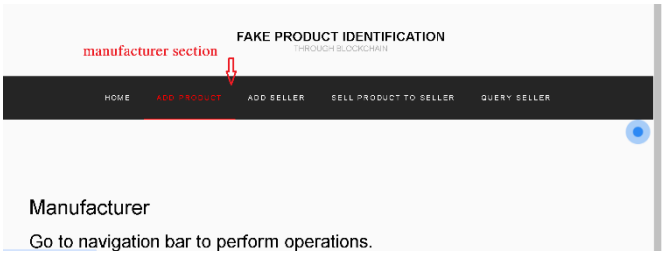


**Fig:-** Manufacturer section

### 5. Consumer Section

The consumer section likely refers to a component or feature designed to empower consumers in the detection and prevention of counterfeit products through the utilization of blockchain technology.

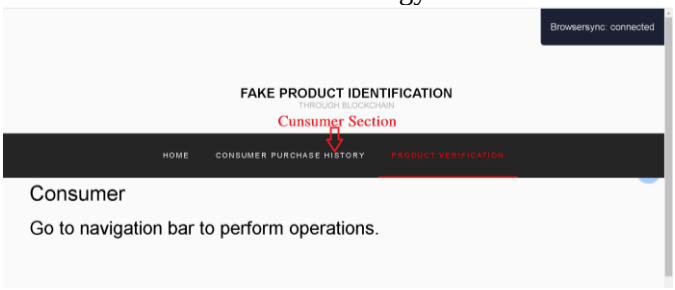


**Fig:-**Counsumer Section

### 6. Query Seller

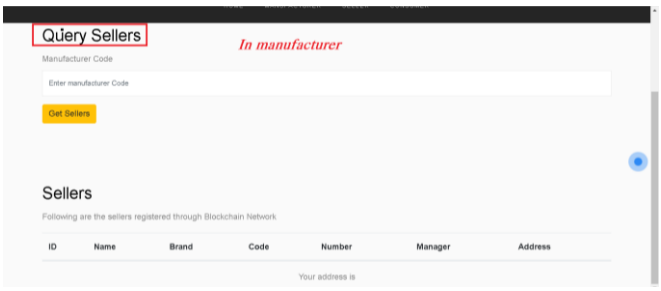


**Fig:-** Query Seller

## CONCLUSION

In conclusion, the development and implementation of the blockchain-based coun- terfeit detection system represent a significant step forward in addressing the perva- sive issue of counterfeit products within supply chains. By harnessing the power of blockchain technology, the system offers a robust solution that enhances transparency, traceability, and trust throughout the supply chain. Through immutable records and streamlined authentication processes, stakeholders can effectively detect and combat counterfeit products, thereby safeguarding consumers and businesses alike. However, while the system shows great promise, there are still challenges to overcome, such as refining user interfaces and ensuring widespread adoption. Nevertheless, with continued innovation and collaboration, the blockchain-based counterfeit detection system has the potential to revolutionize supply chain management, ensuring the integrity and authen- ticity of products in the marketplace for years to come.[9]

The blockchain-based counterfeit detection system holds immense potential for further advancement and expansion. One promising avenue for future de- velopment lies in enhancing the system's scalability and interoperability, allowing it to seamlessly integrate with a wider range of supply chain networks and industries. Addi- tionally, advancements in machine learning and artificial intelligence could bolster the system's capabilities, enabling more accurate and efficient product authentication pro- cesses. Moreover, as blockchain technology continues to mature and gain mainstream acceptance, the system could serve as a foundational framework for addressing other pressing challenges in various domains, such as food safety, pharmaceuticals, and luxury goods authentication. Collaborative efforts between industry stakeholders, policymak- ers, and technology experts will be crucial in driving these advancements and unlocking the full potential of blockchain-based solutions in combating counterfeit products and promoting trust and transparency across global supply chains.

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