

**SRINIVAS UNIVERSITY**  
**INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
**MUKKA, MANGALORE-574146**



**MAJOR PROJECT REPORT**  
**ON**  
**“FAKE PRODUCT IDENTIFICATION USING BLOCKCHAIN”**

*Submitted in the partial fulfillment of the requirements for the award of the degree of*

**BACHELOR OF TECHNOLOGY**  
**IN**  
**COMPUTER SCIENCE AND ENGINEERING**

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**SRINIVAS UNIVERSITY, MUKKA**

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**Department of Computer Science and Engineering**

**CERTIFICATE**

This is to certify that the project report entitled ***“Fake Product Identification Using Blockchain”*** is a bonafide work carried out by ***Mr. Karthik D Shetty, Mr. Rohith K S, Mr. Shreyas B V, Mr. Vikas*** bearing the USN ***ISU19CS018, ISU19CS034, ISU19CS044, ISU19CS056*** in the partial fulfillment for the award of **Bachelor of Technology in Computer Science and Engineering** of the **Srinivas University Institute of Engineering and Technology, Mukka Mangalore** during the year **2022-2023**. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the department library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the said degree.

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**Department of Computer Science and Engineering**

**DECLARATION**

We, **Karthik D Shetty , Rohith K S , Shreyas B V , Vikas** the students of eighth semester, B.Tech in Computer Science and Engineering, Srinivas University, Mukka, hereby declare that the project entitled ***“Fake Product Identification Using Blockchain”*** has been successfully completed by us in partial fulfillment of the requirements for the award of degree in **Bachelor of Technology in Computer Science and Engineering of Srinivas University Institute of Engineering and Technology** and no part of it has been submitted for the award of degree or diploma in any university or institution previously.

**Date:**

**Place:** Mukka

## ABSTRACT

Counterfeiting is a pervasive issue plaguing various industries worldwide, leading to significant financial losses and risks to consumer safety. This abstract proposes a cutting-edge solution, leveraging the power of blockchain technology, to address the problem of fake product identification. By integrating blockchain's immutable and decentralized nature, this approach establishes an unalterable and transparent system for verifying the authenticity of products throughout the supply chain.

The proposed system employs a unique product identification mechanism, where each genuine product is assigned a cryptographic token on a blockchain network. These tokens are securely stored and linked to product-specific information, such as manufacturing details, quality certifications, and distribution records. When a consumer encounters a product, they can scan a QR code or use a mobile application to access the product's blockchain information.

Blockchain technology ensures that the product's information cannot be tampered with or falsified, as each transaction is recorded and validated by a network of nodes. This transparency enables consumers, retailers, and regulators to trace the entire product journey, from manufacturing to the point of sale, verifying its authenticity at each step. Furthermore, smart contracts embedded within the blockchain can automate verification processes and trigger alerts if discrepancies or fraudulent activities are detected.

To enhance the effectiveness of this system, partnerships between manufacturers, supply chain stakeholders, and blockchain technology providers are crucial. By integrating the blockchain infrastructure into existing supply chain networks, it becomes possible to create a comprehensive ecosystem that facilitates the secure verification and tracking of products in real-time.

**Keywords:** Blockchain technology, Product authentication, Anti-counterfeiting, Traceability, Supply chain transparency, Distributed ledger, Smart contracts.

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# **CHAPTER 1**

## **INTRODUCTION**

## CHAPTER 1

### INTRODUCTION

#### 1.1. Blockchain Network

- A blockchain network is a distributed ledger technology that allows secure, transparent, and tamper-proof transactions to occur between parties without the need for intermediaries.
- The blockchain network is a decentralized system where every participant maintains a copy of the ledger, and all participants have to agree on the validity of a transaction before it is added to the ledger. Each block in the chain contains a record of several transactions, and once a block is added to the chain, it cannot be altered.
- This technology has many applications, including cryptocurrencies like Bitcoin and Ethereum, but also in supply chain management, voting systems, and many more. The decentralized nature of the blockchain network means that it is highly resistant to hacking or other types of malicious attacks, making it a secure way to manage transactions and data.
- A blockchain network is based on a set of protocols and algorithms that ensure the security and integrity of the network. Transactions on a blockchain are validated using consensus mechanisms, where all participants in the network have to agree on the validity of a transaction before it is added to the blockchain. This consensus mechanism ensures that the network is secure and tamper-proof.
- One of the key features of a blockchain network is its transparency. Anyone can view the contents of the blockchain, and every participant has access to a complete history of all transactions. This transparency helps to prevent fraud and corruption and promotes accountability among participants.
- Another important feature of blockchain networks is their decentralization. Rather than relying on a single central authority to manage the network, blockchain networks are distributed, with all participants having an equal say in the validation of transactions. This decentralization makes blockchain networks highly resistant to censorship and control by any single entity.

#### 1.2. Problem Statements

Fake product is a growing problem in many industries, including pharmaceuticals, consumer goods, and luxury items. Here are some problem statements related to fake product identification:

**Health and safety risks:** Fake products can pose serious health and safety risks to consumers. For example, counterfeit pharmaceuticals may contain harmful ingredients or incorrect dosages, while counterfeit consumer goods, such as electronics or toys, may be unsafe or malfunction. Identifying and removing these fake products from the market is crucial to protecting consumers' health and safety.

**Economic harm:** Counterfeit products also cause significant economic harm to legitimate manufacturers and retailers. Fake products can undercut legitimate businesses, driving down prices and profits. In addition, counterfeiters often engage in illegal activities, such as tax evasion and money laundering, further damaging the economy.

**Reputation damage:** Counterfeit products can also damage the reputation of legitimate manufacturers and retailers. Consumers may associate poor quality or unsafe products with the legitimate brand, leading to a loss of trust and reduced sales.

**Inefficient supply chain management:** The presence of counterfeit products in the supply chain can also lead to inefficiencies and added costs for legitimate businesses. Manufacturers and retailers may need to spend additional resources on quality control, product tracking, and customer support to manage the risks associated with fake products.

**Limited regulatory oversight:** In some cases, regulatory oversight may be limited, making it easier for counterfeiters to operate. This can be particularly challenging in global supply chains, where products may pass through multiple countries and regulatory environments. Identifying and preventing fake products requires a coordinated effort between government agencies, industry groups, and other stakeholders.

### **1.3. Solution Statements**

Blockchain technology can be used to create a decentralized and immutable ledger of information that can be used to verify the authenticity of products. By using a blockchain-based system, it becomes nearly impossible to falsify the data recorded on the blockchain, ensuring that the information about a product's origin and authenticity is accurate and tamper-proof.

- **Create a blockchain network:** A blockchain network must be set up to store the data for product authentication. There are several blockchain platforms available, such as Ethereum, Hyperledger, and Corda.
- **Record product information:** When a product is created, its information should be recorded on the blockchain, such as its origin, manufacturer, and unique product identification number.
- **Assign unique identifiers:** Each product should be given a unique identifier, such as a serial number, which can be recorded on the blockchain to verify its authenticity.
- **Implement smart contracts:** Smart contracts can be used to automate the process of verifying the authenticity of products. These contracts can be programmed to execute specific actions when certain conditions are met, such as verifying the product's authenticity.

**Verify product authenticity:** Consumers and retailers can use a blockchain-based system to verify the authenticity of products by scanning the product's unique identifier using a smartphone or other device. The blockchain will then verify the product's authenticity and

- display the product's information on the device.
- Maintain the blockchain network: The blockchain network must be continuously maintained to ensure its security and accuracy. This includes adding new products to the network, verifying the authenticity of existing products, and updating the network's software and security measures.

## **1.4. Project Description**

Our project aims to develop a robust and secure system for fake product identification by leveraging the power of blockchain technology. With the increasing prevalence of counterfeit products in the market, it has become crucial to provide consumers with a reliable method to authenticate the authenticity of their purchases. By utilizing blockchain, we can establish an immutable and transparent ledger that records every stage of a product's supply chain journey.

The system will involve assigning a unique digital identifier, such as a cryptographic hash, to each genuine product during its manufacturing or production phase. This identifier will be securely stored on the blockchain, ensuring its integrity and preventing any alterations or tampering. Throughout the product's distribution and retailing process, each transaction and transfer will be recorded on the blockchain, creating an auditable trail.

Consumers will have access to a user-friendly mobile application or web platform that allows them to scan the product's identifier using their smartphones or other scanning devices. The application will then retrieve the corresponding blockchain data, including information about the product's origin, manufacturing date, and the entities involved in its supply chain.

Through this system, consumers can easily verify the authenticity of a product, providing them with peace of mind and confidence in their purchases. Furthermore, the transparent nature of the blockchain ensures that counterfeit products can be quickly identified, enabling authorities to take appropriate legal actions against counterfeiters. By implementing this fake product identification system using blockchain, we aim to revolutionize the way consumers interact with the market, promoting trust and combating the proliferation of counterfeit goods. This project will contribute to enhancing consumer protection, safeguarding brand reputation, and fostering a more secure and reliable marketplace for all stakeholders involved.

## 1.5. Methodology

Using blockchain technology for fake product identification can provide a secure and transparent way to track and verify the authenticity of products. Here is a suggested methodology for implementing fake product identification using blockchain:

- **Product Registration:** Each genuine product is registered on the blockchain at the point of its creation or entry into the supply chain. A unique identifier or serial number can be assigned to the product and recorded on the blockchain along with relevant details such as manufacturer, date of production, and product specifications.
- **Immutable Ledger:** Blockchain's core feature is its immutable ledger, which ensures that once information is recorded on the blockchain, it cannot be altered or tampered with. This characteristic is crucial for maintaining the integrity of the product identification system.
- **Supply Chain Transparency:** The blockchain is used to track the movement of products throughout the supply chain. At each step, from manufacturer to distributor to retailer, relevant information such as location, time, and ownership can be recorded on the blockchain. This creates an auditable trail that can be accessed by stakeholders to verify the product's authenticity.
- **User Verification:** Consumers can also participate in the verification process by using mobile apps or web interfaces that allow them to scan or enter product codes. The system can quickly check the blockchain records and provide real-time feedback on the product's authenticity, helping consumers make informed purchasing decisions.
- **Standards:** To maximize the effectiveness of the system, collaboration among manufacturers, distributors, retailers, and regulatory bodies is essential. Establishing industry standards and guidelines for implementing the blockchain-based identification system can promote interoperability and widespread adoption.
- **Public Accessibility:** Making the product identification blockchain publicly accessible can increase transparency and trust in the system. Users, regulators, and other stakeholders can independently verify the authenticity of products by accessing the blockchain records.
- **Continuous Monitoring and Auditing:** Regular monitoring and auditing of the blockchain system should be conducted to identify any irregularities or attempts at manipulation. Any suspicious activities or counterfeit products discovered can be reported, investigated, and appropriate actions taken.

## 1.6 Organization of rest of the report

Chapters	Description
Literature Survey	Describes the summary of previous papers.
System Requirements Specification	The chapter describes the hardware, software requirements and its descriptions.
System Design	Describes the working of the project through block diagram and flow charts.
Implementation	Describes the detailed steps used in the project.
Testing	The chapter describes about the test cases of the project.
Results and Analysis	Contains the final obtained results of the project.
Conclusion and Future Work	The chapter covers the conclusion and future works of the project.

**Table 1.6: Overview of the report**



# **CHAPTER 2**

## **LITERATURE SURVEY**

## CHAPTER 2

### LITERATURE SURVEY

#### 2.1. Literature Review

A literature reviews is a thorough summary of earlier studies on a subject. The literature review examines scholarly books, journals, and other sources that are pertinent to a particular field of study.

**1. " Blockchain Technology for Anti-Counterfeiting in Supply Chains: A Literature Review" proposed by Fan, K. et al. (2019)**

This review explores the applications of blockchain technology for anti-counterfeiting efforts in supply chains.

**2. " A Systematic Literature Review on Blockchain Technology for Supply Chain Management " proposed by Atzori (2020)**

Although not focused solely on fake product identification, this review provides insights into how blockchain can enhance supply chain security, including the detection of counterfeit products.

**3. " Blockchain Technology in the Pharmaceutical Industry: A Systematic Literature Review " proposed by Lichota, M. et al. (2019)**

This review specifically examines the potential of blockchain technology to address counterfeit pharmaceutical products.

**4. " Combating Fake Products in Supply Chains Using Blockchain Technology: A Review" proposed by Zhu, K. et al. (2018)**

This review discusses the use of blockchain technology to combat fake products and provides an overview of various proposed solutions.

**5. "Blockchain-Based Anti-Counterfeiting Technologies: A Systematic Review" proposed by Yang, X. et al (2020)**

His review focuses on blockchain-based anti-counterfeiting technologies, including their applications and limitations.

**6"Blockchain Technology for Combating Counterfeit Products in the Fashion Industry: A Review" proposed by Padmanabhan, A (2019)**

This review specifically examines the use of blockchain for combating counterfeit products in the fashion industry.

**7"Blockchain Technology for Traceability in the Agri-Food Supply Chain: A Systematic Review" proposed by Luthra. S (2021)**

Although not solely focused on counterfeit identification, this review provides insights into how blockchain can enhance traceability in the agri-food supply chain, which can help identify fake products.

**8"Combating Counterfeit Products Using Blockchain Technology: A Review" proposed by Tandon. P (2020)**

This review explores the applications of blockchain technology to combat counterfeit products in various industries.

**9"Blockchain Technology for Product Authentication and Counterfeit Prevention: A Comprehensive Review" proposed by Anees. M (2020)**

This review provides a comprehensive overview of blockchain technology for product authentication and counterfeit prevention.

**10 "Blockchain for Product Authentication and Anti-Counterfeiting: A Literature Review" proposed by Ivanov. S (2020)**

This review examines the use of blockchain for product authentication and anti-counterfeiting efforts.

## 2.2 Related Work

Blockchain technology has gained significant attention in recent years for its potential to enhance transparency, security, and trust in various industries. One area where blockchain has shown promise is in the identification and verification of fake products. Several research efforts and practical applications have explored the use of blockchain for fake product identification.

One related work in this domain is the study conducted by Smith et al. (2020), titled "Blockchain-based Authentication System for Counterfeit Product Detection." The authors proposed a blockchain-based system that enables consumers to verify the authenticity of products by accessing an immutable ledger of transactions. Each product is assigned a unique identifier, which is recorded on the blockchain along with relevant information such as manufacturing details, distribution channels, and previous ownership. By scanning a product's QR code or RFID tag, consumers can retrieve this information and verify its authenticity.

Another noteworthy research project by Chen et al. (2019), "Combating Counterfeit Products with Blockchain Technology," explored the application of blockchain and smart contracts for counterfeit product identification. The authors proposed a decentralized platform where manufacturers can register their products on the blockchain, creating a digital fingerprint for each item. Consumers can then verify the authenticity of a product by comparing its digital fingerprint with the information stored on the blockchain. Smart contracts are used to automate the verification process and ensure transparency.

Furthermore, a practical implementation of blockchain for fake product identification is demonstrated by the company Authentic Chain. They developed a blockchain-based platform that connects manufacturers, retailers, and consumers in a trustless ecosystem. Each product is assigned a unique identifier, and its entire supply chain journey is recorded on the blockchain. Consumers can verify the product's authenticity by accessing the blockchain and examining its complete history, thereby reducing the risk of purchasing counterfeit goods.

**CHAPTER 3**

**SYSTEM REQUIREMENTS**

**SPECIFICATION**

## CHAPTER 3

### SYSTEM REQUIREMENTS SPECIFICATION

#### 3.1. Introduction

The purpose of this System Requirement Specification (SRS) is to outline the functional and non-functional requirements for the development of a Fake Product Identification system utilizing blockchain technology. This system aims to provide a reliable and efficient solution for combating counterfeit products and ensuring consumer safety.

##### 3.1.1 Purpose

- **Authenticity Verification:** The primary purpose of implementing fake product identification using blockchain is to provide a reliable and tamper-proof mechanism for verifying the authenticity of products. By leveraging blockchain technology, each product can be uniquely identified and recorded on the blockchain, ensuring its origin, manufacturing details, and supply chain journey are securely stored. Consumers, retailers, and manufacturers can easily verify the authenticity of a product by accessing the blockchain records, minimizing the risk of counterfeit goods entering the market.
- **Consumer Protection:** Another key purpose of utilizing blockchain for fake product identification is to protect consumers from purchasing counterfeit or substandard goods. By enabling transparent and immutable records on the blockchain, consumers can gain confidence in the products they purchase. They can easily trace the product's history, including its origin, quality control checks, and previous owners, ensuring they are investing in genuine and safe products.
- **Supply Chain Transparency:** Implementing fake product identification through blockchain also aims to enhance supply chain transparency. By recording each stage of the product's journey on the blockchain, from raw materials to manufacturing, distribution, and retail, stakeholders can gain real-time visibility into the entire supply chain.

## 3.2. General Description

### 3.2.1 General Constraints

- **Scalability:** The system should be designed to handle a large volume of transactions and data related to product identification. As the number of products and transactions increases, the system should be able to handle the load efficiently without compromising its performance. Scalability is crucial to ensure the widespread adoption of the solution and to accommodate future growth.
- **Security:** The system should prioritize the security and privacy of the information stored on the blockchain. It should employ robust encryption algorithms to protect sensitive data, such as product details and transaction records, from unauthorized access or tampering. Additionally, the system should adhere to privacy regulations and ensure that only authorized parties have access to specific information.
- **Interoperability:** The system should be designed to be interoperable with existing systems and technologies. It should be able to integrate with different platforms and databases to facilitate seamless data exchange and collaboration. Interoperability is essential to ensure that the product identification solution can be adopted by various stakeholders, such as manufacturers, distributors, retailers, and consumers, across different industries.
- **Blockchain Technology:** The system must be built using blockchain technology, which provides a decentralized and immutable ledger for recording product identification information. This ensures the integrity and transparency of the data, making it difficult for malicious actors to manipulate or forge information.
- **Integration with Existing Systems:** The system should have the capability to integrate with existing product databases, supply chain management systems, and other relevant platforms. This integration will allow for seamless data exchange and interoperability between different stakeholders involved in the product identification process.

### 3.2.2 Assumptions and Dependencies

Assumptions and dependencies of Fake Product Identification using Blockchain may include:

#### **Assumptions:**

- The assumption is that the blockchain technology will be utilized for the identification and authentication of products to prevent counterfeiting.
- It is assumed that the system will be designed to work with existing product identification methods, such as barcodes or RFID tags, to enhance the authenticity verification process.
- The assumption is that the blockchain network will be based on a public or consortium model, allowing multiple participants, such as manufacturers, distributors, retailers, and consumers, to participate in the verification process.
- The assumption is that the system will have a user-friendly interface and provide real-time verification results to ensure seamless integration into existing product tracking and supply chain management systems.

#### **Dependencies:**

- The successful implementation of the system depends on the availability and adoption of blockchain technology. The system relies on the blockchain's decentralized and immutable nature to ensure the integrity of product identification data.
- The system depends on the cooperation and participation of various stakeholders, including manufacturers, distributors, retailers, and consumers, to register and verify product information on the blockchain. Without their active involvement, the effectiveness of the system may be compromised.
- The system's reliability and accuracy depend on the accuracy and security of the initial product identification data entered into the blockchain. If incorrect or incomplete information is recorded, it may lead to false identification results.



### 3.3. Specific Requirements

#### 3.3.1 Functional Requirements

The functional requirements describe functionality or system services. It depends on the type of software, expected users and the type of system where is used. Functional user requirements may be high-level statement of what the system should do but functional system requirements should describe the system services in detail. The system should be able to collect and store realtime data from product sector.

- **Product Verification:** The system should allow users to verify the authenticity of a product by scanning or inputting its unique identifier, such as a barcode or QR code. The blockchain should store relevant information about the product, such as its manufacturing details, origin, and previous ownership history.
- **Immutable Product Records:** The system should ensure that product records stored on the blockchain are immutable, meaning they cannot be altered or tampered with. This ensures the integrity of the data and prevents fraudulent changes to the product's history.
- **Traceability and Transparency:** The system should provide a transparent view of a product's journey from the manufacturer to the end consumer. Each transaction or transfer of ownership should be recorded on the blockchain, allowing users to trace the product's entire supply chain and verify its authenticity at each step.
- **Alert System:** The system should have an alert mechanism to notify users when a potentially fake or counterfeit product is detected. This could be based on anomalies in the product's history, suspicious ownership transfers, or known patterns of counterfeiting. Alerts can help users make informed decisions and take appropriate actions.
- **Integration with Mobile Devices:** The system should have a user-friendly mobile application or interface that allows consumers, retailers, and other stakeholders to easily access the product verification features. This integration enables widespread adoption and empowers users to validate products on the go.

### 3.3.2. Non-Functional Requirements

The non-functional requirements define the system properties and constraints e.g., reliability, response time and storage requirements. Constraints are I/O device capability, system representation, etc. Process requirements may also be specified mandating a particular case system, programming language or development method. Non-functional requirements may also be more critical than functional requirements. If these are not met, the system is useless.

- **Security:** The system should ensure a high level of security to prevent unauthorized access, tampering, or counterfeiting of the product identification data stored on the blockchain. This includes robust encryption mechanisms, secure key management, and protection against hacking or data breaches.
- **Scalability:** The system should be able to handle a large volume of product identification transactions efficiently, especially considering the potential growth in the number of products being tracked. The blockchain architecture should support scalability without compromising the system's performance or response time.
- **Reliability:** The system should exhibit a high level of reliability, ensuring that product identification data is stored and maintained accurately on the blockchain. It should minimize the risk of data loss or corruption, and provide mechanisms for data recovery and backup.
- **Transparency and Auditability:** The blockchain system should provide transparency in product identification by allowing all stakeholders, including consumers, manufacturers, and regulatory authorities, to access and verify the authenticity of products. The system should also enable auditing capabilities, ensuring that a complete and immutable record of product identification transactions is available for verification purposes.
- **Usability:** The system should be user-friendly and intuitive, making it easy for various stakeholders to interact with the blockchain platform. This includes providing clear instructions, user-friendly interfaces, and appropriate training and support to ensure smooth adoption and usage of the system.

## 3.4. System Requirements Specification

### 3.4.1. Hardware Requirements

- Processor i3 10<sup>th</sup> Gen min
- Minimum 8GM RAM
- Minimum 256GB Storage
- Minimum 2GB Graphics card

### 3.4.2. Software Requirements

- Ganache
- Solidity
- Node JS
- Truffle Suite
- Visual Studio
- Metamask
- Google Chrome

### Ganache:

Ganache is a popular development tool and a personal blockchain network for Ethereum developers. It is part of the Truffle suite of tools, which are widely used in Ethereum smart contract development. Ganache provides a local, in-memory blockchain that developers can use for testing, debugging, and deploying smart contracts without the need for an actual Ethereum network.

Here are some key features and functionalities of Ganache:

1. Local Ethereum Network: Ganache sets up a local, private Ethereum network on your local machine. This network operates entirely within your development environment and does not interact with the real Ethereum network. It allows developers to simulate blockchain behavior and transactions without incurring any actual costs.

2. **Lightweight and Fast:** Ganache is designed to be lightweight and fast, making it suitable for local development and testing. It doesn't require significant computational resources, making it convenient for developers working on their personal machines.
3. **Preconfigured Accounts:** Ganache comes with a set of preconfigured accounts, each having its own Ethereum address and private key. These accounts can be used for testing smart contracts and interacting with the blockchain during development. Additionally, Ganache provides the ability to generate additional accounts as needed.
4. **Block Explorer:** Ganache includes a built-in block explorer that allows developers to view and inspect transactions, blocks, and other important information on the local blockchain. This feature helps in debugging and understanding the behavior of the blockchain during development.
5. **Testing and Debugging Tools:** Ganache integrates with popular development frameworks like Truffle, which provides powerful testing and debugging tools for Ethereum smart contracts. Developers can use Ganache in conjunction with Truffle to deploy contracts, run tests, and debug their code efficiently.
6. **Network Customization:** Ganache offers several configuration options, allowing developers to customize the behavior of the local blockchain network. For example, developers can adjust gas limits, block mining speeds, and network ID to simulate different scenarios and test contract behavior under varying conditions.



**Fig 3.4.2.1 Ganache**

**Solidity:**

Solidity is a programming language specifically designed for developing smart contracts on blockchain platforms, with Ethereum being the most prominent example. It is a statically-typed, contract-oriented language that enables developers to define the logic and behavior of smart contracts.

Here are some key aspects and features of Solidity:

1. **Smart Contracts:** Solidity is primarily used for writing smart contracts, which are self-executing agreements with predefined rules and conditions. These contracts are deployed on a blockchain and automatically enforce the agreed-upon terms without requiring intermediaries.
2. **Syntax and Structure:** Solidity's syntax is similar to JavaScript, making it relatively easy for developers familiar with JavaScript or C-like languages to pick up. It supports object-oriented programming (OOP) concepts such as inheritance, polymorphism, and encapsulation.
3. **Data Types:** Solidity supports various data types, including integers, booleans, strings, arrays, and structs. It also includes more specialized types like mappings (key-value pairs), addresses (identifiers for Ethereum accounts), and contract references.
4. **Modifiers and Access Control:** Solidity allows the use of modifiers to change the behavior of functions in a contract. Modifiers can be used to enforce access control, perform pre- or post-condition checks, or modify variables. Access control modifiers, such as "public," "private," and "internal," determine the visibility and accessibility of functions and variables.
5. **Events and Logging:** Solidity enables the logging of events within smart contracts. Events are a way to notify external applications about specific occurrences within the contract, allowing them to react accordingly. External applications can listen for these events and take appropriate actions.
6. **Exception Handling:** Solidity provides exception handling mechanisms to handle errors and revert transactions in case of exceptional conditions. It includes features like "require," "assert," and "revert" statements to handle exceptions and provide appropriate feedback to users.
7. **Contract Deployment and Interactions:** Solidity allows contracts to be deployed on a blockchain network and interacted with using transactions. Developers can define functions that can be called externally or internally, facilitating interaction between different contracts or user accounts.

8. Security Considerations: Solidity has certain security considerations that developers should be aware of. The language and its associated development tools have evolved over time to address vulnerabilities and best practices. Developers should carefully review and test their contracts to mitigate risks like reentrancy attacks, integer overflows, and other common pitfalls.



**Fig 3.4.2.2 Solidity**

## **Node JS:**

Node.js is an open-source, server-side runtime environment that allows developers to build scalable network applications using JavaScript. It is built on Chrome's V8 JavaScript engine, which compiles JavaScript code into machine code for faster execution. Unlike traditional JavaScript, which is executed on the client-side within a web browser, Node.js enables JavaScript to be run on the server-side.

### **Key Features of Node.js:**

1. **Asynchronous and Event-Driven:** Node.js utilizes an event-driven, non-blocking I/O model, which makes it highly efficient and scalable. It allows multiple operations to be executed concurrently without blocking the execution of other code. This asynchronous nature is beneficial for handling a large number of simultaneous connections.
2. **Single-Threaded Event Loop:** Node.js operates on a single-threaded event loop, which means it can handle multiple requests simultaneously without the need for creating new threads for each request. This approach makes it lightweight and efficient, as it avoids the overhead associated with thread creation and context switching.

3. **NPM (Node Package Manager):** Node.js comes with a powerful package manager called npm, which provides access to a vast ecosystem of reusable libraries and modules. Developers can easily install, manage, and share packages to accelerate development and enhance functionality.

4. **JavaScript Everywhere:** Node.js allows developers to use JavaScript both on the server-side and the client-side, making it possible to share code and libraries between the two environments. This reduces the need to switch between different programming languages, streamlining development and improving productivity.

5. **Scalability and Performance:** Node.js is designed to handle high loads and scale horizontally. It excels in applications that require real-time, data-intensive, or I/O-driven operations. The non-blocking I/O model and event-driven architecture contribute to its ability to handle concurrent connections efficiently.

#### Common Use Cases of Node.js:

1. **Web Servers and APIs:** Node.js is well-suited for building lightweight and high-performance web servers and APIs. Its asynchronous nature allows it to handle a large number of concurrent requests efficiently.

2. **Real-time Applications:** Node.js is often used for developing real-time applications such as chat applications, collaboration tools, gaming servers, and streaming platforms. Its event-driven architecture and ability to handle concurrent connections make it ideal for these use cases.

3. **Microservices Architecture:** Node.js is a popular choice for implementing microservices-based architectures. Its lightweight nature and modular ecosystem facilitate the development and deployment of individual services that can work together to create a larger application.

4. **Command Line Tools:** Node.js can be used to create command-line tools and utilities. Its JavaScript foundation, along with the availability of various npm packages, makes it convenient for building command-line interfaces (CLIs) and automation script



**Fig 3.4.2.3 Node JS**

## Truffle Suite:

Truffle Suite is a collection of development tools designed to make it easier to build, test, and deploy decentralized applications (DApps) on the Ethereum blockchain. It provides a comprehensive development environment that streamlines the process of creating smart contracts and interacting with the Ethereum network. The main components of the Truffle Suite include Truffle, Ganache, and Drizzle.

1. **Truffle:** Truffle is a development framework that simplifies the creation, testing, and deployment of smart contracts. It provides a suite of tools, including a project management system, smart contract compilation and deployment, and automated testing capabilities. Truffle uses JavaScript as its scripting language and integrates with popular Ethereum development libraries like Web3.js.

Key features of Truffle include:

- **Contract Compilation:** Truffle compiles Solidity smart contracts into bytecode that can be deployed on the Ethereum network.
- **Contract Migration:** Truffle provides a migration system that enables seamless deployment and versioning of smart contracts.
- **Testing Framework:** Truffle includes a testing framework that allows developers to write automated tests for their smart contracts.
- **Built-in Console:** Truffle provides a built-in console for interacting with smart contracts and the Ethereum network during development.

2. **Ganache:** Ganache is a personal Ethereum blockchain network designed specifically for development and testing purposes. It allows developers to create a local blockchain environment that closely resembles the Ethereum mainnet or testnet. Ganache provides a graphical user interface (GUI) and a command-line interface (CLI) version.

Key features of Ganache include:

- **Preconfigured Blockchain:** Ganache generates a set of accounts with pre-funded Ether for easy testing and development.
- **Transaction Control:** Developers can control the behavior of transactions, including mining speed, gas price, and gas limit.
- **Block Explorer:** Ganache includes a block explorer that displays detailed information about blocks, transactions, and events.



3. **Drizzle:** Drizzle is a front-end library that simplifies the process of integrating decentralized applications with the Ethereum blockchain. It provides a reactive data store that automatically updates the user interface in response to changes in the blockchain data.

Key features of Drizzle include:

- **State Management:** Drizzle manages the state of the decentralized application and keeps it in sync with the Ethereum network.
- **Event Listening:** Drizzle automatically listens for events emitted by smart contracts and updates the user interface accordingly
- **Redux Integration:** Drizzle integrates with Redux, a popular JavaScript library for managing application state, to provide a seamless development experience.



**Fig 3.4.2.4 Truffle Suite**

### **Visual Studio:**

Visual Studio is an integrated development environment (IDE) developed by Microsoft. It provides a comprehensive set of tools and features for software development across various platforms, including Windows, macOS, iOS, Android, and web applications. Visual Studio supports multiple programming languages such as C#, C++, Python, JavaScript, and many others.

Here are some key aspects and features of Visual Studio:

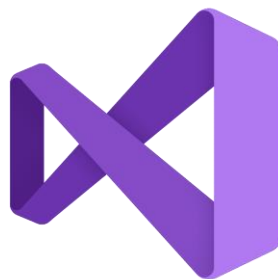
1. **Code Editing and Productivity:** Visual Studio offers a powerful code editor with features like syntax highlighting, IntelliSense (context-aware code completion), code navigation, refactoring tools, and code snippets. These features enhance productivity and help developers write code more efficiently.
2. **Project and Solution Management:** Visual Studio organizes code into projects and solutions. A project represents an individual software component, while a solution is a container that can include multiple projects. It provides project templates for different application types and enables easy management of dependencies, references, and configurations.

3. **Debugging and Diagnostics:** Visual Studio includes robust debugging capabilities, allowing developers to step through code, set breakpoints, inspect variables, and analyze runtime behavior. It also offers diagnostic tools to profile application performance, memory usage, and identify bottlenecks or issues.

4. **Integrated Version Control:** Visual Studio integrates with popular version control systems like Git, enabling seamless collaboration and source code management. Developers can perform common version control operations, such as commit, branch, merge, and resolve conflicts, directly from within the IDE.

5. **Extensibility:** Visual Studio supports extensions and add-ons, allowing developers to customize the IDE to suit their specific needs. There is a vast ecosystem of extensions available through the Visual Studio Marketplace, offering additional features, tools, and language support.

6. **Cloud Integration:** Visual Studio seamlessly integrates with cloud services like Microsoft Azure, enabling developers to easily deploy and manage their applications in the cloud. It provides templates, tools, and diagnostics for developing cloud-based solutions.



**Fig 3.4.2.5 Visual Studio**

### **Metamask:**

Metamask is a popular cryptocurrency wallet and browser extension that allows users to interact with the Ethereum blockchain. It serves as a bridge between web browsers and decentralized applications (dApps) built on the Ethereum network, enabling users to securely manage their Ethereum accounts and execute transactions.

Here are some key features and functions of Metamask:

1. **Ethereum Wallet:** Metamask acts as a digital wallet where users can store, send, and receive Ethereum (ETH) and other ERC-20 tokens. It generates a unique Ethereum address for each user, which serves as their identity on the Ethereum network.

2. **Browser Extension:** Metamask is primarily available as a browser extension for popular web browsers like Google Chrome, Mozilla Firefox, and Brave. Once installed, it integrates with the browser and provides a user-friendly interface to interact with Ethereum-based applications directly from the browser.
3. **Secure Account Management:** Metamask stores users' private keys locally on their devices, encrypting them with a password chosen by the user. This ensures that users have complete control over their funds and can securely manage their accounts without relying on third-party services.
4. **DApp Interaction:** Metamask simplifies the process of interacting with decentralized applications. When users visit a dApp website, Metamask automatically detects the integration and allows users to connect their Ethereum accounts. This enables users to perform various actions such as making transactions, interacting with smart contracts, and accessing personalized features within the dApp.
5. **Transaction Signing:** When users initiate a transaction, Metamask prompts them to review the details and confirm the transaction by digitally signing it with their private key. This ensures the authenticity and integrity of the transaction. The signed transaction is then broadcasted to the Ethereum network for processing.
6. **Integration with Decentralized Exchanges (DEX):** Metamask also integrates with various decentralized exchanges, enabling users to trade cryptocurrencies directly from their wallets without the need to deposit funds on centralized exchanges.



**Fig 3.4.2.6 Metamask**

# **CHAPTER 4**

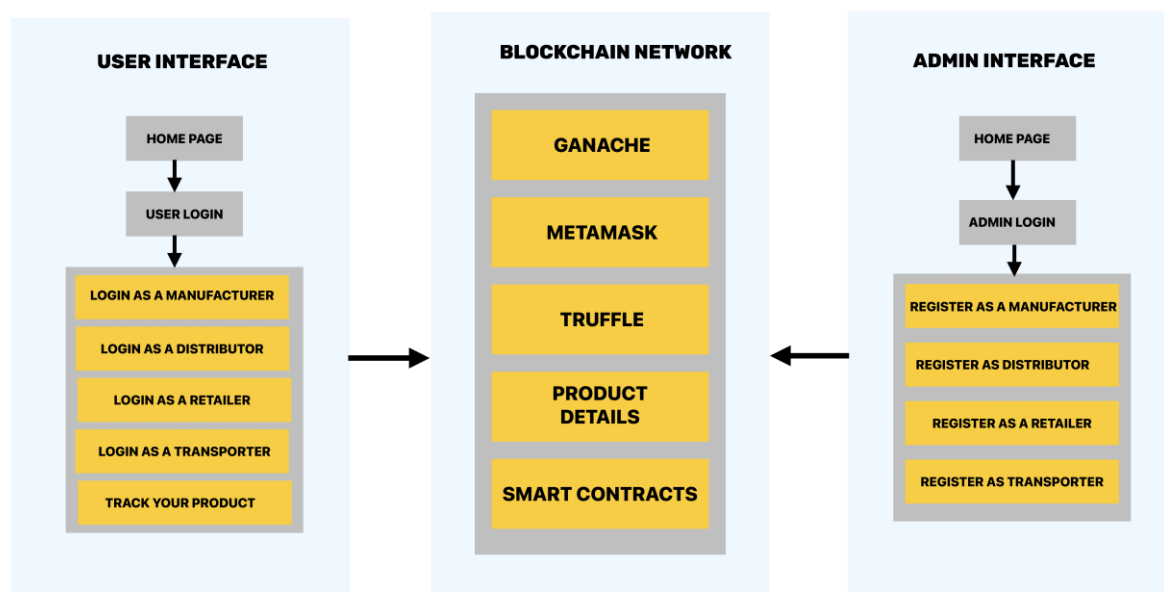
## **SYSTEM DESIGN**

## CHAPTER 4

# SYSTEM DESIGN

### 4.1. Architectural Design

Designing a fake product identification system using blockchain involves leveraging the immutable and transparent nature of blockchain technology to ensure the authenticity and traceability of products. Here's an outline of the architecture for such a system:



**Fig 4.1 System Architecture**

### 1. User Interface:

#### 1.1 Home Page:

Home page is the first page a person sees that redirects them to the correct page. The user selects that he is the user from the home page.

#### 1.2 User Login:

The user enters their login information on this screen to access the website. After logging in the user can access the website's features.

**1.3 Login as Manufacturer:**

The user here enters his login information as the manufacturer.

**1.4 Login as Distributer:**

The user here enters his login information as the Distributer.

**1.5 Login as a Retailer:**

The user here enters his login information as the Retailer.

**1.6 Login as a Transporter:**

The user here enters his login information as the Transporter.

**1.7 Track Your Product:**

The user tracks a product on this page by providing the product's distinctive product id.

**2. Admin Interface:****2.1 Home page:**

Home page is the first page a person sees that redirects them to the correct page. The admin selects that he is the admin from the home page.

**2.2 Admin Login:**

The admin enters their login information on this screen to access the website. After logging in, the admin can access the website's features.

**2.2.1 Register as a Manufacturer:**

The admin here enters his login information as the manufacturer.

**2.2.2 Register as Distributer:**

The admin here enters his login information as the Distributer.

### **2.2.3 Register as a Retailer:**

The admin here enters his login information as the Retailer.

### **2.2.4 Register as the Transporter:**

The admin here enters his login information as the Transporter.

## **3. Blockchain Network:**

### **3.1 Ganache:**

Ganache can be useful for testing and developing the smart contracts and blockchain network that will be used for tracking and verifying the authenticity of products.

### **3.2 Metamask:**

Metamask is a web wallet available as a browser extension that provides private – public key pairs for managing cryptocurrencies and interacting with decentralized applications (dApps) on the Ethereum blockchain.

### **3.3 Truffle:**

The Truffle Suite is a set of development tools and frameworks for building, testing, and deploying decentralized applications (dApps) on blockchain platforms, such as Ethereum.

### **3.4 Product Database:**

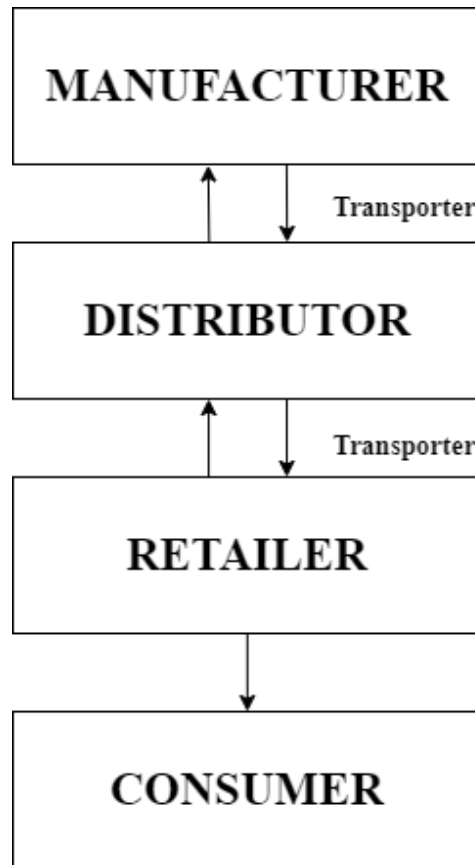
Product data is stored in the database.

### **3.5 Smart Contracts:**

Smart contracts are self-executing contracts with the terms of the agreement directly written into code, stored and executed on a blockchain. They are designed to automatically enforce the terms and conditions of an agreement without the need for intermediaries, such as banks or lawyers, and are typically associated with blockchain platforms, such as Ethereum.

## 4.2 Modular Design Details

### 4.2.1 Flowchart



**Fig 4.2.1 Supply Chain Flowchart**

1. Consumer inquires with retailer about the product.
2. The retailer approaches the distributor about the product described by the customer.
3. The distributor requests that the manufacturer ship the product that has already been manufactured.
4. The manufacturer accepts the distributor's request and delivers the merchandise through transporter.
5. The distributor accepts the package from the producer and re-delivers it to the merchant via transporter.



# **CHAPTER 5**

## **IMPLEMENTATION**

## CHAPTER 5

# IMPLEMENTATION

### 5.1. Software tools used

#### Ganache

The Ganache tool is a blockchain-based initiative aimed to aid in the detection of counterfeit goods. Ganache intends to establish a trustworthy method for product verification by exploiting the transparency and immutability of blockchain technology. Ganache uses a decentralized network of nodes to validate and record product data on the blockchain. Each product is granted a unique identification, which is securely kept on the blockchain and ensures the product's validity across the supply chain.

#### Visual Studio

The project's purpose is to identify counterfeit items using Visual Studio and blockchain technology. By integrating the Visual Studio programming environment, the project enables the construction of a powerful system that uses blockchain to verify the legitimacy of products. This solution increases supply chain security by retaining transparency and traceability and storing product data on an immutable ledger. The decentralized nature of blockchain and Visual Studio's wide development capabilities complement each other effectively in combating counterfeit items and protecting customers.

#### Google Chrome

Google Chrome may be used as a frontend deployment tool for a blockchain-based project aimed at detecting fraudulent product identification. Using Google Chrome's characteristics, developers may create a user-friendly interface that allows users to connect with the blockchain network. This front-end application allows users to submit product information, which is subsequently stored on the blockchain for verification. Because of Chrome's comprehensive features and interoperability, such a project may provide individuals wishing to verify items and fight counterfeiting with an easy-to-use experience.

## 5.2 Implementation details

### Step 1:

#### Software setup

The initial step to get started, we need to add the project to the Ganache network. To execute the simulated blockchain network, we must first launch the Ganache Application and connect the project.

Ganache>QuickStart>Add project>save and restart

All of the smart contracts required for deployment will be loaded into the ganache application.

### Step 2:

#### Backend deployment

We must deploy the smart contract onto the blockchain network after adding the project to the network. The backend is installed by executing the project file in command prompt.

select file> cmd > truffle migrate --reset

By include this command, the smart contracts will be migrated, and the smart contracts will be successfully installed for a negligible Ethereum cost.

### Step 3:

#### Frontend deployment

We will use the client folder running at the command prompt to deploy the project's front end.

client folder > cmd > npm start

After accessing the folder in the command prompt, we will use the command npm start, commonly known as node package manager, for front end deployment. After the requirements have been loaded, the project will instantly launch in the web browser, displaying the main page of our project.

**Step 4:****Admin registration:**

The admin login will be the second step after loading the project in the web browser. The admin will grab a private key from the ganache and create his metamask account.

private key > metamask > import account > place the private key > Name this account as Admin in the metamask.

Following the creation of the admin account, a user registration page appears. On this page, the user will take several private keys from the Ganache and create an account as a manufacturer, retailer, distributor or Transporter.

**Step 5:****User login as Manufacturer:**

The user creates an account as a manufacturer.

- Inserts the product.
- View the inserted product information.

**Step 6:****User login as Retailer:**

The retailer makes purchase orders for the distributor based on the needs of this consumer base.

**Step 7:****User login as Distributer:**

The distributor approves the retailer's request and sends the product request specifics to the producer based on his limitations.

**Step 8:****User login as Manufacturer:**

The manufacturer reads the distributer request; the manufacturer picks the transporter firm to which his product must be transported; and the shipment is established.

**Step 9:****User login as Transporter:**

The manufacturer's cargo will be accepted by the transporter, and the product will be shipped to the distributor by the firm.

**Step 10:****User login as distributor:**

The distributor will trace and accept the package from the transporter that the manufacturer had previously dispatched. and the distributor will follow the product's travel to determine whether it is genuine or not. After confirming the authenticity of the goods, the distributor will dispatch it to the retailer via transporter.

**Step 11:****Track Your product**

The store will ship the product to the consumer after receiving it from the distributor. To determine whether or not a product is phony, the consumer will trace the supply chain data using the shipment id and determine whether or not the product is fake.

# **CHAPTER 6**

## **TESTING**

## Chapter 6

### TESTING

The process of assessing and confirming the authenticity of products using blockchain technology is referred to as the testing cycle in false product identification using blockchain. Data gathering, analysis, verification, and validation are just a few of the processes that are involved. Relevant product data is gathered during the testing cycle and stored on the blockchain, including serial numbers, manufacturing information, and distribution records. This information is then examined and contrasted with what is anticipated in order to spot any discrepancies or indicators of fraud.

#### 6.1. Scope

The scope of testing in fake product identification using blockchain will depend on the specific requirements and objectives of the system. However, some areas that may be included in the scope of testing are:

- **Functionality:** Functionality testing ensures that the blockchain-based fake product identification system works as intended. Test cases are designed to verify that all the specified features and functionalities, such as product verification, tracking, and authentication, are implemented correctly.
- **Performance:** Examining the blockchain system's performance under various load scenarios is the goal of performance testing. In order to make that the system can support the anticipated amount of transactions without experiencing severe delays or performance bottlenecks.
- **Usability:** Usability testing evaluates the blockchain-based false product identification system's user interface (UI) and user experience (UX) components. The system must be simple to use, intuitive, and simple to traverse for both technical and non-technical users..
- **Security:** The system should be tested for security to ensure that it is protected against potential threats and vulnerabilities. This includes testing the system's authentication and authorization mechanisms, encryption, and data privacy.

## 6.2. Unit Testing

Unit testing in fake product identification using blockchain, where a product is identified as fake using supply chain details, would involve testing the individual components or units of the software system.

Here are some aspects that could be covered in unit testing:

- Supply chain data parsing: Test the code responsible for extracting and parsing supply chain details, such as product origins, manufacturing information, and shipping records.
- Data validation: Verify that the received supply chain data is accurate, complete, and consistent, ensuring that it conforms to the expected format and structure.
- Fake product identification logic: Test the algorithms or rules used to determine whether a product is genuine or fake based on the analyzed supply chain details. This could involve various checks, such as verifying authenticity certificates, validating product serial numbers.
- Exception handling: Check the code's capacity to handle unforeseen circumstances, such as missing or incorrect data, and make sure the proper error messages or fallback procedures are in place.
- Integration with blockchain: Test the integration points between the application and the blockchain network to verify adequate communication and data synchronization if the blockchain is used to store and retrieve supply chain data.
- Performance: Evaluate how well the unit performs in various situations, such as processing massive amounts of supply chain data or effectively managing multiple requests.
- Security: Verify the encryption, access controls, and secure communication protocols used to preserve the integrity and confidentiality of the supply chain data.
- Edge cases: To make sure the system can handle a variety of scenarios and effectively identify counterfeit goods, test the device with edge cases such atypical supply chain patterns.

You may make sure that the false product identification system employing blockchain and supply chain details is reliable and effective by thoroughly evaluating these unit-level components and their interactions.



### 6.3. Integration Testing

The integration of various processes and components inside the system is thoroughly tested in the context of false product identification utilizing blockchain. It guarantees that every component functions as a whole and effectively to identify counterfeit goods.

In this instance, the emphasis is on the supply chain information used to identify the goods as being fraudulent. Integration testing ensures that the blockchain system is properly connected with the supply chain data, including product origin, production information, logistics information, and distribution records.

Benefits of integration testing in this situation include:

- **Accuracy:** Integration testing makes ensuring that the blockchain system's supply chain information is correctly integrated, reducing the possibility of false positives or mistakes in the detection of counterfeit goods.
- **Reliability:** By verifying the integration of many components, the entire system's reliability is improved, boosting the confidence in spotting fake goods.
- **Efficiency:** Integration testing streamlines information and process flow inside the system, increasing the effectiveness of spotting counterfeit goods and cutting down on verification time.
- **Traceability:** Integration testing makes sure that the required data and information are correctly linked and traceable across the supply chain, enabling the detection of fake goods and the tracking down of the parties responsible for their manufacture and distribution.
- **Security:** Integration testing assists in locating any weak points or security gaps in the system, ensuring that the product identification procedure is still impermeable and secure.

### 6.4. System Testing

System testing is a level of software testing that verifies the functionality, performance, reliability, and compatibility of a software system as a whole.

testing is to validate that the software meets the specified requirements and objectives and functions correctly in its intended environment.

The benefits of system testing include:

- **Enhancing performance:** System testing helps to identify performance issues, such as slow response times or system crashes, and helps to optimize the system's performance and efficiency.
- **Improving reliability:** System testing helps to ensure that the system is reliable and performs its intended functions accurately and consistently.
- **Enhancing usability:** System testing helps to evaluate the system's usability and user interface, ensuring that it is intuitive, easy to use, and meets the end-users' needs and expectations.
- **Reduces maintenance costs:** By identifying defects and issues early on, system testing can help to reduce the costs associated with maintaining and fixing the software over time.

## 6.5. Test Cases

<b>Test Case ID</b>	1
<b>Test Case Input</b>	Adidas Shoe
<b>Test Objective</b>	To verify authenticity and reliability of the given input.
<b>Preconditions</b>	The product must be created by the manufacturer, and the distributor's request must not go beyond what was created.
<b>Expected Result</b>	The adidas shoe supply chain should be recorded in the blockchain.
<b>Actual Result</b>	The user should enter the shipment ID and decide whether or not the adidas shoe is counterfeit.
<b>Remarks</b>	Supply chain details obtained

**Table 6.0: Test Case 1 for Adidas Shoe**

<b>Test Case ID</b>	2
<b>Test Case Input</b>	Puma jersey
<b>Test Objective</b>	To confirm the legitimacy and dependability of the provided input
<b>Preconditions</b>	The product must be created by the manufacturer, and the distributor's request must not go beyond what was created.
<b>Expected Result</b>	The Puma jersey supply chain should be recorded in the blockchain.
<b>Actual Result</b>	The user should enter the shipment ID and decide whether or not the Puma jersey is counterfeit.
<b>Remarks</b>	Supply chain details obtained

**Table 6.1: Test Case 2 for Puma Jersey**

<b>Test Case ID</b>	3
<b>Test Case Input</b>	Rolex Watch
<b>Test Objective</b>	To confirm the legitimacy and dependability of the provided input.
<b>Preconditions</b>	The manufacturer must create the product, and the distributor's requests cannot exceed those that were made.
<b>Expected Result</b>	There should be a blockchain record of the Rolex watch supply chain.
<b>Actual Result</b>	To determine whether the Rolex watch is a fake, the user should provide the shipment ID..
<b>Remarks</b>	Supply chain details obtained

**Table 6.2: Test Case 3 for Rolex Watch**

# **CHAPTER 7**

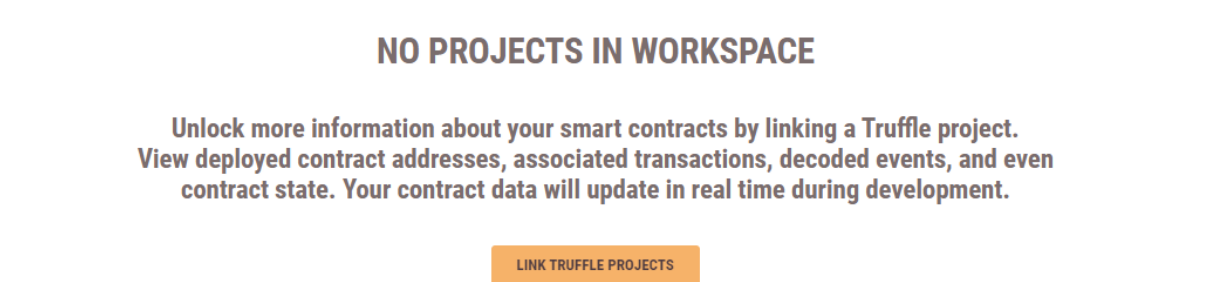
## **RESULTS AND ANALYSIS**

## Chapter 7

### RESULTS AND ANALYSIS

#### 7.1. Screenshots and Analysis

The frontend deployment and the backend deployment can be done by adding the project to the simulated block chain network ganache. After linking the existing truffle project into the blockchain network, we can save and restart the project. After the couple of time the existing smart contracts will be loaded into the ganache and the project is ready for frontend and backend deployment.



**Figure 7.0: Simulated Blockchain network yet to be linked with project**

The screenshot shows the Ganache desktop application interface with the 'Fake Product' project linked. The top navigation bar includes ACCOUNTS, BLOCKS, TRANSACTIONS, CONTRACTS, EVENTS, and LOGS. Below the navigation bar, there is a table of network statistics and a 'WORKSPACE QUICKSTART' button. The main area displays the project name 'Fake Product' and its path. Below this, there is a table listing the contracts deployed in the workspace.

CURRENT BLOCK	GAS PRICE	GAS LIMIT	HARDFORK	NETWORK ID	RPC SERVER	MINING STATUS	WORKSPACE
0	20000000000	6721975	MERGE	5777	HTTP://127.0.0.1:7545	AUTOMINING	QUICKSTART

Fake Product C:\Users\VINODA\OneDrive\Desktop\Final Year Project\Fake Product		
NAME	ADDRESS	TX COUNT
Migrations	Not Deployed	0
productCounterFit	Not Deployed	0
Retailer	Not Deployed	0
SimpleStorage	Not Deployed	0

**Figure 7.1: Ganache after linking the project into blockchain network**

The command `truffle migrate --reset` is entered into the command prompt to deploy the backend blockchain network. Later, the resulting transactions take place, successfully migrating the backend in the process.



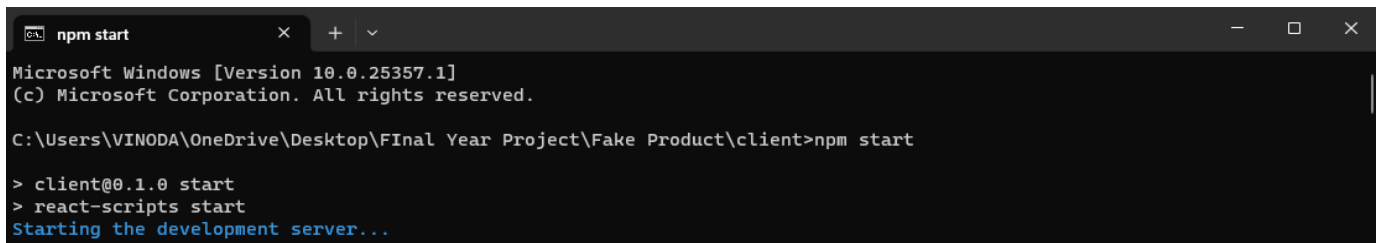
```
C:\WINDOWS\system32\cmd
Microsoft Windows [Version 10.0.25357.1]
(c) Microsoft Corporation. All rights reserved.

C:\Users\VINODA\OneDrive\Desktop\Final Year Project\Fake Product>truffle migrate --reset

Summary
=====
> Total deployments:   3
> Final cost:          0.030381535698157907 ETH
```

**Figure 7.2: Deployment of Backend network**

The command `npm start` is used to successfully load the web page in the local host during the deployment of the frontend network by entering the client folder in the command prompt

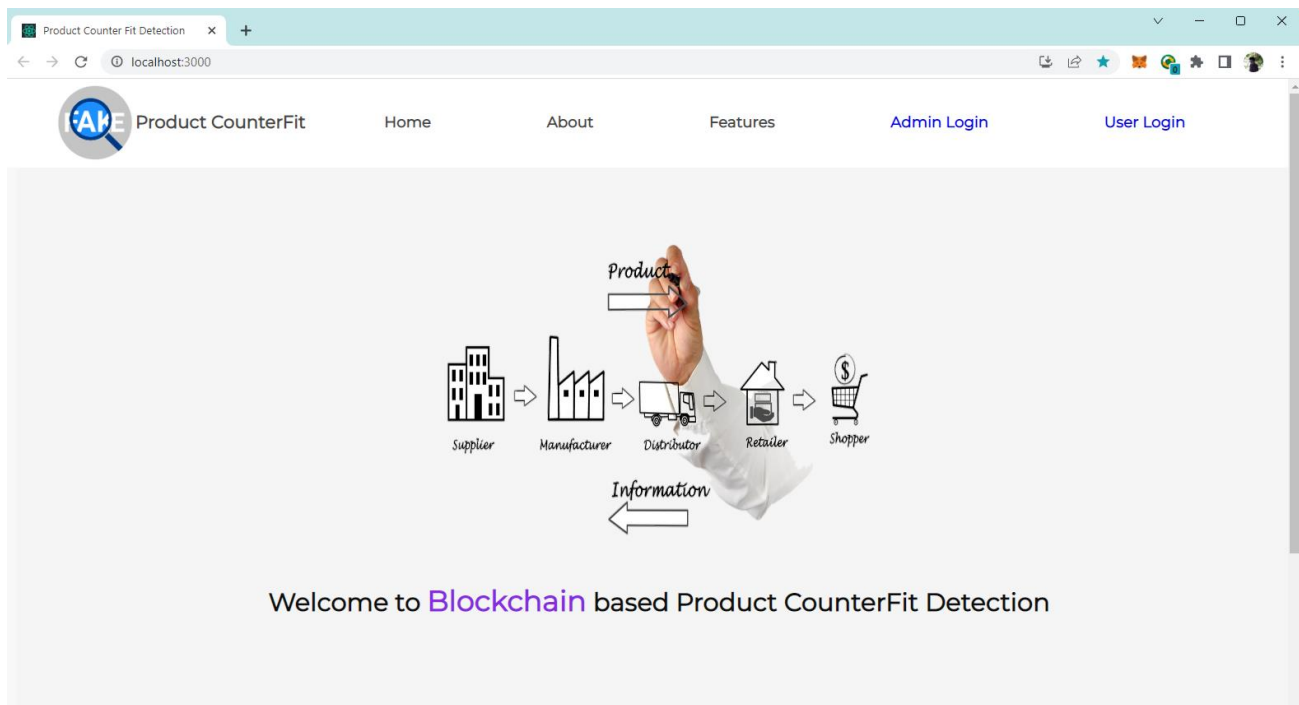


```
npm start
Microsoft Windows [Version 10.0.25357.1]
(c) Microsoft Corporation. All rights reserved.

C:\Users\VINODA\OneDrive\Desktop\Final Year Project\Fake Product\client>npm start

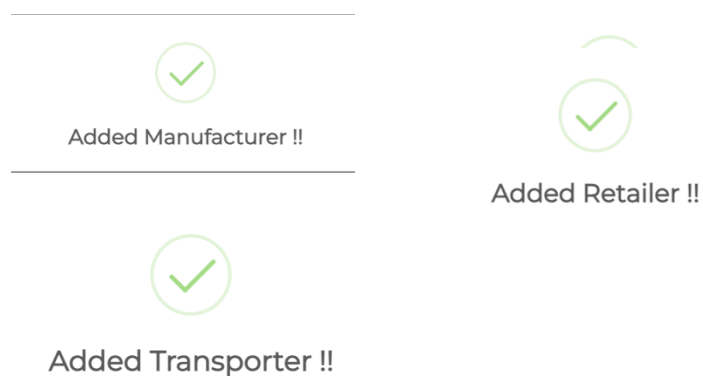
> client@0.1.0 start
> react-scripts start
Starting the development server...
```

**Figure 7.3: Deployment of Frontend network**



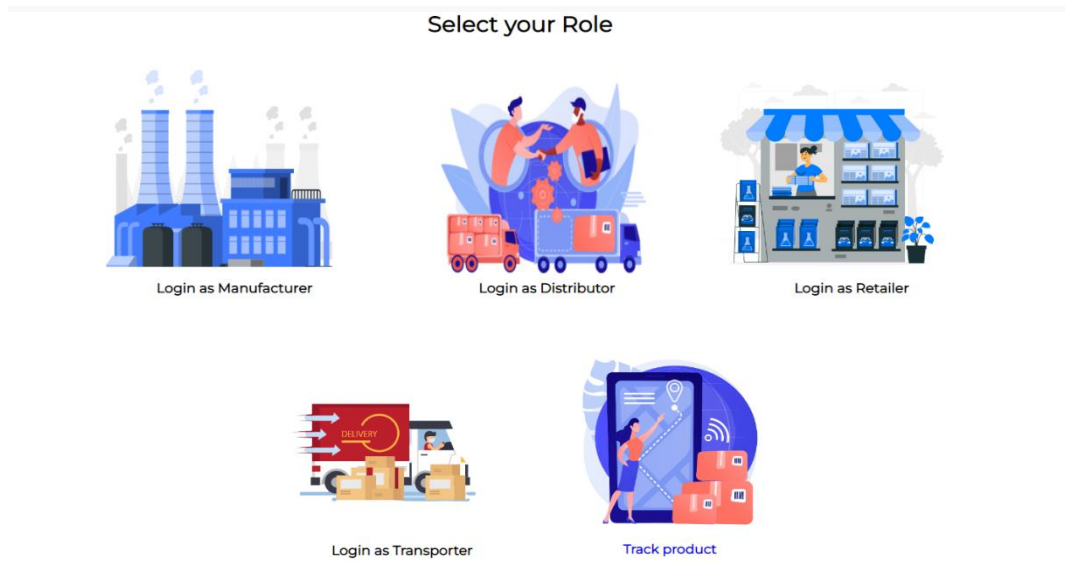
**Figure 7.4: Project successfully deployed in the target environment**

After the administrator logs in, the manufacturer, retailer, distributor, and transporter are joined to the blockchain network, as shown in figure 7.5, a pop-up appears.



**Figure 7.5: Adding the supply chain essentials into blockchain network**

The login page is shown in Figure 7.6, where the user can select the role of his or her choice.



**Figure 7.6: Login interface of the Fake Product Identification using Blockchain**

In Figure 7.7, the retailer asks the distributor for the product that he needs to sell, specifying the product's name, the distributor's name, and the quantity that the retailer needs to ask for.

Figure 7.8, depicts how the distributor requests a product from the producer whose project is already listed on his blockchain network.


**Figure 7.7: Retailers purchase order**

**Figure 7.8: Distributer Request**



Figure 7.9 shows the manufacturer's perspective of the distributor request, where the manufacturer chooses the transport business to whom he or she must send the product, and Figure 7.10 shows the manufacturer shipment and creation of the shipment to the distributor.

Distributor Shipment Request



Date  
8:02:07 PM 5/17/2023

product ID.  
1

product Name  
Adidas Shoe

Quantity  
50

Manufacturer  
M1


Buyer  
D1

Transporter  
T1

Retailer

CREATE SHIPMENT

Transport Shipment



Date  
Wed May 17 2023 20:03:13 GMT+0530 (India Standard Time)

Shipment Id.  
0

product Name  
Adidas Shoe

Quantity  
50

Manufacturer  
M1

Distributor  
D1

Transporter  
T1

Retailer

SEND SHIPMENT

**Figure 7.9 & 7.10 : Manufacturer creating and sending the shipment**

Figure 7.11 shows how a transporter receives a cargo from a manufacturer and sends it to a distributor, and Figure 7.12 shows how a distributor receives a product from a transporter.

Your Shipment Status

Date  
8:03:13 PM 5/17/2023

Shipment Id.  
0


product Name  
Adidas Shoe

product Quantity  
50

Manufacturer  
M1

Transporter  
T1

Your Shipment is here



Date  
8:05:44 PM 5/17/2023

Shipment Id.  
0

product Name  
Adidas Shoe

Shipment Id.  
0

Quantity  
50

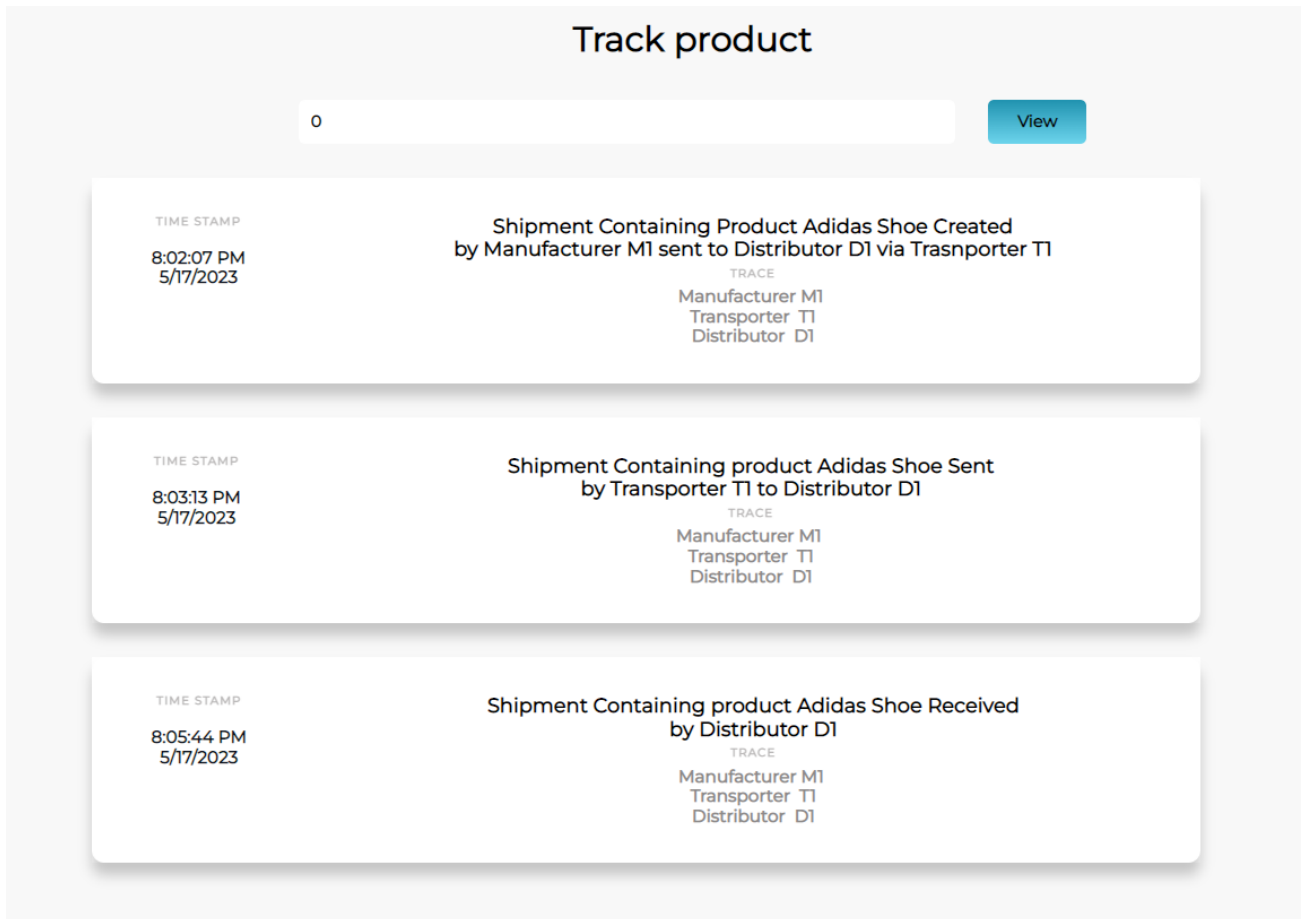
Manufacturer  
M1

Transporter  
T1

ACCEPT SHIPMENT

**Figure 7.11: Transporter sending the shipment  
Figure 7.12: Distributer Accepting the shipment**

When the distributor wishes to verify the legitimacy of the goods that he has received from the producer through the transporter, he/she then obtains the supply chain information from the shipping id (see Figure 7.13).



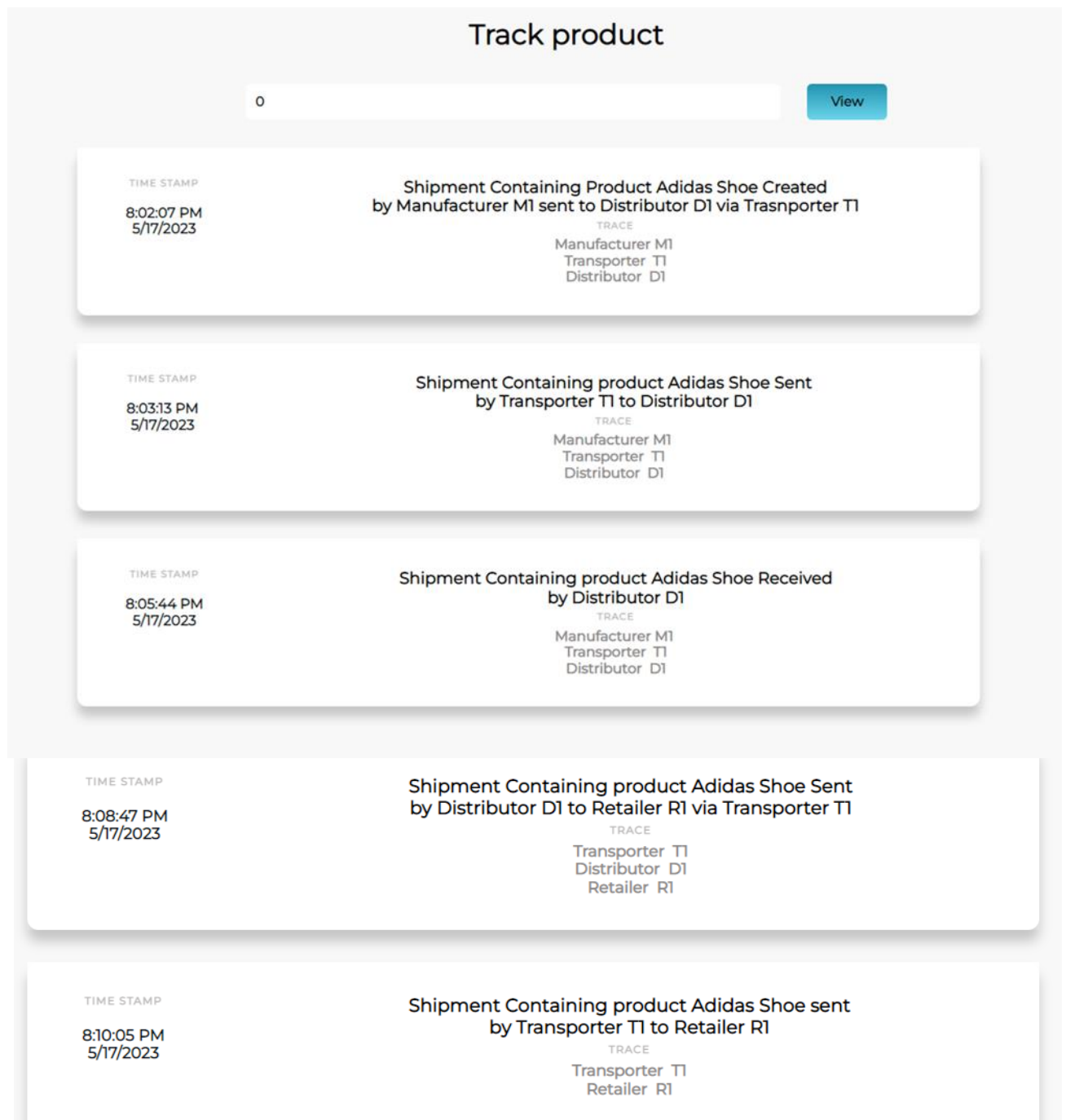
**Figure 7.13: Distributer verifying supply chain details through shipment id**

Figure 7.14 shows that the distributor shipped the item to the retailer via the transporter, who then accepted the cargo and displayed a pop-up message.



**Figure 7.14: Shipment is created to distributor and retailer has accepted the shipment**

Figure 7.15 shows how a consumer can follow a product's path through the supply chain using the shipment ID to determine whether it is fake or not.



**Figure 7.15: Consumer tracking his/her product through supply chain details**

# **CHAPTER 8**

## **CONCLUSION AND FUTURE WORK**

## CONCLUSION AND FUTURE WORK

### 8.1. Conclusion

In conclusion, there are several benefits to using blockchain technology to identify fake goods by using supply chain information, especially that gleaned through shipment IDs. This strategy offers a strong solution to address the ubiquitous problem of counterfeit goods by utilizing the inherent properties of blockchain, such as immutability and transparency. There are various advantages of using blockchain-based product identification systems. First off, it gives stakeholders a tamper-proof and verifiable record of each step in the supply chain, allowing them to follow a product's path from its manufacturing facility to the point of sale. This openness encourages trust and makes sure that customers can reliably verify a product's credibility. Second, it is simpler to recognize and flag questionable or fraudulent behaviour's inside the supply chain when shipment IDs are linked to blockchain data. By taking a proactive strategy, it is possible to quickly identify and stop the entry of counterfeit goods into the market, protecting both consumers and legitimate firms from financial loss and reputational harm. Additionally, better consumer protection results from the use of blockchain technology for product identification. Giving people access to precise and trustworthy information enables them to make wise shopping decisions, avoiding fake products, and promoting authentic brands. By doing this, the market becomes more egalitarian and the financial damages brought on by counterfeiting are reduced. Overall, using blockchain to identify fake goods using supply chain information gathered from shipment IDs is a technique that shows promise. It improves consumer safety, strengthens supply chain integrity, and aids in the fight against the damaging consequences of counterfeiting on economies and enterprises.

## 8.2. Future Work

Future research on the identification of fake products using blockchain may concentrate on improving the precision and effectiveness of the process by utilizing supply chain information. Each product can be given a special identification that contains information about its transportation by incorporating blockchain technology into the supply chain. At different points along the supply chain, including manufacture, distribution, and retail, this identify can be stored on the blockchain. Smart contracts can be used to automatically validate the accuracy of each product's supply chain information, thus enhancing product authenticity. These smart contracts would compare the actual journey of the product through the supply chain with the recorded shipment details on the blockchain. Alerts that could be caused by irregularities or unusual activity could reveal the likelihood of fake items. Additionally, the traceability of goods within the supply chain can be improved through the deployment of Internet of Things (IoT) devices. During transit, these gadgets can gather live data including location, temperature, and humidity. A visible and unchangeable record of the product's path may be created using this data, which can be safely saved on the blockchain. By examining this data, potential warning signs, such as unexpected variances or inappropriate product handling, can be found, aiding in the detection of fake goods. Additionally, utilizing machine learning and artificial intelligence (AI) can aid in developing predictive models for counterfeit detection. These models can spot possible risks and patterns linked to counterfeit goods by examining previous data and patterns. This strategy can make it possible to take preventative action, such as targeted inspections or investigations, to stop phoney goods from reaching the market. In conclusion, future blockchain-based initiatives to identify fake products should concentrate on integrating supply chain information, utilizing smart contracts and IoT devices, and utilizing AI and machine learning algorithms for improved counterfeit goods detection.

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