FAKE PRODUCT IDENTIFICATION USING BLOCKCHAIN TECHNOLOGY

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Authors

Abstract

The "Fake Product Identification Using Blockchain" system functions as a pioneering solution in the battle against counterfeit products. At its core is a decentralized and tamper-resistant blockchain ledger. Each product is assigned a unique cryptographic identifier during manufacturing, and this identifier is recorded on the blockchain. The blockchain acts as an immutable and transparent record, detailing the entire journey of the product through the supply chain.

Smart contracts, self-executing pieces of code embedded in the blockchain, automate the authentication process. These contracts are designed to validate the product's legitimacy at each stage of the supply chain, ensuring that the information recorded on the blockchain remains accurate and unchanged.

User-friendly interfaces, such as mobile applications or web platforms, empower consumers to access this blockchain-recorded information in real-time. By scanning a product's unique identifier, consumers can instantly verify its authenticity. This transparent and automated approach not only enhances supply chain traceability but also provides consumers with a reliable means of confirming the legitimacy of the products they purchase.

This unique system stands out for its ability to leverage blockchain's decentralization and cryptographic security to create an immutable and transparent record of each product's origin and journey. By doing so, it not only combats counterfeit products but also reshapes the way authenticity is verified, fostering trust and reliability in the global marketplace.

Contents

List of Figures

1 Introduction

1.1 Background

The prevalence of counterfeit products poses a grave threat to consumer safety and brand integrity, necessitating innovative solutions. Traditional methods have proven insufficient against sophisticated counterfeiters. This project, "Fake Product Identification Using Blockchain," addresses this challenge by leveraging blockchain's decentralized and tamper-resistant nature. Blockchain's transparency and security features are harnessed to create an immutable record of a product's journey, from manufacturing to the end consumer. The project aims to provide consumers with real-time authentication, enhance supply chain security, and foster trust by offering a transparent and traceable system to combat counterfeit goods.

1.2 Objectives

The system project aims to achieve the following specific objectives:

1. To develop a secure blockchain ledger for transparent product tracking.
2. To deploy a decentralization system for verifying products.
3. To implement smart contracts for instant product authenticity verification.
4. To design user-friendly interfaces to enhance accessibility for consumers.
5. To promote industry collaboration for standardized blockchain adoption.

1.3 Scope

The scope of the "Fake Product Identification Using Blockchain" project encompasses the development and implementation of a versatile system designed to combat counterfeit products across industries. The project will focus on creating a secure blockchain ledger for transparent tracking of a diverse range of products, integrating seamlessly into existing supply chain processes. User-friendly interfaces, including mobile applications and web platforms, will be designed to facilitate real-time product authentication, ensuring accessibility for consumers and stakeholders. The project's scope extends to defining a scalable technology stack, conducting pilot programs for real-world validation, and addressing regulatory compliance. Additionally, comprehensive documentation and

training sessions will be provided to empower stakeholders for successful integration and utilization of the blockchain-based identification system. This holistic approach aims to establish a standardized and effective solution to the persistent challenge of counterfeit products in the market.

1.4 Unfamiliarity of the problem

The prevalence of counterfeit products in the global market poses a multifaceted challenge that extends beyond mere economic concerns. The unfamiliarity with this problem often stems from a lack of visibility into the pervasive and far-reaching consequences. Counterfeit goods not only deceive consumers and erode trust in brands but also jeopardize public health and safety, especially in the case of counterfeit pharmaceuticals and consumables. The intricate networks of illicit trade in counterfeit products undermine regulatory efforts, leading to financial losses for businesses and potential legal ramifications. The socio-economic impact of this issue is profound, affecting industries ranging from technology to healthcare, with far-reaching implications for economies and public welfare. Addressing the unfamiliarity of the problem involves raising awareness about its nuanced repercussions and the urgent need for innovative solutions, such as blockchain-based product identification, to safeguard consumer well-being and maintain the integrity of global supply chains.

1.5 Project planning

The project planning for 'Fake Product Identification Using Blockchain' involves defining objectives, establishing a project team, and creating a detailed timeline. It includes designing a secure blockchain infrastructure, conducting pilot programs for validation, and deploying the system into supply chains. Continuous monitoring and documentation ensure sustained effectiveness in combating counterfeit products.

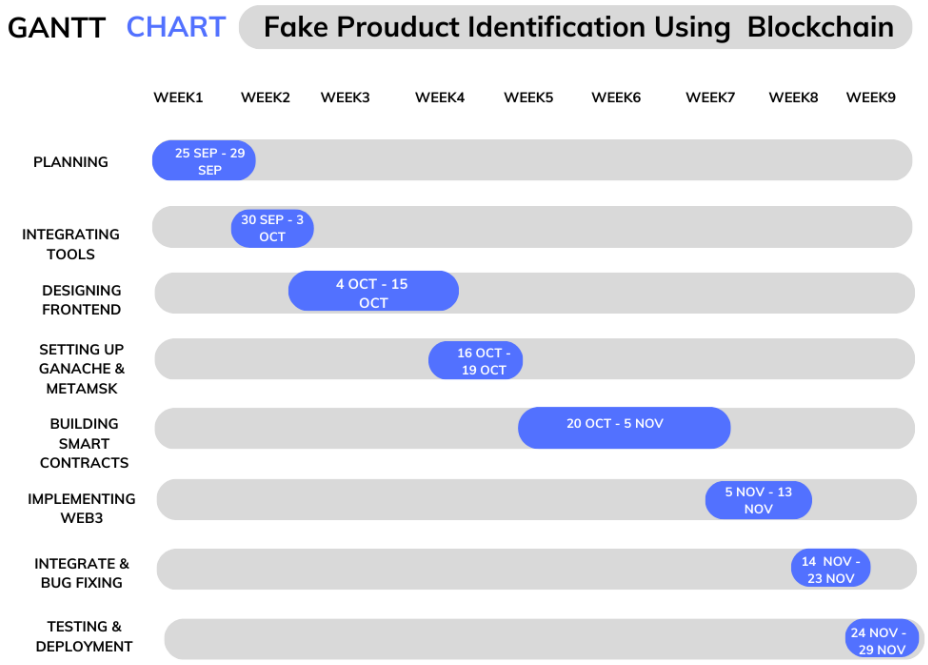

Fig1.5(a): Gantt Chart for project planning & work flow.

2 Related Work

2.1 Existing Solutions and Limitations

In [1] the traditional cloud storage model runs in a centralized manner, so single point of failure might lead to the collapse of system. The system is a combination of the decentralized storage system, IPFS, the Ethereum blockchain, and attribute-based encryption technology. Based on the Ethereum blockchain, the decentralized system has keyword search function on the cipher text solving the problem in traditional storage systems where cloud server returns wrong results.

The worldwide economy loses masses of billions of dollars yearly because of counterfeit gadgets.In [2] it discusses how Radio frequency identity (RFID) generation gives a capability solution to this problem with using at ease, hard-to-forge tags affixed to each product. But there's severe safety risks connected to RFID technology. As an illustration, if the verbal exchange channel between the reader and the tag is compromised, a cunning

adversary might be capable of get right of entry to the sensitive facts saved on the device. The demonstration of tag cloning attacks as additionally being feasible have seriously undermined the functionality of RFID era to prevent counterfeiting. One approach to address the problem is by means of the usage of an authentication protocol, but present solutions lack mutual authentication and are nevertheless vulnerable to tag cloning. So we can add a blockchain technology to makes to authentication process more secure.

This study [5] is based on Smart Tags for Brand Protection and Anti-Counterfeiting in the Wine Industry. This article proposes a trademark protection and anti-counterfeiting solution for the wine sector based on smart tags and Cloud enabled technology. The fundamental idea behind smart tags is to use rapid response codes and functional inks backed by the Cloud system, as well as two- way communication between the winemaker and end-user.

3 System Design

The system design for "Fake Product Identification Using Blockchain" is a meticulous process focusing on creating a secure and scalable architecture. This involves defining the blockchain structure, including encryption protocols, consensus mechanisms, and smart contracts.

3.1 Analysis of the system

The "Fake Product Identification Using Blockchain" system demonstrates robust functionality and notable advantages. The blockchain architecture provides an immutable and transparent ledger, enhancing supply chain traceability. Smart contracts streamline authentication processes, ensuring rapid and secure product verification. User-friendly interfaces promote accessibility. Pilot programs validate real-world efficacy, and ongoing monitoring and documentation facilitate continuous optimization. The system exhibits substantial potential in combating counterfeit products across diverse industries.

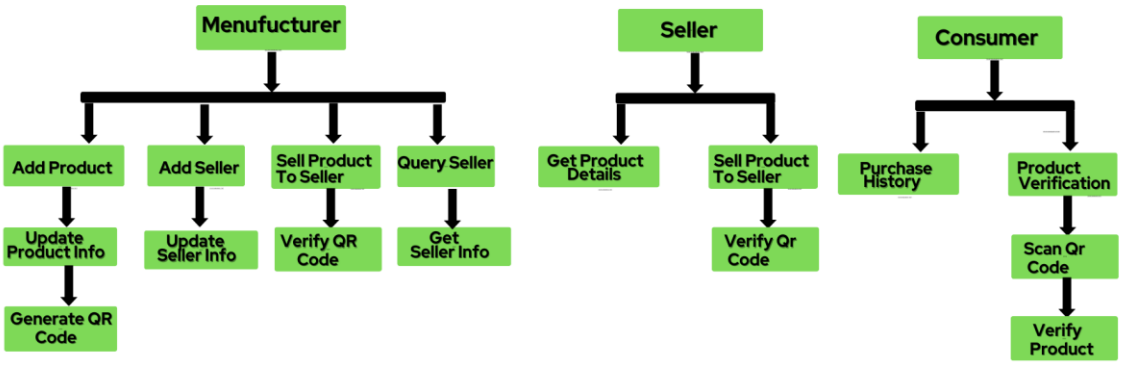

Fig 3.1(a) : Flow Chart of the System

3.2 System architecture

The architecture of the "Fake Product Identification Using Blockchain" system is based on a decentralized blockchain framework. The core components include a distributed ledger utilizing cryptographic hashing for immutability, smart contracts for automated authentication, and consensus algorithms to ensure data integrity. User interfaces, designed for accessibility, interact with the blockchain, offering real-time product verification. This modular and secure architecture not only ensures transparency and traceability but also lays the foundation for scalability and adaptability across various industries

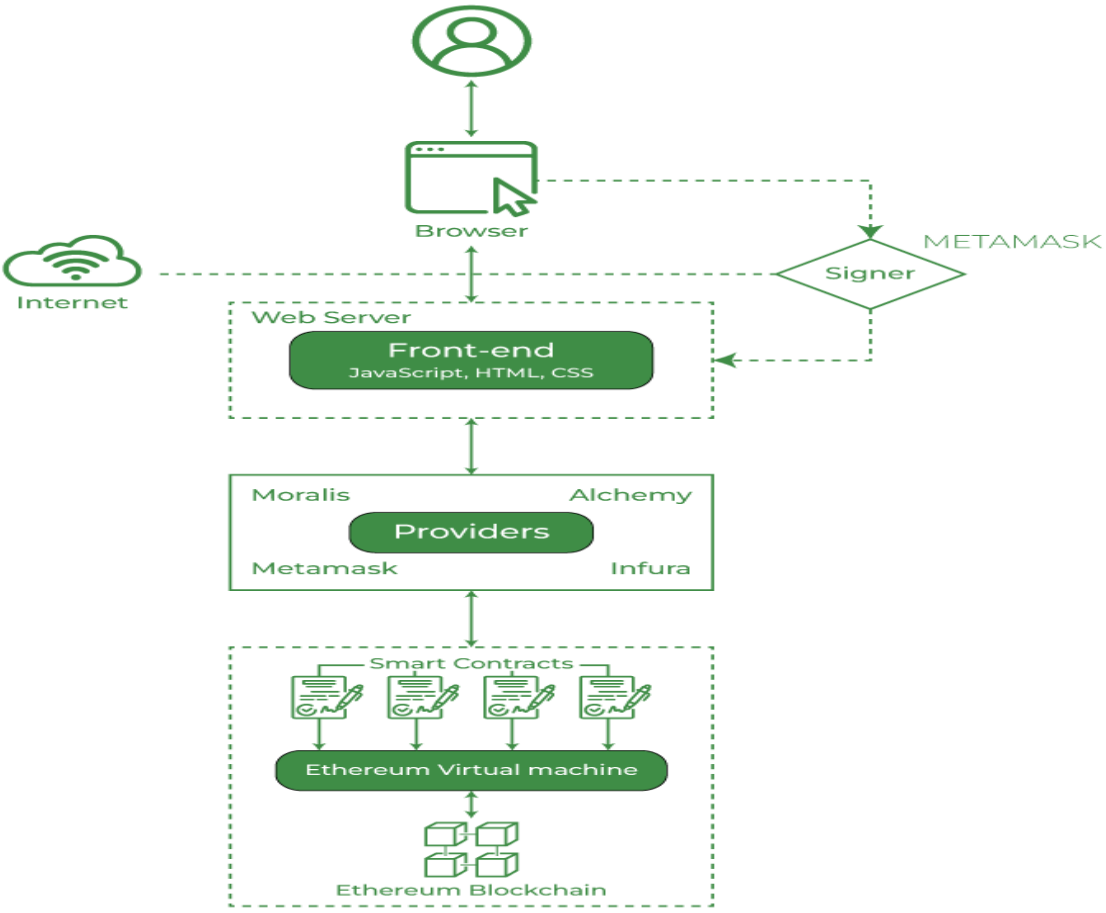

Fig 3.2(a) : System Architecture

3.3 Tools used

Truffle v5.11.5 (core: 5.11.5)

Ganache v7.9.1

Solidity v0.5.16 (solc-js)

Node v18.13.0

Web3.js v1.10.0

3.3.1 Truffle

- Truffle is a development framework for Ethereum that makes it easier to build and manage smart contracts. It provides a suite of tools for developing, testing, and deploying smart contracts on the Ethereum blockchain.

3.3.2 Ganache

- Ganache is a personal blockchain for Ethereum development that we can use to deploy contracts, develop your dApps, and run tests. It's a part of the Truffle suite and provides a local Ethereum blockchain that we can use during development.

3.3.3 Solidity

- Solidity is a programming language specifically designed for writing smart contracts that run on the Ethereum Virtual Machine (EVM). It is statically typed and supports inheritance, libraries, and complex user-defined types among other features.

3.3.4 Node.js

- Node.js is a JavaScript runtime that allows us to execute JavaScript code server-side. In the context of our development stack, it's likely being used to run server-side JavaScript scripts, including those for deploying and interacting with Ethereum smart contracts.

3.3.5 Web3

- Web3.js is a JavaScript library that provides a convenient way to interact with Ethereum nodes, allowing us to build decentralized applications (dApps) that interact with the Ethereum blockchain. It abstracts the complexity of the underlying JSON-RPC calls to Ethereum nodes and provides a more user-friendly API for developers.

4 Project Implementation

4.1 System implementation

In this project, we proposed a fake product identification system using blockchain technology as a website application for the detection of counterfeit products. The proposed system consists of two main parts, User's application composed of three roles, the Manufacturer role, the Seller role, and the Consumer role and Blockchain storage. Extended Flow of the Proposed System for Fake Product Identification Using Blockchain:

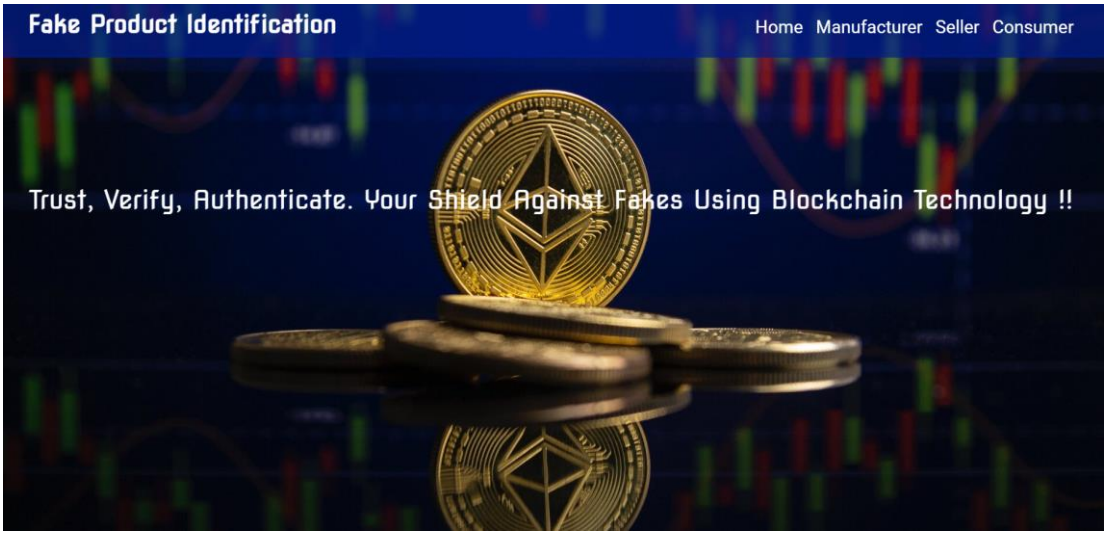

Fig 4.1(a): Home Page

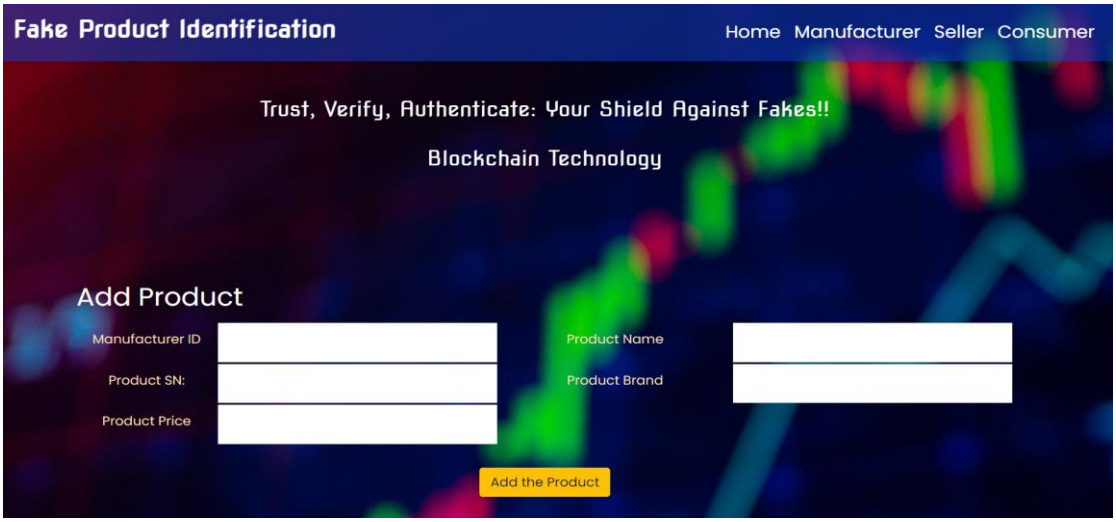

Fig 4.1(b) : Add Product Page

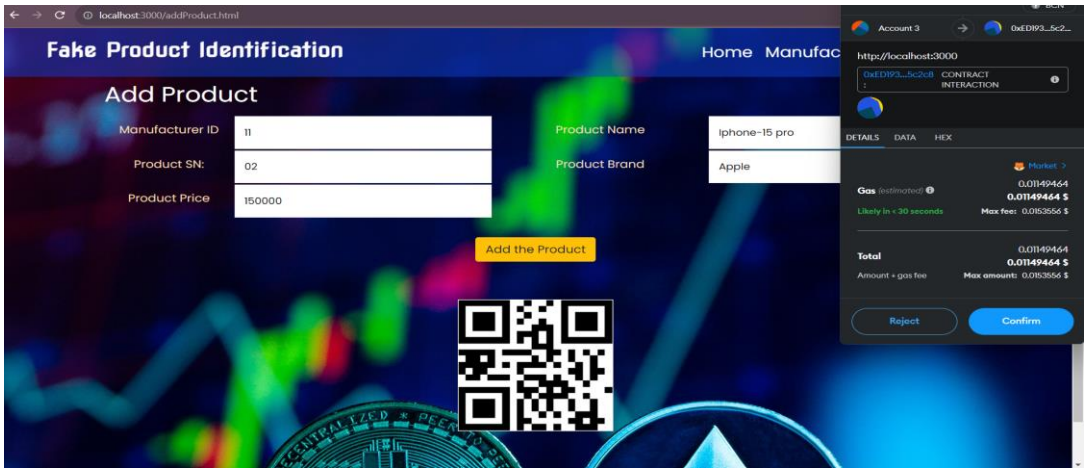

Fig 4.1(c) : Interacting with Meta-mask

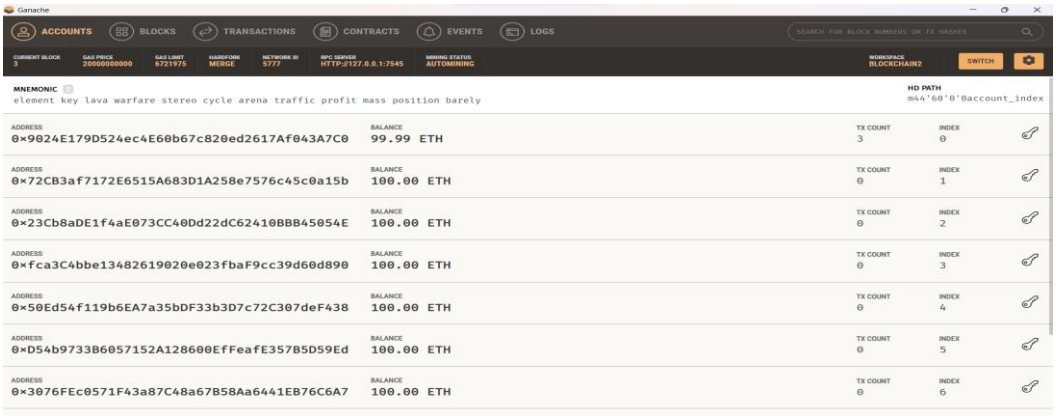

Fig 4.1(d) : Blockchain Account Address

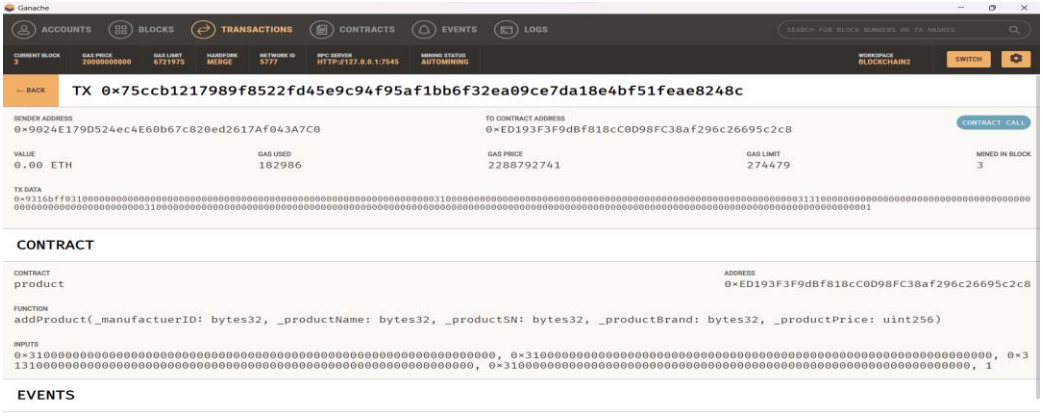

Fig 4.1(e) : Deployment of Smart Contracts

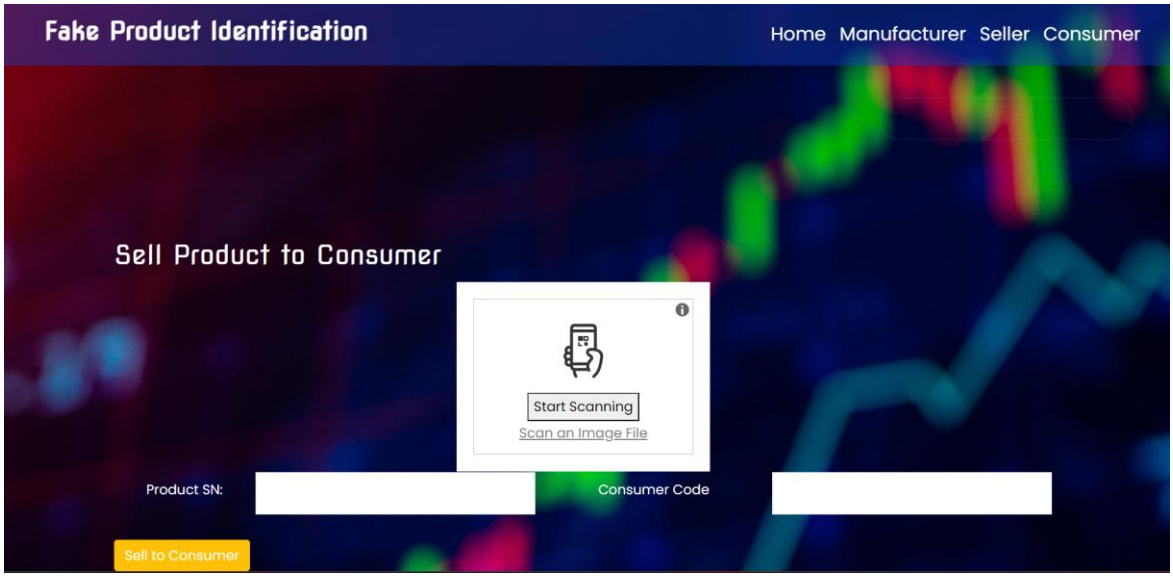

Fig 4.1(f) : Sell Product To Consumer Page

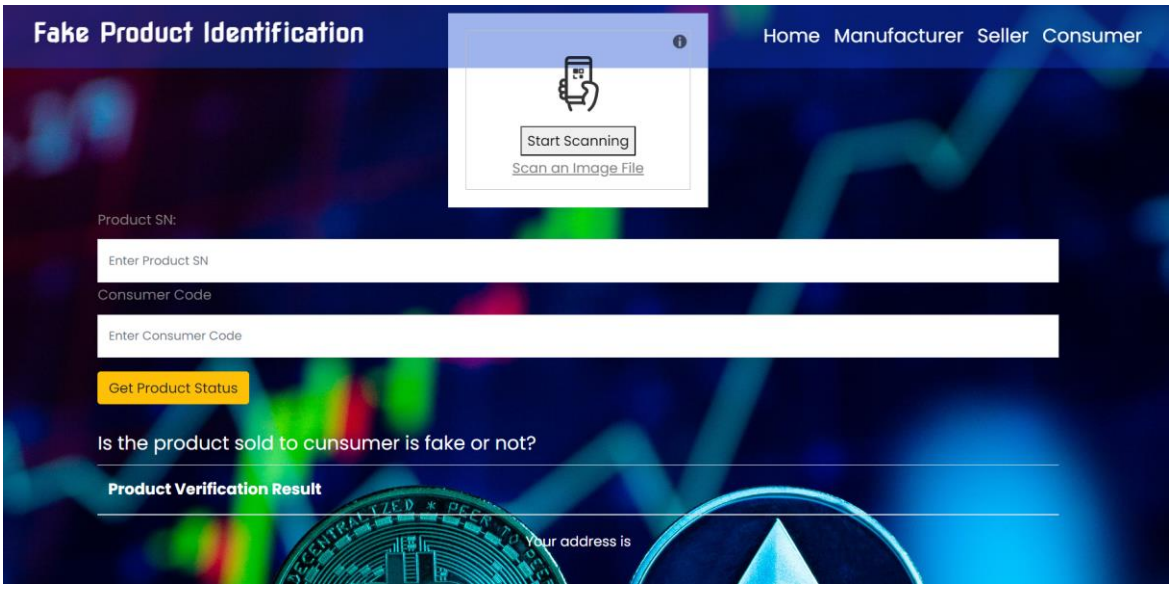

Fig 4.1(g) : Product Verification Page

4.1.1 Product Registration – Manufacturer

- The manufacturer registers the product on the blockchain by entering key details such as product specifications, manufacturing information, and a unique identifier. A QR code is generated and assigned to the product, which will be used for verification and accessing the blockchain record.

4.1.2 Seller Registration – Manufacturer

- The manufacturer registers the sellers on the blockchain by entering sellers details and unique seller code with manufacture id.

4.1.3 Ship Product to Seller - Manufacturer

- In the next step manufacturer will ship the product to seller scanning the generated QR code. Here all the information of manufacturer and seller of the transaction will be stored in blockchain.

4.1.4 Sell Product to Consumer - Seller

- A seller will sell the product scanning the assigned QR code on the product to the consumer having consumer code and will update the information of available status of the product on the blockchain. A seller also can see the information of the product which is available to sell.

4.1.5 End User Authentication Process - Consumer

- At the end of the chain, customer will take the product, go to website and upload QR code over there, and using consumer code, consumer will be able to detect authenticity of the product. From the user end consumer also can see the previous purchase history. The blockchain system enables transparency and traceability, allowing users to identify any inconsistencies or discrepancies in the product's history.

By implementing this, the proposed system using blockchain provides a secure and decentralized platform for tracking product ownership, verifying authenticity, and detecting counterfeit goods. The immutable nature of blockchain ensures the accuracy and integrity of the product data, enabling users to make informed decisions and mitigate the risks associated with counterfeit products.

4.2 Morality or Ethical Issues

4.2.1 Citation and Acknowledgment

- To uphold ethical standards, the project documentation incorporates proper citations and acknowledgments. Sources of information, research papers, and frameworks are explicitly stated, with acknowledgment given to third-party contributions.

4.2.2 Plagiarism

- An unwavering commitment to avoiding plagiarism is emphasized throughout the project documentation. Originality is maintained through rigorous citation and referencing practices, ensuring due credit for all intellectual contributions.

4.3 Socio-economic Impact and Sustainability

4.3.1 Societal Impact

- The project addresses the societal impact of counterfeit products by providing a transparent and traceable system. It contributes to reducing the circulation of counterfeit goods, fostering consumer trust, and enhancing public safety.

4.3.2 Health and Safety

- The project directly contributes to improving consumer safety, particularly in industries such as pharmaceuticals, where counterfeit goods pose significant health risks.

4.3.3 Legal and Cultural Impact

- Ensuring compliance with legal regulations related to product identification, the project also addresses cultural acceptance by providing a secure and standardized solution for combating counterfeit products.

4.3.4 Environmental Impact and Sustainability

- Aligned with environmental sustainability goals, the project promotes authenticity, potentially reducing the environmental impact of disposing of counterfeit goods. The use of blockchain technology contributes to eco-friendly practices.

4.4 Financial Analyses and Budget

4.4.1 Overall Budget Planning

- The project involves a meticulously planned overall budget, encompassing costs related to hardware, software, personnel, and other relevant expenses. This budget ensures the successful implementation and long-term sustainability of the system.

4.4.2 Component/Software Budget Planning

- A detailed breakdown of the budget into specific components or software licenses is provided. This includes cost estimates for tools such as Truffle, Ganache, Solidity, Node.js, and Web3.js, ensuring transparency and accountability in financial planning.

5 Conclusion

5.1 Conclusion and challenges faced

- Counterfeiting products are growing exponentially with the enormous amount online. So, there is a strong need to detecting counterfeit products and blockchain technology is used to detect fake products. Furthermore, the information is encoded into a QR code. Customers or users scan the QR code and then they can detect the fake product. Digital information of product can be stored in the form of blocks in blockchain technology. As blockchain is a growing platform for security so we faced many difficulties to implement in our system. As version of truffle, web3 and meta-mask should be compatible, here we faced problems to setup them with each other.

5.2 Future Study

5.2.1 Integration with Emerging Technologies

- Consider incorporating emerging technologies like Internet of Things (IoT) devices and artificial intelligence (AI) for more dynamic and real-time tracking. This could lead to proactive identification of potential counterfeit activities.

5.2.2 Enhanced User Interfaces

- Continuously improve user interfaces to ensure a seamless experience for all stakeholders. Consider developing mobile applications with augmented reality features for enhanced product verification.

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