Counterfeit Product Identification

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Developer's Submission

"This report is being submitted to the Department of Electrical Engineering of the National University of Computer and Emerging Sciences in partial fulfillment of the requirements for the degree of BS in Electrical Engineering"

Developer's Declaration

"We take full responsibility of the project work conducted during the Final Year Project (FYP) titled **"Counterfeit Product Identification".** We solemnly declare that the project work presented in the FYP report is done solely by us with no significant help from any other person; however, small help wherever taken is duly acknowledged. We have also written the complete FYP report by ourselves. Moreover, we have not presented this FYP (or substantially similar project work) or any part of the thesis previously to any other degree awarding institution within Pakistan or abroad.

We understand that the management of Department of Electrical Engineering of National University of Computer and Emerging Sciences has a zero-tolerance policy towards plagiarism. Therefore, we as an author of the above-mentioned FYP report solemnly declare that no portion of our report has been plagiarized and any material used in the report from other sources is properly referenced. Moreover, the report does not contain any literal citing of more than 70 words (total) even by giving a reference unless we have obtained the written permission of the publisher to do so. Furthermore, the work presented in the report is our own work and we have positively cited the related work of the other projects by clearly differentiating our work from their relevant work.

We further understand that if we are found guilty of any form of plagiarism in our FYP report even after our graduation, the University reserves the right to withdraw our BS degree. Moreover, the University will also have the right to publish our names on its website that keeps a record of the students who committed plagiarism in their FYP reports."

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Certified by Supervisor

Verified by Plagiarism Cell Officer

Counterfeit Product Identification

Sustainable Development Goals

(Please tick the relevant SDG(s) linked with FYDP)

SDG No	Description of SDG	SDG No	Description of SDG
SDG 1	No Poverty	SDG 9	Industry, Innovation, and Infrastructure
SDG 2	Zero Hunger	SDG 10	Reduced Inequalities
SDG 3	Good Health and Well Being	SDG 11	Sustainable Cities and Communities
SDG 4	Quality Education	✓ **SDG 12**	**Responsible Consumption and Production**
SDG 5	Gender Equality	SDG 13	Climate Change
SDG 6	Clean Water and Sanitation	SDG 14	Life Below Water
SDG 7	Affordable and Clean Energy	SDG 15	Life on Land
✓ **SDG 8**	**Decent Work and Economic Growth**	✓ **SDG 16**	**Peace, Justice and Strong Institutions**
		SDG 17	Partnerships for the Goals

Range of Complex Problem Solving			
	Attribute	**Complex Problem**	
1	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.	✓
2	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.	✓
3	Depth of knowledge required	Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach.	
4	Familiarity of issues	Involve infrequently encountered issues	✓
5	Extent of applicable codes	Are outside problems encompassed by standards and codes of practice for professional engineering.	✓
6	Extent of stakeholder involvement and level of conflicting requirements	Involve diverse groups of stakeholders with widely varying needs.	
7	Consequences	Have significant consequences in a range of contexts.	✓
8	Interdependence	Are high level problems including many component parts or sub-problems	✓
Range of Complex Problem Activities			
	Attribute	**Complex Activities**	
1	Range of resources	Involve the use of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies).	✓
2	Level of interaction	Require resolution of significant problems arising from interactions between wide ranging and conflicting technical, engineering or other issues.	✓
3	Innovation	Involve creative use of engineering principles and research-based knowledge in novel ways.	✓
4	Consequences to society and the environment	Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.	✓
5	Familiarity	Can extend beyond previous experiences by applying principles-based approaches.	✓

Abstract

The threat posed by counterfeit goods has spread to several industries, including consumer electronics, pharmaceuticals, and luxury items, among others. These goods not only undermine customer and producer trust but also result in significant monetary losses and possible dangers to consumer health and safety. By creating a reliable and effective system for recognizing fake products using blockchain technology, our project seeks to address this problem.

Distributed ledger technology, or blockchain, offers special characteristics including immutability, transparency, and decentralization. It is the perfect platform for enhancing the security and authenticity of supply chains because of these features. By leveraging these qualities, the suggested solution combines blockchain with product identification methods to provide a trustworthy and tamper-proof mechanism for identifying and preventing the entry of counterfeit goods into the market.

Acknowledgments

We would like to express our sincere gratitude to Dr. Ata ul Aziz, our supervisor. This project has advanced significantly as a result of his outstanding advice, perceptive comments, and helpful recommendations. We especially value how he consistently encourages effort and cooperation throughout the team.

TABLE OF CONTENTS

Developer's Submission 2
Developer's Declaration..... Error! Bookmark not defined.
Abstract 9
Acknowledgments.....10
List of Figures ..... Error! Bookmark not defined.
Chapter 1 Introduction..... Error! Bookmark not defined.
Motivation .....**Error! Bookmark not defined.**
1.1 Problem statement.....**Error! Bookmark not defined.**
1.2 Literature review .....**Error! Bookmark not defined.**
1.4Report Outline 14
Chapter 2 Solution Design & Implementation.....14
2.1 Block Diagram 14
2.2 Flow Chart.....15
2.3 Smart Contract:.....16
2.4 Gas Money:**.....18**
2.5 Ganache:**.....19**
2.6 MetaMask:**.....20**
2.7 Website: **.....20**
2.8 App Interface:**.....22**
.....22
Chapter 3 Result and Recommendations.....22
3.1 Results: 22
3.1.1 An original Product:.....22
3.1.2 A Fake Product:.....23
3.1.3 Two products having same QR code: 24
3.2 Conclusion:.....24
3.3 Future Work:.....24
Bibliography..... Error! Bookmark not defined.

CHAPTER #1 : Introduction

The proliferation of counterfeit goods has caused severe problems for many economies and enterprises throughout the globe. Producing and selling counterfeit goods puts customer safety in peril, erodes consumer faith in the brand, compromises the integrity of the supply chain, and is very costly for legal producers. Therefore, there is a pressing need for this problem's effective remedies.

Blockchain technology has evolved for cryptocurrencies like Bitcoin, making it a potential tool with the capacity to address issues with identifying fake goods. Due to public ledger, it makes blockchain to be more immutable, secure, authentic, transparent and traceable

The main aim of this system is to start a swift process that shows the use of blockchain technology to configure and signify the sale of counterfeit products. By implementing this blockchain technology with presently in use product identifying technologies, such serialization, barcoding, and RFID tagging, we want to create a robust and tamper-proof solution that restores trust and transparency in supply chain ecosystems.

Motivation

This initiative was motivated by the alarming increase in counterfeit goods across numerous industries and the urgent necessity to develop efficient countermeasures. In addition to posing serious hazards to consumer safety and undermining the integrity of supply chains, counterfeit goods often result in huge financial losses for legitimate businesses.

1.1 Vision

The main objective of the research is to determine whether blockchain technology can assist to solve the issue of counterfeit goods. We want to show how blockchain may revolutionize efforts to detect and battle counterfeit products by evaluating the limitations and shortcomings of traditional product identification systems.

"Design a system to detect counterfeit products to rebuild the trust between manufacturer and Customer "

"Design a system to detect counterfeit products, thereby rebuilding trust between manufacturers and customers," is the stated goal of this project. We seek to provide a transparent and tamper-proof platform for safe information sharing, traceability, and verification by combining blockchain technology with current product identification methods. In the face of the challenge of counterfeit goods, the suggested approach will enable industries to defend their supply chains, protect customer interests, and preserve brand integrity.

1.2 Literature review

Research on the effects of counterfeit products [1]

Elsantil, Yasmeen G., and Eid G. Abo Hamza. "A review of internal and external factors underlying the purchase of counterfeit products." Academy of Strategic Management Journal 20.1 (2021): 1-13.

Research on Blockchain Based Smart Contracts [2]

Hewa, Tharaka Mawanane, et al. "Survey on blockchain-based smart contracts: Technical aspects and future research." IEEE Access 9 (2021): 87643-87662.

Research on Anti-counterfeiting Technology Based on QR Code [3]

De Li, X. G., Y. Sun, and L. Cui. "Research on anti-counterfeiting technology based on QR code image watermarking algorithm." Int J Multimed Ubiquitous Eng 12.5 (2017): 57-66.

Blockchain technology, bitcoin, and Ethereum: [4]

Vujičić, Dejan, Dijana Jagodić, and Siniša Ranđić. "Blockchain technology, bitcoin, and Ethereum: A brief overview." 2018 17th international symposium infoteh-jahorina (infoteh). IEEE, 2018.

Research on Android Studio: [5]

Golhar, Reetesh V., et al. "Design and implementation of android base mobile app for an institute." 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT). IEEE, 2016.

1.4 Report Outline

There are multiple chapters in this report.

The proposed solution, including the block diagram and the process flowchart, are covered in full in Chapter 2.

In order to increase website accuracy, Chapter 3 covers the outcomes of running the website on various products.

CHAPTER # 2: Solution Design & Implementation

2.1 Block Diagram

The project's whole block diagram is shown in Figure 2.1, along with thorough descriptions of each block and the associated technical requirements.

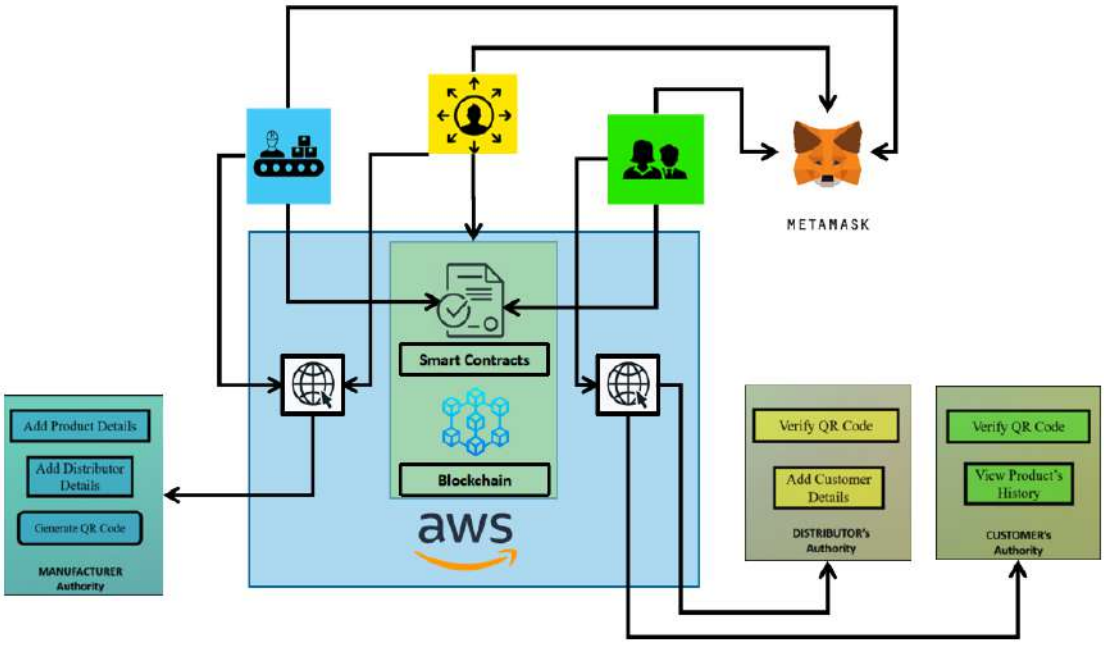


Figure 2.1 Block diagram of the project.

Users and their Authorities:

Three different user kinds, each with a different level of authority:

a) Manufacturer:

The block chain is made by the manufacturer, who also adds the product block with the product information. A specific product is added to that seller's block and all designated sellers are added.

b) Retailer:

A retailer uses a website or app to verify the legitimacy of the product. Following confirmation, the shop places the item on the sale list so that customers may determine whether it is or is not in stock. The store then buys the customer the item and uploads their block.

c) Customer:

A customer uses our app or website to verify the legitimacy of the merchandise. Additionally, they can look into the product's past.

2.2 Flow Chart

The project's whole flow chart is shown in Figure 2.2.

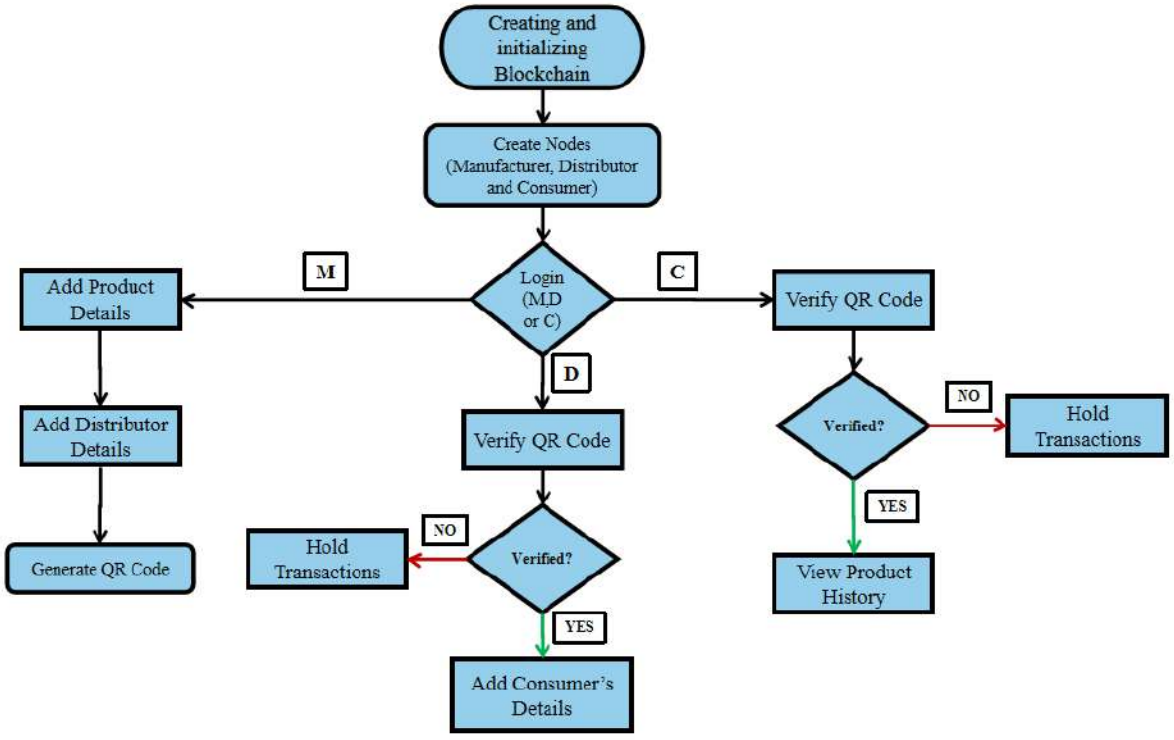


Figure 2.2 Flow chart of project.

Making and Initializing the Blockchain:

Using the tools we utilized for the project, the manufacturer makes their own blockchain. In essence, the company will use Solidity to produce smart contracts.

Making nodes:

The maker makes the nodes for the distributor, customer, and distributor. The distributor adds the block from the manufacturer, and the manufacturer adds the block from the consumer.

Login requirements:

The client, distributor, and manufacturer can all log in to our website. Each person will log in to their account and move forward as necessary.

Producer Authority:

After adding the product information and retailer information, the manufacturer sends the product to the right retailer.

Distributor Authority:

Before selling a product to a customer, the distributor verifies its legitimacy

.

Customer Authority:

The consumer verifies the legitimacy of the goods and examines its specifications and background.

2.3 Smart Contract:

Smart contracts on a block chain are self-executing contracts in which the conditions of the agreement are written directly into the code itself. These contracts provide a decentralized and tamper-proof means to enable and enforce agreements by automatically executing actions when specific predefined conditions are satisfied.

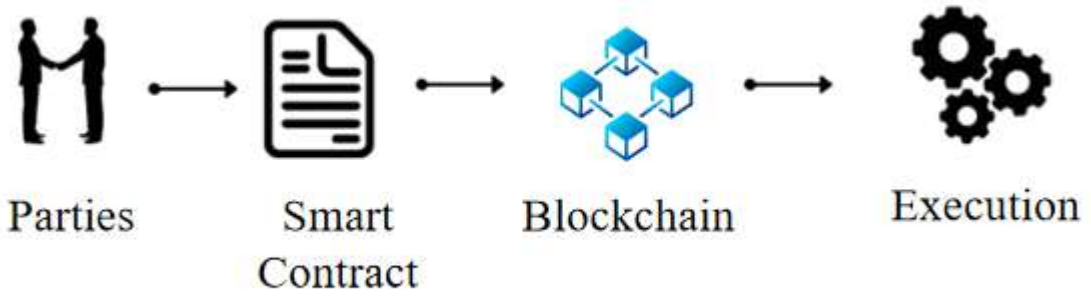


Figure 2.3 Smart Contract.

Advantages of a Smart Contract:

- **Automation:**

Smart contracts automate procedures, doing away with the need for middlemen or outside parties like escrow companies or attorneys. This lowers expenses and boosts effectiveness.

- **Security:**

Security is top priority in any of authenticity network. Smart contacts are deployed on block chain, which assure to the high level of security in any case. Block chain as a public ledger has all the benefits to be visible to everyone and not being able to alter the contact once it is published. This allows every member of block chain to stay immune to tampering, hacking and frauds.

- **Cost Savings:**

Savings in transaction costs are possible with smart contracts because they do away with middlemen and automate many of the steps involved in traditional contract execution and enforcement.

- **Trust and Transparency:**

Trust and Transparency: Since distributed ledger technology is used to power smart contracts, all users of the network may access the same information. This openness promotes trust between the parties since the parties may independently validate the terms and conditions of the contract without depending on a central authority.

- **Accuracy and Efficiency:**

Because smart contracts are based on code, they carry out preset activities with accuracy and precision, lowering the possibility of human error and boosting operational effectiveness.

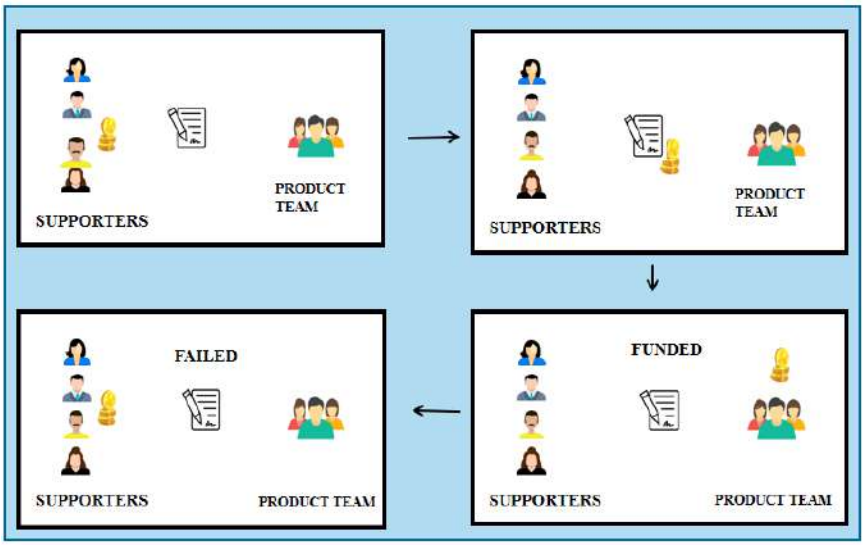


Figure 2.4 Smart Contract working.

2.4 Gas Money:

'Gas' plays a crucial function in the context of blockchain transactions, especially those utilizing Ethereum. Gas costs apply to all operations, whether they are computational, storage-related, or data access-related. The idea of gas has two main functions: it ensures equitable resource distribution and guards against malevolent players that might try to overwhelm the network with excessive computation or infinite loops.

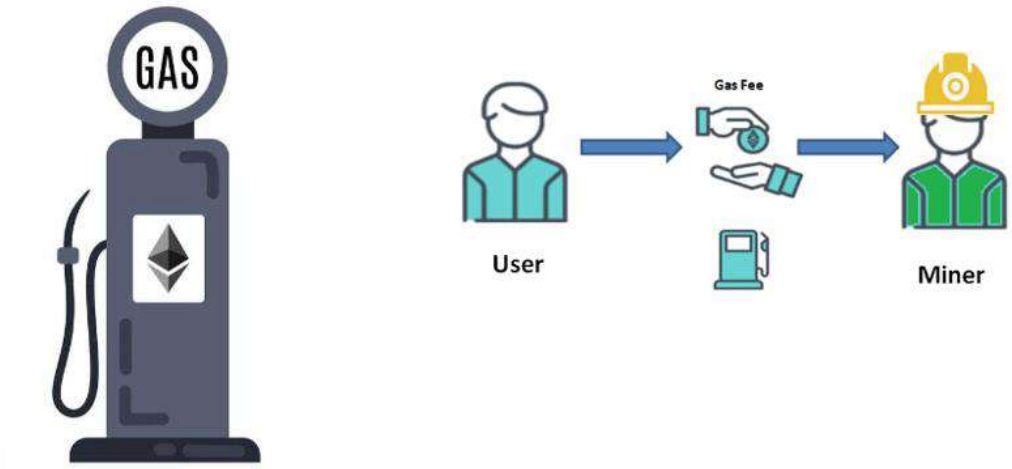


Figure 2.5 Gas Money.

Miners are the people or organizations that participate in validating and adding new transactions to the blockchain (also referred to as mining pools).

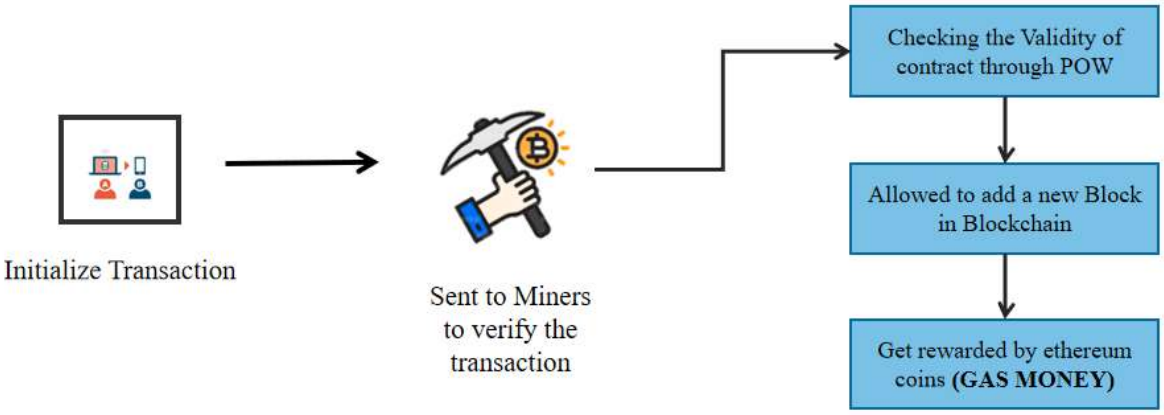


Figure 2.6 Miner's work.

2.5 Ganache:

For Ethereum development, you can deploy contracts, create applications, and conduct testing using Ganache, a private blockchain. Both a desktop program and a command-line tool are accessible. In terms of Ethereum development, Ganache is essentially your own personal blockchain.

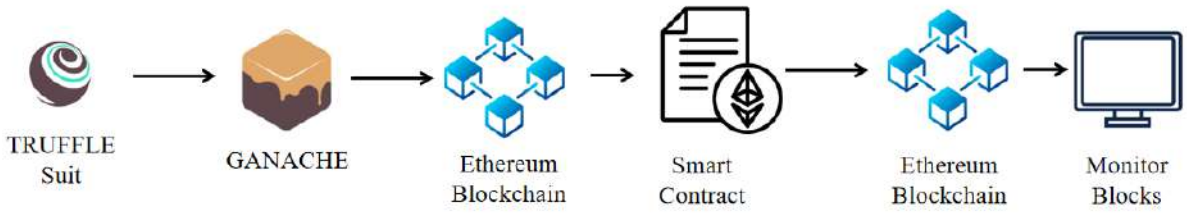


Figure 2.7 ganache working.

Block Diagram to understand the working of ganache:

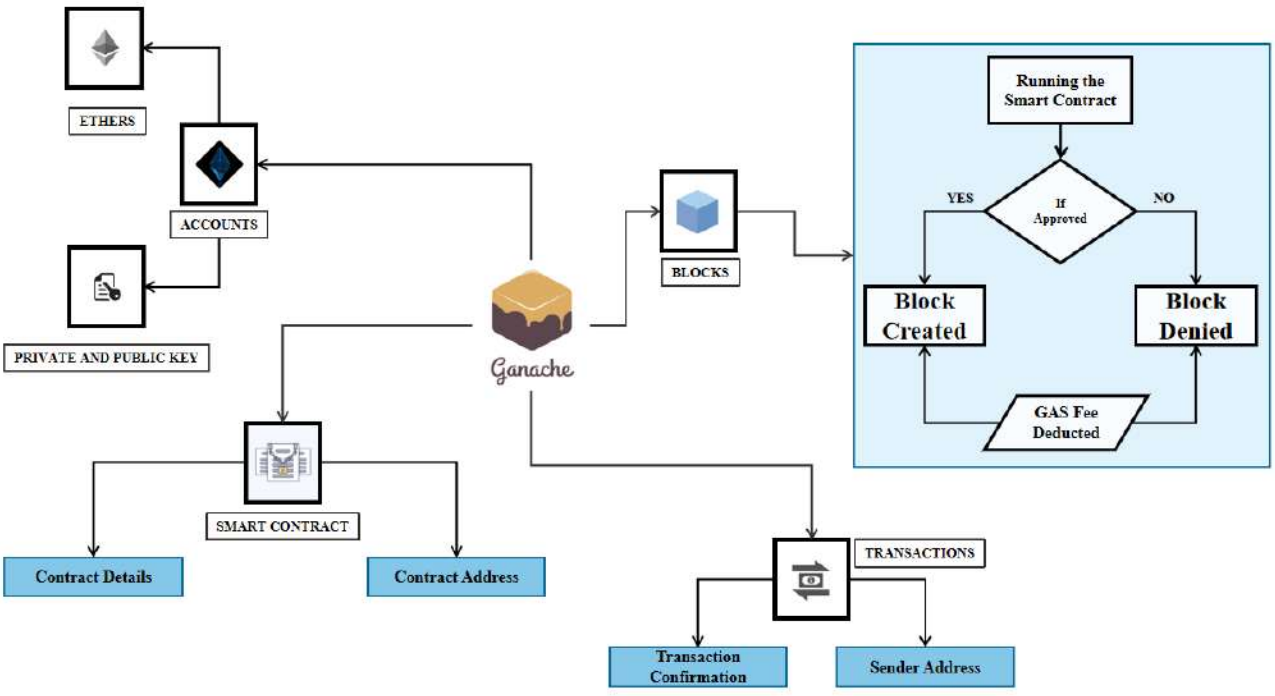


Figure 2.8 block diagram of ganache working.

2.6 MetaMask:

A software cryptocurrency wallet called MetaMask is used to communicate with the Ethereum network. Users can utilize a browser extension or mobile app to access their Ethereum wallet, which can then be used to connect with decentralized applications.

Ganache and MetaMask are connected, offering real-time tracking of transactional changes, contract extensions, and account modifications.

2.7 Website:

Three nodes on the website for our project stand for the Manufacturer, Distributor, and Customer. Here is a snapshot of the website's user interface.

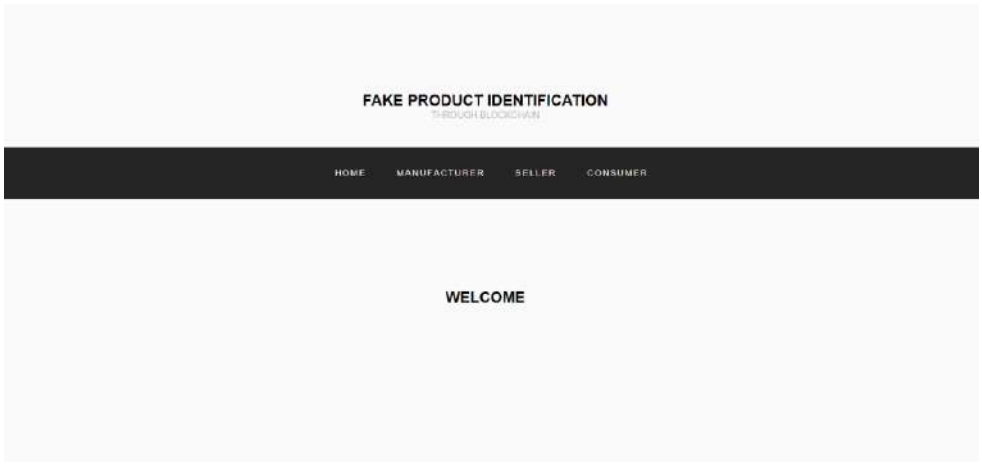


Figure 2.9 Website home page

Manufacturer's Interface:

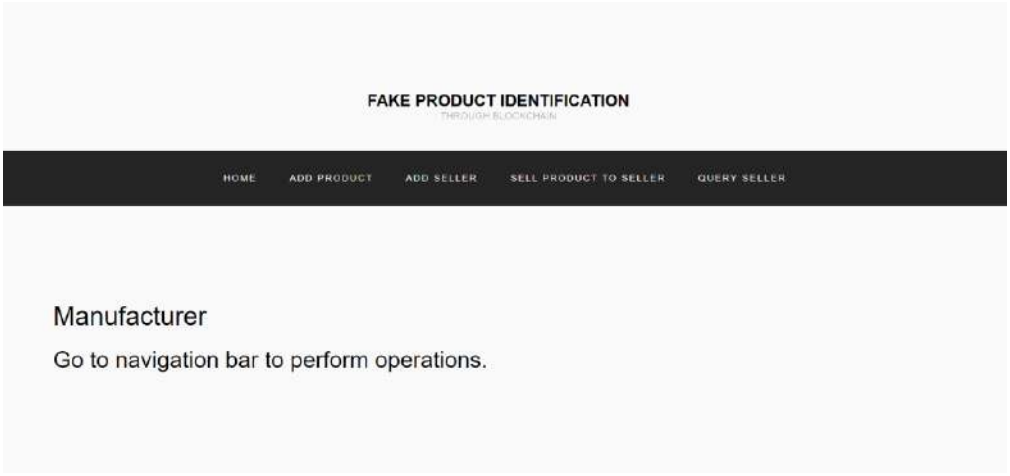


Figure 2.10 Website Manufacturer page

Distributor's Interface:

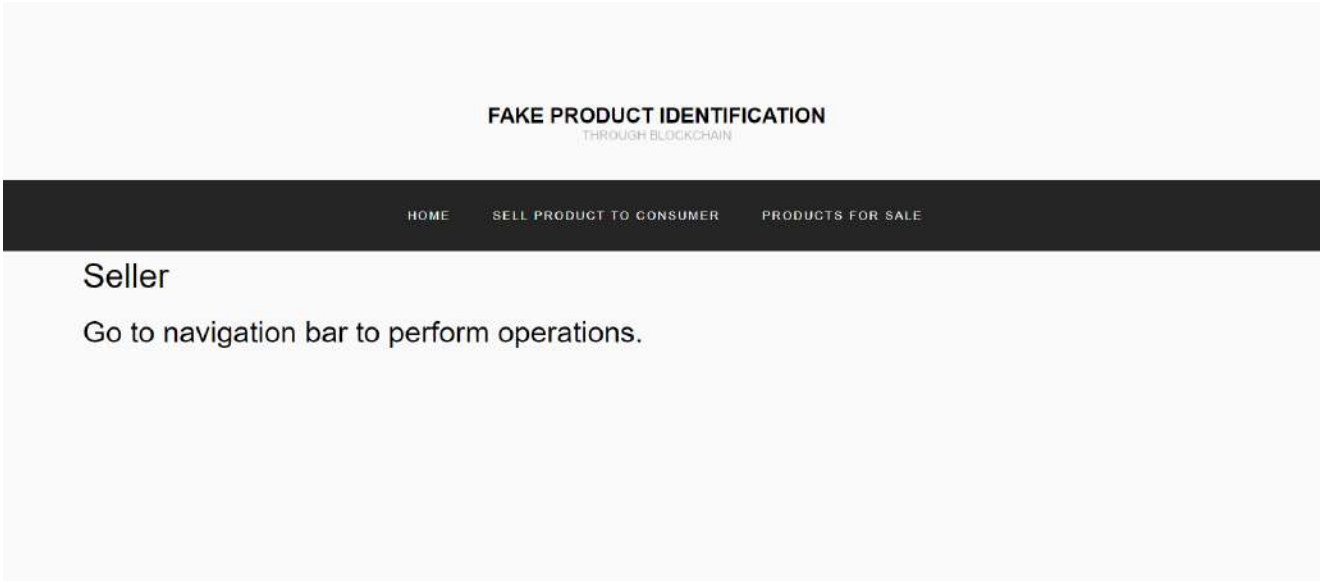


Figure 2.11 Website distributor's page

Consumer's Interface:

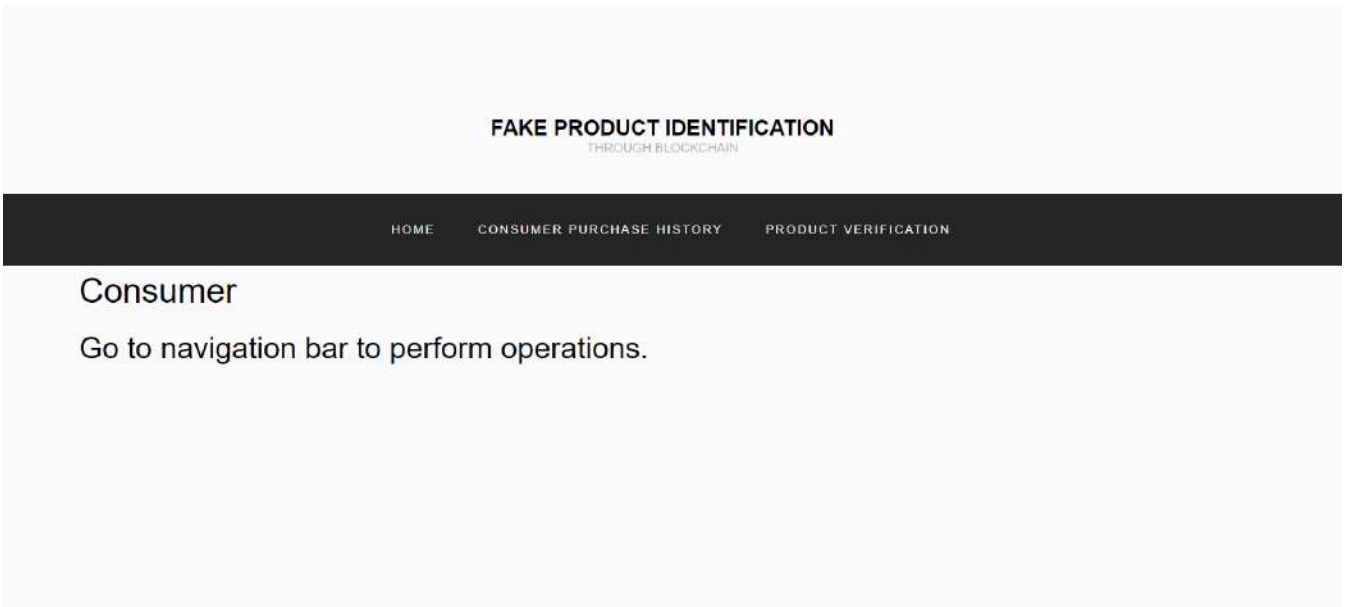
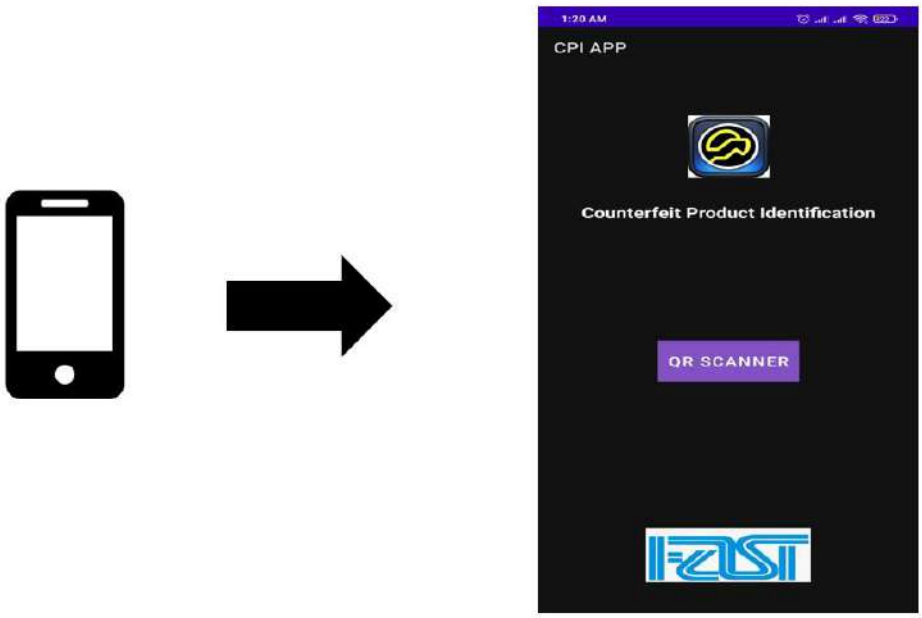


Figure 2.12 Website consumer's page

2.8 App Interface:

A QR code scanner that pulls up product information when scanned is part of the application created for this project. The app's user interface is displayed as follows.



Chapter 3 Result and Recommendations

3.1 Results:

For the purposes of this project, we experimented with three distinct product scenarios:

1. An original product.
2. A counterfeit product.
3. Two products with the same QR code.

3.1.1 An original Product:

Firstly the manufacturer will provide a real product detail of the products are added through website under the owner authority and then all the information is added to blockchain. Then product is sent to store and eventually sold to costumer. The costumer will be able to validate product using public blockchain.

Figure 3.1 Original Product

3.1.2 A Fake Product:

When a consumer scans a QR code for a product whose information isn't recorded on the blockchain, a warning about a possible counterfeit appears.

Figure 3.2 Fake Product

3.1.3 Two products having same QR code:

For this instance, we used two goods with similar QR codes. Only one of them, though, was acknowledged as real.

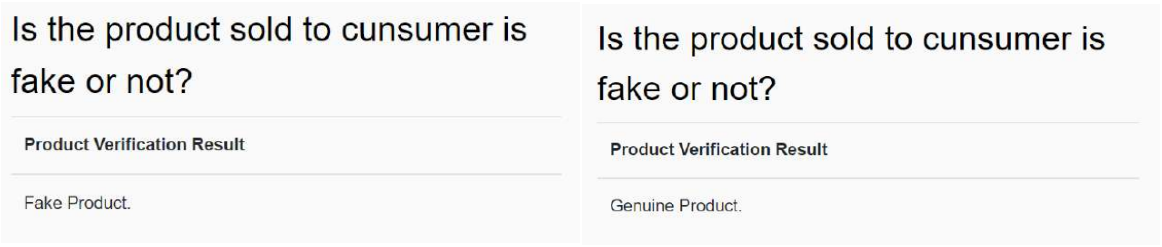


Figure 3.3 Comparison Fake vs original

3.2 Conclusion:

The comprehensive approach to identify fake goods introduced in this senior project makes use of blockchain technology. The economy, customers, and industries are all seriously threatened by counterfeit products, which also risk consumer safety. The project intends to address these problems by fusing traditional product identification techniques with blockchain, providing a full solution.

We identified the drawbacks of conventional methods of product identification, such as serialization, barcodes, and RFID tags, in terms of traceability, transparency, and data security. These flaws highlighted the need for a novel strategy to strengthen supply chain authenticity and integrity.

By adding smart contracts to the blockchain foundation, corporate regulations are further automated and enforced, assuring compliance and reducing the possibility of fraud or human error. Advanced encryption techniques were utilized to preserve the integrity and confidentiality of product information, transaction records, and customer feedback in order to secure sensitive data.

3.3 Future Prospects:

For future endeavors, we plan to explore the following areas:

1. Metaverse and Web 3.0

2. Transparent and Genuine Charity Application

3. Here's a refined version of your report:

Metaverse and Web 3.0

The traditional charitable systems sometimes struggle with issues like misuse of finances, lack of transparency in fund allocation, and difficulty determining how gifts will be used. Our proposed application aims to revolutionize the way charitable donations are made and managed by exploiting the immutability, transparency, and decentralized features of blockchain.

Transparent and Genuine Charity Application:

The traditional charitable systems frequently struggle with problems like poor fund management, lack of transparency into resource allocation, and difficulty tracing the effects of gifts. Our proposed application aims to revolutionize the way charitable asset are made and managed by utilizing the immutability, transparency, and decentralized features of the technology.

Blockchain Development:

Learning blockchain development skills can help you to benefit from a range of opportunities and growth in your career. Due to the increased demand for blockchain developers, compensation and benefits are now comparable with the online market. Many businesses around the world are ready to give high wages to blockchain developers. As a blockchain engineer,you could earn above average money and other incentives.

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