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A PROJECT REPORT ON

"COUNTERFEIT PRODUCT IDENTIFICATION USING BLOCKCHAIN"

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

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE & ENGINEERING

Submitted By:

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CERTIFICATE

This is to certify that the major project work titled **'COUNTERFEIT PRODUCT IDENTIFICATION USING BLOCKCHAIN'** is carried out by **SANTHOSH RAAJ G(1MJ19CS145), SHILPA D K(1MJ19CS151), S SARANYA (1MJ19CS140)** and **SHUCHITHA S (1MJ19CS158)** who are bonafide students of MVJ College of Engineering, Bengaluru, in partial fulfilment for the award of Degree of **Bachelor of Engineering in Computer science and Engineering** of the Visvesvaraya Technological University, Belagavi during the year 2022- 2023. It is certified that all corrections/suggestions indicated for the Internal Assessment have been incorporated in the major project report deposited in the departmental library. The major project report has been approved as it satisfies the academic requirements in respect of major project work prescribed by the institution for the said Degree.

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DECLARATION

We, **SANTHOSH RAAJ G(1MJ19CS145), SHILPA D K(1MJ19CS151), S SARANYA (1MJ19CS140)** and **SHUCHITHA S (1MJ19CS158)** students of eighth semester B.E., Department of Computer science and Engineering, MVJ College of Engineering, Bengaluru, hereby declare that the major project titled **'Counterfeit Product Identification Using Blockchain'** has been carried out by us and submitted in partial fulfilment for the award of Degree of **Bachelor of Engineering** in **Computer science and Engineering** during the year 2022-2023. Further we declare that the content of the dissertation has not been submitted previously by anybody for the award of any Degree or Diploma to any other University. We also declare that any Intellectual Property Rights generated out of this project carried out at MVJCE will be the property of MVJ College of Engineering, Bengaluru and we will be one of the authors of the same.

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ABSTRACT

In the recent days, as the use of E-commerce is increasing, the consumers are more prone on buying fraud or fake products. The project "COUNTERFEIT PRODUCT IDENTIFICATION USING BLOCKCHAIN" aims to address the growing concern of fraudulent or fake products in the e-commerce industry. By leveraging blockchain technology, the project intends to enable the identification of counterfeit products and authenticate genuine ones. The primary objective is to reduce and ultimately eliminate the presence of counterfeit goods in the market.The process begins by placing a product under a scanner for identification purposes. The scanner reads the QR codes that are generated at the manufacturing level. These QR codes serve as a means to distinguish between fake and genuine products. To ensure transparency and traceability, the product details contained within the QR code are added to a blockchain network.By utilizing blockchain technology, the project enables the tracking of the product from its origin, creating a verifiable and immutable record. This process allows for the certification of the product as either counterfeit or authentic. Consumers can utilize this system to verify the authenticity of a product before making a purchase, mitigating the risk of buying fraudulent goods.

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CHAPTER 1

INTRODUCTION

1.1 Overview

In the recent days, as the use of E-commerce is increasing, the consumers are more prone on buying fraud or fake products. More than 76% of the consumers buy fake products unknowingly. The intermediates imitate the logos or the products with a cheaper quality of the famous brands. Hence there is a need for identifying the difference between the counterfeit goods and the original goods. A fake product identification systems may be prolonged overdue, an imperative factor of failure and more than one counterfeits of fake products because of intermediaries, makes it difficult for the consumers or users to determine whether the product is original/authenticate.The presence of fake/counterfeit goods not only undermines consumer trust but also poses significant risks to health, safety, and intellectual property rights.

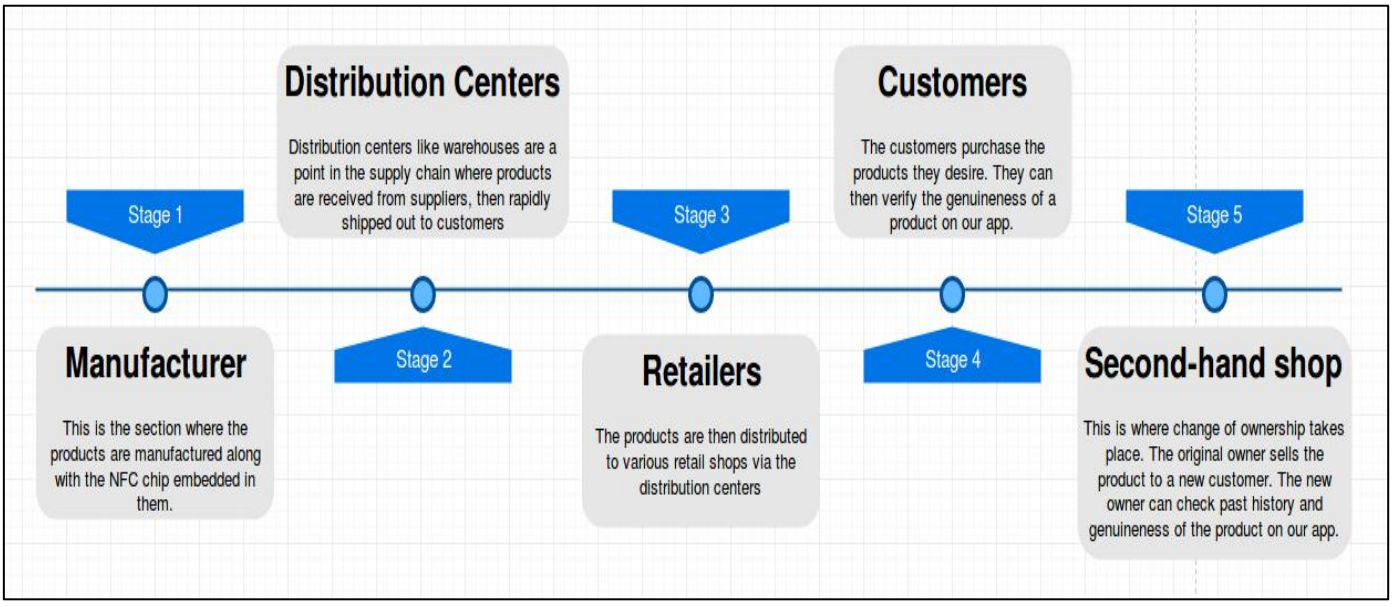

Fig 1.1 : Supply chain of marketing

To address this issue, our project, "Counterfeit Product Identification Using Blockchain", proposes an approach to combat the expansion of counterfeit products in the e-commerce industry. By utilizing the power of blockchain technology, we aim to provide a secure and

transparent system for identifying counterfeit products and certifying the authenticity of genuine goods.

The primary objective of our project is to reduce and eventually eliminate the circulation of counterfeit products in the market. We recognize the urgency of developing effective mechanisms to ensure that consumers can make informed purchasing decisions and have confidence in the products they buy online. The solution involves leveraging the unique properties of blockchain technology to create an immutable and decentralized record of product information. By incorporating QR codes at the manufacturing level, our system enables the identification and verification of products throughout their lifecycle. When a product is subject for analysis, it undergoes a scanning process where the QR code embedded within the product is read by a specialized scanner. This scanner interfaces with the blockchain network, accessing the product's details stored securely on the blockchain. Through this process, the system can determine whether the product is genuine or counterfeit, providing consumers with accurate and trustworthy information.

By using blockchain technology, we establish an unalterable and transparent ledger that tracks the product from its origin, ensuring an auditable trail of its journey. This comprehensive record allows the consumers to verify a product's authenticity before making a purchase, thereby mitigating the risks associated with counterfeit goods. Hence, the project "Counterfeit Product Identification Using Blockchain" aims to fight against counterfeit products in the e-commerce industry. By leveraging blockchain technology, establishing a robust system that fosters consumer trust, protects intellectual property rights, and ultimately eliminates the circulation of fraudulent goods. Through the incorporation of QR codes and a decentralized blockchain network, to provide a secure and transparent platform for the identification and certification of authentic products, safeguarding consumer interests in the digital marketplace.

1.2 Basics of Blockchain

Blockchain is a decentralized digital ledger that allows multiple parties to record and verify transactions in a secure and transparent manner. It is the underlying technology behind cryptocurrencies like Bitcoin, but its applications go beyond digital currencies. In a traditional centralized system, a single authority (such as a bank or government) maintains a central ledger to record transactions. In contrast, a blockchain is a distributed ledger that is maintained by a

network of participants, called nodes. Each node in the network has a copy of the entire blockchain, and they work together to validate and add new transactions to the ledger.

1.2.1 Characteristics of Blockchain

Here are some key characteristics of blockchain technology:

- Decentralization: Blockchain operates on a peer-to-peer network, eliminating the need for a central authority. This decentralization enhances transparency, security, and censorship resistance.
- Transparency: The ledger is visible to all participants in the network. Each transaction is recorded in a "block," which contains a timestamp, a unique identifier (hash), and the transaction data. Once added, a block is virtually impossible to modify, ensuring an auditable and transparent record of transactions.
- Security: Blockchain uses advanced cryptographic techniques to secure transactions and ensure data integrity. Each block is linked to the previous block through a cryptographic hash, forming a chain. Modifying a single block would require altering all subsequent blocks, making the blockchain tamper-evident.
- Immutability: Once a block is added to the blockchain, it is extremely difficult to alter or remove the information contained within it. This property makes blockchain suitable for applications where data integrity is crucial.
- Smart Contracts: Blockchain can support programmable transactions through smart contracts. Smart contracts are self-executing contracts with predefined conditions and terms encoded within the blockchain. They automatically execute actions when specific conditions are met, eliminating the need for intermediaries.

Blockchain technology has applications beyond cryptocurrencies. It can be used in various industries, including finance, supply chain management, healthcare, voting systems, and more. By leveraging blockchain, organizations can enhance efficiency, transparency, and security in their operations while reducing the reliance on intermediaries and central authorities.

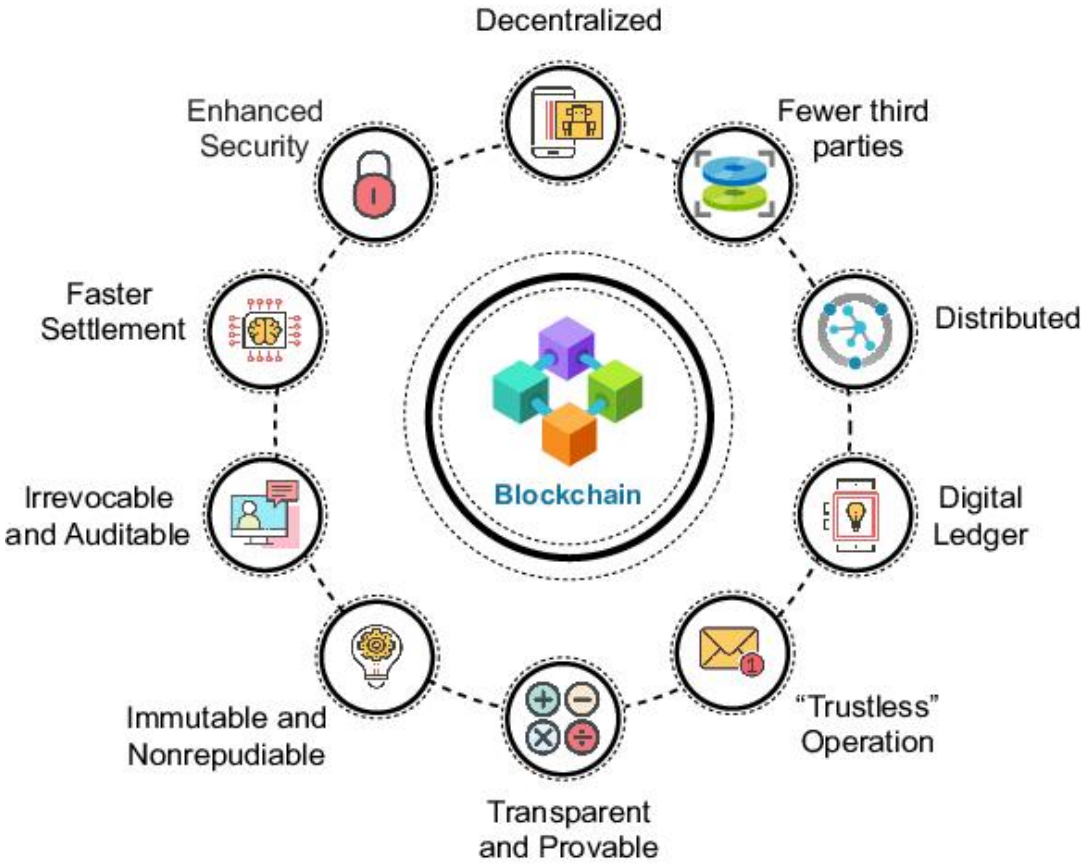

Fig 1.2.1 : Characteristics of Blockchain

1.2.2 Basic Architecture of Blockchain

The basic architecture of a blockchain consists of a distributed network of computers called nodes. Each node maintains a copy of the entire blockchain ledger. Transactions are grouped into blocks, which contain a list of validated and ordered transactions along with metadata such as timestamps and unique identifiers. Blocks are linked together using cryptographic hashes, creating an immutable chain. The consensus mechanism, determined by a set of rules and protocols, ensures that all nodes agree on the validity and order of transactions. This agreement is crucial for maintaining the integrity of the blockchain. Nodes independently validate and verify transactions and blocks, ensuring compliance with the consensus rules. Blockchain operates in a decentralized manner, meaning that no single entity has control over the entire network. Nodes communicate through a peer-to-peer network, exchanging information and synchronizing their copies of the blockchain. Cryptographic techniques, such as digital signatures and hash functions, are used to secure transactions and protect data integrity. Some blockchain platforms support smart contracts, which automate the execution of predefined

conditions without intermediaries. The architecture of a blockchain combines decentralization, security, and consensus mechanisms to create a transparent, tamper-proof, and trusted system for recording and verifying transactions.

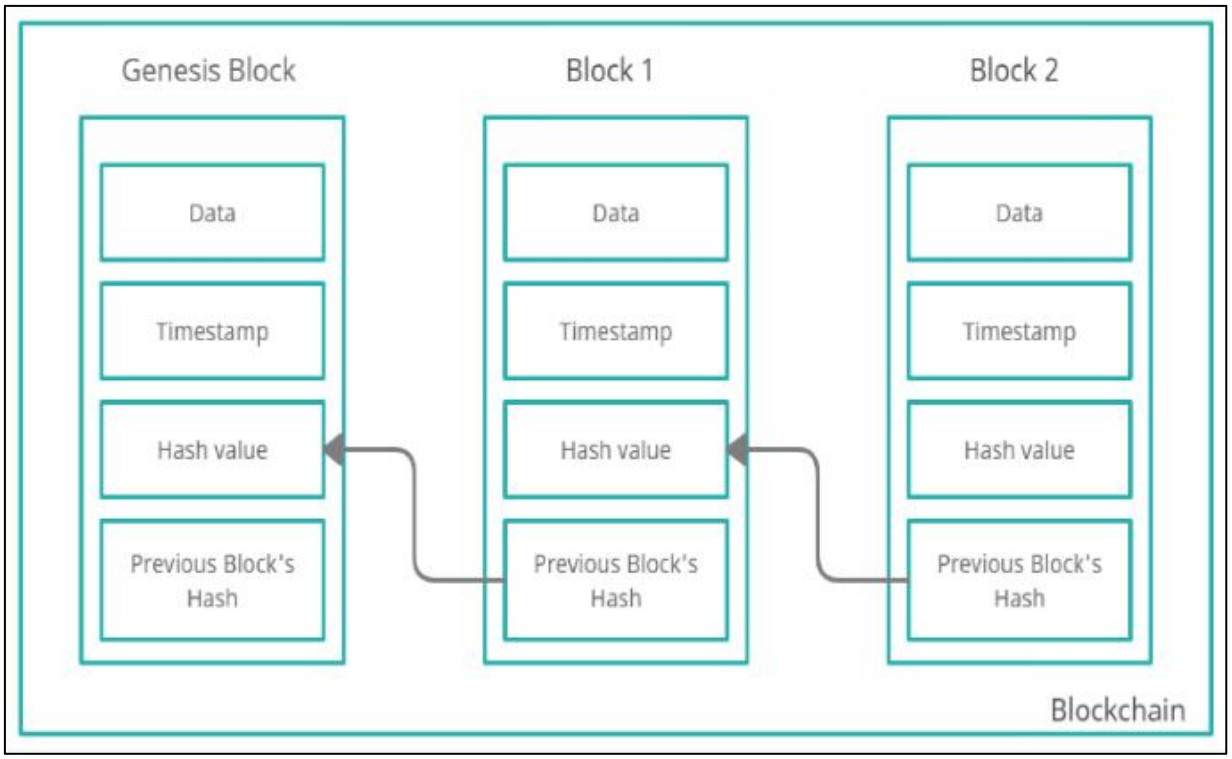

Fig 1.2.2 : Basic Architecture of Blockchain

1.2.3 Working of Blockchain

These below points provide a simplified overview of the working principles behind blockchain technology. The specific details and mechanisms may vary depending on the blockchain protocol and consensus algorithm being used.

- Distributed Network: A blockchain operates on a network of computers (nodes) that communicate and share information with each other. Each node has a copy of the entire blockchain.
- Transactions: Participants in the network initiate transactions, which represent the exchange of assets or information. These transactions are bundled together into blocks.
- Block Creation: Miners or validators in the network compete to solve a complex mathematical problem, known as the consensus algorithm (e.g., Proof of Work or Proof of Stake). The first miner to solve the problem adds a new block to the blockchain.

- Block Verification: Once a miner creates a new block, other nodes in the network verify its validity. They check if the transactions within the block are legitimate and comply with the rules of the blockchain protocol.
- Consensus Mechanism: Nodes in the network collectively agree on the validity of the new block through a consensus mechanism. This ensures that all participants have the same version of the blockchain.
- Block Addition: Once a block is verified and accepted by the network, it is added to the existing chain of blocks, forming a chronological and immutable sequence.
- Chain Linkage: Each block contains a reference (hash) to the previous block in the chain, creating a link between them. Modifying the data in one block would require altering all subsequent blocks, making it extremely difficult to tamper with the blockchain.
- Decentralization and Security: The distributed nature of the blockchain and the use of cryptographic algorithms provide security against fraudulent activities. The consensus mechanism ensures that a majority of the network agrees on the state of the blockchain, preventing malicious actors from manipulating the system.
- Transparency: The blockchain ledger is transparent and visible to all participants. Each participant can view and verify the entire transaction history, promoting transparency and accountability.
- Smart Contracts: Blockchain platforms often support smart contracts, which are self-executing contracts with predefined conditions. Smart contracts automatically enforce and execute the terms of an agreement once the specified conditions are met.

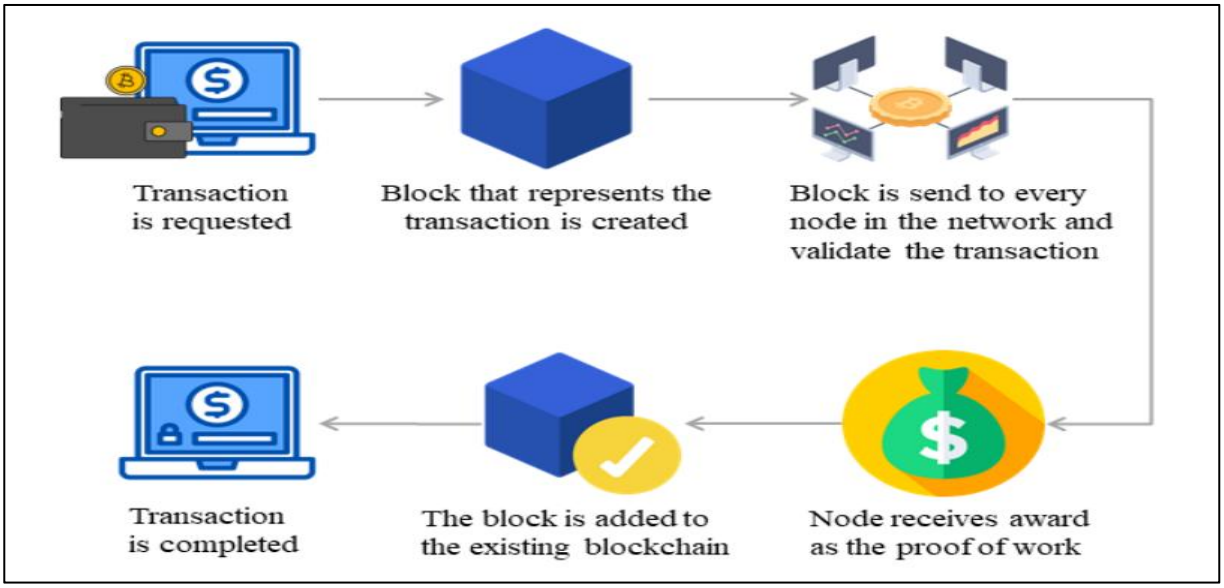

Fig 1.2.3 : Working of Blockchain

1.3 QR Codes

A QR code, short for Quick Response code, is a two-dimensional barcode that consists of a pattern of black squares on a white background. It can store various types of information, such as text, URLs, contact information, or other data.A Static QR Code contains information that is fixed and uneditable once the Code has been generated.

The basic working of a QR code involves the following steps:

- Encoding: To create a QR code, a specific encoding algorithm is used to convert the desired data into a QR code pattern. This encoding process varies based on the type of information being stored. For example, if it's a URL, the encoding algorithm would convert the URL into a format that can be represented by the QR code pattern.
- Pattern Generation: The encoded data is then translated into a pattern of black squares and white spaces, following the specifications of the QR code standard. The pattern is structured into multiple alignment patterns, timing patterns, and data modules, forming a square grid.
- Error Correction: To enhance reliability, error correction codes are added to the QR code. These codes allow for the recovery of data even if the QR code is partially damaged or obscured. The level of error correction can be adjusted to balance the amount of data storage capacity and error recovery capability.
- Printing or Displaying: Once the QR code is generated, it can be printed on various media or displayed on electronic screens. The QR code can be scaled and resized as needed, while still retaining its readability by scanning devices.
- Scanning: To read the information stored in a QR code, a QR code scanner or reader is used. Most smartphones have built-in QR code scanning capabilities through their cameras. When the scanner app is activated, the user aligns the camera with the QR code, and the scanner captures an image of the code.
- Decoding: The scanned image is processed by the QR code scanner software, which extracts the pattern of the QR code from the image. The software then analyzes the pattern, decodes the encoded data, and retrieves the information stored in the QR code.
- Action or Display: Once the data is decoded, the QR code scanner software can perform various actions based on the type of information stored. For example, if it's a URL, the scanner may open a web browser and navigate to the website. If it's contact information, it may prompt the user to add the contact to their address book.

QR codes are widely used for various purposes, such as marketing, product information, payment systems, event ticketing, and more. They provide a convenient way to store and retrieve data quickly and accurately using smartphones or other scanning devices.

1.3.1 Anatomy of QR Codes

A QR Code reminds one of complex matrix of black and white squares. Though looking like a pixelated image, each one of those squares is actually a marker serving a greater function in the information-sharing capabilities of the Code.

- Positioning detection markers :

  Located at three corners of each code, it allows a scanner to accurately recognize the Code and read it at high speed, while indicating the direction in which the Code is printed. They essentially help quickly identify the presence of a QR Code in an image and it's orientation.

  Alignment markings

  Smaller than the position detection markers, they help straighten out QR Codes drawn on a curved surface. And, the more information a Code stores, the larger it is and the more alignment patterns it requires.

- Timing pattern:

  Alternating black/white modules on the QR Code with the idea of accurately helping configure the data grid. Using these lines, the scanner determines how large the data matrix is.

Fig 1.3.1.1: Positioning detection markers

Fig 1.3.1.2: Timing pattern

- Alignment markings:

  Smaller than the position detection markers, they help straighten out QR Codes drawn on a curved surface. And, the more information a Code stores, the larger it is and the more alignment patterns it requires

- Version information:

  With currently 40 different QR Code versions, these markers specify the one that is being used. The most common ones are versions 1 to 7.

Fig 1.3.1.3: Alignment markings

Fig 1.3.1.4: Version information

- Format information:

  The format patterns contain information about the error tolerance and the data mask pattern and make it easier to scan the Code.

- Data and error correction keys:

  The error correction mechanism inherent in the QR Code structure is where all your data is contained, also sharing the space with the error correction blocks that allow up to 30% of the Code to be damaged.

Fig 1.3.1.5: Format Information

Fig 1.3.1.6: Data and error correction keys

- Quiet zone:

  This is similar to the importance of white space in design, that is it offers structure and improves comprehension. For whom or what you may ask? For the scanning program. In order to distinguish the QR Code from its surroundings, the quiet zone is vital.

Fig 1.3.1.7 : Quite zone

CHAPTER 2

LITERATURE SURVEY

2.1 Fake Product Detection System Using Blockchain

Published on: Dec 2022

Authors: Aadeesh Bali, Amrit Singh and Sunandan Gupta

Summary: One of the biggest challenges in today's retail market is the counterfeiting of products. Counterfeiting is a significant challenge in today's retail market, where low-quality copies of genuine brands flood the market. Various methods have been employed to combat counterfeiting, including RFID tags, artificial intelligence, machine learning, and QR code-based systems. However, each method has its drawbacks. QR codes, for example, can be replicated from genuine products to fake ones, while AI and machine learning require substantial computational power. Despite these attempts, a comprehensive solution has not yet been developed. To address this issue, our project focuses on leveraging blockchain technology to enhance fake product detection. Our approach involves storing the supply chain information of products at every stage of their transaction using QR codes. By employing a blockchain-based system, we create a decentralized infrastructure that offers several advantages. Most notably, blockchain ensures that once data is recorded, it becomes immutable, making it highly secure and safeguarded against tampering by third parties. Each product is assigned a unique QR code that holds critical information about its journey through the supply chain, such as the manufacturer, production date, location, and significant checkpoints. When a product is sold or transferred to a new party, the transaction is recorded on the blockchain, creating an unalterable record of its movement and preserving the authenticity and integrity of the supply chain data. The decentralized nature of blockchain ensures that no single entity possesses control over the data, safeguarding it against unauthorized manipulation attempts. Moreover, the transparency provided by blockchain allows consumers and stakeholders to verify the authenticity of a product by scanning its QR code and accessing the corresponding supply chain information. This empowers them to make informed decisions and avoid purchasing counterfeit goods. However, implementing a blockchain-based solution for supply chain management does present challenges. Scalability is a concern, as blockchain networks can face difficulties handling a large volume of transactions, which is crucial in the retail market. Achieving widespread adoption and integration across the industry requires collaboration

among manufacturers, distributors, retailers, and other stakeholders. Furthermore, ensuring the accuracy and reliability of the data initially inputted into the blockchain is vital for maintaining the system's integrity. Finally, the cost of implementing and maintaining a blockchain infrastructure must be considered. Despite these challenges, the use of blockchain technology holds promise in detecting fake products and enhancing supply chain transparency. As the technology continues to evolve and industries increasingly embrace its potential, we can anticipate further advancements in leveraging blockchain for anti-counterfeiting efforts in the retail market.[1]

2.2 Fake Product Detection Using Blockchain Technology

Published in: July 2022

Authors: Nruthya Ganapathy B, Keerthan Kumar, Poojary Shreya Jaya, Rajath D Shetty, Dr. Shreekumar

Summary: The manufacturing and marketing of counterfeit products pose significant risks to end users, including financial, health, and safety threats. It also negatively impacts the original manufacturers and businesses, leading to revenue loss, product defamation, downtime, and additional expenses in fighting counterfeits. To address these detrimental effects, a blockchain-based system is employed to identify original products and detect duplicates, ensuring the authenticity of goods. In this project, the use of QR codes and barcodes, enabled by emerging wireless technology trends, plays a crucial role in combating counterfeiting practices. By leveraging camera scanners, the system scans the QR or barcode on a product, linking it to a blockchain database that stores the product details and a guaranteed unique code for each item. When a customer scans the code, the system checks if it matches the stored code in the database. If there is a match, a notification is sent to the customer, indicating the authenticity of the product. However, if the scanned code does not match the code in the database, a notification is sent to the customer, informing them that the product is fake or counterfeited. Additionally, the system notifies the manufacturer about the place of purchase if the customer accepts the request made by the application. This approach reduces the reliance of consumers solely on merchants to determine the authenticity of products. By utilizing the blockchain's decentralized and immutable nature, customers can independently verify the genuineness of goods through the provided notifications. Implementing such a system helps protect consumers from counterfeit products, ensuring their safety and well-being. It also assists original

manufacturers in safeguarding their reputation, revenue, and business growth by minimizing the negative impacts caused by counterfeiting practices.[2]

2.3 Fake Product Identification Using Blockchain

Published in : June 2022

Authors : Pooja K, Prof. Alamma B H

Summary : In the current supply chain landscape, the presence of counterfeit items poses a significant challenge. To address this issue, it is crucial to establish a system that enables end users to access comprehensive data about the products they intend to purchase, thereby allowing them to verify the authenticity of the items. Blockchain technology, with its decentralized and immutable characteristics, offers a suitable solution. Blockchain functions as a network of peer-to-peer nodes that maintain a record of transactions, known as blocks, forming chains within various databases. This storage mechanism is often referred to as a "digital ledger." Our system utilizes IPFS (InterPlanetary File System), a Distributed Web File System, to track the ownership of products. IPFS is advantageous over HTTP because it efficiently distributes large amounts of data and prevents duplication. The combination of IPFS and blockchain yields several benefits. IPFS enables the handling of substantial data volumes and allows the embedding of immutable, persistent IPFS links in blockchain transactions. This ensures the protection and timestamping of content without the need to store all the data on the blockchain itself. The system implemented keeps track of the product's manufacturer and the subsequent changes in ownership. It provides customers with a Graphical User Interface (GUI) that allows them to scan QR codes associated with products. Upon scanning, relevant information about the products is displayed to the customers. This approach empowers customers to make informed decisions by accessing transparent and reliable information about the products they intend to purchase. By leveraging blockchain and IPFS, the system ensures the integrity and traceability of product ownership, enhancing trust and reducing the risk of counterfeit purchases. The inclusion of a user-friendly GUI simplifies the process for customers, enabling them to conveniently scan QR codes and access product information, further enhancing the user experience.Therefore by leveraging blockchain, IPFS, and a user-friendly interface, the proposed system enhances transparency and empowers customers to verify product authenticity, thereby addressing the issue of counterfeit items in the supply chain.[3]

2.4 Fake Product Detection Using Blockchain Technology

Published in : 2021

Authors : Tejaswini Tambe ,Sonali Chitalkar, Manali Khurud , Madhavi Varpe , S. Y. Raut

Summary : Blockchain technology serves as a distributed and decentralized digital ledger that securely stores transactional information across multiple connected databases in the form of blocks and chains. Its inherent security features make it resistant to modification or tampering. By leveraging blockchain, customers no longer need to rely solely on third-party validation for product safety assurance. In this project, the utilization of Quick Response (QR) codes, in conjunction with emerging mobile and wireless technology trends, offers a robust approach to combat product counterfeiting. Counterfeit products are identified through the use of a QR code scanner, which links the QR code of a product to a blockchain. The blockchain serves as a database to store product details and unique codes generated for each product, represented as blocks. The system operates by collecting the unique code from the user and comparing it against the entries in the blockchain database. If the code matches an entry in the blockchain, a notification is sent to the customer, confirming the authenticity of the product. Conversely, if the code does not match any entry in the blockchain, a notification is issued to the customer indicating that the product is fake. By implementing this system, customers can independently verify the authenticity of products by scanning the QR code and relying on the blockchain's immutable and secure nature. This approach enhances trust and enables consumers to make informed purchasing decisions, while also deterring counterfeiters. By integrating QR codes and blockchain technology, the project provides a reliable and efficient means to detect counterfeit products. It empowers customers with immediate notifications regarding product authenticity, contributing to a safer and more secure retail market.[4]

2.5 Blockchain In Fake Product Identification System Using QR code

Published in : 2020

Authors : Udhaya Nila and Abalin Luther Aathi Vignesh

Every popular brand has fake manufacturers selling a counterfeited item at cheaper rates. Mostly Counterfeiting of medicines poses a significant threat to public health, and incorporating blockchain technology can provide an effective and comprehensive approach to address this issue. Pharmaceutical organizations encounter numerous challenges in detecting and combating counterfeit medicines, making it crucial to enhance security measures in the distribution of legitimate pharmaceutical products. By leveraging blockchain technology, the

entire journey of a medicine from manufacturing to the end user can be recorded and validated, ensuring transparency and authenticity throughout the supply chain. This provides users with the assurance that the scans they perform to verify the product's authenticity are not manipulated or falsified. The implementation of a QR code system enables the identification of counterfeit products. Each medicine is assigned a unique QR code that carries relevant product data, such as manufacturing details, batch number, and expiration date. When a user scans the QR code, the blockchain system retrieves and verifies the information associated with that specific medicine. If the product data matches the records stored on the blockchain, the user is assured of its authenticity. Conversely, if discrepancies or inconsistencies are detected, it indicates the presence of a fake or counterfeit product. By employing blockchain and QR codes, the system improves traceability and accountability in the pharmaceutical supply chain. It enables the verification of product authenticity at any point in the distribution process, providing a reliable means to combat counterfeit medicines. This approach enhances patient safety, safeguards public health, and fosters trust in the pharmaceutical industry. It's important to note that implementing such a system requires collaboration and cooperation among pharmaceutical manufacturers, distributors, and regulatory authorities. Additionally, measures need to be taken to ensure the secure and accurate recording of product data on the blockchain to maintain the integrity of the system. Therefore, combination of blockchain technology and QR codes offers a robust solution to tackle counterfeit medicines. By leveraging the decentralized and immutable nature of blockchain, along with the ease and accessibility of QR codes, it becomes possible to establish a comprehensive and efficient approach in the fight against counterfeit pharmaceutical products.[5]

CHAPTER 3

EXISTING SYSTEM AND PROPOSED SYSTEM

3.1 EXISTING SYSTEM

1. Dec 2022-Fake Product Detection System Using Blockchain : This project aims to combat the issue of fake products by utilizing blockchain technology. The supply chain of each product is stored at every stage of its transaction using QR codes. Tools such as Ganache, metamark, Truffle suite, Node.js, and Solidity are employed to develop the system. By leveraging blockchain's transparency and immutability, this solution provides a reliable means of tracking and verifying product authenticity.
2. July 2022-Fake Product Detection Using Blockchain Technology : In this project with massive emerging trends in wireless technology, QR codes and Barcodes provides a technique to cut down the practice of counterfeiting the products.With the emergence of wireless technology, this project focuses on utilizing QR codes and barcodes to tackle the problem of counterfeiting. By leveraging blockchain technology, the system aims to enhance the authentication process and reduce instances of fake products. QR codes and barcodes provide a robust and efficient method for identifying and validating product authenticity.
3. June 2022-Fake Product Identification Using Blockchain : This project employs blockchain technology and the InterPlanetary File System (IPFS) to detect fake products. The system tracks product ownership and ensures the integrity of the supply chain using the distributed web file system provided by IPFS. By leveraging blockchain and IPFS, the project aims to provide a secure and transparent solution for identifying counterfeit products.
4. 2021-Fake Product Detection Using Blockchain Technology : In this project, in response to the increasing prevalence of counterfeiting, this project utilizes QR codes and the SHA-256 algorithm along with blockchain technology. By leveraging the robustness of QR codes and the cryptographic security of the SHA-256 algorithm, the system provides a reliable means of detecting and combating fake products.
5. 2020- Blockchain In Fake Product Identification System Using QR code : Focusing on the identification of medication authenticity, this project utilizes blockchain technology and QR codes. The system records the journey of the product from the manufacturer to the user,

6. ensuring transparency and reliability. By utilizing QR codes for product data handling, the system enables users to verify the authenticity of scanned products and detects counterfeit items.

3.2 DISADVANTAGES OF EXISTING SYSTEMS

The disadvantages of the existing system are listed below:

- Checking for counterfeit goods only at the manufacturing level.
- Lack of Transparency: The existing system for product identification and verification often lacks transparency. Consumers have limited access to reliable information about the authenticity of products, making them vulnerable to purchasing counterfeit goods.
- Inefficient Tracking: Without a robust system in place, it becomes challenging to track the entire supply chain and trace the origin of products. This lack of traceability increases the risk of counterfeit products entering the market unnoticed.
- Limited Authentication Methods: Existing systems may rely on traditional authentication methods, such as serial numbers or labels, which can be easily replicated or tampered with by counterfeiters. This limitation undermines the effectiveness of product verification.
- Consumer Risk: Consumers bear the risk of unknowingly purchasing counterfeit products, leading to financial loss, compromised safety, and reduced trust in the marketplace. The absence of a reliable authentication system puts the burden on consumers to differentiate genuine and fake products.

3.3 PROPOSED SYSTEM

- The proposed system aims at addressing the issue of fake products by implementing a system using blockchain technology and unique QR codes. It is designed to be utilized by users at various levels of the supply chain, including manufacturers, sellers, and consumers.
- At the manufacturing stage, a unique QR code is generated for each product, which serves as the product's identifier. This QR code contains the Product ID, providing a specific and traceable reference for the product.
- The generated QR codes are stored in the blockchain network, taking advantage of its decentralized and immutable nature. This ensures that the QR codes and associated product information cannot be altered or replaced, preventing sales malpractices and guaranteeing the integrity of the product data.
- Throughout the product's lifecycle, data is continuously added to the blockchain network, allowing for comprehensive tracking of the product from its origin. This tracking is made possible through the QR code generated by the manufacturer, which serves as a reliable means of identifying and verifying the product's authenticity.
- Both sellers and consumers can leverage the system to verify whether a product is counterfeit or authentic by simply scanning the QR code on the product. This process enables quick and convenient validation, ensuring that consumers can make informed purchasing decisions and reducing the risk of falling victim to counterfeit products.
- By utilizing blockchain technology and unique QR codes, this project offers a robust and efficient solution for the identification and elimination of fake products from the market. It enhances transparency, traceability, and trust within the supply chain, ultimately safeguarding consumers and promoting the sale of genuine products.
- With the implementation of this system, the project aims to significantly reduce and eliminate counterfeit products from the market. The combination of unique QR codes and blockchain technology provides a robust defense against counterfeiting practices, ensuring that only genuine products are traded and consumed.
- Therefore, this project proposes a comprehensive solution for identifying and eliminating fake products using blockchain technology and unique QR codes. By providing transparency, traceability, and verification capabilities, the system empowers manufacturers, sellers, and consumers to make informed decisions and create a more secure marketplace.

3.4 ADVANTAGES OF PROPOSED SYSTEM

Advantages of the proposed system are listed below :

- Enhanced Transparency: The proposed system leverages blockchain technology, providing a transparent and immutable record of product information. This transparency allows consumers to verify the authenticity of products by accessing reliable and tamper-proof data on the blockchain.
- Efficient Tracking: By utilizing QR codes and blockchain, the proposed system enables efficient tracking of products throughout the supply chain. Manufacturers, sellers, and consumers can easily trace the product's journey, ensuring its legitimacy and minimizing the risk of counterfeit goods.
- Secure Authentication: The integration of QR codes and blockchain technology offers a robust authentication method. QR codes provide a unique identifier for each product, while blockchain ensures the integrity and immutability of the associated data. This combination enhances the security and reliability of product verification.
- Consumer Empowerment: The proposed system empowers consumers by providing them with a means to verify the authenticity of products before making a purchase. By scanning the QR code and accessing the blockchain records, consumers can make informed decisions, mitigating the risk of buying counterfeit goods and protecting their interests.
- Counterfeit Elimination: With the ability to track products from their origin, the proposed system contributes to the reduction and elimination of counterfeit products from the market. By establishing a transparent and trustworthy ecosystem, the system deters counterfeiters and safeguards the reputation of genuine manufacturers and sellers.
- Improved Consumer Trust: By implementing a reliable product identification system, the proposed solution enhances consumer trust in the e-commerce marketplace. Consumers can confidently purchase products, knowing that they are authentic and meet their expectations, fostering long-term trust and loyalty..

CHAPTER 4

METHODOLOGY

4.1 IMPLEMENTAION

- The methodology for the fake product identification project using blockchain and QR code involves several steps. Which includes designing and developing of a blockchain-based system that can authenticate products using QR codes. The system should be decentralized, secure, and transparent to ensure that all stakeholders can trust it.
- Firstly for the user interface, NodeJs , HTML,CSS have been used.The user interface includes the frontend for the user to operate and backend for storing the user history,login details etc. JavaScript is used for the linking of the web pages to each other.
- Second step is creating and building smart contracts. Smart contracts are like contracts/ agreements which are simple programs in blockchain that are executed when the predefined conditions or rules are satisfied. For creating this smart contract, we will be using selenium.
- Third step involves the compilation of the website and the smart contracts, for that we are using the Truffle smart contract framework. Truffle acts as an interface for connecting the webpages and the smart contracts.Truffle is a world-class development environment, testing framework and asset pipeline for blockchains using the Ethereum Virtual Machine (EVM), aiming to make life as a developer easier.

Fig 4.1.1: Requirements for personal Etherium Blockchain creation

- Fourth step is to test the website after linking it to the the smart contracts. For this, we use Ganache, which is a component of Truffle. Ganache creates an alternative environment for the testing of the website as deploying it in real time would be very expensive. Ganache also provides the ethereum coins. Ethereum is a decentralized blockchain platform that establishes a peer-to-peer network that securely executes and verifies application code, called smart contracts.
- The fifth step involves the storing of the ethereum coins gained by the user, This is achieved by creating a wallet to store the coins and keep a track of the user history. These ethereum coins are stored using MetaMask. MetaMask is a software cryptocurrency wallet used to interact with the Ethereum blockchain. It allows users to access their Ethereum wallet through a browser extension or mobile app, which can then be used to interact with decentralized applications.
- The last step includes the connecting of the wallet and Ganache together and finally compiling it using the Truffle framework. Hence, in short fake product identification project using blockchain and QR code involves designing and developing a decentralized system, creating a database of authentic products, educating stakeholders, integrating the system with the manufacturing process, and evaluating the effectiveness of the system.

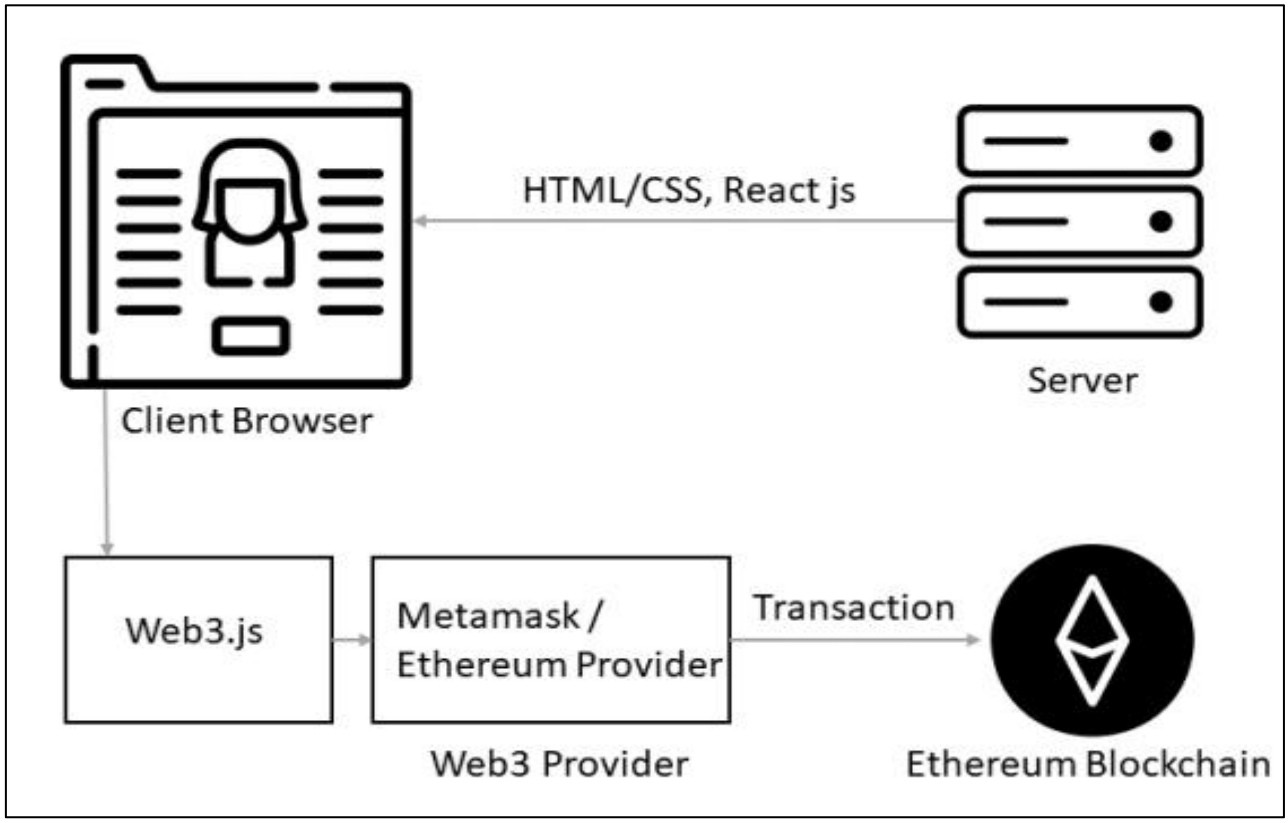

Fig 4.1.2: System Architecture

4.2 WORKING

- Firstly the users are divided into three categories, which are, Manufacturer, Seller, Consumer. Manufacturer is the one who manufactures and makes the products,i.e, Seller is the middlemen who operates between the manufacturer and the consumer. The seller buys the products from the manufacturer and sells it to the consumer. The consumer is the ultimate user of the product who purchases it from the seller.

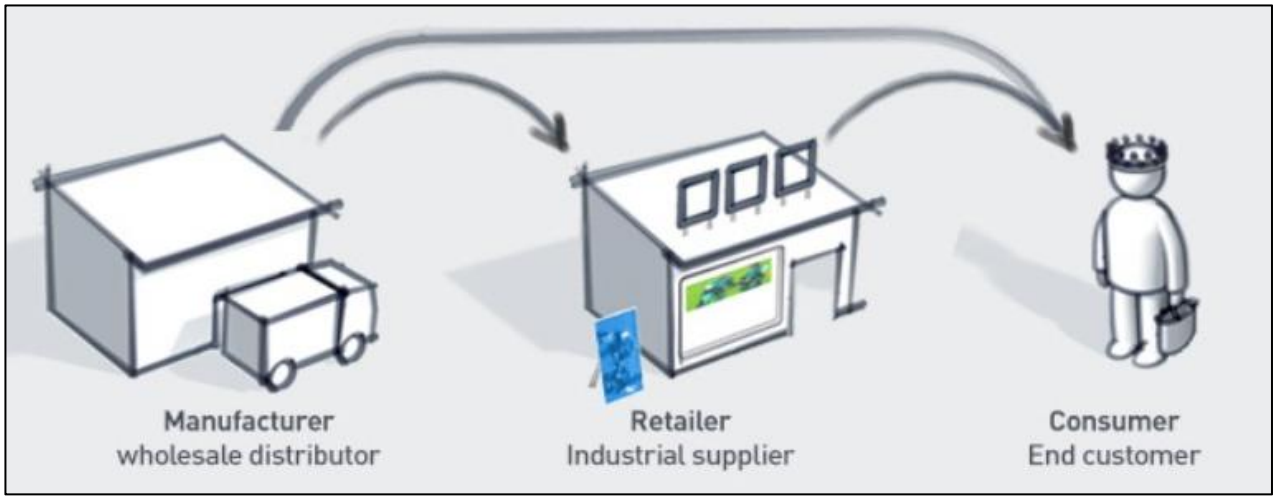

Fig 4.2.1: User categories

- The users will have to login to the website with their user credentials if they already have an account else the option for creating an account is provided wherein the user can register or sign up.
- The manufacturers part includes the following operations: Add product, Add seller, Sell Product to Seller and Query seller.
    - Add Product: Manufacturers can log into their accounts and add product details. This includes information such as the product's serial number, price, brand, and any other relevant details. These details are important for tracking and verifying the authenticity of the product.
    - Add Seller: Manufacturers can add authorized sellers to their supply chain. This step ensures that only approved sellers can sell the manufacturer's products.
    - Sell Product to Seller: Once a product is manufactured and its details are added, the manufacturer can sell the product to a registered seller. This transaction involves associating the product's serial number with the specific seller who will be responsible for selling it to consumers.

  - Query Seller: Manufacturers can check the number of connections they have with different sellers. This operation helps manufacturers keep track of their distribution network and relationships with various sellers.

- The seller part includes the following operations: Sell product to consumer and Products for sale.
  - Sell Product to Consumer: Sellers, after purchasing products from the manufacturer, can list the products they have for sale. When a consumer wants to purchase a product, the seller can initiate the transaction using the product's serial number obtained from the QR code. This process ensures that the seller can only sell genuine products associated with their account.
  - Products for Sale: Sellers can view and manage the products they have available for sale. This feature enables sellers to keep track of their inventory and monitor which products have been sold and which are still available.
- The consumers part includes the following operations: Consumer purchase history, Product verification.
  - Consumer Purchase History: Consumers can access their accounts and view their purchase history. This feature allows consumers to review their previous activities, track their orders, and obtain details of the products they have purchased.
  - Product Verification: To ensure the authenticity of a purchased product, consumers can verify it using the QR code provided on the product's packaging. By scanning the QR code, the consumer obtains the product's serial number and can compare it with the manufacturer's and seller's records stored on the blockchain. If the serial number matches, the product is considered authentic, providing the consumer with confidence in their purchase..
- For the above procedure, the QR Codes generated and used will be stored on the ethereum blockchain network. By using the truffle framework and ganache ,the product details will be stored and can be verified. Hence if the product is replaced or altered ,it could be easily identified and informed to the consumer.Therefore, in simple words,
  - Each product is assigned a unique QR code during the manufacturing process, containing essential information such as the product's serial number.
  - The QR codes and corresponding product details are stored on the Ethereum blockchain network, leveraging its decentralized and immutable nature.
  - The Truffle framework and Ganache are utilized to interact with the blockchain network, ensuring the integrity and security of the product information.

- Whenever a product is scanned for verification, the QR code is read, and the product's serial number is cross-referenced with the information stored on the blockchain. This process enables the detection of any product replacements or alterations, allowing the consumer to make informed decisions.

- The below diagram shows the system workflow of the project for easier understanding and visualization of the above content.It briefly explains about the basic functioning of this project "Counterfeit Product Identifiction Using Blockchain".

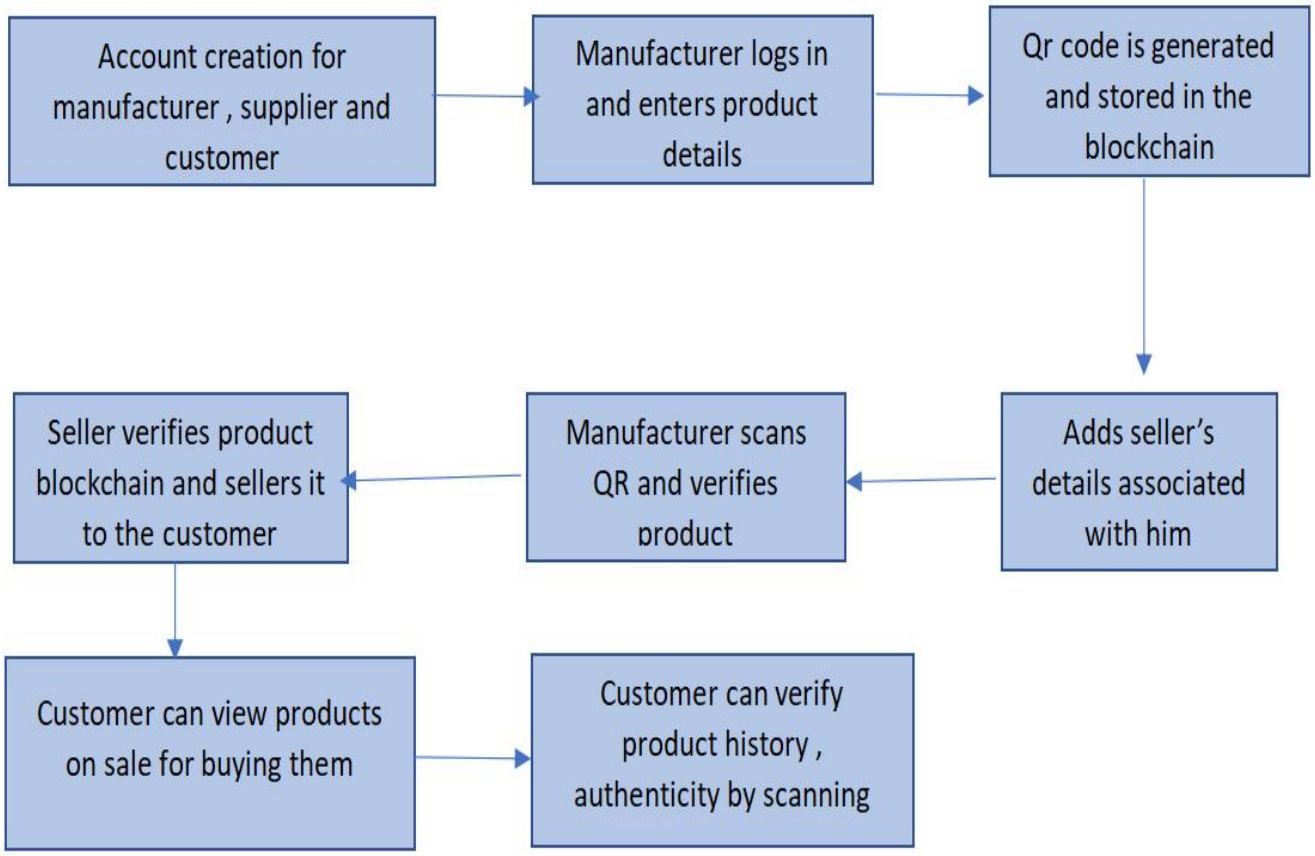

Fig 4.2.2: System Workflow

- The block diagram below illustrates how a product moves from the manufacturer to the consumer while ensuring its authenticity. Thereby preventing consumers from being deceived by fake products. The diagram shows the steps involved, the manufacturer assigns a unique code to each product and records it in a blockchain. As the product moves through the supply chain, participants update the blockchain with its location and status. When a consumer buys the product, they can

scan a QR code to verify its authenticity. The blockchain ensures that the records are trustworthy and cannot be tampered with, giving consumers confidence in their purchases.

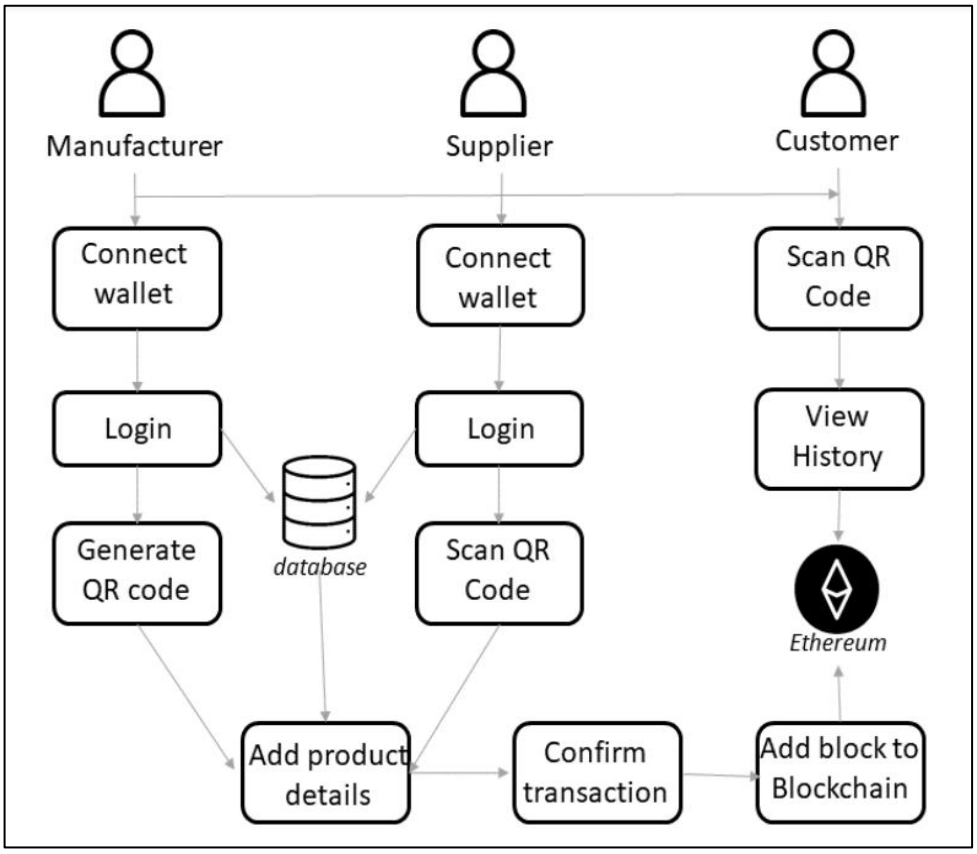

Fig 4.2.3: Block Diagram

CHAPTER 5

HARDWARE AND SOFTWARE REQUIREMENTS

5.1 HARDWARE REQUIREMENTS

The hardware requirements for the project are:

- Computer with the latest specifications
- Scanner or camera for capturing QR codes
- Hard Disk: Minimum 120 GB of storage
- Monitor: 12" LED or higher
- Input devices: Keyboard and Mouse
- RAM: Minimum 4GB

5.2 SOFTWARE REQUIREMENTS

The software requirements for the project are:

- Operating System: Windows 10, 64-bit Operating System
- Coding Language: Python, Selenium
- Integrated Development Environment (IDE): Visual Studio Code or similar
- Anaconda: Python distribution for data analysis and scientific computing
- API: TensorFlow for machine learning, OpenCV for computer vision, and Ethereum blockchain network for blockchain functionality

CHAPTER 6

RESULT ANALYSIS AND OUTPUT

6.1 Result

The results of the project "Counterfeit Product Identification Using Blockchain" have been highly promising. Through the implementation of the system, we have successfully demonstrated the effectiveness of using blockchain technology and unique QR codes for product authentication and counterfeit detection. One of the key results of the project is the successful integration of blockchain technology into the product identification process. The use of blockchain ensures the immutability and transparency of product data, making it highly secure and reliable. By storing product details and transaction history on the blockchain, we can track the entire lifecycle of a product and verify its authenticity at any point in the supply chain.

The implementation of the QR code scanning mechanism has also yielded positive results. By scanning the QR code on a product, users can quickly and easily verify its authenticity. This user-friendly approach has the potential to significantly reduce the risks associated with counterfeit products, as consumers can make informed purchasing decisions based on verified information. Furthermore, the project has successfully demonstrated the ability to identify and flag counterfeit products. By comparing the QR code data with the information stored on the blockchain, the system can detect any inconsistencies or tampering attempts, providing an effective means of counterfeit product detection.

In addition to the technical results, the project has also showcased the potential impact and benefits of using blockchain for counterfeit product identification. The system offers enhanced consumer protection, increased trust in the marketplace, and improved brand reputation. It has the potential to minimize financial losses for both businesses and consumers and contribute to the overall reduction of counterfeit products in the market.

While the project has achieved significant results, it is important to acknowledge that further testing, optimization, and real-world implementation are necessary to fully validate its effectiveness. Collaboration with industry partners and regulatory authorities can help refine the system and address any potential challenges or limitations.

In conclusion, the results of the project "Counterfeit Product Identification Using Blockchain" demonstrate the potential of blockchain technology and QR codes in effectively combating counterfeit products. The system's ability to ensure product authenticity, detect counterfeits, and enhance consumer trust highlights its value in addressing the challenges posed by counterfeit products in various industries.

6.2 Output

The below images are the screenshots of the project implementation.

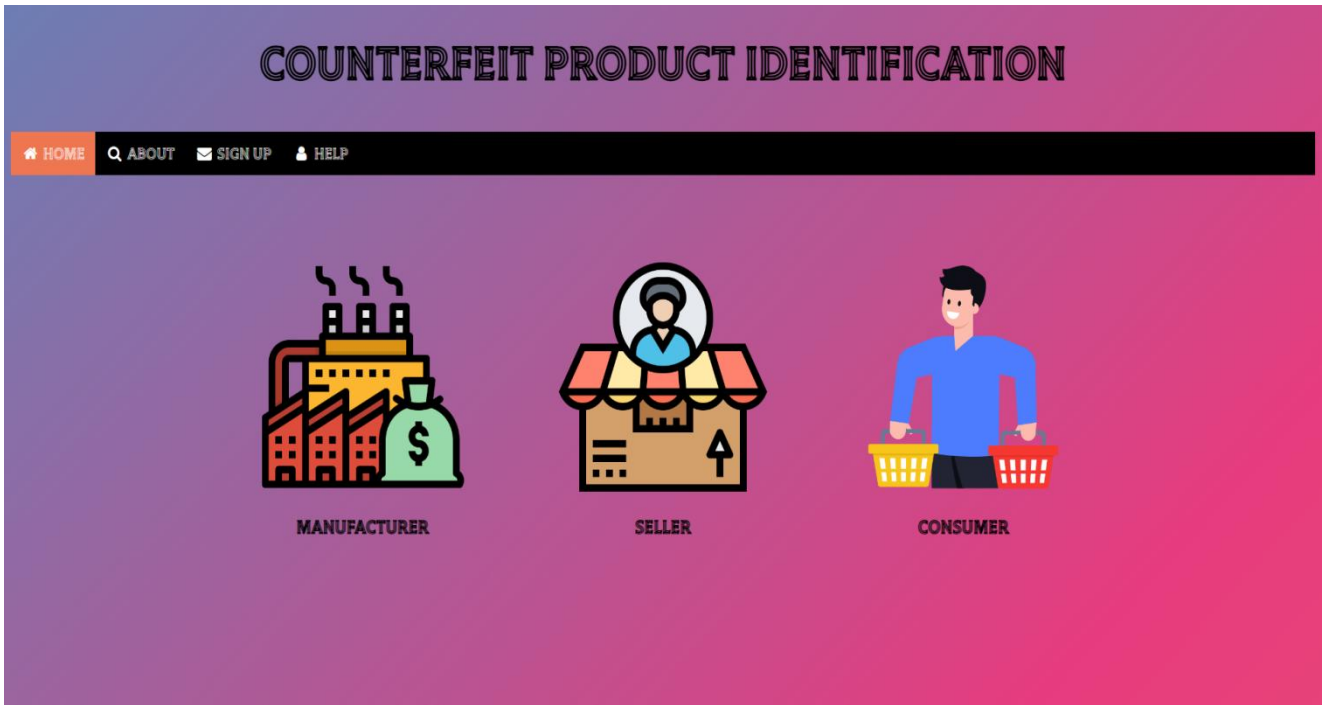

Fig 6.2.1: Home page

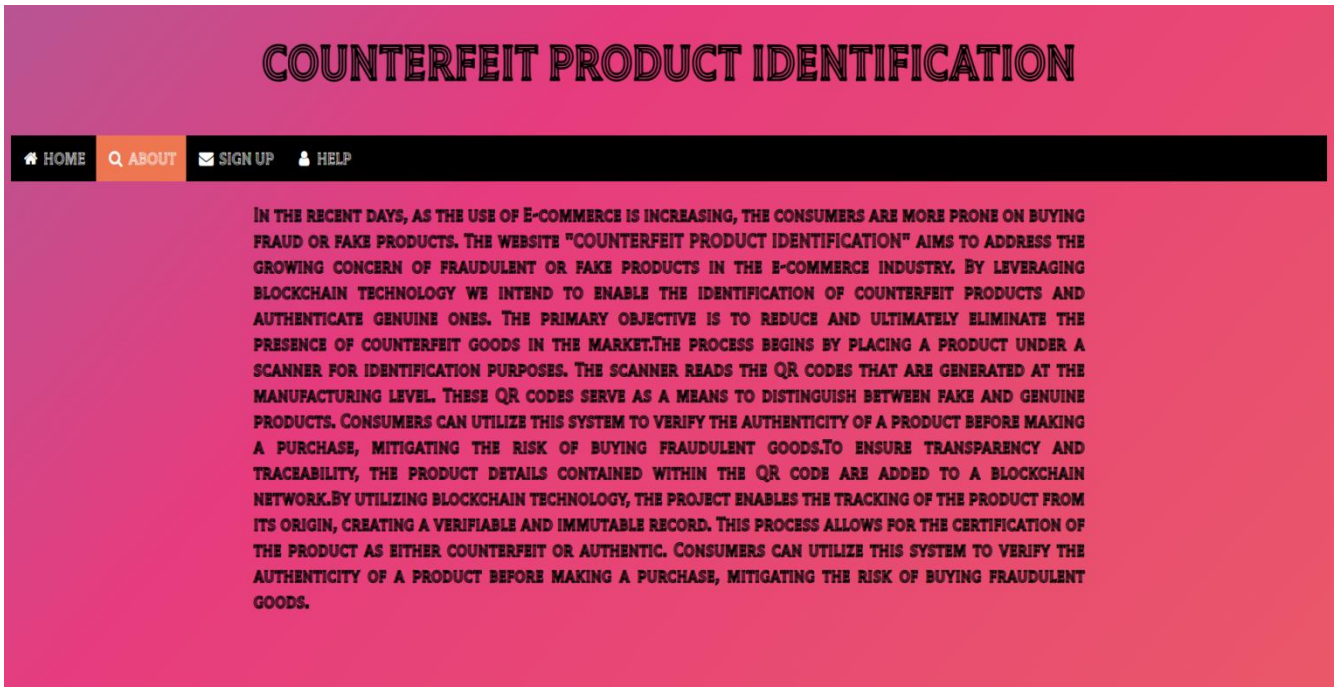

Fig 6.2.2: About the website page

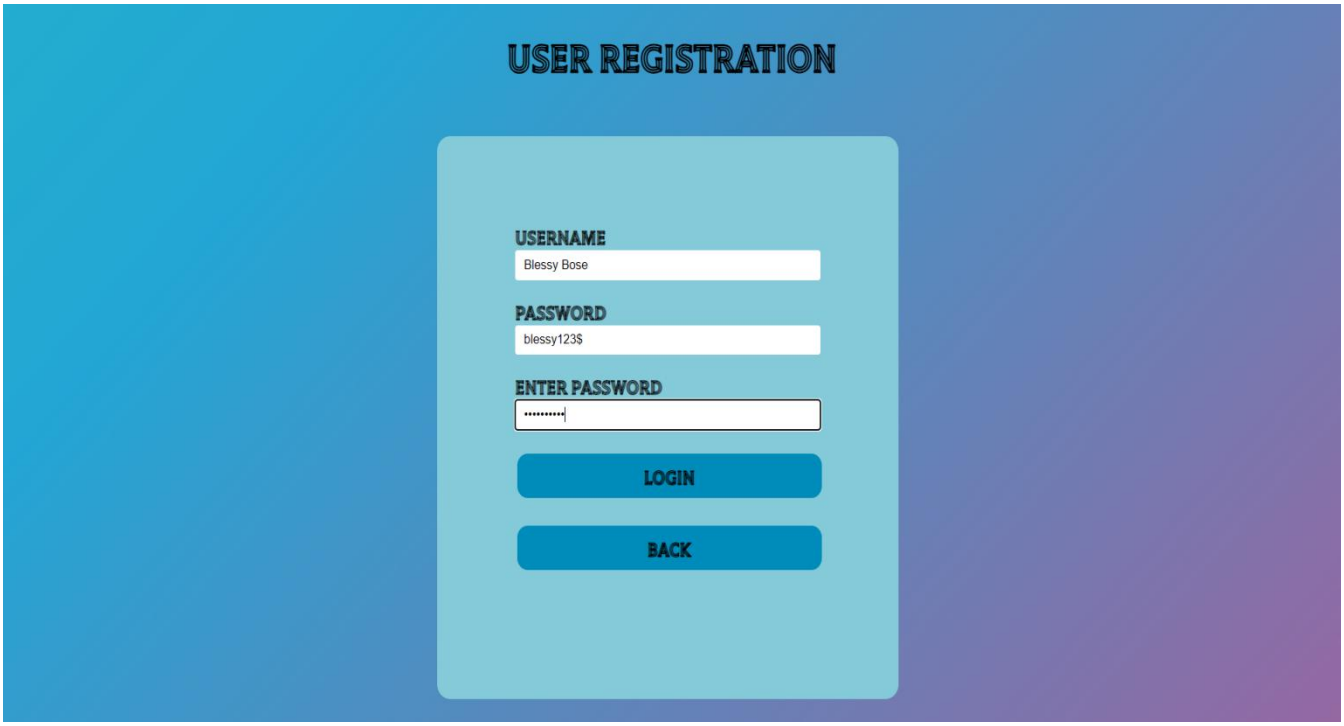

Fig 6.2.3: SignUp page

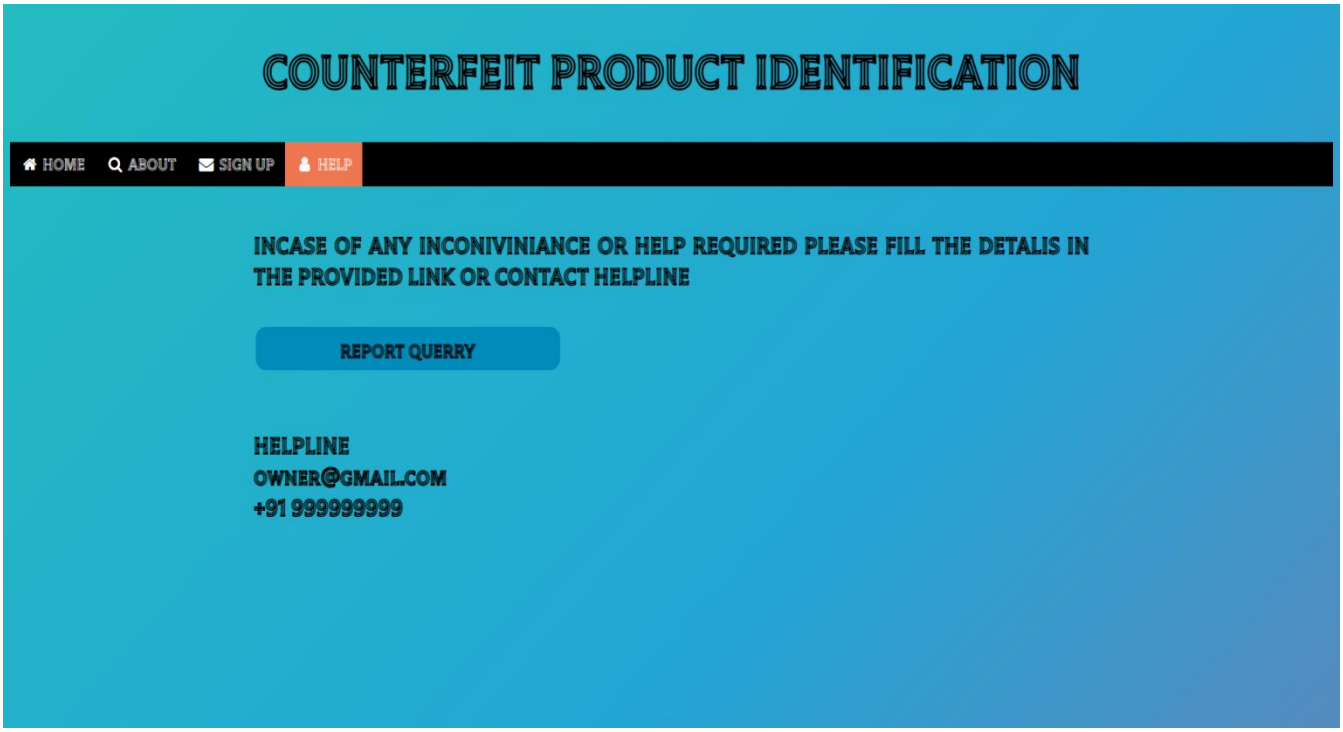

Fig 6.2.4: Help page

Fig 6.2.5 : Manufacturer Login page

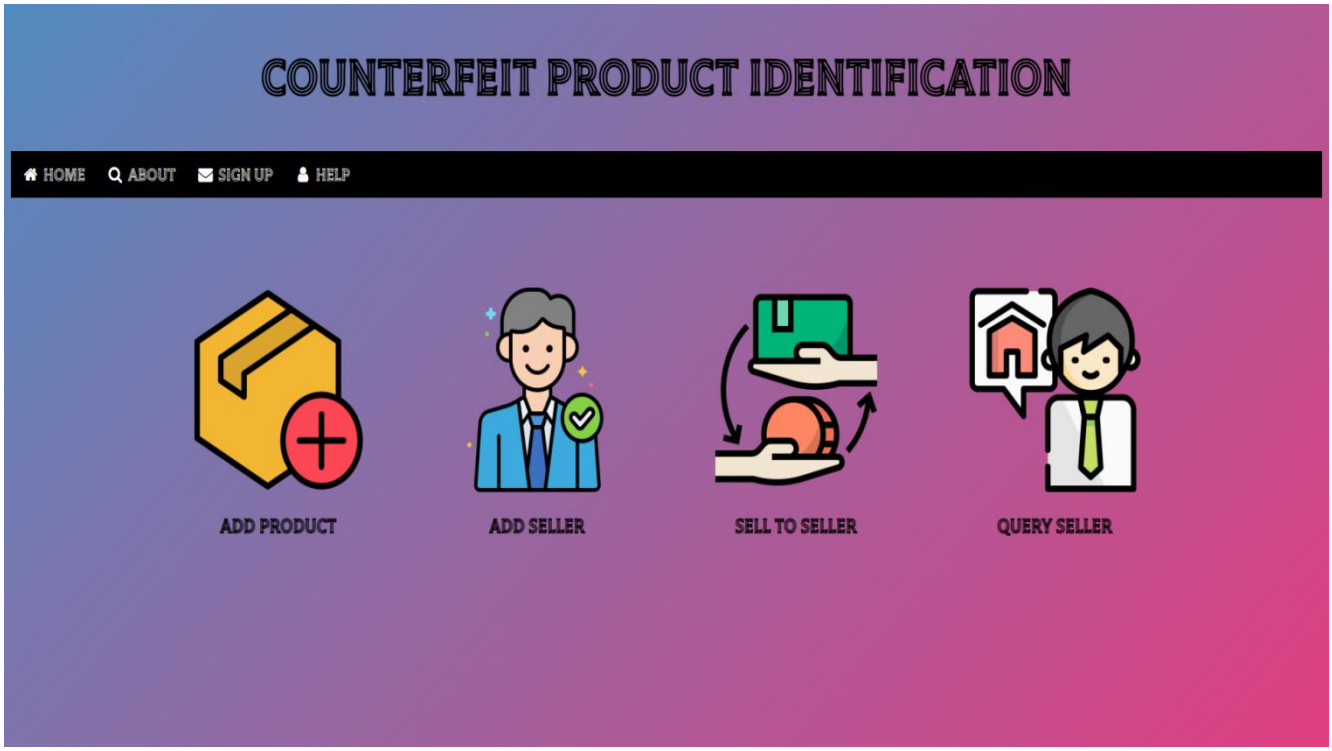

Fig 6.2.6 : Manufacturer page

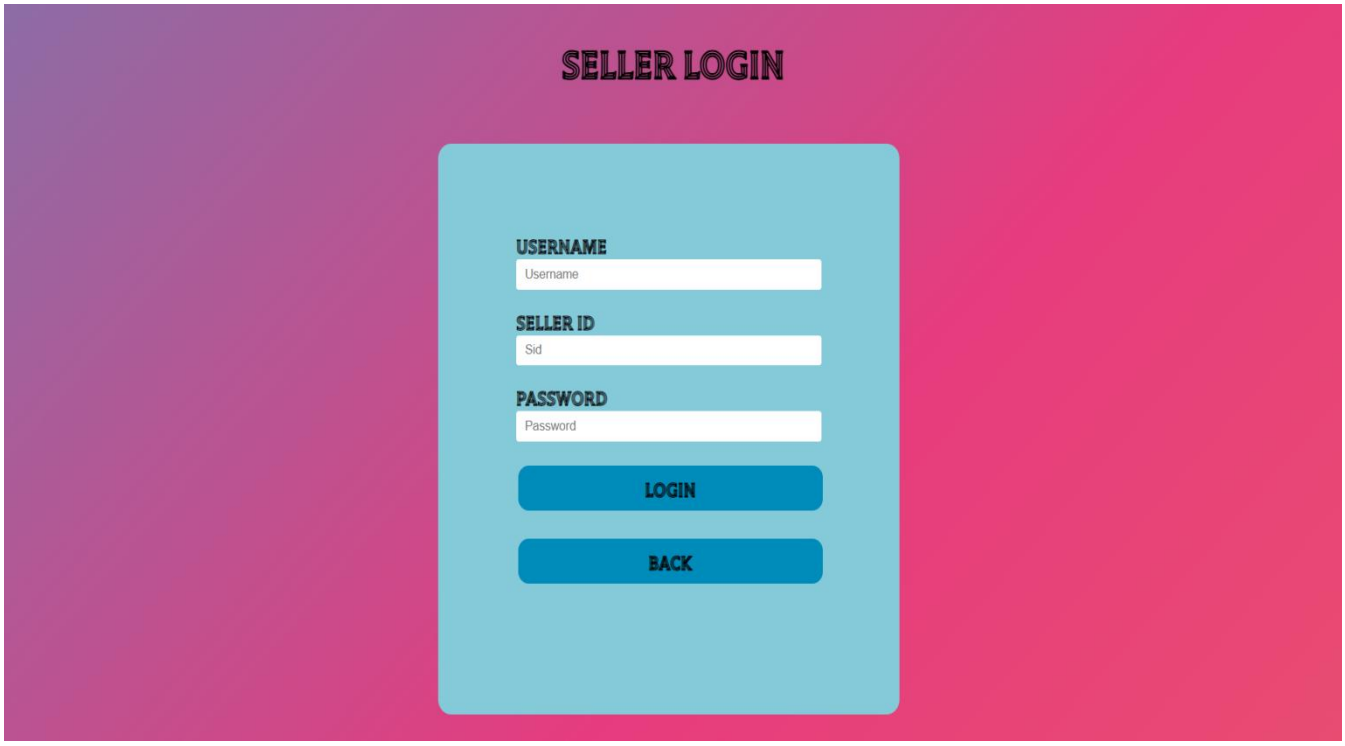

Fig 6.2.7 : Seller Login page

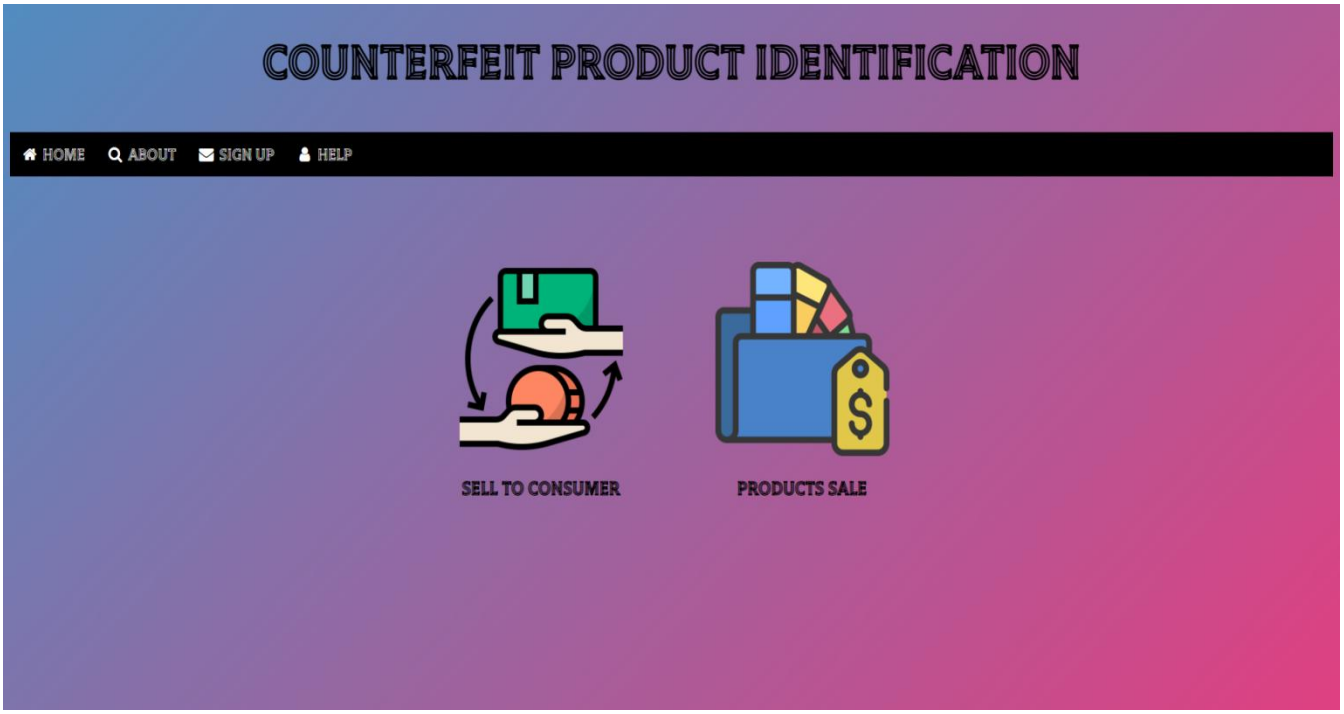

Fig 6.2.8 : Seller page

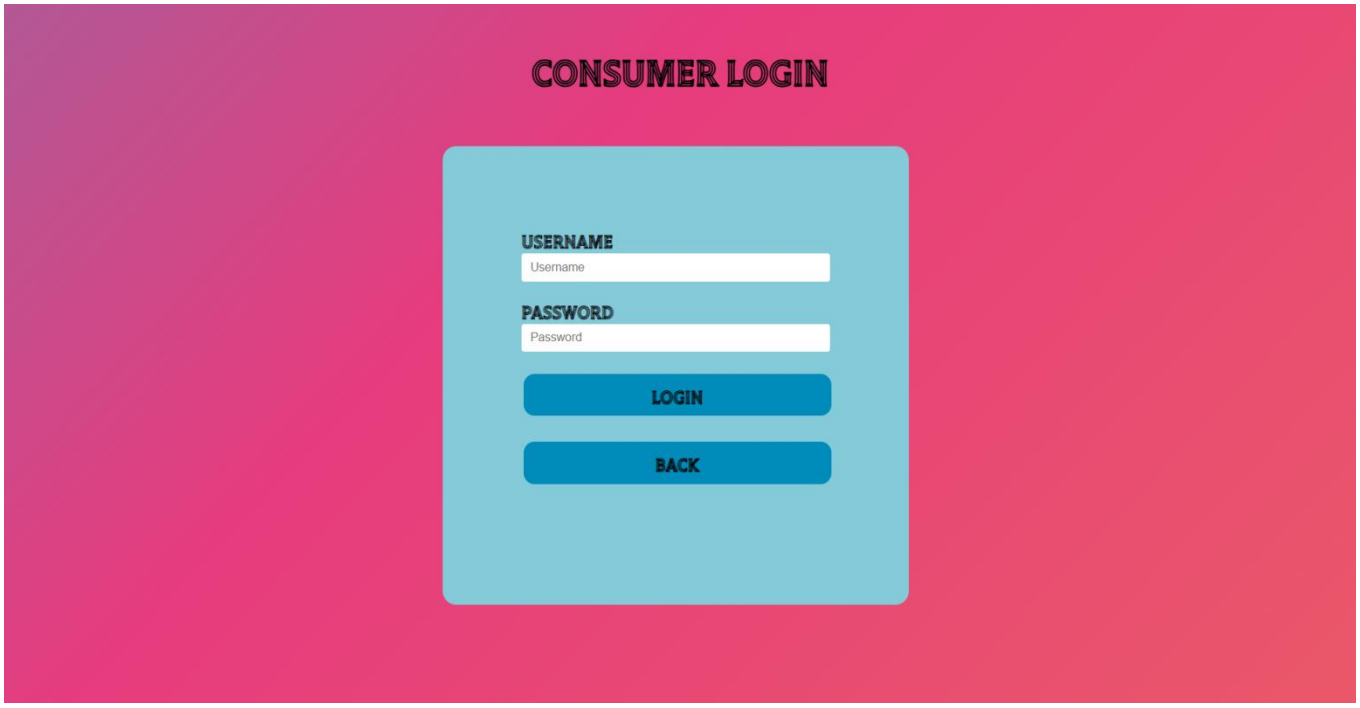

Fig 6.2.9 : Consumer Login page

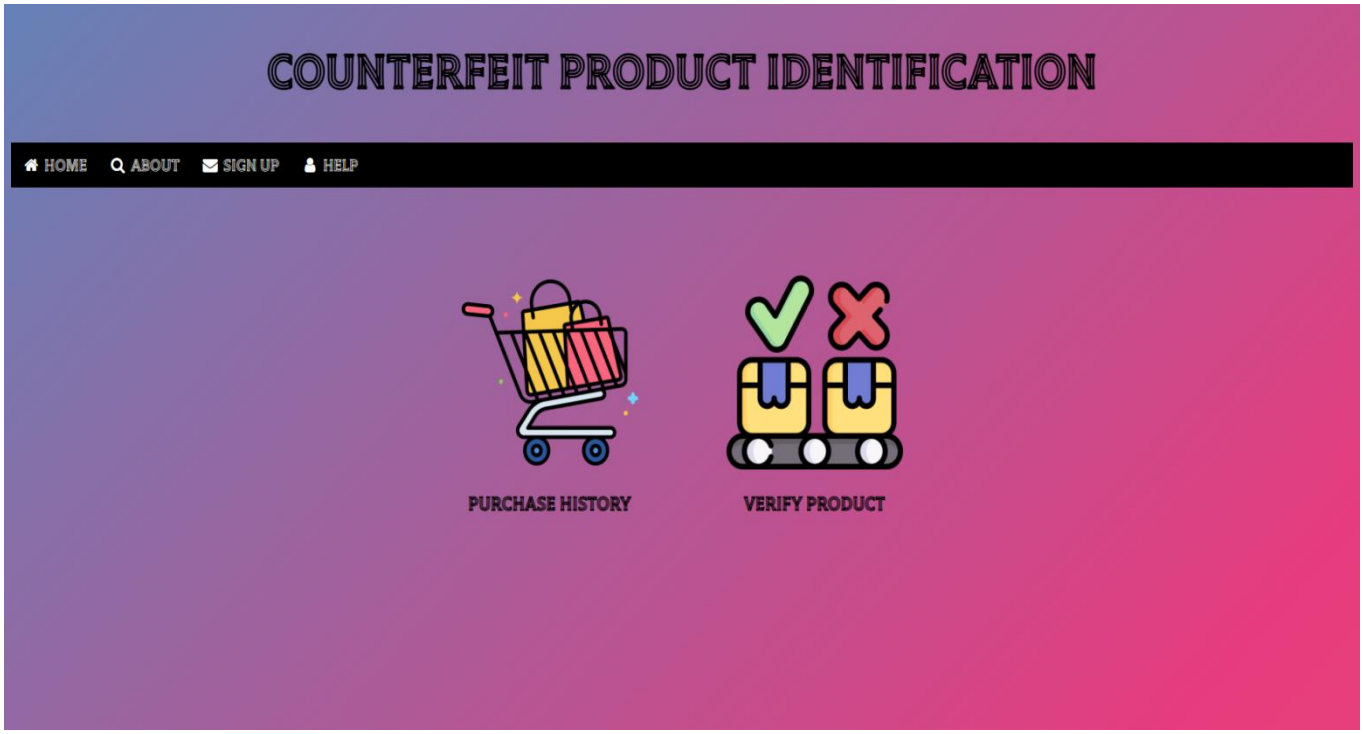

Fig 6.2.10 : Consumer page

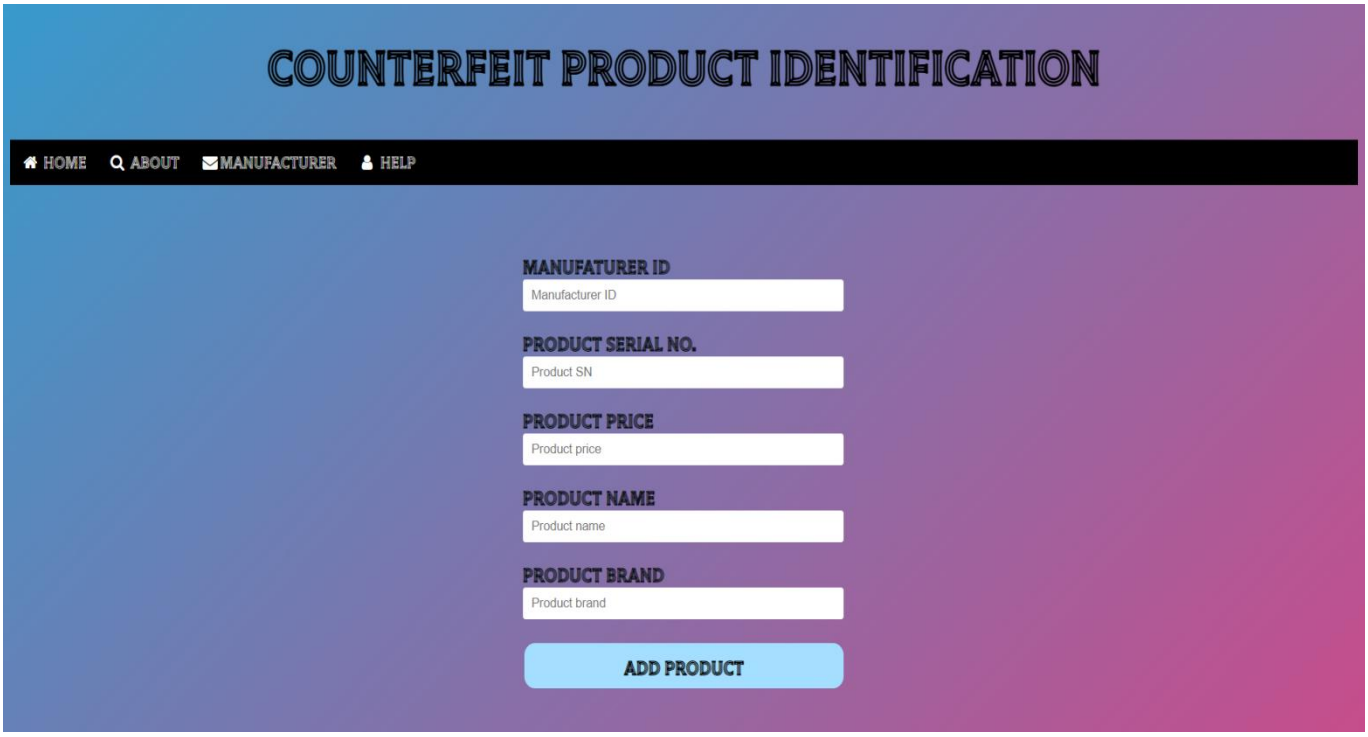

Fig 6.2.11 : Manufacturer- Add Product

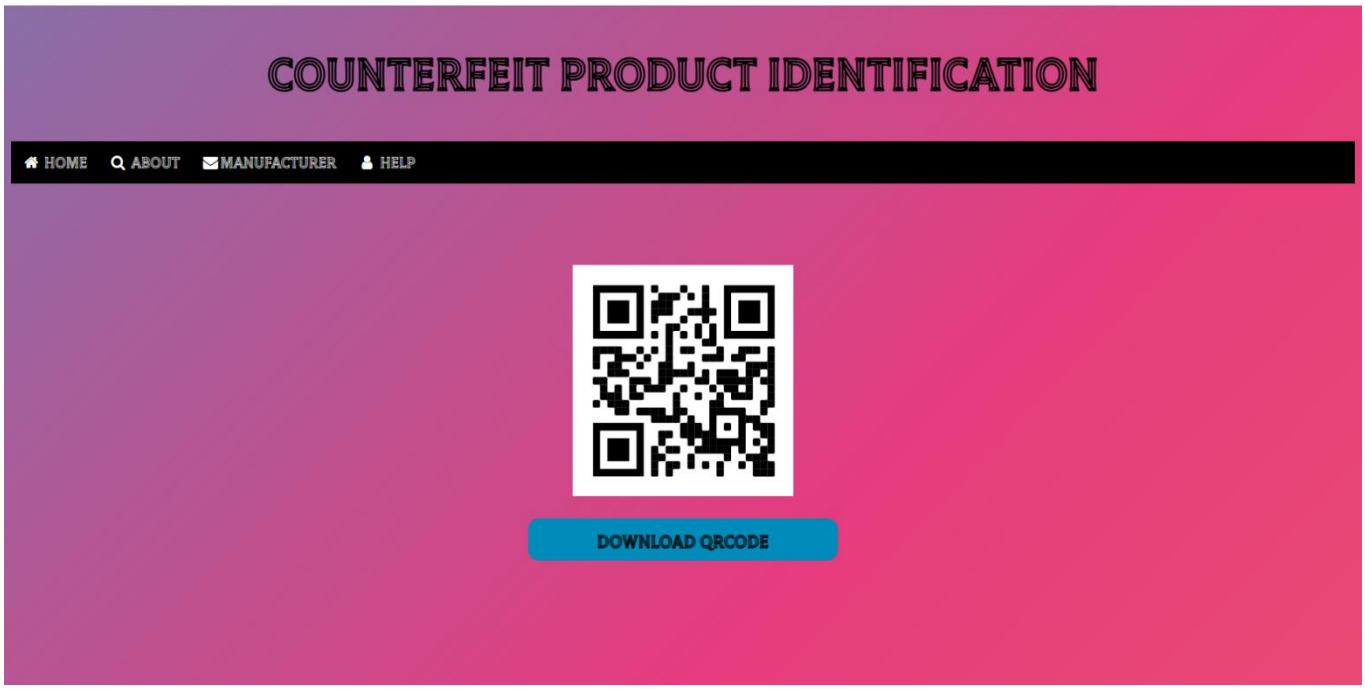

Fig 6.2.12 : Manufacturer-Add Product:Product QRcode generation

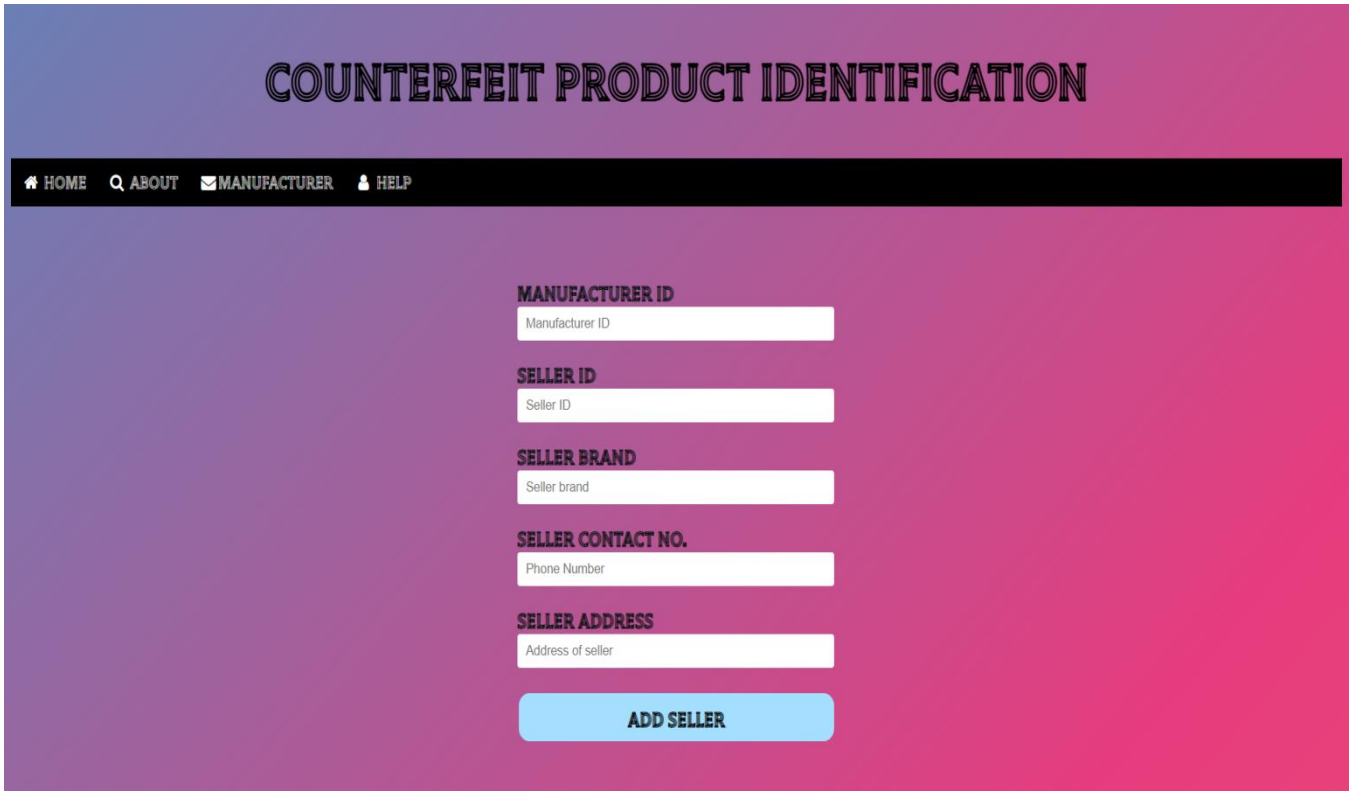

Fig 6.2.13 : Manufacturer- Add Seller

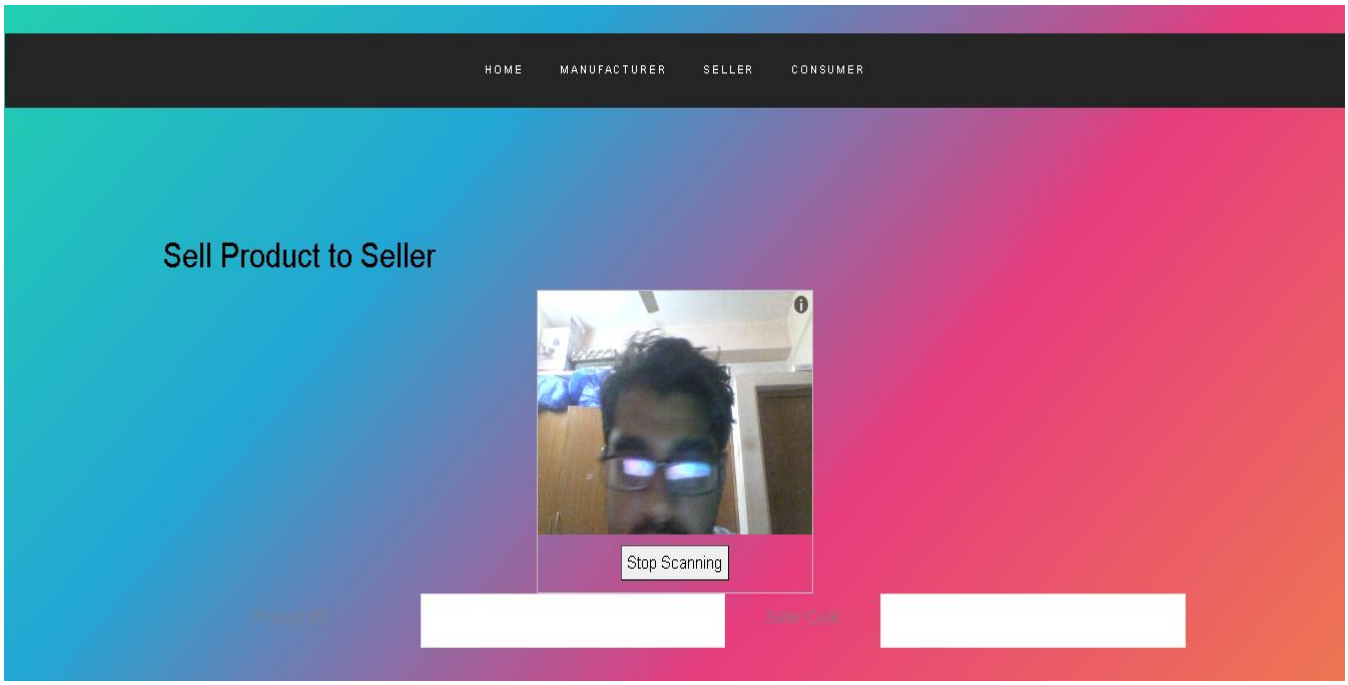

Fig 6.2.14 : Manufacturer- Sell to seller

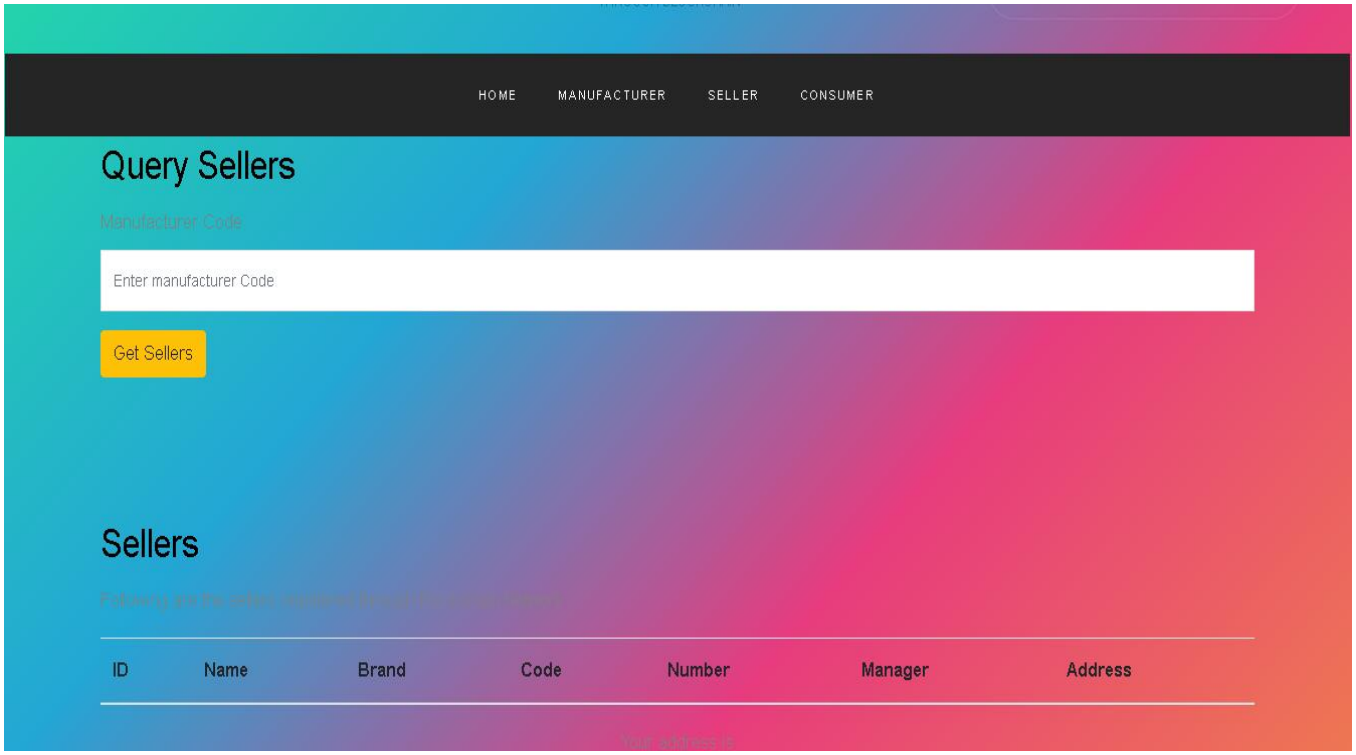

Fig 6.2.15 : Manufacturer- Query Seller

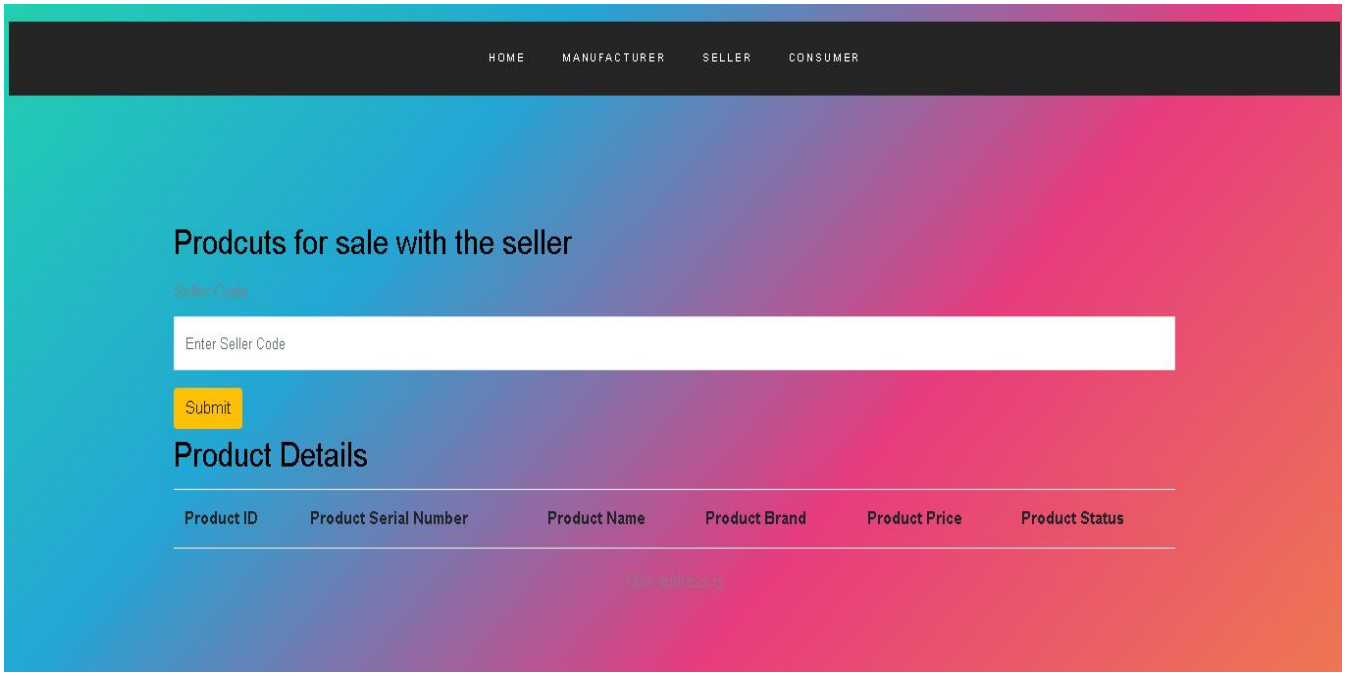

Fig 6.2.16 : Seller- Products for sale

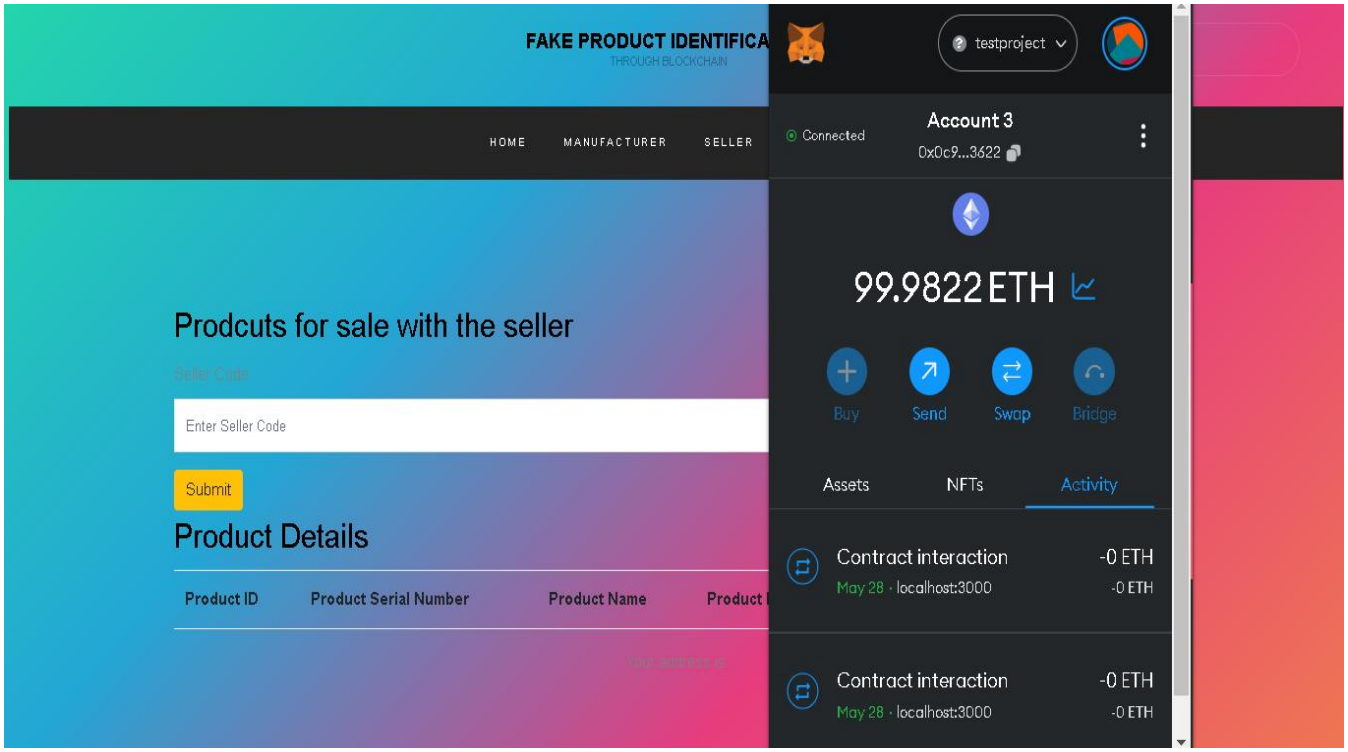

Fig 6.2.17 : Seller- Products for sale :Smart Contracts

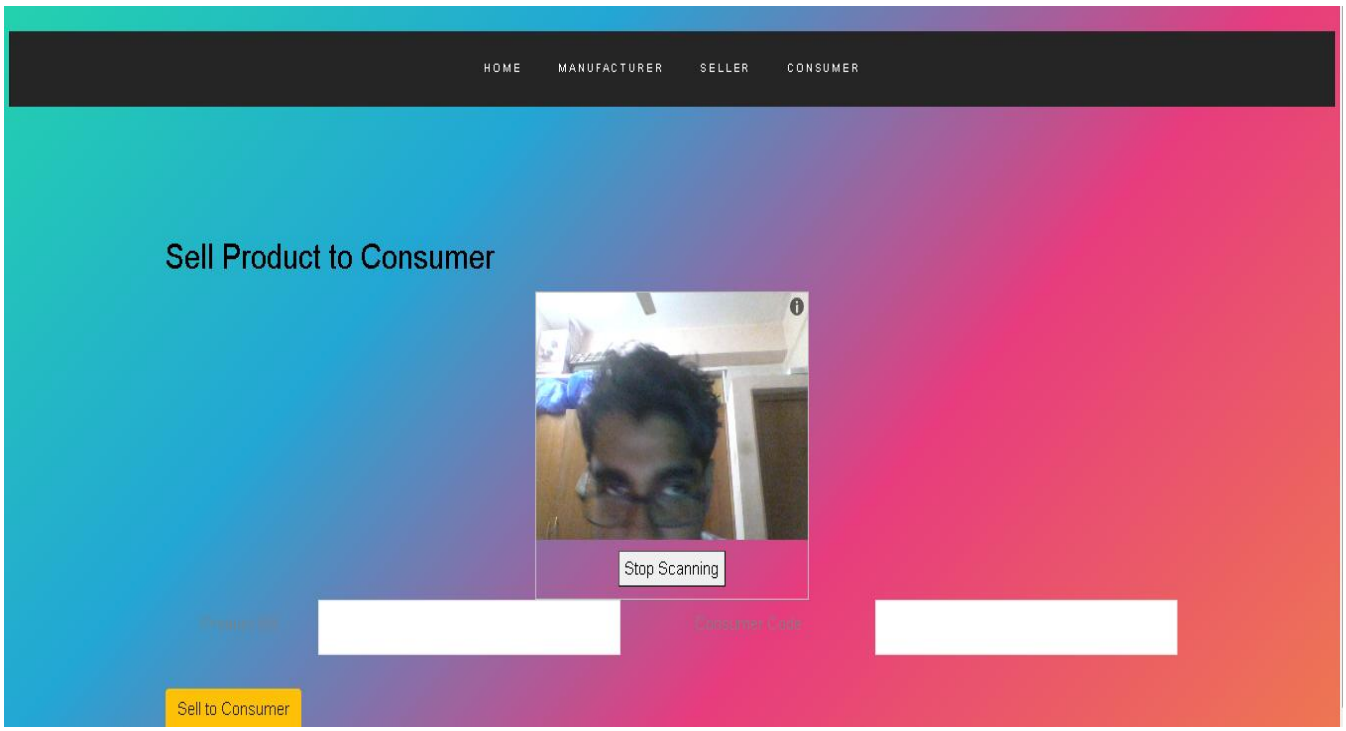

Fig 6.2.18 : Seller- Sell to consumer

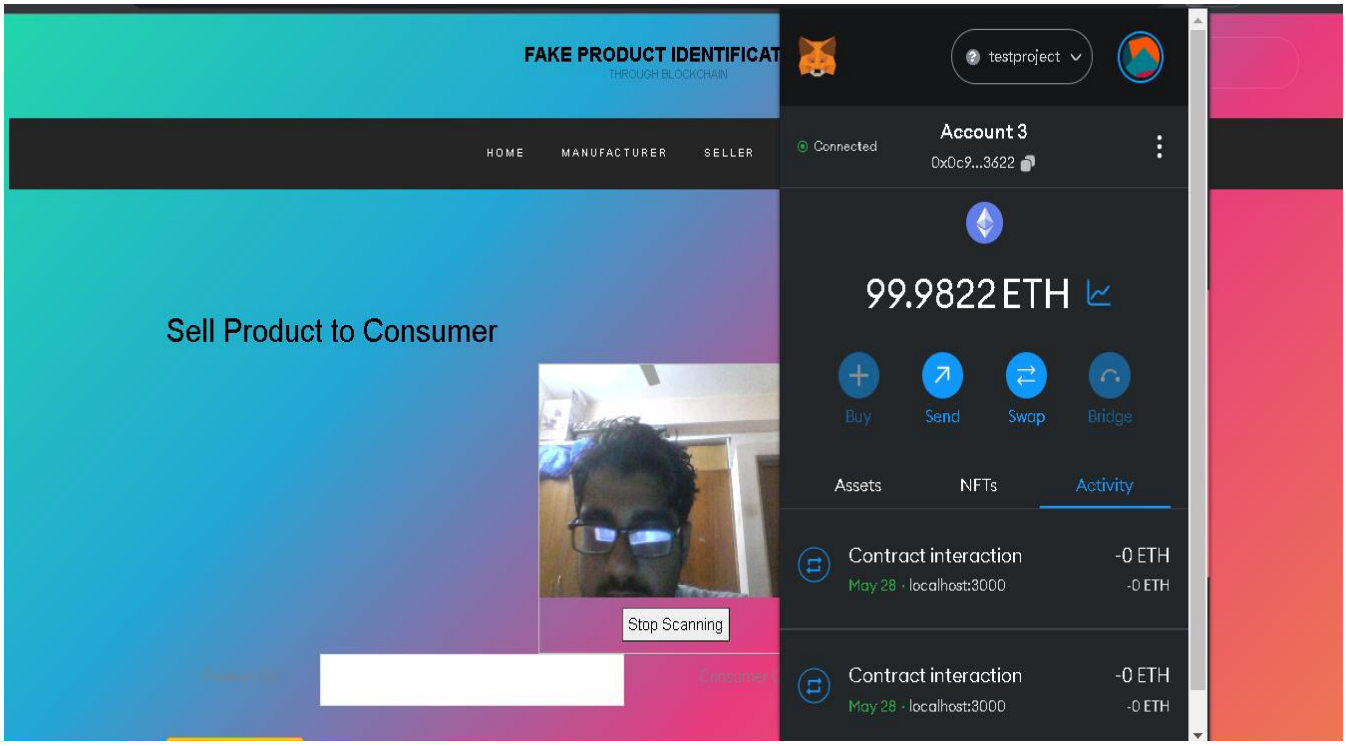

Fig 6.2.19 : Seller- Sell to consumer : smart contract for the product

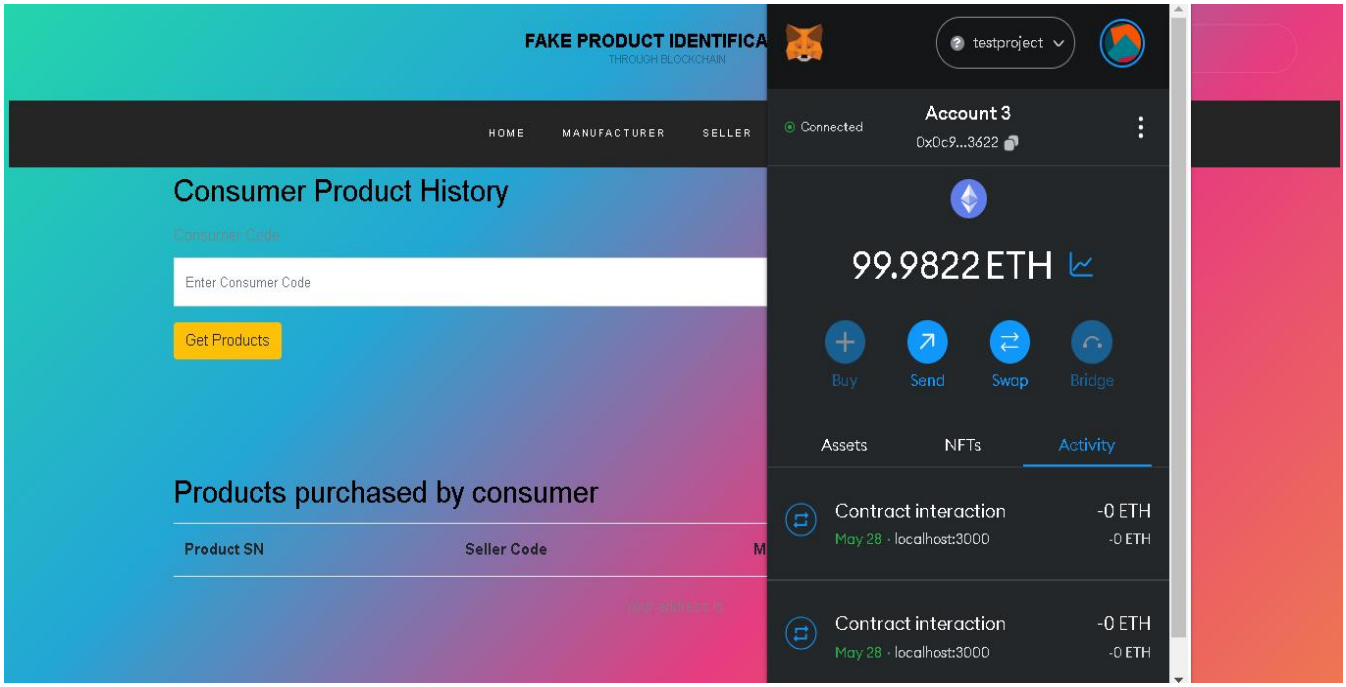

Fig 6.2.20 : Consumer- Purchase history

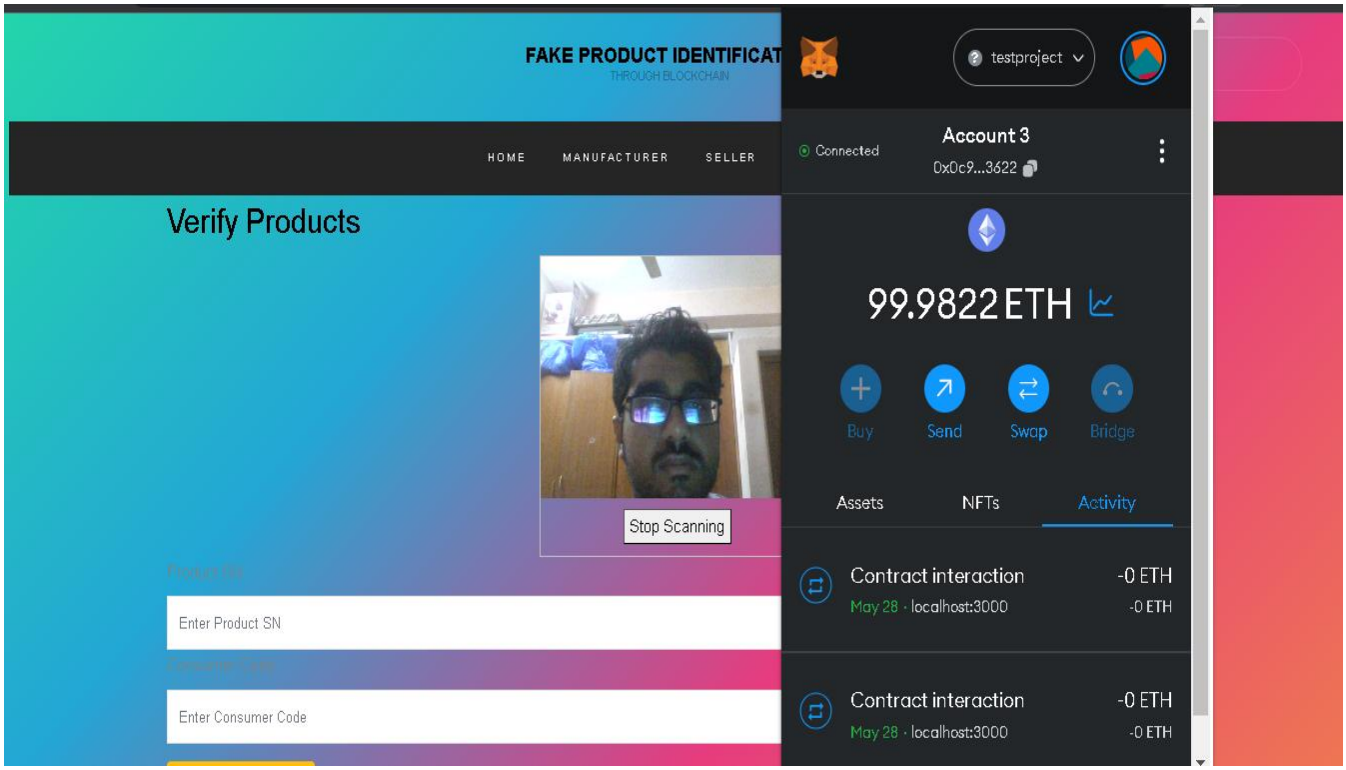

Fig 6.2.21 : Consumer- Verify product

CHAPTER 7

APPLICATIONS

The applications of "Counterfeit Product Identification Using Blockchain" are listed below:

- Consumer Goods: The project can be implemented in the consumer goods industry to combat the issue of counterfeit products. It allows consumers to verify the authenticity of the goods they purchase, ensuring they are getting genuine and safe products.
- Pharmaceuticals: Counterfeit drugs pose a significant threat to public health. By applying this project in the pharmaceutical industry, consumers can verify the authenticity of medications, reducing the risk of consuming counterfeit or substandard drugs.
- Luxury Goods: The luxury goods industry often faces challenges with counterfeit products. Implementing this project enables customers to verify the authenticity of luxury items such as designer bags, watches, and accessories, protecting their investment and brand reputation.
- Automotive Parts: The automotive industry can benefit from this project by ensuring the authenticity of critical components and spare parts. It helps prevent the use of counterfeit parts that may compromise vehicle safety and performance.
- Electronics: With the increasing market for electronic devices, the risk of counterfeit electronics has grown. Implementing this project allows consumers to verify the authenticity of electronic products, reducing the chances of purchasing counterfeit or faulty devices.
- Food and Beverages: This project can be utilized in the food and beverage industry to ensure the authenticity of products and ingredients. Consumers can scan QR codes on packaging to verify the source and quality of food items, reducing the risk of consuming counterfeit or adulterated products.
- Supply Chain Management: The project's blockchain technology can enhance supply chain transparency and traceability across various industries. It enables manufacturers, suppliers, and retailers to track the movement of products, ensuring the integrity of the supply chain and reducing the risk of counterfeit products entering the market.
- Online Marketplaces: E-commerce platforms can integrate this project to provide an additional layer of trust and security for online transactions. It allows buyers to verify the authenticity of products before making a purchase, minimizing the risk of buying counterfeit items.

CHAPTER 8

FUTURE SCOPE

The project "Counterfeit Product Identification Using Blockchain" has significant potential for future advancements and expansions. Some of the possible future scopes for the project include:

- Integration with IoT Devices: The project can be extended to integrate with Internet of Things (IoT) devices, enabling real-time tracking and verification of products. IoT sensors can be used to capture additional data points and provide enhanced transparency throughout the supply chain.
- Integration with Smart Contracts: Smart contracts can be incorporated into the project to automate and enforce transactions within the supply chain. This would streamline processes, enhance security, and ensure trust between parties involved in the product journey.
- Expansion to Global Markets: The project can be scaled up to cater to global markets, allowing manufacturers, sellers, and consumers from different regions to participate. This would help create a standardized and globally recognized system for product authentication and eliminate counterfeit products on a larger scale.
- Collaboration with Regulatory Authorities: Collaboration with regulatory authorities and industry watchdogs can strengthen the project's impact. By partnering with organizations responsible for monitoring and combating counterfeit products, the project can contribute to regulatory efforts and support legal actions against counterfeiters.
- Enhanced User Interfaces: The project can be further developed to provide user-friendly interfaces for manufacturers, sellers, and consumers. Intuitive mobile applications and web portals can be created to facilitate easy scanning of QR codes, product verification, and accessing blockchain information.
- Machine Learning for Counterfeit Detection: Incorporating machine learning algorithms can enhance the project's ability to detect counterfeit products. By analyzing patterns, images, and other data, the system can learn and improve its accuracy in identifying counterfeit items.
- Collaboration with Payment Providers: Integration with payment providers and financial institutions can enhance the project's effectiveness in combating counterfeit products. Verifying product authenticity at the point of purchase can help prevent fraudulent transactions and protect consumers from purchasing counterfeit goods.
- Expansion to Other Blockchain Networks: While the project currently utilizes the Ethereum

blockchain network, future developments can explore integration with other blockchain networks, such as Hyperledger or Corda. This would provide flexibility and options for different industries and organizations to adopt the solution.

Overall, the future scope of the project lies in further technological advancements, collaboration with industry stakeholders, and expanding its reach to address the global challenge of counterfeit products. By using new technologies and working together with other organizations, the project can keep improving and have a big effect in stopping counterfeit products in different industries. This forward-looking approach ensures that the project remains adaptable and capable of addressing new challenges that may arise in the future.By harnessing emerging technologies and forming strategic partnerships, the project can continue its evolution and play a pivotal role in the ongoing battle against counterfeiting.

CONCLUSION

In conclusion, the project "Counterfeit Product Identification Using Blockchain" presents a solution to overcome the growing problem of counterfeit products. By leveraging blockchain technology, unique QR codes, and secure data storage, the project aims to provide a reliable and transparent system for product authentication.Through the implementation of the project, we have successfully demonstrated the feasibility and effectiveness of using blockchain for counterfeit product identification. The integration of hardware and software requirements, such as scanners/cameras, computer systems, and coding languages, has facilitated the smooth functioning of the system.The project's applications extend across various industries, offering benefits to manufacturers, sellers, and consumers. By ensuring the authenticity of products, the project enhances consumer trust, protects brand reputation, and mitigates the financial and health risks associated with counterfeit goods. Looking ahead, the future scope of the project is promising. Further technological advancements, such as IoT integration and machine learning algorithms, can enhance the system's capabilities in detecting and preventing counterfeit products. Collaboration with regulatory authorities, industry stakeholders, and payment providers can strengthen the project's impact and facilitate wider adoption.

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