A Report

On

Product Authentication using Blockchain

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Chapter 1

1.1 Problem Statement

If you are a wine lover, you going to love this. Do you know experts estimate 20% of wine consumed worldwide is counterfeit? These fake wines are refilled and sold to us. Not only have these fakes caused a loss of revenue of more than 2 billion a year. More importantly, consumer lost confidence in branded wine. Design a suitable solution using blockchain platform to secure the identities of wine labels and bottle tops. With this, you can easily verify authenticity by scanning the seal with smartphone.

1.2 Abstract

Product authentication using blockchain technology and a unique code, such as a 6-digit code or QR code, is a promising solution to address the issue of counterfeiting and ensure product authenticity. The approach involves assigning a unique digital identity to each product and recording its journey on the blockchain, creating a transparent and secure supply chain. Each product is also tagged with a unique code that consumers can scan to verify the product's authenticity through the blockchain data. This technology can revolutionize several industries, including pharmaceuticals, luxury goods, and food supply chains. Overall, product authentication using blockchain and a unique code offers a powerful solution to improve supply chain transparency, build consumer trust, and eliminate counterfeit products.

1.3 Introduction

Counterfeiting is a pervasive problem in today's global economy, with fake products infiltrating virtually every industry, from luxury goods and pharmaceuticals to electronics and food products. This not only results in significant financial losses for businesses but also poses a serious threat to consumer safety and trust. To address this issue, a solution has been created involving blockchain technology and a unique code, such as a 6-digit code or QR code, is being proposed to ensure product authentication and prevent counterfeiting.

The solution involves assigning a unique digital identity to each wine bottle and recording its journey from production to consumption on the blockchain. Additionally, each bottle is tagged with a unique code that consumers can scan to access the blockchain data and verify the authenticity of the product through a mobile phone. This solution not only enhances transparency and trust in the supply chain but also offers a powerful tool to eliminate counterfeit products and build consumer confidence in branded wine.

1.4 Literature Survey

PAPER	AUTHOR'S WORK	DRAWBACKS
A Study on Product Authentication and Authorization	• A good number of products found fake or altered now-a-days. Basic information of the product including company-logo, price, manufacturing and expiring date are printed on product-body or packet. • Usually, customers believe that information during purchase time. However, this information can be altered in many ways such as generation and distribution of fake product, and changing the tag. • Under these circumstances, an idea is generated that can solve the above issues using a cryptographic tool such as authenticated encryption (AE) and Quick Response Code (QR Code).	• Threat of Security • No blockchain platform integrated for trust and traceability.

Table 1: Literature Survey 1

PAPER	AUTHOR'S WORK	DRAWBACKS
Research on Lightweight Mutual Authentication for the Product Authorization Chain [2]	• A lightweight wireless mutual authentication scheme for the product authorization chain was proposed in opposition to the security flaw of Kaul and Awasthi's scheme, which was easily vulnerable to offline password guessing attacks, in order to ensure that legitimate users connect to the wireless network correctly.	• The Kaul and Awasthi's plan's inability to fend off offline password guessing attacks

Table 2: Literature Survey 2

PAPER	AUTHOR'S WORK	DRAWBACKS
Fake Product Detection System Using Blockchain	• In this research, they aimed to use blockchain technology to enhance the detection of fake goods. With the aid of a QR code, our technique involves storing the product supply chain at each stage of the sale of a product to a new party. • A blockchain-based system creates a decentralised system, and one of its primary advantages is that if data is recorded in the system, no one can change it at any time, making our data more secure and secured from third parties. Blockchain aids in the storage of the product supply chain.	• Disadvantages such as QR code can copy from a genuine product to a fake product, artificial intelligence and machine learning need high computational power to do operations, and many more methods adopted but a fulfilled method has not been developed.

Table 3: Literature Survey 3

Chapter 2

2.1 Design

Inputs – Product Information (Product Name, Product ID), Blockchain Technology

Actors – Product Manager, Blockchain, Smart Contracts, Verification Entity, End Customer

Expected Output – Verification of product's authenticity communicated to the End Consumer

2.1.1 Data Processing –

Manager – records the product information and stores it on the blockchain

Blockchain (using Ganache GUI) – uses the smart contracts to verify the authenticity of the product

Verification Interface – retrieves the product information from the blockchain and displays it to the user

2.1.2 Components –

Platform – Ganache (Ethereum blockchain environment)

Smart Contract Language – Solidity

Web-Development Languages

ADB (Android Debug Bridge) – To enable QR scanning from phone

Physical Label with QR scanner and unique 6-digit code

2.1.3 Flowchart –
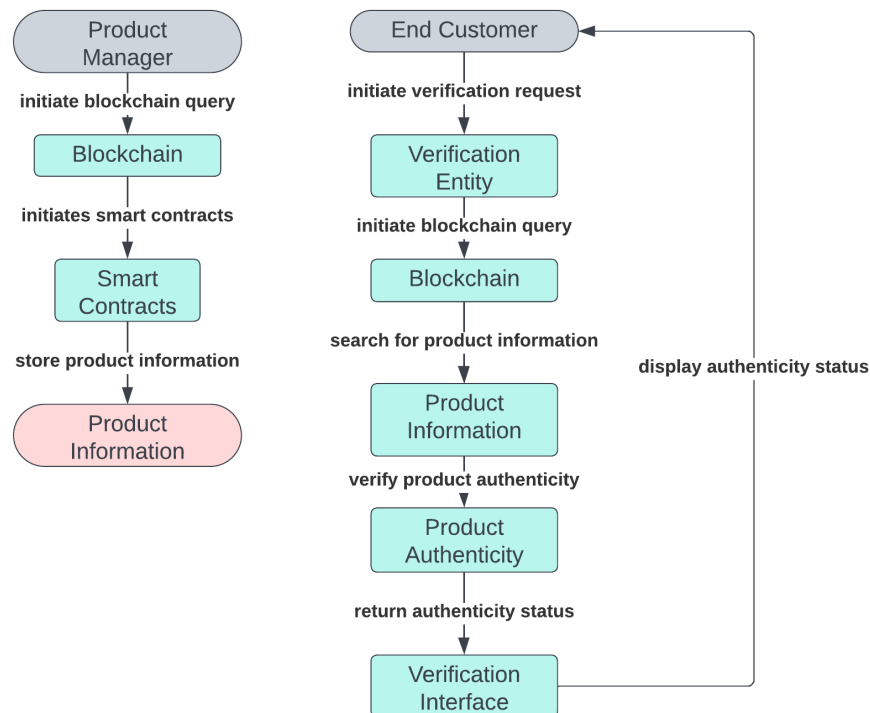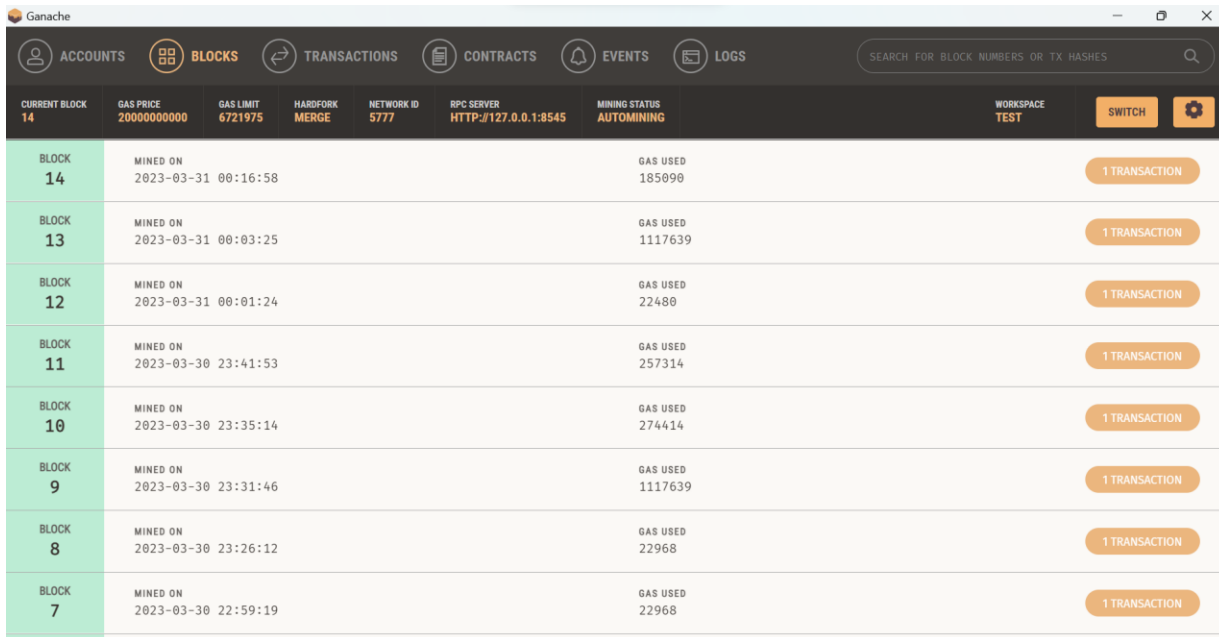
2.1.4 Diagram
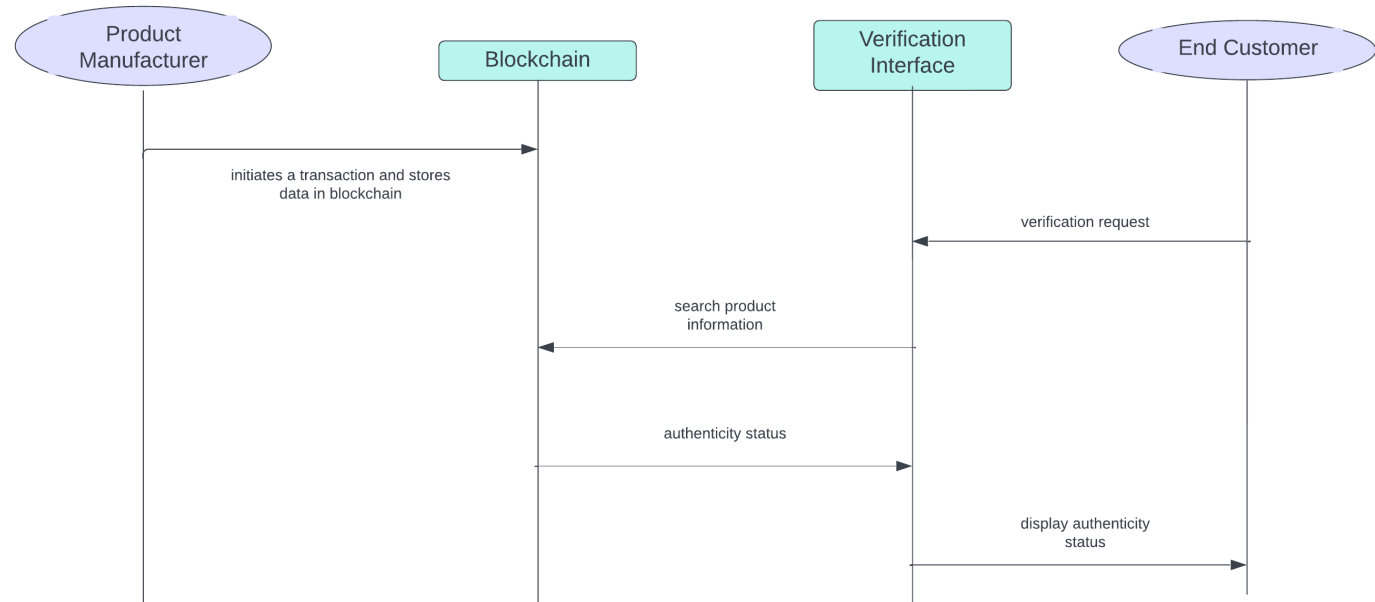
2.2 Implementation

Ganache GUI

Create a new workspace after installing Ganache. This is the graphic interface which display all the transactions and contracts created.
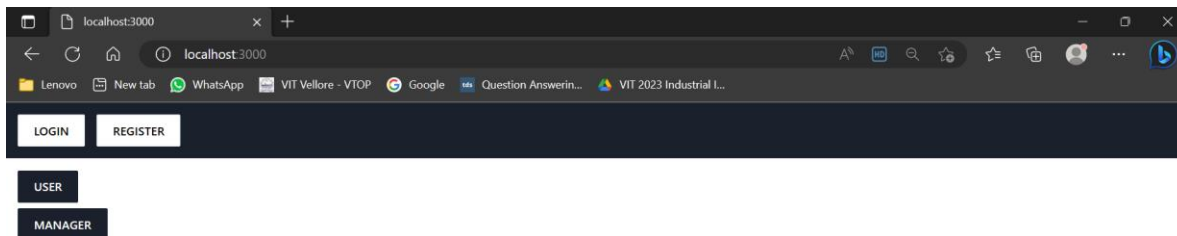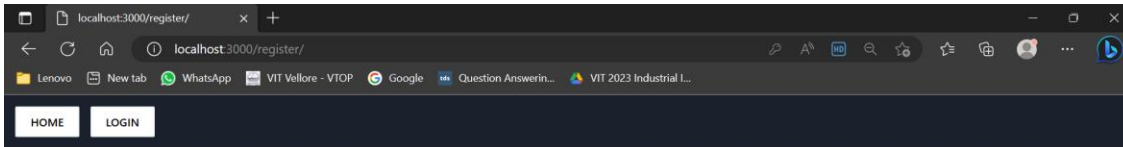

Home Page

In this page the user can either sign in/log in as the manager or just a customer (user).

Register Page

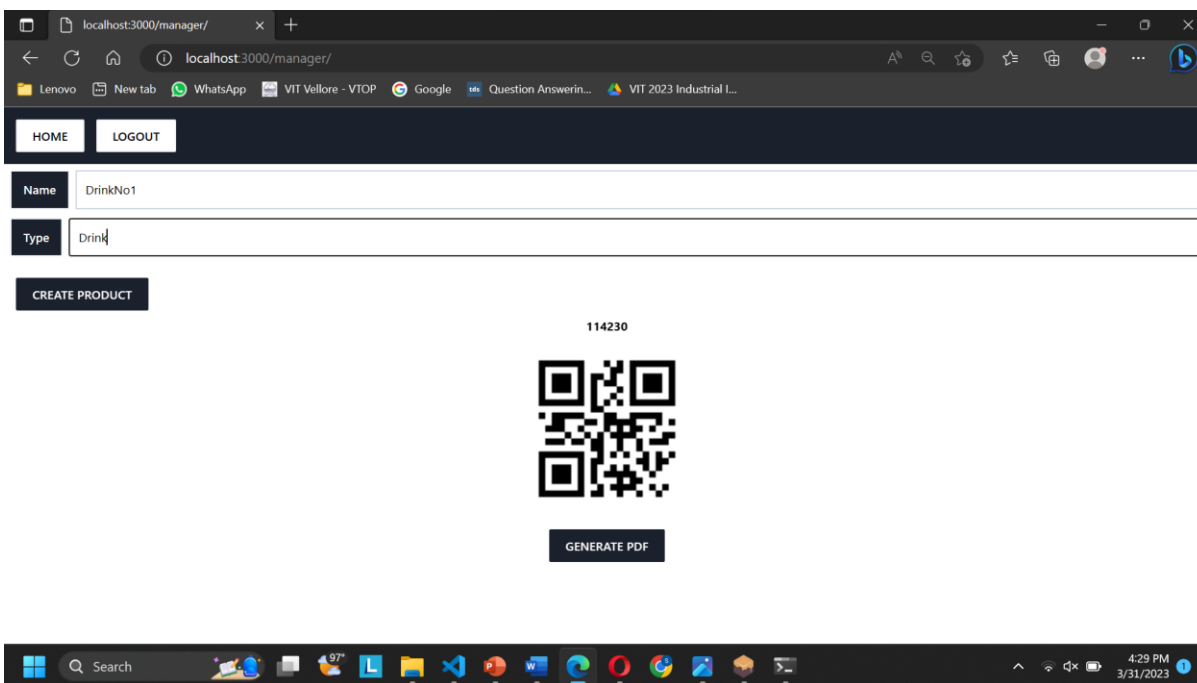Any manager/user who have are new comers to the system must first register themselves.

Manager Page

After registering and logging in as a manager, the manager has to give the product details, specifically product name and the product type. After inputting the values, he can create the unique 6 digit code and QR code for that product.

Ganache

We see that a transaction occurred at the same time when the manager created a QR code/gave the product details.

User Page

Now, through ADB, use the phone and open the website. We'll use the phone as the user and register a user account and finally go to the user page. The user can give either the unique 6-digit code or a QRcode.
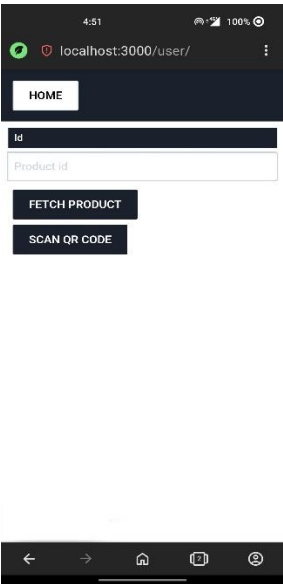
Chapter 3

3.1 Results and Discussion

Verification

Now, through the phone, scan the QR code (the one which generated when we gave the details of the product name: Drink1 and Type: Drink). It should display the product.

HOME

Id
Product id

FETCH PRODUCT

SCAN QR CODE

Product Info

Product Name	DrinkNo1
Product Type	Drink

If the wrong QRcode or 6-digit is shown/entered:

HOME
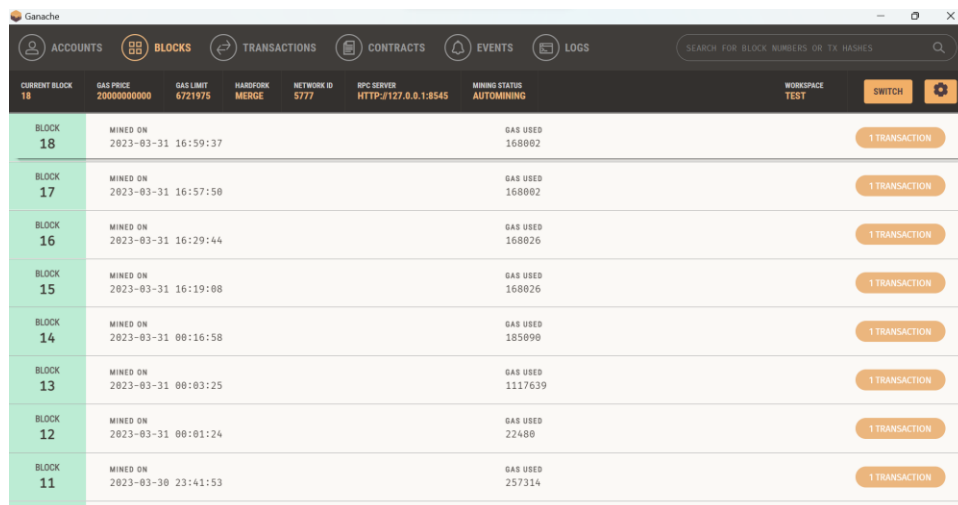
Id
123456

FETCH PRODUCT

SCAN QR CODE

No product with that id exists

Ganache Transaction UI

We see that for each process we did, there was a transaction made and added into the blockchain.

Chapter 4

4.1 Conclusion

In conclusion, the use of Ganache blockchain for product authentication is a powerful solution that can help prevent counterfeiting and build trust between consumers and manufacturers. The implementation of a QR code system to verify product authenticity using the blockchain technology offers a secure and transparent platform that enables consumers to check the origin and authenticity of the product easily.

Through this project, we have demonstrated that it is possible to create a website that integrates with Ganache blockchain to provide a reliable and accurate product authentication process. By creating a smart contract to handle the verification process, we have ensured that the product authentication process is secure and tamper-proof.

However, it is important to note that the implementation of this technology requires collaboration among manufacturers, retailers, regulators, and consumers to establish a standardized and interoperable system. As such, it is critical to work together to ensure the successful implementation of this solution and address the issue of counterfeiting in today's global economy.

Chapter 5

References

[1] Mahmuda Khan Moon, Roksana Akter and Rashed Mazumder. A Study on Product Authentication and Authorization. International Journal of Computer Applications 183(45):1-7, December 2021.

[2] Hindawi, Security and Communication Networks, Volume 2021, Article ID 8852901, 9 pages, https://doi.org/10.1155/2021/8852901

[3] https://www.youtube.com/watch?v=LSf1MkjmOvw

[4] https://www.youtube.com/watch?v=OEvZuXAx4EI

[5] https://www.gs1india.org/authentication-counterfeit-detection/

Chapter 6

Smart Contract code –

```solidity
//SPDX-License-Identifier: Unlicense
pragma solidity 0.8.7;

contract ProductAuth {
  // Mapping between id and Product to store product using its id
  mapping(string => Product) public productsMap;
  // An array that keeps tracks of all products created
  Product[] public products;
  // Public address that stores the address that deployed the smart contract on the network
  address public owner;
  // Custom product type using struct, a Product has the following three data
  // 1. Name of the product
  // 2. Type of the product
  // 3. Id of the product
  struct Product {
    string productName;
    string productType;
    string productId;
  }

  // Constructor runs only once when the smart contract is deployed
  constructor(){
    // This sets the owner state variables to the address that deploys the smart contract
    // in our case it will be the first address located in the ganache blockchain
    owner = msg.sender;
```

```solidity
  }

  // function to add the product to the state variables
  function addProduct(string memory productName, string memory productType, string memory
productId) public {
    require(msg.sender == owner, "Only the manager can add product");
    // Create a product of type Product using the passed parameters
    Product memory product = Product({
      productName: productName,
      productType: productType,
      productId: productId
    });
    // Add the product using its id into the state map variable
    productsMap[productId] = product;
    // Push the product at the end of the state array variable
    products.push(product);
  }

  // Fetch all the currently stored products
  function fetchProducts() public view returns (Product[] memory){
    return products;
  }

  // Fetch an individual product by its id
  function fetchProductById(string memory productId) public view returns (Product memory){
    return productsMap[productId];
  }
}
```