

# QUALITY ASSURANCE & FOOD AUTHENTICITY USING BLOCKCHAIN

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## ABSTRACT

Quality Assurance and Food Authenticity using Blockchain is an advanced system designed to improve transparency, traceability, and trust in the food supply chain. The increasing incidents of food adulteration, counterfeit products, and lack of proper monitoring have raised serious concerns regarding food safety and consumer health. Traditional food tracking systems often suffer from poor transparency, data manipulation, and inefficient record management. To overcome these challenges, blockchain technology provides a decentralized and tamper-resistant platform for securely storing and sharing food supply chain information. In the proposed system, every stage of the food lifecycle, including production, processing, packaging, transportation, and distribution, is recorded as immutable transactions on the blockchain network. Smart contracts are used to automate verification processes and ensure compliance with food quality standards. Consumers, suppliers, farmers, and regulatory authorities can access real-time product information such as origin, manufacturing details, storage conditions, and authenticity verification through QR codes or digital tracking systems. The integration of blockchain enhances food safety, reduces fraud, improves supply chain efficiency, and increases consumer confidence. This system provides a reliable solution for maintaining food quality assurance and ensuring authenticity in modern agricultural and food distribution industries.

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## INTRODUCTION

Food quality and authenticity have become major concerns in modern food supply chains due to the increasing cases of food adulteration, contamination, counterfeit products, and lack of transparency in product handling. Consumers today demand safe, healthy, and genuine food products, while governments and regulatory authorities require strict monitoring systems to ensure compliance with food safety standards. However, traditional food supply chain management systems often face problems such as poor traceability, centralized data storage, manual record maintenance, and difficulty in verifying product authenticity.

In many conventional systems, information related to food production, transportation, storage, and distribution can be altered or manipulated, making it difficult to identify the source of contamination or fraud. This lack of transparency reduces consumer trust and creates serious risks to public health. Food fraud and counterfeit labeling also lead to financial losses for producers, distributors, and retailers. Therefore, there is a growing need for secure and transparent technologies that can improve food quality assurance and authenticity verification.

## **LITERATURE SURVEY**

### **1. “Blockchain Technology in the Food Supply Chain”**

**Authors:** Feng Tian

**Description:**

This paper discussed the application of blockchain technology in improving transparency and traceability within food supply chains. The author proposed a blockchain-based agricultural food tracking system that records every stage of food production and distribution. The study highlighted how blockchain can enhance food safety, prevent data tampering, and improve consumer trust.

### **2. “Food Traceability System Using Blockchain and IoT”**

**Authors:** Qijun Lin, Huaizhi Wang, Xuan Pei, and Jian Shen

**Description:**

The research focused on integrating Internet of Things (IoT) devices with blockchain technology for real-time food monitoring and traceability. Sensors were used to collect environmental data such as temperature and humidity during transportation and storage. The collected data was securely stored on the blockchain to ensure transparency and product quality assurance.

### **3. “Blockchain-Based Food Safety Traceability System”**

**Authors:** Xiaolu Zhao, Shiwei Liu, and Xiangyu Lopez

**Description:**

This study proposed a blockchain-enabled food safety framework for tracking food products from farms to consumers. The system improved traceability, reduced fraudulent activities, and enabled quick identification of contaminated food sources. The research demonstrated the effectiveness of decentralized data management in maintaining food authenticity.

### **4. “A Survey on Blockchain Applications in Supply Chain Management”**

**Authors:** Min Xu, Xingtong Chen, and Gang Kou

**Description:**

This survey reviewed various blockchain applications in supply chain systems, including food logistics and quality assurance. The paper analyzed the benefits of blockchain such as decentralization, immutability, transparency, and security. It also discussed challenges related to scalability, implementation cost, and data privacy.

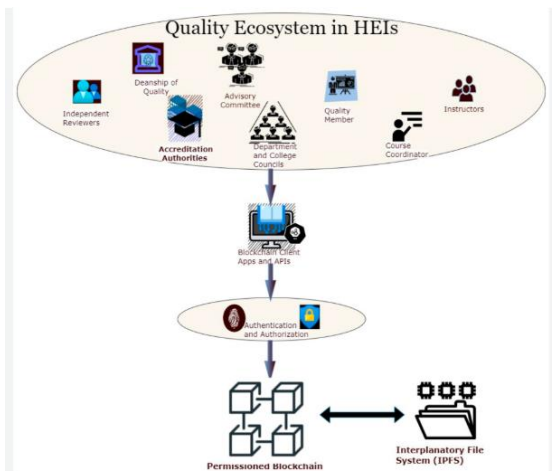
### **5. “Smart Contracts for Food Quality Monitoring”**

**Authors:** Christidis Konstantinos and Devetsikiotis Michael

**Description:**

The paper explored the role of smart contracts in automating food quality verification processes. Smart contracts were used to validate storage conditions, product certifications, and transportation requirements automatically. The study showed that blockchain automation can reduce manual intervention and improve operational efficiency.

## **SYSTEM ARCHITECTURE**



## IMPLEMENTATION

The Quality Assurance and Food Authenticity Using Blockchain system is implemented to ensure food safety, product originality, transparency, and traceability across the complete food supply chain. The system uses blockchain technology to store food product information in a secure and tamper-proof manner. Every stage of the supply chain, such as farmer production, food processing, packaging, transportation, warehouse storage, retail distribution, and customer verification, is recorded as a blockchain transaction.

In the implementation phase, each participant in the food supply chain is registered into the system with a unique digital identity. Farmers upload product details such as crop type, batch number, harvesting date, location, organic certification, and quality test reports. Food processing units update information about cleaning, grading, processing, packaging, and expiry dates. Quality assurance officers verify the food samples and upload laboratory test results, contamination status, freshness level, and authenticity certificate details.

A blockchain network is used to store these records in distributed blocks. Once a record is added, it cannot be altered or deleted, which helps prevent food fraud, fake labeling, and unauthorized modification of quality data. Smart contracts are implemented to automatically validate food quality parameters. For example, if temperature, expiry date, or contamination level does not satisfy the required standard, the system can reject the batch or generate an alert.

## SCREEN SHOTS

**Register Module:** using this module various users like Farmer, Producer, Consumer, Distributors can sign up with the application and each user details will saved in Blockchain

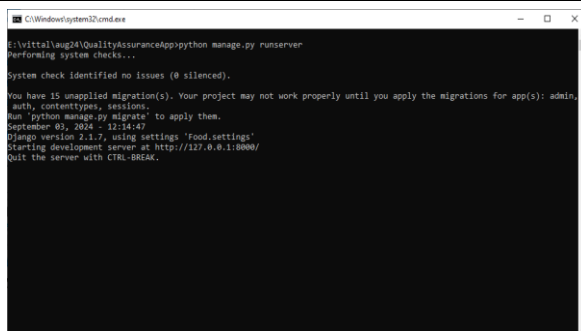
**Farmer Login:** farmer login to system and then add new product details, can view orders from producers or distributors and then complete the orders and once completed farmer can view all sale product details

**Producer Login:** can login to system and purchase product from farmers and do some pasturing and add his own product details. Can view orders from Distributors and complete those orders

**Distributor Login:** can login to system and purchase products from Producer and Farmers and can sale to consumers and can view all sale product details

**Consumer Login:** can login to system and can view all purchase details

All Product details can be validated through QR CODE



In above screen in white colour text can see Food contract deployed and got contract address also and this address can be specify in python or any

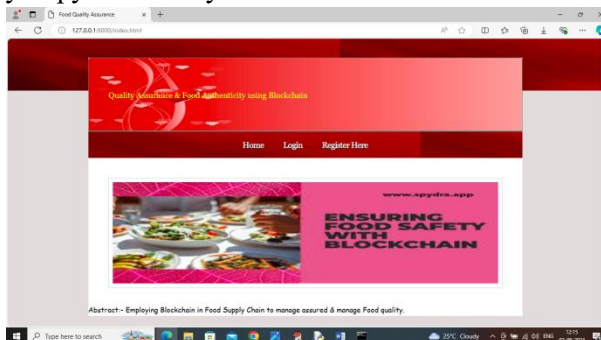


Fig No: 1 Home Page

In above screen python server started and now open browser and enter URL as <http://127.0.0.1:8000/index.html> and press enter key to get above page

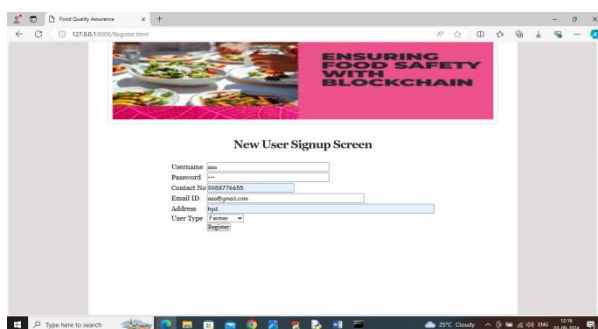


Fig No: 2 New User Signup

In above screen click on 'Register Here' link to sign up all 4 users like Farmer, Producer, Consumer and Distributor

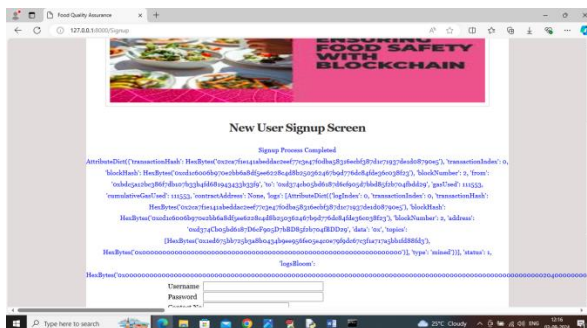


Fig No: 3 Completed

In above screen Farmer sign up task completed and then I am displaying all logs obtained from Blockchain after data storage. In above log can see Transaction No, Block No, hash code and many



In above screen Farmer adding his product details along with image and description and then press button to save data and get below page

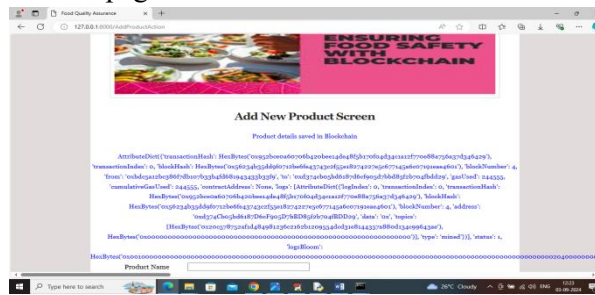


Fig No: 8 New Product Screen

In above screen product details added to Blockchain and similarly you can add other products and now logout and login as Producers to make purchase



Fig No: 9 Predict

In above screen Producer can view all products from all farmers and can click on 'Click Here' link to make purchase and get below page

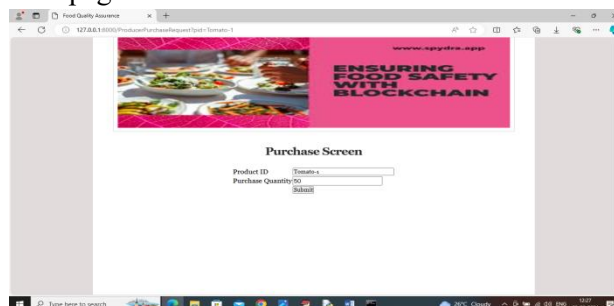


Fig No: 10 Purchase Screen

In above screen producer will purchase some quantity of products from farmer and then press button to get below page

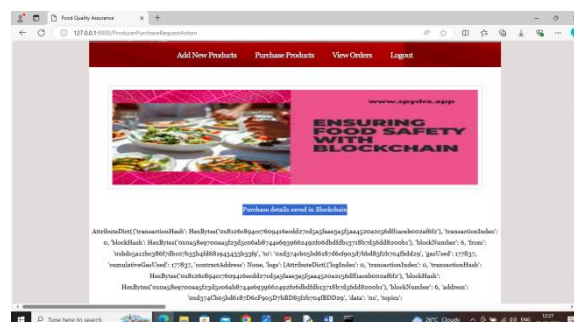


Fig No: 11 Purchase Details

In above screen purchased details added to Blockchain and Farmer will view this order and complete and send the order in below screen. Just login as Farmer again and view order to complete

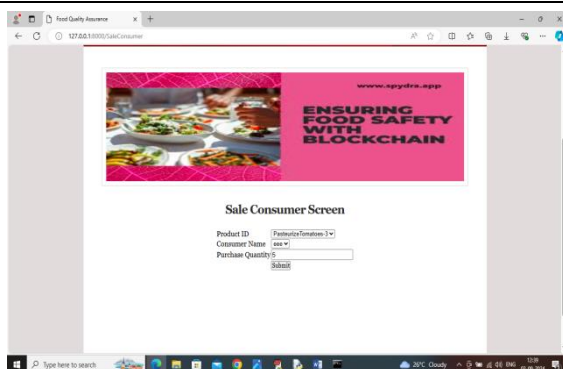


Fig No: 12 Sale Consumer Screen

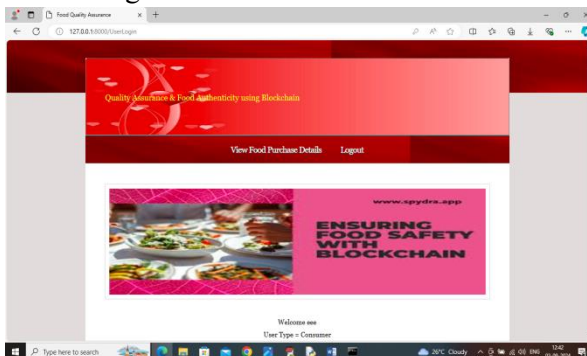


Fig No: 13 Sale Page

In above screen consumer can click on ‘View Food Purchase Details’ link to get below page

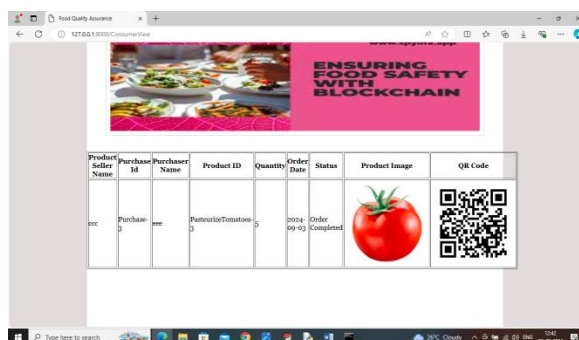


Fig No: 14 Predict

In above screen consumer can view what all products he purchase from distributors and can view all product details along with QR code and images.

So by following above screens you can run entire project with all modules. Above products will be authenticated using QR code as Blockchain will not allow any data tamper.

**CONCLUSION**

The increasing demand for safe, high-quality, and authentic food products has highlighted the need for secure and transparent food supply chain management systems. Traditional food tracking methods often suffer from poor traceability, centralized data storage, manual errors, and vulnerability to fraud or data manipulation. These limitations reduce consumer trust and make it difficult to identify the source of contamination or counterfeit products.

The proposed blockchain-based system for quality assurance and food authenticity provides an effective solution to these challenges by ensuring transparency, security, and traceability throughout the food supply chain. Blockchain technology enables secure and immutable recording of transactions related to food production, processing, transportation, storage, and distribution. Since the stored information cannot be altered, the system ensures reliable verification of food quality and authenticity.

The integration of smart contracts further improves automation by validating food safety standards and reducing manual intervention. Consumers can access detailed product information such as origin, manufacturing details, storage conditions, and supply chain history through QR codes or digital tracking systems. This improves consumer confidence and promotes accountability among supply chain participants.

#### **FUTURE WORK**

The proposed blockchain-based food quality assurance and authenticity system can be further enhanced by integrating advanced technologies and expanding its capabilities for large-scale real-world applications. Future improvements can focus on increasing automation, scalability, security, and real-time monitoring within the food supply chain.

One important enhancement is the integration of Internet of Things (IoT) sensors for continuous monitoring of environmental conditions such as temperature, humidity, and storage quality during transportation and warehousing. Real-time sensor data can be directly recorded on the blockchain to ensure accurate monitoring and immediate detection of quality issues.

Future research can also incorporate Artificial Intelligence (AI) and Machine Learning (ML) techniques to predict food spoilage, detect abnormal supply chain activities, and improve quality assessment. AI-based analytics can help identify patterns related to contamination risks, counterfeit products, and supply chain inefficiencies more effectively.

Another possible extension is the development of mobile applications and user-friendly dashboards for farmers, suppliers, retailers, and consumers. These applications can provide easy access to food traceability information, product certifications, and authenticity verification through QR code scanning systems.

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