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SEMESTER : IV

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ABSTRACT

The purpose of the article is to determine the importance of blockchain technology in food supply chain management. A practical reference to the adopted research aim was to indicate the usefulness of blockchain technology to build trust between food chain stakeholders. Research shows that the properties of blockchain technology can enable it to solve many problems and shortcomings of the current food production system. Its added value is primarily a significant increase in transparency of operations among all stakeholders using big data in all parts of the food chain.

Key words: food safety, blockchain technology, digitization in agriculture.

INTRODUCTION

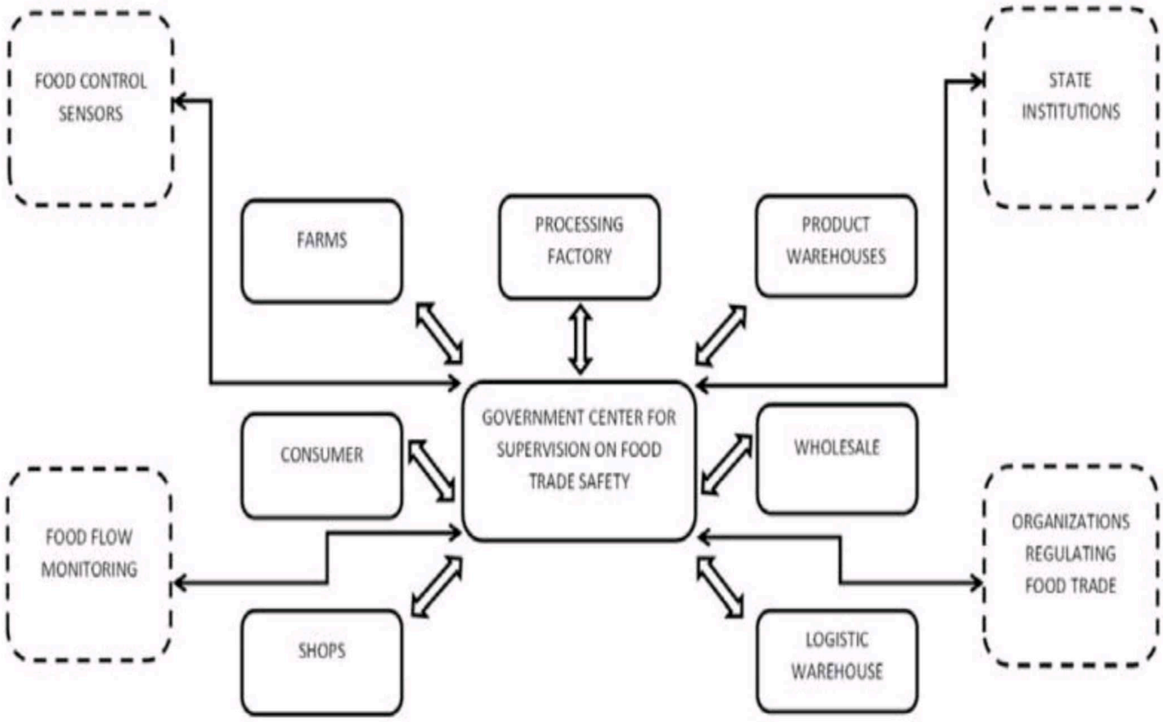
Contemporary food supply chains include producers, suppliers, carriers, wholesalers, retailers, other intermediaries and even the customers themselves. They consist of many very diverse stakeholders, striving to achieve their autonomous goals. Managing them in a classical way often becomes an inefficient process, and even impossible, especially when considering the development of globalization. It is growing globalization that makes enterprises need new methods and solutions to improve the management of often dispersed resources.

They can also be an important source of competitive advantage for food producers in India. The Indian agricultural model is undergoing transformation to reach a good competitive position in the global market. Its high placement in ranking can be demonstrated by the growing dynamics of Polish food exports, which has reached the value of 107% [GUS 2019]. One of the areas to improve the competitiveness of food on the world market is its quality, achieved, among other things, by improving the supply chain.

As researchers indicate [2019], the supply chain is a series of independent, discrete, largely autonomous events controlled by marketing, production and distribution activities. Nowadays, the digitization of these processes is observed in enterprises as a result of the development of technology and the accompanying infrastructure. Digitalization of the economy is one of the most dynamic changes of our time, which opens new possibilities in creating business models. At the same time, it brings uncertainty and various types of threats related, among other things, to the social effects of manufacturing process automation or broadly understood food safety.

PROBLEM STATEMENT:

CENTRALIZED TRACEBILITY SYSTEM FOR THE FOOD SUPPLY CHAIN



The problem of food safety in the supply chain is a significant challenge that affects consumers, producers, distributors, and retailers. Contaminated or spoiled food can cause serious health problems, and the lack of transparency and accountability in the supply chain can make it difficult to trace the source of the problem.

One major issue is the difficulty of tracking food items from the producer to the consumer. Traditional supply chain systems often rely on paper records or centralized databases that can be tampered with or lost. This makes it difficult to identify the source of a problem if a food item is contaminated or if there is a breach in food safety protocols.

Another issue is the lack of trust between parties in the supply chain. Each party has their own incentives and priorities, which can lead to conflicts of interest and a lack of transparency. This can make it difficult to ensure that all parties are following food safety protocols and that food items are being handled and stored correctly.

Blockchain technology offers a solution to these problems by providing a decentralized, transparent, and immutable system for tracking food items through the supply chain. By using blockchain, it becomes possible to create a secure and transparent record of each food item's journey from the producer to the consumer, making it easier to identify the source of a problem and prevent the spread of contaminated food.

BLOCKCHAIN TECHNOLOGY IN THE FOOD SUPPLY CHAIN

The presented analysis shows that the increased demand for transparency in the food supply chain causes an increase in the interest of modern digital solutions, such as blockchain technology. Figure presents the concept of using blockchain in the process of building food safety. Due to the methodological limitations and practical experience of the author, the focus has been on the proposed solution.

First of all, attention is paid to preventive measures consisting in eliminating the symptoms of problem situations in the link in the chain in which they were detected. In this way, it limits the development of problem situations in the entire food market chain.

The presented system is decentralized and is based on sharing data from all partners of the food value chain, collected in the digital book (ledger). In the case of animal production, this knowledge may relate to such parameters as:

− accepting the animal to blockchain records along with the opening balance;

− installation of responders on animals, enabling monitoring of their activity;

− body temperature anomaly or behavioural changes;

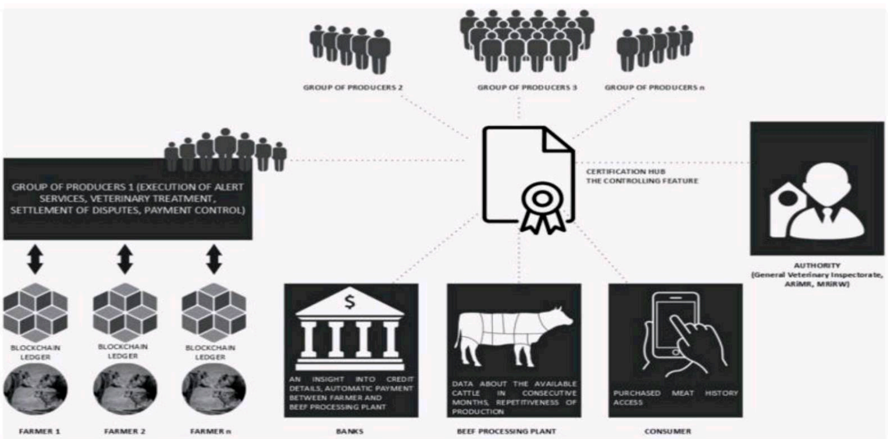
− treatment ordered;

− stages of the food cycle;

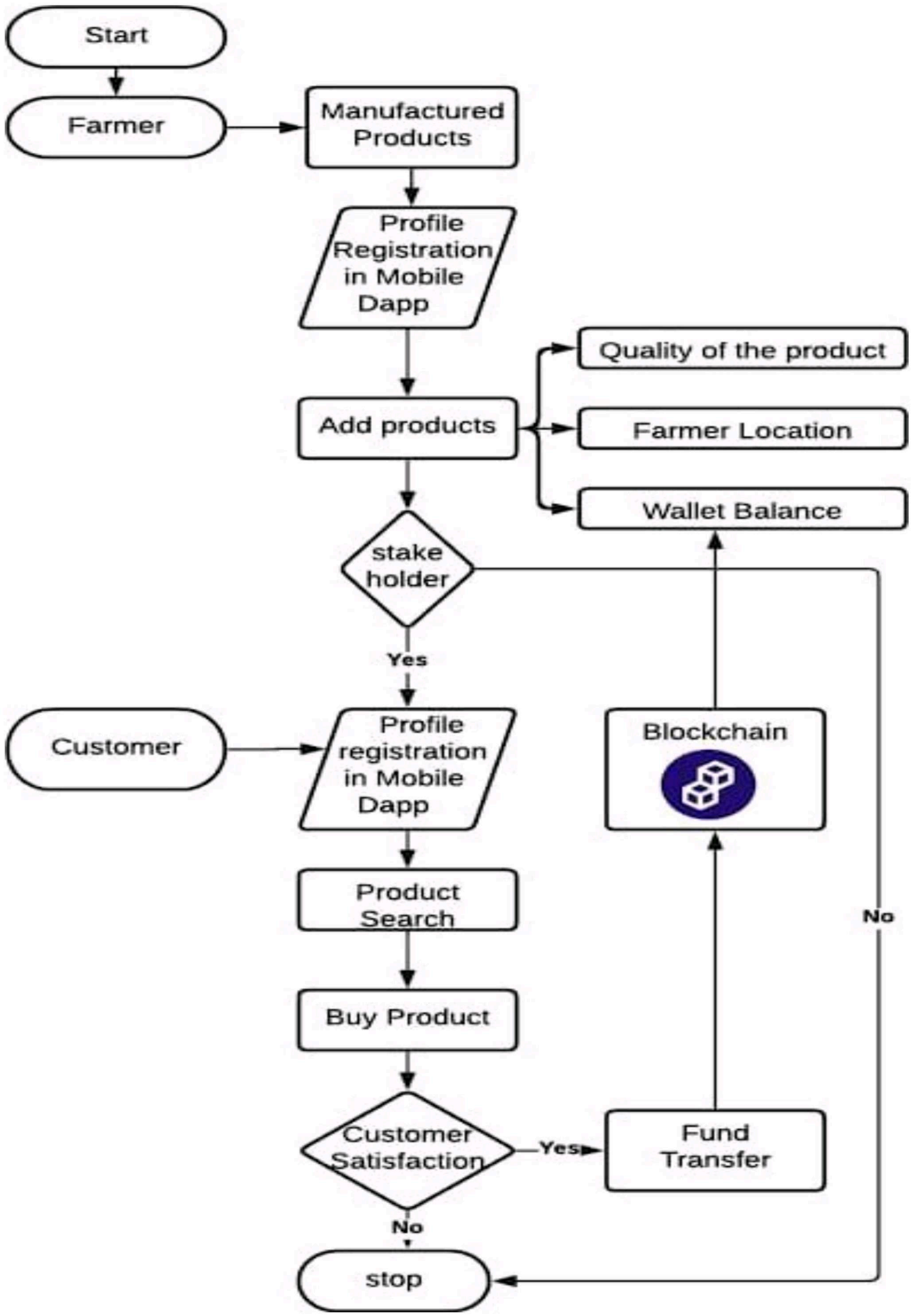
− readiness to receive by the meat processing plant after obtaining appropriate technological maturity;

− scope of preventive measures and substances used throughout the entire animal husbandry period;

− drawing up a description of the animal's silhouette and coding it in the form of a QR code.

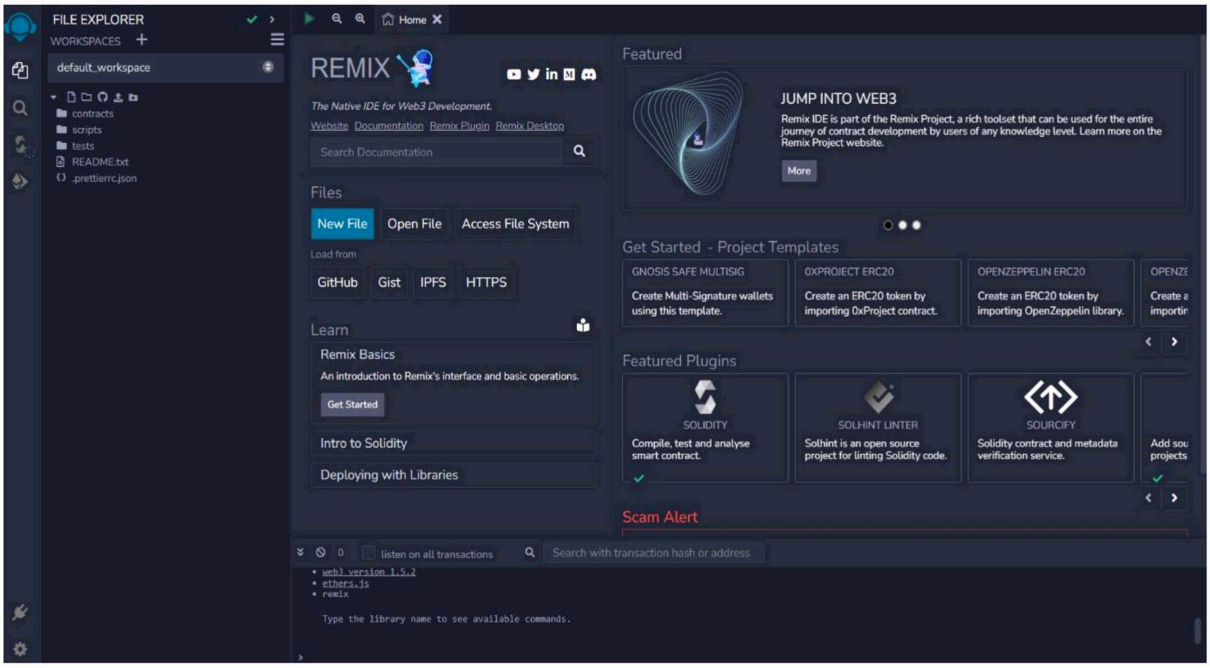


FLOW CHART



Start
Farmer
Manufactured Products
Profile Registration in Mobile Dapp
Add products
Quality of the product
Farmer Location
Wallet Balance
stake holder
Yes
No
Customer
Profile registration in Mobile Dapp
Blockchain
Product Search
Buy Product
Customer Satisfaction
Yes
Fund Transfer
No
stop

REMIX IDE



Remix Project is a platform for development tools that use a plugin architecture. It encompasses sub-projects including Remix Plugin Engine, Remix Libraries, and of course Remix IDE.

Remix IDE is an open source web and desktop application. It fosters a fast development cycle and has a rich set of plugins with intuitive GUIs. Remix is used for the entire journey of contract development with Solidity language as well as a playground for learning and teaching Ethereum.

SOURCE CODE

Step 1: Import required Solidity libraries

```
pragma solidity ^0.8.0;
import "./SafeMath.sol"; // Importing SafeMath library
```

In this step, we are importing the SafeMath library, which is used to perform arithmetic operations in a safe manner to avoid integer overflows/underflows.

Step 2: Define a struct to represent a food item

```
struct FoodItem {
  uint256 id;
  string name;
  uint256 timestamp;
  address owner;
}
```

This struct represents a food item and contains the following information: a unique identifier (id), name of the food item, timestamp of the creation of the item, and the Ethereum address of the owner of the item.

Step 3: Define a mapping to store food items

```
mapping(uint256 => FoodItem) public foodItems;
```

This mapping stores the food items with their unique identifier (id) as the key.

Step 4: Define a function to add a new food item to the mapping

```
function addFoodItem(uint256 _id, string memory _name) public {
  FoodItem memory newFoodItem = FoodItem(_id, _name,
block.timestamp, msg.sender);
  foodItems[_id] = newFoodItem;}
```

This function allows a new food item to be added to the mapping. It takes in the unique identifier and name of the food item as parameters, creates a new FoodItem struct, and adds it to the mapping with the unique identifier as the key. The block.timestamp is used to record the timestamp of the creation of the item, and the msg.sender is used to record the Ethereum address of the person who added the item.

Step 5: Define a function to transfer ownership of a food item

```
function transferFoodItem(uint256 _id, address _newOwner) public {
  require(foodItems[_id].owner == msg.sender, "You are not the owner of this food item");
  foodItems[_id].owner = _newOwner;
}
```

This function allows the ownership of a food item to be transferred from the current owner to a new owner. It checks that the person calling the function is the current owner of the food item before allowing the transfer to occur. The new owner's Ethereum address is passed as a parameter.

Step 6: Define a function to get the current owner of a food item

```
function getFoodItemOwner(uint256 _id) public view returns (address) {
  return foodItems[_id].owner;
}
```

This function returns the Ethereum address of the current owner of a food item. It takes in the unique identifier of the food item as a parameter and returns the owner's Ethereum address.

Step 7: Define a function to get the timestamp of a food item

```
function getFoodItemTimestamp(uint256 _id) public view returns (uint256) {
  return foodItems[_id].timestamp;
}
```

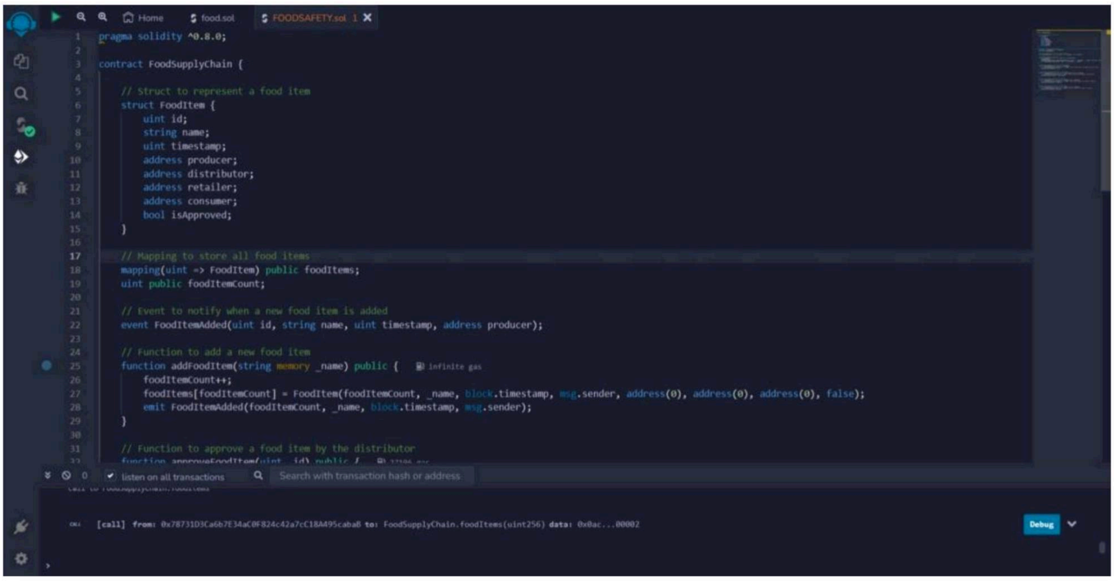
This function returns the timestamp of the creation of a food item. It takes in the unique identifier of the food item as a parameter and returns the timestamp.

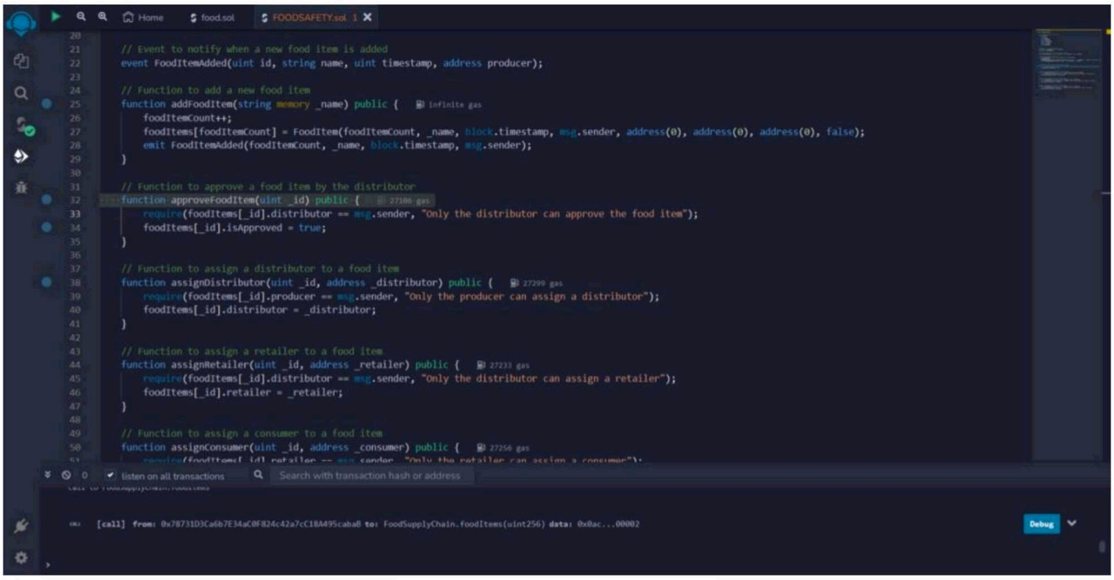
Step 8: Define a function to get the name of a food item

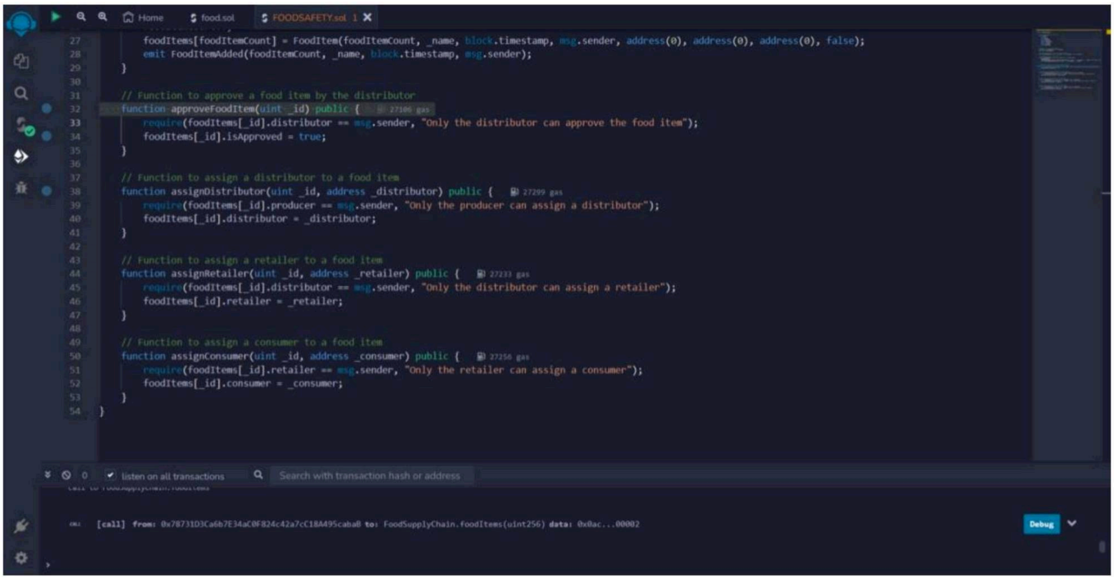
```
function getFoodItemName(uint256 _id) public view returns (string memory) {
  return foodItems[_id].name;
}
```

This function returns the name of a food item. It takes in the unique identifier of the food item as a parameter and returns the name.

These functions can be used to implement food safety in the supply chain using blockchain. By storing the ownership, timestamp, and name of each food item.







Explanation:

• The smart contract defines a 'FoodItem struct to represent a food item with an ID, name, timestamp, producer, distributor, retailer, consumer, and approval status.

• It uses a mapping to store all food items and a counter to keep track of the number of food items.

• The addFoodItem function allows a producer to add a new food item to the supply chain.

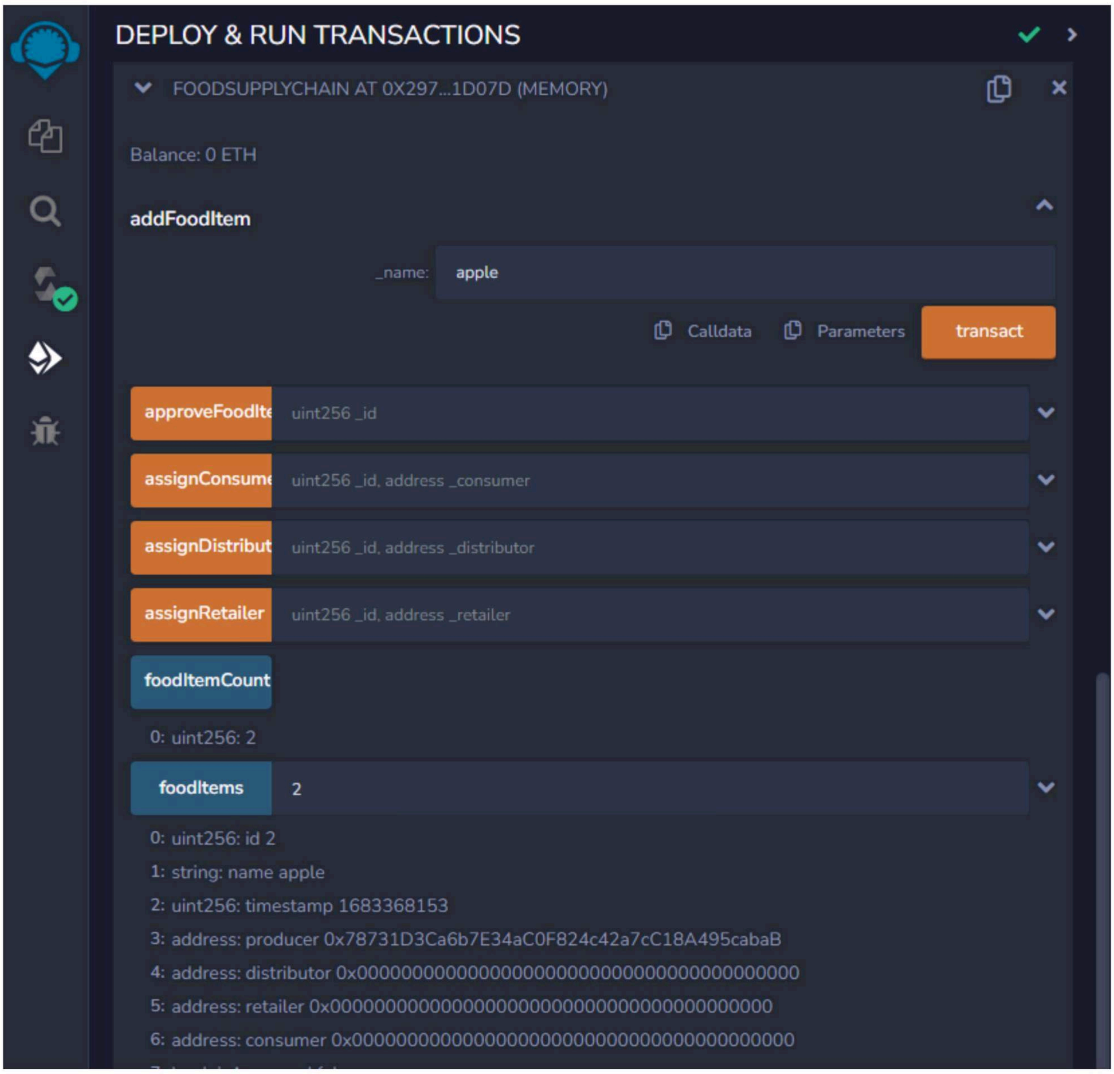
The approveFoodItem function allows a distributor to approve a food item once it has been inspectedand verified.

• The 'assignDistributor, assignRetailer', and "assignConsumer functions allow a producer, distributor, and retailer respectively to assign the next party in the supply chain to the food item.

The contract emits an event when a new food item is added to the supply chain.

• The contract could be extended with additional functionality, such as tracking the temperature and location of the food item during transport using loT sensors and integrating with a payment system to automatically release funds to the producer once the food item is approved and delivered.

RESULTS



OUTCOMES

1. Improved traceability: A blockchain-based system would enable regulators and producers to track food products from their origin to their final destination, which would make it easier to identify and contain outbreaks of foodborne illness.

2. Increased transparency: A blockchain-based system would provide consumers with more information about the food they consume, including its origin, production methods, and quality.

3. Reduced fraud: A blockchain-based system would make it more difficult for bad actors to adulterate or counterfeit food products, which would increase consumer confidence in the food supply chain.

4. Improved efficiency: A blockchain-based system would streamline supply chain operations and reduce waste by enabling producers to optimize production, reduce overproduction, and better match supply and demand.

However, implementing a blockchain-based food safety project would require significant investment in infrastructure, technology, and personnel. Additionally, there may be challenges related to data privacy, standardization, and interoperability across different supply chains and regions. Nonetheless, the potential benefits of such a system could be significant for improving food safety and consumer confidence.

FUTURE SCOPE

The future scope of blockchain technology is vast and includes various industries such as finance, healthcare, supply chain management, voting systems, and more. Some potential applications of blockchain technology include increased security and transparency in transactions, reduced fraud and corruption, more efficient record-keeping, and the ability to automate complex processes. As the technology continues to develop, we can expect to see new use cases and innovations that have the potential to transform various industries.

CONCLUSION

blockchain technology has the potential to significantly improve food safety in the supply chain by providing increased transparency and accountability. By utilizing a blockchain-based system, all parties involved in the supply chain can have access to a tamper-proof, decentralized ledger that tracks every stage of the food production and distribution process. This can help prevent food fraud, reduce the risk of contamination, and ensure that consumers are receiving safe and high-quality food products. Additionally, blockchain technology can enable faster and more effective recalls in the event of a food safety issue, which can help prevent illnesses and save lives. Overall, the use of blockchain technology in the food supply chain has the potential to revolutionize the way we ensure food safety and protect public health.

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