Fuzzy Systems and Soft Computing
ISSN : 1819-4362

AUTOMATED SMART CONTRACT GENERATION FOR AGRI-FOOD TRACEABILITY ON ETHEREUM

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ABSTRACT: Agri-food supply lines need to be more open to both governments and consumers. It is becoming easier to keep track of the agri-food chain safely, share information about food products like where they come from, and stop food theft as blockchain technology quickly develops. The reason for this is that blockchain technology is very stable and doesn't change. Despite this, these companies have a lot more trouble than their competitors making smart contracts that work in these situations. A lot of blockchain- and smart contract-based agri-food chain management systems have been suggested, but they are all one-time fixes that are hard to work into a particular product or manufacturing process. We present a new, quick, and easy-to-change way to create big Ethereum-based smart contracts for the food and agriculture industry. We can automate the process and reuse modules and code with this method, which cuts down on development time and makes sure that the system is safe and reliable. Starting with the manufacturing process, our goal is to create user interfaces that talk to the smart contracts that run the system. The method will only become more and more automated as a result. For the purpose of showing how our system works, we present a case study about how honey production works. In the future, the technology will be used in more parts of supply lines. Our method works very well with Ethereum, but it can be easily changed to work with any blockchain platform.

Keywords: Block chain technology, Network node, RFID technology and SC programming languages.

1. INTRODUCTION

A new distributed, decentralized, immutable ledger database is employed by blockchain technology to safeguard data security and immutability. This eliminates the necessity for a third party that can be trusted. This is one of the reasons why this technology is believed to have the potential to address issues in sectors such as the agri-food sector, where a high number of dishonest individuals collaborate..

The paper was the first to discuss Bitcoin. It is possible to transmit it from one individual to another without the necessity of a central authority or intermediary due to its block chain architecture.The securely unchangeable block chain records of the data in a distributed database are visible to anyone with network access.

The fundamental technology protocol enables users to exchange data with one another, while protected transactions enable users to join the P2P network without being observed. In order to be included in the unalterable sequence of blocks that contain the transactions in each network node and are recorded in the ledger, each transaction must be approved by a group of users who adhere to a consensus process. Blockchain technology is being implemented by both established organizations and innovative startups, which is resulting in the rapid development of numerous novel concepts and applications.

2. LITERATURE SURVEY

The year 2020. S. S. Kamble and Associates. "MODeling the Blockchain-enabled Agri-food Supply Chain." This essay examines the factors that facilitate the implementation of blockchain technology in the agri-food sector. It underscores the significance of smart contracts in terms of data protection, privacy, and transparency.

Yu, X., et al. (2020). " "Blockchain-Integrated Quality Monitoring for Flatt Peach Juice Production." This research recommends the utilization of blockchain technology to monitor the quality of flat peach juice production.

Ethereum smart contracts enable stakeholders to monitor the quality of production at any stage by collecting data in real time.

Alharby, M., & Van Moorsel, A. (2021). "Practices in Ethereum Smart Contract Development." The issues that have arisen during the development of Ethereum smart contracts, particularly in agri-food systems, are highlighted in this work.

Marchesi, M., et al. (2021). Marchesi with his companions. "Agri-Food Blockchain: Creating Ethereum-Based Reusable Contracts." The authors propose a modular approach that is predicated on the traceability of agri-food in order to create smart contracts that can be reused repeatedly. This framework provides a variety of product types through flexible contracts. This minimizes development periods while simultaneously guaranteeing stability and security.

Yu, H., et al. (2021). "Automatic Blockchain Traceability in Agriculture." Focusing on the need for transparent agri-food traceability, this paper presents an automated Ethereum-based blockchain solution that records every stage of the agricultural supply chain, ensuring data integrity and enhancing consumer trust through verifiable information.

Zou, X., et al. (2021). "Empirical Research on Smart Contract Problems." This empirical study investigates the challenges that arise during the development of Ethereum smart contracts, including their scalability, efficiency, and safety. The authors enhance the reliability of smart contracts for agri-food monitoring by resolving these issues.

Tonelli, R., et al. (2021). "E Ethereum Based Smart Contract Generation for Agri-Food Supply Chains." This article discusses a method by which Ethereum smart contracts can be generated autonomously for various purposes within agri-food supply networks.

Luo, X., et al. (2022). " Blockchain for Open Supply Chains in Agri-Food." This document discusses the potential of blockchain technology to ensure the authenticity of products and assist the food industry in preventing food fraud. The authors investigate the ways in which blockchain technology fosters transparency by employing Ethereum smart contracts to accumulate a wealth of information regarding the origin and management of products.

Ahrary, A. A., & Marchesi, M. (2022). The objective of this paper is to investigate the potential of Ethereum smart contracts to enhance user confidence in food traceability and reduce fraud. A semi-automated approach has been implemented to maintain product information throughout the supply chain.

Mannaro, K., et al. (2022). "Ethereal Contracts for Honey Production Traceability." This paper recommends the implementation of blockchain technology to ensure that all processes are transparent and traceable, with a particular emphasis on honey production. The authors demonstrate how Ethereum contracts can automatically capture data, which enhances customer trust and simplifies the verification of the authenticity of products in accordance with smart contracts.

Yu, X., et al. (2023). The authors established a system that ensures the veracity of agri-food data by utilizing Ethereum smart contracts to monitor and verify data at every stage of the supply chain. This guarantees security. The objective of this approach is to prevent individuals from altering the facts and to clarify the situation.

Zhou, W., et al. (2023). "Blockchain and Smart Contracting for Food Traceability." This article examines the potential of smart contracts on Ethereum and blockchain to enhance the transparency of food supply chains by reducing fraud and ensuring quality. The authors examine case studies that demonstrate the potential for increased sales as a result of increased consumer trust and transparency.

Cagliero, R., et al. (2023). "Securing Agri-Food supply using Blockchain." This paper concentrates on security and elucidates the manner in which blockchain technology reduces the likelihood of data manipulation in agri-food supply chains. The authors demonstrate the security of product tracking during management and shipment by employing Ethereum smart contracts.

Alharbi, S., et al. (2023). " "Advances in Blockchain-Based Traceability Systems." This paper examines the most recent advancements in blockchain technology for authentication. To be

more precise, the investigation pertains to sophisticated Ethereum smart contract systems. The paper demonstrates how these enhancements will elevate the standard of supply chain transparency in the future by facilitating the tracking of products and enhancing the efficiency of the agri-food sector.

Garcia, M., & Mannaro, K. (2023). "Automated Smartcontracts for Agri-Food Transparency." Garcia and Mannaro investigate the extent to which automated Ethereum smart contracts enhance the agri-food supply chain's transparency and facilitate its monitoring. The paper asserts that automated smart contracts can assist in the establishment of trust and faith among consumers of businesses.

3. SYSTEM DESIGN

EXISTING SYSTEM

According to Alharby and Van Moorsel (2015), there are four potential issues that writers may encounter when creating smart contracts. It can be challenging to make commitments that are unbreakable at the outset. Consequently, a contract cannot be altered or terminated once it has been executed. Third, contracts are difficult to locate due to the scarcity of practical instruments and methods. Lastly, the computer languages required to create smart contracts may be challenging to acquire and comprehend.

Zou et al. conducted an empirical research on the Ethereum blockchain to investigate the potential issues that coders may encounter when utilizing smart contracts. The research demonstrated that there are numerous significant issues. The current suite of SC development tools is deficient in certain respects. The act of writing code in a conventional computer language is distinct from that of writing code for a smart contract, as the blockchain and its code are irrevocable once they are implemented. Rocha and Ducasse devised a comprehensive strategy that encompassed novel blockchain concepts or methods of integrating them with existing software modeling notations. Furthermore, the authors' preliminary research demonstrates that specific modeling notations can be employed in dApps and argues that modeling is a critical component of software development. The Entity-Relationship Model (ERM), the Unified Modeling Language (UML), and the Business Process Model and Notation (BPMN) are all highly recommended. In the end, the specialists employ these concepts to conduct a comprehensive analysis of a program known as block chain-oriented software (BOS). This application executes business logic within the blockchain system through the utilization of smart contracts (SCs).

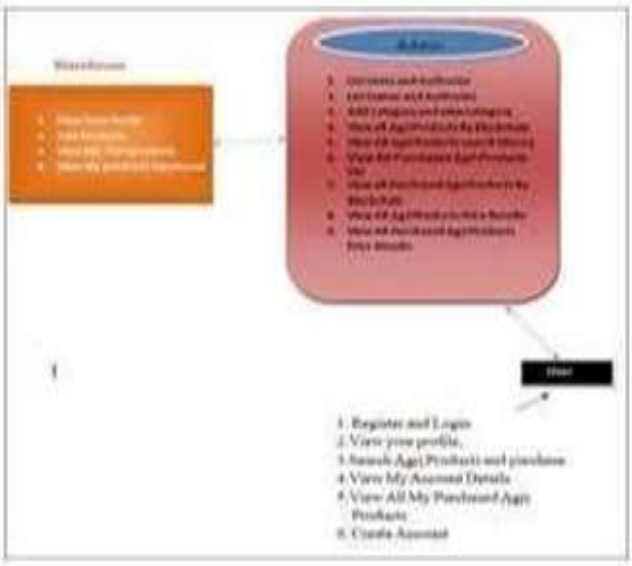
PROPOSED SYSTEM

Finally, we propose a novel approach to utilizing the Ethereum blockchain to assist in the creation and modification of smart contracts (SCs) that are tailored to the agricultural and farming industries. This approach simplifies the process while adhering to security and reliability regulations, thereby reducing the amount of time required for development. The food and agriculture sector is in search of a solution that is partially automated, adaptable, and capable of connecting with all supply lines for the first time. Although this method was initially developed for the agricultural sector, it is applicable to any industry that involves the assembly and modification of components in numerous ways.

Currently, efforts are underway to establish a more comprehensive and robust framework for food production, with an emphasis on blockchain-driven field monitoring systems. The initial phase in this process is to establish a modular system that can be easily modified to ensure that the food and agricultural supply lines are monitored 24 hours a day, seven days a week. Global supply lines and user interface tools comprise this system. Additional security and fuel economy assessments were implemented for supply chains (SCs). The initial stage in the systematic method was to utilize pre-made tables to simplify the process of preparing meals.

This approach enables developers who are not well-versed in blockchain technology to create these modules and develop the most effective solution. Additionally, a recent case study was conducted to demonstrate the efficacy of this approach, with honey production serving as the primary objective.

SYSTEM ARCHITECTURE DIAGRAM



MODULES:

USER

You acquire an item from a retail establishment. The individual is typically not informed of its location. Customers should adhere to the following guidelines when purchasing farm products and services online from stores that specialize in these sectors: The issue pertains to the specific account in question. An analysis of the agricultural and food supply. Create an account to initiate the registration procedure. Please review your account information to obtain a comprehensive inventory of all agricultural products that you have acquired.

WAREHOUSE

The overwhelming majority of Warehouse's sales efforts have been directed toward individuals who purchase items online. In order to make an informed decision, individuals who wish to conduct business with a reliable organization should be able to readily communicate with the seller and obtain additional information about the organization. This is advantageous for all parties. Additionally, it is crucial to monitor consumer products' usage and purchase statistics. You may have heard from individuals you know who have utilized your services that "Add Products," "View All Agri Products," and "View Purchased Products" are all indicators of a successful business. Warehouses are facilities that receive, store, and transport products. Users have the option to either record that the tokens are in cold storage without relinquishing control, or they can purchase tokens that directly represent the actual asset.

ADMIN

The program supervises and regulates the read and write privileges of other users. This is feasible with the majority of business process management (BPM) software. The superintendent is required to grant merchants and warehouse users permission to perform tasks such as monitoring others. Agricultural products of all types, including solitary agricultural products, agricultural products categorized by blockchain technology, agricultural products purchased using blockchain technology, agricultural product price results, and agricultural product price trend results, are displayed and accessible.

4. CONCLUSION

In the present day, consumers desire to be assured that the food they purchase is free of hazardous chemicals and that the source can be traced to ensure its accuracy and healthfulness. Consequently, individuals are prepared to pay a premium for benefits that are intangible, such as secure monitoring and marking that indicates the country of origin. Furthermore, they desire that the entire food supply system adhere to stringent regulations regarding food safety. People employed in the food industry generally concur that food traceability systems are crucial for the prevention of food fraud and the preservation of product safety. The current monitoring systems may be exploited by a manufacturer if they are dishonest, which is detrimental to customers.

The Internet of Things, smart contracts, and blockchain technology are combined to create a method for monitoring objects. Makers can collaborate and exchange information regarding their products in this manner. Additionally, impartial third parties may verify the accuracy of the information regarding the origin and quality of the products. The likelihood of individuals accepting the information is significantly increased when this approach is implemented. We have a method that enables programmers to create traceability systems for the agriculture and food industries without the need to possess a deep understanding of the intricate technical aspects of

supply chain development. It is impossible to overstate the extent to which this approach differs from the software company's typical operations. In order to accomplish this objective, software was developed that can generate the system components (SCs) and user interface (UI) of a tracking system automatically. The proposed method could accurately depict the issue area due to the system's intended functionality. The initial stage of the method involves the extraction of the entire supply chain that is required.

This category encompasses all producers, stakeholders, resources, products, events, data, and other entities.This straightforward instrument is contained within a sequence of files. It is accessible to individuals of all skill levels, regardless of their proficiency with computing. The distributed application (dApp) acquires its user interface and the capacity to communicate with users after HTML5 pages are converted to CSV files. This technology enables all individuals in the supply chain to monitor and verify significant events in a permanent journal. It is also feasible to identify the individual who is accountable for documenting the events that have already been detailed. People have a significantly greater level of confidence in the accuracy of product information than they did in the past, when certification was strictly dependent on the producer's statements. This is due to the fact that each stage of the creation process can be examined thoroughly.

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