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BLOCK-CHAIN BASED APPROACH FOR FOOD SUPPLYCHAIN MANAGEMENT

1st Arpitha K
Dept. of Computer Science
BGS Institute of Technology
Adichunchanagiri University
BG Nagara, India
arpithak@bgsit.ac.in

2nd Sindhu M R
Dept. of Computer Science
BGS Institute of Technology
Adichunchanagiri University
BG Nagara, India
sindhumr621@gmail.com

Abstract: **The management of food supply chains has become increasingly vital in the agricultural sector due to the involvement of various stakeholders in decision-making processes. The proliferation of low-quality agricultural products in the market necessitates the use of chemicals in the production process. Consequently, these practices pose significant challenges, impacting both the quality of agricultural products and the well-being of consumers.**
Keywords—supply chain management,stakeholders.

I. INTRODUCTION

Blockchain represents an advanced technology with the potential to revolutionize various sectors, including the facilitation of trust in distributed networks within food supply chain applications. Leveraging blockchain can enhance information sharing among partners in the food supply chain while maintaining confidentiality and security. The integration of blockchain-based applications holds promise for improving food traceability, transparency, and authenticity. Additionally, combining blockchain with the Internet of Things (IoT) can enhance secure communication among network nodes. Utilizing Decentralized Ledger Technology (DLT), blockchain ensures secure data storage and retrieval in distributed environments. With the widespread deployment of IoT devices for data management, the proposed system is well-suited for creating a decentralized distributed access system supported by blockchain. The evolution of the global food supply chain has significantly increased product and information flows among countries. Early food supply chain practices focused on integrating supply chain partners to enhance efficiency, reduce transactional and operational costs, and meet consumer demands for food quality and safety. Consequently, there is a growing imperative for food supply chain partners to prioritize transparency, exchange trusted information, and improve traceability from farms to retailers.

II RELATED WORK

[1].Blockchain based solution to improve the Supply Chain Management in Indian agriculture.

The food products are more sensitive, and it is very hard to trace the origin, buyers, sellers, farmers with the existing centralized method. The usage of Block- chain technology is proposed and experimented in this work along with the features of decentralization, increased security, immutability, and tamper proof for supply chains. The proposed work uses the smart contract on Ethereum for food supply chain management systems, which avoids falsifying information, corrupting database, external attacks. The analysis of food supply chains is shown in the experimental results.

[2]. How Blockchain can Revolutionize the agriculture industry

Blockchain is booming technology in many industries. Especially, supply chain management. This paper talks about how the perishable food product to take safely in cold supply chain management with the help of blockchain technology. Here, we proposed the immutable ledger from farm to consumer. This ledger is distributed. So, whoever (farm to consumer) can take this data and check the details. With the help of an immutable ledger, no one can change the food item data. Example: what temperature we assigned to the perishable products and which company manufacture the food products and date, etc., all data stored forever. No one can be changed the data. So, with this technology, we can reduce the food losses, reduce the economic losses for a manufacturing company, and avoid the foodborne illness of our valuable consumer. Eventually, we increase consumer trust.

[3]. Blockchain in Agriculture Traceability

Blockchain, a decentralized technology, has found application in various sectors like banking, healthcare, energy and supply chain management. Hyperledger fabric (HLF), an open-source platform to implement blockchain technology (BKCT), is gaining widespread attention in the industries. However, the analysis of performance of platforms as the like of HLF has been done in a restricted manner in the past. The performance analysis will indicate the effectiveness of these platforms to implement BKCT.

III. PROPOSED SYSTEM

The objective of implementing blockchain technology in a food supply chain management project is to establish a secure and transparent system for tracking food products throughout the supply chain, from origin to consumption. This initiative aims to harness the advantages of blockchain to enhance efficiency, cut costs, boost food safety, and foster trust among all stakeholders, including farmers, suppliers, distributors, retailers, and consumers. By deploying a decentralized and tamper-proof system for recording and authenticating transactions, the project endeavors to tackle issues pertaining to traceability, sustainability, and ethical sourcing of food products, thereby fostering a more sustainable and accountable food system.

IV SYSTEM ARCHTECTURE

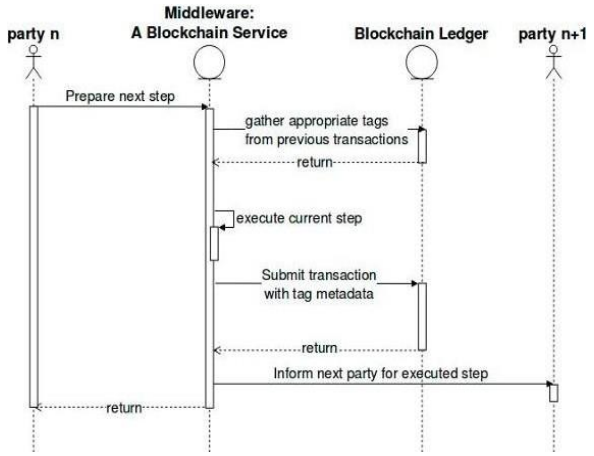


Fig 1. System Architecture

The Blockchain Layer within the architecture encompasses the fundamental low-level functionalities of the blockchain network. It comprises modules designed to achieve consensus among peers and manage transactions recorded in the ledger. The Consensus Module plays a pivotal role in confirming data authenticity and ensuring the proper execution of operations within the blockchain network. It oversees transaction validation, verification, and facilitates agreement on the current ledger state among participating nodes. This module closely interacts with the Transactions Handling module to collectively structure the blockchain data.

In permissioned blockchain platforms, novel consensus protocols are employed, contrasting with traditional ones used in public blockchains. These consensus algorithms are tailored to expedite and enhance efficiency within private environments, facilitating trust-less node interaction and decentralized application implementation.

The Transactions Handling Module is another critical component of the blockchain network, responsible for storing transaction data on the blockchain ledger. It collaborates closely with the Consensus Module to form the blockchain data structure. When a transaction is submitted to the blockchain network, pertinent information such as transaction hash, sender and receiver addresses, timestamp, transaction value, and additional data are recorded on the ledger.

The Middleware Layer serves as the linchpin of the infrastructure, bridging the Blockchain Layer with top layers closely related to supply chain management, such as Enterprise Resource Planning (ERPs) and other relevant software packages. Interaction with the Smart Contract Manager module is anticipated, as transactions

often adhere to specific conditions outlined by smart contracts. These smart contract-related functionalities generate new transactions controlled by the Transactions Handler and forwarded to the Blockchain Layer, ensuring seamless integration and operation within the blockchain scheme.

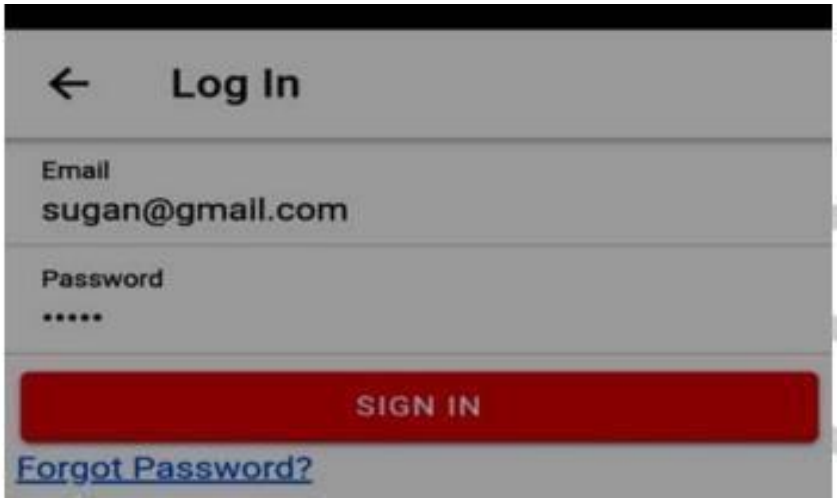
V METHODOLOGY

The method proposed in this paper defines each database segment as a "block." As the transaction activity progresses, a block with a connection to the previous block is added to the block sequence in a sequential flow procedure. Subsequently, this new block is replicated across the network, ensuring consistency of the blockchain across all storage regions. In this transaction activity, each participant receives a copy of the blockchain, allowing any participant to verify the action without the need for centralized, trustworthy third-party confirmation of transactions.

Blockchain technology offers a wide range of applications and ample room for innovation. Consequently, customers can record specific prices for goods, facilitating the discovery of fair prices for farmers' products. Authorities can maintain records on agricultural prices and broker misconduct. The authors propose a basic structure and solution based on smart contracts and blockchain for monitoring, tracking, and executing business operations in the agricultural supply chain, eliminating brokers and key points of crop pricing in traceability. Consequently, the government, customers, and, most importantly, farmers stand to benefit. This solution presents an acceptable option for all three key stakeholders.

VI RESULTS AND DISCUSSION

Results were obtained from the blockchain consortium involving two peers in the network. Initially, the blockchain generates all



certificates and keys for various network entities, utilizing the genesis block to bootstrap the ordering service and execute a collection of configuration transactions necessary to configure a channel. The Genesis Block serves as a prerequisite for obtaining transactions within the blockchain.

Fig. 2. (a) login view (b) profile view

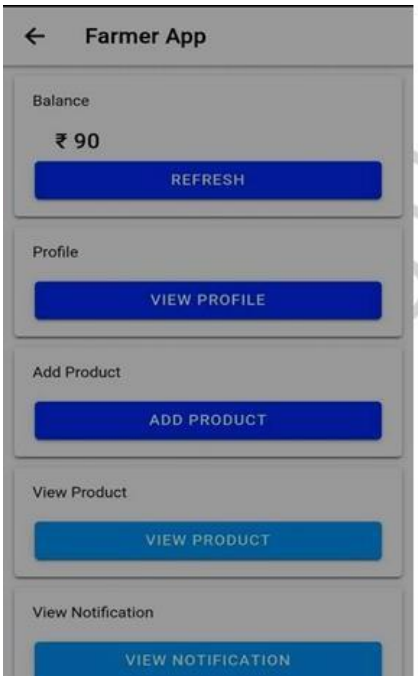


Fig 3 Farmer view

VII CONCLUSION AND FUTURE WORK

Blockchain technology holds immense potential to transform the food supply chain management system. Its decentralized and secure nature offers transparency, traceability, and accountability throughout the supply chain, thus mitigating risks such as fraud, errors, and food contamination. By leveraging blockchain, stakeholders including food manufacturers, suppliers, retailers, and consumers can access real-time information regarding the origin, quality, and safety of food products. This heightened visibility can optimize supply chain efficiency, decrease compliance costs, and foster greater consumer trust.

However, the effective deployment of blockchain in food supply chain management necessitates collaboration among stakeholders, standardization of data, and the establishment of a resilient infrastructure. Furthermore, addressing issues related to scalability and interoperability is crucial to ensure widespread adoption and seamless integration with existing systems.

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