TRACKING ORGANIC FOOD SUPPLY CHAINS WITH BLOCKCHAIN TECHNOLOGY

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ABSTRACT:- The capacity of blockchain to preserve and disseminate transactions in a permanent, tampered ledger makes it important. Sanitation and authenticity cannot be ensured in a typical supply chain, thus purchasers cannot be certain their products are genuine. The goal of this study is to develop a decentralized Blockchain-based product quality and origin verification system. To ensure product authenticity, we will establish a certified organic food supply chain. This paper will discuss how block chain technology can help to safeguard supply chain data. We can eliminate data tampering and fraudulent data allocation by using blockchain technology to build a Smart contract, and clients can be assured of product quality by acquiring a quality assurance certificate. This article assists professionals from various fields in understanding and utilizing the blockchain-based system to improve system efficiency.

Index Terms: Blockchain technology, food supply chain, Ethereum, smart-contract, quality assurance, trust ability, security, and transparency.

1. INTRODUCTION

Agriculture is the most important industry in Bangladesh. Agriculture employs over 70% of the population. With a fast rising population, we must consider how to use agriculture to meet our needs. Bangladesh generates a large portion of the world's agricultural. Bangladesh produces the most rice, jute, wheat, tobacco, and other commodities. Boost agricultural output to ensure food security. Any company or food manufacturing facility must deal with food quality and nutritional issues that affect consumer health. The world is attempting to provide food security for its expanding population. When purchasing food from a secure food network, the manufacturing process and ingredients must be revealed. Understanding the underlying components and processing of each product is one of the most important strategies to ensure food safety, and all organic food supply chain partners must communicate this information. Traceability, product safety and quality, communication, origin and processing method, and transparency are all potential difficulties in traditional supply chains. Blockchain technology is the solution to our dilemma. Blockchain, a relatively new technology, is ideal for improving the current supply chain structure. Blockchain is a decentralized database that is auditable, transparent, and secure, allowing FSC network append-only transactions. Blockchain employs cryptographic hashing. Each block contains encrypted, unchangeable data. The blockchain's data encryption increases trust and product demand. We minimized the number of assailants who provided false information. Following an analysis of the manual supply chain, we will develop a blockchain-based solution that provides everyone with verifiable data. Following investigation, this research may achieve the following objectives:

- Develop a method for validating producer data.
- Our system validates producer data.
- A quality assurance index will be used to rate farmers' produce.
- Providing organic items to customers

2. RELATED WORK

Modern technologies have benefited every industry. Electronic voting, robotics, automotive registration, national identity card administration, sentiment analysis, block chain-based payment

systems, stock market predictions, and network systems are all automated nowadays. Many studies have been conducted to investigate the incorporation of blockchain technology into supply chain systems. In the supply chain, blockchain enables raw material and operation traceability as well as transaction security. A well-designed block chain supply chain should ensure product quality. Center record data must be saved on-chain in smart contracts, but verification and certification data must be stored off-chain. To address concerns about double-spending (digital crypto currency), the author compares Block chain technology to a peering network. The implementation of intelligent contracts is critical to the indicated capabilities.BCT can significantly increase traceability. Using Ethereum smart contracts and tokens, we demonstrate inter-node supply chain management collaboration. The author demonstrates the bounds of traceability in information storage and dissemination. A blockchain analysis uncovered food traceability issues. The author suggests using Ethereum and smart contracts to track intermediates. The EVM in this architecture contains data from grain elevators, distributors, seed companies, grain processors, growers, clients, and so on. The author uses a prototype of the culinary Quality Index (FQI) algorithm to produce an index value to judge culinary quality. With a block chain innovation strategy, you can provide security and trust in the IC manufacturing supply chain management. This essay will look at the aspects and requirements of supply chain integration. The author uses blockchain, IoT, and AI to change the halal food industry. RFID and Blockchain solutions were developed by the author for China's agricultural food supply chain. The author's solidity contract compilation can be used by any EVM-compatible block chain. For a demonstration, the author advised using unified KPIs. OPM, which receives control-based security based on block chains.After reading numerous supply chain system research publications and systems, we assessed their faults. Previous research just offered product information; it was unable to establish their validity through quality assurance certification.

3. TRADITIONAL BLOCK CHAIN TECHNOLOGY IN FOOD SUPPLY CHAIN

Agriculture is being transformed by blockchain technology. Our strategy reduces the length of organic product supply chains. Using a decentralized blockchain record that all parties involved in an activity may accept can increase communication about what has to be done, whether it's harvesting crops, altering storage, or implementing new technologies. The blockchain organic food supply chain monitors and validates food quality. Because of the traditional Blockchain system's lack of openness, quality assessment is highly awaited. Blockchain technology has the potential to solve this problem. In the background, traditional supply networks transmit data. It is possible to modify data.

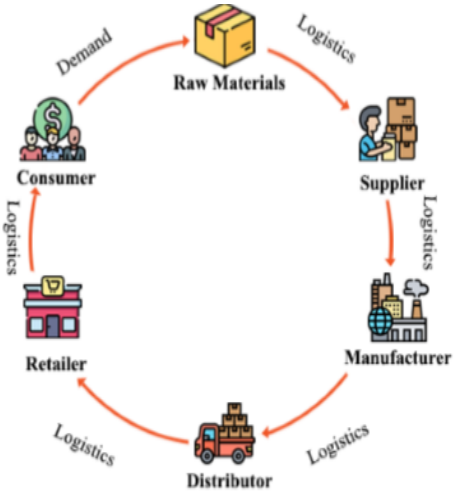

Fig.1.TraditionalSupplychainforOrganicFoodSupplyChain.

Data can be changed by third parties. The author proposes a smart contract approach to secure data from unauthorized access. However, the producer is unable to supply accurate information.

The goal of this research is to develop a blockchain-based decentralized system. By providing a quality certification certificate, this system streamlines secure transactions, ensures product authenticity, and allows members to exchange accurate and evocative information.

4. SYSTEM DESIGN

Our agricultural food supply is improved through block chains. Agribusiness provides food for the majority of the world's population. The organic food supply chain administration framework is

depicted in Figure 2. This is how our proposed system works. The procedure requires the farmer to first register his land. Assume the farmer grew vegetables. Quality assurance firms will assign him a quality index based on the quality of his products. Members of the soft supply chain can keep an eye on the state of the goods at all times. Customers can check the status of their orders by scanning a QR code. All transaction details will be included in the blocks. As a result, no data will be changed or compromised. Because of the quality certification, the consumer will also obtain an organic product.

5. IMPLEMENTATION AND WORKING PROCESS

An application technique will be used to demonstrate the functionality of our block chain-based system. State variables are specified and initialized using solidity contracts. It has been added to Ethereum solidity.

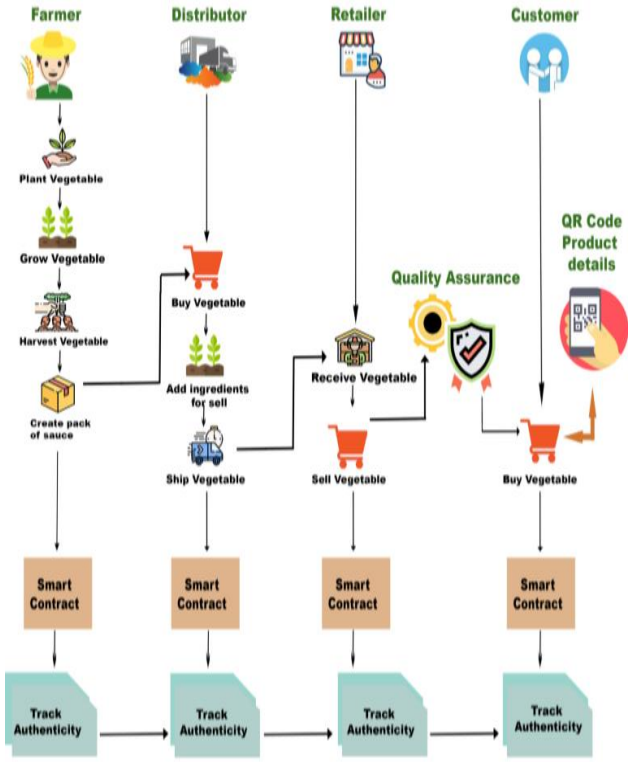

Fig.2.A system view using smart contract and quality as suranceforensuring the transparency of organic food supply chain.

Solidity

Smart contracts are supported by Solidity, an object-oriented programming language. Ethereum block chain smart contracts are well developed. Solidity makes use of both state and local variables. State variables are defined and available in smart contracts. State variables in blockchain blocks store smart contract states. Functions are often where local variables are declared and initialized. Local variables in functions lose their initialized values after the function call. After a function call, local variables release memory and cannot retain given values. Solidity language variables, functions, and data are stored in three segments:

Stack: Function local variables are kept in memory on the stack.

Memory: This memory sector is where transient value variables are created. Each Ethereum VM contains the same components. The values of this variable are released following function calls.

Storage: This memory space is where smart contract state variables are defined and initialized.

In a blockchain setting, supply chain solutions can reduce customer service costs while increasing transparency. Blockchains record all product actions so that they may be tracked by anyone. The first step of supply chain development d the app is evaluating the data and activities required to provide functionality. Our supply chain app requires four types of data.

Create products: Create and market products.

Create participants: Creation and display by participants.

Move products along the supply chain: Transfer product ownership to a third party.

Track a product: With rudimentary capability, display a product's supply chain history.

Supply chain knowledge should include:

Initialize tokens: To begin, use payment tokens.

Transfer tokens: Tokens can be used to buy or transfer between accounts.

Authorize to ken payments: Allow a user account to send tokens on behalf of another.

Create products: Create and market products.

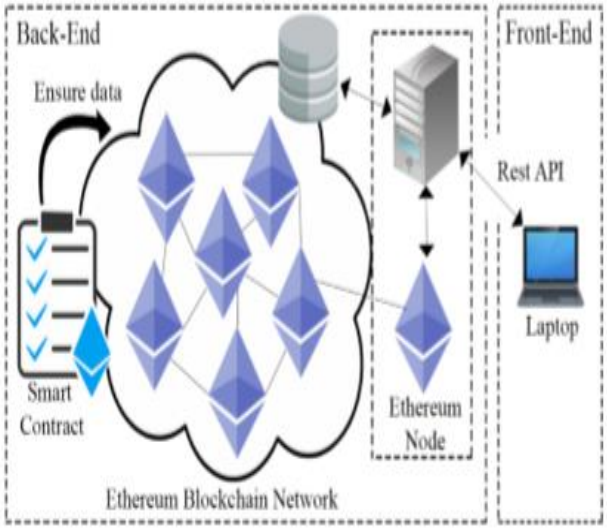

Fig.3.dAppblockchainnetworkinethereumthatusin gethereunnode.

Create participants: Creation and display by participants.

Move products along the supply chain: Transfer product ownership to a third party.

Track a product: Display the product's supply chain history.

Algorithm 1: Creating Participant in our proposed system

1. function createParticipant(*stringmemory_name*, *address_pAdd*,string *memory_pType*)
2. userId = *u_id* + +
3. Require valid *participants_name*
4. *Require_pass*.length>0
5. *Requirevalid participants_pAdd*>0
6. *Requirevalid participants_pAdd*>0
7. *Require_pType*;
8. return userId;

Algorithm 2: Participant Details in our proposed system

1. function getParticipantDetails(*uint32_p_id*)
2. return participants[*_p_id*].userName

Algorithm 3: Creating Product in our proposed system

1. function createProduct(ownerId,frameworkNumber ,*_partNumber*,_serialNumber, *_productCost*)
2. productId = *p_id*++
3. *Require_frameworkNumber*
4. *Require_serialNumber*>0
5. *Require_productCost*>0
6. Require participants[*_ownerId*]
7. return productId;

Ethereum, Solidity, and data storage in block chain applications have all been discussed. Figure 3 depicts this. We demonstrated how our blockchain-based program generates participants and stuff, transfers products along the supply chain, and tracks commodities, among other things. The algorithm (Algorithm1, 2, 3, 4) that describes the functional requirements for our blockchain-based solution was provided by us.

Algorithm 4: Transferring data to the Owner in our proposed system

1. function transferToOwner(*uint32_user1Id* ,*uint32_user2Id*, *uint32_prodId*)
2. Require participants[*_user1Id*];
3. *Requireregistration_id*
4. Requireregistrations[*registration_id*].productId
5. Requireregistrations[*registration_id*].productOwner
6. Requireregistrations[*registration_id*].ownerId
7. Requireproducts[*_prodId*].productOwner
8. RequireproductTrack[*_prodId*].push (*registration_id*)
9. emit Transfer(*_prodId*);
10. return (true);

6. RESULT ANALYSIS

- To demonstrate its utility, we built a system based on block chain standards. Summarizing the outcomes of our system:
- Our technology secures participant-to-participant block chain transactions.
- To ensure security, segmented data is encrypted. To transact and sign digital documents, each blockchain network participant utilizes their own private key. Any participant in the block chain network who modifies the information renders it invalid.
- Blockchain system participants may always determine product status and component source. The origin city certification provided

by our suggested method ensures the end user's expectation of product authenticity. These indices are provided by independent organizations, which ensure their accuracy. This ensures transparency and product quality.

- The shipper can benefit from the transparency, scalability, and security of blockchain, which can secure the supply chain system from damage and data manipulation throughout the product life cycle. Table I compares the requirements for data protection, verification, and authentication.

TABLEI

A COMPARISON BETWEEN BLOCKCHAIN-BASED SUPPLY CHAIN AND TRADITIONAL SUPPLY CHAIN

Comparative item	Blockchain-based supply chain	Traditional supply chain
Data integrity	Tamper proof	No tamper proof
Data Security	Decentralized protection	Centralized protection
Data Verification	Achieved	Not achieved
Government regulations	use authentication protocol	without authentication protocol

Supply chain processes that differentiate blockchain-based supply chains from traditional supply chains.

7. EXECUTION TIME

It takes time to mine a block. Block times for Ethereum and bitcoin are regular and expected. Ethereum blocks typically last between 10 and 19 seconds. It is projected that the block time would be constant. After N squares, the usual block time of the arrangement is evaluated; if it exceeds the expected block time, the work calculation for verification of work is easier; otherwise, it is more difficult.

The Ethereum difficulty will be as follows:

BT=CBT-PBT

CBD = PBD + (PBD / 2048) * max (1 - (BT/10) - 99) + int (2*((CBN / 100000) - 2))

If the current block is mined in less than 10 seconds, the compute value will climb, making the problem more difficult. If the Block Time is shorter than ten seconds, the over condition will be:

CBD = PBD + (PBD / 2048) * max (1 - (0/10),- 99) + int (2 * ((CBN / 100000) - 2))

CBD = PBD + (PBD/2048) * 1 + int (2 *((CBN / 100000) -2))

Our CBN is less than 100000 so the value will be int (2 *(0 - 2)) or int (2*(-2)) or int (1/4) which is 0.

So, CBD = PDD + (PBD / 2048) * 1 Our PBD = 20516

Then, CBD=20516+ (20516/2048)*1

=>CBD=20516+10.01758

=>CBD=20526.017558

That increases10.01758.

8. CONCLUSION

The standardization of blockchain supply chains has raised numerous problems and challenges. Blockchain technology will aid suppliers and consumers in negotiating reasonable prices. Consensus is required in traditional blockchain supply chains. Intelligent contracts have a significant impact on consumer confidence. This method is used to verify every transaction. Furthermore, no previous data can be deleted. Each is documented. To assist individuals in understanding food grade. Through quality assurance, our process ensures product authenticity. This promise is genuine because the certificate is issued by a quality assurance company following a quality evaluation. Uncertain opinions and knowledge may apply to no traceable things that anyone in the traditional agricultural supply chain can change or supply. Our system will assist customers by displaying the most popular bio-pure items.

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