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Transparent and Traceable Food Supply Chain based on Decentralized Approach

Ms.C. Kudiyarasudevi
Dept. of Computer Science and Engineering
SRM Institute ofScience and Technology
Chennai,India

D Jaswanth
Dept. of Computer Science and Engineering
SRM Institute ofScience and Technology
Chennai,India

P Venu Gopal
Dept. of Computer Science and Engineering
SRM Institute ofScience and Technology
Chennai,India

V Krishna Teja
Dept. of Computer Science and Engineering
SRM Institute ofScience and Technology
Chennai,India

Abstract- Firstly, we provide an overview of the Fourth Industrial Revolution and its implications for the agricultural sector, highlighting the need for innovative solutions to address challenges such as food safety, traceability, and sustainability. Next, we delve into the fundamentals of blockchain technology, elucidating its decentralized nature, immutability, and cryptographic security features, which make it an ideal candidate for enhancing trust and transparency in agricultural supply chains. In the Fourth Industrial Era, agriculture faces new challenges. Blockchain technology offers a simple, secure way to address them. Our framework outlines how blockchain can boost transparency and efficiency in food supply chains. By tracking products from farm to table, we ensure safety and trust. With real-world examples, we show how blockchain improves traceability and reduces waste. This framework empowers stakeholders to embrace blockchain's potential, creating a stronger, safer food system for all.

Keywords- Traceability, sustainability, blockchain technology, decentralized, immutability

I. INTRODUCTION

Consistent and safe food production is the foundation of success in the food industry when considering farm-to-table production. Therefore, coordination of operations from raw material production to final delivery is key to supply chain management. The continuous development of international food chains (FSCs) and trade has led to significant growth in cross-border trade in goods and materials. But fraud, poor marketing and poor performance on the FSC have raised concerns about the authenticity and quality of products and created an urgent need for better information exchange and trust. In general, the information distributed by all nodes in the computer network is called blockchain. Blockchain is an electronic device that stores information digitally and is often used to record transactions in cryptocurrencies such as Bitcoin. The main feature of blockchain technology is that it ensures the integrity and security of information without the need for a trusted third party, which increases trust in the body. There are four basic features that distinguish blockchain technology from other ledgers (centralization). These are origins, endings, immutability, and algorithmic

consensus. Provenance refers to the complete documentation of all transactions related to the asset created and stored on the blockchain. Finality, on the other hand, means that once a transaction is committed to the blockchain, it is final and cannot be reversed or undone. Third, transactions cannot be modified, deleted, or added to before or after they are recorded on the blockchain. This property is called blockchain immutability. This feature allows users to review data without worrying about human error. Finally, consensus refers to the process of selecting new changes, distributing them to network users, and reaching an agreement on the history of the changes.

II. METHODOLOGY

Blockchain traceability in agricultural product chains. Blockchain can reduce labor and guarantee traceability, record the history of all transactions, reproduce information in a simple way and control the underlying product.

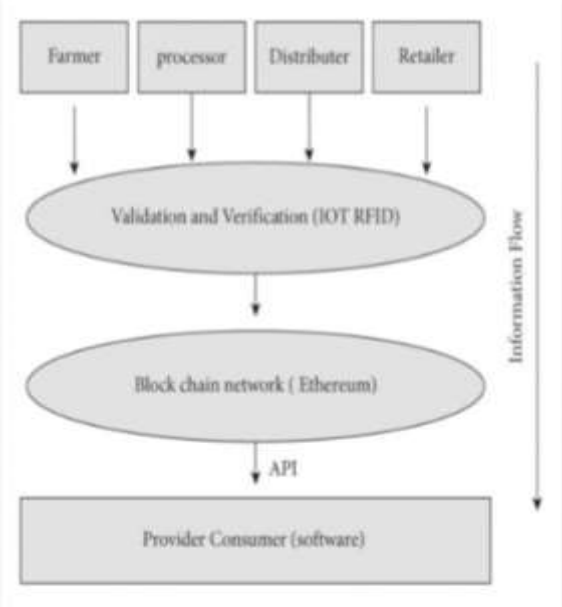


Fig-1 Blockchain based model

2.1. Data Collection and Preprocessing

The first stage of data search is data collection and preliminary preparation. The important stage is preliminary data because only valid data can create correct data. The information used in this project is collected by users. Although data has many characteristics, initial data only considers important data and ignores others.

2.2. Decision Tree

Decision trees created from training data help make predictions. Creating the decision tree is done by selecting the best available features divide the structure in the most efficient way. The decision tree of this system is shown below. 2:

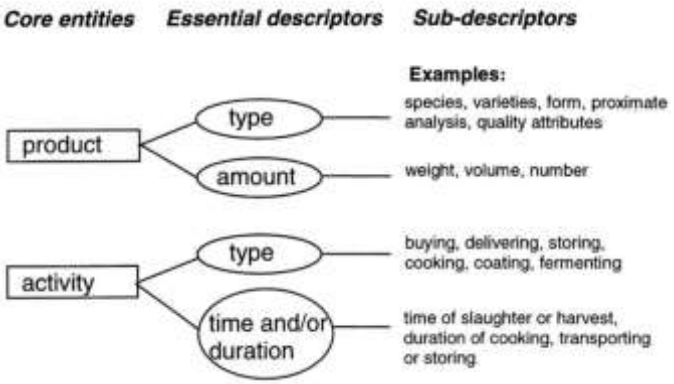


Fig-2 Decision Tree

III.PROPOSED MODELS

3.1. Blockchain Technology for food supply chain

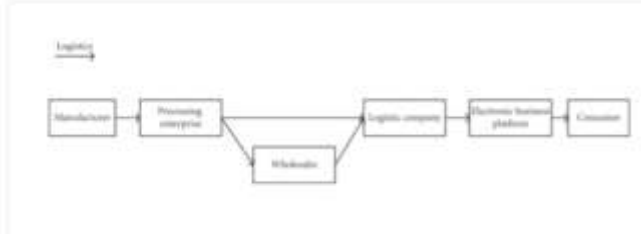
In general, the information distributed by all nodes in the computer network is called blockchain. Blockchain is an electronic device that stores information digitally and is often used to record transactions in cryptocurrencies such as Bitcoin. The main feature of blockchain technology is that it ensures the integrity and security of information without the need for a trusted third party, which increases trust in the body. Unlike traditional information organizations, information in a blockchain is organized into blocks where specific resources are stored and linked together in a chain. Each block has a set of data, which is closed when writing, the next data is placed in a new block and added to the chain when it is full. According to Investopedia, the asset value on the Bitcoin blockchain runs into trillions of dollars. On the other hand, the food chain is a complex system that includes many nuances and complex processes. Food products in general are the most technologically advanced in the world. Key problems in agricultural production include low technology, poor management, misinformation and poor supply chain. Many studies have shown that blockchain should be integrated into the food chain to make it more transparent, traceable and trustworthy. These are origins, endings, immutability, and algorithmic consensus. Provenance refers to the complete documentation of all transactions related to the asset created and stored on the blockchain. Finality, on the other hand, means that once a transaction is committed to the blockchain, it is final and cannot be reversed or undone. Third, transactions cannot be modified, deleted, or added to before or after they are recorded on the blockchain. This property is called blockchain immutability. This feature allows users to review data without worrying about human error. Finally, consensus refers to the process of selecting new changes, distributing them to network users, and reaching an agreement on the history of the changes.

Dataset 1 (Smart Contracts)

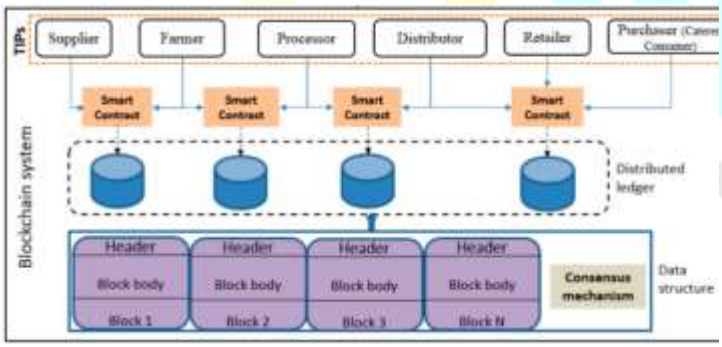
Contracts based on smart contracts are more useful on connected devices because they provide a complete view of the peers on the network. Each part of the P2P network has access to the current state of all smart contracts, as well as the history of all smart contracts and transactions. For example, the Ethereum blockchain is a blockchain designed to support the use of smart contracts and suitable for tracking systems. Yao and Zhang developed and implemented the Ethereum blockchain with minimal data dependency and did not leak sensitive information to all participating companies. However, for large networks, the Ethereum blockchain has disadvantages such as difficulty in protecting sensitive data, time and cost.

Dataset 2 (Block creation process)

In six steps, a new file can be created and entered into the existing blockchain. First, one of the P2P networks initiates an action (for example, a new file). A new block of data will be created and the creation of this new block will be passed to the rest of the blockchain for verification. Once the transaction is verified by other nodes, a new block will be added to the existing blockchain. In the end, the venture will be successful and safe. When the block creation process is completed, the information of all nodes in the P2P network will be updated with the new information.



3.3. Architecture



IV Proposed work

The main problems encountered in food supply management are inconsistency and inaccuracy. The current supply chain is centralized, relies on third parties, and is not identified and verified by standard methods. Medium size machines are needed. We use the food product identification number to complete tracking and record all changes. To ensure confidentiality, only authorized users can access information and ensure that users are authorized to do business. Smart contracts in our system; It focuses on the interactions between different organizations, including producers, carriers/shippers, and consumers. Only registered users can perform certain transactions, unregistered users are not allowed to perform transactions. Blockchain-based traceability allows people to investigate product defects, contamination points and food waste to ensure the origin of products; Producer: Producer is the first person who deals with food production and mass production of food. He sells the food to shippers/shippers. It collects food information and collects payment after 30 days and refunds the remaining amount to the customer. Transporter/Logistics: Transporters purchase finished food products from manufacturers and are responsible for selling the products to consumers. It is responsible for the fair delivery of goods from producer to consumer. Consumers: Consumers play an important role in the food industry. He buys food from transporters. They can purchase the necessary products according to their needs and communicate with the manufacturers. Administrator: Administrator identifies new sites on the network. It adds, defines all parts of the network and interacts with them using smart contracts.

V. RESULTS AND DISCUSSION

The results show that Blockchain based model in food supply chains is the most computationally efficient model, which is then followed by smart contracts , traceability , decentralized , immutability that is still able to achieve comparable performance.

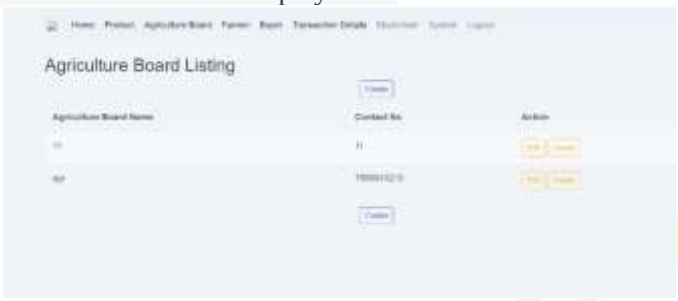
After using the following code for importing the data module for web application the data is ready to be compiled in all the models.

```
from flask import Flask, request,
render_template, redirect, url_for
import os
import pyodbc
import uuid
import time
from datetime import datetime
from Constants import connString

from AgricultureBoardModel import
AgricultureBoardModel
from BuyerModel import BuyerModel
```

```
from FarmerModel import FarmerModel
from ProductModel import ProductModel
from RoleModel import RoleModel
from TransactionDetailsModel import
TransactionDetailsModel
from UsersModel import UsersModel
```

The dataset results displayed as:



The Truffle test of the addItem() function is shown in . It contains all the necessary information about the job created by the job, such as the address of the exchange, the hash of the exchange, the block number, the address of the node called responsibility, and the address of the smart contract it contains. Gas Wie substance to test work and consumption of work.

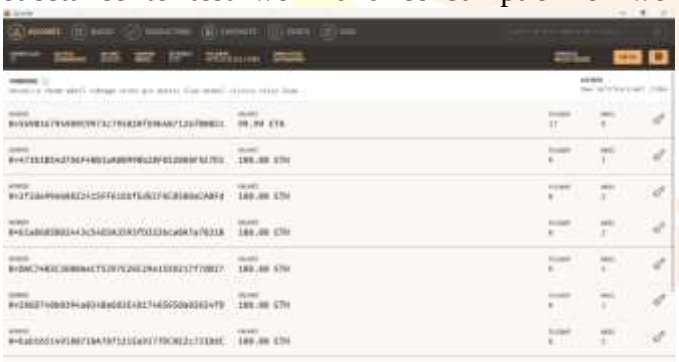


Fig-4 Ganache account contracts

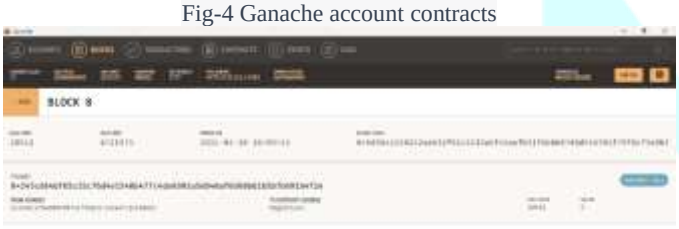


Fig-5 Ganache Blocks

CONCLUSION

Blockchain is a technology that can only be successful if all participants in the chain adopt it. Blockchain-based traceability and transparency systems help food chain participants build better relationships with customers, increase efficiency, and reduce collection risks and costs in the event of return fraud and product loss. But business customers still face challenges such as reliance on technology, human error and fraud, management, availability and access to business information, and willingness to pay for products. Stakeholders should be encouraged to participate, share responsibility and act ethically. Open standards and integration are important considerations when creating an effective data management system. Traceability systems based on blockchain technology provide transparency, trust, product traceability, etc. Although it can solve problems, it is not universal, solutions to all problems in management are difficult, especially when products are affected for a long time or worldwide. This study will help experts, managers and specialists participating in AFSC to understand and promote the design, development and use of blockchain and blockchain technology-based traceability systems in AFSC, which will also help to understand and promote the design, development and use of blockchain and blockchain technology-based traceability systems in AFSC. Using blockchain technology. transition to smart systems.

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