END SEMESTER REVIEW

A BLOCKCHAIN-BASED TRACEABILITY SYSTEM FOR AGRI-FOOD SUPPLY CHAIN

Keerthana S (FIT18CS070)
Kevin Poly (FIT18CS073)
Mary Alice (FIT18CS080)
Guide : Ms. Meera Treesa Mathews

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Content

ABSTRACT

▶ Traditional traceability system has problems of centralized management, opaque information, untrustworthy data, and easy generation of information islands.

▶ A traceability system based on blockchain technology for storage and query of product information in supply chain of agricultural products.

▶ A dual storage structure of database + blockchain traceability information is constructed to reduce load pressure of the chain and realize efficient information query. .

▶ Blockchain technology combined with cryptography is proposed to realize the safe sharing of private information in the blockchain network and this system uses smart contract to upload traceability data

▶ Provides performance analysis and practical application and the results show that the system improves query efficiency and the security of private information.

- ▶ In recent years, domestic and international safety incidents of fruit and vegetable agricultural products have occurred frequently.

- ▶ Applies blockchain technology to the traceability of agricultural products, and propose solutions to the problems of heavy load, slow query speed and privacy data protection on the existing blockchain technology.

- ▶ Blockchain is a kind of distributed database which is decentralized, tamper-proof, traceability, and maintained by multiple parties which improves the traceability
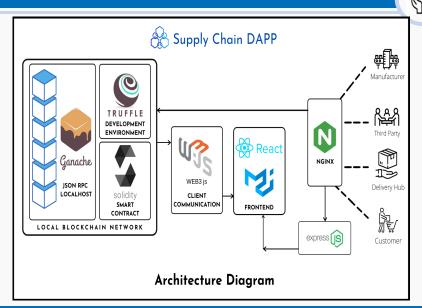
► Blockchain based and centralized system are implemented for storing data.

► Proof of Stake is used for validating information.

► Accuracy check is done by comparing the values at the output in both the networks.

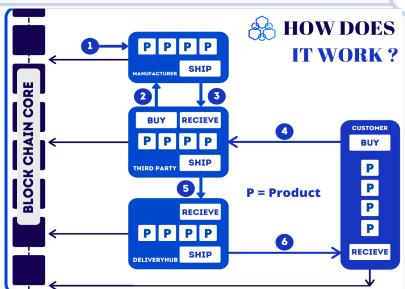► Corruption can be found, and more safety can be ensured.

SYSTEM ARCHITECTURE

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► We apply blockchain technology to the traceability of agricultural products, and propose solutions to the problems of heavy load, slow query speed and privacy data protection on the existing blockchain technology.

► First we input data from farmers, customers, third party sellers, logistics , and sends it to both centralized and blockchain network.

► We creates a centralized system using VueJs, Laravel, Core PHP, MySQL and adds the data to this network.

► We implement a blockchain network using ReactJs, Web3Js, Solidity, NGINX, Truffle, Ganache, ExpressJs and adds the values to blockchain after doing suitable hashing.If the value is accepted then adds it as a block, else it's discarded.

► Then consumers check the data from both the blockchain network and centralized system and checks for the differences and will remove the corrupted datas.
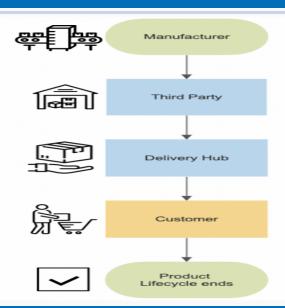
Architecture Diagram

Owner

owner = new_owner

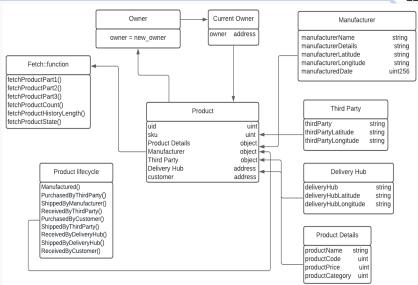**Current Owner**

owner	address

Manufacturer

manufacturerName	string
manufacturerDetails	string
manufacturerLatitude	string
manufacturerLongitude	string
manufacturedDate	uint256

Fetch::function

fetchProductPart1()
fetchProductPart2()
fetchProductPart3()
fetchProductCount()
fetchProductHistoryLength()
fetchProductState()

Product

uid	uint
sku	uint
Product Details	object
Manufacturer	object
Third Party	object
Delivery Hub	address
customer	address

Third Party

thirdParty	string
thirdPartyLatitude	string
thirdPartyLongitude	string

Delivery Hub

deliveryHub	string
deliveryHubLatitude	string
deliveryHubLongitude	string

Product lifecycle

Manufactured()
PurchasedByThirdParty()
ShippedByManufacturer()
ReceivedByThirdParty()
PurchasedByCustomer()
ShippedByThirdParty()
ReceivedByDeliveryHub()
ShippedByDeliveryHub()
ReceivedByCustomer()

Product Details

productName	string
productCode	uint
productPrice	uint
productCategory	uint

► **Client-side communication** : The front end uses Web3.js to communicate with the smart contract and local blockchain network and is written using React.js framework for better component and state life cycle management.

► **Server-side communication** : The requests from user are forwarded to frontend through Nginx(load balancer) and Express.js for dynamic routing.

► **Centralised System** : The centralised system also captures the data from the users and saves it in mysql database. These values are controlled by an admin.
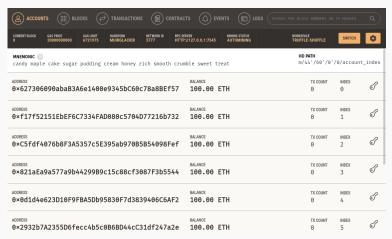
► **Blockchain network** : The blockchain network is created locally with truffle suite for testing purpose with limited blocks. We uses ganache for getting the ethereum test blocks. The contracts are migrated into blocks.The test block size will be 100 and amount of blocks we are getting is 10.

► **Smart Contracts** : We will code the contracts for manufacturers, customers, logistics and third parties which mainly includes functions like fetch products, ship products, third party shipping, manufacture products, product state, recieved by customer etc.
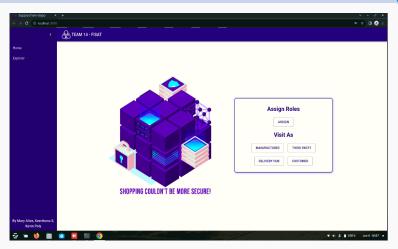
▶ **Solidity** : Solidity is used to develop the smart contracts. They will provide proper hashing in blockchain, which makes the network more and more secure. The hashes are generated using the Solidity cryptographic function keccak256() which implements a SHA-3 hash in the blockchain setup. keccak256() generates a secure 256-bit hash which is the main basis of security in the entire network. In our supply chain setup certificates are generated at every stage of shipping of the product.

▶ **Ethereum and Proof of Stake** : Proof-of-stake is a mechanism for processing transactions and creating new blocks in a blockchain and is developed by Ethereum and we are using the ethereum network for our transactions and smart contract validation.
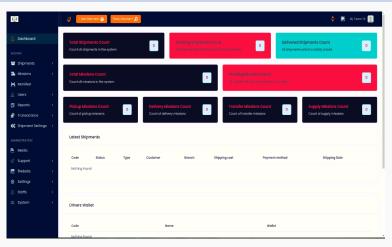
RESULTS

Ganache Screen

Main Screen

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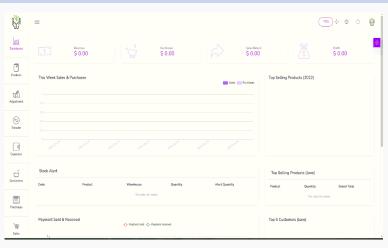
Add Product
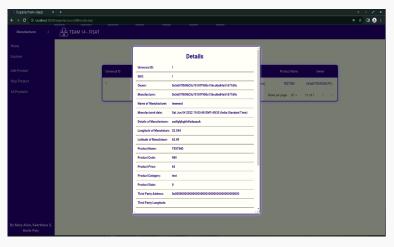
Centralised Transport

Centralised Supply Chain

RESULTS

Fetch Product
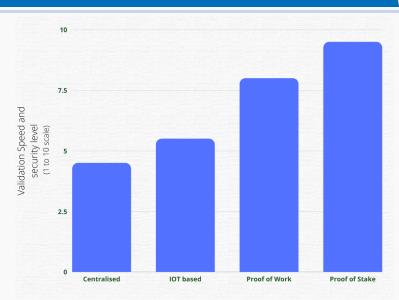
SOCIAL RELEVANCE

- ▶ Management of untrustworthy data in food supply chain.

- ▶ Decentralized control of datas.

- ▶ Traceability of agricultural products.

- ▶ Reduce heavy load issues and slow query speed.

- ▶ Avoiding health issues related to food products.

- ▶ Reduce the wastage of food.

- ▶ Maintain the quality of food.

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- ▶ The traceability system of fruits and vegetables agricultural products based on the non-editable and traceable characteristics of blockchain, and discussed the storage and query design of the system.

- ▶ The storage method ensures the encryption of private information and made the informations traceable to public in supply chain.

- ▶ Compared to other methods, Here efficiency is more, computation is fast and the work load is reduced

- ▶ Identifies the tampered informations easily.

- ▶ Complexity of the project is comparatively low due to the use of proof of stake.

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3. H. Chen, Z. Chen, F. Lin and P. Zhuang, "Effective Management for Blockchain-Based Agri-Food Supply Chains Using Deep Reinforcement Learning," in IEEE Access, vol. 9, pp. 36008-36018, 2021, doi: 10.1109/ACCESS.2021.3062410.

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THANK YOU