Decentralized Food Supply Bazar Using Blockchain

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ABSTRACT

Blockchain is an expanding piece of technology helping us in designing and development of decentralized distributed solutions. It has impacted many industries by reducing intermediate authorities. So, we decided to explore its feasibility in the Food supply industry. The Food Agro sector has been responsible for several catastrophes, and as the industry expands globally it is strenuous to keep check and credence of and certify the food data. The fertile land for agriculture is diminishing and more yields need to be produced to content the need of the country. We propose a Blockchain based Decentralized market place where we implement a collaborative agro model between farmers and consumers. The farmers will be able to record the potential crops and the anticipated output on his farm land on the decentralized ledger. The consumers can check the information and the farmer integrity based on the previous supplies. This creates a far open and full proof digital market framework for agro-products and will help to reduce hoarding. This research paper explores one possible model of blockchain in the Food Supply Market by creating a breach proof ledger of records. We have used HTML, CSS, Javascript for frontend, Ethereum and Solidity based frameworks for backend working of this model.

Keywords : Blockchain, Ethereum, Food Supply Market, Decentralized.

I. INTRODUCTION

This paper provides a model for implementation of Blockchain on the Food Supply market.In the recent past, we have read many incidents regarding the farmers suicides due to debts and poor yield from farming. For a country like India, with the rise in population, dependency over the land for building houses and industrial areas is increasing rapidly. The fertile land for farming is dwindling and more yields have to be produced to satisfy the need of the country. Also the yield produced is wasted as there is no proper infrastructure for warehouses and crops are eaten by pests and the degraded quality of crop is taken on a very little price from farmers. Farmers in developing countries are heavily reliant on Bank Loans. Due to this heavy debt farmers can't maintain a stable production of agriculture. Micro-Finance can help these farmers out of debt. The solution to above problems is by use of Decentralized Food supply Bazar that tracks cultivated product from the farmer to the consumer.

Blockchain

The blockchain is a chain of similar immutable blocks on a decentralized network. The most popular implementation of blockchain is "Bitcoin" by Satoshi Nakamoto which basically the first known successful implementation of the blockchain. Many more implementation came in existence after that and one such is Ethereum by Ethereum foundation which not only provides us with independent blockchain but also provides smart contracts and dapp to operate and

better presentation for our blockchain based application.

On basis of trust there are 3 major classes of blockchain: -

❖ Private Blockchain: There are set of nodes with full trust on each other. These are usually in companies and are not much more than a database. They also find some implementation in research and prototyping experiments.

❖ Consortium Blockchain: Restricted to few nodes this blockchain and those network nodes first have to attain rights to enter chain. This makes it permissioned blockchain but also making flexible than private chain.

❖ Public Blockchain: There is no central authority controlling network rather works with different consensus algorithm like proof of work or proof of stake etc. to allow establishing a trustless network where a node can join and leave any time they want. This is most commonly used chain and has seen successful implementation as cryptocurrency platform like "Bitcoin" and "Ether".

Ethereum Foundation is a foundation which works on developing decentralized Ethereum Virtual Machines. EVM provides us with facilities to deploy blockchain and develop Smart Contract that helps in interacting with present blockchain but also interact with other blockchains in the network. This property is called interoperability. Ethereum foundation also came up with the concept of DAPP or a decentralized application. They are like normal web application but they are not hosted on a dedicated server rather hosted on the decentralized network.

Food Supply Market in India

India is a country where more than 50 percent of the workforce is related to agriculture. It is one of the most distressed sectors where farmers suffer from lack of good infrastructure, proper reimbursement for their crops and unstable work life balance. Generally,

due to intervention of mediators, there is a lack of timely distribution of resources and utilities to farmers.

With these issues in mind, we recognized major issues in the next section and a solution model for it. By making everything decentralized and free of intermediaries, we can hope for more transparency, reliability, and consistency in the system. It would also speed up the process and make it efficient.

II. PROBLEMS RECOGNIZED IN CURRENT FOOD-SUPPLY CHAIN SYSTEM

❖ Raising the initial investment for setting up the field due to high bank interest rates.

❖ They are not able to get reasonable compensation for their produce due to the intervention of middlemen in market.

❖ They are not able to get insights from market trends and customer needs.

❖ The farmer and consumer are segregated in the market because of the mediator.

❖ The inefficient supply chain and issues in storage and transportation leads to deterioration of crops.

III. SOLUTION PROPOSED

A public, permission-less blockchain based system developed on Ethereum is proposed where farmer and customer will be able to interact with each other without any mediator.

Main Controllers of Chain

❖ Farmers : Farmers would register themselves by entering ID, name,crop name,location,price, phone number and quantity of expected crop produce.

❖ Government Officials: Government officials would be responsible for quality testing of the crop produce. Above process will be done by sanctioning the details given by farmer. After this officer would give a Lot Number to farmers produce with grade and expected price. He/She

will also update the validity and test date of the product.

❖ Customer : Customers first enter the Farmer Id and lot number to access the details entered by farmers and government officials. After that, he can use the details to microfinance the farmer directly.

Environment Setup

Ethereum is an open blockchain platform that lets anyone build and use decentralized applications that runs on blockchain technology. Ethereum is best suited for applications that automate direct interaction between peers or facilitate coordinated group actions across a network.

We used **Ganache-cli** version –v6.4.1 which provides us with various accounts and their private keys to test out our model by providing free ethers. Any one account is selected as public key for testing purposes.

Solidity is an object-oriented, high-level language for implementing smart contracts. A **smart contract** is a computer code running on top of a blockchain containing protocols under which the participants to that smart contract agree to connect with each other. Predefined rules are made for the participants to agree on and if conditions are met contract is automatically enforced. The smart contract code facilitates, verifies, and enforces the negotiation or performance of an agreement or transaction. It is the simplest form of decentralized automation. We made files 'migrations.sol' and '2_deploy_contracts.js' to deploy our smart contract which is coded in 'StructStorage.sol'. When smart contract file is deployed following values are updated.

❖ Transaction hash - A 256 bit hash value written in hexadecimal generated by SHA256 Algorithm to the data being sent on blockchain.

❖ Contract Address - A 20 byte address written in hexadecimal over which smart contract is deployed.

❖ Account - A 20 byte address written in hexadecimal which is one of the account address given by ganache-cli.

❖ Balance - Left amount of ethers after smart contract is deployed.

❖ Gas Used - Gas is what you pay to execute code on the blockchain and to transfer ether to another address.

❖ Gas Price – Price of each gas unit.

❖ Value Sent – Amount of ethers sent as transaction.

❖ Total Cost – total cost required to execute the transaction in ethers.

The following figure shows the aforementioned:-

Figure 1. Smart Contract Deployment

The genesis block is the first or origin block of a private network on Ethereum. The genesis block contains all the essential information to configure the network as well as find related peers. It's basically the config file for your Ethereum network. Initial Block /Genesis Block or Block -0 is produced after deploying contract and this contains the following information in it.

❖ Transaction hash - A 256 bit hash value written in hexadecimal generated by SHA256 Algorithm to the data being sent on blockchain.

❖ Contract Address - A 20 byte address written in hexadecimal over which smart contract is deployed.

❖ Block Time – Time at which block is mined on the network.

❖ Eth-accountser – Number of Block in Blockchain.

Figure 2. Genesis Block

Farmer Details

Farmer needs to enter their details which are specified above.

Figure 3. Farmer's details

Using SHA256 Algorithm and details of farmer, a hash value is generated for the block mined. Along with this gas usage, Block Number and Block Time is printed.

Figure 4. Block Mining

Government Officials

Government officials are responsible for approving the farmer details and upload following data to help customer in microfinancing.

❖ Lot Number - A lot number helps in locating a particular crop of a farmer from bunches of crops he produce.

❖ Grade – A quality value assigned to farmer produce based on their previous record in food-supply-bazar.

❖ Expected Price – Expected price of the product produced by farmer.

❖ Test Date – Date on which crop has been verified.

❖ Expiry Date – A date on which crop is expected to expire.

Following figure shows the process:-

Figure 5. Quality testing

Figure 6. Product Details

Customer

Customer can see the details about farmers using farmer ID and Lot number given in database as

shown in the figure below. Customer will be able to check the quality, expected price and produce of a particular crop. Government officials would have updated the quality of crop and also the viable price so that a consumer can make a smart decision. Customer will also be able to check the expiry date of the crop because warehouse infrastructure problem is a big mess in countries like India. Using all this information he/she can decide as to what amount to finance to farmer. Following is shown in Fig 7.

Micro-Finance

This option helps the consumer to directly buy the crop from the farmer without having to visit a marketplace. He/she can fund the crop he/she wants and also it will help farmer to accordingly decide the quantity of crop to be produced. The balance of both customer and farmer would be updated simultaneously without any delay. Following is shown in Fig 8.

Figure 7. Farmer information for customer

Figure 8. Micro Finance

Advantages of this model compared to Conventional Food Supply Market

❖ Farmers :

- Main issue of delayed funds to farmer will be resolved with the help of Micro-Financing.
- It will make a transparent system which would help them in understanding crop buying patterns in the market.
- It will bring them close to the customer, which will help them to know about the need of their crop in the market.
- Their crops will be safe from overproduction. Hence won't get wasted by rotting or exploitation in the warehouses.
- Farmer will get a better price if there are less intermediators.
- Farmers will already know their customers.

❖ Customer :

- It would be easy for customer to keep a check on quality of crop and accordingly invest his money.
- It would give him sense of relief from knowing that his funds are not victim of corruption.
- Customers would get a better price if there are less intermediators.

❖ Government Official :

- It would be easy for an official to validate and monitor crop quality and requirement.
- It would help them design an efficient distribution and supply chain.

IV. CONCLUSION

Decentralized Food supply chain using Blockchain helps farmer and customer to build a cooperative environment. This helps farmer to analyse customer market needs.
The farmers list the potential crops and the expected yield on his farm on the distributed public ledger.

The consumers view the details and check for the farmer credibility based on the previous cultivation and supply. This creates a transparent and tamper-proof digital market platform for farm products. Thus an agreement (consensus) can be formed between farmer and consumer, such that the consumer can fund individual crops or a field and can acquire the yield from the farm or the profit percentage of its market value.

There is a rating mechanism to build the credibility of farmer and consumer based on the previous experiences in the food supply chain. Credit rating gives the encouragement to the whole system to improve on their shortcomings. This helps farmer to have customers before actual crop is ready for market and avoid wastage of food in warehouses. This will ultimately help us resolve the grave agrarian crisis India is facing. Developing countries would see less suicides in the sector. In a nutshell the blockchain technology can help us to curb a crisis India is heading to.SS

V. FUTURE SCOPE

Decentralized Food Supply Chain using Blockchain till now is limited to just funding farmer and helping them cultivate their crop without any mediator in this process. This can be extended to providing options to customer to buy particular farmer products directly. Here we have created a DApp and can be extended.Above can be done by creating a GUI for farmer, where he can upload data about crops and customer will finance him with digital money along with quantity of crop they want. Farmer can directly send that crop food to farmer. Peer-to-Peer Transaction or Money lending would be possible by this technique.

Since data is the new fuel of 21st century, blockchain technology seems to be the most viable solution where corruption and data breaching are major breakthrough as blockchain is very difficult to hack.

Very high amount of power is required to hack these type of networks which is not even possible for a supercomputer. It also encourages transparency, reliability and consistency in the system.India virtually banned cryptocurrencies like bitcoin with the Reserve Bank of India barring regulated entities from providing services to any individual or business dealing in digital currencies. So in brief, money transfer would be basically done by Bank account in terms of physical money but this can be extended to involve cryptocurrencies be it in the form of Ethers. After cryptocurrencies are authorized, project can include it.

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