Perishable Supply-Chain

Exploring Distributed Ledger Technology (DLT) alternatives for current supply-chain systems.

A concept by:
Abdullah Nawaz Sheikh (101296124)
Dryan Wong (101308923)
Rushang Shah (101278515)

Goals

What does the system aim to acheive?

Blockchain technology would be a very good alternative to existing supply-chain networks. There are many flaws with current supply-chain networks, such as high costs and highly prone to manufacturing malfunctions or human errors. Some of the goals we aim to achieve with our networks are the following:

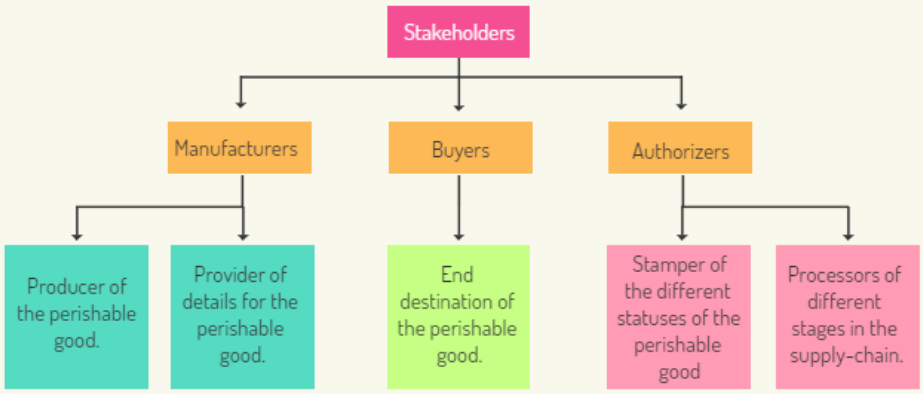
- To provide up-to-date updates and real-time timestamps for products throughout each stage in the supply chain.
- To provide utmost trustlessness in transactions between different clients on the network using DLT.
- To be able to track malfunctions, errors and mishandles throughout the process which would potentially cause loss of value.

Stakeholders

Smart contracts will be used for storing the status and timestamps of stakeholder to ensure full transparency on the network. Three of the major stakeholders will be the following:

- Buyers of perishable goods.
- Accounts in charge of stamping the status and the different processes of the goods will be through the supply chain.
- Manufacturers of the perishable good and the origin of the good.

Stakeholder Structure



State Data

Different states will be in place which will be used to indicate which process the perishable good currently is in the supply chain. The different states would be the following:

- Timestamps of transitions between processes will also be represented in the state data to show accurately when the perishable good is changing processes.
- The description of the perishable good will also be available in the state data to show the status of the perishable good and whether the good was mishandled or if there was any malfunction during any stage in the supply chain.
- Authorized signers will also be represented in the state data to show that the perishable good was authorized by different parties in the network.

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Restrictions

Certain restrictions will be put into place on the network, to ensure that there is no sort of abuse of power taking place at any time on the supply-chain network. The following would be the restrictions:

- One of these restrictions would be that the ability to update the status and description, and even the transfer of ownership of the goods to the next authorized signer who would be responsible for the next step, would only be given to authorized signers.
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- Another restriction would be that only one entry for each good would be allowed (possibly in the form of a hash), to ensure there are no errors later in the supply-chain and so that confusion would be avoided.

Exceptions

There are some exceptional cases that might happen, for instance:

- One or more authorized signers cheated and provided fake information.

In this case, a blacklist system would be needed for preventing future actions from these malicious. Also, the manufacturer should be able to change the signer if they found the previous one is not trustworthy.

Objectives

Some of the objectives we hope to achieve with this network would be the following:

- We aim to provide a solution to enable better track and traceability for perishable goods throughout any stage of processing, transportation, or warehousing, from origin to destination.
- To provide a solution for goods owners to acquire a reimbursement from the correct stakeholder, in case there is a malfunction or mishandle throughout any stage in the supply-chain network which would result in loss.
- To provide trustless interaction and transactions between different parties involved in the supply-chain network.
- To provide a better, more robust, and secure alternative to bypass security flaws in existing supply-chain networks, which would in turns increase trust among different parties transacting on the network.
- To provide a faster alternative to current systems, by using state-of-the-art technology like smart contracts to vastly improve transaction times among different parties.
- To vastly reduce costs of operations by using smart contracts, effectively eliminating the need to use physical assets like paper or using middlemen to complete transactions.

Architecture

Components of the smart contract:

- A struct containing the address of the creator, addresses of all the authorized signers according to the order of involvement, a flag for showing which stage is the product at, and an array for storing all the data provided by the authorized signers.
- Modifiers for checking if the product with the given product hash exists and if the authorized signer is signing it at the correct orders assigned by the manufacturer.
- Function createRequest for manufacturers to create the struct for tracking the data provided by the authorized signers.
- Function updateData for authorized signers to provide the status and metadata of the goods. The metadata could be provided through an oracle and connected physical sensors for checking the relevant metrics of the goods, such as the weight, temperature and length.
- Function changeProvider for the manufacturer to change an authorized signer in case there are some malicious signers
- Function blacklistProvider for the contract owner to put a proven malicious signer into a blacklist and prevent any manufacturer to assign them as an authorized signer for any future requests
- Function unblockProvider for the contract owner to remove a signer from a blacklist in case there is some misunderstanding.
- Function getData for any users with the product hash to check the current status of the product as well as all the meta data provided by the authorized signers.

Project Plan

Perishable Supply Chain

PLANNING SUMMARY

The perishable food supply chain is one of the challenging areas in the food industry sector, but supply chain management is trying to achieve better quality for satisfying the strict provisions. Food safety is facing serious problems for purchasing to consumers due to the impact of the global pandemic. On the other side, they are more sensitive to food quality, origin, and shipping rules. Based on this situation, there is a need for a food traceability system to over-change the supply chain sector. Blockchain and other Distributed Ledger Technologies (DLTs) are predicted in many industries, because of the allowance of storing the dataset that can be switched between organizations that do not trust each other, to provide a trustless network for different parties to interact. Similarly, blockchain is still considered under development technology and some of the trust-required applications in blockchain have already been developed. Another aspect of blockchain and DLT can design the smart contract that can define the self-sufficient decentralized codes, which contain the rules and conditions for business processes. The smart contract defined codes are based on legal terms that control the practicable programs' physical and digital objects.

OBJECTIVE & GOALS

1. To provide trustless interaction and transactions between different parties involved in the supply-chain network by providing a fully transparent and trustless network.
2. To increase the quality of the end product by allowing better traceability of goods from the origin to the destination, and real-time updates.
3. To provide a better, more robust, and secure alternative to bypass flaws like fake invoicing, which would provide more trust among parties involved in the transactions.
4. To provide a faster alternative to existing supply-chain networks, by using state-of-the-art technology like smart contracts and to vastly improve transaction times.
5. To vastly reduce costs of operations by using smart contracts, effectively eliminating the need to use physical items like paper or using middlemen to complete transactions.

TIME FRAME OVERVIEW

PHASE 1
Development and Testing (2-6 weeks)

Rigorous testing will be done to ensure that the network is as secure as possible and could withstand any attack. The speed and efficiency of the network will also be tested to make sure that the network would be at an optimal level.

PHASE 2
Funding and Investing (6-8 weeks)

After the development, investing and funding for the development of the network will begin. ICOs and Airdrops will be issued to attract investors to invest in the project and get in at the ground floor of the project.

PHASE 3
Researching on upgradability (8-10 weeks)

After funding and investing, we will research extensively the pros and cons of using DLT in the supply chain network and identify potential trade-offs as a result. We will also identify fully the users involved in the network and plan accordingly on the architecture of the network.

PHASE 4
Launch/Deployment (10-12 weeks)

After ensuring that the network performs as expected and is a good viable alternative to existing supply-chain networks and that it is secure and fast enough to handle large amounts of transactions from different parties, the project will be launched publicly.