

A Methodological Approach for the Supply of Agricultural Produce by Ensuring Quality Through Block Chain Technology

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Abstract: According to the World Health Organization an estimated 600 million, almost 1 in 10 people in the world, fall ill after eating contaminated food and 420,000 die every year, resulting in the loss of 33 million healthy life years. Food can become contaminated at any point of production and distribution. The journey of the food product is unseen to the customer, though it flows from the producer, distributor, storage facilities, retailer etc. Thus in this paper we aim at using RFID (Radio-Frequency IDentification) and block chain technology as a platform of traceability. An open-source, decentralized, distributed database for storing transaction information is utilized rather than relying on centralized intermediaries. This technology will allow parties to transact directly using duplicate, linked ledgers. This will monitor the supply chain of the produce so as to build a positive trust with a end user about the product.

Keywords: food, agriculture, supply chain, block chain

1. Introduction

Anyone who consumes food is affected by food safety. Ensuring the quality of the food is a shared responsibility among producers, industry, government, and consumers. As the pace of life quickens, we often eat meals on the run. Canned foods and ready to eat meals are majorly preferred. This means that by the time you eat your food, it may have been transported, cooked, cooled, stored, transported again, reheated, and touched by numerous individuals. Each processing step introduces new hazards. Food safety accidents keep happening one after the other for instance the "horsemeat scandal" in Europe in the year 2013 [1]. "Sudan red", " clenbuterol", "Sanlu toxic milk powder" and "trench oil"[2] was set of serious food Safety scandals in China. These kind of incidents play a humongous role in the trust that the consumers have on domestic food markets. Also this adversely degrades the growth of the economy of any country. Agricultural produce is one of the highly perishable food substances. Maintaining their temperature and humidity plays a vital role in logistics. This leads to losses in the produce. In developed countries such as Europe and America the ratio is normally less than 3% [3]. This is not possible in developing countries, as the loss ratio is of a higher margin. The supply chain technologies in such countries is still at initial stage and researches have been going on steadily.

As food-borne diseases continue to increase, many consumers have become less reliant on food, thus creating a need for more detailed information on food production.

Based on the reasons above, the primary purpose of this paper is to establish a food supply chain traceability system based on block chain technology for helping food markets to enhance their food safety and quality, at the same time, to significantly reduce the losses during the logistics process. Block chain is a transformative tool in the fight against food fraud, allowing an open and transparent ledger of our food products journey. This allows unalterable trust to be introduced into an untrustworthy system, ensuring every actor in the chain records and shares their interactions with our food.

2. Drawbacks of prevailing supply chain methods

The food supply chain is multidisciplinary and multi sectoral. Here a multitude of various professionals is working together. For even the most seemingly simple of food items there can be a huge number of actors involved that are spread around the globe with little to no knowledge of one another's actions. It is vital then that stakeholders within the chain prioritize communication with their suppliers, through the implementation of traceability. For instance, to trace your hamburger from farm to fork may involve tracing the beef back to the cattle (prevents scandals such as horse meat scandal). A recent transparency survey found that consumers want to see everything from a complete ingredient breakdown to sourcing information, with 94% of respondents saying they are likely to be more loyal to a brand that offers complete transparency.

3. Proposed system

RFID system had been used for tracking-food in the entire supply chain from planting to the distributor and retailer. In these supply chain processes, RFID systems provide management information and safety data of food for producer, wholesaler, retailer and consumer. Block chain is a technical scheme of reliable database which is collectively maintained by the way of decentralized and trust less method. This technical scheme could create blocks through any number of the nodes in the system by using cryptography. Each block contains the data

of all transactions in the system within a period of time, and it could create digital finger printing which can be used to verify the validity of the information and connect with the next block [6]. This implements data acquisition, circulation and sharing in production, processing, warehousing, distribution and sales links of food supply chain. Besides that, it also uses block chain technology for guaranteeing the information which shared and published in this traceability system is reliable and authentic. This traceability system not only covers each enterprise in the food supply chain, but also includes some compulsory food safety & quality supervision inspection centers, such as government departments and third-party regulators. For example, government departments could use this system to check the safety status of the products at any time. Once food safety accident happens, they could take emergency measures immediately to prevent the spreading of the hazard.

4. Stages of the system

A. Production stage

For plant products, RFTD tags are mainly used on their packaging, which save many kinds of information of food product including the variety, name, producing area, planting time, fertilization condition, usage of pesticides, plucking time, etc. For the meats products, such as pig, RFID ear tags are normally used to save the information of the pig, including the information of its parents, fodder, and epidemic prevention checking and medication situation, from birth to slaughter. Moreover, these RFID tags also record the information of production managers and operational staff, and once the food safety accident happens the relevant managers and staff can be found and to deal with the accident immediately. All relevant information which is saved in the RFTD tag can be uploaded to the block chain system through the wireless network.

B. Processing enterprise work

For the plant products, like the production link, RFID tags are used for the products which have relatively high value and strict requirement for environment; for these products with low value, RFID tags are only used on their pallets and packing-cases, and the bar-codes are mainly used for the single food products. For the meat products, taking pigs as an example, the information, such as the source, number, receiving date and epidemic prevention should be written into the RFTD tag. The RFTD tag which is bound with animal product could also record the information in its processing stage such as product type, weight, expiration date, storage conditions, inspection and quarantine information, etc.

C. Warehousing management

First of all, information in the RFTD tag can be used to query food product's information such as quantity, category and storage time, etc. Secondly, in order to avoid loss and spoilage, based on the product quantity and storage time, managers can make decision for which products should be given priority to

move out of the storage. Finally, RFTD systems can be also used to check the real-time environmental information of cold storage, including temperature and humidity, which could avoid food safety accident occurring.

D. During sales

Information tracing- Since RFID tag saved the information of food in the entire supply chain, once food safety accident happens, the defective products can be located immediately. Reasons of occurrence, location and responsible staff can be traced by block chain system as well, which could extremely reduce the losses and hazards. Guarantee the freshness of products. Due to the short freshness lifetime of food, RFID system can be applied to monitor the freshness lifetime of products. Transparency of product information. When consumers are shopping in the supermarket, they can use the RFID reader to obtain the basic information of food products by scanning their RFID tags. Moreover, thanks to block chain technology, all the information along the food supply chain is fully audit-able, which means customers could also obtain details information about the final products in a real-time manner by inspecting the block chain system.

5. Benefits of using block chain

A. Reduced paperwork

International container transports have a long trail of paperwork. The cost of trade related paperwork is estimated to be between 15 to 50 percent of the cost of the physical transport. Thus block chain digitalize all these and reduces the inherent paperwork.

B. Identifying counterfeit products

It is easier to identify duplicated food products. As it is a shared and linked ledger any changes made can be easily traced. Adulteration is reduced to a maximum extent.

C. Facilitate origin tracking

When faced with a food borne disease outbreak retailers have a hard time finding out where the bad ingredients came from and to which stores they were delivered. It can take weeks to trace the origin. Here, block chain is used to augment the supply chain partner's existing IT systems through a transparent, subordinate ledger, tracking the movement of food items.

6. Literature review

La Londe and Masters has proposed that a supply chain is a collection of businesses passing material forward. They argue that normally there are several independent companies that are involved in the manufacturing of a product and eventually reselling it to the end user of a supply chain. When a party in a transaction has been paid to provide a goods or service, the paying party expects the goods or service provider to perform a particular action. Inter-firm trust levels have been shown to be a central part of supply chain relationships [4]. The Block chain

protocol was invented by an anonymous person with the alias "Satoshi Nakamoto" and released as an underlying technology for enabling a new kind of digital currency called Bitcoin. A research paper was sent to a cryptography mailing list called "Bitcoin: A Peer-to-Peer Electronic Cash System"[5]. Here it is shown how to style a subsection and sub-sub-section also

7. Conclusion and future work

As above mentioned, promoting the block chain is a well worth technology for helping government track, monitor and audit the food supply chain and helping manufacturers to record the transactions in authenticity. It is obvious and naturally an advantage to have trust in relationships, also in the supply chain. We also learned of the growing awareness of its importance how this has become increasingly relevant in today's emerging relationships. Not only this technology can benefit the customers, manufacturers and the supervision departments but also improving the efficiency of food supply chain's processing and circulation. This system will deliver real-time information to all supply chain members on the safety status of food products, extremely reduce the risk of centralized information systems, and bring more secure, distributed, transparent, and collaborative. Our system can significantly

improve efficiency and transparency of the food supply chain, which will obviously enhance the food safety and rebuild the consumer's confidence in the food industry.

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