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FOOD TRACEABILITY BASED ON THE INTEGRATION OF FINITE CREDIBLE DATA ON BLOCK CHAIN

Shaziya Nusrath SK
[1]PG Student, Department of CSE, Akshaya Institute of Technology, Tumakuru, Karnataka
[3]Visvesvaraya Technological University, Belagavi, Karnataka, India

Rakesh S
[2]Assistant Professor, Dept of CSE, Akshaya Institute of Technology, Tumakuru, Karnataka
[3]Visvesvaraya Technological University, Belagavi, Karnataka, India

Abstract— **The recent, exponential rise in adoption of the most disparate Internet of Things (IOT) devices and technologies has reached also Agriculture and Food (Agri-Food) supply chains, drumming up substantial research and innovation interest towards developing reliable, auditable and transparent traceability systems. Current IOT-based traceability and provenance systems for Agri-Food supply chains are built on top of centralized infrastructures and this leaves room for unsolved issues and major concerns, including data integrity, tampering and single points of failure. Blockchains, the distributed ledger technology under pinning crypto currencies such as Bitcoin, represent a new and innovative technological approach to realizing decentralized trust less systems. Indeed, the inherent properties of this digital technology provide fault-tolerance, immutability, transparency and full traceability of the stored transaction records, as well as coherent digital representations of physical assets and autonomous transaction executions. This paper presents AgriBlockIoT, a fully decentralized, block chain-based traceability solution for Agri-Food supply chain management, able to seamless integrate IoT devices producing and consuming digital data along the chain. To effectively assess AgriBlockIoTIoT, first, we defined a classical use-case within the given vertical domain, namely from-farm-to-fork. Then, we developed and deployed such use-case, achieving traceability using two different block chain implementations, namely Ethereum and Hyper Ledger Saw tooth. Finally, we evaluated and compared the performance of both the deployments, in terms of latency, CPU, and network usage, also highlighting their main pros and cons.**

This paper aims to address the issue of food safety using Block chain and encrypted QR(quick response) code security. **Manufacturer generates an encrypted QR (quick response) code for the details and attaches the transaction to the block chain system. If any participants want details of food items, then public key must be shared by that participant to the manufacturer. Manufacturer will encrypt the QR code and will send back to the participant. The QR code will be decrypted by the valid participant by their private key.**

Keywords: **Blockchain, digital ledger, distributed ledger technology, Ethereum.**

I. INTRODUCTION

Agri-Food domain, in order to maintain trust and reliability along the whole supply chain, it is essential for the stored records to be tamper-proof, while the best case would be if each actor issuing transactions could do that without relying on any centralized third-party intermediary. A potential solution to alleviate all of such issues and concerns is the Block chain technology, which is a peer-to-peer digital ledger that does not rely on centralized servers. Since all the records stored in a blockchain are based on a consensus reached at least by the absolute majority of peers of the network itself, this distributed ledger is immutable by design and offers an auditable and transparent source of information. And from an IoT perspective, instead of requiring connectivity to a central cloud, sensor networks in a blockchain-based traceability solution would only require stable connection to their closely located peer. Thus, blockchains exposes allthe required properties for decentralizing food traceability systems, while making traceable data available at every step of the supply chain.

This paper present AgriBlockIoT, a fully decentralized traceability system for the Agri-Food supply chain management. Specifically, the proposed solution can rely either on the Ethereum1 or the Hyper ledger Sawtooth2 publicly available blockchain implementations, while it is able to integrate various IoT sensor devices. By directly producing and consuming valuable information from the IoT devices along the whole supply chain and storing such data directly in

its underlying blockchain, AgriBlockIoT guarantees transparent and auditable asset traceability. To assess the feasibility of the proposed solution, engineered and deployed the so called from-farm-to-fork use-case: a classical food traceability scenario fostering certified traceability of food along the whole supply chain, e.g., from agricultural production (the farm side)to consumption (the fork-side). Then, compare the two implementations, in terms of three performance metrics, namely latency, CPU load, and network usage. Blockchain technology has been around for just under a decade, initially introduced as a way to store and/or send the first crypto currency, Bitcoin. However, as the technology has gradually spread worldwide, people have begun using it in a variety of ways in numerous industries, including as a means to increase cyber security. Blockchains are distributed networks that can have millions of users all over the world. Every user can add information to the blockchain and all data in the blockchain is secured through cryptography. Every other member of the network is responsible for verifying that the data being added to the blockchain is real. This is done using a system of three keys (private, public, and the receiver's key) that allow members to check the veracity of the data while also confirming who it comes from. A verified piece of data forms a block which then has to be added to the chain. To do this, blockchain users have to use their respective keys and powerful computing systems to run algorithms that solve very complex mathematical problems. When a problem is solved, the block is added to the chain and the data it contains exists on the network forever, meaning that it cannot be altered or removed. In order to make updates to a particular piece of data, the owner of that data must add a new block on top of the previous block, creating a very specific chain of code. If anything, even something as small as a comma, gets altered from how it appears in a previous block, the entire chain across the network also changes accordingly. This means that every single alteration or change to any piece of data is tracked and absolutely no data is lost or deleted because users can always look at previous versions of a block to identify what is different in the latest version. Using this thorough form of record-keeping makes it easy for the system to detect blocks that have incorrect or false data, preventing loss, damage, and corruption.

II. LITERATURE SURVEY

[1] C. Verdouw, H. Sundmaeker, F. Meyer, J. Wolfert, and J. Verhoosel, "Smart agri-food logistics: requirements for the future internet," in Dynamics in Logistics. Springer, 2013, pp. 247–257.

In this paper, authors have witnessed an explosion of research and development activity around the Blockchain technology, mainly within the financial technology (FinTech) industry. Indeed, its intrinsic capability of providing immutable and tamper-proof records, together with its potential of enablingtrust and reliability among untrusted peers represent too attractive features, preventing this technology to stay relegated into a single vertical sector. For this reason, several industries beyondthe FinTech sector have already identified the Blockchain technology as a driver for a paradigm shift.

[2]. X. Liang, S. Shetty, D. Tosh, C. Kamhoua, K. Kwiat, and L. Njilla, "ProvChain: A block chain-based data provenance architecture in cloud environment with enhanced privacy and availability," in Proc. of the CCGRID, 2017, pp. 468–477.

In this paper, the author uses For data reliability, ProvChain explored the use of the Block chain technology in a cloud storage scenario to verify three levels of data provenance: collection, storage and validation. In this work,the use of block chains showed good results in terms of tamperproof records and user privacy, with very low overhead for the storage itself.

[3]. A. Ramachandran and K. Murat, "Using blockchain and smart contracts for secure data provenance management," arXiv preprint arXiv:1709.10000, 2017.

In the paper, the author explored the use of blockchains with smart-contracts to achieve secure data provenance, using the Open Provenance Model (OPM) with an access control-based privacy-preserving solution.

[4] C. Sun, "Application of RFID technology for logistics on Internet of Things," AASRI Procedia, vol. 1, pp. 106–111, 2012

In this paper, the adoption of some IoT devices and technologies in the supply chain management sector has attracted a lot of research interest in the last few years. From the impact of autonomous identification system to the application of RFID technologies in logistics, the technological maturity of the devices and of the sensors is literally revolutionizing each step of the process.

[5]. F. Tian, "An agri-food supply chain traceability system for china based on rfid and block chain technology," in Proc. of the ICSSSM. IEEE, 2016, pp. 1–6.

In this paper, the author proposes the use of both the Block chain and the IoT technologies in the Agri-Food domain is still an underexplored, yet worth-to-explore, research field. A traceability system based on the block chain and the RFID technology was proposed with a sharp focus on Chinese food markets.

[6]. YounessTribis, Abdelali El Bouchti, Houssine Bouayad, "Supply Chain Management based on Blockchain: A Systematic Mapping Study", MATEC Web of Conferences (2018).

In this paper, the author presents a systematic mapping study in order to map out all relevant research on SCM based on BCT. The paper took a survey on other block chain applications in SCM that need additional investigation, such as agricultural supply chain, security of additive manufacturing, product ownership management, common-pool resource management, purchasing and supply management, supply chain quality management, supply chain performance measurements. Nevertheless, many of the proposed frameworks-based solutions lack real performance evaluation on the industrial context.

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III. ISSUES IN THE EXISTING SYSTEM

Existing system works on centralized system, where every information is centralized controlled by an administrator having rights to modify data which leads privacy issue. Most of existing blockchain technology proposed for industrial purpose only. Lack of transparency, Centralized approaches can lead privacy issues; Authority can temper data in centralized server.

IV. PROPOSED SYSTEM

Organic food supply chain companies aiming to improve food traceability with blockchain face two key decisions, depending on the characteristics of the organic value chain, regarding (1) optimizing chain partner collaboration and (2) the selection of which data to capture in the blockchain. Other challenges were data confidentiality, validation of data inputs, and interoperability. Easy verification of certification data, accountability, improved risk management, insight into trade transactions, simplified data collection and exchange, and improved communication account for the benefits. Regardless of what drives companies toward whole-chain traceability, for example, customer satisfaction, it does not necessarily require blockchain technology.

Blockchain does enable faster food traceability, which is expected to be more applicable to a complex food supply chain as shown in fig 1.

The fig 2 shows the methodology for proposed work is shown in Figure, which is based on private Blockchain technique, where all the authorities has to get the membership by provider(Regulatory Body) and digital signature by certificate authority. The digital signature will be provided by the certificate authority , hence the participants can trust on it.

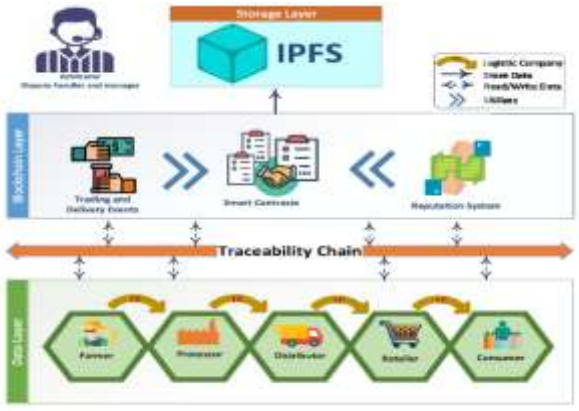

Figure 1: Data flow diagram

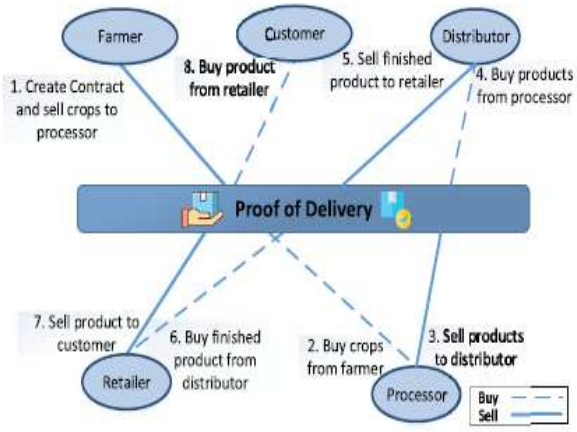

Figure 2 : Food supply chain stakeholders and their relationships

The following steps are involved during transaction in food safety:

1) Transaction between participants will consist sender public key and digital signature, receiver public key and the information which is sent by sender.

2) The shared information between the participants will be in encrypted QR code format, which can be only accessed by receiver public key.

3) Sender public key will be verified by all the participants of medical chain supply.

4) Once the transaction gets committed then it will be distributed to all the participants.

The block chain is useful in keeping track of the entire manufacturing chain of the food item. Each new transaction added to a block is immutable and time stamped which means that the information cannot be tampered with. Companies can either have a public or a private block chain. On these block chains, the companies can have a distributed ledger shared among the parties involved in the manufacturing and distribution of the food item. Moreover, access is only limited depending on information sharing contract between the two parties. Through block chain, we are able to get the complete trail of the food item. Each time the food item moves from an entity to another, the information is stored on the block chain which makes it easy to track the food item and wipe off counterfeits from the shelves. As a result, the block chain technology will help with two main issues: first, it will allow companies to track their products down the supply chain, creating an airtight circuit, impermeable to counterfeit products. Second, it will also allow stakeholders, and especially labs, to take action some posteriori in case of a problem by identifying the exact location of their food items.

V. IMPLEMENTATION

The proposed food traceability system architecture is built around a new set of smart contracts for transaction

manipulation and validation. We get several sets of smart contracts by following the blockchain-based system. (1) Registration all participants, including the Task Initiator Registry, sign a registration agreement. In a secure communication channel, all parties confirm their identities by sending the miner their address and role. Participants will be accepted without a formal signature after the miners' agreement is completed. The technical intricacies of the blockchain encryption algorithm are not covered in this article. Blockchains are distributed networks that can have millions of users all over the world. Every user can add information to the blockchain and all data in the blockchain is secured through cryptography. (2) Every other member of the network is responsible for verifying that the data being added to the blockchain is real. This is done using a system of three keys (private, public, and the receiver's key) that allow members to check the veracity of the data while also confirming who it comes from. Blockchains are distributed networks that can have millions of users all over the world. Every user can add information to the blockchain and all data in the blockchain is secured through cryptography. Every other member of the network is responsible for verifying that the data being added to the blockchain is real. (3) This is done using a system of three keys (private, public, and the receiver's key) that allow members to check the veracity of the data while also confirming who it comes from. A verified piece of data forms a block which then has to be added to the chain. To do this, blockchain users have to use their respective keys and powerful computing systems to run algorithms that solve very complex mathematical problems. (4) When a problem is solved, the block is added to the chain and the data it contains exists on the network forever, meaning that it cannot be altered or removed. In order to make updates to a particular piece of data, the owner of that data must add a new block on top of the previous block, creating a very specific chain of code. If anything, even something as small as a comma, gets altered from how it appears in a previous block, the entire chain across the network also changes accordingly. (5) This means that every single alteration or change to any piece of data is tracked and absolutely no data is lost or deleted because users can always look at previous versions of a block to identify what is different in the latest version. Using this thorough form of record-keeping makes it easy for the system to detect blocks that have incorrect or false data, preventing loss, damage, and corruption. his article describes how we started with internal PoC and ended up with a real prototype for one of our clients from the finance industry. You'll see how we advanced our approach and how the technology stack evolved. Nevertheless, future work must address several blockchain related technical issues such as throughput, security, scalability, and interoperability. Similar efforts are limited and related quantitative study regarding these topics is still rare. More research work needs to address the diffusion of blockchain technology.

VI. CONCLUSION

The key explanation of how blockchain can improve food traceability in the organic food supply chain is the combination of "chain discovery" and "data capture" and for the supply chain leader to make the relevant choices depending on the characteristics of the organic chain. This article evaluates the application of blockchain technology to improve organic or fair-trade food traceability from "Farm to Fork" in light of European regulations. This study aims to shed light on the challenges in the organic food chain to overcome, the drivers for blockchain technology, and the challenges in current projects.

VII. REFERENCE

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