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Blockchain Based Traceability in Supply Chain Using Smart Contracts

Dr. C. Viji[1], Aniket Kuntal[2], Aryan Bhardwaz[3], Darshan Bandari[4]
[1]*Associate Professor, Department of CSE, HKBK college of Engineering, Bangalore, India*
[2, 3, 4]*Student, Department of CSE, HKBK college of Engineering, Bangalore, India*

Abstract: ***A supply chain is defined as all the various points involved in the production and distribution of goods, from the stage of supply to the final customer. While agriculture is the most important industry in rural areas and provides livelihoods for 70% of the world's poor, it is also the industry that creates the greatest disconnect between suppliers and retailers. In addition, due to lack of transparency, buyers and customers cannot be sure of the true value of a product or service. The proposed system is an agricultural supply chain model using the Ethereum platform. Smart contracts are implemented in different stages of the supply chain. These contracts guarantee to meet all predefined conditions before conducting transactions ensuring security, reliability and transparency. This can give consumers greater confidence in the products they buy, and it is also an opportunity to reward producers who use good agricultural practices to develop their products. This will ultimately lead to sustainable farming practices and responsible consumption.***
Keywords: Supply Chain; Ethereum; Smart Contracts; Transparency; Agriculture;

I. INTRODUCTION

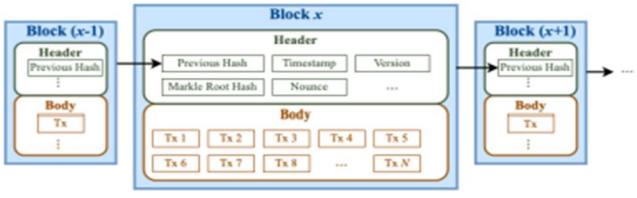
India is among the largest fruit and vegetable producing countries. The main reasons for loss of production from the farmer's point of view include marketing through intermediaries, lack of better storage systems, huge transaction costs and arrangements. An efficient marketing process that uses the latest technologies such as blockchain to increase farmers' profit levels by reducing the loss of commissions by intermediaries. Traceability is a concept to know the details of the manufacturer, the place of origin of the product, the production time, the harvest time, etc. To ensure the safety of food in the system, it is very important to have traceability in food supply chain management. Decentralized systems increase transparency, increase consumer and manufacturer awareness of consumer satisfaction, and improve communication between stakeholders. Blockchain has distributed ledger technology that requires synchronization of data, which increases network transparency because a single node cannot modify the records that exist in the blockchain. With the implementation of DLT, customers can understand the product life cycle.

II. RELATED WORKS

The analysis basically deals with determining whether the use of blockchain in an agricultural supply chain model is feasible while solving existing problems.

A. Ethereum Blockchain

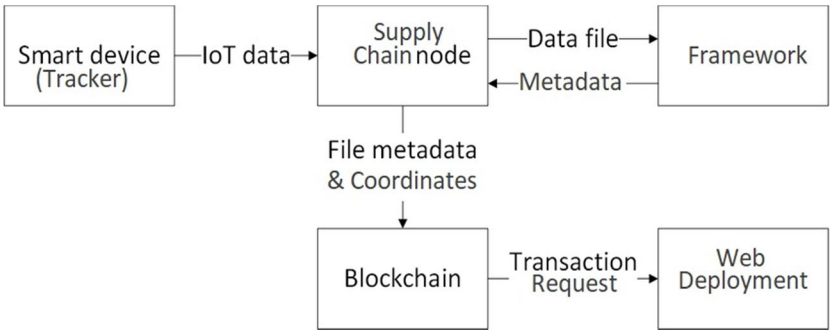
Ethereum was created by Vitalik Buterin and was built to provide a framework through which we can run all our Decentralized Applications. In Ethereum, smart contracts are written in the Turing Complete language, providing developers with nearly full access to a wide range of options and tools to create the necessary smart contracts as they might do with any other programming language. When Ethereum was released, people saw it as a breakthrough in the field of cryptography and the advantages of a high-level programming language like solidity were weighed. Vitalik Buterin talks about a state transition in which the distributed ledger moves from one state to another at the discretion of the entire network. This injects trust, transparency, and immutability into the entire system.



B. Supply Chain Management in Agriculture

Our traditional agricultural supply chain is made up of various intermediaries who try to make a profit while producers suffer significant losses. There are problems with this supply chain like the demand for the product may soar it may get sold out. Manufacturers, retailers, and shipping companies are all involved in the operation of the supply chain and need to work together to provide consumers with products that meet their needs.

The standard supply chain was flawed. Food safety was not guaranteed at many stages and could not be explained. Using blockchain as a shared ledger on a distributed network eliminates some of the drawbacks. The blockchain ensures that the data is always immutable and time stamped. The entire network is very fragmented and smart contracts can be used.



C. Traceability in Supply Chain Management

The applications of blockchain traceability in the supply chain are obvious from the decentralized aspect of blockchain. The use of blockchain in supply chains may imply that blockchain or distributed ledger technology applications can enable global trading partners to engage in secure transactions with de facto consensus while working to improve visibility, transparency, and efficiency.

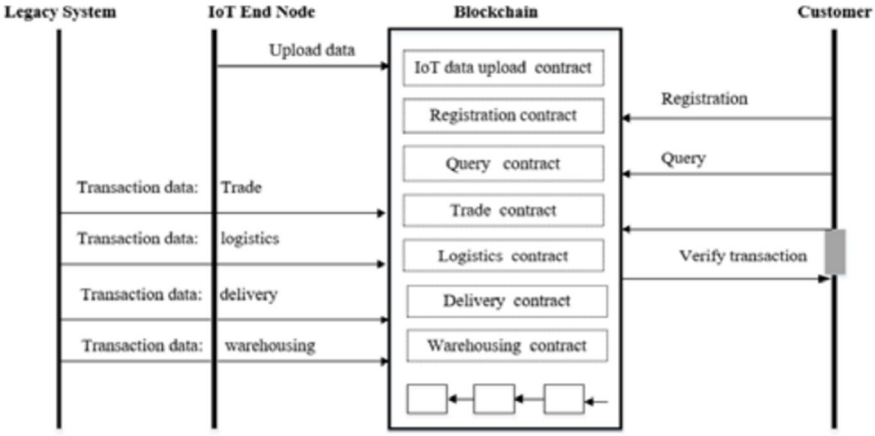
The main use cases of blockchain in the supply chain focus on the immutability of the location of goods. In addition, the use of blockchain-based traceability in supply chain also ensures the resolution of mediation issues that may arise with multiple parties.

More importantly, blockchain can also provide the benefit of real-time visibility to enable tracking and tracing analytics.

III. EXPERIMENTAL SETUP AND METHODS

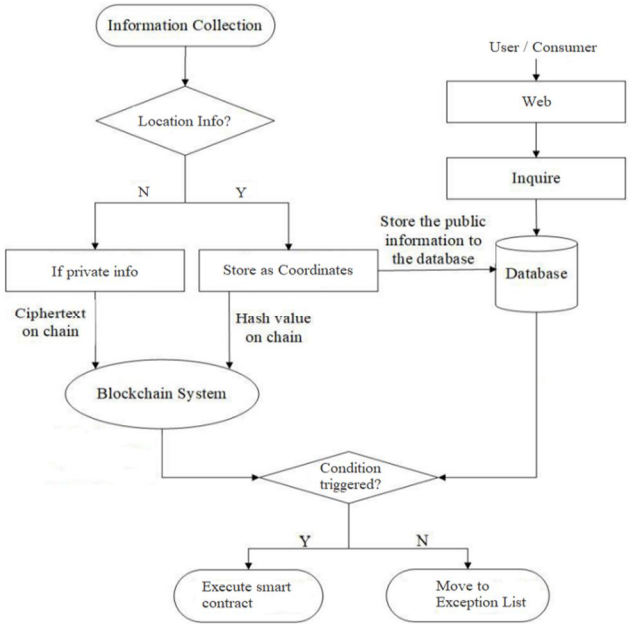
This framework will focus on the usage of smart contracts executed autonomously on the public Ethereum blockchain platform. The execution of the smart contract functions and code will be carried out by nodes that are logically distributed, and the execution outcome is agreed by all of the participating nodes. A participant node can be any computing machine that collects, validates, and executes transactions. The nodes also store data and outcome of these transactions in a ledger that is replicated and synchronized by all existing nodes.

In blockchain, smart contracts will receive transactions in form of function calls, and will also trigger events to enable the participating entities to continuously monitor, track and get suitable alerts when violations or exceptions occur. If any violations are detected or if the conditions for the contract are not met, then the product and it's related info are moved to the exception list for further validation. As a result, it ultimately helps restore optimal conditions and respond to food value chain violations.



Operators upload the information of production, processing, logistics and sales to the system. After classification by system, the traceability information is divided into location information and all other data. The private information is uploaded to blockchain after encryption, and any other data can be uploaded as it is. The location information is stored as coordinates and is uploaded to an online database.

An algorithm is used to hash the public location info. The hash value obtained is stored in the blockchain system, and the block number is returned. The block number is updated to the public information record corresponding to the database.



If the agricultural products information related to location needs to be modified, the hash value of the coordinates needs to be rewritten into the blockchain to update its block number. Consumers can obtain available information and block number from the database by using the web deployment and compare the consistency with the hash value stored on the blockchain through the block number to determine whether the product traceability information has been tampered with.

IV. CONCLUSION

A framework is given using Ethereum blockchain and smart contracts to trace, track, and perform business transactions removing intermediaries and central point of processing for traceability across agricultural supply chain. The presented aspects and details can be applied to provide trusted and decentralized traceability to any crop or produce in the agricultural supply chain. To date, blockchain technology still faces major challenges in terms of scalability, governance, identity registration, privacy, standards and regulation. In the future, we plan to integrate automatic payments and proof of delivery into the proposed system where the parties are paid in cryptocurrencies automatically and centrally using smart contracts upon successful actual delivery of crops or products.

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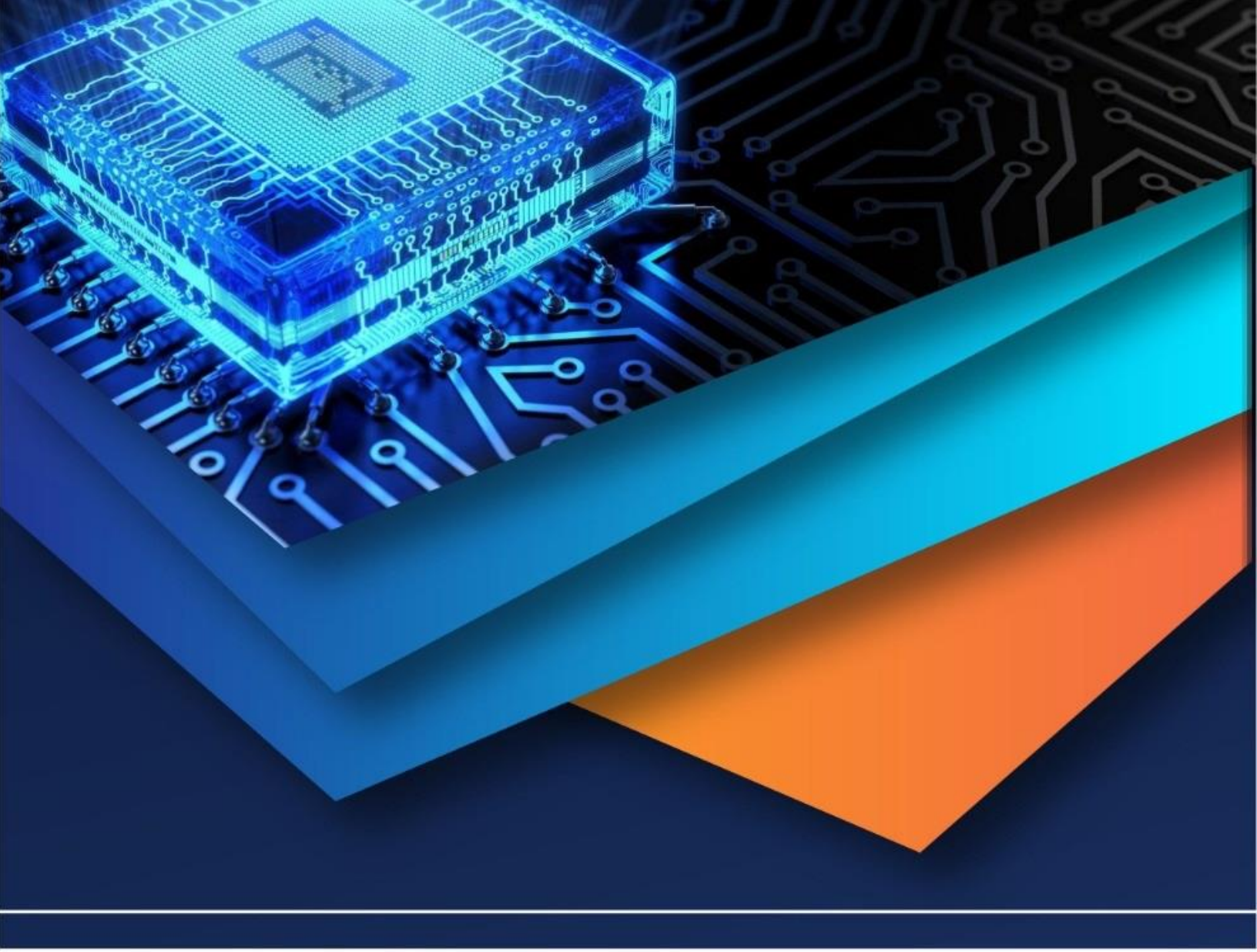

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