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Block Chain and IoT based Food Traceability for Smart Agriculture

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Abstract: ***Food safety is becoming an increasingly serious topic worldwide. To address food safety issues from a technical perspective, people need a reliable food traceability system that can track and monitor the entire food production lifecycle, including process of growing/propagating food ingredients, processing, transporting, storing and selling, etc. In this article, we propose a reliable, self-organizing, open and ecological food traceability system based on blockchain and Internet of Things (IoT) technology, which includes all parts of smart agroecosystems, even if they do not trust each other. We use IoT devices to replace as much as possible manual registration and verification, which can effectively reduce human intervention in the system. In addition, we plan to use smart contract technology to help enforcers find problems and resolve them in a timely manner.***
Keywords: Block chain, IOT, Agro System

I. INTRODUCTION

Food safety is a critical concern for consumers, regulators, and businesses alike. The integration of blockchain technology and the Internet of Things (IoT) offers promising solutions to enhance food safety practices and ensure the traceability and quality of food products throughout the supply chain. Blockchain technology provides a decentralized and transparent ledger that securely records and verifies transactions. By leveraging blockchain in the food industry, various stakeholders can track and authenticate the movement of food products from their origin to the consumer's plate. Here's how blockchain and IoT can improve food safety:

1) *Traceability:* Using IoT devices such as sensors, RFID tags, and QR codes, data about the food's journey can be collected at each stage of the supply chain. This information, including origin, processing, transportation, and storage conditions, can be recorded on the blockchain. Consumers can access this data by scanning a QR code on the product, ensuring transparency and enabling them to make informed decisions about the safety and quality of the food.
2) *Quality Control:* IoT sensors can monitor various parameters like temperature, humidity, and storage conditions in real-time. Data from these sensors can be automatically recorded on the blockchain, creating an immutable record of the food's environmental conditions throughout its journey. If any deviations occur, alerts can be triggered, allowing timely actions to be taken to prevent spoilage or contamination.
3) *Authentication:* Counterfeit food products pose a significant risk to consumers' health and brand reputation. Blockchain technology can enable the authentication of food products by storing unique identifiers on the blockchain. This allows consumers and regulators to verify the authenticity and integrity of the product by cross-referencing the recorded data with the product's history.
4) *Recall Management:* In the event of a food safety issue or recall, blockchain technology can expedite the process by quickly identifying the affected products and their origins. With the decentralized nature of blockchain, stakeholders can trace the entire supply chain, pinpointing the source of the problem, and taking necessary actions promptly, preventing further distribution and minimizing health risks.
5) *Supplier Management:* Blockchain can improve supplier management by creating a transparent and auditable system for verifying and validating suppliers' compliance with food safety standards. Records of certifications, inspections, and other relevant data can be stored on the blockchain, enabling easy access and reducing the administrative burden of manual verification processes.
6) *Smart Contracts:* Blockchain's smart contract capabilities can automate compliance and quality control processes. These contracts can be programmed to execute predefined actions based on specific conditions or triggers. For example, if a shipment's temperature exceeds a certain threshold, the smart contract can automatically trigger an alert or reroute the shipment to a different storage facility.

The integration of blockchain and IoT has the potential to revolutionize food safety practices, ensuring transparency, traceability, and accountability throughout the food supply chain. By leveraging these technologies, businesses can build trust with consumers, improve operational efficiency, and mitigate risks associated with foodborne illnesses and counterfeit products.

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II. OBJECTIVE

The main goal of this paper is to create a smart peer-to-peer system that can monitor and analyse agricultural data for surplus production. The agriculture sector is one of the most significant in the Indian economy, even though it only contributes about 18% of the country's gross domestic product (GDP) and employs about 50% of the country's workforce.
Additionally, pre-existing database systems like enterprise resource planning and warehouse management systems must be connected with blockchain.

III.SYSTEM ANALYSIS

A. *Existing System*

Large farm owners may utilise wireless IoT apps to gather information about the locations, wellbeing, and health of their livestock. They can use this information to identify sick animals and separate them from the herd to stop the spread of illness. They can locate their animals using IoT-based devices, which lowers labour expenses. JMB North America is a business that offers cow monitoring systems to cattle producers.One method for assisting cattle owners in keeping an eye on pregnant cows that are about to give birth. An electrical sensor powered by batteries is expelled when the heifer's water breaks. To the rancher or herd manager, this conveys a message. Farmers may deal with heifers that are giving birth while being more focused thanks to the sensor.

B. *Proposed System*

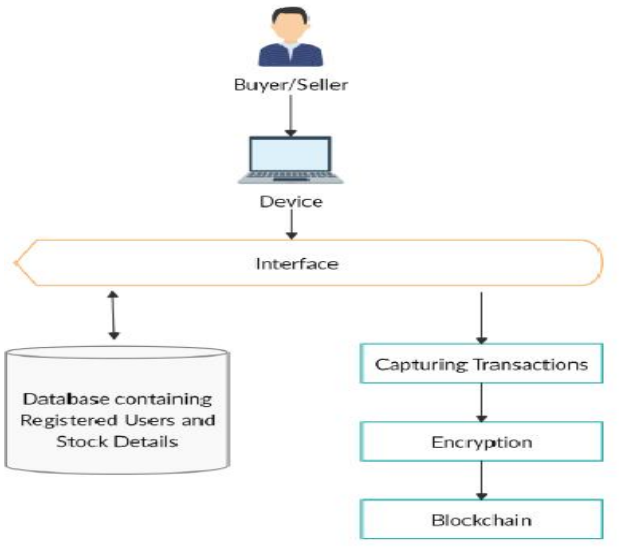
We discovered the possibilities of three particular use cases when researching the uses of blockchain technologies in the agriculture industry: supply chain traceability, smart contracts and crop insurance, and utilisation of Hyperledger Composer.In this work, we suggest a blockchain-based trustworthy, self-organized, open, and ecological food traceability system.
As far as feasible, we employ IoT devices to replace manual recording and verification, which can effectively decrease human interaction in the system. The aforementioned research work demonstrates that IoT and blockchain applications can improve smart agriculture and food traceability systems in a variety of ways, however the majority of them are ad hoc solutions for a single function or a few particular elements.

IV.METHODOLOGY

By offering security and complete transparency, blockchain is a cutting-edge technology that has a lot of promise for enhancing traceability performance. The advantages, difficulties, and development strategies of blockchain-based food traceability systems, however, have not yet been adequately analysed in the literature. Therefore, the primary goal of this paper is to review the features and functions of blockchain technology, identify blockchain-based solutions for resolving food traceability issues, highlight the advantages and implementation challenges of blockchain-based traceability systems, and assist researchers and practitioners in applying blockchain technology based food traceability systems by proposing an architecture design framework and suitability application analysis framework.

V. SYSTEM DESIGN

A. *System Architecture*



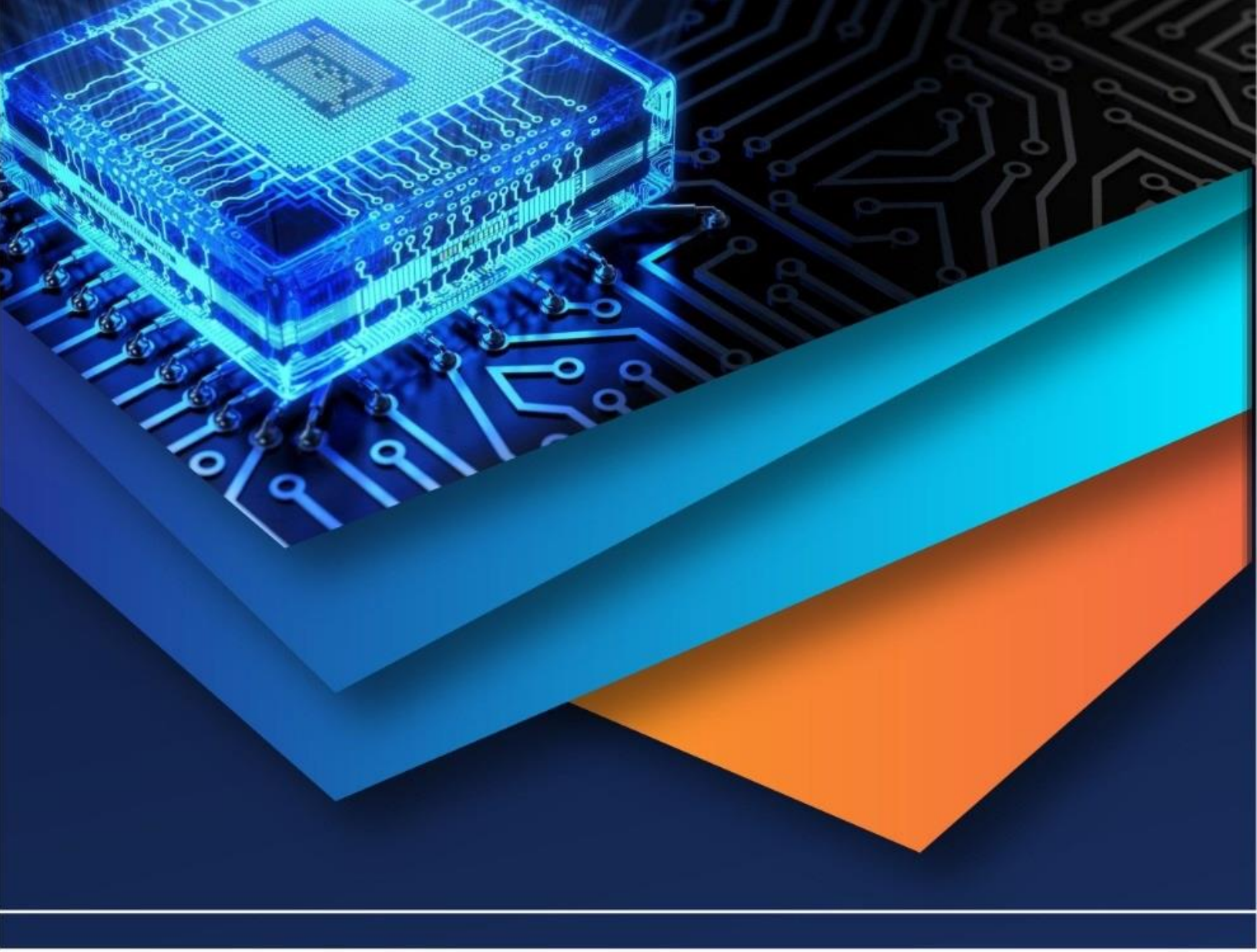
VI. CONCLUSION

In conclusion, blockchain and IoT technologies can aid in the development of a reliable, autonomous, open, and ecological smart agricultural system that engages all players in the ecosystem, even if they don't necessarily trust one another. To the best of our knowledge, this is the first effort to address food safety challenges by integrating blockchain and Internet of Things (IoT) technologies into a traditional smart agricultural ecosystem. The suggested approach aims to employ IoT devices rather than manual recording and verification, which successfully decreases human participation in the system. In the future, we may design a set of automatic warning codes for the system using smart contract script technology, which will aid law enforcement in quickly identifying and fixing issues.

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