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IOT AND BLOCKCHAIN BASED DISTRIBUTED AGRICULTURE SYSTEM TO ASSIST SMART FARMING

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Abstract

The "IoT and Blockchain based distributed Agriculture System to Assist smart framing" discusses the challenges faced by traditional agriculture, such as input wastage and inaccurate fertilizer application due to limited soil and yield data. Despite technological advancements, these issues remain unaddressed. The proposed solution involves the use of smart farming techniques that leverage IoT and Blockchain. IoT enables real-time monitoring of soil, crop health, and other parameters, facilitating informed decision-making. Blockchain adds security and transparency to the agricultural system, enhancing trust and traceability. This integration has the potential to revolutionize farming by optimizing resources, reducing wastage, and empowering farmers with data-driven insights to adapt to environmental changes and improve resilience.

Keywords – IoT, Blockchain, Smart farming, Agriculture system, Distributed agriculture

I. INTRODUCTION

The significance of IoT stems from its capacity to establish a seamless network facilitating information sharing and autonomous task performance, thereby augmenting efficiency and convenience. For example, in smart homes, devices can adjust settings based on weather forecasts or remotely detect intruders. Wearable devices in healthcare monitor vital signs, enabling proactive management by sending alerts. In agriculture, sensors monitor soil moisture levels, automating irrigation processes to enhance resource utilization and crop yields. Similarly, IoT-enabled machines in manufacturing streamline operations, reducing downtime. However, despite its benefits, IoT raises legitimate concerns regarding privacy and security due to the immense volume of data generated. Therefore, robust cybersecurity measures are imperative to safeguard against potential threats. Nonetheless, the undeniable potential of IoT continues to propel advancements, broadening its applications across various facets of daily life.

In manufacturing, machines enabled with IoT communicate among themselves, aiming to streamline production processes and reduce operational downtime. However, despite its numerous advantages, IoT also brings about concerns regarding privacy and security due to the massive amounts of data generated by interconnected devices. Implementing strong cybersecurity measures becomes essential to mitigate potential threats. Nevertheless, despite these challenges, the potential of IoT to revolutionize various aspects of daily life remains undeniable. Ongoing advancements continually

expand its capabilities and applications. As IoT progresses, addressing concerns related to privacy and security becomes crucial to ensure its sustainable integration into societal frameworks.

II. LITERATURE SURVEY

The literature survey for the " IoT and Blockchain based distributed Agriculture System to Assist smart framing" Effective water management is vital where water is scarce, impacting agriculture, which uses a substantial amount of water. Studies aim to lower irrigation water demand, but expensive sensors make them unsustainable for small-scale farmers. However, companies are developing cost-effective sensing devices connected to nodes for affordable agriculture monitoring and irrigation management systems. The main objectives of irrigation systems are to minimize labor and resource requirements while maximizing efficiency. Success depends on the irrigation system's type, design, and management practices. Factors like crop type, farm location, time of year, system compatibility with farm services, topography, soil properties, crop specs, economic feasibility, and social constraints influence system selection. Irrigation systems are essential for agriculture in water-scarce regions. They aim to minimize water use while maximizing productivity and saving costs. However, The literature survey provides an essential backdrop for the" " IoT and Blockchain based distributed Agriculture System to Assist smart framing" conventional sensors for irrigation management are too expensive for small-scale farmers. Some companies are developing low-cost devices that can be linked to nodes for efficient and affordable irrigation monitoring and control. The type, design, and management of irrigation systems influence their performance. Various factors, such as crop, location, season, system compatibility, topography, soil, crop requirements, economic feasibility, and social constraints, determine the selection of irrigation systems.

A. EXISTING SYSTEM

WATER WASTAGE IN AQUEDYCT PROCESS: The Aqueduct irrigation method uses artificial channels or structures to transport and distribute water to crops. However, this method is prone to water wastage due to evaporation, leakage, and runoff. Moreover, the water supply is often inconsistent and unreliable, depending on the availability and quality of the source. Therefore, the Aqueduct irrigation method is inefficient and unsustainable for water management in agriculture.

PESTICIDE WASTAGE: The existing system has an automated fertilizer application process, but it essentially replicates the tasks that humans normally do. This means that the system does not account for the specific needs and conditions of the crops, soil, and environment. As a result, the system may apply excessive or insufficient amounts of fertilizer, leading to pesticide wastage and environmental pollution.

Furthermore, the system does not monitor or control the pests and diseases that may affect the crops, reducing the effectiveness of the fertilizer application.

PRODUCTIVITY IS LOW: The existing system relies on the Aqueduct irrigation method and automation for water and fertilizer delivery, but it does not change the traditional human-oriented practices in agriculture. This means that the system does not optimize the use of resources, technology, and information to enhance the productivity and quality of the crops. The system also does not adapt to the changing climate and market demands, limiting the profitability and competitiveness of the farmers. Therefore, the existing system has low productivity and potential for improvement.

III. BLOCKCHAIN-BASED DISTRIBUTED AGRICULTURE SYSTEM:

Agriculture serves as a cornerstone for food security, livelihoods, and economic advancement. However, this critical sector grapples with myriad challenges, including the ramifications of climate change, water scarcity, food integrity issues, and inefficiencies in supply chains. In response, we advocate for the establishment of a Blockchain-based Distributed Agriculture System (BDAS), leveraging the advantages inherent in blockchain technology and Internet of Things (IoT) devices.

BDAS represents a decentralized, transparent, and secure framework facilitating seamless data exchange, traceability, and execution of smart contracts among diverse stakeholders within the agricultural domain. Through the adoption of BDAS, we anticipate improvements in food product quality and safety, reductions in resource wastage and costs, and enhancements in the productivity and profitability of agricultural practitioners. Our proposition encompasses the architectural design and practical

implementation of BDAS, elucidated via a case study focused on tomato cultivation and distribution.

Furthermore, we delve into the prospective opportunities and obstacles associated with the integration of blockchain technology into agricultural processes, offering valuable insights into avenues for future research and development. This innovative approach holds promise for revolutionizing agricultural methodologies while addressing pressing challenges within the sector.

IV. PROJECT ANALYSIS

The project deals with modern farming management challenges, emphasizing the delivery of authentic organic produce to end consumers with superior quality and health benefits. The analysis highlights inefficiencies in traditional farming methods, including resource wastage and suboptimal productivity due to inaccurate fertilizer application based on rudimentary soil analysis and crop yield estimations. The current system relies on outdated techniques such as aqueduct irrigation and manual fertilization, resulting in excessive water and pesticide usage and reduced productivity. In contrast, the proposed system revolutionizes agriculture by leveraging IoT and Blockchain technology. Through sensor networks monitoring environmental parameters like moisture, humidity, temperature, and pH levels, the system optimizes farming while ensuring food source traceability and authenticity. Automation and blockchain- based tracking promise increased production efficiency, transparency, and product quality consistency. Advantages include enhanced production efficiency, consumer trust, and product uniformity. The system also holds potential for smart roof gardening and resource- efficient cultivation in water-scarce regions, fostering sustainable agricultural practices.

PROBLEM STATEMENT

The problem statement introduces the issue of delivering authentic organic produce with optimal quality and health attributes to end consumers, which is a challenge in current farming management systems. It explains the inefficiencies of conventional farming methods, such as resource wastage and low productivity, due to inaccurate fertilizer application based on simple soil analysis and crop yield estimations. It also describes the lack of transparency and traceability in the food supply chain, which affects consumer trust and satisfaction.

The problem statement then proposes a smart agriculture system that combines IoT and blockchain technologies to optimize farming operations, ensure food source authenticity, and enhance production efficiency and quality. It outlines the main components of the system, such as sensor networks, blockchain, and retail market, and how they work together to monitor, manage, and automate various aspects of the agricultural process.

The problem statement finally highlights the advantages of the proposed system, such as improved production efficiency, consumer trust, and product uniformity. It also mentions the potential applications of the system for smart roof gardening and resource-efficient cultivation in water-scarce regions. It concludes by stating the aim of the problem statement, which is to transform smart farming practices by leveraging the collective strengths of IoT and blockchain technologies.

V. PROPOSED SYSTEM

The proposed smart agriculture model combines IoT and blockchain technologies to improve efficiency and transparency in the agricultural supply chain. The system has three main components: IoT, blockchain, and the retail market. In the IoT component, farm sensors collect data throughout the production cycle, capturing essential information such as product details, origins, and real-time growth updates. This data is available to stakeholders, providing increased visibility and accountability.

The blockchain component manages data storage, consensus, encryption, decryption, and verification tasks. It uses smart contracts to execute logic at specific intervals, improving scalability, simplifying processes, and reducing costs. The retail market component handles product delivery automation to successful bidders, such as distributors and retailers. Furthermore, the system automates smart drip irrigation and pesticide fertilization based on variables such as moisture, humidity, weather forecasts, temperature, and pH levels. This holistic approach aims to transform smart farming practices by leveraging the combined strengths of IoT and blockchain technologies.

1. Integration of IoT and Blockchain in Smart Agriculture:

This topic mainly focuses on how IoT and blockchain technologies are seamlessly integrated into the agricultural supply chain to enhance efficiency and transparency for Agriculture. It explores the synergy between these two technologies and their

combined impact on modernizing farming practices.

2. Components of the Smart Agriculture System:

Smart agriculture encompasses a system that integrates IoT, blockchain, and the retail market to enhance farming operations. IoT entails a network of sensors and devices gathering data on crops, soil, and environmental conditions. Meanwhile, blockchain technology serves as the backbone for storing, verifying, and securing data on a distributed ledger. The retail market aspect acts as the platform facilitating connections between farmers and buyers, automating product delivery processes. Each component plays a distinct role within the smart agriculture system. This paper aims to delve into the synergistic workings of these components, elucidating how they collaborate to optimize farming operations while ensuring traceability and authenticity in the food supply chain.

3. Components of the Smart Agriculture System:

Components of SAS: The exploration of the smart agriculture system delves into its fundamental components: IoT, blockchain, and the retail market. Each component's functionality and role in enhancing farming operations are examined in detail, offering comprehensive insights into their contributions to agricultural optimization.

4. Blockchain Management in Agricultural Data:

Blockchain Management: The smart agriculture system sheds light on its pivotal role in overseeing data storage, consensus, encryption, decryption, and verification functions. It emphasizes the critical role of blockchain technology in upholding data integrity and transparency throughout agricultural processes. smart agriculture system delves into its fundamental components: IoT, blockchain, and the retail market. Each component's functionality and role in enhancing farming operations are examined in detail, offering comprehensive insights into their contributions to agricultural optimization.

5.Advantages of the Smart Agriculture System:

Smart Agriculture System: The proposed smart agriculture system offers many benefits for the agricultural sector. It records and stores the data collected by IoT sensors on the blockchain, which allows stakeholders to access production information in real-time and ensures transparency. It also uses blockchain technology to decentralize data management, which improves security and efficiency. Moreover, it automates and simplifies various tasks using smart contracts, which reduces costs and errors.

6. Enhanced Transparency through Blockchain Technology:

Blockchain Technology: Blockchain technology enhances transparency in the agricultural supply chain. It uses an immutable ledger to store the data from IoT and Blockchain sensors, which offer visibility and accountability for every stage of the production process from farm to fork process.

7. Security Measures in the Smart Agriculture System:

Security Measures : Smart agriculture relies on blockchain technology to ensure the security and integrity of sensitive agricultural data. By using a decentralized ledger that does not require a central authority, blockchain technology prevents data tampering and enhances data accountability.

V. RESULT

Integrating IoT sensors into smart agriculture systems is designed to ensure efficient and accurate data collection. Instant monitoring of environmental factors such as temperature, humidity and soil m oisture helps make decisions on managing crops for good growth. The use of blockchain technology solves fundamental problems s uch as data security, storage and transparency. The system imple ments data security, approval mechanism and encryption protocol using smart contracts.The smart agriculture model shows the pote ntial for carrying out important agricultural activities such as irrig ation and pesticides. Leveragingdata generated by the Internet of Things, the system automatically adjusts irrigation schedule and p esticide usebased on realtime factors such as humidity, soil moist ure, weather forecasts, temperature and pH. levels.The integration of the retail market as a smart farming model facilitates the delive ry of products to the winning bidder, including distributors and m erchandise stores.By recording and analyzing production data, rel evant business suppliers obtain important information aboutprodu ct base, quality and size growth stage Using blockchain technolog y can improve resources and reduce the cost of smart agriculture. Smart contracts ensure the relationship between certain levels, si mplifying the process, reducing the management burden and allo wing the system to adapt to larger projects

VI. FUTURE WORK

Although smart farming models are seen as successful as there is r oom for improvement and future use, some challenges need to be overcome before they can be adopted. Issues related to investment in startups, interaction of different IoT devices, design of informat ion, and ensuring privacy in the integration of the blockchain netw ork need further research and development. Additionally, the strea mlined process increases overall efficiencyand helps save costs by reducing process complexity

VII. CONCLUSION

In short, the integration of IoT and Blockchain into smart farmi ng has revolutionized agriculture. IoT sensors facilitate data col lection, improve crop management, and provide supply chain tr ansparency. Blockchain provides secure and transparent data st orage and verification by eliminating the need for intermediarie s. Automated processes based on realtime data increase efficien cy, while participation in retail transactions increases reliability and traceability. Using blockchain technology can increase the efficiency and reduce the costs of smart agriculture. Smart cont racts ensure the relationship between certain levels, simplifying the process, reducing the management burden and streamlining the system for larger operations.

The integration of IoT and blockchain technology into smart far ming modelsshows the potential to revolutionize agriculture.

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