Transforming Poultry Management through the Fusion of Cutting-Edge Technologies: A Robust Approach to Secure Poultry Insight with Integration of IoT and Blockchain

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Abstract—**This paper focuses on the integration of Internet of Things (IoT) and blockchain technology modernizing the poultry industry. Production of poultry is highly dependent on environmental parameters like temperature, humidity, air, and lighting to maintain and boost the production of poultry. Monitoring several environmental parameters is crucial for a large poultry farm, especially in the traditional way. Recently, the adoption of IoT and Blockchain has been used for monitoring and maintaining the farm automatically. At first, the temperature is monitored using IoT-based sensors. All the details of the registered users are stored in the blockchain to provide security for their details. Since storing the entire supply chain data on Blockchain is very costly, distributed off-chain file storage IPFS is used.**

Keywords—poultry, blockchain, IoT , Environmental monitoring

I. INTRODUCTION

The operation of poultry farms is tremendous and limited when using manpower, especially in a large farm. As the environment of poultry farms has to be monitored regularly, farmers need to observe all the environmental parameters of the poultry manually. Therefore, with the implementation of IoT in poultry farms, it could reduce cost, and manpower and is highly manageable. Blockchain is a digital ledger in which transactions made are recorded   chronologically and stored publicly in a chain of blocks that are produced through cryptographic algorithms. Commonly blockchain is the engine behind the cryptocurrency that ensures the integrity of the data in a decentralized and secured way.

In recent years, the poultry industry has undergone significant technological advancements aimed at improving efficiency, productivity, and sustainability. However, traditional poultry management systems often face challenges such as data security, traceability, and real-time monitoring. To address these challenges and revolutionize poultry management practices, our project aims to implement a groundbreaking solution: "Transforming Poultry Management through the Fusion of Cutting-Edge Technologies: A Robust Approach to Secure Poultry Insight with Integration of IoT and Blockchain."

The integration of Internet of Things (IoT) and blockchain technologies presents a powerful opportunity to enhance poultry management processes by providing secure,

transparent, and data-driven insights. By leveraging IoT devices such as sensors and actuators, we can collect real-time data on various aspects of poultry farming, including environmental conditions, feed consumption, and health indicators. This wealth of data enables proactive decision-making and ensures optimal conditions for poultry welfare and productivity. The technologies used for the development of this project are IoT and Blockchain.

A.IoT

Internet of Things (IoT) is a transformative technological paradigm that interconnects various physical devices, sensors, actuators, and other objects to the internet, enabling them to collect, exchange, and analyze data. This interconnected network of devices facilitates seamless communication and interaction between physical objects and digital systems, leading to enhanced efficiency, productivity, and convenience across numerous domains.

B.BlockChain

Block chain is a technology that provides a secure and transparent way of recording, storing, and verifying data. At its core, blockchain is a decentralized and distributed ledger system which is used to record several transactions across a network of computers in a secure, transparent, and immutable manner. Unlike traditional centralized databases, where data is stored and controlled by a single entity, blockchain enables a peer-to-peer network of participants to collectively validate and record transactions without the need for intermediaries. The foundation of blockchain technology lies in its ability to create a tamper-proof and transparent record of transactions through cryptographic techniques and consensus algorithms.

II. FRAMEWORKS

MANY EXISTING FRAMEWORKS LEVERAGE ISO STANDARDS RELATED TO IoT (E.G., ISO/IEC 30141) AND BLOCKCHAIN (E.G., ISO/TC 307) TO ENSURE INTEROPERABILITY, SECURITY, AND COMPATIBILITY WITHIN THE POULTRY MANAGEMENT ECOSYSTEM. FRAMEWORKS LIKE CRISP-DM (CROSS-INDUSTRY STANDARD PROCESS FOR DATA MINING) AND TDSP (TEAM DATA SCIENCE PROCESS) PROVIDE STRUCTURED METHODOLOGIES FOR CONDUCTING DATA ANALYTICS PROJECTS. THESE FRAMEWORKS GUIDE PRACTITIONERS THROUGH THE STAGES OF DATA PREPARATION, MODELING, EVALUATION, AND DEPLOYMENT, ENABLING INSIGHTS GENERATION FROM POULTRY MANAGEMENT DATA.SOLUTIONS LIKE IoT PLATFORMS (E.G., AWS IoT, AZURE IoT HUB) AND BLOCKCHAIN INTEGRATION PLATFORMS (E.G., HYPERLEDGER FABRIC SDK) PROVIDE TOOLS AND APIS FOR CONNECTING IoT DEVICES WITH BLOCKCHAIN NETWORKS, FACILITATING DATA EXCHANGE AND INTEROPERABILITY IN POULTRY MANAGEMENT SYSTEMS.REGULATORY COMPLIANCE FRAMEWORKS SPECIFIC TO THE POULTRY INDUSTRY, SUCH AS USDA REGULATIONS AND INDUSTRY STANDARDS (E.G., NATIONAL POULTRY IMPROVEMENT PLAN), PROVIDE GUIDELINES FOR ENSURING COMPLIANCE WITH FOOD SAFETY, ANIMAL WELFARE, AND ENVIRONMENTAL REGULATIONS IN IoT AND BLOCKCHAIN-ENABLED POULTRY MANAGEMENT.PRIVACY AND SECURITY FRAMEWORKS SUCH AS GDPR (GENERAL DATA PROTECTION REGULATION) AND NIST CYBERSECURITY FRAMEWORK OFFER GUIDELINES AND BEST PRACTICES FOR ENSURING THE CONFIDENTIALITY, INTEGRITY, AND AVAILABILITY OF DATA IN IoT AND BLOCKCHAIN-ENABLED POULTRY MANAGEMENT SYSTEMS.

III. METHODOLGY

The monitoring of poultry here is entirely based on IoT technology. The IoT information such as temperature and humidity parameters are taken from DHT11 sensor along with detection of dangerous gases through the gas sensor. LDR module is used for the purpose of monitoring the light intensity. All the IoT sensors are integrated using the ESP8266 microcontroller with certain memory capabilities.

Firstly all the sensors are connected and integrated to the microcontroller. Then the code appropriate to interface with each sensor individually is written for the purpose of reading the relevant data (temperature, humidity, light intensity, gas levels). Threshold-based monitoring is done through each sensor to detect abnormal conditions. For example, triggering alerts if temperature or humidity levels exceed predefined thresholds, or if gas levels rise above safe limits.

The functionality of the monitoring system is checked under various conditions to ensure accuracy and reliability. Also regular maintenance checks are done for the purpose of ensuring the proper functioning of sensors and the ESP8266

microcontroller, and to replace any faulty components as necessary. All the gathered data from the IoT is stored on the Blockchain so that the data can be viewed for the purpose of checking the integrity and quality of the poultry product to buy.

Three types of status notations are used here for knowing about the ordered product status such as
1-When the product is ordered
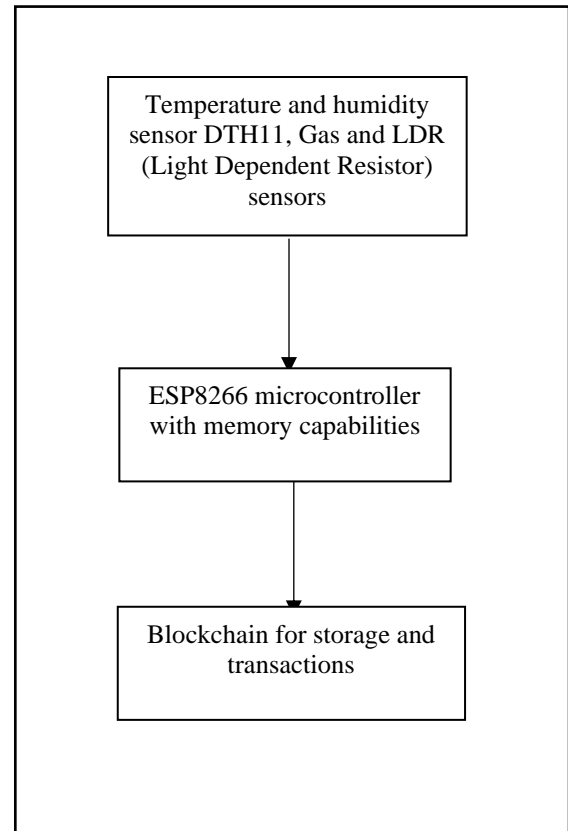**2-When the order is receivied**
3-When the order is confirmed
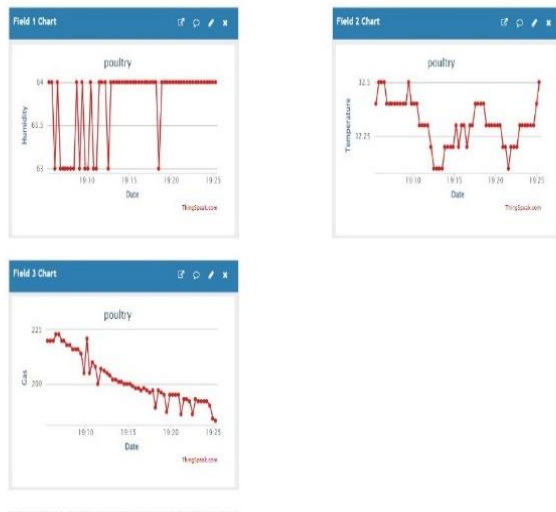

IV. PROPOSED SYSTEM

The figure below represents the proposed system. For preliminary study, temperature and humidity along with gas and light intensity are measured where these parameters are critical for the success of the poultry operation. Therefore, the DHT11 sensor as shown in Figure are used for measuring the temperature and humidity along with a ESP8266 board. The measured data is then transmitted and stored on the blockchain.

The blockchain based web application is provided for the purpose of sending and receiving orders of the poultry products. The web application mainly consists of 3 users admin, retailer and consumer. Admin maintains the application whereas the retailer's and consumer's operations are almost same i.e sending and receiving the orders.

The UI of the web application represents login page for 3 of the users and registration page for the new retailers and consumers. The consumer or retailer can check the quality and integrity of the product in the web application itself and can buy the product. Admin maintains all the information whereas the retailers and consumers can view the form data such as several details of the product (breed, quantity) to order the product. Respective consumer can order the product based on the breed of the product, Quantity required etc.

Temperature and humidity sensor DTH11, Gas and LDR (Light Dependent Resistor) sensors

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ESP8266 microcontroller with memory capabilities

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Blockchain for storage and transactions

V. RESULTS AND DISCUSSIONS

VI. CHALLENGES AND FUTURE OUTLOOK

While the transformation of India's poultry farming sector is highly promising, it is important to acknowledge that it is not without its challenges and complexities. One of the important concerns is ensuring that the benefits of innovative technology and sustainable practices to reach out all segments of the farming community, including small-scale and marginalized farmers. Access to technology and resources can be a barrier for these groups, and addressing this digital methodology is crucial for the sector's equitable growth.

Another challenge pertains to ethical considerations surrounding poultry farming. There is an increasing focus and care on animal welfare and the ethical treatment of animals within the poultry industry. While technological advancements have improved conditions for poultry, there is still work to be done to ensure that all poultry farming practices adhere to the highest ethical standards. Striking the right balance between efficiency and ethical considerations is an ongoing and current challenge that the sector must address at present.

CONCLUSION

In conclusion, the poultry farming sector in India is undergoing a rapid transformation, driven by innovative technology and sustainable practices. These advancements are not merely incrementing changes but represent a revolution that is reshaping the poultry sector's landscape. They have helped the poultry sector to overcome such traditional challenges and promoted sustainability to enhance economic viability.

The future holds great promising changes for India's poultry farmers as they continue to embrace and adapt to these innovative changes. However, it is essential that the benefits are accessible to all, and that ethical considerations are integrated into the core of the sector's practices. As this sector evolves, it will play a vital role in India's journey toward a more sustainable and prosperous agricultural and poultry future.

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