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IoT based Smart System for Safe and Secure Poultry Farming

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Abstract

In this research, the implementation of advanced sensor technologies to bolster safety and security in the global poultry industry is discussed. By addressing challenges such as disease outbreaks, environmental pressures, and security threats, the proposed approach integrates motors for waste management, buzzers for alerts, and gas sensors for detecting hazardous gases detection, like ammonia (NH3) and carbon monoxide (CO). A primary gas sensor assumes a pivotal role in promptly identifying harmful gases, initiating alarms, and activating waste management systems. The result not only mitigates risks and ensures timely responses but also streamlines operations, optimizes efficiency, and fosters a secure and sustainable poultry farming environment.

Keywords: Poultry Industry, Environment Safety, Hazard Detection, Automation, Internet of Things.

1. Introduction

The global poultry industry, essential for meeting the increasing demand for protein, faces significant challenges ranging from disease outbreaks to environmental strains and security vulnerabilities [1]. This research focuses on enhancing the safety and security within poultry farming through the integration of advanced sensor technologies. Beginning with an

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acknowledgment of these challenges, it emphasizes their economic and ethical implications, urging the adoption of proactive strategies to address them.

In addition to conventional practices such as disease monitoring and environmental management, this research includes innovative measures such as motors for efficient waste management, buzzers for timely alerts, and gas sensors for hazardous gas detection, such as ammonia (NH3) and carbon monoxide (CO) [2]. Together, these technologies form a comprehensive framework aimed at fortifying safety and security within poultry farming operations. The primary gas sensor in the research takes a pivotal role in swiftly identifying harmful gases, triggering alarms, and facilitating prompt waste management actions [3].

This holistic approach not only addresses immediate safety concerns and issues timely warnings but also proactively manages risks, automates cleaning processes, enhances production efficiency, and ensures a secure and healthy environment for poultry farming [4]. By embracing technological advancements, the industry aims to strengthen overall resilience and sustainability in the face of evolving challenges.

2. Existing System

The existing method relies on a smart system driven by Internet of Things (IoT) technology to supervise and regulate environmental factors within poultry farming environments [5]. The primary objective is to maintain ideal conditions for poultry birds, with a focus on temperature, humidity, and air quality. This is achieved through a network of sensors continuously monitoring these parameters and transmitting data to a central control unit [6].

The control unit, equipped with processing capabilities, analyzes incoming data and initiates appropriate actions when specific thresholds are reached. The temperature surpasses a predetermined level, the system can activate mechanisms to mitigate heat stress, such as adjusting lighting or ventilation. Additionally, the system integrates security features like motion detectors to detect potential intrusions and alerts farmers accordingly.

3. Proposed System

The proposed system aims to revolutionize safety and security within poultry farming by leveraging advanced sensor technologies to combat challenges like disease outbreaks, environmental pressures, and security threats. Integrated components such as motors for waste

management, buzzers for alerts, and gas sensors detecting NH3 and CO gases work in tandem to ensure comprehensive protection.

At its core, a primary gas sensor swiftly detects harmful gases, promptly triggering alarms and activating waste management mechanisms [9]. Real-time environmental monitoring through the Blynk app enables remote access to sensor data, empowering users to intervene promptly when necessary. Additionally, notifications are sent directly to the farm manager's mobile phone upon sensor detection, ensuring swift action to maintain a secure and healthy environment.

This integrated approach not only addresses immediate safety concerns but also proactively manages risks, automates cleanup processes, and optimizes production efficiency. By embracing technological advancements and real-time monitoring capabilities, the proposed system seeks to enhance overall industry resilience and sustainability, paving the way for safer and more efficient poultry farming practices.

3.1 Block Diagram of Proposed system

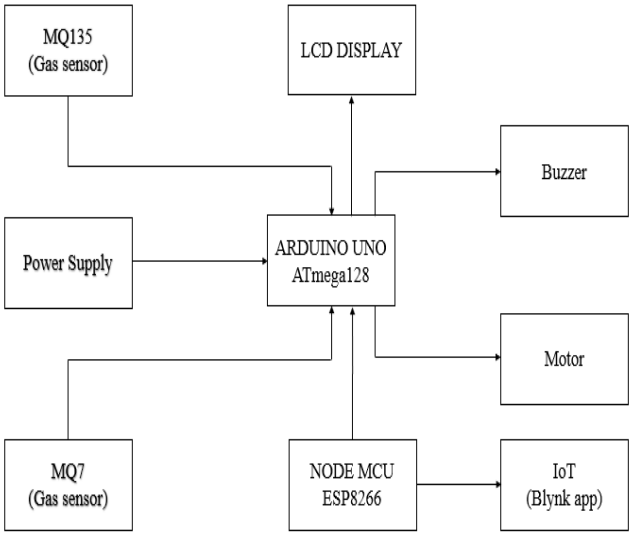

Figure 1. The Block Diagram of Proposed System

The proposed system block diagram is illustrated in Figure (1). Consists of the following components:

- Power Supply

- Arduino UNO
- MQ135 Gas Sensors
- MQ7 Gas Sensors
- Node MCU (ESP8266)
- Buzzer
- Motor
- LCD Display
- Mobile app (Blynk app)

The function of each block in the proposed block diagram is given below:

- **Power Supply**

The power supply setup is a critical component in ensuring the seamless operation of the system. It relies on a 12V adapter as the primary power source, providing ample voltage to power the various components. To distribute power effectively, the voltage is carefully regulated: it is reduced to 5V for the Arduino UNO and Node MCU, ensuring steady performance of these microcontrollers.

Concurrently, a segment of the power remains unmodified at 12V, dedicated specifically to driving the 12-volt motor. This voltage segmentation is facilitated through the use of a voltage regulator, which adeptly converts and regulates the incoming voltage to match the unique requirements of each component. By implementing this power supply configuration, the system can efficiently manage power distribution, thereby facilitating optimal performance across all integrated devices.

- **Arduino UNO**

The Arduino UNO, powered by a 5V battery, acts as a central monitoring hub for detecting harmful gases like ammonia (NH3) and hydrogen sulfide (H2S) in poultry farms [7]. It triggers alerts through a buzzer and collaborates with the motor for waste management tasks. Integrated with NodeMCU, it wirelessly transmits data to cloud platforms like Blynk, enabling remote surveillance of environmental conditions. This connectivity allows for insights crucial

in ensuring enhanced safety measures within poultry facilities and facilitates timely interventions to maintain optimal conditions.

- **MQ135 Gas Sensors**

The MQ135 gas sensor is to detect various gases in the air, including harmful gases such as ammonia (NH3), nitrogen oxides (NOx), benzene, smoke, and carbon dioxide (CO2). This sensor is commonly used in applications related to air quality monitoring, indoor air quality assessment, and gas leakage detection.

- **MQ7 Gas Sensors**

The MQ7 gas sensor is to detect the presence of carbon monoxide (CO) gas in the environment. Carbon monoxide is a colorless, odorless gas that is highly toxic and can be lethal if inhaled in high concentrations.

- **Node-MCU (ESP8266)**

The Node-MCU in the described setup is to facilitate wireless communication and data transmission between the Arduino UNO and cloud platforms such as Blynk. NodeMCU acts as an intermediary device, allowing the Arduino UNO to transmit the collected data on harmful gases, alerts, and motor coordination wirelessly to the cloud platform. This enables remote monitoring and surveillance of environmental conditions in poultry farms, providing real-time insights for enhanced safety measures and timely interventions when necessary.

- **Buzzer**

The buzzer in the proposed system is to provide timely alerts in response to detected hazards or security threats in poultry farming environments. When harmful gases or other risks are identified by the gas sensors, the buzzer is activated to immediately notify farm operators or personnel.

- **Motor**

The motor in the proposed system is to facilitate efficient waste management within poultry farming operations. When triggered by the detection of harmful gases by the gas sensors, the motor is activated to initiate waste management mechanisms. By automating these

cleanup processes, the motor helps to swiftly remove potential hazards, mitigate risks, and maintain a healthy environment for both poultry and farm in-charge.

- **LCD Display**

The LCD display in the poultry farming system shows real-time gas sensor data from the MQ135 and MQ7 sensors. It provides immediate feedback on gas concentrations, including harmful gases like ammonia (NH3) and carbon monoxide (CO) [8]. This allows farmers to monitor air quality, take prompt action to address any issues, and ensure the safety of poultry and farm in-charge. The LCD display and other components are illustrated in figure (2).

- **Mobile App(Blynk)**

The Blynk app serves as a platform for real-time environmental monitoring and remote access to sensor data in the poultry farming system [9]. It enables farm managers to monitor gas sensor readings, receive alerts, and notifications directly on their mobile phones. This facilitates prompt intervention and action to maintain a secure and healthy environment within the poultry facility.

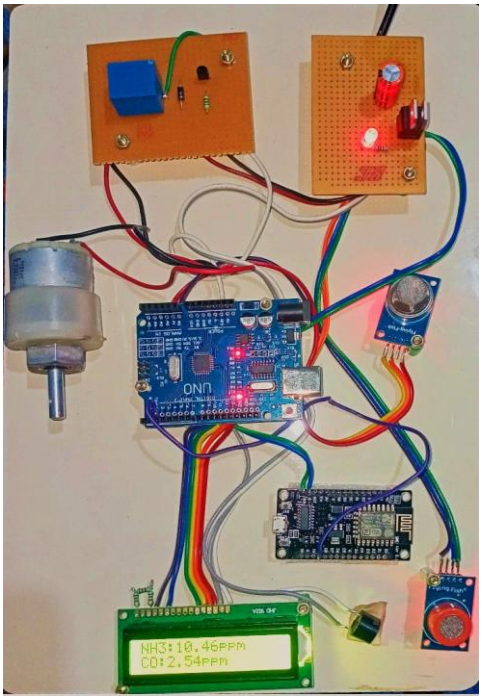

Figure 2. Hardware of Proposed System

4. Result and Discussion

The integration of advanced sensor technologies presents a promising solution to the multifaceted challenges encountered by the global poultry industry. These challenges, including disease outbreaks, environmental strains, and security vulnerabilities, underscore the pressing need for proactive measures to safeguard the industry's economic viability and ethical integrity [10]. The proposed innovative measures, such as the integration of motors for waste management, buzzers for alerts, and gas sensors for detecting hazardous gases like ammonia (NH3) and carbon monoxide (CO) shown in figure (4), (5), constitute a complete approach to enhance the safety and security within poultry farming operations [13]. Notably, the primary gas sensor assumes a pivotal role in rapidly identifying harmful gases, thereby enabling timely interventions to mitigate risks. The monitoring of gas values in Blynk App is illustrated in figure (3,4,5).

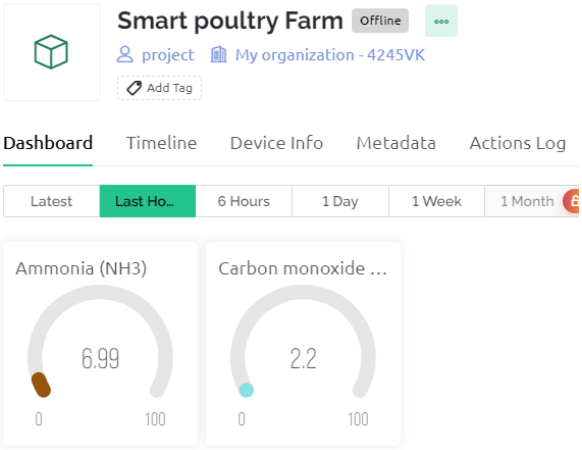

Figure 3. Monitoring of Gas Values in Blynk APP

Moreover, the discussion delves into the potential outcomes of implementing these advanced technologies, anticipating benefits such as improved production efficiency, reduced environmental impact, and enhanced animal welfare [11,12]. Despite the challenges associated with integrating these technologies into existing practices, the imperative to embrace technological advancements remains paramount. By doing so, the poultry industry can strengthen its resilience and sustainability, ensuring its continued viability in the face of evolving challenges and uncertainties [14].

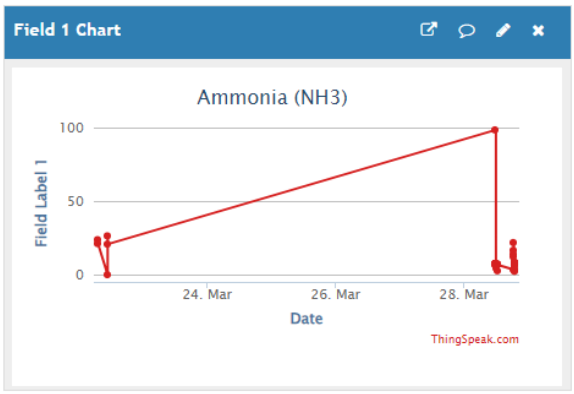

Figure 4. Monitoring of Ammonia (NH3) in ThingSpeak

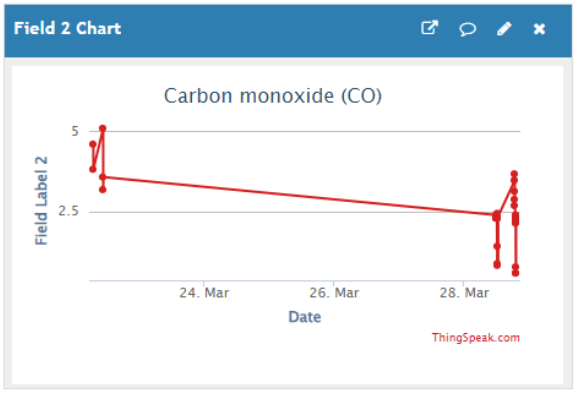

Figure 5. Monitoring of Carbon Monoxide (CO) in ThingSpeak

5. Conclusion

In conclusion, the integration of advanced sensor technologies represents a transformative approach to addressing the diverse challenges confronting the global poultry industry. By leveraging innovations such as motors for waste management, buzzers for alerts, and gas sensors for detecting hazardous gases, poultry farming operations can bolster safety and security measures. The primary gas sensor emerges as a critical component in swiftly identifying harmful gases, facilitating prompt responses to mitigate risks effectively. While challenges exist in integrating these technologies into existing practices, the potential benefits—including improved production efficiency, reduced environmental impact, and enhanced bird welfare—underscore the necessity of embracing technological advancements.

Moving forward, the poultry industry must remain proactive in adopting these advanced solutions to enhance its resilience and sustainability. By doing so, it can navigate the complexities of disease outbreaks, environmental strains, and security vulnerabilities with greater efficacy and foresight. Ultimately, the integration of advanced sensor technologies offers a pathway towards ensuring the continued viability and integrity of poultry farming operations in an ever-evolving landscape.

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