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Intelligent IoT Driven Smart Poultry Farm Management System

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ABSTRACT:

This paper proposes an IoT-based solution for monitoring and managing the environmental conditions of poultry farms to ensure optimal health and productivity. The system incorporates MQ-135, MQ-2, and MQ-7 gas sensors to detect air pollution levels, a DHT-11 sensor to measure temperature and humidity, and an LDR to monitor light intensity. Data from these sensors is processed by an Arduino microcontroller and displayed on an LCD screen for real-time visibility. IoT integration enables app-based remote monitoring of environmental parameters. If air pollution, temperature, or light levels cross critical thresholds, an alarm is triggered to alert farm operators, ensuring timely intervention. This system is designed to improve poultry health by maintaining a safe and comfortable environment, reduce the risk of diseases caused by poor living conditions, and enhance the overall efficiency of poultry farm management through advanced monitoring and alert mechanisms.

Index terms: **IoT, Poultry farming, Air quality monitoring, Arduino microcontroller, Sensors(MQ-135, MQ-2, MQ-7, DHT-11)), Alarm systems, Mobile application.**

I. INTRODUCTION

In poultry farming, maintaining optimal environmental conditions is essential for ensuring the health, productivity, and overall well-being of the poultry. Key factors such as air quality, temperature, humidity, and light intensity have a direct impact on the living conditions of the poultry. Poor environmental conditions can lead to stress, disease outbreaks, and reduced growth rates, which in turn affect the farm's productivity and profitability. However, traditional manual monitoring methods are labor-intensive, time-consuming, and often prone to errors, making it challenging to ensure consistent environmental quality

To address these challenges, this project introduces an IoT-based Poultry Environmental Monitoring and Alert System. The system integrates MQ-135, MQ-2, and MQ-7 gas sensors to monitor air pollution levels, a DHT-11 sensor to measure temperature and humidity, and an LDR to detect light intensity. The collected data is processed using an Arduino microcontroller and displayed on an LCD for real-time visibility. Additionally, IoT connectivity enables remote monitoring of environmental parameters via a mobile application. In critical situations, such as elevated pollution levels, extreme temperatures, or insufficient lighting, the system triggers an alarm to alert farm operators for immediate corrective action.

This system ensures a safe and controlled environment for poultry, reduces the risk of diseases, and enhances farm management efficiency through automation and real-time monitoring.

II. LITERATURE REVIEW

This research discusses the use of IoT in agriculture, specifically in monitoring environmental factors in poultry farms. It highlights the integration of various sensors such as gas sensors, temperature, humidity sensors, and light sensors to optimize environmental conditions for livestock. The use of IoT platforms allows real-time data collection and remote monitoring, improving efficiency and reducing the risk of diseases caused by poor environmental conditions. This technology has proven effective in enhancing productivity and overall health in poultry farming by maintaining ideal conditions.

A smart poultry farm monitoring system using IoT technologies is presented, incorporating environmental sensors and a microcontroller (such as Arduino or Raspberry Pi). The system measures key parameters like temperature, humidity, air quality, and light intensity, and displays this data on an LCD or mobile interface for easy monitoring. The research indicates that the integration of real-time monitoring can significantly improve farm management by detecting issues early and triggering alarms when conditions become hazardous. The system ensures optimal health conditions for poultry, improving productivity.

Using IoT and Cloud Computing A data-driven approach to poultry farm management that uses cloud computing for storing and analyzing environmental data is discussed. This system integrates the various sensors for monitoring temperature, humidity, and gas levels in real-time. Cloud computing allows farmers to access and analyze data remotely, ensuring they can intervene promptly if any critical parameters go beyond set limits. This research shows that using IoT systems to gather data and analyze trends in poultry farm environments can significantly improve management practices and farm efficiency.

III. PROPOSED SYSTEM

The proposed system aims to create an automated and IoT-based poultry environmental monitoring and alert system to enhance the health and productivity of poultry farms. This system integrates a variety of sensors and microcontroller technologies to continuously monitor critical environmental parameters such as air pollution, temperature, humidity, and light intensity.

The system utilizes MQ-135, MQ-2, and MQ-7 gas sensors to detect pollutants in the air, a DHT-11 sensor to measure temperature and humidity, and an LDR sensor to monitor light levels. Data from these sensors are processed by an Arduino microcontroller, which converts the sensor readings into meaningful information. This data is then displayed on an LCD screen for real-time on-site monitoring.

For remote access and control, the system also leverages IoT technology, enabling app-based monitoring via a mobile application. In scenarios where critical thresholds for air quality, temperature, humidity, or light intensity are reached, the system automatically triggers an alarm to alert farm operators, prompting immediate action to correct environmental conditions. This IoT-based poultry monitoring and alert system offers a more efficient, accurate, and user- friendly solution compared to traditional manual monitoring methods.

It not only helps in maintaining optimal conditions for poultry health but also significantly reduces the risk of diseases caused by poor environmental conditions, improves farm management efficiency, and it ensures the safety and its comfort of poultry at all times.

IV. IMPLEMENTATION

To implement the proposed IoT-based poultry environmental monitoring and alert system, the detailed implementation of the system is described with reference to the block diagram shown in Fig. 1 which includes hardware setup, sensor integration, microcontroller programming, and the IoT setup for remote monitoring and alerts. Below is a detailed implementation guide for the system.

1. Connect the MQ-135, MQ-2, and MQ-7 gas sensors to analog input pins (e.g., A0, A1, A2) of the Arduino. These sensors typically have three pins: VCC, GND, and Analog Output (A0).
2. Connect the DHT-11 sensor to a digital pin (e.g., D2) of the Arduino. DHT-11 has two pins: VCC and Data Pin.
3. Connect the LDR to an analog pin (e.g., A3) using a voltage divider circuit (resistor and LDR in series).
4. LCD display: Use the I2C interface for easier wiring, connecting SDA, SCL, VCC, and GND pins to the Arduino.
5. ESP8266 Wi-Fi Module: Connect the RX, TX pins to the Arduino, and make sure to connect the ESP8266 to a 3.3V power source (since it doesn't work on 5V).
6. Buzzer/LED for visual or sound alerts, connected to one of the digital pins (e.g., D13).
7. The mobile app built to Set up notification widgets to send alerts to your phone if any sensor readings exceed safe limits.
8. If the temperature exceeds 30°C, or the air quality goes beyond a certain level, a buzzer will sound.
9. The buzzer can be controlled through the Arduino code, which turns it on when an alert is triggered.

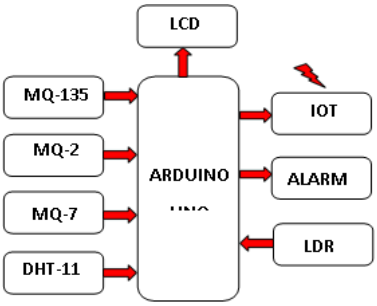

Fig. 1. Block Diagram Representation of smart poultry farm management system

V. RESULTS

By continuously monitoring critical parameters such as air pollution, temperature, humidity, and light intensity, the system ensures that environmental conditions remain within optimal ranges. This contributes to the health and productivity of poultry, as such factors directly affect growth, egg production, and disease prevention. The use of IoT technology enables farm operators to remotely monitor conditions via a mobile application. This feature ensures that the farm environment can be monitored from anywhere, improving efficiency and reducing the need for physical presence on-site.

By maintaining an optimal environment, the risk of diseases like respiratory infections, heat stress, and other poultry health issues caused by poor conditions is significantly reduced. This leads to healthier birds and potentially lower veterinary costs. Over time, the system can prove to be cost-effective by reducing losses due to poor environmental conditions, preventing disease outbreaks, and optimizing poultry farm management. The initial investment in sensors and IoT infrastructure may be outweighed by the long-term improvements in productivity and farm efficiency. . The simulation output obtained is shown in below fig 2.

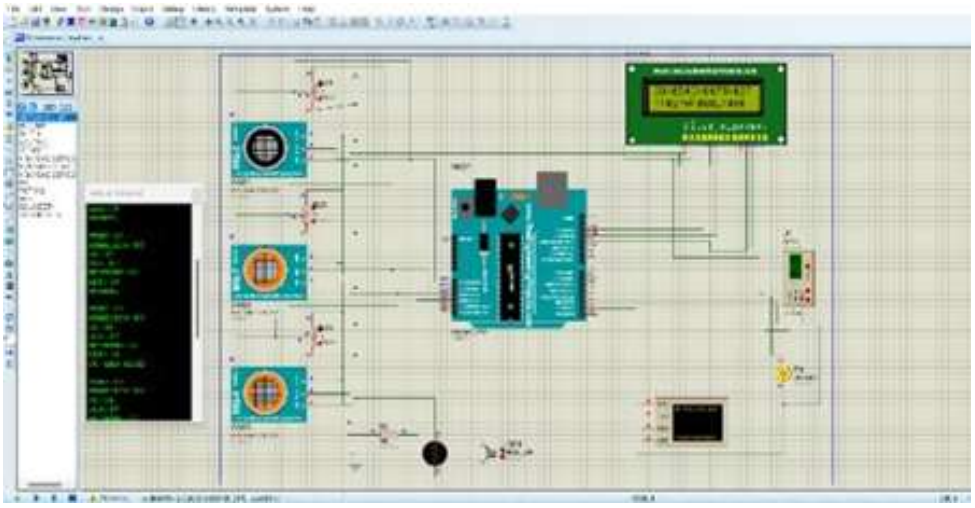

Fig.2 Simulation Output

VI. CONCLUSION

The IoT-based Poultry Environmental Monitoring and Alert System effectively ensures optimal conditions for poultry health and productivity. By integrating sensors like the MQ-135, MQ-2, MQ-7 for air quality, DHT-11 for temperature and humidity, and LDR for light intensity, the system provides real-time data. Using an Arduino microcontroller, data is displayed on an LCD and sent to a mobile app for remote monitoring. In case of critical conditions, the system triggers an alarm for immediate action. This project enhances farm efficiency, reduces health risks, and improves poultry management through automation and real-time monitoring.

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