AN INTELLIGENT POULTRY HEALTH MONITORING SYSTEM BASED ON MULTIMODAL SENSING TECHNOLOGIES

Yu-Jen Shih[1]*, Jen-Hung Huang[1], Ming-Wen Wu[1], Li-Yun Huang[1], Yan-Siang Chen[1], Ming-Kun Hsieh[2], and Yao-Chuan Tsai[1]

[1]Dept. of Bio-Industrial Mechatronics Engineering, National Chung Hsing University, Taichung, Taiwan
[2]Graduate Institute of Microbiology and Public Health, National Chung Hsing University, Taichung, Taiwan

*Corresponding Author: kb3789@gmail.com

ABSTRACT

Traditional poultry farming primarily relies on manual observation to assess the chicken flock health status. However, this approach is not only time-consuming and labor-intensive but also highly dependent on individual experience, making real-time monitoring difficult to achieve. With the advanced Internet of Things (IoT) and Artificial Intelligence (AI) technologies, the animal industry is gradually transitioning toward intelligent farming. At present, most sensors focus primarily on environmental parameters and are unable to directly observe poultry health conditions. Therefore, this study proposed an intelligent poultry health monitoring system based on multimodal sensing technologies. This system integrates microphones and high-resolution cameras into a commercial poultry house and applies AI algorithms for the automated detection of abnormal chicken vocalizations, eye conditions, and comb appearances. Additionally, the system incorporates production data such as body weight and water consumption along with environmental sensor data to provide scientifically grounded health information for farm management. The experimental results show that high concentrations of carbon dioxide and dust are associated with abnormal eye conditions, causing eyelid swelling in chickens. Abnormalities in combs are primarily related to external injuries caused by fighting among chickens. Further analysis combining mortality rates and body weight gain suggests that these abnormalities are not caused by infectious diseases. In addition, based on farm records, sound-based abnormality detection was shown to provide earlier warnings compared to manual observation. In summary, the proposed system enables continuous and automated monitoring of poultry health conditions and performs cross-analysis using both environmental and production data. It offers a more comprehensive basis for health evaluation and demonstrates strong potential for early anomaly detection and decision support in smart poultry farming.

Keywords: Multimodal Sensing, Smart Agriculture, Artificial Intelligence, Poultry Health Monitoring

INTRODUCTION

Traditional poultry farming relies on manual observation, limiting real-time monitoring. This study proposes an intelligent multimodal sensing system to enhance health assessment and enable data-driven management.

MATERIALS AND METHODS

The experiment was conducted in a commercial poultry house with 18,000 red-feathered native chickens, monitored from December 25, 2024. Three controllable cameras captured images every three hours for YOLOv7-based eye and comb classification, and two devices recorded sounds daily at 3:00–4:00 a.m. for vocalization analysis. The field layout is shown in Figure 1.
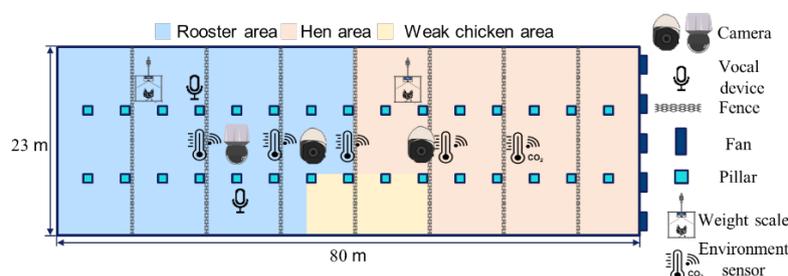

Fig.1 Field Equipment Layout Diagram.

RESULTS & DISCUSSION

From figure2(a),Results showed that image analysis revealed scabbing as the main comb abnormality Owing to its accumulative characteristic, the comb-abnormality ratio increased progressively over the rearing period. Periods of elevated CO_2 (Fig. 2c) coincided with increases in the eye-abnormality ratio (Fig. 4a), suggesting a potential link with ventilation conditions. By contrast, culling count did not co-vary with either eye or comb abnormalities (Fig. 3c), indicating that these image-based signs were largely non-pathogenic during observation. The vocalization-derived three-day moving-average slope generated timely alerts around vaccination events and provided earlier, more objective warnings than manual inspection (Fig. 5). Overall, integrating image and acoustic sensing demonstrated strong potential for real-time poultry health assessment.
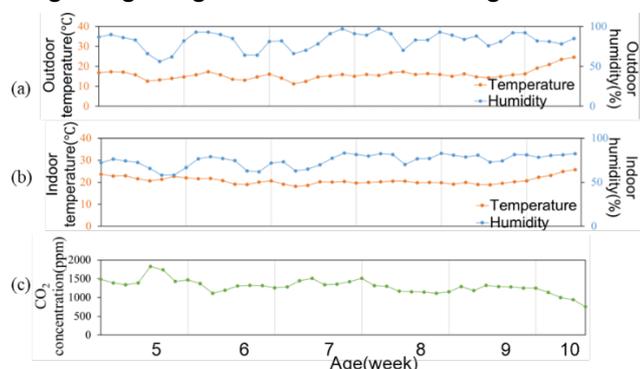

Fig.2 Environmental sensing data: (a) outdoor temperature and humidity; (b) indoor temperature and humidity; (c) carbon dioxide concentration.
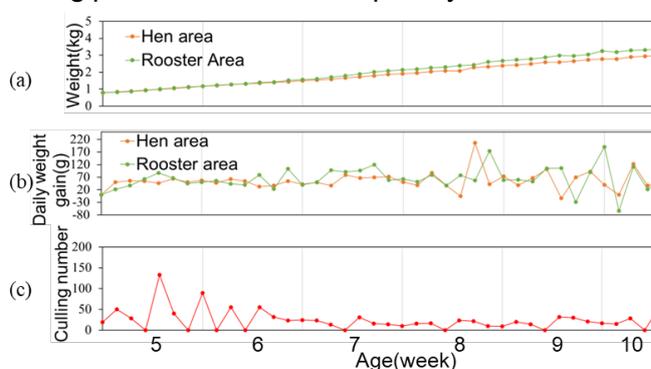

Fig.3 Production and rearing records: (a) chicken body weight; (b) daily weight gain; (c) number of culled chickens.
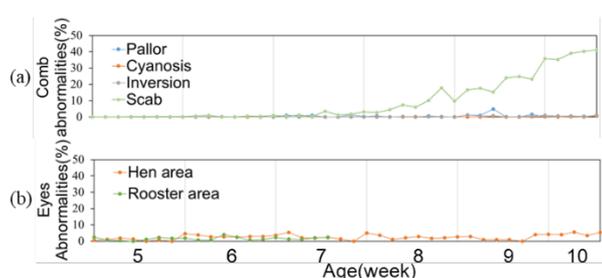

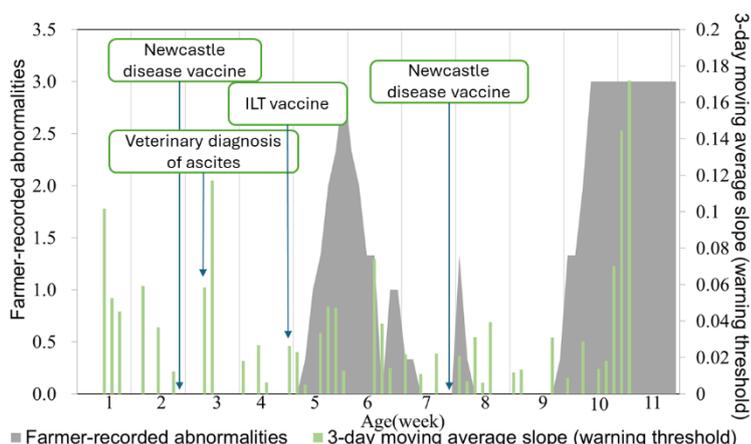Fig.4 Image analysis results: (a) abnormal eye ratio; (b) abnormal comb ratio.

Fig.5 Farmer records and vocalization-based early warning analysis.

CONCLUSIONS

The results showed no significant association between comb and eye abnormalities and mortality, suggesting that these abnormalities were likely non-pathogenic symptoms. In addition, vocal analysis effectively reflected stress responses following vaccination and demonstrated early-warning capability. Overall, the system enabled continuous monitoring and provided comprehensive health information, highlighting the potential of smart farming for anomaly detection and management decision-making.

REFERENCES

Ahmed, M.M., Hassanien, E.E., Hassanien, A.E. 2024. A smart IoT-based monitoring system in poultry farms using chicken behavioural analysis. Internet Things 25, 101010.

Cakic, S., Popovic, T., Krco, S., Nedic, D., Babic, D., & Jovovic, I. 2023. Developing Edge AI Computer Vision for Smart Poultry Farms Using Deep Learning and HPC. Sensors, 23(6), 3002.