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動物管理系統
SYSTEM FOR MANAGING ANIMALS

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Abstract
This study presents a smart poultry management system using a mobile robot for inspection and feeding. It employs fuzzy logic, deep learning, and LSTM for activity and anomaly detection, with ROS handling object detection, path planning, and control. Positioning is enabled by GNSS-RTK, IMU, SLAM, and UWB.

一、研究動機與目的 Motivation and Objective

因應家禽養殖人力不足與滿足生物安全需求，透過智慧型動物管理機器系統，達成精準量測動物體重與即時健康監控，降低人力成本、提高管理效率。

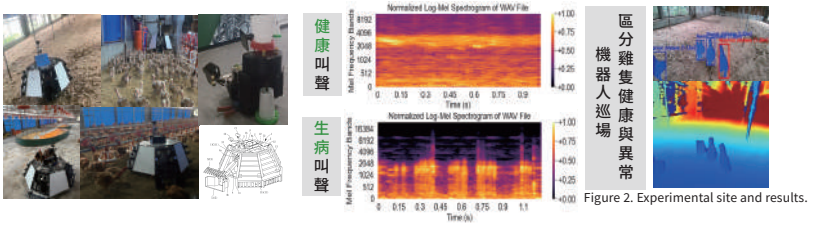


Figure 2. Experimental site and results.

二、系統特色與功能 System Features and Capabilities

- 雞隻體重AI量測與異常偵測
- 多元識別動物活動力與病徵(包含頭部、背部、足底、糞便、聲音)
- 即時特徵標記與死雞運送
- AIoT系統，地面潮濕狀態偵測及自動翻土，改善環境

三、實驗成果與效益 Results and Implications

提升體重量測效率達**80%**；健康狀態判斷準確率達**90%**
自動化搬運與隔離系統可節省人工成本**60%**
即時準確的健康警示系統，整體管理人力成本節省約**50%**

MOTIVATION AND OBJECTIVE

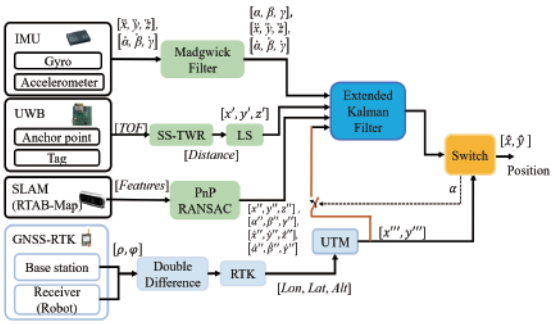
Maintaining a poultry-friendly environment requires significant manpower for monitoring activity, measuring weight, checking health, and collecting floor eggs. Intelligent robots can assist in management, addressing labor shortages and enabling individualized monitoring of chicken flocks.

UBIQUITOUS POSITIONING

The EKF algorithm: integrate IMU, UWB, SLAM, RTK-GNSS data and obtain the position of robot. Use RTK-GNSS to obtain positioning accuracy for fixed solutions. The integration of Pos_{UTM} and Pos_{EKF} position-n-ing system through a weighted method.

$$\text{Current Position} = \alpha Pos_{UTM} + (1-\alpha)\, Pos_{EKF}$$

SLAM: visual sensing, odometry, efficient graphical optimization, and advanced memory management (GFTT/BRIEF/NNDR/PnP/RANSAC).



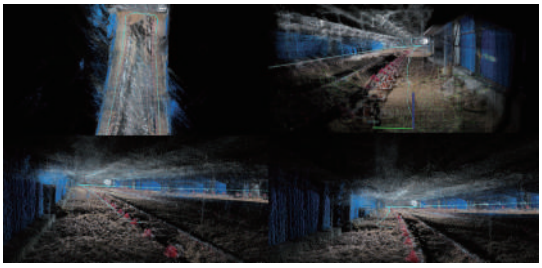


Figure 1. Block diagram of sensor fusion with IMU/UWB/GNSS-RTK.

POULTRY ACTIVITY EVALUATION

Video cameras capture chicken activities, extract skeletal models with posture angles using deep learning, and the LSTM network identifies behaviors. A dual-layer fuzzy inference system evaluates activity levels based on behavior range and duration.

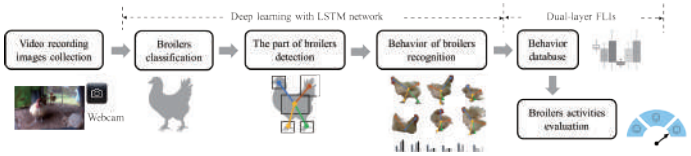


Figure 3. Schematic of the proposed broiler posture and activity evaluation scheme.

POULTRY HEALTH DIAGNOSIS

The proposed chicken health diagnosis system uses YOLOv7 and LSTM networks to recognize poultry feces and analyze chicken vocalizations. Feces images are labeled and trained with YOLOv7, while audio signals are processed by LSTM. Alerts are sent via LINE for real-time notifications.

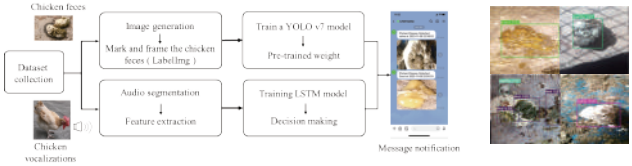


Figure 4. The block diagram of smart chicken health diagnosis.

CONCLUSIONS

The robotic system provides environmental data, disease alerts, and growth information, improving poultry farm management, reducing labor costs, and minimizing disease risks.

ACKNOWLEDGMENTS

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