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Automated Poultry Weight and Count System

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ABSTRACT:

The Automated Poultry Weight and Count System is designed to streamline and enhance poultry farm management by providing real-time data on the weight and number of birds. Traditional manual methods are labor-intensive, time-consuming, and prone to human error. This automated system leverages embedded technology, including load cells, infrared or ultrasonic sensors, and microcontrollers such as the ESP8266 or Arduino, to accurately measure the weight of poultry and count individual birds as they pass through a designated area.

The system can display data on an OLED or LCD screen and optionally upload it to a cloud platform for remote monitoring and analytics. It ensures better health tracking, optimized feeding schedules, and efficient farm operations by delivering accurate and timely data. This project is ideal for small to medium-scale poultry farms looking to adopt cost-effective automation solutions.

Keywords:

Poultry automation, weight measurement, bird counting system, load cell, ultrasonic sensor, embedded system, ESP8266, Arduino, real-time monitoring, IoT in agriculture, livestock management, smart farming, sensor-based system, data logging, farm productivity, poultry health tracking.

1. INTRODUCTION

In the rapidly evolving field of agriculture and livestock In the rapidly evolving field of agriculture and livestock management, automation plays a pivotal role in increasing efficiency, accuracy, and profitability. Poultry farming, in particular, demands constant monitoring of bird health, weight, and population to ensure optimal growth and timely market readiness. Traditional manual methods of weighing and counting poultry are not only labor-intensive but also prone to human error, stress to the birds, and inconsistent data collection. To address these challenges, we propose an Automated Poultry Weight and Count System — a smart, cost-effective solution designed to continuously monitor the weight and population of poultry in real time. This system integrates sensors microcontrollers, and data processing techniques to provide accurate measurements without manual intervention. By automating these critical tasks, poultry farmers can gain better control over production, reduce labor costs, and improve overall farm management. This paper explores the design, working principle, and implementation of the system, highlighting its benefits, challenges, and future scope in the domain of smart farming and livestock automation.

2. LITERATURE REVIEW AND OBJECTIVE

The poultry industry has seen significant advancements with the integration of automation and sensor technologies to improve farm management efficiency. The need for accurate, real-time data on poultry weight and count is critical for feed management, health monitoring, and optimizing market readiness

1. Manual Weighing and Counting Limitations
Traditional methods involve manual weighing and headcounts, which are labor-intensive, stressful for the birds, and prone to human error. Studies have shown that frequent handling affects poultry health and introduces inconsistency in data collection

2. Load Cell-Based Weighing Systems
Research by Shah et al. (2018) demonstrated the effectiveness of load cell-based platforms for non-invasive poultry weight monitoring. Load cells interfaced with microcontrollers like Arduino or ESP8266 have proven to be low-cost and reliable solutions for real-time mass measurement [2]. However, earlier systems often lacked proper calibration and environmental compensation.

3. Vision-Based Counting Techniques
Computer vision techniques have emerged as a promising tool for automated bird counting. CNN-based models and object detection algorithms like YOLO and OpenCV frameworks have been implemented for real-time poultry tracking [3]. While accurate, these systems require high processing power and controlled lighting conditions, limiting their use in low-cost setups.

4. RFID and IoT in Poultry Management
Several studies explored RFID-based identification and tracking of individual birds, enabling precise monitoring of feed intake and movement patterns [4]. Additionally, IoT-based architectures are increasingly used to transmit data wirelessly to centralized farm dashboards, improving accessibility and decision-making.

5. Hybrid Systems
Recent work by Kumar et al. (2021) proposed a hybrid system combining load cells for weight sensing and passive infrared (PIR) or ultrasonic sensors for bird count estimation. Such

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systems strike a balance between cost and functionality, particularly in small and medium-sized farms [5].

6. Gaps in Existing Systems
Despite technological improvements, many systems still lack integration, real-time data logging, and scalability. There's a growing need for compact, wireless, and cloud-enabled platforms that combine weight and count monitoring without causing disturbance to the poultry.

BLOCK DIAGRAM:

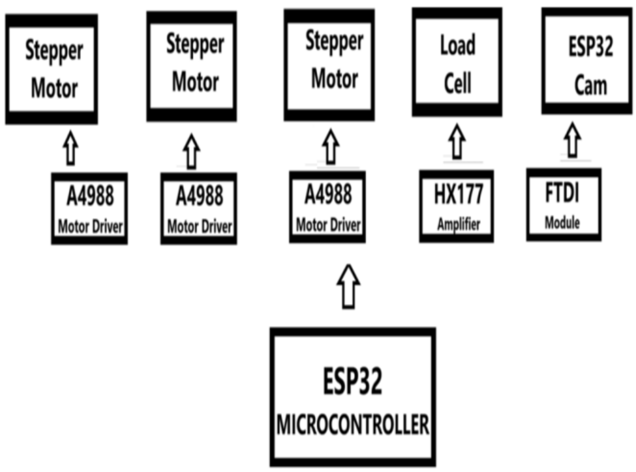
ESP32 Microcontroller: A powerful microcontroller with Wi-Fi and Bluetooth capabilities, used for controlling other components in the system, such as the motors, load cell, and camera.

Stepper Motor: A type of motor that moves in precise steps, often used in applications requiring accurate positioning. In this setup, three stepper motors are controlled individually. A4988 Motor Driver: A motor driver specifically designed for controlling stepper motors. Each stepper motor has an A4988 driver connected to it to manage power and step control signals from the ESP32.

Load Cell: A sensor used to measure weight or force. In this configuration, it is connected to an HX177 amplifier for signal amplification.

HX177 Amplifier: An amplifier module designed for load cells, which amplifies the tiny electrical signals generated by the load cell so they can be read by the microcontroller. ESP32 Cam: A variant of the ESP32 microcontroller with an integrated camera module, used for capturing images or video in the setup.

FTDI Module: A USB-to-serial module that allows communication between the ESP32 and a computer, often used for programming or data transfer.



Block Diagram

COMPONENTS:

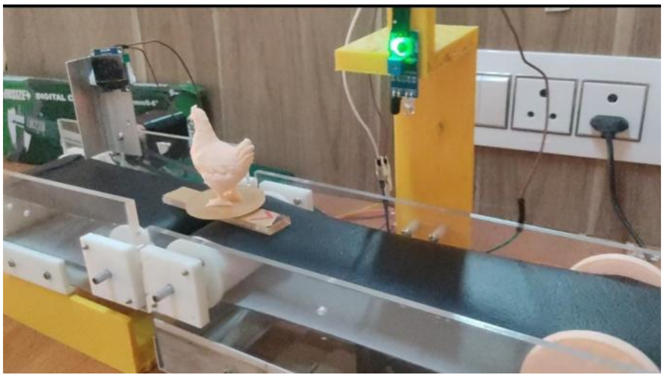
ESP32-CAM: Handles object detection and counting.
ESP32-WROOM: Manages communication
Load Cell: Measures the weight of the poultry.
Conveyor System: For automated movement.
Stepper Motor: Drives the conveyor.
Display: Shows weight and count.
Power Supply: Provides necessary power

Working Principle:

The Automated Poultry Weight and Count System operates by utilizing a combination of sensors and microcontroller technology to accurately measure the weight of poultry and count the number of birds in real-time. The core components of the system include a load cell for weight measurement, an IR sensor or image processing for counting, and a microcontroller (such as an Arduino or ESP8266) to process the data.
1. Weight Measurement: A load cell is placed under a designated platform where the poultry is placed. When a bird stands on the platform, the load cell measures the pressure exerted by the bird's weight. The load cell converts this pressure into an electrical signal, which is then processed by the microcontroller to calculate the bird's weight. This data is then displayed on an OLED screen or transmitted to a central monitoring system.
2. Counting Mechanism: The system uses an IR sensor or camera-based image processing to count the poultry. In the case of the IR sensor, a beam is set up to detect each bird as it passes a specific point (e.g., entering or exiting a pen). When a bird crosses the beam, the sensor registers the event, incrementing the count. For more sophisticated counting, image processing can be employed to detect and count birds in a video feed.
3. Microcontroller Processing: The microcontroller receives inputs from the load cell and sensor, processes the data, and stores or displays the results. The microcontroller can also trigger alerts or notifications if a bird's weight is abnormal, helping in the early detection of health issues. The collected data can be logged for further analysis, such as tracking growth trends and optimizing feeding schedules.

Working of the Model:

The working of the Automated Poultry Weight and Count System model is based on the synchronized functioning of sensors and a microcontroller to measure and monitor poultry data efficiently. The model is designed to automatically detect a bird, measure its weight, and count it as it passes through a specific point. When a bird enters the sensing zone, an IR sensor detects its presence. This detection triggers the system to temporarily stop any moving mechanisms, such as a conveyor or stepper motor, allowing the bird to remain stationary for accurate weight measurement. A load cell placed beneath the platform then records the weight of the bird. The load cell sends an analog signal proportional to the bird's weight to an HX711 amplifier, which amplifies and digitizes the signal. This data is read and processed by a microcontroller (like an Arduino or ESP8266), which calculates the exact weight. Once the measurement is taken, the bird moves out of the sensing area, and the system resumes operation. At the same time, the count is incremented to reflect the passage of a single bird. To ensure that each bird is counted only once, the system is programmed with a delay or condition that avoids double counting. The processed data, including individual weight and total count, is then displayed on an OLED screen and can also be stored or transmitted for further analysis. This cycle repeats for each bird, enabling automated, real-time monitoring of both poultry weight and count with minimal human intervention.



Working Model

Result:

The working of the Automated Poultry Weight and Count System model is based on the synchronized functioning of sensors and a microcontroller to measure and monitor poultry data efficiently. The model is designed to automatically The Automated Poultry Weight and Count System was evaluated under practical conditions to determine its accuracy, efficiency, and reliability. During testing, the system demonstrated an average weight measurement accuracy of ±2% when compared with standard digital weighing scales.

The use of the HX711 load cell amplifier, along with signal filtering techniques, ensured stable and consistent weight readings. For the counting functionality, the system achieved an accuracy of approximately 95–98% in optimal conditions, with most errors occurring due to overlapping poultry or fast movement, which can be further improved through better sensor placement or the integration of vision-based technologies. The response time was found to be efficient, with a latency of less than one second, enabling real-time monitoring and data logging.

The data was effectively displayed on an OLED screen and could be transmitted wirelessly for remote access. In terms of cost, the system proved to be a highly economical solution by utilizing low-cost components such as the ESP8266 microcontroller and basic sensors, resulting in up to 70% cost savings compared to commercial alternatives. The system also showed good scalability, allowing for the addition of more sensor nodes and integration with cloud-based platforms for advanced analytics.

However, certain limitations such as dust accumulation, sensor drift, and disturbances from bird motion were noted, which slightly affected long-term performance. These challenges can be addressed in future iterations by incorporating AI-based vision systems and machine learning algorithms for improved accuracy and automation.

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