Project Report: Poultry Monitoring Prototype

System Overview

This prototype provides a high-throughput pipeline for monitoring poultry health and density. By leveraging edge-compatible AI (YOLOv8), the system transforms standard CCTV footage into actionable data.

Methodologies

1. **Bird Counting (Detection + Tracking):**
    - **Detection:** We use the YOLOv8 architecture to generate localized bounding boxes for each bird.
    - **Tracking:** To solve the "Temporal Continuity" problem, we implemented **ByteTrack**. This algorithm maintains a memory of unique IDs.
    - **Occlusion Handling:** If a bird is momentarily hidden behind a feeder or another bird, the system utilizes a **Kalman Filter** to predict its trajectory and re-associate the ID once it reappears.
2. **Weight Estimation (The Proxy Approach):**
    - Since true weights are not available in the raw video, we use a **Projected Dorsal Area (PDA)** index.
    - The system calculates the area of the bounding box (or segmentation mask) for each bird in real-time.
    - **Assumption:** We assume a fixed-height camera mount. If the bird is closer to the camera, its "index" increases; if it is further away, it decreases.

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2. Technical Breakdown: Bird Weight Estimation

The Defined Weight Proxy (RWI)

The **Relative Weight Index (RWI)** is defined as the number of pixels occupied by the bird's body from a top-down perspective.

Mathematical Formula:

$$Index = (x_{max} - x_{min}) \times (y_{max} - y_{min})$$

Conversion to Grams (Required Data)

To turn this index into a physical weight in grams, the following calibration artifacts must be provided:

Requirement	Description	Purpose
GSD Reference	A physical 10cm x 10cm square on the floor.	Converts "Pixels" into "cm²".

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Allometric Constant (k)	A regression constant derived from weighing 50 birds.	Solves the $Weight = k \cdot (Area)^{1.5}$ equation.
Height Map	Camera mounting height and focal length.	Adjusts for perspective distortion at the edges of the frame.

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3. Sample Artifacts

Sample JSON Response Snippet

JSON

```
{
  "timestamp": "00:00:05",
  "bird_count": 24,
  "weight_estimates": {
    "mean_proxy_index": 14250.8,
    "confidence": 0.89,
    "unit": "pixels^2"
  }
}
```

Annotated Video Artifact

The video result_82a1bc.mp4 displays the following:

- **Green Boxes:** Detected birds.
- **Unique Numbers:** Persistent tracking IDs.
- **A-Value:** The calculated area (Weight Proxy) per bird.