Smart Pet Feeder System

Technical Design and Implementation Report

Team Members: Gota Timeea, Toader Diana, Boga Karla, Michliuc Cristina

Abstract

This report details the engineering of an automated smart pet feeder designed to monitor pet proximity and bowl weight to ensure timely feeding. The system incorporates environment-aware features, such as night-time illumination, and utilizes a dual-microcontroller architecture for distributed processing.

1 Project Objectives

The primary goal of this project is to create a solution that ensures pets are fed appropriately without constant human intervention. The system addresses three main challenges:

1. **Proximity Detection:** Identifying when the pet approaches the feeding station.
2. **Precise Portion Control:** Measuring the exact weight of food in the bowl before dispensing.
3. **Environmental Adaptability:** Providing visibility for the pet during night-time hours.

2 System Hardware Components

The hardware stack is chosen for reliability and ease of integration with the Arduino platform:

Ultrasonic Sensor (HC-SR04) Used to detect the distance between the pet and the feeder. It triggers the feeding check sequence when the pet is within 10cm.

Load Cell & Weight Sensor Monitors the weight of the food in the bowl. This prevents overfilling and allows the system to reach a specific target weight.

Photoresistor (LDR) Measures ambient light. If the light level drops below a threshold, the system activates the auxiliary LED.

Servo Motor (MG90S) Controls the mechanical door of the food reservoir, opening to dispense food and closing once the weight target is met.

LED Provides localized illumination for the pet at night.

3 Technical Implementation

3.1 Proximity Calculation Logic

The system calculates distance by timing the travel of an ultrasonic pulse. The implementation ensures accuracy by using a precise trigger pulse.

```
float masoaraDistanta() {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  long durata = pulseIn(echoPin, HIGH);
  // Speed of sound is 0.034 cm/us
  float distanta = durata * 0.034 / 2;
  return distanta;
}
```

Listing 1: Ultrasonic Proximity Detection Function

3.2 Environmental Awareness

To assist the pet at night, the system evaluates the LDR analog value. A value below 600 indicates a dark environment, triggering the LED.

```
void controlLEDs(int lightLevel) {
  if (lightLevel > 600) {
    digitalWrite(ledPin, LOW); // High ambient light: LED off
  } else {
    digitalWrite(ledPin, HIGH); // Low ambient light: LED on
  }
}
```

Listing 2: Light Control Logic

3.3 Automated Feeding Workflow

The main loop correlates the proximity of the pet with the current weight of the bowl to determine if the servo should actuate.

```
// Target weight is set to 20 units
if(distanta < 10 && currentWeight < 20) {
  motorServo.write(100); // Open the dispenser door
} else if (currentWeight >= 20) {
  motorServo.write(70);  // Close the dispenser door
}
```

Listing 3: Dispensing Control Logic

4 Schematic and Design Architecture

The current prototype utilizes a dual-Arduino configuration to separate the sensing logic from the actuation control.

5 Future Improvements

To evolve this project into a commercial-grade product, the following enhancements are planned:

- **Feeding Interval Timer:** Implement software logic to enforce a minimum time between feedings, preventing pet obesity.

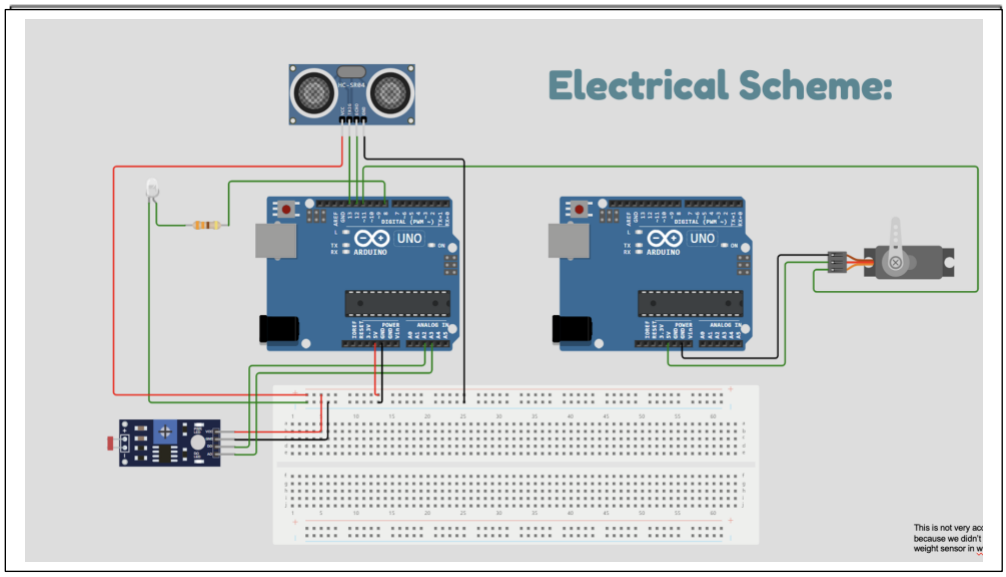

Figure 1: Conceptual Electrical Scheme.

- **LCD/7-Segment Display:** Add a visual interface to show the last feeding time and the current weight of food in the reservoir.
- **IoT Connectivity:** Integration of an ESP8266/ESP32 module to send mobile notifications when food levels are low.

6 Conclusion

The Smart Pet Feeder successfully demonstrates an integrated sensor-actuator system. By combining proximity detection with weight-based dispensing, the project provides a functional, automated solution that enhances the pet care experience while offering peace of mind to the owner.