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Project based on Embedded Systems, Automation and Mechatronics

Title of the Project

Paws-o-Aid: Coin and Gesture Based Smart Feeding System for Street Dogs

Introduction

Street dogs often struggle to find proper food and rely on inconsistent human feeding. At the same time, unregulated feeding can lead to food wastage, fights among dogs, and hygiene issues. To address this, **Paws-o-Aid** introduces a simple, low-cost, and user-friendly automated food dispenser. It ensures **controlled feeding** using a **coin-based activation** and **gesture detection**, promoting animal welfare while engaging the community.

While this version focuses on feeding street dogs, a similar system can also be adapted for street cats with minor modifications in food dispensing design and portion size. This widens the scope of the project to provide care for multiple stray animals.

Objectives

- To design and implement a **coin + hand wave activated food dispenser**.
- To ensure **fair distribution of food** with a cooldown system.
- To create a **low-cost, sustainable, and community-driven solution** for feeding stray dogs.
- To improve **hygiene and safety** during animal feeding.
- To promote **charity and compassion** through a practical IoT-based project.
- Since the system is fun and interactive, **children can wave to activate it** and encourage their parents to put in coins. This increases **community participation** and spreads awareness about helping animals.

System Overview

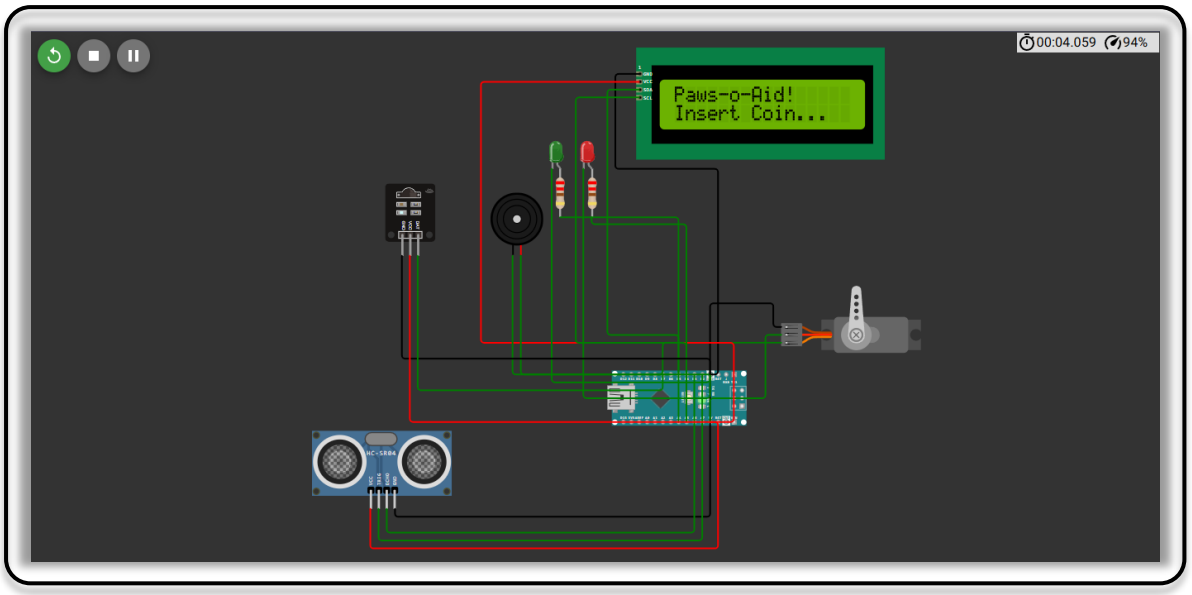
The system integrates **Arduino Nano**, **IR sensor**, **ultrasonic sensor**, **servo motor**, **buzzer**, **LED indicators**, and an **I2C LCD**.

- **Coin Insertion (IR Sensor):** Detects when a user donates a coin.
- **Hand Wave Detection (Ultrasonic):** Confirms presence of a volunteer/feeder.
- **Servo Mechanism:** Dispenses food in controlled portions.
- **LCD + Buzzer + LEDs:** Provide user feedback (e.g., “Insert Coin”, “Dispensing”, “Thank You”).
- **Cooldown Mechanism:** Prevents continuous dispensing to avoid overfeeding.

System Representation

The *Paws-o-Aid* prototype is illustrated through both **block diagrams** and **real implementation images**.

Block Diagram Representation:



Circuit made on - https://wokwi.com

My project link: https://wokwi.com/projects/443349945354955777

The system can be represented in a simple block diagram with the following major components:

- **Input Unit:** Coin Acceptor (IR sensor-based).
- **Control Unit:** Microcontroller (Arduino-based system).
- **User Interaction Unit:** Human-Machine Interface (LCD + Ultrasonic Sensor for gesture recognition).
- **Output Unit:** Servo-controlled Food Dispenser and buzzer feedback.

Prototype Implementation:

Working Prototype Images

Working Prototype Video:
https://drive.google.com/file/d/1EQ0QmcMSH2DFX0z5OyMFcapZWU_N9KFd/view?usp=drive_link

The image above represents the **working prototype** of the *Paws-o-Aid* system. The setup is divided into three main functional units:

1. **Coin Acceptor (Left Side):** A simple coin input system has been integrated using an improvised slot, which detects the presence of a coin through an **IR sensor**. In future upgrades, a proper **coin acceptor module** can be installed to prevent misuse (such as inserting non-coin objects).
2. **H.M.I (Human-Machine Interface) (Centre):** The central unit consists of an **LCD display** and an **ultrasonic sensor**. The LCD provides real-time feedback to the user with prompts such as *"Insert Coin"*, *"Wave to Dispense"*, *"Dispensing…"*, and *"Thank You"*. The ultrasonic sensor detects a **hand wave gesture**, which acts as a trigger for food dispensing after coin validation.
3. **Food Dispenser (Right Side):** A servo-motor-driven mechanism controls the opening and closing of the food outlet. When activated, the servo briefly rotates, allowing a portion of food (in this case, biscuits/kibble) to be dispensed. After dispensing, the system enters a cooldown state, preventing overuse.

This prototype demonstrates the **core functionality** of the project:

- **Coin-based activation**,
- **Gesture-based dispensing**, and
- **Automated feeding for stray dogs**.

While the model is currently made using **cardboard housing** for cost-effectiveness, future iterations can be fabricated with more durable materials (plastic or metal casing) for real-world deployment.

Applications

- Feeding stray dogs in streets, shelters, and public places.
- Educational tool for **automation and embedded systems**.
- Adaptable for **other animals** (cats, cows, birds) with small modifications.
- Community engagement in **charity and animal welfare**.

Advantages

- Encourages **community participation** and **parent-child involvement**.
- **Prevents food wastage**.
- **Safe and hygienic feeding** without direct contact.
- **Affordable, scalable, and easy to replicate**.

Disadvantages / Limitations

- The **IR sensor detects any object**, not just coins. This means people could insert any token (e.g., cardboard, bottle caps) instead of real coins. A **dedicated coin acceptor module** could solve this, but it was avoided here due to higher cost.
- The system **relies on external refilling of food**, and has no automatic refill detection yet.
- **Servo motor has limited strength** – cannot handle very heavy loads of food.
- The system is **not weatherproof** in its current form, so long-term outdoor usage may require an enclosure.
- **Power supply dependency** – currently requires a stable 5V source, though solar/battery backup could be added in the future.

Future Scope

- **Coin acceptor integration:** Replace the IR sensor with a dedicated coin acceptor to prevent misuse and ensure only valid coins trigger the dispenser.
- **Digital payments via QR scanning:** Allow users to donate through mobile payment apps, making the system cashless and more convenient.
- **RFID-based animal monitoring:** Street dogs (and future cats) can wear RFID tag neckbands, enabling tracking, feeding history, and vaccination records.
- **Extension to other animals:** Adapt the dispenser for street cats and other stray animals with minor modifications in portion size and dispensing design.
- **Solar-powered operation:** Implement solar panels or battery backup for outdoor, off-grid operation.
- **Mobile app integration:** Enable real-time monitoring, usage statistics, and refill alerts.
- **Automatic refill alert system:** Sensors to detect food levels and alert caretakers when the container needs refilling.
- **Enhanced dispensing mechanism:** Use stronger servo or stepper motors to handle larger food quantities or multiple animal types.

Conclusion

Paws-o-Aid demonstrates how **technology and compassion can merge** to solve a real-world problem. By combining simple electronics with community involvement, it ensures that street dogs receive food in a fair, controlled, and sustainable manner.

Moreover, the **interactive nature of the project** makes it fun for children, who can wave to trigger the dispenser and encourage their parents to contribute coins. This way, the project not only supports animal welfare but also inspires **future generations to develop empathy and kindness towards animals**.