Outdoor Cleaning Rover

Project Plan Presentation (PPP)

Shoebox-sized autonomous rover that patrols patio/sidewalk and collects dog waste

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CSC 494

Problem & Motivation

- Pet waste on patios/sidewalks is unsanitary and easy to miss
- Manual cleanup is time-consuming and often delayed
- A small rover can:
    - Patrol routinely
    - Avoid obstacles safely
    - Perform a pickup cycle

Topics to Learn With AI

Software: Finite State Machines

- Keeps the rovers movements organized and predictable.
  Prevents actions from overlapping and leadiing to errors.

Hardware: Power Distribution

- Motors and servos create voltage dips.
  Without solid power distribution there
  can be an increase in glitches.

Sprint 1

- **How to power everything safely**
  - battery basics, turning the robot on/off, and keeping the electronics stable
- **How to make the rover move reliably**
  - drive forward/backward/turn and keep it controllable at a slow, safe speed
- **How to connect and read sensors**
  - distance sensors to “see” obstacles and bumpers as an emergency stop
- **How to test and troubleshoot**

Sprint 2

- **Build the rover and pickup system**
  - a shoebox sized robot with a front scoop and a small bin so the rover can collect waste and store it
- **Make the scoop move automatically**
  - program the scoop to go down, collect, dump into the bin, then reset
- **Connect everything into one complete system**
  - the rover drives, stops when needed, picks up, then continues patrolling

Sprint 2 (cont.)

- **Test outside and improve reliability**
  - run repeated outdoor tests and fix movement issues
- **Full Demo**
  - complete working system that collects and disposes waste

Project Goals

1. Safe Autonomous Movement

- Drives on concrete and wood at low speed
- Avoids obstacles and stops on contact

2. Reliable Pickup Mechanism

- Scoop lowers, collects, dumps into bin, resets

3. Demo

- Successful pick up and removal

Key Features

1. **Autonomous Patrol**
2. **Obstacle Avoidance**
3. **Physical Fail-Safe**
4. **Pickup Sequence**
5. **Status Feedback**

System Architecture

- **ESP32 (3.3V):** main logic + state machine + Wi-Fi
- **Arduino Nano (5V):** optional real-time I/O (servo PWM, encoders)
- **Motor Driver:** dual H-bridge for DC motors
- **Sensors:** ToF (front/left/right), bumpers, encoders
- **Actuators:** DC motors, servos
- **Power:** 2S battery → fuse → switch → buck converter (5V)