Agro-Bot User Manual

Overview

This document provides detailed instructions on how to use the Agro-Bot system. Agro-Bot is an Arduino-based robot designed for agricultural tasks. It follows a black line using infrared sensors, detects obstacles using an ultrasonic sensor, and checks soil moisture levels to determine whether irrigation is needed.

Features:

01. **Line Following**: Uses two infrared sensors to follow a black line.
02. **Obstacle Detection**: Halts operation if an obstacle is detected within 6 inch.
03. **Soil Moisture Detection**: Measures soil moisture and activates a pump for irrigation if necessary.
04. **Servo Motor Control**: Lowers a servo arm for soil moisture measurement and raises it back after completion.
05. **Timed Operation**: Runs the line-following mode for 30 seconds before performing a soil moisture check.

Components and Pin Configurations

Arduino Pin Assignments:

- **Motor Control:**
    - enaA (PWM): Pin 5
    - enB (PWM): Pin 6
    - in1 (Motor A direction): Pin 8
    - in2 (Motor A direction): Pin 9
    - in3 (Motor B direction): Pin 10
    - in4 (Motor B direction): Pin 11
- **Sensors and Actuators:**
    - Left IR Sensor: Pin A0
    - Right IR Sensor: Pin A1

- Moisture Sensor: Pin A2
- Pump Motor: Pin 12
- Ultrasonic Sensor (Trig): Pin 3
- Ultrasonic Sensor (Echo): Pin 2
- Servo Motor: Pin 4

How It Works

1. Initial Setup:

- **Connect Components:**
  - Attach the motors to the designated pins on the Arduino.
  - Connect the infrared sensors for line following.
  - Wire the ultrasonic sensor to pins 2 (Echo) and 3 (Trig).
  - Connect the moisture sensor to pin A2.
  - Attach the servo motor to pin 4 and the pump motor to pin 12.
- **Power Up:**
  - Ensure the Arduino and connected components are powered appropriately.
  - Open the Arduino IDE, upload the code, and open the Serial Monitor for debugging.

2. Line Following Mode:

- Infrared sensors detect the black line:
  - If both sensors detect the line, the robot moves forward.
  - If only the left sensor detects the line, the robot turns left.
  - If only the right sensor detects the line, the robot turns right.
  - If neither sensor detects the line, the robot stops.

3. Obstacle Detection:

- The ultrasonic sensor measures the distance to objects in front:
  - If an object is detected within 1 inch, the robot halts immediately.
  - The robot resumes line following once the path is clear.

4. Moisture Check:

- Every 30 seconds, the robot halts to check soil moisture:
    - The servo motor lowers the moisture sensor into the soil.
    - The sensor reads soil moisture levels.
    - If the moisture level is below the threshold (e.g., 987), the pump activates for 3 seconds to irrigate.
    - After the check, the servo raises the sensor back to its resting position.

Operating Instructions

1. **Power On:**
    - Supply power to the Arduino board and ensure all components are properly connected.
2. **Line Following:**
    - Place the robot on a track with a black line.
    - Observe as it follows the line using its infrared sensors.
3. **Obstacle Detection:**
    - Place an object in front of the robot at a distance of 1 inch or less.
    - Verify that the robot stops immediately and resumes operation once the path is clear.
4. **Moisture Detection:**
    - Allow the robot to run for 30 seconds.
    - Observe as the servo arm lowers the sensor, performs a moisture check, and activates the pump if required.
5. **Debugging:**
    - Open the Serial Monitor in the Arduino IDE to view sensor readings and debug messages.

Troubleshooting

Issue: Motors are not working

- Check the motor connections to pins 5, 6, 8, 9, 10, and 11.
- Verify that the motor driver is powered and functional.

Issue: Obstacle detection not working

- Ensure the ultrasonic sensor is connected to pins 2 (Echo) and 3 (Trig).
- Verify the sensor's alignment and clean its surface.

Issue: Moisture sensor not responding

- Confirm the sensor is properly connected to pin A2.
- Check the Serial Monitor for moisture readings.

Maintenance

- Regularly clean the IR and ultrasonic sensors to ensure accurate readings.
- Ensure the moisture sensor is free of debris and corrosion.
- Check motor connections and lubricate mechanical parts as needed.
- Verify the pump motor's operation periodically to prevent clogging.

Notes

- Adjust thresholds for IR sensors and moisture detection based on the specific environment.
- Use a stable power supply to ensure consistent operation.

Enjoy using your Agro-Bot for smarter agricultural solutions!