iBot Club Workshop Phase

Task Set 1.1: Sensor Interfacing

Coordinator Team

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PREREQUISITE

YOU MUST COMPLETE TASK SET 1.0 BEFORE STARTING THIS SET.

REQUIREMENT

Laptop with Arduino IDE is required.

1 Overview

This set focuses on interfacing the Arduino with the environment. You will read data from various sensors, process it, and visualize it on the Serial Monitor.

2 Component Locations

- **Arduino, Breadboard, Cables:** Middle Drawer.
- **All Sensor Modules: White Drawer**.
- **Jumper Cables:** Box in the **Open Shelf**.

3 Task 1.1.1: IR Sensor Module (Reflectivity)

Objective

Interface an Infrared (IR) Sensor Module to detect obstacles and surface reflectivity.

Instructions

1. Connect the IR Sensor Module to the Arduino.
2. **Crucial:** Connect the **Analog Output (A0)** pin of the sensor to an Analog Pin on the Arduino to read raw intensity.
3. **Experiment:** Place a **White object** and a **Black object** at the exact same distance.
4. **Analysis:** Observe and explain how the readings differ for black vs. white surfaces.

4 Task 1.1.2: LDR Module (Light Intensity)

Objective

Interface a Light Dependent Resistor (LDR) module to detect ambient light.

Instructions

1. Connect the LDR Module (Analog Output) to the Arduino.
2. **Experiment:** Shine a torch (phone flashlight) on the sensor and gradually move it away.
3. **Analysis:** Explain the change in values (Inverse Square Law).

5 Task 1.1.3: PIR Sensor (Motion Detection)

Objective

Interface a Passive Infrared (PIR) Sensor to detect human motion.

Instructions

1. Connect the PIR Sensor (Digital Output) to the Arduino.
2. **Experiment:** Trigger the sensor by waving your hand.
3. **Analysis:** Observe the "Hold Time" (latency) where the sensor stays HIGH after motion stops.

6 Task 1.1.4: Ultrasonic Sensor (Distance)

Objective

Measure distance using the HC-SR04 Ultrasonic Module.

Instructions

1. Connect the **Trig** and **Echo** pins to two Digital Pins on the Arduino.
2. Write code to send a $10\mu s$ pulse on the Trig pin and measure the duration of the response on the Echo pin (use `pulseIn()`).
3. Calculate the distance in centimeters using the speed of sound ($343 m/s$).
4. **Check:** Verify the accuracy using a ruler or phone measurement app.

7 Task 1.1.5: Sound Sensor Module

Objective

Detect audio thresholds (claps/noise).

Instructions

1. Connect the Sound Sensor to the Arduino.
2. Use the potentiometer on the module to adjust sensitivity.
3. **Goal:** Write code that turns on the built-in LED (Pin 13) for 2 seconds when a loud clap is detected.

8 Task 1.1.6: IR Receiver / Flame Sensor (Verification)

Objective

Use a Flame Sensor (which is an IR Receiver photodiode) and verify its operation using an IR source.

Hardware Note

- **Receiver:** Flame Sensor Module (Black LED appearance).
- **Source:** IR Sensor Module (from Task 1.1.1).

Instructions

1. Connect the Flame Sensor to the Arduino and read the Analog value.
2. Power up the IR Sensor Module (from Task 1.1.1) using 5V/GND (no signal pin needed for the source).
3. Point the **Clear LED (Emitter)** of the IR Sensor Module directly at the **Black LED (Receiver)** of the Flame Sensor.
4. **Analysis:** Observe how the Flame Sensor readings change when exposed to the IR emitter vs. ambient light.

9 Task 1.1.7: DHT11 Module (Temp & Humidity)

Objective

Read environmental data using the DHT11 sensor.

Instructions

1. Connect the DHT11 module to the Arduino.
2. Install the **DHT Sensor Library** via the Arduino Library Manager if required.
3. Read and print both **Temperature** (°C) and **Humidity** (%) to the Serial Monitor.
4. **Check:** Breathe on the sensor to observe the humidity value rising.

10 Submission Guidelines

Submit via Google Form:

- **GitHub Link:** Repository containing 7 folders/files (one for each task).
- **Drive Link:** Video demonstrations

11 Cleanup (Strictly Enforced)

- Dismantle all circuits.
- Sort sensors back into the **White Drawer**.
- Return Arduino/Cables to **Middle Drawer**.
- Clear your workspace entirely.