**Wiring Documentation for Arduino-Controlled Robot System**

**1. System Overview:**

This wiring documentation covers the connections for a robot system controlled by an **Arduino Nano 33 IoT**, integrated with various sensors, motors, a camera, and a power management system. The primary objective is to manage the power distribution, motor control, sensor integration, and provide real-time status through LED indicators, while ensuring safe battery management using a **PowerBoost 1000C** and Qi wireless charging.

**2. Components and Connections:**

**2.1. Arduino Nano 33 IoT:**

* **Power Source (5V)**: Powered by the **PowerBoost 1000C**.
* **GND**: Common ground shared with all components.

**Digital Pins:**

* **D0/D1 (TX/RX)**: Connected to the **Pixy2 camera** for serial communication.
* **D2**: Connected to the **DS18B20 temperature sensor** data line.
* **D3 to D6**: Used to control the motor controller's direction (AIN1, AIN2, BIN1, BIN2) for the two DC motors.
* **D7**: Used to monitor the **Low Battery Output (LBO)** from the PowerBoost, signaling when the battery is critically low.
* **D8**: Connected to the **APA106 RGB LED** to display battery levels or charging status.
* **D9**: Controls the **relay**, allowing or preventing charging based on temperature and other conditions.

**Analog Pins:**

* **A0**: Connected to a **voltage divider** for continuous battery voltage monitoring.
* **A4/A5 (I2C SDA/SCL)**: Used for the **proximity sensor (Adafruit #466)** to measure distances and obstacles.

**2.2. PowerBoost 1000C:**

* **BAT Pin**: Connected directly to the **LiPo battery's positive terminal**. This pin reads the voltage from the battery and steps it up to 5V for the system.
* **5V Output**: Powers the **Arduino Nano 33 IoT** and other 5V components, such as the **Pixy2 camera** and **LEDs**.
* **GND**: The ground pin is connected to the common ground of the entire system.
* **LBO Pin**: Connects to **D7** on the Arduino to signal when the battery drops below **3.2V**, ensuring that critical low-battery conditions can be handled appropriately.

**2.3. LiPo Battery (3.7V, 3000mAh):**

* **Positive Terminal**: Connected to the **BAT pin** on the PowerBoost.
* **Negative Terminal**: Connected to the common ground, shared across all components in the circuit.

**2.4. DS18B20 Temperature Sensor:**

* **VDD**: Connected to the **3.3V** output of the Arduino Nano.
* **GND**: Connected to the common ground.
* **DQ Pin**: Connects to **D2** on the Arduino for temperature data communication.

**2.5. Pixy2 Camera:**

* **TX/RX Pins**:
  + **TX Pin** connected to **D0** (RX on the Arduino Nano).
  + **RX Pin** connected to **D1** (TX on the Arduino Nano).
* **5V Input**: Connected to the **5V output** from the PowerBoost to power the camera.
* **GND**: Connected to the common ground.

**2.6. Qi Receiver:**

* **Connected through Relay**: The Qi receiver’s output is connected to the relay’s **NO (Normally Open)** terminal to control the charging circuit.
* **GND**: Common ground with the system.
* **Relay Control**: The relay is controlled by the Arduino to start/stop charging based on temperature and other conditions.

**2.7. Relay (Adafruit Power Relay FeatherWing):**

* **COM (Common)**: Connected to the **positive terminal** of the Qi receiver.
* **NO (Normally Open)**: Connected to the **LiPo battery** via the PowerBoost.
* **Relay Control Pin (D9)**: Controlled by the Arduino to open or close the circuit depending on the system's conditions (temperature, low battery).

**2.8. APA106 RGB LED:**

* **DIN**: Data input connected to **D8** of the Arduino to display different colors based on the battery charge status.
* **VDD**: Connected to the **5V output** from the PowerBoost.
* **GND**: Connected to the common ground.

**2.9. Proximity Sensor (Adafruit #466):**

* **SDA (A4)**: Connected to the Arduino's **I2C SDA** pin for communication.
* **SCL (A5)**: Connected to the Arduino's **I2C SCL** pin for communication.
* **GND**: Connected to the common ground.
* **VDD**: Connected to the **3.3V pin** from the Arduino.

**2.10. Motor Controller (Adafruit DRV8833):**

* **AIN1 (D3)** and **AIN2 (D4)**: Control motor A (first motor) for direction.
* **BIN1 (D5)** and **BIN2 (D6)**: Control motor B (second motor) for direction.
* **VMOT**: Connected directly to the **LiPo battery’s positive terminal** to supply power to the motors.
* **GND**: Connected to the common ground.

**2.11. Motors:**

* **Connected to the Motor Controller**: The two DC motors are connected to the **AOUT1, AOUT2, BOUT1, and BOUT2** of the motor controller, allowing control of the direction and speed of both motors.

**3. Voltage Divider for Battery Monitoring:**

* **R1 (10KΩ)**: Connected between the **BAT pin** of the PowerBoost and **A0** on the Arduino.
* **R2 (20KΩ)**: Connected between **A0** and **GND**. This reduces the battery voltage to a level that can be safely read by the Arduino for continuous monitoring of the battery state.

**4. Power and Grounding Scheme:**

* **Common Ground**: All components share a **common ground**, which is connected to both the **PowerBoost 1000C**and the **LiPo battery’s negative terminal**.
* **5V Distribution**: The **PowerBoost 1000C** outputs 5V to power the Arduino and 5V components (e.g., the **Pixy2 camera** and **RGB LED**).

**5. Software Integration:**

The Arduino code manages:

1. **Battery Monitoring**: Through the **LBO pin** and **voltage divider**, the Arduino monitors battery status and controls power management.
2. **Temperature Control**: Reads the temperature from the **DS18B20** and stops charging when the temperature exceeds the threshold (e.g., 45°C).
3. **Proximity and Camera Systems**: Manages sensor data and communicates with the Pixy2 camera for object detection.
4. **Motor Control**: Uses the motor controller to drive the two DC motors in response to sensor inputs and commands.

**Conclusion:**

This system integrates multiple components for robust control of a robot platform, including safe battery management via the **PowerBoost 1000C** and Qi charging, temperature monitoring, and proximity sensing. The wiring ensures efficient power distribution, safe sensor operation, and motor control, with real-time feedback provided by an RGB LED for status indication.