Battery Voltage Divider

Given Parameters

- Battery voltage (V_{in}): Up to 4.2V (LiPo fully charged).
- Resistor values:
  - $R1 = 3.3k\Omega$ (connected to the battery's positive terminal).
  - $R2 = 10k\Omega$ (connected to ground).
- Arduino input voltage range: Maximum 3.3V (for Arduino Nano 33 IoT).

Step 1: Voltage Divider Output Formula

$$V_{out} = V_{in} \times \frac{R2}{R1 + R2}$$

Substitute Values:

$$V_{out} = 4.2V \times \frac{10k\Omega}{3.3k\Omega + 10k\Omega}$$

1. Calculate the total resistance:

$$R_{total} = R1 + R2 = 3.3k\Omega + 10k\Omega = 13.3k\Omega$$

2. Calculate the ratio:

$$\frac{R2}{R_{total}} = \frac{10k\Omega}{13.3k\Omega} \approx 0.751$$

3. Calculate V_{out}:

$$V_{out} = 4.2V \times 0.751 \approx 3.15V$$

Step 2: Check Voltage at Lower Battery Levels

For a minimum battery voltage of $V_{in} = 3.0V$:

$$V_{out} = 3.0V \times \frac{10k\Omega}{13.3k\Omega} = 3.0V \times 0.751 \approx 2.25V$$

This is well within the Arduino's readable range and ensures that the voltage divider functions correctly across the full range of battery voltages.

Current Draw

The current through the divider is:

$$I = \frac{V_{in}}{R1 + R2}$$

At $V_{in} = 4.2V$:

$$I = \frac{4.2V}{13.3k\Omega} \approx 0.316mA$$

This is a small and acceptable current draw for monitoring purposes.

Conclusion

The resistor values $R1 = 3.3k\Omega$ and $R2 = 10k\Omega$ are **correct and safe** for your setup. The divider ensures V_{out} stays within the Arduino's 3.3V input limit while allowing accurate monitoring of the battery voltage.