Voltage Sensor Analysis

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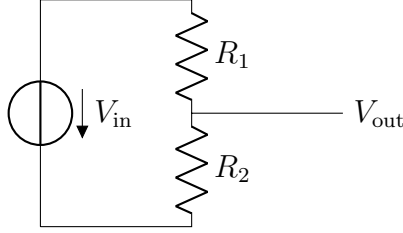
1   Introduction

This document provides an analysis of a simple voltage sensor circuit based on a voltage divider configuration. The sensor reduces the input voltage (V_{in}) to a lower voltage (V_{out}) that can be safely read by a microcontroller such as an Arduino.

2   Circuit Diagram

The voltage divider circuit used in the sensor is shown below:

3   Voltage Divider Formula

The output voltage of the circuit is determined by the voltage divider formula:

$$V_{\text{out}} = V_{\text{in}} \times \frac{R_2}{R_1 + R_2}$$

4   Resistor Selection

From the calculation:

$$\text{Factor} = \frac{R_2}{R_1 + R_2}$$

Given:

$$\text{Factor} = 0.2$$

and resistors:

$$R_1 = 30\text{k}\Omega, \quad R_2 = 7.5\text{k}\Omega$$

Substitute into the equation:

$$0.2 = \frac{7.5\text{k}\Omega}{30\text{k}\Omega + 7.5\text{k}\Omega}$$

5   Experimental Observations

- Input voltage (V_{in}) from the adapter: 12.11 V

- Output voltage (V_{out}) read on the Arduino: 5.06 V

- Voltage reference on Arduino (V_{CC}): 5.06 V

6　Verification of Factor

The factor for the voltage divider can also be determined as:

$$\text{Factor} = \frac{V_{\text{in}}}{V_{\text{out}}}$$

Substituting the values:

$$\text{Factor} = \frac{12.11}{5.06} \approx 2.43$$

Key Observation

The calculated factor matches the expected division ratio, validating the resistor selection and circuit performance.

7　Conclusion

The voltage sensor successfully scales down the input voltage to a level that is readable by the Arduino. The calculated and measured values demonstrate consistency, and the voltage divider circuit provides a simple yet effective solution for voltage measurement in microcontroller-based applications.