SANTA CLARA UNIVERSITY	ELEN 115 Spring 2023	Shoba Krishnan
Project # 1: Sensors		

I. OBJECTIVES

- To learn how to configure a sensor.
- To learn how to read a data sheet to understand device behavior.
- To design an experiment to study the characteristics of a sensor.

LAB PROCEDURE

Part I: Sensor 1 - photoresistor

1. The light sensor you were given today is a photoresistor whose resistance varies with the amount of light intensity that it sees. Connect the photoresistor to a multimeter in the resistance mode. Block the light that falls on it with a paper and use light from your phone or a flash light to vary the intensity and note the value of its resistance.
2. To use the photoresistor, the simplest implementation is a voltage divider on a protoboard.

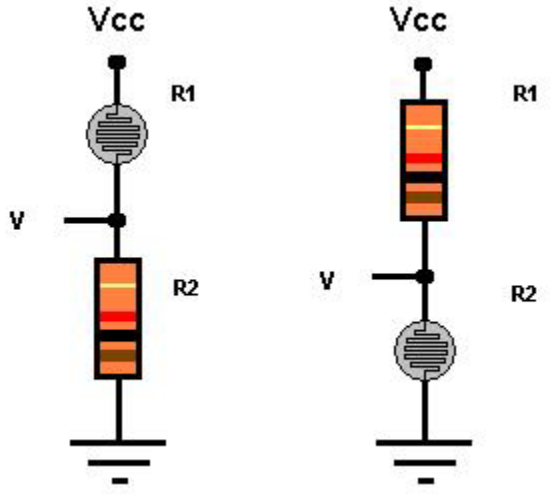


Figure 2 (a) Figure 2 (b)

Figure 1: Two possible Photoresistor configuration

(i) Connect the photoresistor and a 10K resistor provided to you as seen in Figure 2(a) with the photoresistor as R1. Use the 5V and GND for power connections.
(ii) Using a multimeter in voltage mode, note the values of voltage as light changes.
(iii) Also connect the output to the oscilloscope and observe how the voltage changes.
(iv) Hold a light one arms-length away from the photo resistor. Use a potentiometer in place of R2 on the previous circuit and produce a 2.5 volt output.
(v) Observe the output on an oscilloscope with the previous circuit as you change the light intensity from dark to bright.

TA Check Point: Complete Part I and demo the results to your TA

Post lab: If you were to connect the photoresistor as R2 and resistor at R1, what changes would you observe as you change the brightness of your light from low to high. (light intensity from dark to bright)

Part II: Noise interference on photoresistor

1. All sensor inputs sometimes have noise from the environment. Assume there will be noise at 1KHz introduced into the environment.
   You have to provide the sensor output after removing this noise.
2. Figure 3 shows a range of circuits that can be used for signal conditioning. Choose the circuits you would use and explain why you would use them. Assume ideal operational amplifiers. You can use the circuits more than once.
   Draw a final schematic showing the signal path from sensor output to the scope.

(a) Explain what each stage of your design would do and what the output would correspond to for each stage.
(b) Clearly explain the choice of values for the components. If they are correct explain why. If the values are wrong, choose new values.

Figure 3(a)

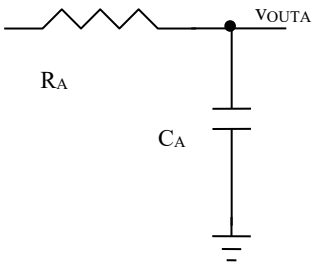


Figure 3(b)

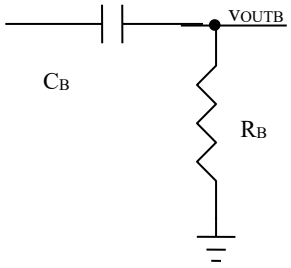
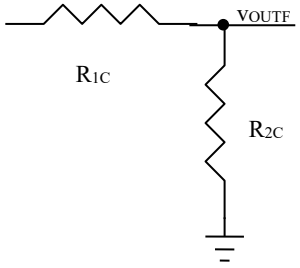


Figure 3(c)



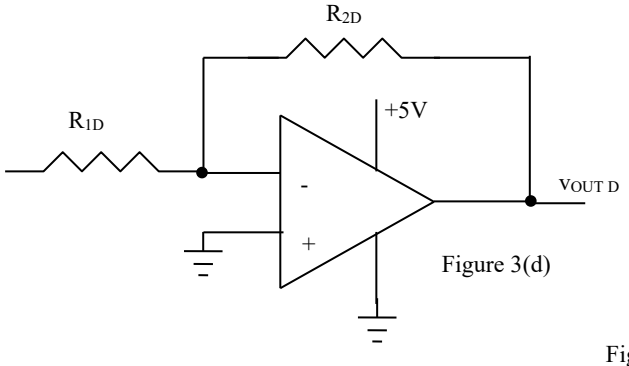


Figure 3(d)

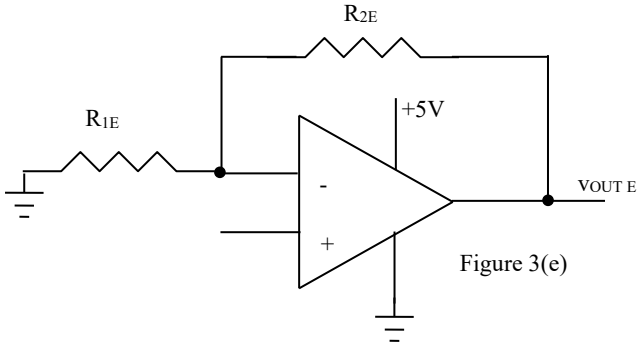
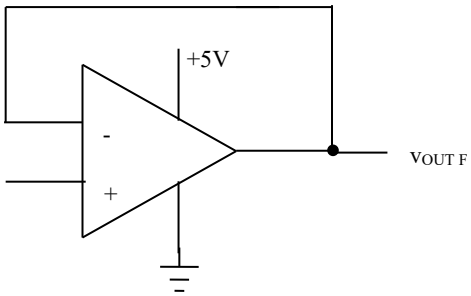


Figure 3(e)

Figure 3(f)



TA Check Point: Complete Part II and demo the results to your TA

Part III: Sensor 2 – Flex Sensor

(i) Look up the data sheet of the flex sensor given to you in lab.

(ii) Design an experiment to characterize the sensor you have been given. Make sure to keep the power draw below the data sheet values. The resistors are 0.25 W. Draw the circuit schematic of your final design. **Before you power on the circuit, please ask your TA to check your circuit.** Build the circuit you designed. Make necessary measurements and graph them to show the sensor characteristics.

(iii) Build a possible application for this sensor. Detail how you would design this application.

TA Check Point: Complete Part III and demo the results to your TA

REPORT

Prepare a detailed project report that includes all your observations and discussions and results from the various parts and sections of the lab.