Lab 3: A Simple Light Sensor System

1 Objectives

The purpose of this lab is to implement a circuit to capture a signal from a light sensor to measure ambient light.

2 Equipments

1. Arduino UNO
2. Breadboard (**bring your own one**)
3. Resistors
4. Light-dependent resistor

3 Procedures

3.1 Ambient Light Measurement

Consider the diagram shown in Figure 1 and choose $R = 10$ KΩ.

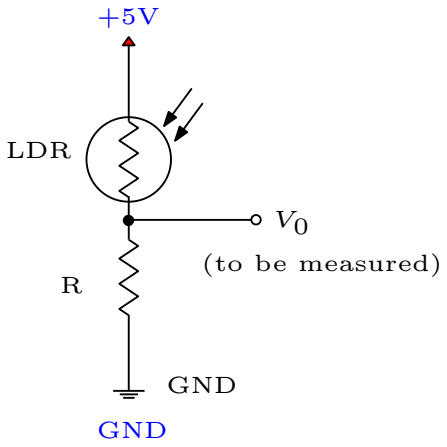
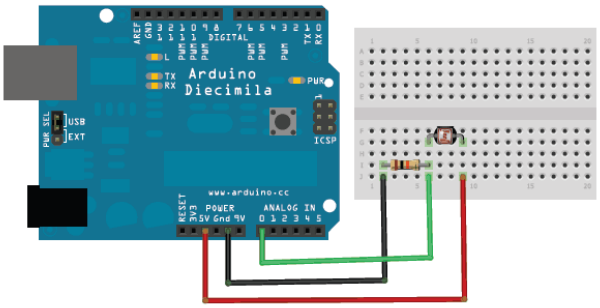


Figure 1: A schematic diagram for ambient light measurement using LDR.

A circuit layout is provided here for your reference.[1]

[1] https://learn.adafruit.com/photocells/using-a-photocell



Note 1: Before you obtain the resistor, you must follow the following steps

- Show the colour code of the resistor to the lab instructors.
- After obtaining the resistor, use the multimeter to check again if the value of the resistor is the expected one.

Note 2: You need to show the lab instructor(s) your circuit implementation to get the marks for this task.

1 For Figure 1, explain how the illuminance can be estimated by measuring V_0. This should be included in the report. You can use the following relation between illumination and resistance of LDR to support your explanation.

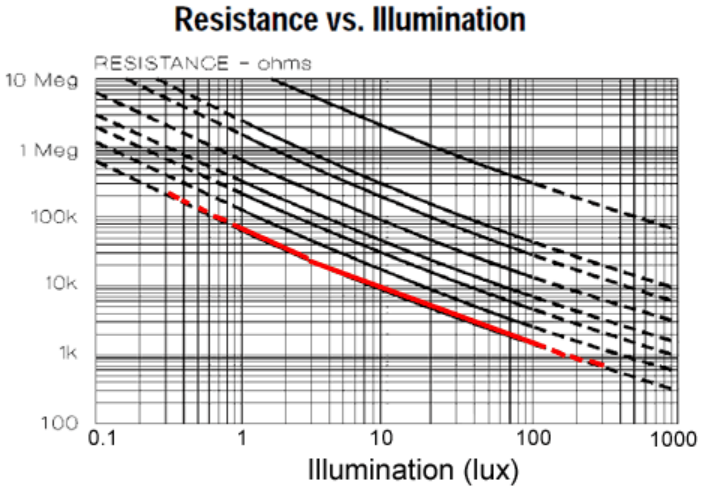


Figure 2: Illumination graph of the photocell.

2 Use oscilloscope to visualize V_0. You can cover the LDR properly to have different light levels such as dark, dim, bright, etc. You should include the values of V_0 when the surrounding light level is very dark and very bright. Give your comments on its amplitude, the rate of change, etc.

3 Write a code to read V_0 (use **analogRead()** function) and send it to the serial port. You can set the baudrate for the serial port to be 9600.

4 Open the serial monitor to see the values of V_0 and observe how V_0 changes if you change the light intensity (refer to Task **2** for setting different light levels). Note that due to the analogue-to-digital converter in Arduino, the values of V_0 are an integer from 0 to 1023. You need to convert the obtained values to the range $0 - 5$V.

5 Copy the values of V_0 from the serial monitor and use a plotting tool of your choice to plot V_0. In our module, MATLAB is preferred but you can use any programming language that you are comfortable. You may wait for some time to get a sufficient number of samples so that the plot is meaningful.

6 From the obtained values of V_0, compute the resistance of the LDR and use the relation between resistance and illuminance given in Fig. 2 to estimate the light intensity (use the red curve for this purpose). You only need to show the results for some specific light levels.

7 Change the resistance of the resistor to 1KΩ and **repeat Tasks 4 to 6**. Compare the obtained results to those for the case $R = 10$ KΩ and comment on your observation.

4 Reports

4.1 Report Contents

Your report should have the following structure

- Provide a brief background on LDR and what the lab is about.
- All the plots you obtained during the lab and the your comments and opinions on the results.
- A summary of what you gained in the lab.

4.2 Submission

- Each group submits a **single report** (group marking).
- To be uploaded via moodle **before 5PM the following day**.
- A penalty 10% of each day will be applied to late submission.
- Poorly written report is subject to deduction.