

EE213 Term Project Pre-Design Report

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1 Introduction and Project Objective

In this document, the design approaches proposed for given term project of EE213. The term-project requirements can be basically summarized that, students are expected to design an experiment to measure the distance of a light source. It is given that the component "LDR (Light Dependent Resistor)" will be used as the sensor element. Also the basic passive components, Op-Amps and laboratory equipments are in the scope of use. The physical appearance of a photoresistor is given in the Figure 1. As students, we are expected to prepare a proper experiment procedure including Pre-Lab work and testing phases. There are two measurement solutions to be proposed. The first one is constructed on the basic working principle of the photoresistor and properties of constant light sources. The second one is based on modified version of the Time of Flight solution which widely used in industrial distance measurement devices. Both proposals share the same objective of to be able to characterize light dependent resistor. Also the preliminary measurements and experiment results for the both approach is reported.

2 Proposal 1

In this section the first proposal is described.

2.1 Linear Approach

In this approach, the linear behavior of the LDR component against light intensity is aimed to be used. The setup simply includes a light source, an LDR and a multimeter connected to that LDR. The circuit schematic is given in the Figure 2.

2.1.1 Light Intensity and Distance Relation

From the fundamentals of physics it is stated that the the light intensity caused by a single light source drops by inverse square of its distance. This is also illustrated in Figure 3. This relation also mathematically modelled by the equation:

$$lightintensity = \frac{1}{distance^2}$$

2.1.2 The LDR Component

The Light Dependent Resistor(frequently abbreviated as LDR), is a semiconductor component so that its resistance changes when the illumination on its surface change. The resistance curve of an LDR is given in the Figure 4. Although it seems this linear curve makes process pretty straightforward, real life conditions (which we can not omit the daylight and ambient light) makes the calibration process crucial.

2.2 Calibration Process

This measurement technique requires a calibration procedure since the light source conditions may differ as well as surrounding light conditions. So, for this process a ruler is needed. Using a ruler the light source should be placed a certain point (e.g. 10 centimeter) and the measurement should be made and recorded using multimeter. This value probably would not match the original calculation plot. So the necessary shift needed to be done to continue the measurement only with resistance value.

2.3 Distance Measurement Calculations

2.4 Preliminary Results

3 Proposal 2

3.1 Time of Flight Approach

3.2 Calibration Process

3.3 Distance Measurement Calculations

3.4 Preliminary Results

4 Conclusion