KLE Technological University
Creating Value
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School of Electronics and Communication Engineering

LIC COURSE PROJECT

IV SEMESTER

'B' DIVISION

Title of the Project: Laser Burglar Alarm

Team members:

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1.1 AIM:To design and implement a laser alarm, using op-amp which can register the obsctacles that comes between the laser and the LDR.

1.1.1 Objective : Implement a circuit to detect light source from a laser and hence mimic a burglar alarm.

1.2 COMPONENTS USED:

SL NO.	COMPONENTS	SPECIFICATIONS	QUANTITY
1	Op-Amp IC	LM358	1
2	Timer IC	NE555	1
3	LDR	-	1
4	Resistors	10KΩ 220Ω	3 1
5	Potentiometer	10KΩ	1
6	NPN transistor	BC547	1
7	Buzzer	-	1
8	Capacitor	100nF	1
9	Push button	-	1
10	Laser pointer	-	1
11	Power supply	9V	1
12	Wires	-	-
13	Breadboard	-	1

1.3 THEORETICAL BACKGROUND:

1.3.1 Light dependent Resistor(LDR):

A light dependent resistor is an electronic component, whose resistance varies as a function of light. The value of electrical resistance of and LDR, can drop to 50 ohm in the presence of light, or can jump upto several mega ohms in the absence of light. The principle of operation of an LDR is photoelectric effect.Usually LDRs are made up of high resistance semiconductor materials like calcium sulfide(CdS).

Working principle of LDR:

Light dependent resistor works on the principle of photo conductivity.Photo conductivity is an optical phenomenon in which the material's conductivity is increased when light is absorbed by the material.

When light falls, i.e., when the photons fall on the device,the electrons in the valence band of the semiconductor materials are excited to the conduction band. These photons in the incident light should have energy greater than

the band gap of the semiconductor material to make the electrons jump form the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers.

Characteristics of LDR:

When an LDR is kept in the dark, in the absence of light, then the resistance is very high during the same time, which is called as dark resistance. It can be as high as $10^{12}\Omega$ and in the other situation/case, the resistance will drastically decrease. If a constant voltage is applied to it and intensity of light is increased the current starts increasing.

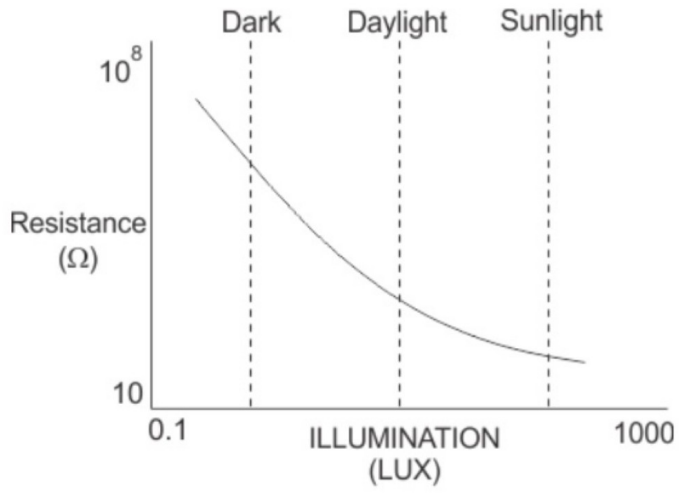


Fig-1.3.1.1 (LDR characteristics)

1.3.2 NE555 Timer IC:

This IC is used in a variety of timer,pulse generation, and oscillator applications, The 555 timer IC can be used to provide time delays,as oscillator and as a filp-flop element.

Pin configuration of NE555 Timer IC:

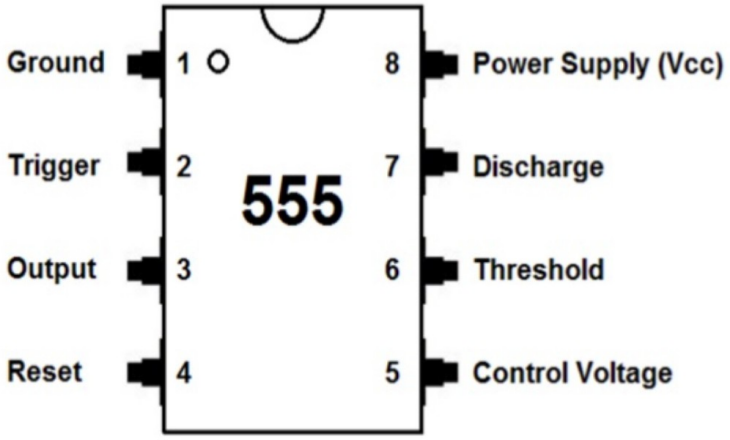
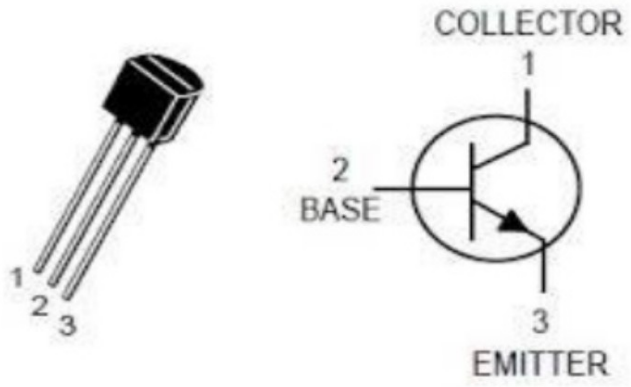


Fig 1.3.2.1 Pin layout for NE555 Timer IC

1.3.3 BC547 Transistor:

BC547 is a general purpose NPN bjt.



1.3.4 LM358 Op-Amp IC:

In this circuit, the op-amp IC is used as a comparator. This means that the op-amp comparator compares one analogue voltage with another voltage level, or some preset voltage level, V_{ref}., and produces an output signal based on the voltage comparison.

Op-Amp comparator circuit:

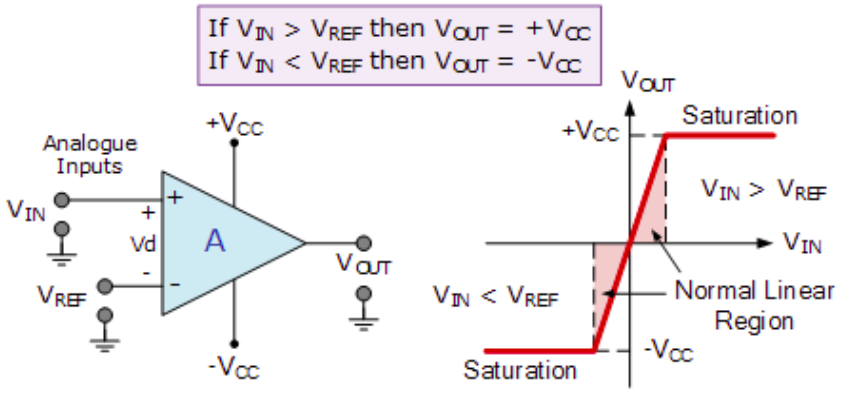
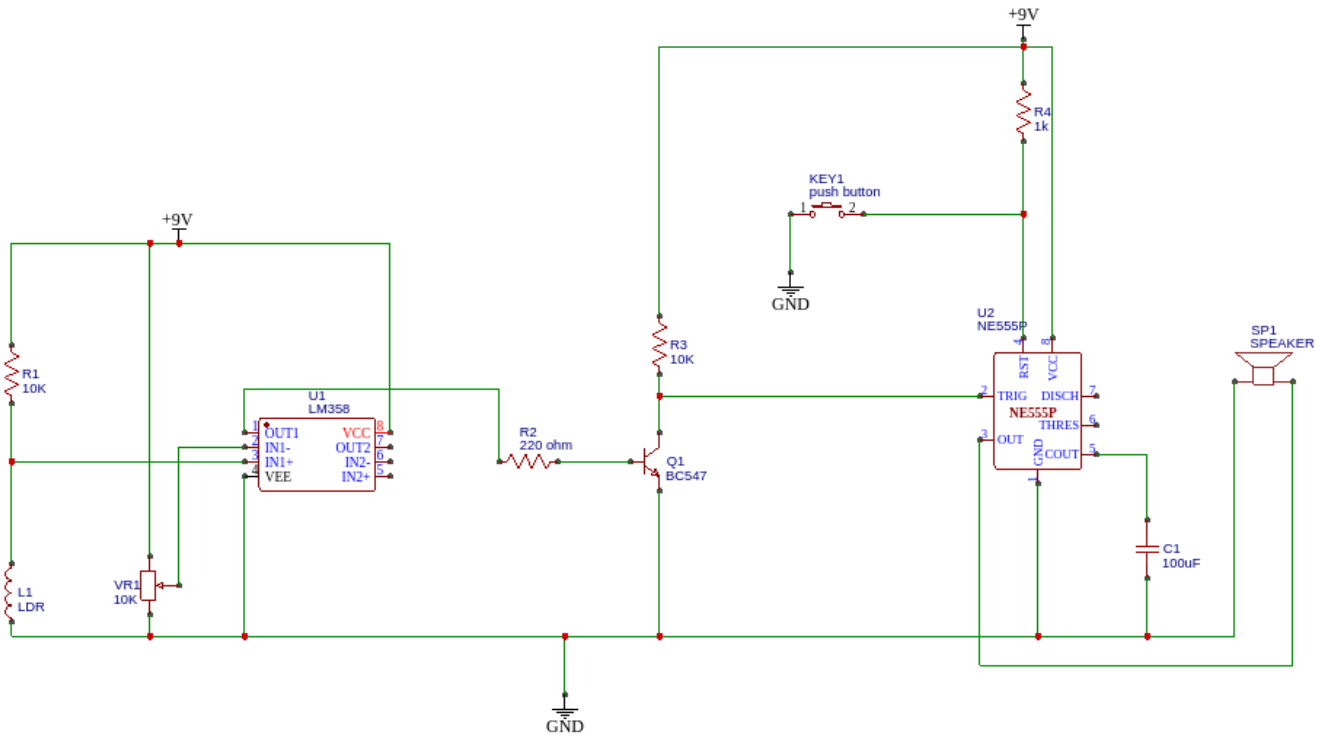


Fig-1.3.4.1(op-amp comparator)

With reference to the op-amp comparator ckt above, first we shall assume that V_{in} is less than the DC voltage level at V_{ref} (V_{in}<V_{ref}).As the non-inverting input of the comparator is less than the inverting input, the output will be LOW and at the negative supply voltage -Vcc resulting in a negative saturation of the output.

Now with increased input voltage V_{in} so that its value is greater than the reference voltage V_{ref} on the inverting input, the output voltage rapidly switches HIGH towards the positive supply voltage, +Vcc resulting in a positive saturation of the output.

1.4 CIRCUIT DIAGRAM:



1.5.1 DESIGN:

Coming to the design of the circuit, first, the LDR and a 10 K Ω resistor are connected in a voltage divider fashion and its output (common point) is connected to the pin 3 (non – inverting) of the Op- Amp IC LM358.

For the inverting terminal (pin 2), connect the wiper of a 10 KΩ potentiometer (other two terminal of the POT are connected to VCC and GND).

The output of the Op – Amp (Pin 1) is connected to the base of the transistor (BC547) through a resistor.
The trigger pin of 555 (Pin 2) is pulled high using a 10 KΩ resistor.

The reset pin (pin 4) of the 555 is connected to VCC through a 10 KΩ resistor and a push button is connected between Pin 4 of 555 and GND. A bypass capacitor of 100 nF is connected between pins 5 and GND. A buzzer is connected to pin 3 of 555 IC.Rest of the connection are shown in the circuit diagram.

1.5.2 Block diagram of the system:

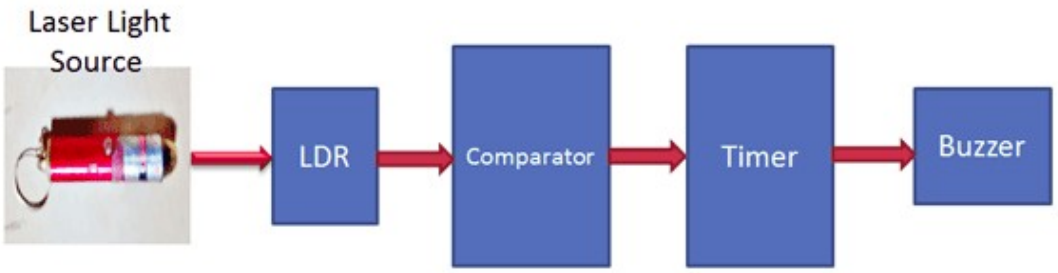
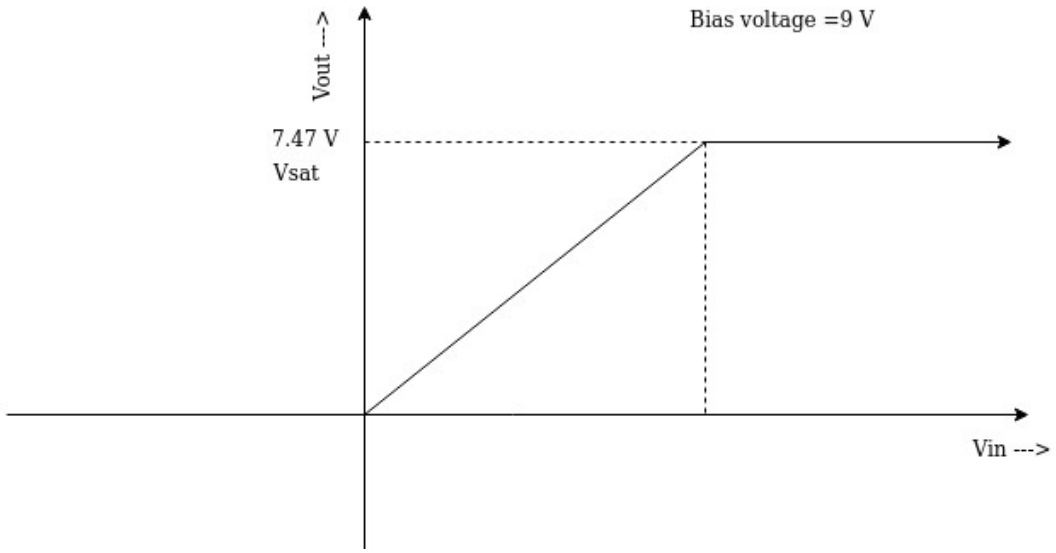


Fig-1.5.2.1 (Block diagram of the system)

1.6 NATURE OF GRAPH:



1.7 SIMULATION PICTURE:

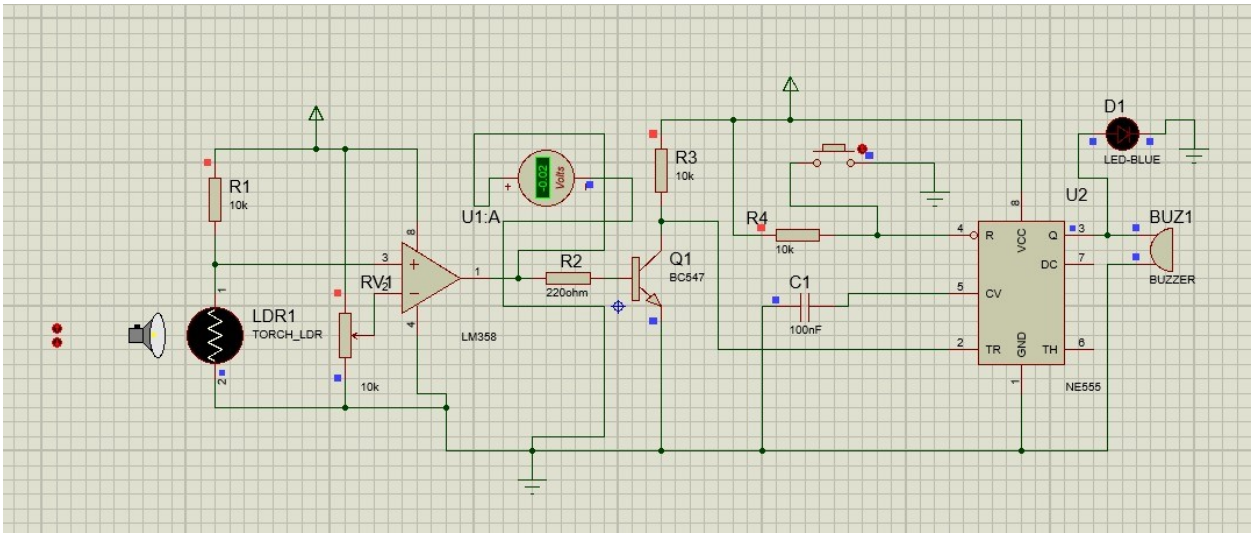


Fig 1.8.1 case (i) when laser is on and not disrupted

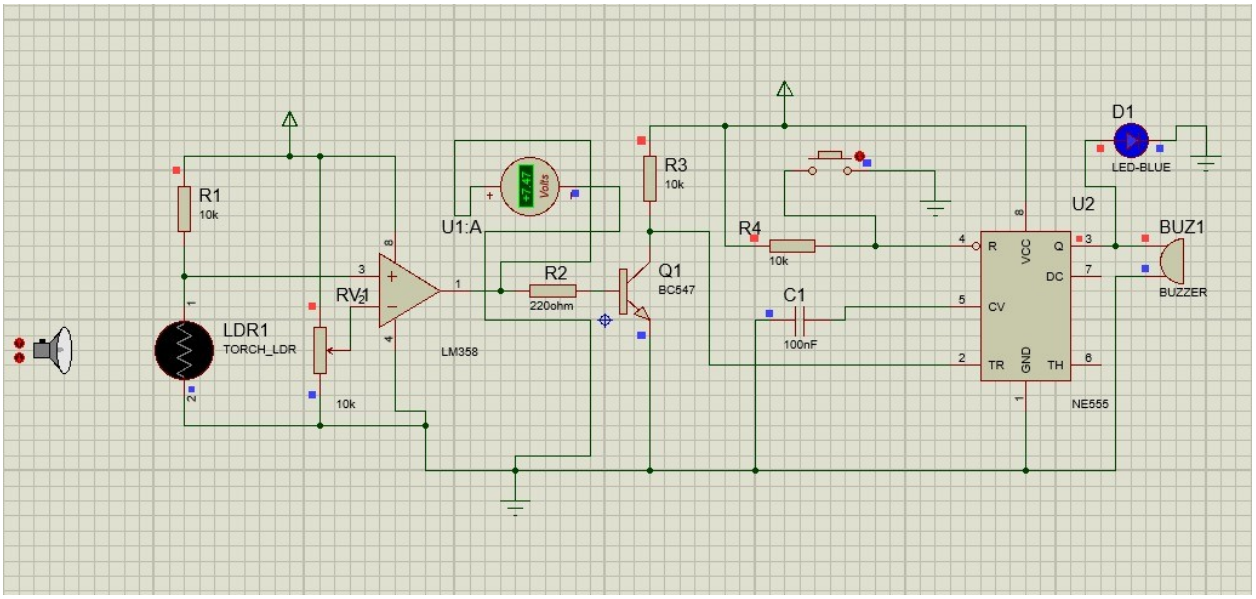


Fig 1.8.2 case (ii) when laser is on and disrupted

1.7.3 BREADBOARD PICTURE:

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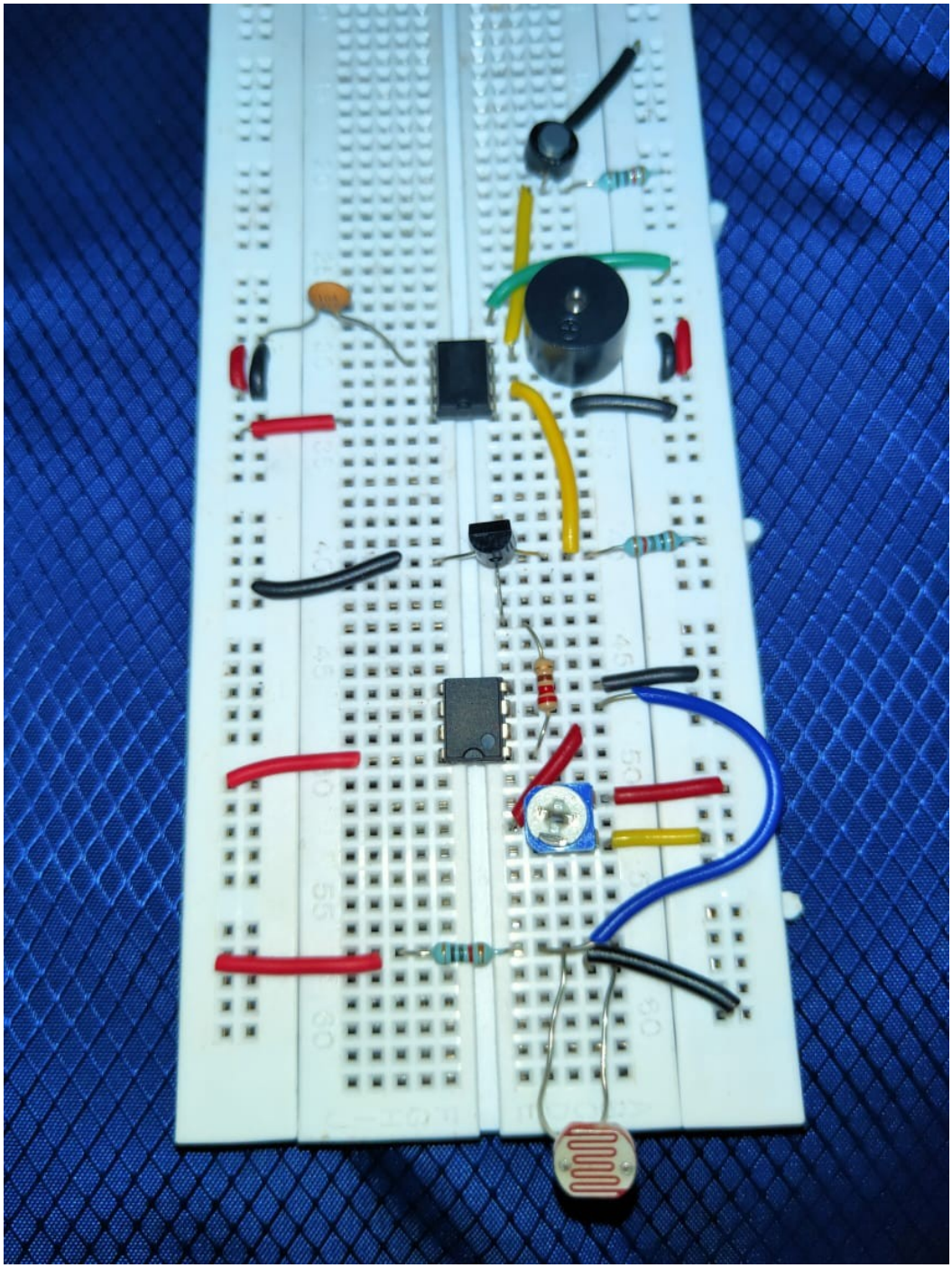


1.8.1 Tabular Column:

Resistance of LDR(in Ohms)	Output voltage of op-amp(in Volts)
1.5kΩ(When laser is on)	-0.02 V
Few mega ohms(when an obstacle is detected between laser and LDR)	+7.47 V

When the output of the op-amp is -0.02 V, the bjt is off, and when the output of the op-amp is +7.47 V, bjt is on, enabling the NE555 timer, and the alarming part of the circuit and the buzzer to buzz, indicating that, the laser has been disrupted.

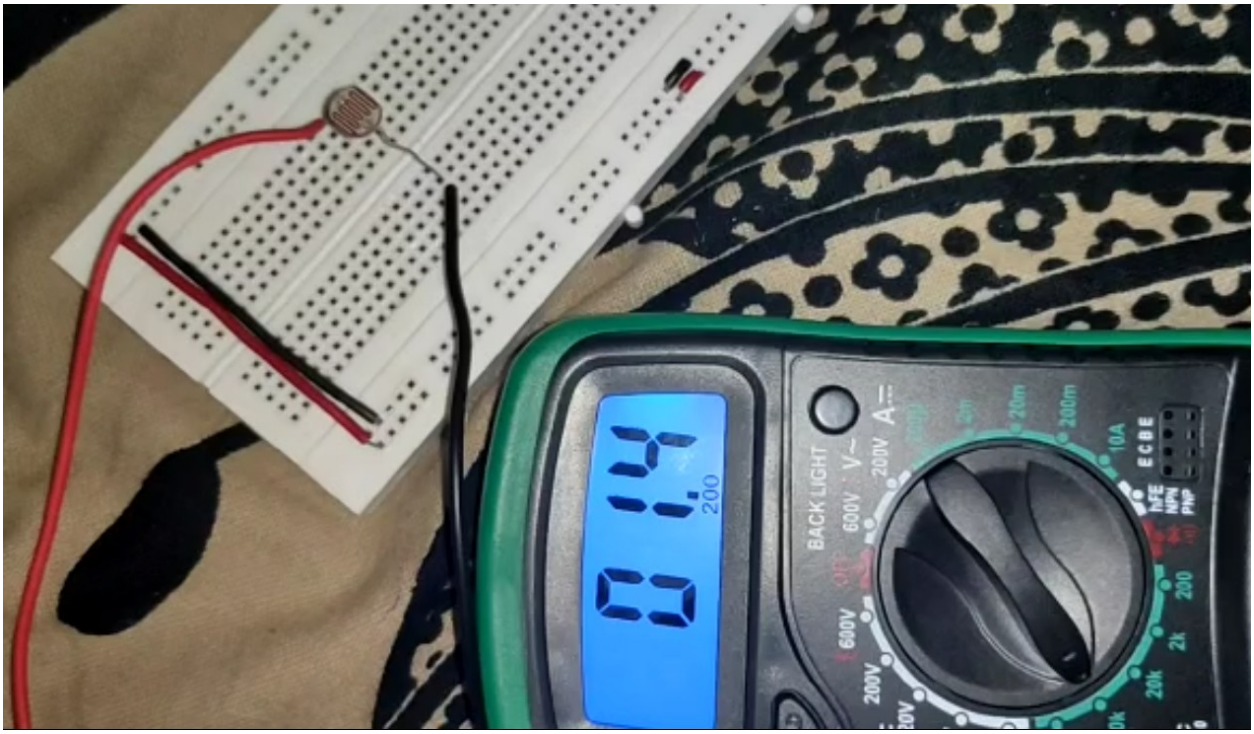
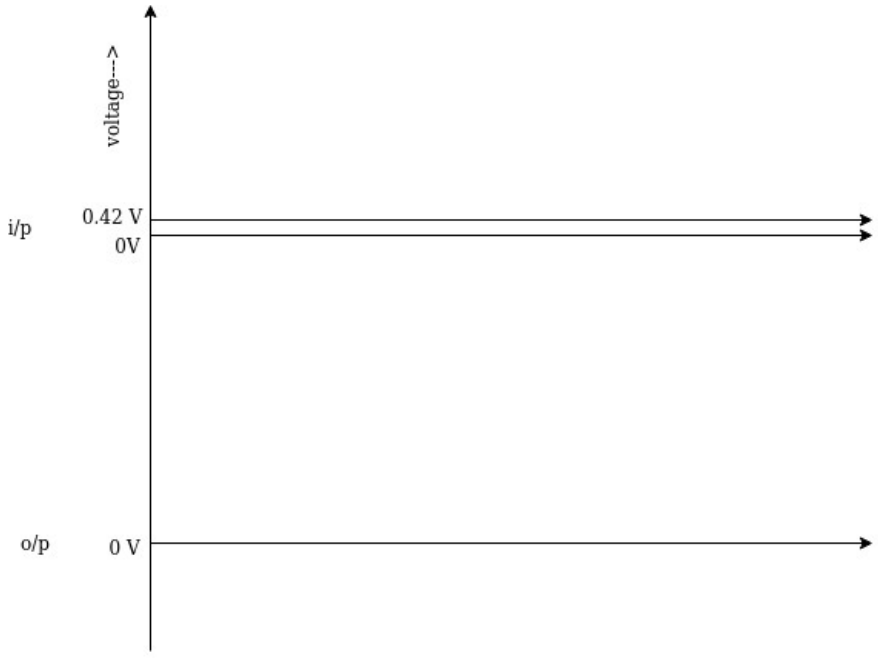
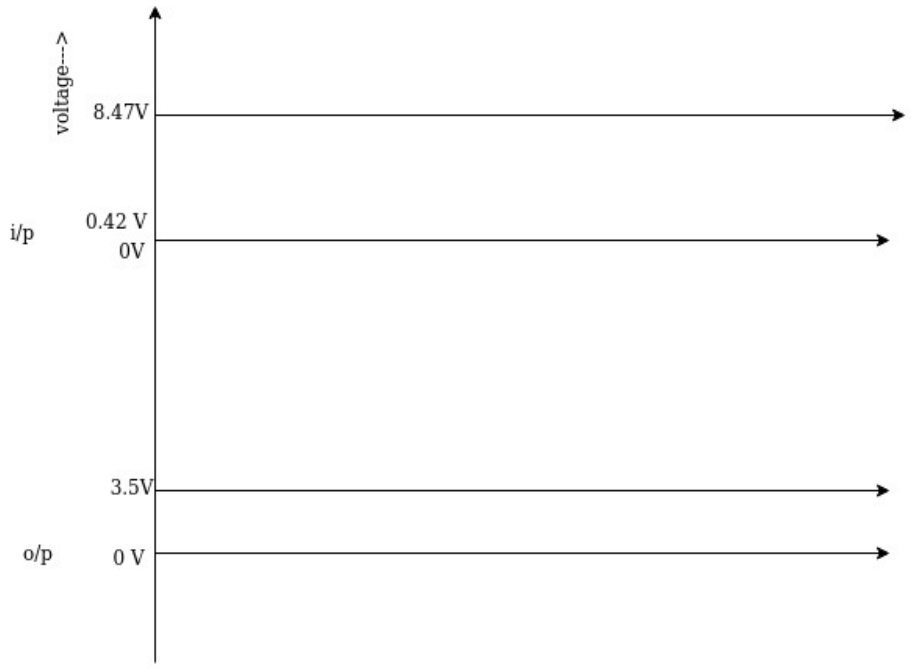


Fig 1.8.1.1 case(i) when light is incidenton LDR, resistance offered by it is about 1.6kΩ

Fig 1.8.1.2 case(ii) when light is not incident on LDR, it offered about several mega ohms of resistance.

1.9 Output Waveform:





1.10 CONCLUSION:

By conducting the experiment and after verifying, we came to a conclusion that, LDR's sensitivity varies with the function of light, and that, the op-amp was used as a comparator in this circuit whose output was fed to a BJT, which in turn controlled decided if there was a disruption in incident light on LDR, based on the voltages that was fed to to the BJT.

References:

Circuit diagram drawn on : EasyEDA tool

Simulation carried out in: Proteus tool

Graph and waveforms images drawn on: draw.io (online tool)