

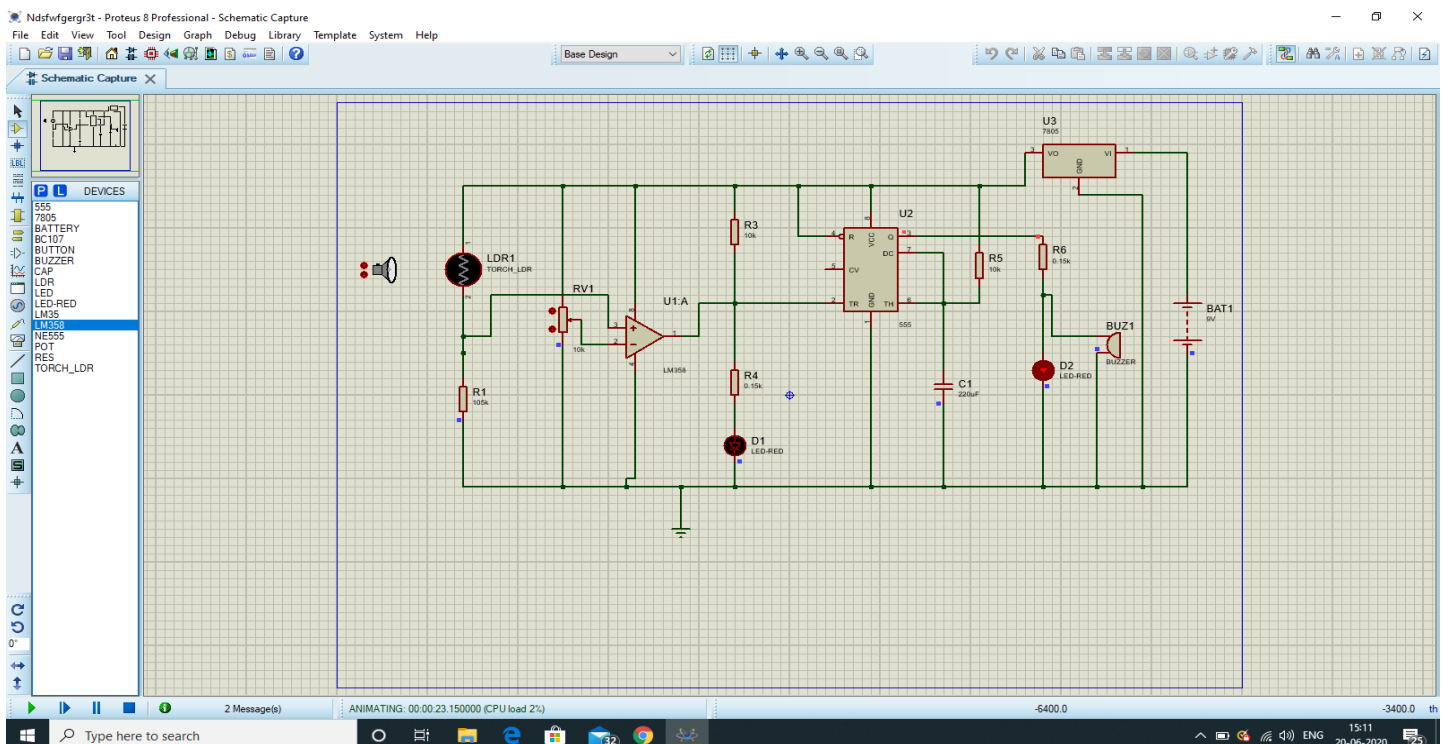
# LASER SECURITY SYSTEM

**AIM:** Designing laser security system using 555 timer .

## COMPONENTS REQUIRED:

- LM358 (Op – Amp IC)
- NE555 (Timer IC)
- LDR
- 3 x 10 K $\Omega$  Resistors (1/4 Watt)
- 220  $\Omega$  Resistors (1/4 Watt)
- 10 K $\Omega$  Potentiometer
- BC547 (NPN Transistor)
- Small Buzzer
- 100 nF Capacitor (Ceramic Disc Type Capacitor – Code 104)
- Push Button
- Laser Pointer
- 9V Battery

## CIRCUIT DIAGRAM:



## **COMPONENTS DESCRIPTION:**

### **555 TIMER (IC 555)**

IC 555 is a precision timing IC that provides time delays or oscillations. 555 Timer IC has three modes of operation: Astable, Monostable and Bi-stable. In this project, we are going to use the IC 555 in Bi-stable mode.

### **LM358 (OP – Amp)**

LM358 is a dual Operational Amplifier IC and it is capable of operating in all the conventional operational amplifier circuits. In this project, the LM358 is used as a Comparator.

### **LDR (Light Dependent Resistor)**

The LDR acts as a light sensor in this project. As the intensity of the light falling on the LDR increases, the resistance of the LDR decreases and vice – versa. The LDR is used in combination with the laser to form the light sensor and source.

## **CIRCUIT DESIGN:**

The design of the laser security system circuit is very simple. We will see the design of the circuit in this section and in the working explanation we will see the working of the individual component.

Coming to the design of the circuit, first, the LDR and a 10 K  $\Omega$  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 K $\Omega$  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 K $\Omega$  resistor.

The reset pin (pin 4) of the 555 is connected to VCC through a 10 K $\Omega$  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.

## **WORKING OF THE PROJECT:**

A simple, cheap and effective laser-based security system is developed in this project. First, the Op – Amp circuit acts as a comparator i.e. it compares the voltages at the inverting and non – inverting terminals and produces an output accordingly.

The LDR – 10 K $\Omega$  resistor Voltage divider is connected to the non – inverting terminal of Op –Amp and a POT is connected to the inverting terminal. Assume, the laser pointer is placed directly in line of sight to the LDR and the light from the laser is continuously being incident on LDR.

In this situation, the resistance of LDR falls down to few Ohms (or tens of Ohms) and as a result, the voltage at the non – inverting terminal will be less than that at the inverting voltage. The output of the Op –Amp is low and the transistor is OFF.

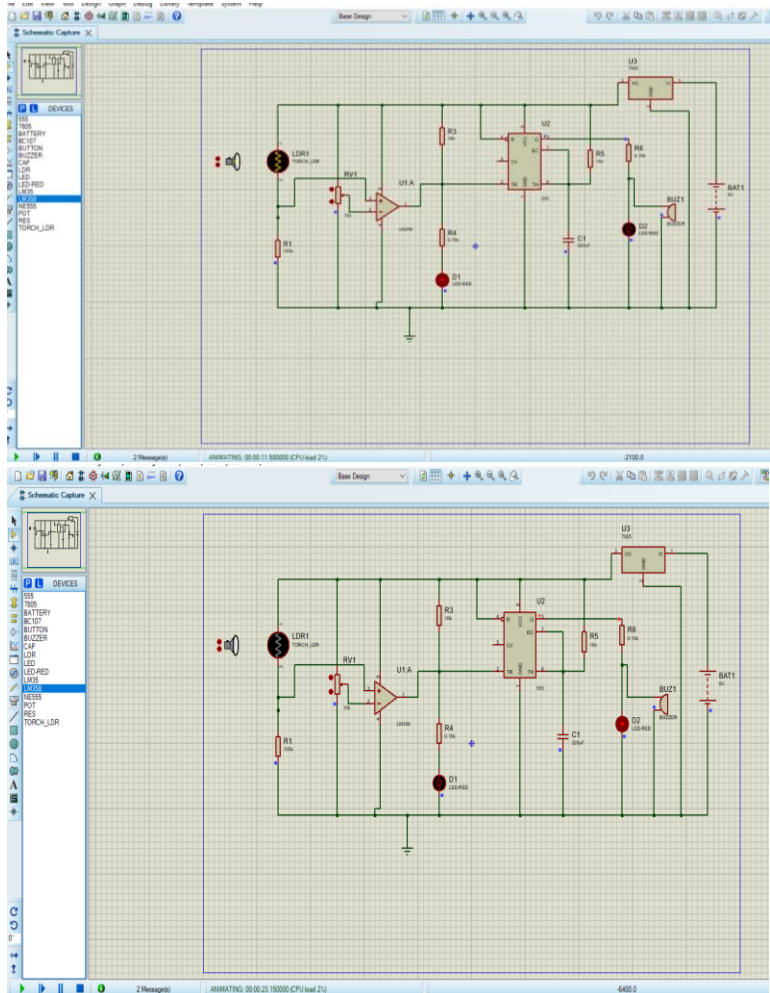
If the laser light is blocked by an intruder from falling on the LDR (even for a small duration), the resistance of the LDR goes to few hundreds of Ohms and as a result, the output of the Op –Amp will be HIGH. This will turn on the Transistor.

As the output of the transistor is connected to the Trigger Pin (Pin 2) of the 555 Timer IC, if the transistor is ON, the trigger pin gets a short low pulse and as a result, the output of the 555 becomes HIGH. This will activate the alarm by turning ON the buzzer.

Since, the 555 Timer IC is configured as a Bi – Stable Multivibrator, a small active low trigger pulse at the trigger pin will set its output to HIGH and in order to reset it we need to push the reset button.

Until the reset push button is pushed, the alarm will stay on hence, we can place the reset button at a secret location so that only the owner can disable the alarm.

# RESULT



## ADVANTAGES:

- The circuit, construction and setup for the Laser Security System is very simple.
- If used with a battery, the laser security system can work even when there is a power outage.

## DISADVANTAGES:

- The laser security system works only if the laser is obstructed. If the intruder passes without obstructing the laser, it is considered as a failure.
- In order to secure a larger area, we need more lasers and corresponding sensors.

## APPLICATIONS:

- Laser Security System can be used in safety lockers in our homes, where even if the locker's code is hacked, it acts as an additional layer of security.
- Apart from security systems, this laser based setup can also be used to check if pets or babies crossed a certain boundary.