Linear Integrated Circuits Lab- Open ended experiment

LIGHT DEPENDENT FREQUENCY VARIATION USING LDR

AIM: To study the light dependent frequency variation using LDR and IC 555 timer

COMPONENTS REQUIRED : IC 555 , Capacitors (1µF and 10nF) , Resistors – 1MΩ , LDR , Breadboard , wires , LED , CRO , Probes and Fixed Power supply (+5V).

THEORY: This circuit responds to the change in light illumination in the form of varying frequency which can be observed through a flashing LED as output. The idea is to use an LDR in place of a fixed value resistor which in turn generates a particular frequency. The generated frequency corresponds to the light conditions of the ambience.

LDR- A LDR (Light dependent resistor), as its name suggests, offers resistance in response to the ambient light. The resistance decreases as the intensity of incident light increases, and vice versa. In the absence of light, LDR exhibits a resistance of the order of mega-ohms which decreases to few hundred ohms in the presence of light. It can act as a sensor, since a varying voltage drop can be obtained in accordance with the varying light. It is made up of cadmium sulphide (CdS). An LDR has a zigzag cadmium sulphide track. It is a bilateral device, i.e., conducts in both directions in same fashion.

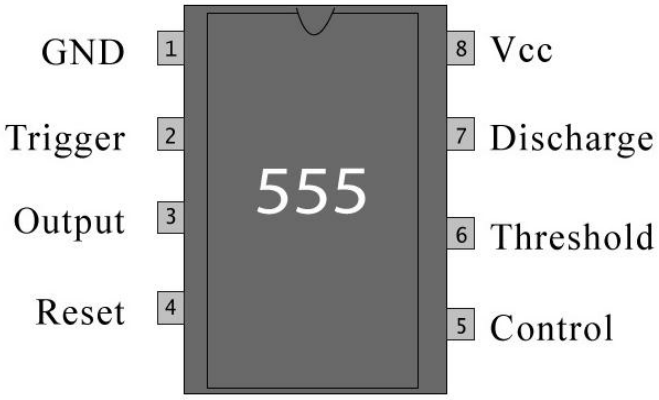
The most common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device. The resistance of an LDR may typically have the following resistances:

Day light = 5000Ω , Dark = 20000000Ω

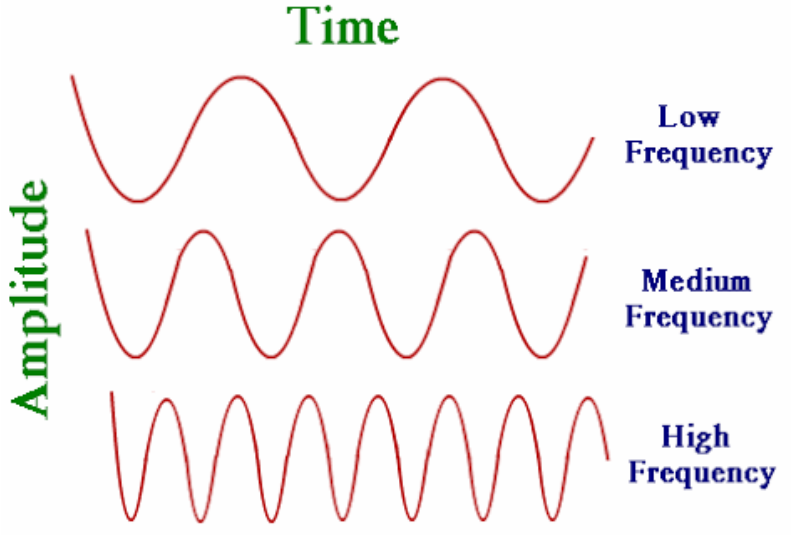
The resistance of the Light Dependent Resistor (LDR) varies according to the amount of light that falls on it. The relationship between the resistance R_L and light intensity Lux for a typical LDR is $\mathrm{RL} = \frac{500}{LUX}$

555 is a very commonly used IC for generating accurate timing pulses. It is an 8 pin timer IC and has mainly two modes of operation: Monostable and Astable. In monostable mode time delay of the pulses can be precisely controlled by an external resistor and a capacitor whereas in astable mode the frequency & duty cycle are controlled by two external resistors and a capacitor. 555 is very commonly used for generating time delays and pulses.

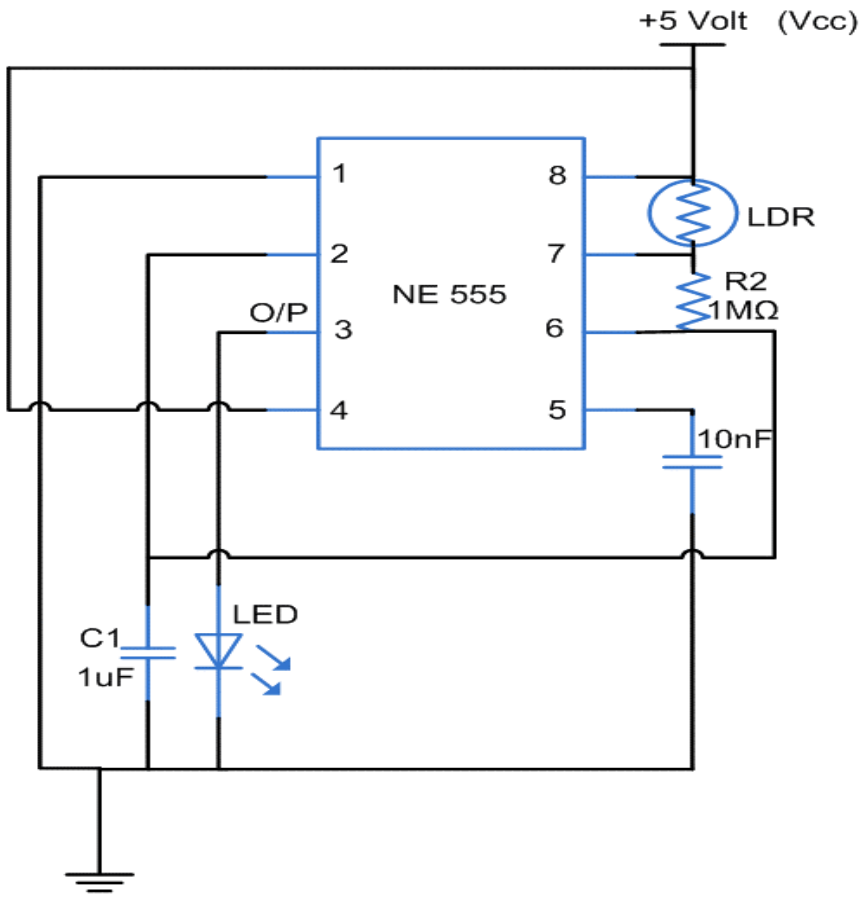
PIN DIAGRAM OF IC 555



WAVEFORMS



CIRCUIT DIAGRAM



DESIGN

This circuit uses IC 555 to generate a continuous series of pulses in ASTABLE mode. The frequency of these pulses is obtained based on values of two resistors, R1 and R2 and by the capacitor, C. The formula for calculating the frequency of the pulses is give as:

$$f = \frac{1.45}{(Ra+2Rb)C}$$

The forward voltage of LED (1.7V-2.2V) is lower than the voltage supplied (5V) to drive it in a circuit. Using an LED as such would burn it because a high current would destroy its p-n gate. Therefore a current limiting resistor is used in series with LED. Without this resistor, either low input voltage (equal to forward voltage) or PWM (pulse width modulation) is used to drive the LED.

Here, the R1 resistor is replaced with a light dependent resistor (LDR) whose resistance varies in response to the light falling on it. The resistance value drops as the incident light gets brighter and vice-versa. For varying light intensity, a varying resistance is offered by LDR and thus the frequency generated at the output (Pin 3) of IC555 also varies according to the above relation. Therefore the speed with which the LED would flash will keep on changing depending upon the intensity of light in the surrounding.

For a typical ½ sec pulse, i.e., 2 Hz frequency, the values can be taken as:

R1 (LDR) = 1 kΩ to 1 MΩ

C1 = 1µF and R2 (preset)= 1 MΩ

PROCEDURE

1. Rig up the circuit as shown in the circuit diagram
2. Provide DC voltage of 5V.
3. Connect positive clip to pin 3 and negative to ground of the probe taken from CRO to observe waveforms.
4. Observe the LED and waveform in the CRO with light only from the surroundings.
5. Apply light from an external source such as mobile flash or torch light and observe the waveform.
6. Draw the waveforms and observe the change in the frequency.

TABULAR COLUMN

Resistance of LDR	Theoretical frequency	Practical frequency

RESULT- The light dependent frequency variation using LDR is studied, waveforms are drawn and theoretical and measured frequency values are found to be almost same.

TEAM

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