Linear Integrated Circuits & Applications Lab

A MINIPROJECT REPORT

ON

Vehicle Headlight Dimmer

Submitted By

Shilpa C Shetty **(4NM17EC147)**
Shirodkar Kanishk Pradeep **(4NM17EC148)**
Shivanand Shenoy **(4NM17EC149)**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

NITTE EDUCATION TRUST | N.M.A.M. INSTITUTE OF TECHNOLOGY
(An Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi)
Nitte – 574 110, Karnataka, India
ISO 9001:2015 Certified, Accredited with 'A' Grade by NAAC
☎: 08258 - 281039 – 281263, Fax: 08258 – 281265

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1. INTRODUCTION

Headlights of vehicles pose a great danger during night driving. The drivers of most vehicles use high bright beam while driving at night. This causes a discomfort to the person travelling from the opposite direction and therefore experiences a sudden glare for a short period of time. This is caused due to the high intense headlight beam from the other vehicle coming towards the one from the opposite direction. Eventually this has become the major reason for accidents occurring at night and also during bad conditions such as rainy and foggy conditions. The driver should have turned down the bright lights immediately to avoid glare to the other person, however they find it difficult to do. Hence, the idea for the design and development of a circuit called the automatic headlight dimmer. It enables the driver to use high beam light when required and also automatically switches the headlight to low beam when it senses a vehicle approaching from the opposite side. Thus, the implementation of this device in every vehicle does not only avoid accidents but also provide a safe and a comfortable driving.

In this project, an automatic headlight dimmer which uses a Light Dependent Resistor sensor has been designed to dim the headlight of on-coming vehicles to avoid human eye effects. This automatically switches the high beam into low beam, therefore reducing the glare effect by sensing the light intensity value of approaching vehicle and also eliminating the requirement of manual switching by the driver which is not done at all times.

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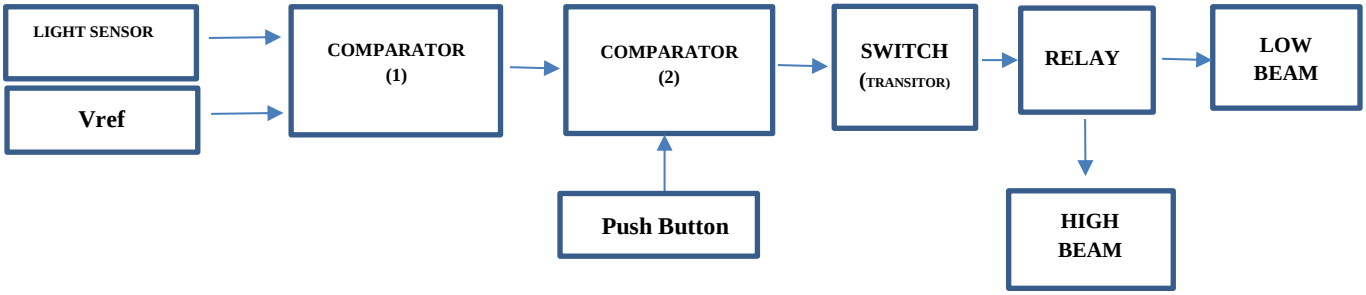
2. BLOCK DIAGRAM



Light sensor used in our project is LDR (Light Dependent Resistor), when light falls on this resistor it's resistance decreases and when there is no illumination on the resistor it will give high resistance. Hence it's resistance depends on light illuminated on it's surface, this property of LDR is used to generate varying voltage by using LDR as one of resistor in voltage divider circuit. Vref voltage is obtained by voltage divider circuit and given to non-inverting terminal. Comparator used in this project are open loop op-amp. The relay is driven by a transistor switch. When there is no vehicle, no light falls on LDR, it will give high resistance, hence voltage greater than Vref is at inverting terminal, so low output is obtained from comparator and relay is at high beam position and when light from vehicle falls on LDR, it will give low resistance, hence voltage lower than Vref is obtained at inverting terminal, so high output is obtained from comparator and relay switches to low beam position. The output of comparator (1) is given to non-inverting input of comparator (2), so when push button is not pressed whatever the output is given by comparator (1) will be present at output of comparator (2). The push button when pressed will give a voltage greater than high output of comparator (1) . If the other vehicle does not switches it's light from high to low beam, then using push button which is given to inverting terminal of comparator (2), we can give a signal to switch their light by switching continuously pressing the push button, which will make comparator (2) output go high-low which intern runs the relay which switches between high and low beam.

3. CIRCUIT DESIGN

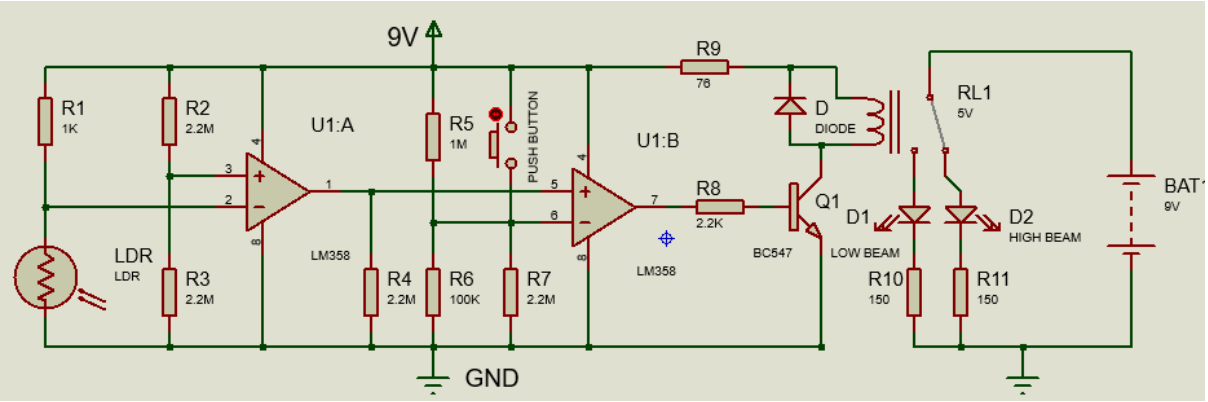


Figure 3-1: Circuit Diagram of Headlight Dimmer

Table 3-1 Component Used

SL. No	Component	Value
1	Power Supply	9V - DC
2	Op-amp	LM358
3	Relay	5V
4	Transistor	BC547

Table 3-2 Properties of LDR Sensor

SL. No	Property	Value
1	Nature	LDR
2	Current	60 µA
3	Voltage	4 to 30 V
4	Temperature range	-55 ° to +150°C

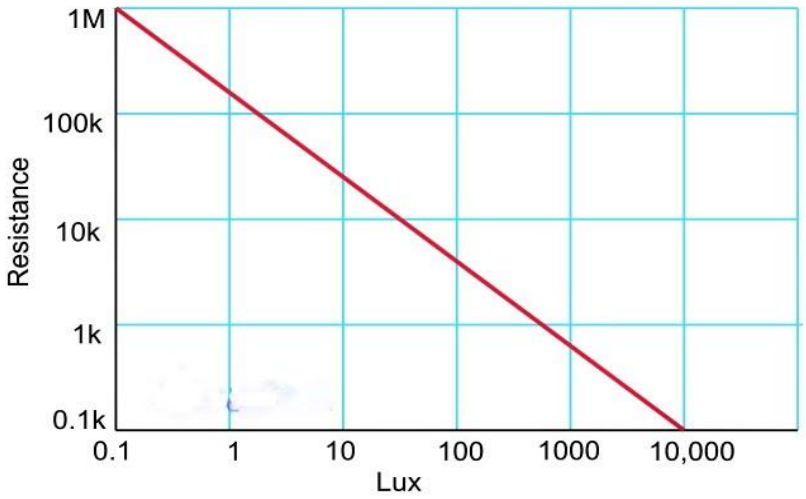


Figure 3-2: Resistance of function of illumination of LDR

Select R1 < LDR resistance at normal illumination(10KΩ - 2KΩ)

R1 = 1KΩ

Select R2=R3=2.2MΩ Let V3 be voltage at non-inverting terminal of op-amp(U1)

$$V3 = \frac{R3}{R2 + R3} Vcc \qquad \textbf{3-1}$$

Substituting values of R2= R3= 2.2MΩ and Vcc= 9V in equation 3-1

We get

$$V3 = \frac{2.2 * 10\text{^}6}{2.2 * 10\text{^}6 + 2.2 * 10\text{^}6} * 9$$

V3=4.5V

Let V4 be voltage at non-inverting terminal of op-amp (U2), that is V4 is voltage across resistor R4, which is output voltage of op-amp(U1).

Select R4 = 2.2MΩ

Due to internal offset error voltage of op-amp (U2) its output goes high without any input, so as to avoid this a small voltage (V6≈1V) is given to inverting terminal.

Select R5 = 1MΩ R6 = 100KΩ

$$V6 = \frac{R6}{R5 + R6} Vcc$$

$$V6 = \frac{100 * 10\text{^}3}{1 * 10^6 + 100 * 10\text{^}3} * 9 \qquad \textbf{3-2}$$

V6=0.81V

Select R7 = 2.2 MΩ. When push button pressed VR7=V6=9V.

Transistor Switch design:-

Ic = 30mA, required to drive the relay. Let V7 be output voltage of op-amp (U2), V7=Vin=7V, I_B = 3mA, using the equation

$$RB = R8 = \frac{Vin - VBE}{Ib} \qquad \textbf{3-3}$$

$$R8 = \frac{7 - 0.7}{3 * 10\text{^} - 3}$$

R8 = 2.1KΩ

Select R8 = 2.2KΩ

Select R9 = 76Ω R10= R11= 150Ω, current limiting resistors for relay and LEDs respectively.

Select flywheel diode D as IN4007 to prevent huge voltage spikes from arising when the power supply is disconnected.

4. TESTING SCHEME

- Emulate the vehicle's headlight, we are using a torch.
- When torch light is directed towards LDR surface which is to say that vehicle is approaching, then circuit will switch to LOW BEAM.
- If torch light is not dimmed indicates that other vehicle didn't switched its light to LOW BEAM, so as indicate them to switch to LOW BEAM, repeatedly press push button which will switch light from LOW to HIGH BEAM simultaneously.
- If torch light is taken away indicating no presence of vehicle circuit will be in HIGH BEAM state.

5. PROJECT OUTCOME'S

An automatic headlamp dimmer of on-coming vehicles had been designed using LDR sensing technique. Thus, the system device automatically switches the headlight to low beam when it senses a vehicle approaching from the opposite side using Light Dependent Resistor (LDR) sensor, removing the work of manual switching by the driver.

The push button mechanism, which is used to signal on-coming vehicle could be made to operate automatically. A server module could be included to this system for receiving and storing headlight rays parameters information in a database application for further improvement of the system.

REFERENCES

[1] International Journal of Emerging Technology and Innovative Engineering Volume 2, Issue 4, April 2016 (ISSN: 2394 – 6598) “DESIGN AND IMPLEMENTATION OF AUTOMATIC HEADLIGHT DIMMER FOR VEHICLES USING LIGHT DEPENDENT RESISTOR (LDR)” SENSOR Date of Publication: 17.04.2016

[2] “Photoresistor,” Wikipedia, 09-Oct-2019. [Online]. Available: https://en.wikipedia.org/wiki/Photoresistor. [Accessed: 18-Oct-2019].

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Evaluator	Signature
1	
2	