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Automatic Street Light Control System using Light Dependent Resistor and Motion Sensor

By Md. Sazol Ahmmed, Tanzima Zoha Chowdhury & Sourav Kumar Ghosh

Bangladesh University of Engineering & Technology

Abstract- Automatic street light control system is used in modern world for energy savings by using Light dependent Resistor (LDR). Nowadays the human has not enough time, and he/she is unable to find time even to switch the lights on or off. This new system can be used more effectively in case of street lights. In proposed system, the street lights will be switched on just before the sun sets and are switched off the next day morning when there is sufficient light on the road. The proposed model also uses motion sensor to control the intensity of light. Huge power is consumed when most the vehicles don't move during the late. This paper shows that the proposed System is relatively low cost, efficiency is better than the existing system.

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Automatic Street Light Control System using Light Dependent Resistor and Motion Sensor

Md. Sazol Ahmmed^α, Tanzima Zoha Chowdhury^σ & Sourav Kumar Ghosh^ρ

Abstract- Automatic street light control system is used in modern world for energy savings by using Light dependent Resistor (LDR). Nowadays the human has not enough time, and he/she is unable to find time even to switch the lights on or off. This new system can be used more effectively in case of street lights. In proposed system, the street lights will be switched on just before the sun sets and are switched off the next day morning when there is sufficient light on the road. The proposed model also uses motion sensor to control the intensity of light. Huge power is consumed when most the vehicles don't move during the late. This paper shows that the proposed System is relatively low cost, efficiency is better than the existing system.

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I. INTRODUCTION

In 21st century it is quite impossible to avoid accident during night without lights. So street light is the essential part in our busy life for safety purposes. But the manpower required for controlling the light cuts a huge cost. So in this situation this project helps to reduce the cost of man power and reducing power Consumption. During day time there is no essence of street light so the LDR keeps the street light off. As soon as the light intensity is low then the LDR is started working and the light is switched on. Motion sensor has a huge indoor and outdoor application. Very common application of motion sensor is activation of automatic door opening. Motion sensor also used instead of convention sensor because of its accuracy. Motion sensor also used as an alarm when it detects the motion of a possible intruder.

II. LITERATURE REVIEW

Bangladesh faces major problem regarding electricity i.e. its rate of generation of electricity is less than rate of consumption. Even small implementations can make large contributions on large scale. We know in this area of development more and more numbers of highways, expressways etc. thus an automation is needed to improve this condition [1]. In the prior automation system i.e. only using LDR the system could only reduce the manual switching, but power saving could not be handled [2]. It can control (on/off) distribution line of a specific region based on the intensity of the daylight was implemented by [3]. The

circuit was built by providing some special features so that it can withstand or adjustable if the intensity of light varies with some others factor. The microcontroller based control systems are more reliable, accurate and easily programmable to perform data transfer, data security, design the control system and tracking the changes in the system. [4]. Street lights are controlled by photocells. These have only one function, which is switching lights on and off according to factory-fixed, light-level thresholds. Telensa's proposed system operates by replacing the traditional photocell with an 'outstation'. This performs the lamp switching and monitoring functions [5].

III. SYSTEM COMPONENTS

It consists of nine main components. These are LDR, LM 358, Diode, BC 547, Relay, Voltageregulator, Bulb, Motion sensor, Resistor, Adapter.

a) Design of system components

i. Automatic switch on off control system components

Light-dependent resistor (LDR): Photo resistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. Photo resistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

The electrons are liberated when the light falls on the sensor. The photons absorbed when the light intensity exceeds a certain limit. For these reason lots of free electrons and hole are released and resistance is decreased dramatically. The equation to show the relation between resistance and illumination can be written as

$$R = A * E^{-a}$$

The value of 'a' depends on the CdS used and on the manufacturing process. Values are usually in between 0.7 and 0.9.

Author ^α ^σ ^ρ: Department of Industrial & Production Engineering, Bangladesh University of Engineering & Technology, Bangladesh.
e-mail: sojol.ipe11@gmail.com

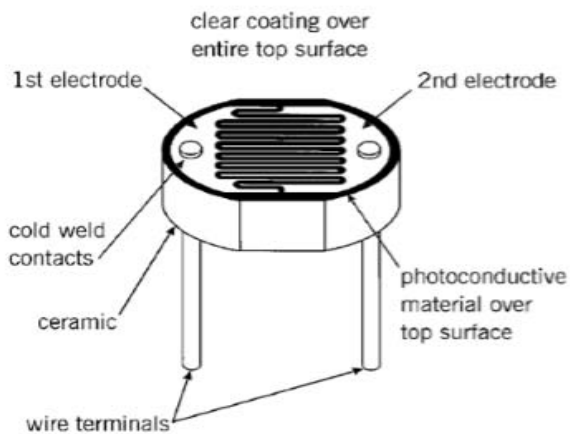


Fig. 1: Light Dependent Resistor



Fig. 3: PIR Sensor

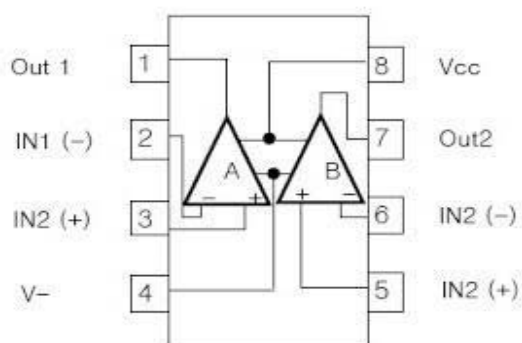


Fig. 2: Pin configuration of IC

LM 358: LM358 consists of two independent and high gain operational amplifiers. It is not require independent power supply for each comparator for wide range of power supply. LM358 may be used as transducer amplifier, DC gain block etc. It consists of dc voltage gain of 100dB. The power supply requires from 3V to 32V for single power supply or from $\pm 1.5V$ to $\pm 16V$ for dual power supply.

ii. *Light intensity control system components*

Motion sensor:

Motion sensor has an optical, microwave, or acoustic sensor. However, a *passive* sensor only senses a signal emitted by the moving object itself. Changes in the optical, microwave, or acoustic field in the device's proximity are interpreted by the electronics based on one of the technologies listed below. Motion detectors can detect in variable distances depends on their cost. In this project we use passive inferred ray motion sensor to detect the arrival of vehicle.

Relay switch:

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. Many relays use an electromagnet, but other operating principles are also used such as solid-state relays.

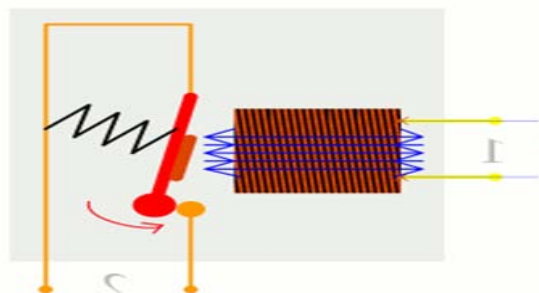


Fig. 4: Relay

IV. WORKING PROCEDURE

This circuit uses divider circuits connected as comparator; the output goes high when the trigger pin 2 is at lower than 1/3rd level of the supply voltage. Conversely, the output goes low increasing its power supply. So small change in the voltage of pin-2 is enough to change the level of output (pin-3) from high to low and high to low. The output has only two states high and low and cannot remain in any intermediate stage. It is powered by a 6V battery for portable use. The circuit is economic in power consumption. Pin 4, 6 and 8 is connected to the positive supply and pin 1 is grounded. To detect the present of an object we have used LDR and a source of light.

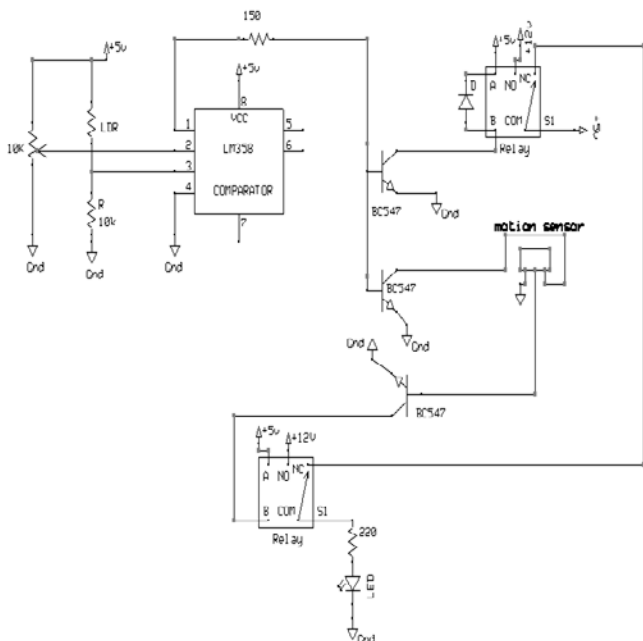


Fig. 5: Main circuit diagram of automatic light on-off and light intensity control.

LDR is a special resistance whose value depends on the intensity of the light which is falling on it. It has resistance of about 1 mega ohm in case of total darkness, but a resistance of only about 5k ohms when brightness illuminated. It responds to a large part of light spectrum. We have built divider circuit with LDR and 100K variable resistance connected in series. It is well known that that voltage is directly proportional to conductance. This divided voltage is given to pin 2 of IC 555. Sensitiveness can be adjusted by using variable resistance. As soon as LDR gets dark the voltage of pin 2 drops 1/3rd of the supply voltage and pin 3 gets high and LED which is connected to the output gets activated. When the switching circuit is activated, the motion sensor circuit will not work, so when light is fall in the LDR that means in day-night motion sensor will not work.

V. DESIGN ANALYSIS

The lamp power rating was 3 WATT and its working voltage is 12v.

The current rating of the lamps is calculated as follows:

$$I \text{ (amp)} = \text{POWER/VOLTAGE}$$

$$= 3 / 12 \text{ A}$$

$$= 0.25\text{A}$$

Therefore, the current rating used in lamps is 0.25A. The bulb number used is 20. Therefore, the current consumption of the lamps used = (0.25 x 20)A. I(amps) = 5. Since the current consumption used is 5A. A Relay of 10A contact current is used for the control circuit of the lamps.

Proper Selection of transistor for the Relay:

Since the voltage rating of the D.C. power supply used for the lamp is 12v. A. 12v D.C. Relay is selected for automatic switching ON/OFF. The coil resistance of the relay used is 82Ω. Relay working voltage = 12v, Resistance of the Relay = 82Ω Therefore, I(relay) = 12/82 A = 0.15 A

Since the current consumption used is 0.15A, a BC 547 transistor with collector current rating of 0.8A, collector to base voltage of 11v, collector to emitter voltage of 7v and emitter to base voltage of 4v is considered suitable to drive the relay used in the output of the control circuit.

VI. COST ANALYSIS

The present situation if the night time is 12 hours and the 300 lights are working under 220 volts, and the power of the light is 60 watts .the road distance consider 1 kilometer, the unit is calculated below

$$\text{Unit} = p \cdot T / 1000$$

$$= 60 \cdot 12 / 1000$$

$$= 0.72 \text{ Units per day per lamp}$$

Let the cost of electricity per unit is 5.50 taka then the total cost per month = 0.72 * 5.5 * 30 = 118.8 taka per month per light The Total amount for all light is = 118.8 * 300 = 35640 Taka Using automatic intensity control circuit The vehicle moves late night small number, so the lamps do not get voltage 220 volt all time .In small-town For the automated system lets consider 2 cases heavy traffic and very light traffic.

Case 1: Heavy traffic, the road is continuously having vehicles; power consumption will be,

$$\text{Total} = 0.72 \text{ Watts per month per vehicle}$$

$$= 216 \text{ watt per month}$$

$$\text{Total cost} = 35640 \text{ taka}$$

Case 2: Light traffic, a very few vehicles pass by this road, For a highway minimum speed can be considered as 30 kilometer per hour, So it will take 2 min to cover the stretch of 1km for light traffic of 100 vehicles it would take 200 minutes i.e.3 hours 20 minutes

$$\text{Unit} = 30 \cdot p \cdot T / 1000$$

$$= 30 \cdot 60 \cdot 4 / 1000$$

$$= 7.2 \text{ Units per month per lamp}$$

$$= 2100 \text{ unit per month for all lights}$$

$$\text{Total cost} = 7.2 \cdot 300 \cdot 5.5 = 11800 \text{ taka}$$

For Thus in any of the cases, the system in this paper is capable of saving electricity.

VII. CONCLUSION

This project is automatic street light control system. It is very economical because it is a very cheap budget project. So it can play an important rule to save energy consumption. As a product design engineer we are trying to analyze the product in such a way that it will

be less costly, good appearance, user-friendly, economical improved performance & after all satisfy customer's requirements. But our effort will be successful if the customers satisfy to get this project benefit. We think post survey is required among the customers to find out further improvement in design.

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