

Low Cost Automatic Street Light Control System With and Without Relay



B.Venkateshnaik, Yathish DP, Venkata phanidhar, A.Nagaraju, K.Lokeswar rao

Abstract: modern society entirely depends on electricity for daily life. It has become the key component for modern technology, without electricity most of the equipments which we are using daily will not work at all. Internet is our gateway for knowledge and we also depend on it a lot to get the things which are surrounding us very easily. Under this situation we are not using proper electrical energy in case of street lights. Street lights are perfect solution for night base loads at most of the utility companies during 1930's were seeking for night timed base loads especially coal based power plants. In India approximately 40 million street lights are there which will generates a total demand of 4000 MW. The cost required to satisfy this demand will also very high. In most of the places maintenance of street lights is very poor. Even though several technologies have used to automatic control of street light but they may turn into several failures because of high cost, improper maintenance, environmental effects on the components or some other major issues. In this paper a low cost maintenance free automatic street light control system is proposed which can be used with relay as well as without relay by using basic electronics components. A small experimental set up has done in laboratory and it can be concluded that the street light automatically turns on and off depends on the darkness of the environment. It can be implemented anywhere irrespective of environmental conditions without any maintenance.

Keywords: Light Dependent Resistor, BT136 TRIAC, DIAC DB3, Single Change over Relay Module

I. INTRODUCTION

India is a developing country, street light monitoring and control plays an important role for reduction in power wastage. In the application of street light technology proposed methodology give so many advantages like reduction in power wastages, manpower to control the street lights, healthy light intensity good capacity and mainly the cost of the proposed system is very less.

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So many technologies already have been proposed to control the street lamps. A TRIAC controlled energy efficient dimmable light emitting diode driver technology has invented where the street lights are controlled by microcontroller programming [1].

By considering the environmental conditions like rain, wind, humidity, temperature, pressure and movement of vehicles an automatic street lights can be controlled by using wireless sensor network [2]. A wireless sensor network technology has developed where the street lights are controlled by using raspberry pi which will works depends on the traffic level and darkness [3]. With the help of GPS the real time data collected for a particular Date and time, micro controller based on locality, results also based on sunset and sunrise times it will automatically switches off and on the street lights [4]. With the help of DC DC converter, by making use of output of solar PV and condition of traffic the traffic signal can be controlled automatically [5]. Energy generated by non conventional method can be used for street lights and this will be controlled automatically by using microcontroller programming [6]. By combining multiple sensors, modern street light intelligent control system has designed where the street lights controlled by ore setting the on and off time [7]. Automated control of street lights in urban areas can be build by SPI communication with the help of dual core architecture [8]. A microcomputer which is having single chip can be used to design a street light control system which performs multiple functions like time cut out and time cut in function for this it uses digital clock, timer, LCD display [9]. A program has been written for micro controller to enable manual free operation of the street lights,, which uses there sensors to sense the humans and vehicles, light and LED arrays[10].

II. PROPOSED MODEL

In this project we have used very simple and low, cost components to control the street lights automatically. No need to write any program, no need to have any micro controller or micro computer. Simple electronics devices like BT 136 TRIAC, 220KΩ resistor, light dependent resistor and bidirectional DIAC DB3.

A. BT 136 TRIAC:

It is an electronic switching device which conducts in both direction and can be used in switching applications. Fig. 1 Shows the symbol and pin diagram of BT 136 TRIAC. When we use this device to control the street lights it consumes less than 6A and can be efficiently controls the light.

So many ways are there to use the TRIAC as it is a bidirectional device, either by using positive or negative voltage its GATE can be triggered. This enables the TRIAC to operate in four different modes.

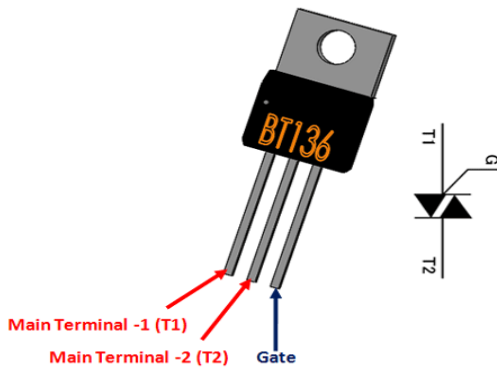


Fig. 1: Pin diagram and symbol of BT136 TRIAC

By using the switch the TRIAC can be turned on, when the switch is closed the AC supply will be given to the bulb, in order to happen this voltage greater than threshold voltage must be applied to the gate pin of the TRIAC. The TRIAC will turn on when the load current is greater than the holding current of the TRIAC. In our project we are using BT 136 TRIAC as switching device to control the street light.

Features of BT 136 TRIAC is,

- Maximum Terminal current: 4A
- On-state Gate voltage: 1.4V
- Gate trigger current: 10mA
- Max Terminal Voltage is 600 V
- Holding current: 2.2mA
- Latching current: 4mA
- Available in To-220 Package

B. LIGHT DEPENDENT RESISTOR

It is resistor whose resistance varies with the amount of light incidence on it, which is if light intensity on it high than its resistance will decrease and vice versa. A light dependent resistor and its symbol is shown in fig 2. It is also known as photo resistor, photocell or photo conductor. Circuits used in light or dark places the light dependent resistor are having plenty of applications. LDRs having varieties of resistance, based on these resistance it performance many functions. for example a light can be turn on in darkness and can be turned off during day time with the application of LDRs variable resistance property. A circuit can be turned on when the LDR is in light and a circuit can be turned off in darkness. Many high resistance semi conductive materials are used to manufacture the light dependent resistor. Very few electrons even though they are free to move, they can't Move because they are attached to the crystal lattice that's why light dependent resistor are having very high resistance. When lights falls on them semi conductive materials in the LDR absorbs the light photons and the energy present in the photons is transferred to the electrons and theses electrons comes out from the crystal lattice, starts electricity conduction

and its resistance decreases. In our project LDR is used to detect the intensity of the sun light.



Fig 2: Light dependent resistor

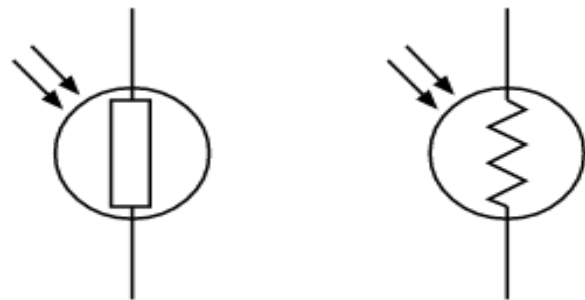


Fig 3: Symbol of light dependent resistor

C. BIDIRECTIONAL DIAC

Diode for alternating current that is nothing but DIAC, starts conducting after it reaches the break over voltage. A symbol of bidirectional DIAC is as shown in fig 4 below. It is having two electrodes between which two diodes are connected in anti parallel. Third electrode that is gate electrode is absent which is used to trigger like in case of TRIAC. By minizing the voltage level below its avalanche breakdown. A transistor which is having no base is also called as DIAC. Sometimes they will work even though avalanche breakdown occurs. Whether we apply positive voltage or negative voltage the DIAC can be turned on and off easily. In our project the DIAC is used to trigger the gate of the TRIAC.

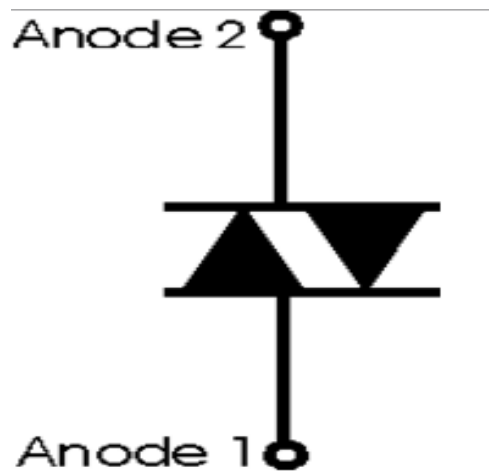


Fig 4: Symbol of light dependent resistor

D. SINGLE CHANGE OVER RELAY MODULE:

When current passes through a relay exceeds the pickup value, its changes its contacts and trips the circuit. Single change over relay module and its symbol is as shown in fig 5 and 6 respectively. A relay will be having two contacts that is normally closed (NC) and normally opened (NO) contacts, depending the required conditions it will make use of these contacts. A single change over switch is nothing but which is having one normally closed contact and one normally open contact. Power supply can be extended to the apparatus and coil can be energized by using normally closed (NC) contact. Common point will comes to normally open contact from the normally closed contact if the relay coil de-energizes. So in this way the relay will acts as a single change over relay module. In this project single change over relay can be used as switch instead of TRIAC and DIAC.



Figure 5: Single change over relay module

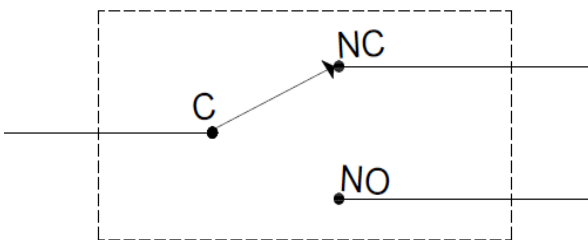


Figure 6: Symbol of single change over relay

AUTOMATIC STREET LIGHT CONTROL SYSTEM WITHOUT RELAY:

The connection diagram shown in fig 7 below gives an automatic control of street lamp without relay. As TRIAC is having three terminals gate, T1 and T2 the one terminal MT1 of DIAC is soldered with gate of the TRIAC. A 220kΩ resistor is soldered between terminal T2 of the TRIAC and terminal MT2 of the DIAC. A light dependent resistor which is used as light detecting sensor is soldered between gate terminal of the TRIAC and terminal T1 of the TRIAC. The input terminal of the 230V AC supply is connected to terminal T through bulb and output of the 220V AC supply is connected to the terminal T2 of the TRIAC.

During night time the light on light dependent resistor is zero that is the LDR is covered by darkness. As the input of the AC supply is connected to MT1 of TRIAC and LDR through bulb the gate of the TRIAC will not triggered because of the high resistance possessed by the light dependent resistor so the bulb will glow during night time easily. In the morning as the light intensity on the light dependent resistor increases the resistance will decreases and the gate will get triggered. As the gate triggers the circuits will gets closed by following the path through MT2, 220kΩ, bidirectional diode, LDR and GT1 of the TRIAC and path through bulb will gets opens, so

the bulb in the morning will get off automatically. Even though small current flows through LDR in the evening because of presence of DIAC the gate will not trigger because the DIAC might not having the sufficient breakdown voltage. The 220KΩ resistor is used as a current limiting resistor, to protect other devices in case of over current flows through in the circuit. This is the way how the street light can be turned on and off automatically without relay.

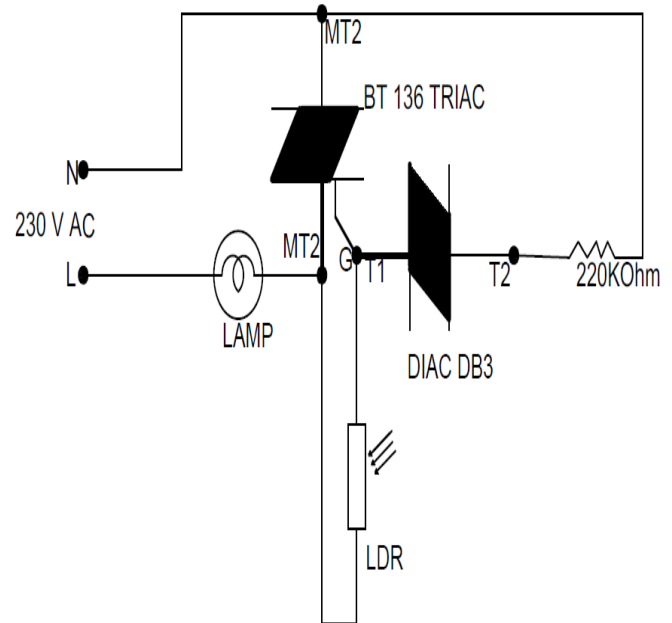


Figure 7: Automatic control system without relay

AUTOMATIC STREET LIGHT CONTROL SYSTEM WITH RELAY

Circuit diagram shown in fig 8 below gives an automatic street light control system with relay. Here we are not using any electronics elements like TRIAC and DIAC except LDR. Instead of this we are using a low cost single change over relay module and light dependent resistor to sense the light intensity. Initially the common point of the single change over relay will be in touch with the normally closed contact of the single change over relay module. In the night time due to darkness the resistance of the light dependent resistor is very high, this blocks the supply to the relay module, so the relay will not sufficient voltage to trip, hence the common point of the relay in touch with the normally closed contact and the bulb will glow in the night time. In the morning, the light dependent resistor senses the light intensity so its resistance starts decreasing. Because of less resistance of LDR in the morning, supply goes to relay module and hence relay will trip. When the relay trips the common point leaves the normally closed (NC) contact and touches the normally opened (NO) contact hence the bulb will off. This is the way to control the street light with relay.

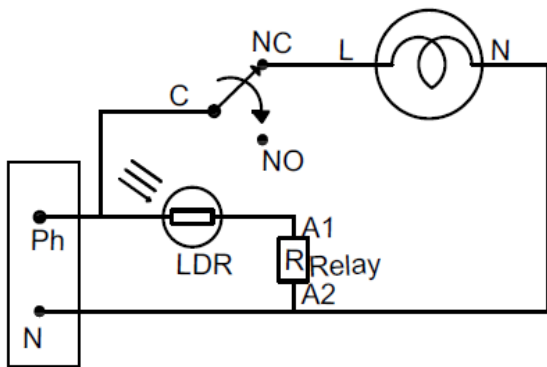


Fig 8: Automatic control system without relay

III. RESULTS AND CONCLUSION:

As we all know that one unit of energy saving is equal to 100 units of energy generation, it means we should avoid wastage of electric energy. In India till today the street light controlling is done by either manually or by using timer but both are inefficient energy control systems. Huge amount of electric energy waste is occurring in India just because of inefficient control. Even though some technologies have adopted here and there, but not efficient control systems or not applied everywhere just due to high cost of installation at each and every pole. Both proposed methods have tested in lab and any one among these two methods can be implemented to each and every pole at low cost, having long life and efficient control of street light can be performed

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