

## International Journal of Innovative Research in Science, Engineering and Technology

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# A Survey on Automatic Street Lighting System on Indian Streets Using Arduino

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**ABSTRACT:** As we all know that our Indian street lights are not automatic hence by the carelessness of the operator or say by some other problems, lights are kept continuously 'ON' even there is no need of any street light on the streets. Like in summer days we came to see many times that the lights are switched on even during the day which is the total wastage of electricity. An attempt has been made in this paper to proposed system which is totally automatic and we do not need any manual operator for controlling the lights. Hence to save energy this system can be implemented. This system has a potential to replace India's current street lightning system. This system is based on arduino controller, a LDR(Light Dependent Resister) which sense the intensity of the sunlight and gives input to the Arduino. The street lights will be switched 'ON' and 'OFF' based on the intensity of sunlight. A prototype model of Indian streets is prepared and amount of energy saved is calculated.

**KEYWORDS:** Energy conservation, Arduino, automatic street lights, LDR ,Future Indian Streets.

## I. INTRODUCTION

We see automatic things everywhere now a days because we are leading towards the development. For an developing country energy conservation is the main need. But we are wasting energy through many means. On Indian streets the lights used are of Sodium Vapour which all are of high wattage. It is difficult to change all the lights hence through this paper we are proposing a system which is very economical and require less time to change the current system. In this system arduino is connected to LDR for the input ,LDR will give input to the analog terminal of the arduino and then according to our code arduino gives the proper output. This is a simple and economical system which helps us to conserve electricity. The main motive of this system is to save electricity of our country as well as the man power. In this project we are making a prototype of the national highway no. 06 , Jalgaon, India in which we are using a Arduino Uno, LDR, Resistors, and LEDs which represent the street lights in the prototype. Here we are not using any relays or ULN IC because we are controlling only LEDs . But when we control 230V lights we have to use Relays. The circuit diagram for the same is also shown in this paper.

## II. LITERATURE REVIEW

The system used here is a closed loop on-off system..Controlling lighting system by means of LDR and Arduino together on Indian streets is relatively a new concept.Still today research has been done only on street light system based on Passive Infrared receiver and few are LDR based but they are controlled by means of timers and analog circuits. Some were controlled by wireless GSM/GUI networks which are too costly and not affordable.The disadvantages of current system used are :

1. Need a manual operator to operate the lights on the street.
2. Switching time is same in all climates.
3. There are many streets on India where Lights are kept 'ON' even during the day. Energy is wasted due to this carelessness.

Hence by using arduino and LDR system considerable amount of energy can be saved.

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### III. HARDWARE AND SOFTWARE COMPONENTS USED

Hardware Components	Software Required
1. Arduino Uno R3	1. Arduino IDE (For Arduino board programming)
2. Light Dependent Resistor (LDR)	
3. LEDs	
4. Resistors	

### IV. HARDWARE DESCRIPTION OF COMPONENTS

#### A. ARDUINO UNO R3

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

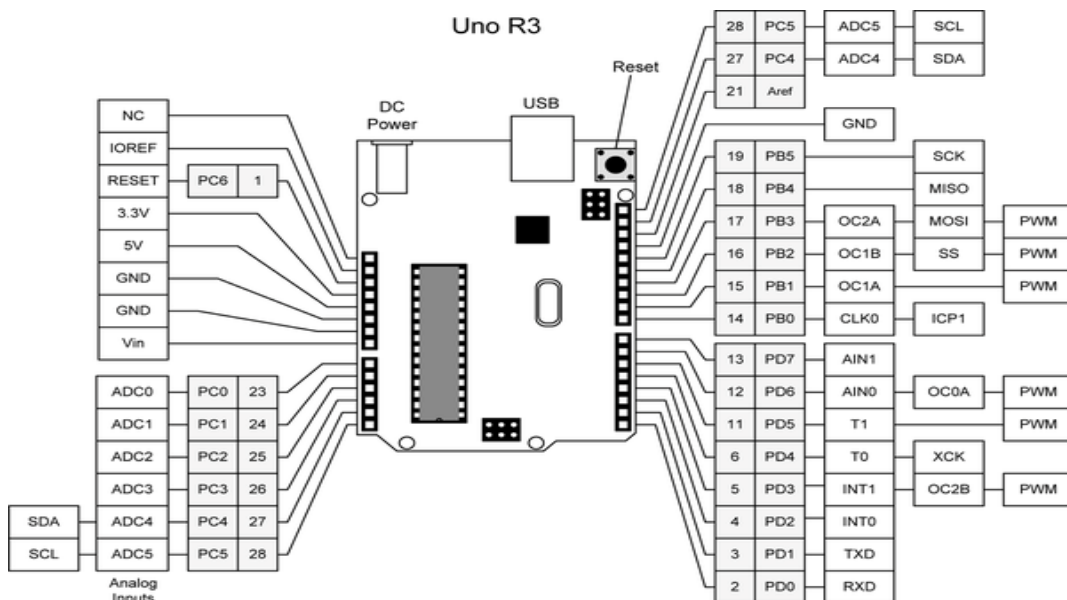


Fig1. Pin Diagram of Arduino Uno R3 board.

#### B. LIGHT DEPENDENT RESISTOR (LDR)

Light Dependent Resistor as the name suggest the resistance is dependent upon the light incident on it. The light dependent resistor's resistance changes with intensity of light, with increase in light intensity the resistance offered by the sensor decreases and with decrease in light intensity the resistance offered by the sensor increases. Hence it acts as variable resistor with change in light intensity. These helps in finding the amount of light intensity at that instant of

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time and thus helping in regulating the lighting of our lighting system accordingly. It is connected to the analog input of the arduino through which we are going to read the intensity of the light.

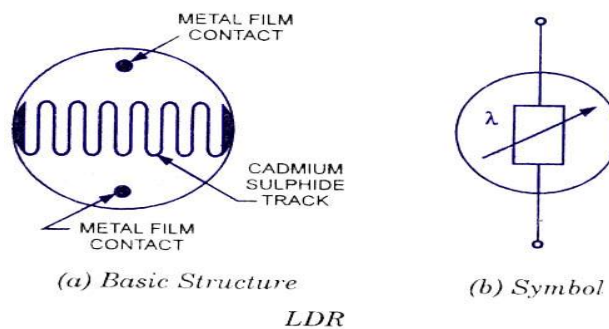


Fig 3: Basic structure and Symbol of LDR.

The snake like track shown in fig 3 is the Cadmium Sulphide (CdS) film which also passes through the sides. On the top and bottom are metal films which are connected to the terminal leads. It is designed in such a way as to provide maximum possible contact area with the two metal films. The structure is housed in a clear plastic or resin case, to provide free access to external light. There are many different symbols used to indicate a LDR, one of the most commonly used symbol is shown in the figure 3. The arrow indicates light falling on it.

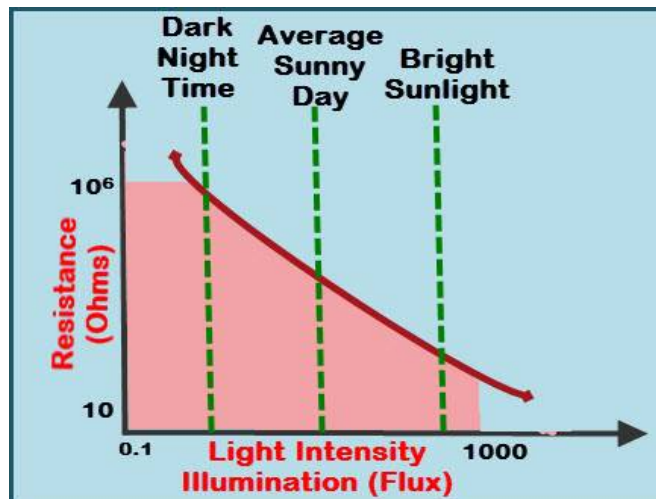


Fig 2: Resistance (Ohms) Vs Illumination (Flux) graph.

When a light dependent resistor is kept in dark, its resistance is very high. This resistance is called as dark resistance as shown in the above graph. It can be as high as  $10^{12} \Omega$  and if the device is allowed to absorb light its resistance will be decreased drastically. If a constant voltage is applied to it and intensity of light is increased the current starts increasing.

### C. LEDs

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p-n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electro illumination, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm<sup>2</sup>) and integrated optical components may be used to shape

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the radiation pattern. In this system for street light prototype we are using LEDs. For controlling main street lights we have to connect Relay and an ULN 2003 IC to the arduino.

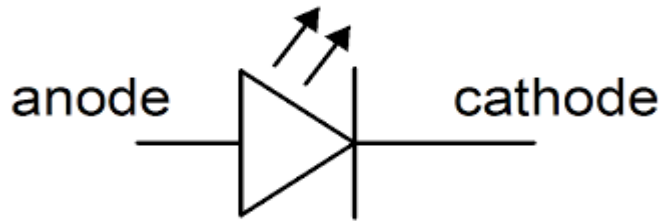


Fig 4. Symbol of LED.

## V. CIRCUIT CONNECTIONS

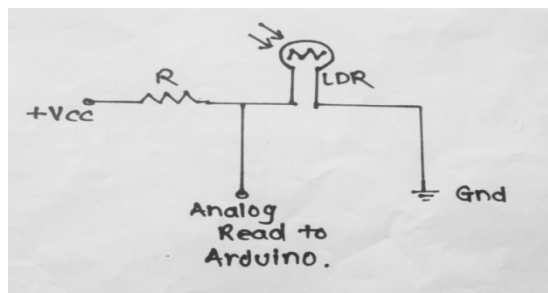


Fig 5. Circuit diagram to connect LDR with Arduino.

A LDR is connected to VCC through a resistor and that terminal will be the input for the arduino. This terminal is connected to the analog input of the arduino. As we know LDR will give analog input hence it will be connected to the analog terminal. The other terminal of the LDR is connected to ground. In this way I connected LDR with the arduino. Then the output of the arduino will be digital as this system is just on-off system hence we need our output as digital. Therefore all the LEDs will be connected to a single terminal of arduino digital output.

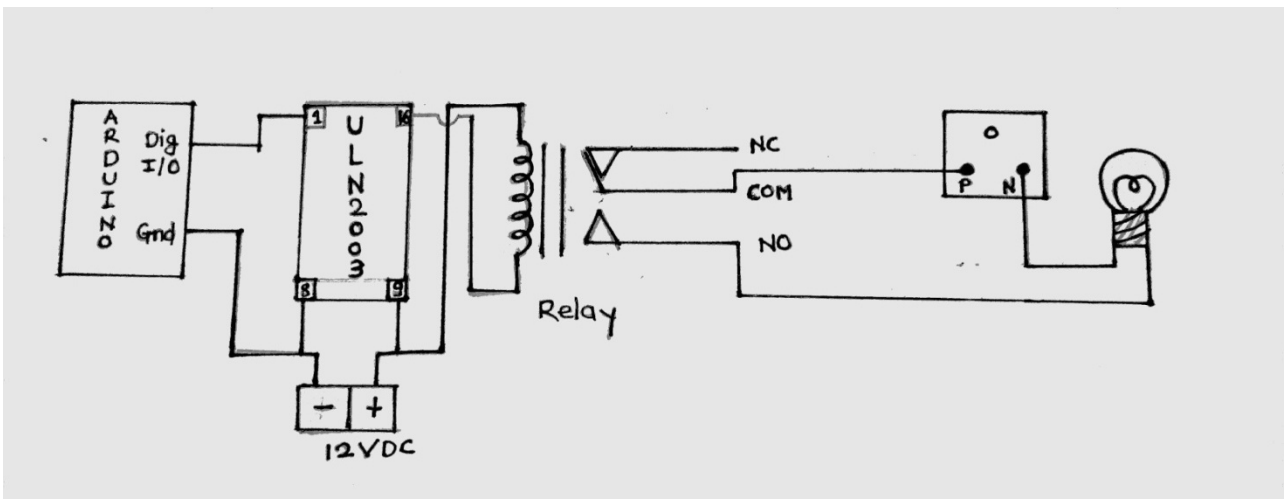


Fig 6. Circuit diagram for actual model using relay and ULN2003

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The above circuit is the actual circuit which should be implemented for controlling the 230V AC lights. The figure shows that the digital output of arduino is connected to pin no. 1 of ULN2003 IC and ground of both arduino and ULN are shorted. The 12V supply is required for controlling the relay which is given through the ULN. And our final control element is connected to the relay through 230V AC.

### VI. WORKING PRINCIPLE

This system is very simple and economical system. LDR has the property to change its resistance according to the intensity of light. When a light of high intensity falls on LDR its resistance decreases and when it goes below our set point value arduino switches 'OFF' the light. When the intensity of light decreases the resistance increases and when it crosses the set point value our controller switches the light 'ON'. In this way our system works as automatic street light control.

### VII. CALCULATIONS

The timing of switching the street lights of Indian streets 'ON' is 17:00 pm to 07:00 am generally. But we don't need lights when there was sunlight. Hence this automatic system will switches the light according to the sunlight. Calculations for amount of energy to be saved by using this system is shown below. Consider only 2 hours per day each street light is kept on as a wastage. As per a survey conducted by me the street lights used on the Indian streets are of Sodium Vapour. The Sodium Vapour lights are of 400 Watts each.

Note: The below calculations is for only 50 street lights of India.

Bulbs = 50

Wattage=400/bulb

Wasted Hours =2 Hours/day

Energy Wasted

= 50 x 400x 2

= 40,000 WH/day

=40 KWH/day

Energy Wasted Per Month

= Energy Wasted Per Day \*30

= 1200 KWH/month

Energy Wasted Per Year

= 1200\*12

= 14,400 KWH/Year

This amount of energy can be saved only by automating 50 lights.



Picture of Indian street light which is 'ON' in afternoon  
Picture Credits: Amul Jalan.

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## VIII. CONCLUSION

Advantages of proposed system on current system

1. There is no need of any manual operator as the system is fully automatic.
2. Switching time changes according to the climate i.e. in summer lights where switched on at 19:00 pm and switched off at 6:00 am and timing also changes in winter and rainy season, hence as it is a closed loop system output will change accordingly.
3. Energy is Conserved.

However, with the help of this system we will conserve energy which indirectly leads our country to the development. This system is economical and easy to implement and replace the current system. This circuit is totally based on arduino which here works as a micro-controller using the input from LDR. This system can be easily implemented on our Indian streets which needs this type of system as soon as possible.

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