INTERNSHIP REPORT

IOT BASED AUTOMATIC STREET LIGHT SYSTEM USING ARDUINO UNO AND LDR SENSOR

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This Report is submitted to the Upskill Campus- Internship in IOT as a weekly progress report

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IOT based Automatic Street Light System Using Arduino

Preface:

During the first week of the internship, I selected the "IOT based automatic street light system" as a project. I have prepared a flowchart/algorithm based on the project. Also, mentioned about the overview of the problem statement, solutions and its pros and cons.

In the second week, I specified the 2-D visualisation and working of the system by using the block diagram architecture of the automatic street light system using Arduino and LDR sensor. Also shown the prototype for better visual understanding of the model.

Moving in the third week, I started further implementation of the project based on the algorithm and the architecture from the previous researched work. Implementation of the proposed system, required hardware and software in the project and also its working.

In the fourth week, I have done the assembly of the components or hardware with the software and the system. Code was run on the Arduino software to check its performance and working. The Simulation of the system was performed.

By the fifth week, I shifted my attention towards checking the performance of the 'Automatic Street Light system'. I conducted test to evaluate the speed and efficiency of the system. I also performed testing on individual hardware, software and the whole system together.

After the successful testing of the system, I got the desired output of the project that I have prepared on the domain "Automatic Street Light System" based on IOT and using Arduino and LDR sensor. The output was as follow, the LED glows up when it is dark and turn OFF when there is enough intensity of light, automatically. Saves the energy.

Introduction:

In today's modern world the development in transportation system plays a vital role. It consists of roads, streets, highways etc., these pathways must be illuminated brightly with the help of several types of glowing bulbs or LEDs. The main purpose of providing the light to these highways, roads or street is to provide safety to the vehicle and number of persons crossing these paths and prevent them from any mis happening or accident. Another purpose of providing lighting to these places is that during the night times when a smaller number of vehicles passes the road. the pedestrian can easy crosses the roads without feeling any darkness on the road. But, for providing large amount of illuminations, huge amount of electricity is required which causes high cost. The main reason behind the high cost is due to the continuous glowing of lightning for more than 12 hours a day. So, for reducing the electricity cost and preventing the high cost there is a need to develop a system that is autonomous Therefore, this project deals with the system that is autonomous, it means that if there is a presence of darkness on the streets, the light must be automatically turn ON and during the presence of enough light, the LED should be automatically turn OFF.

Sometimes, it is also observed that in some places the street lights are turned ON even when there is enough light at late evening and till late morning, this increases the cost of electricity unnecessarily. This system will reduce the consumption of electricity by street lightning system by 30 to 40 %. Conventionally, there the street lighting systems were switched on and switched off manually with the help of some personnel which takes much human efforts and consumes high amount of electricity. Hence, this paper proposes automatic switching system for street lightning. The proposed system is also effective in detecting the faults in street lightning system without actually going physically for inspection.

Problem Statement:

Street Lights are the one of the huge energy expenses for metropolitan cities like Delhi, Gandhinagar and others. Usually there is manual control system where the street lights will be switched ON in the evening before sunset and switch OFF after the early morning even though there will enough sunlight. This leads to the wastage of energy in huge amount across the whole country. Also, becomes more expensive and requires more manpower to monitor the system.

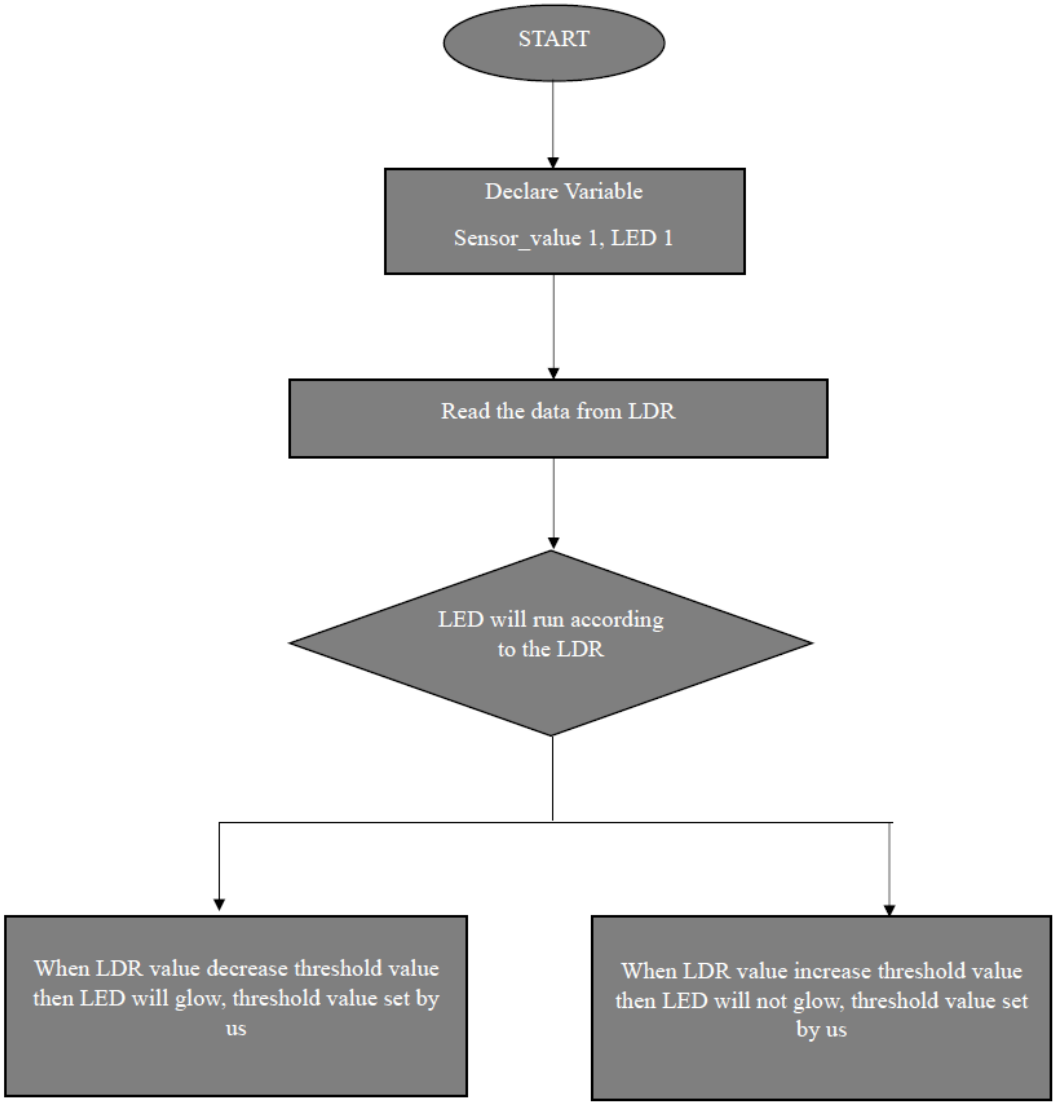

Fig. 1. Flowchart

Proposed System:

The proposed automated system is cloud based that includes automated data update for system lighting. Cloud computing was used to store and monitor a huge amount of data and during an emergency it even reads information from the base station. The Arduino UNO is utilized as brain to control the street light system, where is the programming language used to develop the program to the microcontroller. Arduino UNO is used to wirelessly transmit data from the base station to the lighting system enabling for efficient street lamp control. LDR sensor is used to indicate the light frequency of a day/night. Lastly, the system was successfully designed and can be used as a model system.

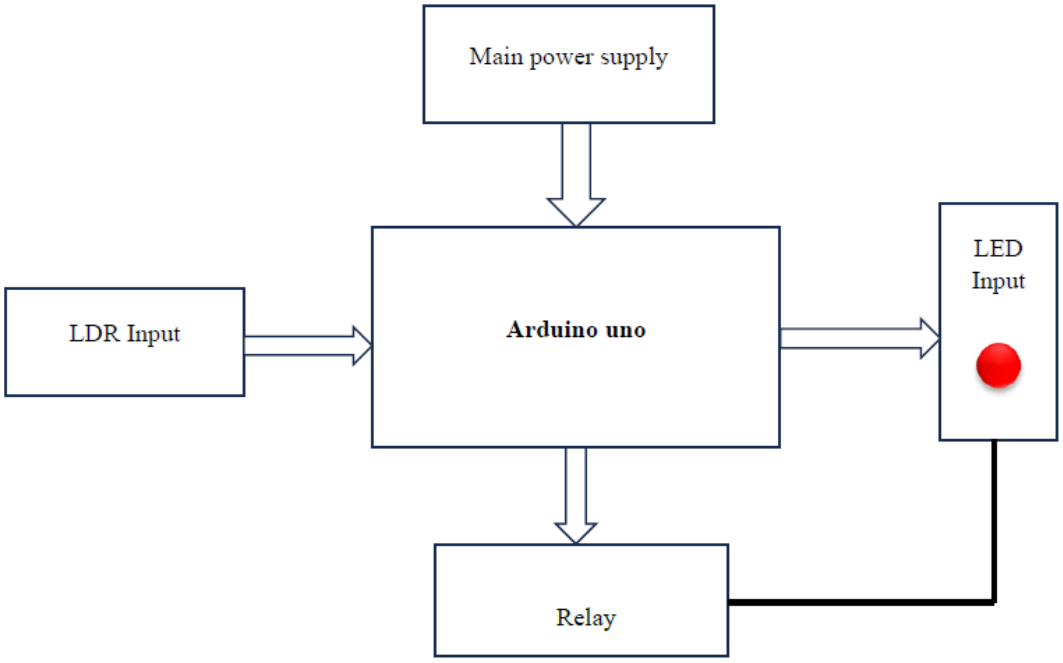

Fig. 2. Block Diagram

Fig.2 represent the block diagram of proposed system and comprises of a main power supply for providing power to the system, a sensor for detecting the presence of an object, a light dependent resistor (LDR) for detecting the presence of light, a microcontroller for receiving the signal from both the sensors and control the system accordingly, a dual power

supply unit for providing power to integrated chip embedded inside the micro controller and LEDs. The proposed system is designed in such a way that during day light time when there is no need of street light, the system will remain in turn off condition even after the system is connected to the power supply. During night time when sun is set. the LDR will sense the intensity of light and sends the signal to microcontroller for turning ON the street lightning system. he switching of LED is controlled by LDR sensor depending on day and night. If LDR detects day time then street light is turned off and if no light is detected i.e., during night time the street light is turn ON. After the light is turn ON the light intensity is controlled by infrared sensor.

Hardware Specifications:

Power supply:

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other type of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. This power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the main is 230V/50Hz which is an AC voltage, but the required is DC voltage with the amplitude of +5V and +12V for varies applications.

LDR Sensor:

Photo resistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light

intensity. The sensor that can be used to detect light is an LDR. Since the LDR give out an analog voltage, it I connected to the analog input pin on the Arduino.

The Arduino, with is built-in ADC (analog-to-digital converter), then converts the analog voltage (from 0-5 V) into a digital value in the range of (0-1023).

LDR is a sensitive device, whose resistivity factor is an electromagnetic radiation function.

Consequently, they are light sensitive devices similar to those of human eyes. LDR operates on the optical conductivity standard as well as monitored by Arduino UNO.

Fig. 3. LDR Sensor

LED Sensor:

LED is lamp which is used for energy savings. Currently, many developed countries are committed to converting their cities into partially smart cities by introducing an energy-efficient street lighting system by using a set of LEDs in poles can be illuminated at night. Moreover, by turning on / off the LED at very high speeds reduce waste energy. LEDs have demand, which means they will only light up if we align the legs accurately. The long leg is often positive and should connect to a digital pin on the node MCU. The short leg should connect to GND. The bulb of the LED will also mostly have a flat edge on this side.

Fig. 4. LER Sensor

The use of LED light in street lightning system instead of conventional bulb ha the following advantages:

i. The LED has longest life as compared to the sodium bulbs.

ii. The LED takes fewer seconds to start whereas tube light takes longer time to start.

iii. The brightness of LED can be controlled very easily.

iv. It takes very less amount of power therefore reduce the energy consumption rate.

v. LED is not affected by power supply fluctuation.

LEDs use much less energy than incandescent bulbs because diode light is much more efficient, power-wise, than filament light. LED bulbs use more than 75% less energy than incandescent lightning. Another advantage of LEDs is the “hassle factor”. LEDs last a lot longer than a regular bulb.

Resistors:

A resistor is a passive electronic component, used with other electronic components such as LEDs and sensors to prevent or limit the flow of electrons through them as illustrated in Fig. 1. It works on the principle of Ohm’s law which prevent overflow of voltage.
For this very simple DIY Arduino project we need: A breadboard, an Arduino (whatever is handy), LED (Light Emitting Diode), LDR (Photoresistor), a 10K resistor for creating the voltage divider and a 220ohm resistor for the LED few breadboards friendly connecting wires and a USB cable to upload the code to the Arduino.

Software specification:

Arduino IDE:

Arduino UNO is an open-source platform, hardware and software. Arduino panels can read inputs sensor light and convert it to output on Light Emitting Diodes (LED) operation, publishing something on the Internet. Arduino IDE **(**Integrated Development Environment) is

utilized to load programs into Arduino boards and these microcontrollers can be used to perform tasks as dedicated in figure 5.

The Arduino Software (IDE) makes easy to the code and upload it to the board. It runs on the different platform Windows, MAC OS, Linux.

Arduino is common term for a software company, project and user community that design and manufactures computer open-source hardware, open-source software and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on microcontroller board designs, produced by several vendors, using various microcontroller. These systems provide set of digital and analog I/O pins that can interface to various expansion board (termed shield) and other circuits. The board feature serial communication interface, including Universal Serial Bus (USB) on some model, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named processing, which also supports the languages, C and C++. The UNO is a microcontroller board based on the ATmega228P. It has 14 digital I/O pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

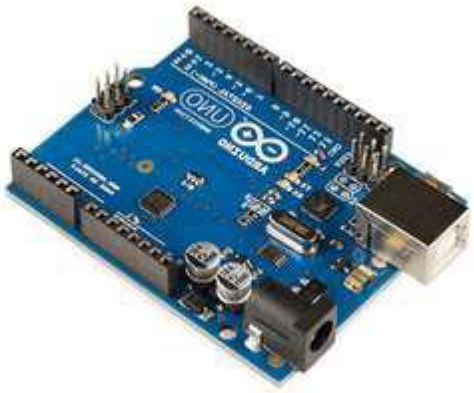

Fig. 5. Arduino

Implementation:

The parts that are utilized in the proposed system are as follows; The lamp module is the first part which is consists of the movement and brightness sensors, the communication and control device. Sensor module is the next part which composed LDR sensors utilized to detect the light. In the daytime, the resistance decreases and the LDR sensors are turned off. Therefore, when there is enough light or the light intensity I higher than the threshold value, the lights not turn on. In order to the resistance LDR only be high during the night. When the street is dark at night, the resistance increases and the LDR is turned on, so the light turns on. These sensors are monitored by Arduino UNO which can be supplied power by solar cells. Nowadays, there are high communication standards for data rate available in the world of communication, but none meets the needs of sensors and controllers. For limited bandwidth, communications technologies with a massive data rate necessitate low power consuming and low latency.

The Arduino UNO system unit is the simplest and little cost used by other wireless sensor networks such as Bluetooth and Wi-Fi. If either IR or LDR sensors are detected to discover the movement or value of light, Arduino sends the value through the sequence (TX) and receives it (RX) to the node, each sensor detects and transmits this data to the controller.

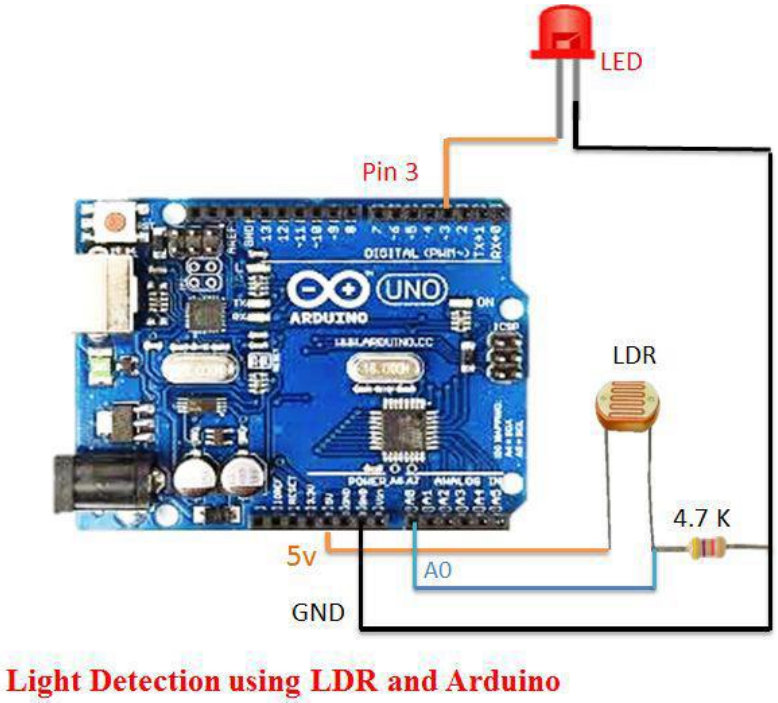

Fig. 6. Implementation

Assembly:

1. Connect the 3.3v output of the Arduino to the positive rail of the breadboard.
2. Connect the ground to the negative rail of the breadboard.
3. Place the LDR on the breadboard.
4. Attach the 10K resistor to one of the legs of the LDR.
5. Connect the A0 pin of the Arduino to the same column where the LDR and resistor is connected (Since the LDR gives out an analog voltage, it is connected to the analog input pin on the Arduino. Arduino, with its built-in ADC (Analog to Digital Converter), then converts the analog voltage from 0-5V into a digital value in the range of 0-1023).
6. Now connect the other end of the 10K resistor to the negative rail and the second (free) leg of the LDR to the positive rail.
7. Place the LED on the breadboard.

8. Connect the 220ohm resistor to the ling leg (positive) of the LED.
9. Then we will connect the other leg of the resistor to pin number 13 (digital pin) of the Arduino and the shorter leg of the LED to the negative rail of the breadboard.

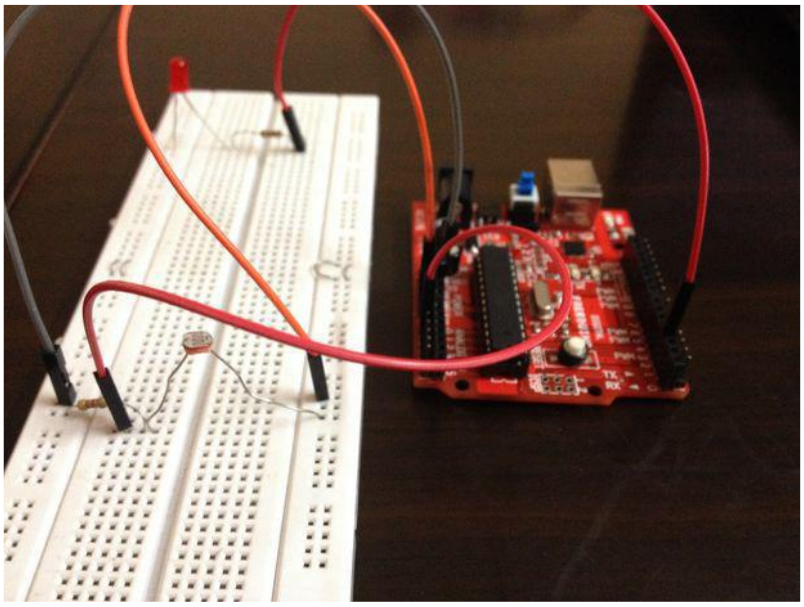

Fig. 7. Assembly

Code:

```
//Automatic Street Light with LDR//


#define sensorPin A5
#define light 2


int sensorValue;


void setup()
{
  pinMode(led,OUTPUT);
  pinMode(sensorPin,INPUT);
}
```

```
void loop()
{
  sensorValue = analogRead(sensorPin);

// check if it is dark then switch on the light else let it remain off

  if (sensorValue <100)
  digitalWrite(light,HIGH);

  else
  digitalWrite(light,LOW);
}
```

Testing:

In this circuit, LDR and 10Kohm resistor form one potential divider pair, which is used to provide a variable voltage at the non-inverting input (that is Pin 3). The second potential divider is built around inverting input (Pin 2) with the help of 10Kohm potentiometer, which will supply half of the supply voltage to inverting pin.

As we know the property of LDR that during the day time, its resistance is low, the voltage at the non-inverting input (i.e., pin 3) is higher than the voltage at the inverting input (pin 2). Hence, the output at the pin 1 is high. As a result, the LED (or the bulb) will not glow. But in dimness or at night time, we know that resistance of LDR is high. Hence, the voltage at non-inverting input pin 3 of the IC decreases than the inverting input pin 2. As a result, the output pin 1 moves to low state, which further makes the LED or bulb associated to it will glow.

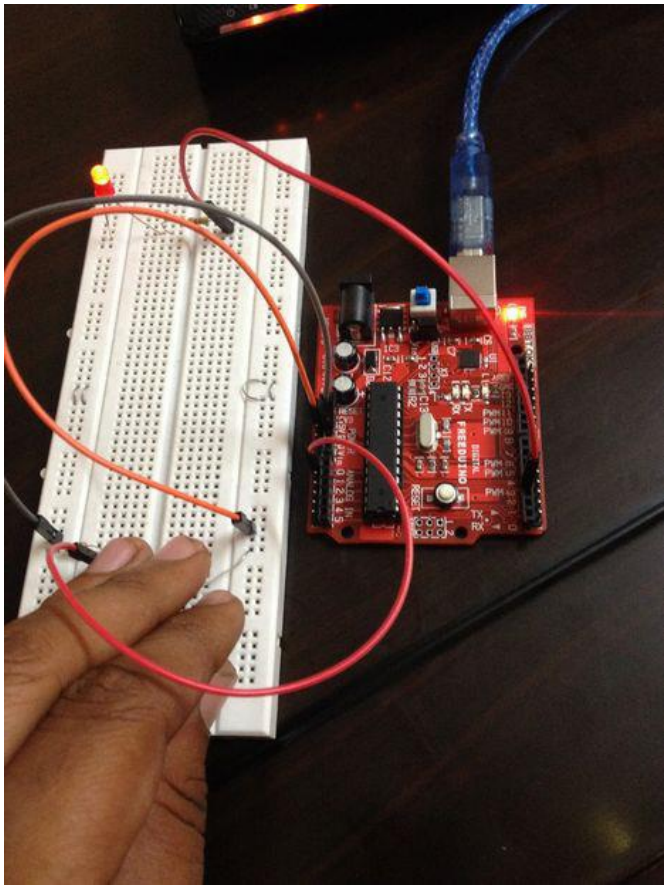

Fig. 8. Testing

Result:

- Results are displayed on the serial window.
- When there is low amount of light the light automatically glows and when there is sufficient amount of light it automatically turns off the light.
- Here based on our room condition the threshold value we took is 100 for the LDR sensor.
- When we place a hand on LDR (Not allowing any light on LDR) Arduino automatically turns on the LED.
- When we remove our hand on LDR. Arduino automatically Turns Off LED.

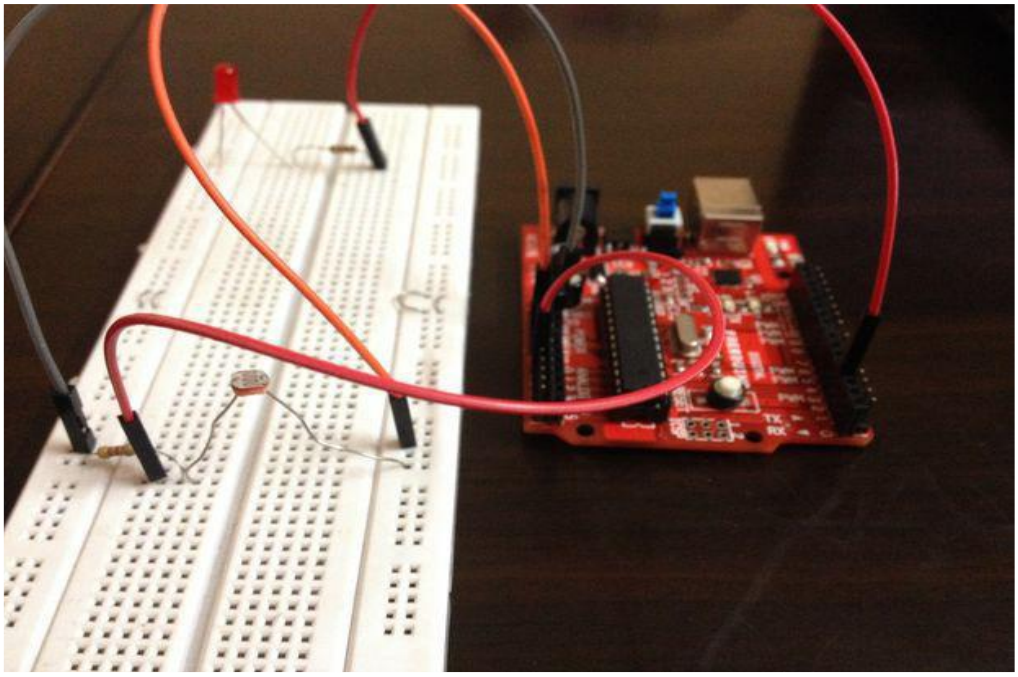

Fig. 9. Result: LED Turns OFF

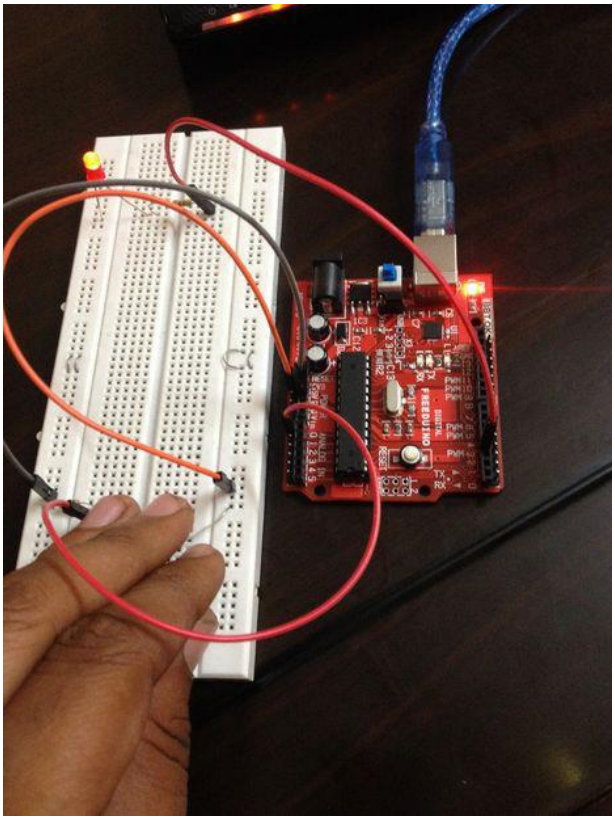

Fig. 10. Result: LED Turns ON

Advantages:

- ✓ Completely remote based or automatic system
- ✓ Useful for energy saving
- ✓ Reduce greenhouse gas emission
- ✓ Reduces Human efforts
- ✓ Cost effective
- ✓ Upgraded technical system using IOT
- ✓ More sensors can be connected such as Li-Fi or inclusion of AI can make the system more effective.

Disadvantages:

- ✓ The automatic street light system requires a higher initial investment compared to the conventional street lights.
- ✓ Risk of theft of the automatic street light system is much higher since they are non-wired and much expensive.
- ✓ Rechargeable batteries of the automatic street light system is required to be replaced a few times which is time consuming and is a difficult management process.
- ✓ Automatic street light may not switch on and off on the needed time that means more accidents may happen and more costs may be spent.
- ✓ These lights are mostly being affected by the weather conditions due to air, thunder, etc.

Future Scope:

Today's existing system is controlled manually, which leads to various inefficiencies. Every time the human is responsible to look after the controlling of the system personally go to the workplace and manage all the activities like ON/OFF the street lights. Today's Street light system is not flexible, biggest problem is to handle remote area locations and manual mistakes results into power wastage. This facilitated the idea to develop a smart system which could minimize the human intervention. The proposed system will be controlled using an android application which there by minimizes the human intervention also the labour cost needed to operate the system. The system efficiently manages the ON/OFF of lights in turn making efficient utilization of energy avoiding wastage which is the case in existing system. Various patterns are being designed to ON/OFF the lights depending upon the traffic conditions thus focusing on reduced energy wastage. We are also taking in LDR sensor in our consideration for this project in future. So that intelligent street light can detect daylight and vehicles and vary the intensity of the light-based street lamps as per the traffic flow.

Conclusion:

The proposed system describes that the new technologies offer ease of maintenance and energy savings and thus using IOT the above automatic street light system is designed. It is clearly observed that the street lights can be operate and controlled automatically using IOT. Hence, IOT is the leading path to the "smart" world and this smart street light system is one of its applications. Automatic street light system pits up a very user-friendly approach and could increase the power. After designing the circuit which controls the light of the street as illustrated in the previous sections. LDR sensor and the photelectric sensors are the two main conditions

in working the circuit. If the two conditions have been satisfied the circuit will do the desired work according to specific program.

Each sensor controls the turning ON or OFF the lighting column. The street lights have been successfully controlled by microcontroller. With commands from the controller the lights will be ON in the places of the movement when its dark. Furthermore, the drawback of the street light system using timer controller has been overcome, where the system depends on photoelectric sensor. Finally, this control circuit can be used in a long roadway between them.