DEPARTMENT OF ELECTRONICS AND COMMUNICATION
B M S COLLEGE OF ENGINEERING
(AUTONOMOUS COLLEGE UNDER VTU, BELGAUM)
BANGALORE – 560019

2020-2021

PROJECT REPORT

ON

MINI PROJECT 2020-21

AUTOMATIC INTENSITY CONTROL OF STREET LIGHTS USING ARDUINO

BY

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Under the guidance of
A P Pooja
Assistant Professor

DECLARATION

We undersigned students of pre-final semester B.E in Electronics and Communication Engineering, BMS College of Engineering ,Bangalore, hereby declare that the dissertation entitled "Automatic intensity control of street lights using Arduino ", embodies the report of my project work carried out independently by us under the guidance of A P Pooja , Professor, E&C Department, BMSCE, Bangalore. In partial fulfilment for the award of Bachelor of Engineering in Electronics and Communication from Visvesvaraya Technological University, Belgaum during the academic year 2020-2021.

We also declare that to the best of our knowledge and belief, this project has not been submitted for the award of any other degree on an earlier occasion by any student.

Place: Bengaluru

Date: 26 - Nov - 2020

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Title

Automatic intensity control of street lights using Arduino.

Introduction

The 21st century is striving hard to save electrical energy. We see automatic things everywhere nowadays because we are leading towards the development. For a developing country energy conservation is the main need. But we are wasting energy through many meansStreet lights are essential, but expensive and It is difficult to change all the lights hence through this paper we are proposing a system which is very economical and requires less time to change the current system. Therefore there is a need to optimize the system in a way that it is affordable and efficiently conserves energy. Manually controlling the street lights is a time taking and tedious process. Working in such a manner could sometimes result in large disasters and destruction. 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 requires less time to change the current system. The traditional light system has been limited to two options: ON and OFF only, which are not efficient because these kinds of operations meant power loss due to continuing to work on maximum voltage. With the negligence of the operator or by some other technical problems, streetlights are continuously kept 'ON', even when there is no light required on the streets and this leads to the wastage of electricity. Hence, the wastage of power from street lights is one of the noticeable power losses, but with the use of automation, it leads to many new methods of energy and money saving. Thus Automation systems comes into place and have the advantage over the manual systems because it increases the productivity, efficiency and reliability, and minimizes the usage of resources to save energy, and reduce the operating cost etc. These automation systems play an essential role in the term "smart home" to make our daily life more comfortable, and to facilitate users from ceiling fans to ovens, and in other applications. Among all exciting applications, streetlights play a vital role in our environment and also play a critical role in providing light for safety during night-time travel. In this scenario, when the streetlights are in a working position over the whole night, which consumes much energy and reduce the lifetime of the electrical appliances such as a light-emitting diode (LED) lamp, incandescent light bulb, gas discharge lamp, and high-intensity discharge lamps. Especially in cities' streetlights, it is a severe power consuming factor and also the most significant energy expenses for a city. In this regard, an automation system is required to control the lights according to needs. we are proposing a system which is very economical and require less time to change the current system. In this system, Leds are powered by the solar energy and conventional energy and

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.

Areas of Applications

As it is a Street Light system, it is commonly used in the areas having low or no light where the light can be conserved.As it is implemented using LDR and Arduino,it can be further implemented as a system in which when the motion of the vehicle is detected then it will automatically turn on and vice versa.

- Rural places
- Highways
- Commercial place and airports.

Literature survey

Light control system using Ldr and arduino is a whole new idea in the world of street lights. In the wake of experiencing numerous exploration papers which were found on the lighting system were only based on their working and not on the consumption of energy or electricity the main thought process of doing this extend make another diagram system for the road lights that don't eat up massive measure of energy and light up tremendous zone with high force. Savvy Street lights system is a basic bit of the making shrewd city which speaks to 10-45% of total power uses which is a segregating mindfulness toward general society powers utilization. So it is key and profitable essentialness method for progressions to be executed for fiscal and standardized savings that too a large portion of the papers are based on the infrared collectors and very few of them are based on the working of LDR and LED by clock method or by the human. Some were found to be controlled by the remote GSM/GUI systems which will likewise devour heaps of energy . Programmed Street light is the winged animal from Flintstones which will naturally kill on and all the road lights without daylight and turn it off within the sight of daylight so it will expend heaps of energy. Worldwide Journal of Engineering Research and General Science Volume 4, Issue 2, March-April, 2016 ISSN 2091-2730 785 www.ieee.org Ancient Lighting framework have been kept to two alternatives on and off, because of its own offer of hindrance. This sort of activity implied vitality misfortune because of constant task greatest voltage however genuine necessity may be less relying outwardly condition whether light is required or not . Gong Siliang describes a remote streetlight monitoring system based on wireless sensor network that means this system runs in an automatic mode. In this the controlling of streetlight was done based on the intensity of sunlight along with the Sunrise and Sunset Algorithm.This system not only monitors the streetlight in Real- time but also the temperature and humidity of surrounding. So, the system integrates a digital temperature-humidity sensor by working like this.

A. C. Kalaiarasandeals about a solar energy based street light with auto-tracking system for maximizing power output from a solar system is desirable to increase the efficiency. As such a means of tracking the sun is required. It has been estimated that instead of using a stationary array, if we use a tracking system in solar panel the yield from solar panels can be increased by 30% - 60%. .The most straightforward answer to it is by adjusting lights as indicated by the outside condition. This is the thing that we are expecting to do in our savvy lighting framework.

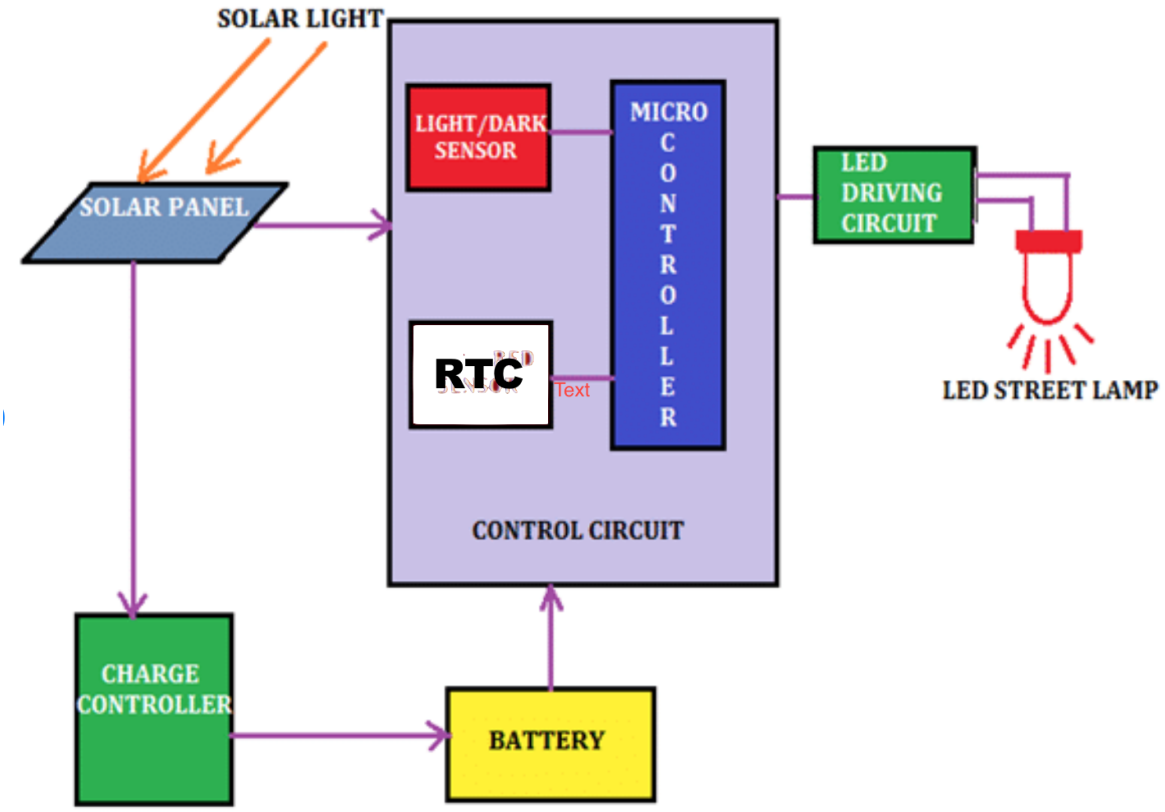
PROBLEM DEFINITION

The main problem is that , currently around a number of cities that the street light is one of the huge expenses in a city. The cost spent is huge that all the sodium vapor lamps consume more power. The expense spent on the street light can be used for other development of the nation. Currently a manual system is used where the light will be made to switched ON/OFF i.e the light will be made to switch ON in the evening and switched OFF in the morning. Hence there is a lot of wastage of energy between the ON/OFF. This is one of the major causes of shifting to the automatic system, since there is less wastage of power and thus saving a lot of monetary expenses.

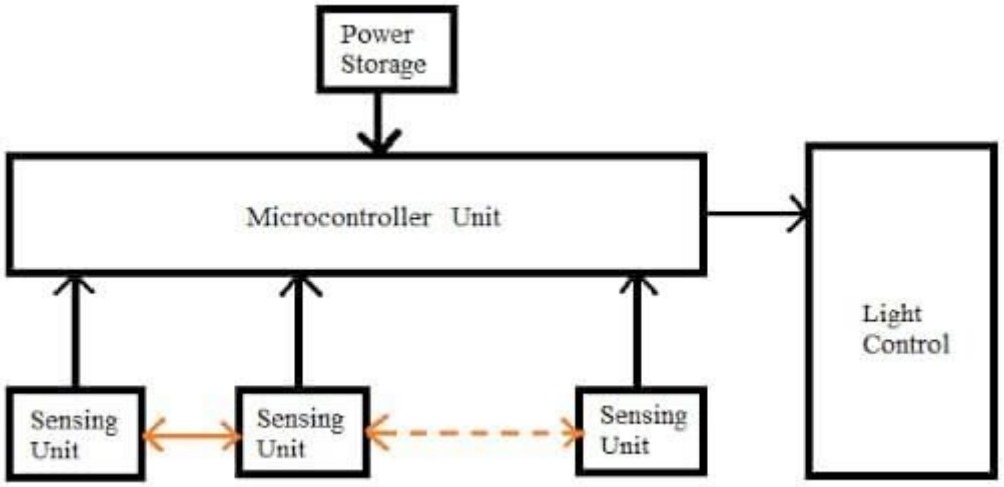
PROPOSED SOLUTION

The solution to the above stated problem is to create a system which does not consist of any expensive hardware which if fails could be easier to replace. Another solution is to make a system which senses the brightness in the environment and adjusts the intensity as per the same. It should eliminate time slot as there would not be any need as the intensity would be according to the environment. Just the time to switch OFF the lights needs to be specified. The principle used to decide the intensity of the street light is the brightness in the surrounding environment. Sensors are affixed to sense the luminosity. The system uses Arduino, LDRs sensor based to find the surroundings light and drive circuit for controlling intensity. A cluster of LEDs acts as a streetlight. HID lamps will be replaced by LEDs same as in an available time slot based systems. There is a LED cluster brightening has gotten consideration as of late as a vitality decreasing light source. Driven street brightening requires around 33% to one portion of the electric force required for HID lighting. The life cycle of an LED can be more than three times the length of a HID light. Driven brightening could lessen the measure of time expected to trade damaged apparatuses and it is normal that an LED framework would be nearly support free. With the help of all these sensor available in the market; we should have 100% control over the street for the safety and security of lives in the streets along with a flexible transportation system.This system will save electricity of our country as well as the man power.

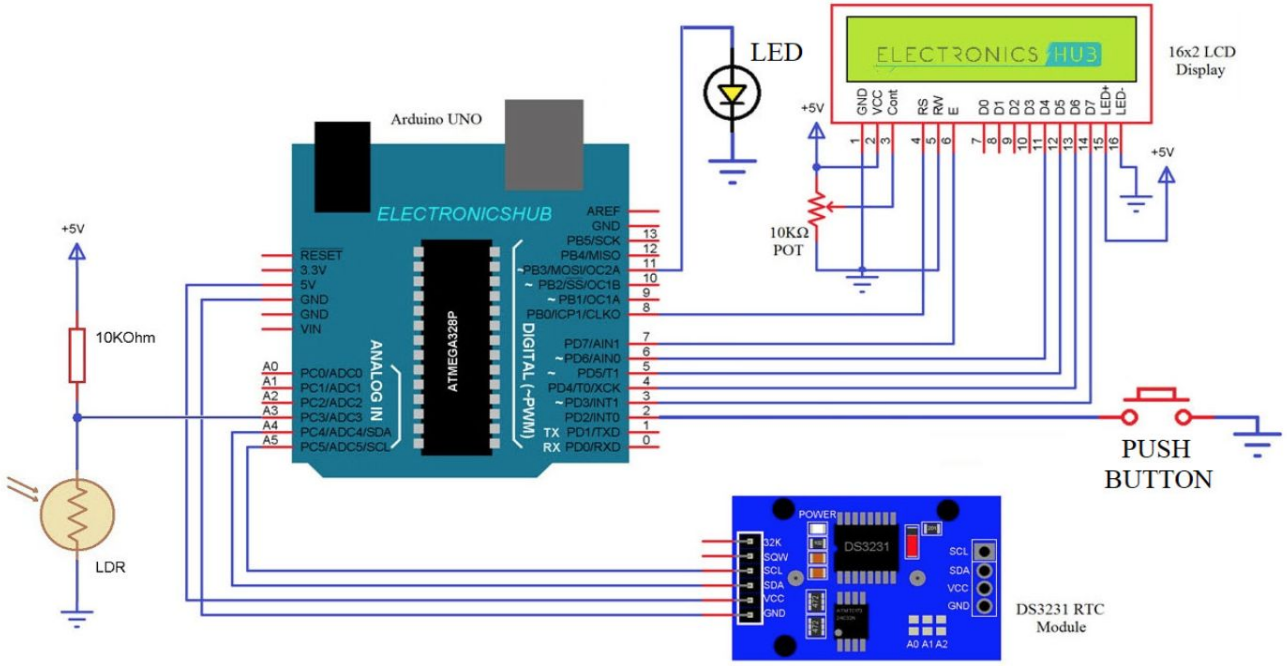
Block Diagram



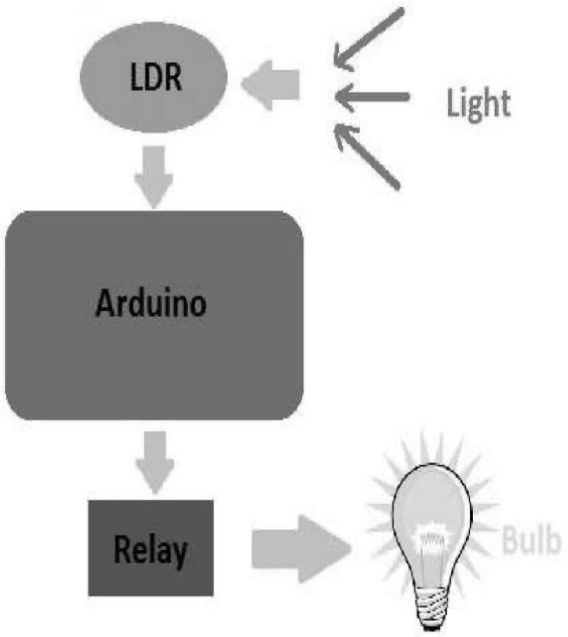
Flow Chart



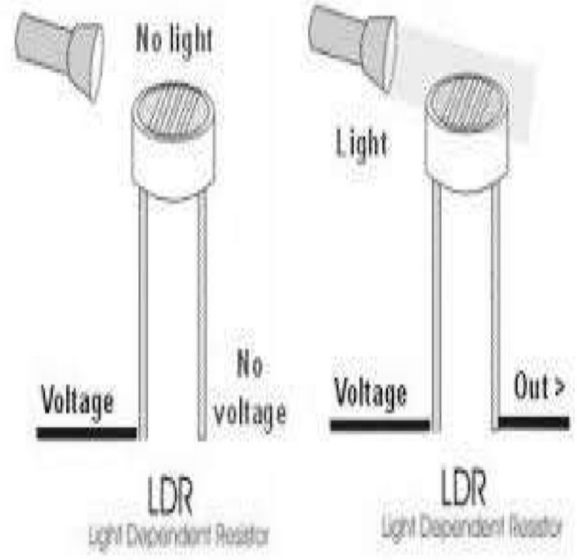
CIRCUIT



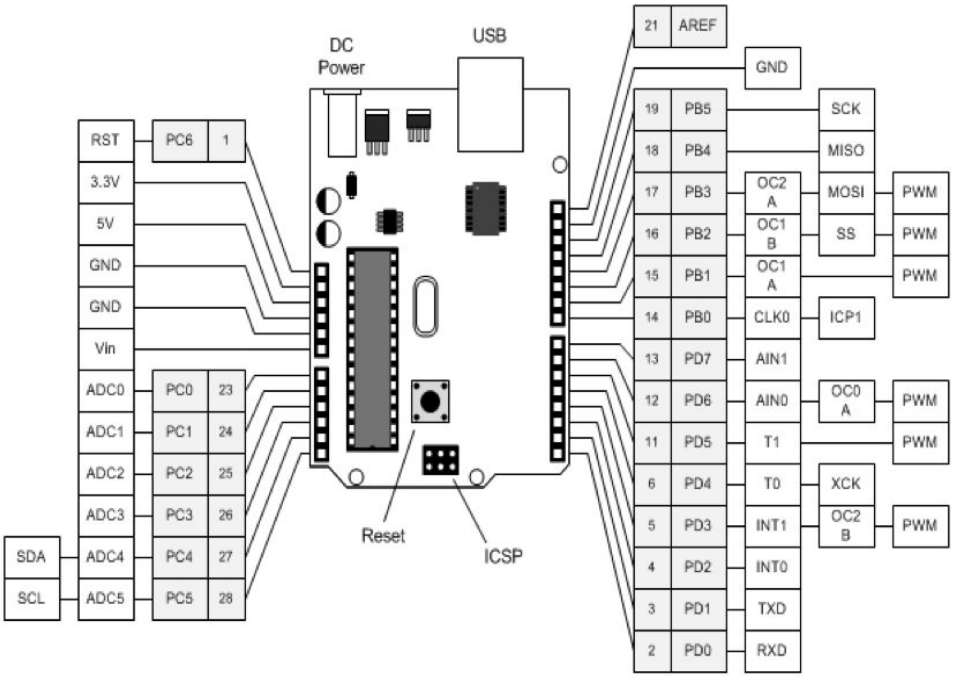
MATERIALS USED



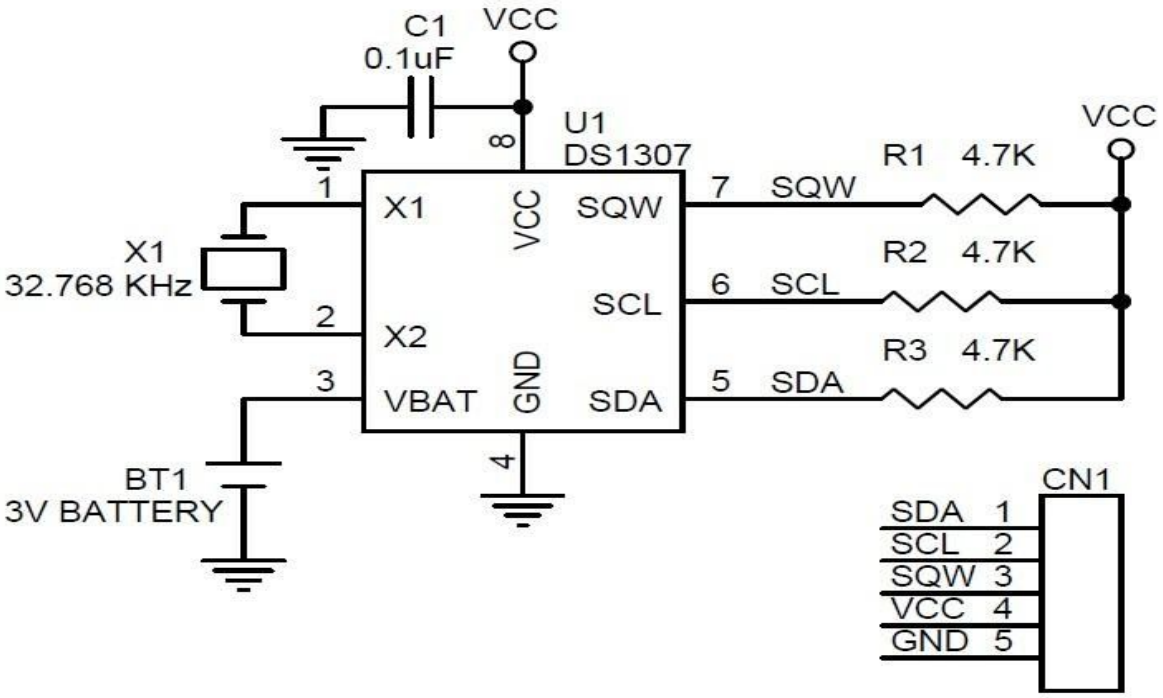
LDR



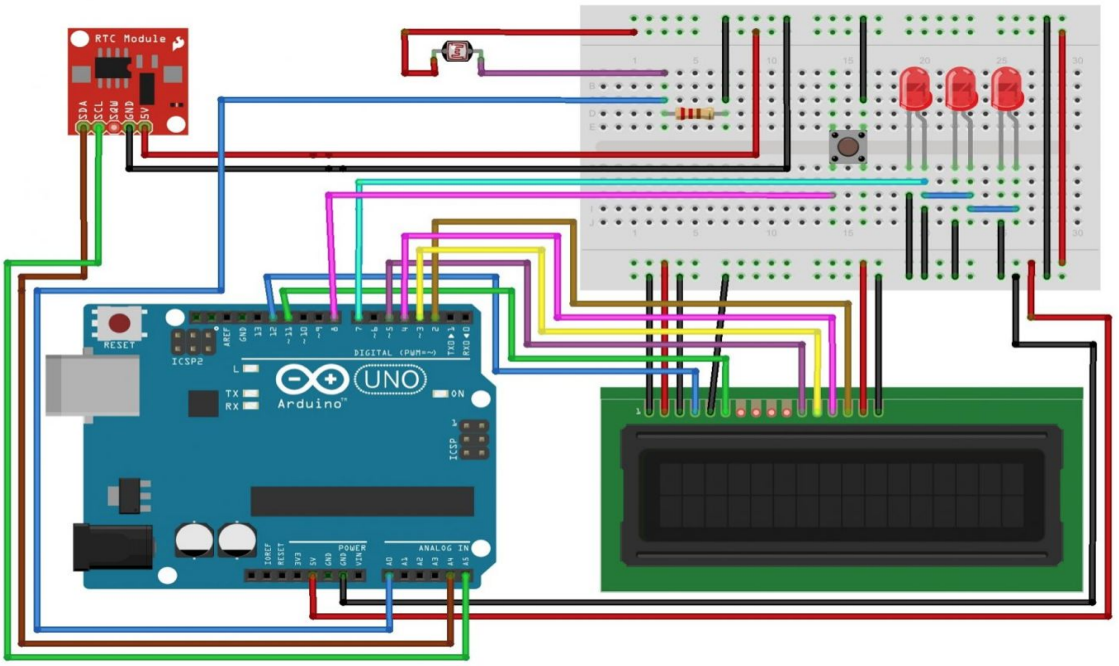
ARDUINO UNO



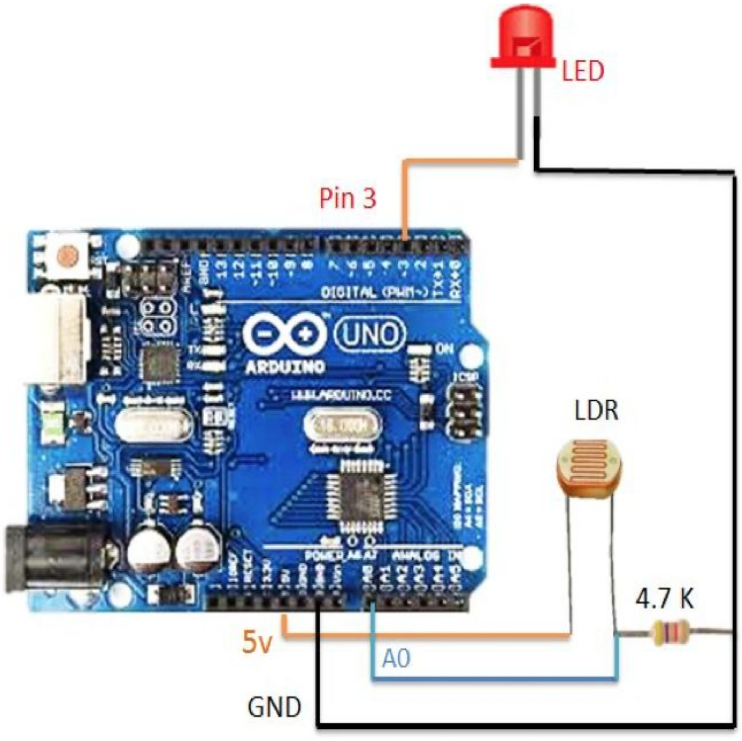
RTC MODULE



CIRCUIT CONNECTIONS



Connections between LDR and Arduino



Light Detection using LDR and Arduino

Code/Programs:

```
#include <Wire.h>

#include <LiquidCrystal.h>

#include "RTClib.h"

#define ON  0

#define OFF 1

DateTime now;



RTC_DS3231 rtc;

LiquidCrystal lcd(8, 7, 6, 5, 4, 3); // (rs, e, d4, d5, d6, d7)



const int buttonPin = 2;

const int led=11;

int nob = A3;

int val = 0;

int val1 = 0;

int path=1;

int a=1;

int previousState = HIGH;

unsigned int previousPress;

volatile int buttonFlag;

int buttonDebounce = 20;
```

```
int on_hour=1;

int on_minute=1;

int on_second=10;


int off_hour=23;

int off_minute=57;

int off_second=10;


int c_hour=0;

int c_minute=0;

int c_second=0;


int onOrOffFlag = ON;


void showDate(void);

void showTime(void);

void showDay(void);


void loadHandler(int, int , int , int , int , int ,  int , int , int );


typedef struct userTime
```

```
{
   int temp_hour;
   int temp_minute;
   int temp_second;
}userTime_t;
unsigned char checkLessThanOrEqual(userTime_t , userTime_t);



void setup ()
{
 Serial.begin(9600);
 lcd.begin(16,2);

 pinMode(buttonPin, INPUT_PULLUP);
 pinMode(led,OUTPUT);
 attachInterrupt(digitalPinToInterrupt(buttonPin), button_ISR, CHANGE);

 if (! rtc.begin())
 {
  Serial.println("Couldn't find RTC Module");
  while (1);
 }
```

```
 if (rtc.lostPower())
 {
  Serial.println("RTC lost power, lets set the time!");
  rtc.adjust(DateTime(F(__DATE__), F(__TIME__)));
 }
 rtc.adjust(DateTime(F(__DATE__), F(__TIME__)));

}

void loop ()
{
 if(path)
 {
  if(a==1)
  {
    lcd.setCursor(0,0);
     lcd.print("      RTC     ");
     lcd.setCursor(0,1);
     lcd.print("    MODE ON    ");
     delay(2000);
     a=0;
```

```
  }
  now = rtc.now();
  showTime();
  c_hour=now.hour();
  c_minute=now.minute();
  c_second=now.second();
  loadHandler( on_hour, on_minute, on_second, off_hour, off_minute, off_second, c_hour,
c_minute, c_second);
  delay(1000);
 }
 else
 {
    if(a==0)
  {
    lcd.setCursor(0,0);
     lcd.print("      LDR      ");
     lcd.setCursor(0,1);
     lcd.print("    MODE ON    ");
     delay(2000);
     a=1;
  }
    val = analogRead(nob);
```

```
if(val>300 && val<450)
{
 lcd.setCursor(0,0);
 lcd.print("      30%     ");
 lcd.setCursor(0,1);
 lcd.print("   Brightness   ");
 analogWrite(led, 400);
}
else if(val>450 && val<550)
{
 lcd.setCursor(0,0);
 lcd.print("      60%     ");
 lcd.setCursor(0,1);
 lcd.print("   Brightness   ");
 analogWrite(led, 600);
}
else if(val>550 && val<600)
{
 lcd.setCursor(0,0);
 lcd.print("     100%     ");;
 lcd.setCursor(0,1);
 lcd.print("   Brightness   ");
```

```
      analogWrite(led, 1023);
     }
     else if(val<300)
     {
      lcd.setCursor(0,0);
      lcd.print("      0%     ");
      lcd.setCursor(0,1);
      lcd.print("   Brightness   ");
      analogWrite(led, 0);
     }
  }
}



 void showTime()  // function to showtime
 {
  lcd.setCursor(0,0);
  lcd.print("   Time:");
  lcd.print(now.hour());
  lcd.print(':');
  lcd.print(now.minute());
  lcd.print(':');
```

```
 lcd.print(now.second());
 lcd.print("    ");
}



void button_ISR()
{
 buttonFlag = 1;
 if((millis() - previousPress) > buttonDebounce && buttonFlag)
 {
  previousPress = millis();
  if(digitalRead(buttonPin) == LOW && previousState == HIGH)
  {
   path =! path;
   previousState = LOW;
  }

  else if(digitalRead(buttonPin) == HIGH && previousState == LOW)
  {
   previousState = HIGH;
  }
  buttonFlag = 0;
```

```
 }
}


unsigned char checkLessThanOrEqual(userTime_t a, userTime_t b)
{
   if(a.temp_hour < b.temp_hour)
      return true;
   else
   {
      if ((a.temp_hour == b.temp_hour) && (a.temp_minute < b.temp_minute))
      {
         return true;
      }
      else
      {
         if(a.temp_hour > b.temp_hour)
            return false;
         else
         {
            if((a.temp_minute == b.temp_minute) && (a.temp_second < b.temp_second))
            {
               return true;
```

```
            }
            else
            {
               if(a.temp_minute > b.temp_minute)
                  return false;
               else
               {
                  if(a.temp_second == b.temp_second)
                  {
                     return true;
                  }
                  else
                  {
                     return false;
                  }
               }
            }
         }
      }
   }
}
```

```
void loadHandler(int onTimeHr, int onTimeMin, int onTimeSec, int offTimeHr, int offTimeMin, int
offTimeSec,  int rtcTimeHr, int rtcTimeMin, int rtcTimeSec)
{

  userTime_t in1 = {onTimeHr, onTimeMin, onTimeSec}, in2 = {offTimeHr, offTimeMin,
offTimeSec}, rtc_hr = {rtcTimeHr, rtcTimeMin, rtcTimeSec}, a = {}, b = {};

  if(checkLessThanOrEqual(in1, in2))
  {
    onOrOffFlag = ON;
    memcpy(&a, &in1, sizeof(userTime_t));
    memcpy(&b, &in2, sizeof(userTime_t));
  }
  else
  {
    onOrOffFlag = OFF;
    memcpy(&a, &in2, sizeof(userTime_t));
    memcpy(&b, &in1, sizeof(userTime_t));

  }

  if((checkLessThanOrEqual(a, rtc_hr)) && (checkLessThanOrEqual(rtc_hr, b))) //checks to display
offtime or ontime
```

```
{
  if(onOrOffFlag == ON)
  {
    // Switch on the load
    digitalWrite(led,HIGH);
    lcd.setCursor(0,1);
    lcd.print("OffTime:");
    lcd.print(off_hour);
    lcd.print(':');
    lcd.print(off_minute);
    lcd.print(':');
    lcd.print(off_second);



  }
  else
  {
    // Switch off the load
     digitalWrite(led,LOW);
    lcd.setCursor(0,1);
    lcd.print(" OnTime:");
    lcd.print(on_hour);
```

```
        lcd.print(':');
        lcd.print(on_minute);
        lcd.print(':');
        lcd.print(on_second);


    }
}
else
{
    if(onOrOffFlag == ON)
    {
        // Switch off the load
        digitalWrite(led,LOW);
        lcd.setCursor(0,1);
        lcd.print(" OnTime:");
        lcd.print(on_hour);
        lcd.print(':');
        lcd.print(on_minute);
        lcd.print(':');
        lcd.print(on_second);
    }
    else
```

```
      {
        // Switch on the load
        digitalWrite(led,HIGH);
        lcd.setCursor(0,1);
        lcd.print("OffTime:");
        lcd.print(off_hour);
        lcd.print(':');
        lcd.print(off_minute);
        lcd.print(':');
        lcd.print(off_second);
      }
    }
}
```

Working of the circuit:

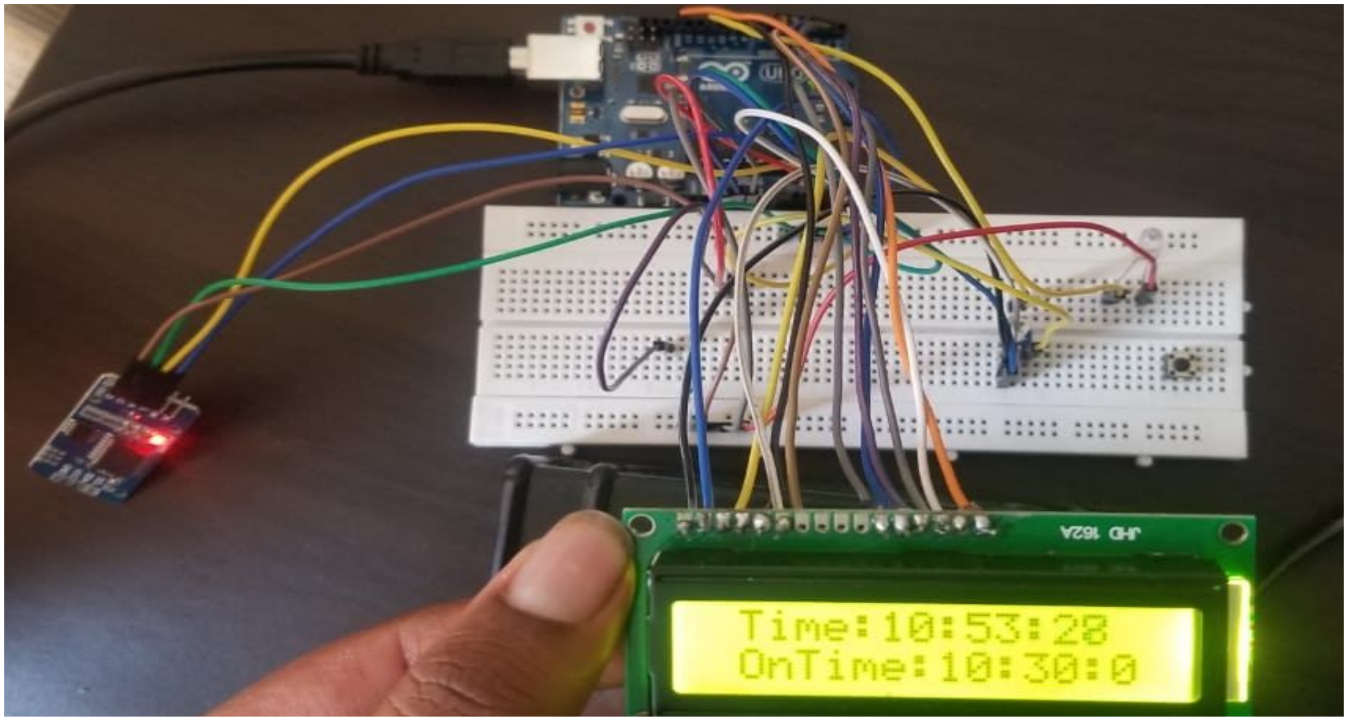
The project RTC Based Automatic Street Light Using Arduino & LDR operates in two modes i.e. **RTC Mode and LDR Mode**. In RTC Mode, the street lights turn on automatically based on the ON Time set in the code and turn off based on the OFF Time. In the LDR Mode, the street lights have an intensity control based on the ambient light near the LDR.

After the code is uploaded the project runs in RTC Mode. There are two times set in the code, i.e. the ON TIME and the OFF TIME.

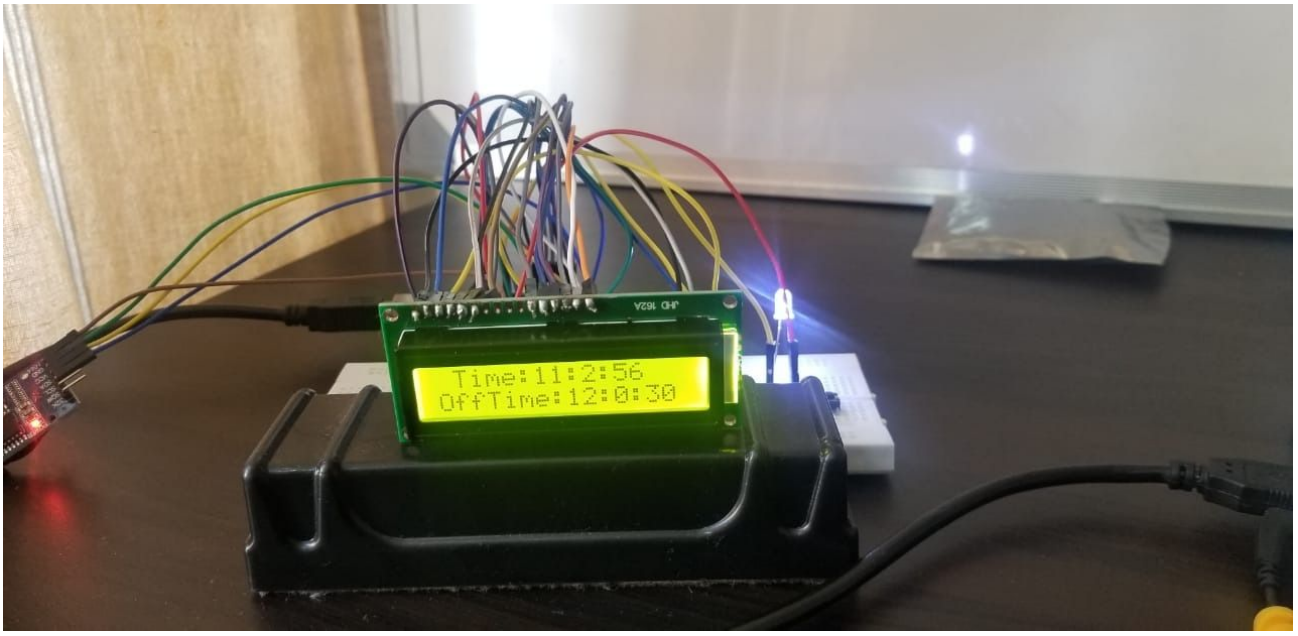
Arduino compares the ON TIME with the time from RTC Module and when they match, the LED is turned ON. After this, the Arduino waits for the OFF TIME and once the time from RTC Module reaches the OFF TIME, the LED is turned OFF.

When the rtc mode is ON and led is ON of this operation, the Arduino enters LDR Mode with In this mode, the Arduino reads the value of the LDR on the basis of the quantity of light falling on LDR, then it adjusts the intensity of the LED. Using the PWM signal generated by the pin 11 of arduino, The led intensity is adjusted

Circuit:

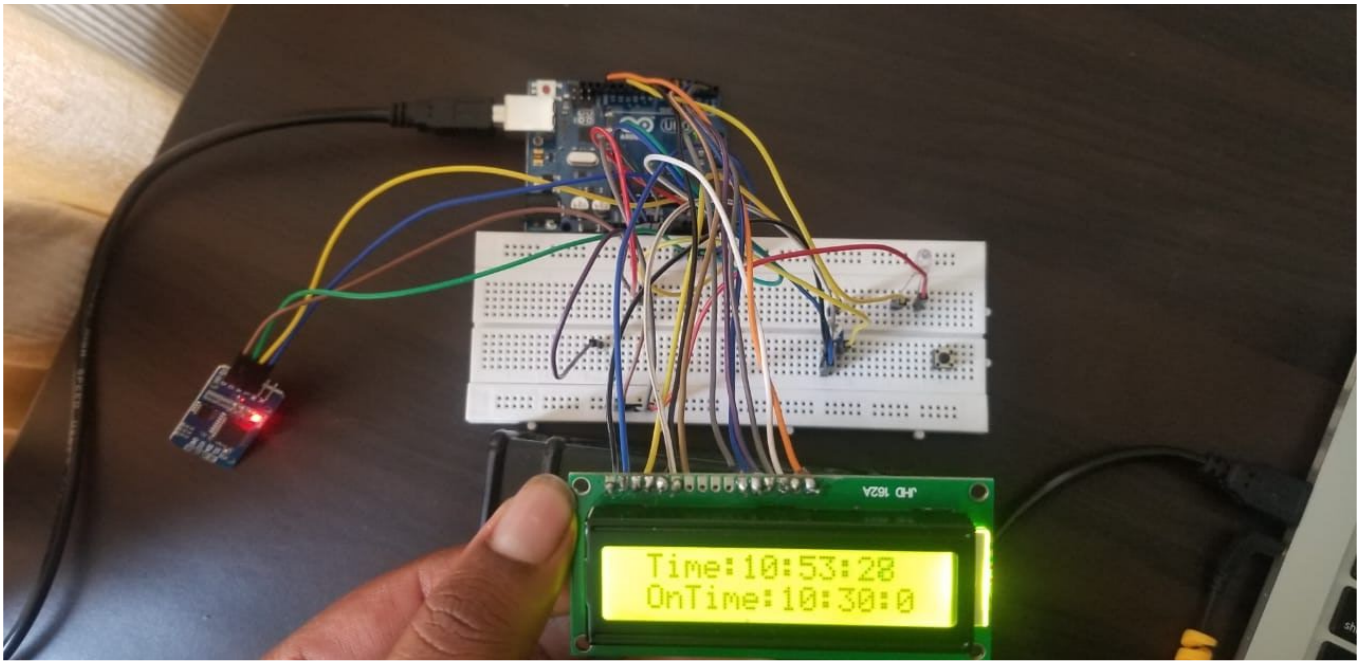


Results: RTC MODE and LED ON



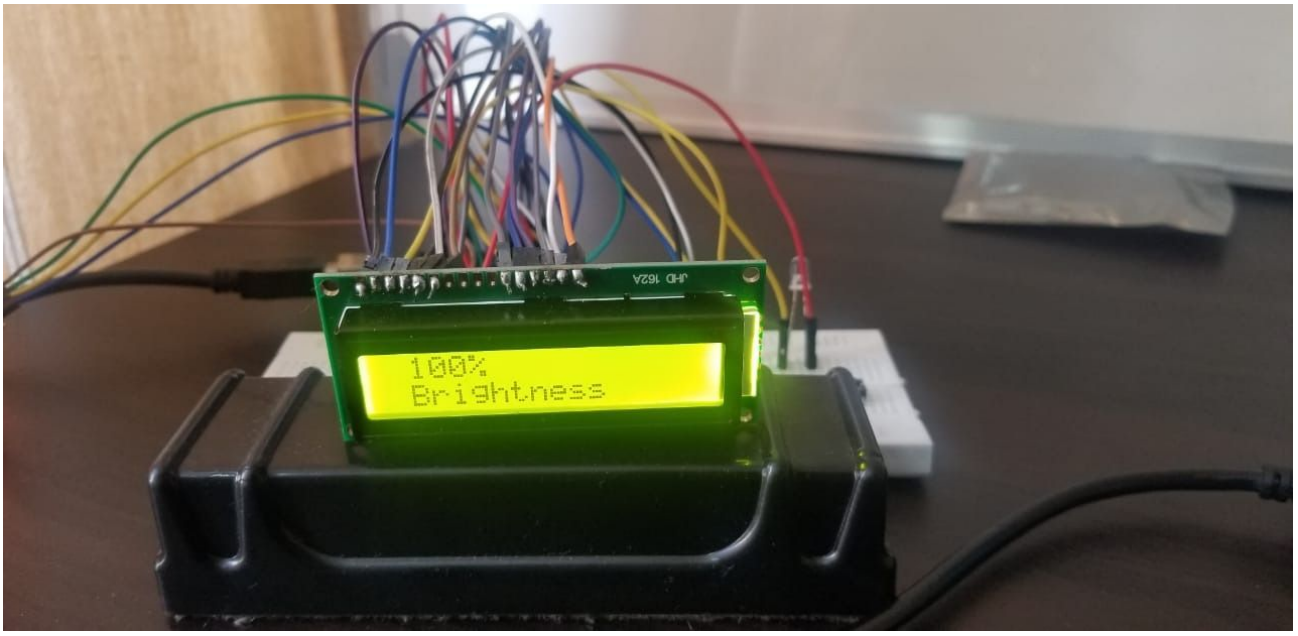
When rtc mode is on and LED is ON . LCD displays the current time and off time which is the next operation of the arduino.

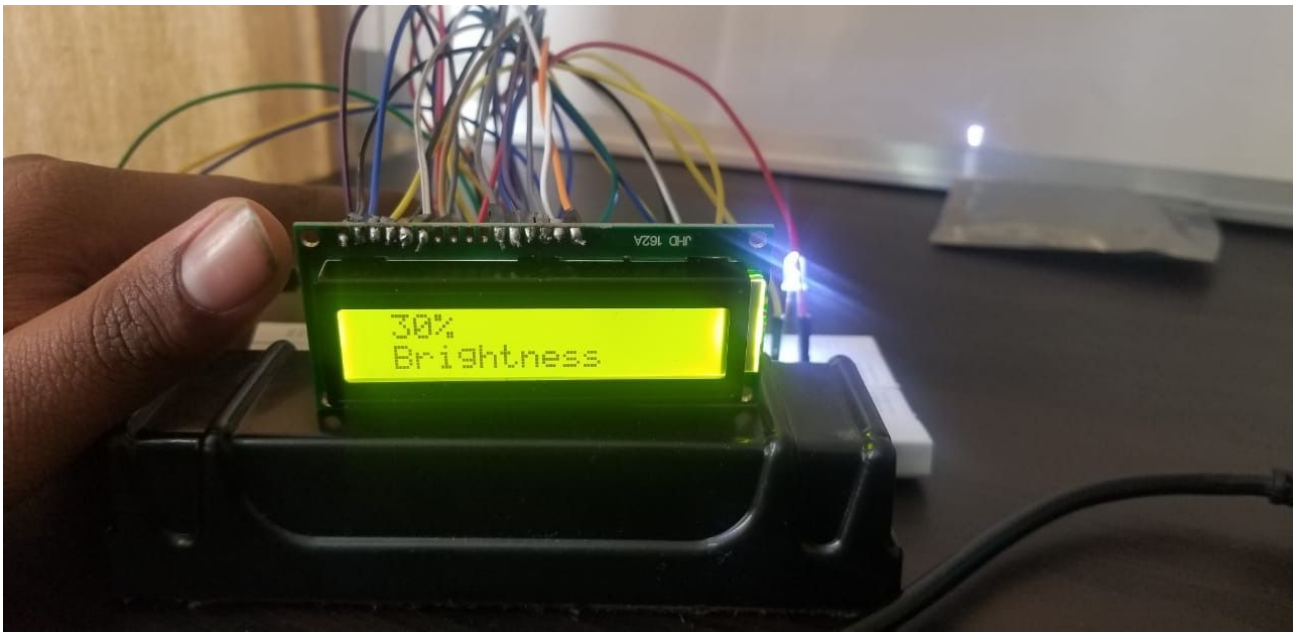
RTC MODE and LED OFF

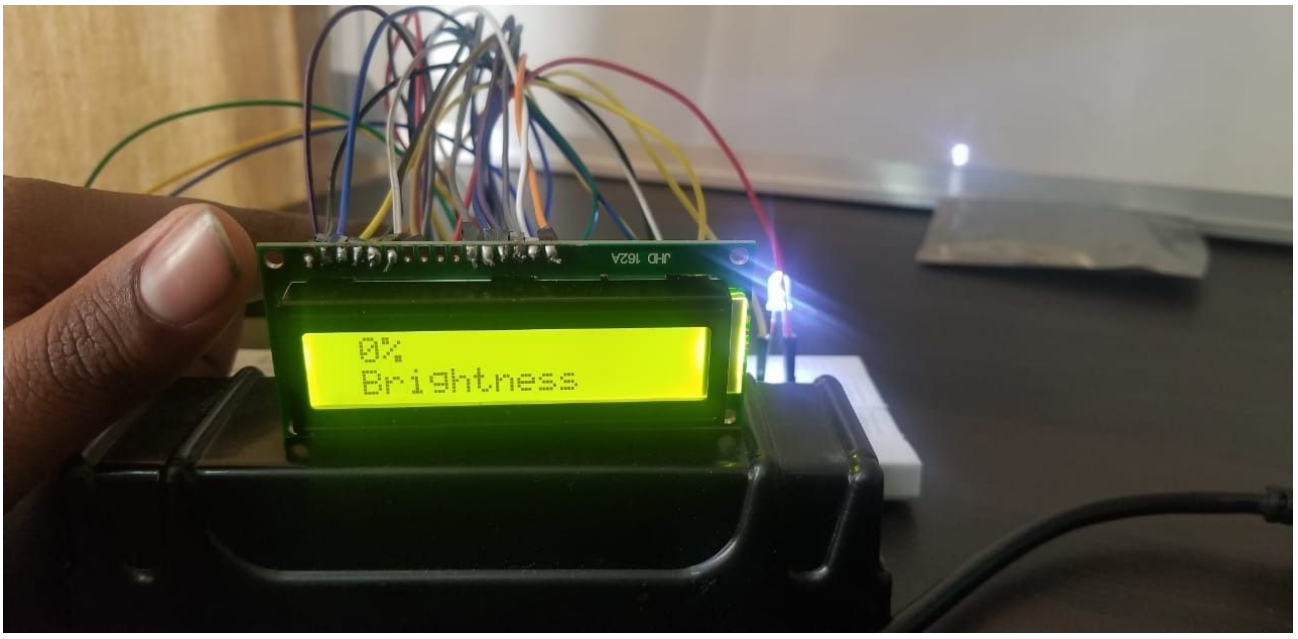


When the rtc mode is ON and off time is set, The led switches off. The lcd displays the ON time in the LCD which is the next operation of the Arduino.

RTC Mode and LDR MODE ON







From the above figures, we can see that the intensity of LED increases proportional to the surrounding light.When there is no light in the surroundings, Lcd display 0% brightness and LED glows with full intensity.When surrounding intensity is at 100% brightness , the LED light didnt glows.Thus we made discrete intervals of 4 using if -else statements thus we can check surrounding light from the surrounding through the LDR sensor which is converted the Arduino pin of A1 which converts analog into Digital which are used in the if-else statements. Thus we can adjust the intensity of LED using PWM of amplitude to LED.Graphs and Data

Figure 1: Existing system block diagram

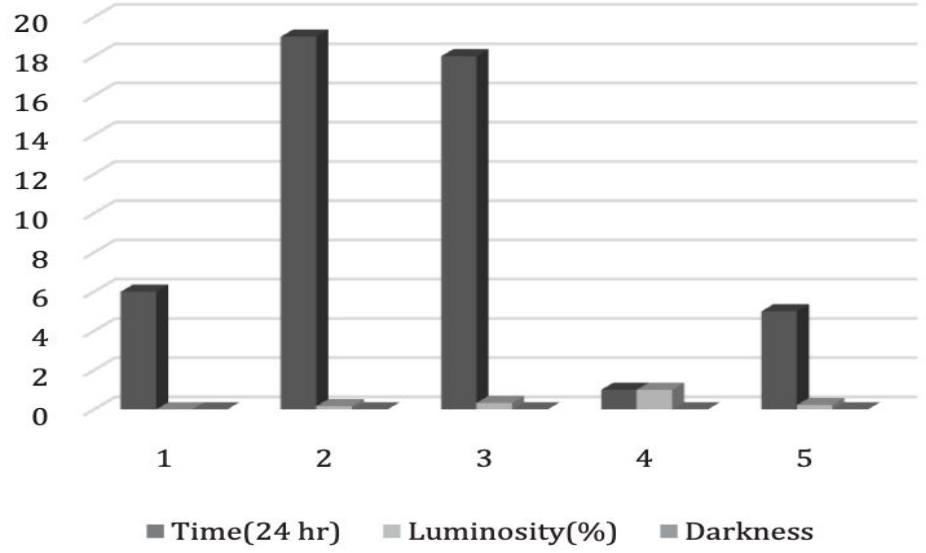
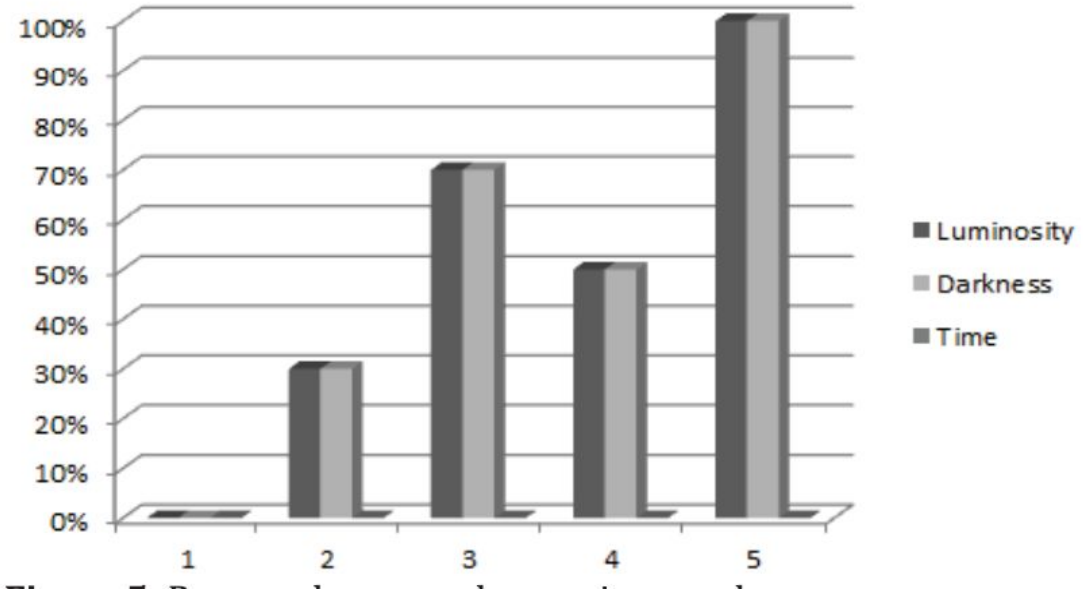
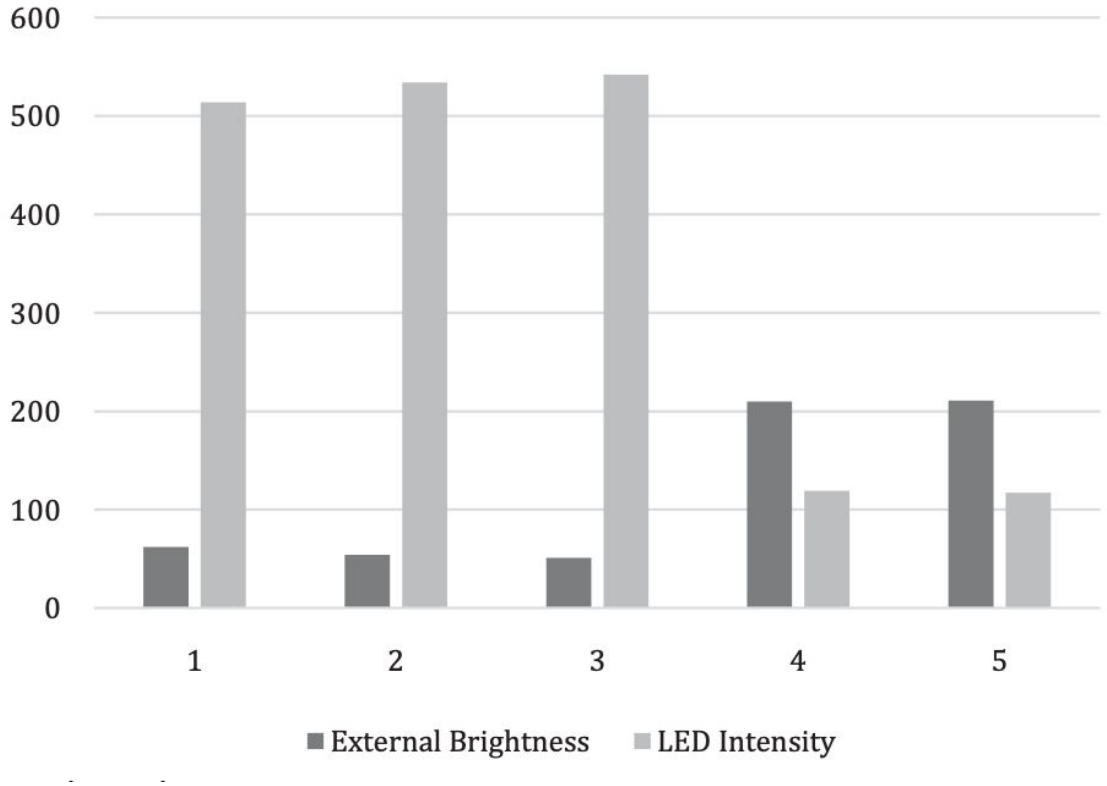


Figure 3: Proposed solution circuit diagram



Graph of LED VS External luminosity



Components Required

- Arduino UNO
- DS3231 RTC Module
- LDR
- 16×2 LCD Display
- LED
- 10KΩ Potentiometer
- 10KΩ Resistor
- Push Button
- Connecting Wires
- Breadboard

Estimated Budget

Component	**Cost (in Rupees)**
Arduino UNO	500
LDRs	36
16×2 LCD Display	130
LEDs	10
10KΩ Potentiometer	30
Push Button	5
10KΩ Resistor	5
Connecting Wires	30
Breadboard	160
DS3231 RTC Module	150
Total	1056

Assumptions and Calculations

For a comparative study we have to take the following assumptions:

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. Assume there are 50 street lights .

Bulbs = 50

Wattage=400/bulb

Wasted Hours =2 Hours/day

Energy Wasted per day

= 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.

Project Timeline

17th September, 2020: Course registration for the Mini Project

27th September, 2020: Selection of domain and team registration

27th to 30th September, 2020: Research of project topics under the selected domain

23rd October, 2020: Finalisation of “Automatic intensity control of street lights using Arduino ” as the project.

24th to 28th October, 2020: Literature Survey on the Automatic intensity control of street lights that are currently in use.

29th October, 2020: Allotment of Guide.

24th November, 2020: Project discussion with guide.

26th November, 2020: Preparation of PowerPoint presentation for Synopsis review

26th November, 2020: Preparation of Report for Synopsis review.

10th December, 2020: First Synopsis review.

CONCLUSION

This project expounds the configuration and development of Smart Street lighting control framework circuit. Circuit meets expectations appropriately to turn road light ON/OFF. In the wake of planning the circuit which controls the light of the road as delineated in the past segments. LDR sensor and the object sensors are the two fundamental conditions in living up to expectations the circuit. On the off chance that the two conditions have been fulfilled the circuit will do the wanted work as indicated by the particular system. Every sensor controls the killing ON or the lighting segment. The road lights have been effectively controlled by Arduino UNO. With orders from the controller, the lights will be ON in the spots of the movements. Besides the downside of the road light framework utilizing timer controller has been succeeded. With the help of this system we will conserve energy and circuit can be utilized as a part of a long roadway between the urban areas as well as the rural areas which indirectly leads our country to the development. This system is economical and easy to implement and replace the current system.

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.

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