A project report on

"Smart Street Light System"

A Project Work Submitted in Partial Fulfillment of the requirements for Award of Diploma

In

ELECTRONICS & TELECOMMUNICATION ENGINEERING

By

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(A Centrally Funded Institute under Ministry of HRD, Govt. of India)

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CERTIFICATE OF DECLARATION

We hereby declare that the project work entitled "Smart Street Light System" is an authenticated work carried out by us under the guidance of Miss Priyanka Mondal for the partial fulfillment of the award for diploma in Electronics & Telecommunication Engineering and this work has not been submitted elsewhere for similar purpose except to Department of Electronics & Communication Engineering at Central Institute of Technology, Kokrajhar.

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CERTIFICATE OF SUBMISSION OF PROJECT REPORT

This is to certify that the following students of 6th semester diploma course (Electronics & Telecommunication engineering) have submitted their project report on "**Smart Street Light System**" to the department in partial fulfillment for the diploma in Electronics & telecommunication engineering.

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Certificate of Approval

This is to certify that the work embodied in this project entitled **"Smart Street Light System** "submitted by Akash Dhakal, Pranab Sarkar, Laishram Manali Devi to the Department of Electronic and Communication Engineering, is carried out under my direct supervisions and guidance.

The project work has been prepared as per the regulations of Central Institute of Technology and I strongly recommend that this project work should be accepted in partial fulfillment of the requirement for the Diploma.

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CERTIFICATE

This is to certify that the project entitled **"Smart Street Light System"** submitted by Akash Dhakal (CIT/15/ET/001), Pranab Sarkar (CIT/15/ET/009) and Laishram Manali Devi (CIT/15/ET/027) to the Department of Electronics and Communication Engineering of Central Institute of Technology, Kokrajhar has been prepared as per the regulations of Central Institute of Technology and qualifies to be accepted as project, a part of the requirements for the Diploma in Electronics and Telecommunication Engineering.

R Chetia 24/05/18

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Finally we would like to appreciate our friends who helped us in coming up with the whole hardware model for our project.

We would like to acknowledge the educational resources that we actually have got from CIT, Kokrajhar.

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Abstract :

Smart Street Light spotlights on different restriction and difficulties identified with traditional and old street lights that are confronted now days and the answer for the deal with those issues by embracing the vision of a smart street light. The noteworthiness of this vision is "a completely mechanized bidirectional force conveyance of power and information between the road lights and all the directions in the middle". Smart street lights are vitality effective as well as extremely dependable. The primary thought in the present field advances are computerizations, power utilization, and expense adequacy. Automation is implied for the decrease of labor as the human has gotten to be excessively occupied and even incapable, making it impossible to discover time to switch the lights. Presently a day's everybody are mindful of the availability of limited power sources like coal, biomass, and hydro and so on. Unnecessary wastage of power in the street lights is one of the noticeable power loss.

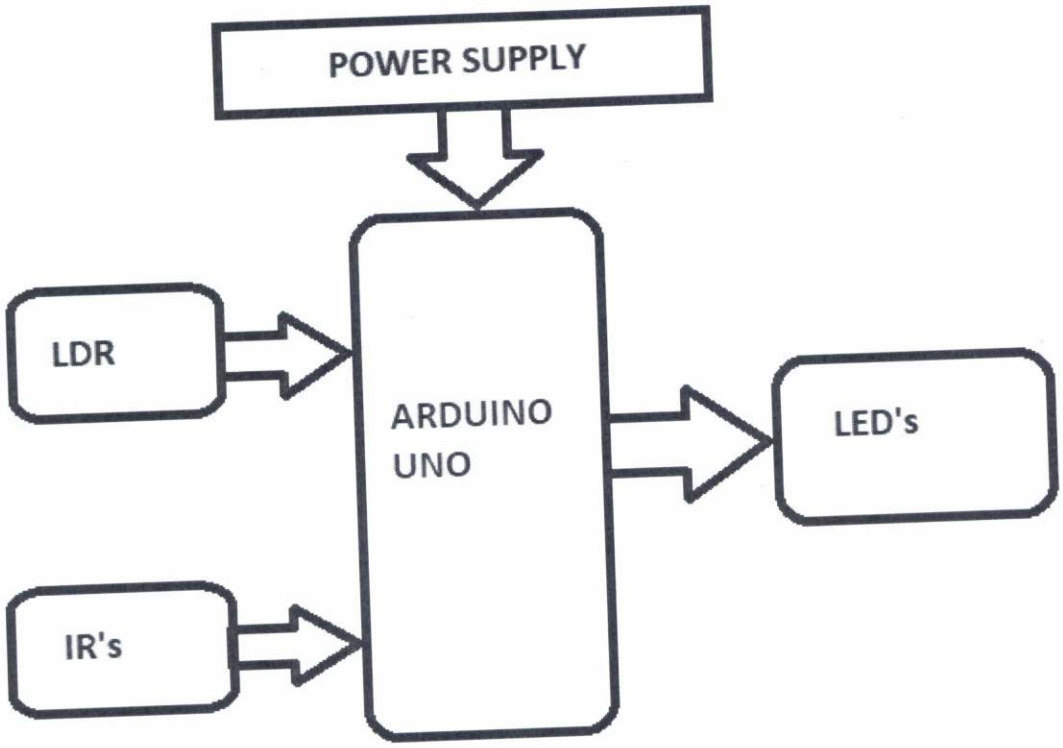
Two sensors viz. The light dependent resistor (LDR) and object sensor which are utilized as a part of the smart street light framework to recognize day and light and distinguish the movement of walker and vehicle separately.

The LDR identifies the vicinity of daylight and naturally turn off the street lights in the day time and turn it on without daylight which decrease the issue of manual switching of road lights. The object sensors identifies the movement of any object and offer command to the microcontroller to glow the road lights with 100% intensity and without any movement in the street give command to the microcontroller to glow with 10% of its maximum intensity or off the street light.

Here I have utilized an Arduino Uno to control all the command from LDR and Object Sensor and execute them legitimately. Fundamentally it acts as the mind of the entire framework.

LIST OF FIGURES:

BLOCK DIAGRAM



CONTENTS

Chapter-1

Introduction :

The thought of outlining a new framework for the street lights that don't devour immense measure of power and light up vast zone with high intensity. Smart Street lights framework is an essential piece of the smart city which represents 10-40% of aggregate power utilizations which is a discriminating attentiveness toward general society powers. So a vital and productive vitality advancements are to be executed for monetary and social security.

Background of Study :

The present framework is similar to, the road lights will be exchanged on in the night prior to the sun sets and they are exchanged off the following day morning after there are adequate lights on the streets. The hindrance of the framework is that we require manual operation of the road light which needs labor.

In sunny and rainy days, ON and OFF time differ discernibly which is one of the significant hindrances of the present street lights systems.

Conventional street lighting systems are online most of the day without purpose. The consequence is that a large amount of power is wasted meaninglessly.

With the wide accessibility of adaptable lighting innovation like light transmitting diode (LED) lights and all over accessible remote web association, quick responding, dependable working, and power moderating street lighting frameworks get to be reality. The reason for this work is to portray the Smart Street Lighting framework, a first way to deal with perform the interest for adaptable smart lighting frameworks. The goal of this undertaking is to plan an automated lighting framework which focuses on the saving of power; to construct a vitally energy efficient smart lighting framework with integrated sensors and controllers; to outline a smart lighting framework with particular methodology plan, which makes the framework adaptability and expandability and configuration a smart lighting framework which similarity and versatility with other commercial products and mechanized automated system, which may incorporate more then lighting frameworks.

Chapter-2

Problem Statement :

Statement [1]: Street lights are on in the presence of sun light.

Statement [2]: Street lights are on in the absence of any vehicle and pedestrian.

Disadvantages of Classical Street Light :

- Street lights are remain on when there is a visible spectrum of light.
- These street lights need a manual switching operation.
- It also needs man power.
- These street lights are unnecessarily glowing with its full intensity in the absence of any activities in the street.
- High power consumption and waste of energy.
- Less reliable.
- Manual hectic operation due to change in season and climate.

To face the various problem mentioned above in the conventional lighting system we need a lighting system that is well equipped with recent inventions and technology. As it is well known to everyone is that the natural sources to generate power is limited and we are wasting so much of energy meaninglessly.

So if we can use automation in this particular case so that all the street lights can be switch on and off automatically when it is really necessary. And if we can use controller circuits to implement a model so that all the street lights can only glow with its maximum intensity when there is activity in its region otherwise it should glow at a minimum given intensity. So that we can save a huge amount of power.

With the inventions of light emitting diodes which has a small amount of power consumptions and high efficiency; we should use light emitting diodes instead of all classical fuse bulbs.

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.

Chapter-3

Development of LDR :

Light Dependent Resistor (LDR) is made up of light sensing material called Cadmium Sulphide i.e. Cds. LDR is a Cadmium Sulphide photo resister that changes its resister according to the spectrum of light falls on it. Its resistance is 1MΩ in the absence of sunlight and 5kΩ in the presence of sunlight. So when there is complete darkness it conducts electricity very poorly due to high resistance and when there is a visible spectrum of light it conducts electricity very well.

So according to problem statement (1) the classical street lights

- Are remain switched on in the presence of sunlight.
- Need manual switching.
- Need man power.
- Face variable On-period due to change in seasons.
- Less reliable.
- Waste of huge amount of energy unnecessarily.

To overcome this problem we can connect a relay in series with all the street lights which will receives the signals from LDR where to switch the street lights on or off. By using this concept we can develop an automatic street light.

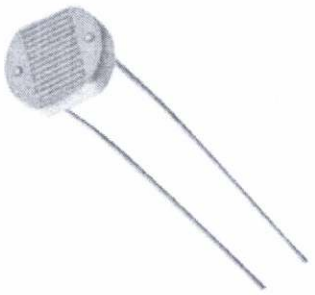


Fig:-LDR(Light Dependent Resister)

LED :

Light emitting diodes (**LEDs**) are semiconductor light sources. The light emitted from **LED**s varies from visible to infrared and ultraviolet regions. They operate on low voltage and power. LEDs are one of the most common electronic components and are mostly used as indicators in circuits. They are also used for luminance and optoelectronic applications.

Based on semiconductor diode, LED**s** emit photons when electrons recombine with holes on forward biasing. The two terminals of LEDs are anode (+) and cathode (-) and can be identified by their size. The longer leg is the positive terminal or anode and shorter one is negative terminal.

The forward voltage of LED(1.7V-2.2V) is lower than the voltage supplied (5V) to drive it in a circuit. Using an LED as such would burn it because a high current would destroy its p-n gate. Therefore a current limiting resistor is used in series with LED. Without this resistor, either low input voltage (equal to forward voltage) or PWM (pulse width modulation) is used to drive the LED.

fig:- LED

Chapter-4

Motion Detection :

According to problem statement (2) all the classical street lights are remain switched on from 6 pm to 6 am whether there is a pedestrian or vehicle is present or not present of any activity. The most probable peak time of movement is from 6 pm to 10 pm in a smart city; so after 10pm all the street lights are glowing at its full intensity which leads to loss of enormous amount of energy. So to overcome this problem if we can install a small motion detection device which will control the street light to glow at its 100% only in the presence of any activity in the street. To overcome this problem we can use IR sensor or proximity sensor or photoelectric beam detector.

IR Sensor :

An infrared Sensor is an electronic device that emits in order to sense some aspects of the surrounding. An IR sensor can measure the heat of an object as well as detect the motion. Usually in the infrared spectrum, all the object radiate some form of thermal radiations. These type of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED and the detector is simply an IR photo diode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltage, change in proportion to the magnitude of the IR light received.

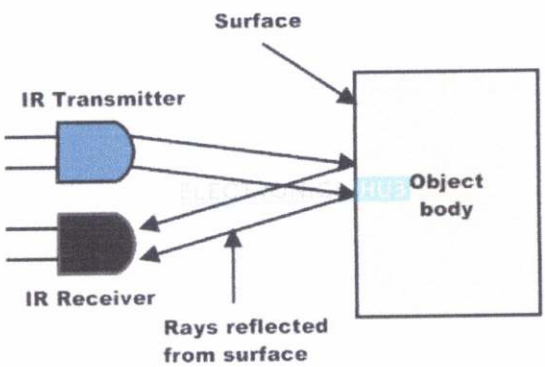


fig:-Working of IR sensor

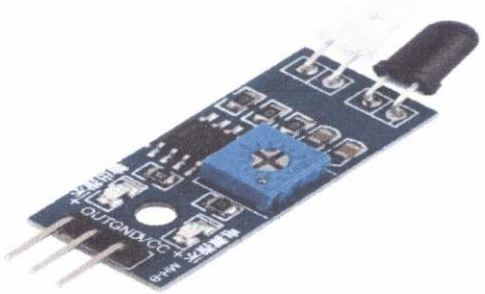


fig:-IR sensor

Chapter-5

Overview on Arduino UNO :

[Reference- http://arduino.cc/en/Guide/Libraries]

The Arduino UNO is ATmega328 datasheet based microcontroller that has 6 analog inputs, 8 digital outputs and 6 PWM outputs. It has a reset button and 16 MHz ceramic resonator with an usb connection facility along with a power jack.

"Uno" implies one in Italian and is named to stamp the forthcoming arrival of Arduino 1.0. The Uno and version 1.0 will be the reference renditions of Arduino, making headway. The Uno is the most recent in a progression of USB Arduino sheets, and the reference model for the Arduino stage.

Summary :

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (of which 0.5 KB used by boot loader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25 g

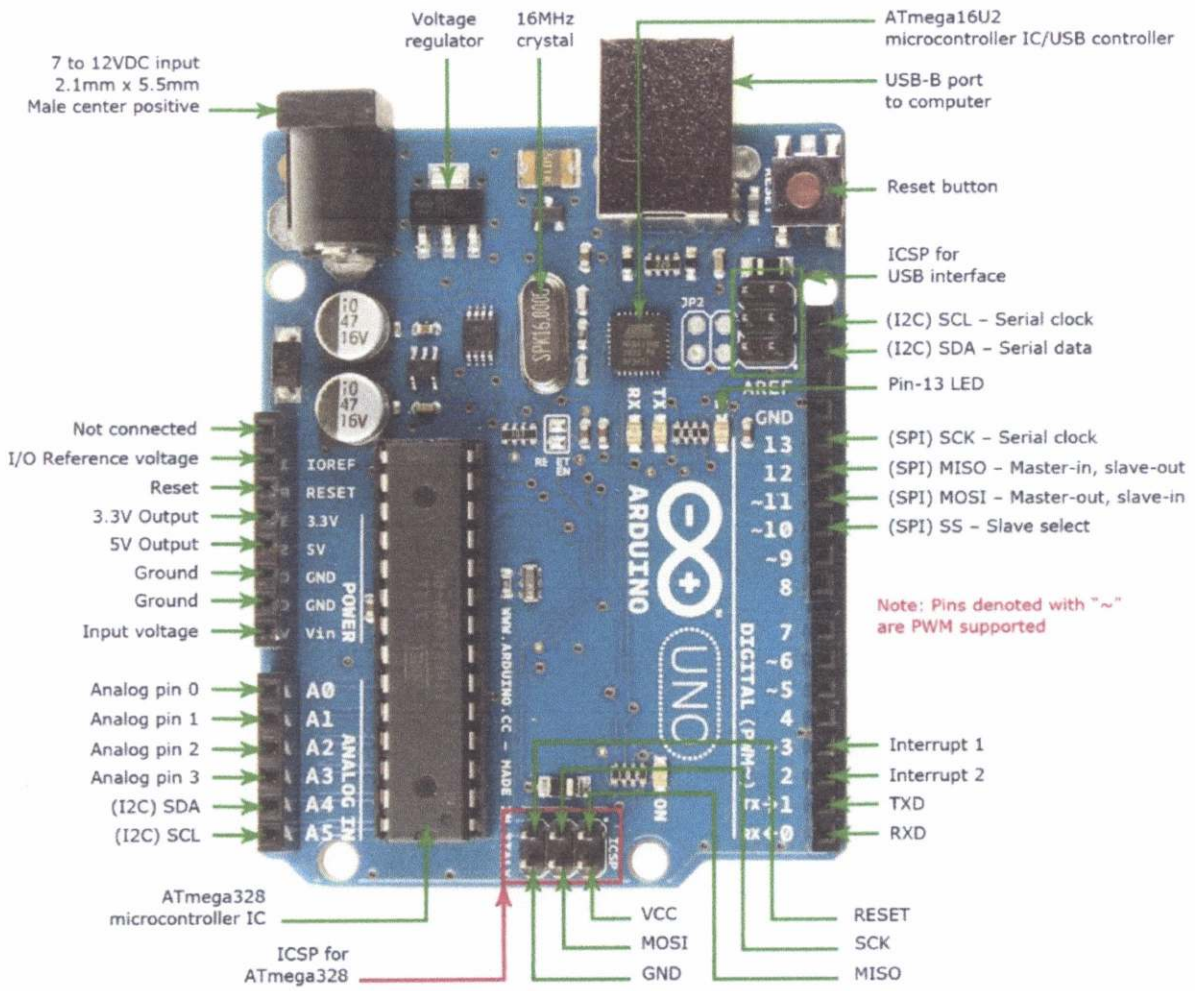


Fig:- Arduino UNO

Physical Characteristics :

The greatest length and width of the Uno PCB are 2.7 and 2.1 inches individually, with the USB connector and force jack augmenting past the previous measurement. Four screw gaps permit the board to be connected to a surface or case. Note that the separation between advanced pins 7 and 8 is 160 mil (0.16"), not an even numerous of the 100 mil dispersing of alternate pins.

USB Overcurrent Protection :

The Arduino Uno has a resettable poly-fuse that shields your PC's USB ports from shorts and overcurrent. Albeit most PCs give their own particular inner insurance, the fuse gives an additional layer of security. In the event that more than 500 mA is connected to the USB port, the circuit will consequently break the association until the short or over-burden is uprooted.

Memory :

The ATmega328 has 35 KB (with 0.5 KB utilized for the boot loader) which includes

- 2KB for SRAM
- 1KB for EEPROM

Power :

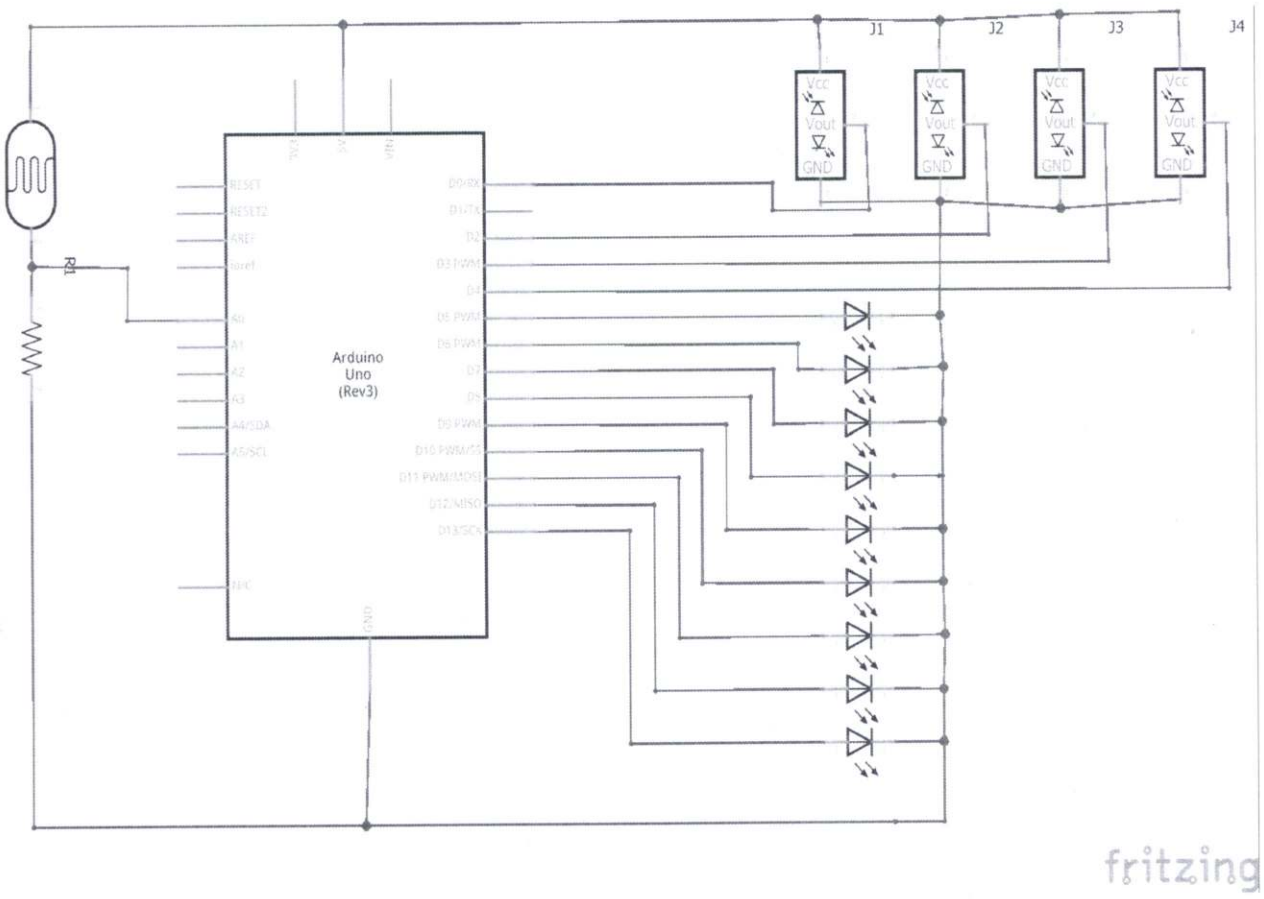
It can only works on 7-12 volts which can be possible via USB connection from the system. We can give supply to it by using a battery between Vin and GND. It also provides a IOREF pin to decide whether it should work on 5v or 3.3v.

Input and Output :

- Serial: 0 (RX) pin to receive serial data.
- Serial: 1 (TX) pin to transmit serial data.
- External Interrupts: Pin 2 and 3 are used to activate interrupt command.
- PWM: 8-bit PWM outputs are provided in ~3,~5,~6,~9,~10,~11
- LED: 13. The built-in-led shows whether Arduino is on or off.
- It has 6 analog input named A0,A1,A2,A3,A4,A5.

Chapter-6

Design and Implementation :



• We have used one LDR circuit to distinguish between the day and night. LDR with a small register in series is connected across the 5V and GND of the Arduino Uno and from the midpoint of the LDR potential divider circuit the output of the circuit is feed to A0 of the Arduino which turn on all the street lights which are represented by Led connected to the output pin (ie: 5,6,7,8,9,10,11,12,13).

• LDR is a special type of resistor whose value depends on the brightness of the light which is falling on it. It has resistance of about 1M-ohm when in total darkness but a resistance of only 5 k-ohm when brightness is illuminated. The voltage is directly proportional to the conductance so more voltage we will get when there is sunlight and vice-versa and then we have to set a reference value for the switching actions of the Led. The reference value is set to 500(baud rate).

• Four infrared receiver and sender circuits are made to detect the movements and output from the receiver is fed to the input terminal (ie.1,2,3,4) which corresponds to the led connected to 5,6,7,8,9,10,11,12,13 respectively. All the object sensors are connected between 5V and GND of the Arduino UNO.

Working of the circuit :

• The output from the LDR is connected to the A0 and initially LDR flag and LDR value is set to zero. The value of LDR reference value is initialized and set to 500(baud rate). If the Arduino UNO reads any value from LDR whose value is less than the LDR reference value than it will turn on the street lights.

• The output from IR1 and IR2, IR3, and object IR4 are connected to the pin 1,2,3,4 and reference value of all sensor is set to 500(baud rate).

• Another four proxy value for each object sensor are set to zero and if any object sensor detects any presence of objects then Arduino UNO compares the value with the object reference value. If the sensed value is less than the reference value it will glow with 100% of its intensity otherwise LEDs will be off.

• The first and the last LED glows continuously to detect the start and end of the road.

Chapter-7

Coding :

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board. The Coding required for this project is given below:-

```
int ir1=0;          //IR sensor input pin declaration
int ir2=2;
int ir3=3;
int ir4=4;
int led1=5;         //LED input pin declaration
int led2=6;
int led3=7;
int led4=8;
int led5=9;
int led6=10;
int led7=11;
int led8=12;
int led9=13;
proxy1=0;           // variable to store the value coming from the IR
proxy2=0;
proxy3=0;
proxy4=0;
int sensorPin=A0;           //select the input pin for LDR
int sensorValue=0;          // variable to store the value coming from the LDR
void setup(){
Serial.begin(9600);          // sets serial port for communication
pinMode(ir1,INPUT);
pinMode(ir2,INPUT);
pinMode(ir3,INPUT);
pinMode(ir4,INPUT);
pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
pinMode(led3,OUTPUT);
pinMode(led4,OUTPUT);
pinMode(led5,OUTPUT);
pinMode(led6,OUTPUT);
pinMode(led7,OUTPUT);
pinMode(led8,OUTPUT);
pinMode(led9,OUTPUT);
}
void loop(){
```

```
sensorValue=analogRead(sensorPin);          //read the value from the LDR
serial.println(sensorValue);               //print the value coming from the LDR
delay(1000);
if(sensorValue<=500)
{
digitalWrite(led1,HIGH);
digitalWrite(led9,HIGH);
proxy1=digitalWrite(ir1);
proxy2=digitalWrite(ir2);
proxy3=digitalWrite(ir3);
proxy4=digitalWrite(ir4);
if(proxy1==HIGH)
{
digitalWrite(led2,LOW);
digitalWrite(led3,LOW);
}
else
{
digitalWrite(led2,HIGH);
digitalWrite(led3,HIGH);
}
if(proxy2==HIGH)
{
digitalWrite(led4,LOW);
digitalWrite(led5,LOW);
}
else
{
digitalWrite(led4,HIGH);
digitalWrite(led5,HIGH);
}

if(proxy3==HIGH)
{
digitalWrite(led6,LOW);
digitalWrite(led7,LOW);
}
else
{
digitalWrite(led6,HIGH);
digitalWrite(led7,HIGH);
}
if(proxy4==HIGH)
{
```

```
digitalWrite(led8,LOW);
}
else
{
digitalWrite(led8,HIGH);
}
}
else
{
digitalWrite(led2,LOW);
digitalWrite(led3,LOW);
digitalWrite(led4,LOW);
digitalWrite(led5,LOW);
digitalWrite(led6,LOW);
digitalWrite(led7,LOW);
digitalWrite(led8,LOW);
digitalWrite(led9,LOW);
}
}
```

Chapter-8

Observations and Outcomes :

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

Assumptions :

- Suppose a 10 km long one-way street contains 500 street lights and the nominal range of all the street lights are 20 meter.
- All the street lights are supposed to glow for a period of 12 hour from 6 pm to 6 am.
- One street light is supposed to consume 1 kwh power for a period of 1 hour when it glows with its maximum intensity so that one street light consumes maximum 12kwh in a day.
- So 500 street lights consume maximum 12kwh*500=6000kwh power in a day.
- Each IR sensor if blocked than two street light glows.

Case-1: (Let one vehicle is in motion during night)

If two Street light glows per one IR sensor

Than power consumed by two Street light = 2*1kWh

= 2kWh

Maximum of only two street light glow for one vehicle movement.

Therefore, Total power consumed for 12 hrs. = 2kWh*12

= 24 kWh

Total power saved = 6000kWh – 24kWh

=5976 kWh

Case-2: (from 5am to 6am and 12 pm to 1 am; let only 10 vehicles are in motion)

If 10 vehicle crosses the street light one by one; than total of 20 street light glows per 10 IR sensor

Therefore, power consumed by 20 Street light = 20kWh

Total power consumed in 12 hrs = 20kWh*12

= 240 kWh

So, total power saved = 6000kWh – 240 kWh

= 5760 kWh

Case-3: (from 10pm to 12am; let only 100 vehicles are in motion)

If 100 vehicle crosses the street light one by one; than total of 200 street light glows per 100 IR sensor

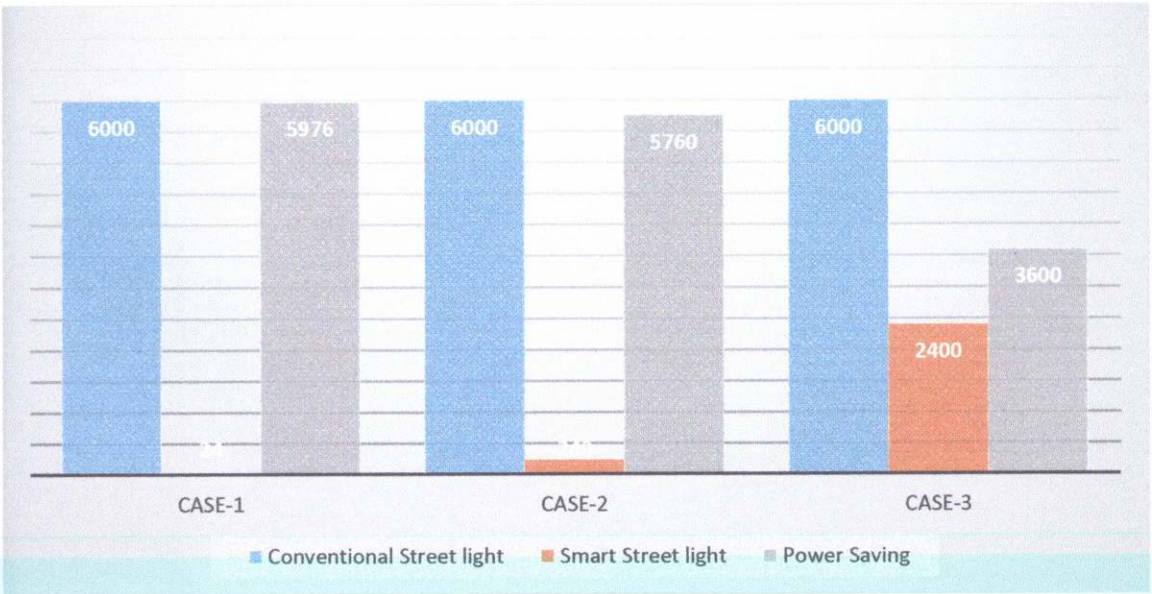
Therefore, power consumed by 200 Street light = 200kWh

Total power consumed in 12 hrs = 200kWh*12

= 2400 kWh

So, total power saved = 6000kWh – 2400 kWh

= 3600 kWh



Conclusion :

This project report gives the detail study of the "Smart Street Light System". The construction, working principle, implementation of the project is given throughout this report. Circuit meets expectations appropriately to turn road light on/off depending on the movement of the vehicle. LDR sensor senses the day or night time. The IR sensor senses the motion of the vehicle. 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, where the framework relies on upon photoelectric sensor. At long last this control circuit can be utilized as a part of a long roadway between the urban areas as well as the rural areas.

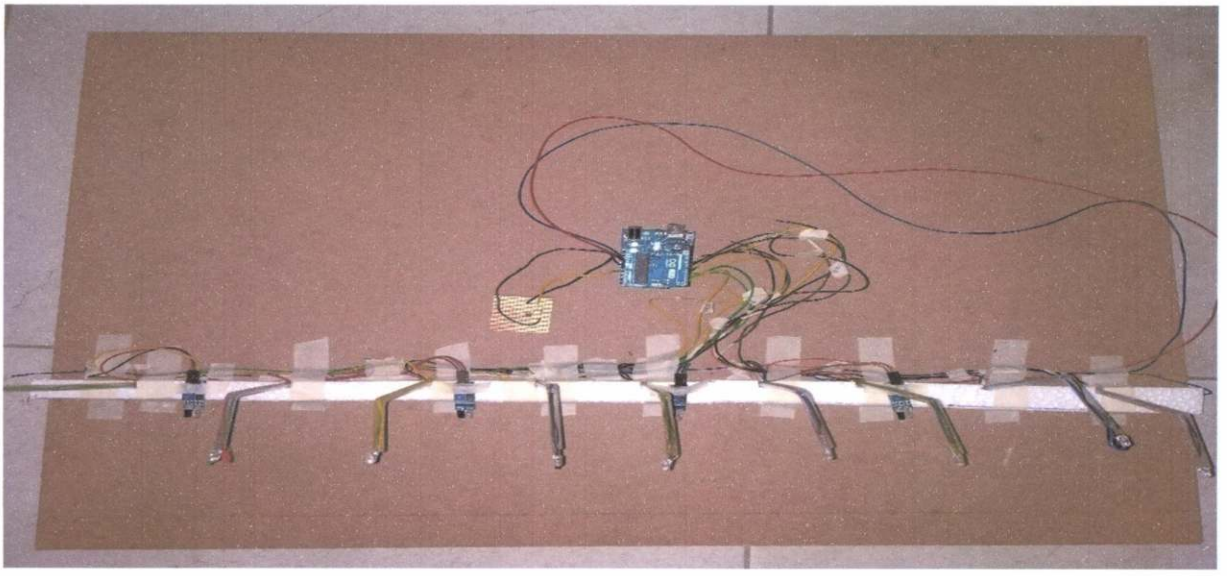
The results of our project work supports our hypothesis that the Smart Street Light circuit would solve the power consumption problem. The final conclusion drawn from our project work is that the circuit is very efficient and it can be used in street of India.

Appendix :

a) Cost Analysis of the project

Sl. No.	Name of the components	Quantity	Cost(Rs)
1	Arduino UNO	1	525
2	IR Sensor	4	120*4=480
3	LDR	1	30
4	LED	9	10*9=90
5	9v DC battery	1	50
6	Plywood	1	100
7	Wires (per meter)	5	100
8	Battery connector	1	10
	TOTAL		1385

Project Picture :



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