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AUTOMATIC STREET LIGHT CONTROLLER SYSTEM USING LDR AND PIR SENSOR

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Abstract: In this paper, we purpose an advanced automatic street light control system that is capable of replacing the old light control system because the manual control of light is not effective in this modern era. By using this system energy consumption is additionally reduced because nowadays the operated-by-hand street lights aren't transitioned even the daylight comes and also switched on earlier before sunset. Automatic street light using Passive Infra-Red (PIR) motion sensor and Light Dependent Resistor (LDR) sensor, where the street lights will automatically turn ON and OFF by detecting the presence of human and amount of luminous energy in the environment at that moment. We can use an Arduino microcontroller for controlling the sensors and output device light-emitting diode. Application of such a system can be implemented in park light, street light, room light, smoke detection, and person detection. The automatic street light system does not need manual work to switch ON and OFF lights. The system itself detects whether there is a need for light or not.

Keyword: Arduino UNO, LDR Sensor, PIR Sensor, LED, Resistor, Light Control.

1. INTRODUCTION:

Generally, we can see street lights are ON even after sunrise and no presence of human thus by having an automatic street light control system, which turns ON and OFF street lights when ambient light falls below a specific intensity, for this, we can use LDR sensor. In this system, we are also using a PIR motion sensor which detects the motion of the object such as human and animal passing through it, using this motion of object LED's are turned ON.

Most of the time we see street lights are ON even after sunrise and no presence of any person who needs light thus by having an automatic street light control system which turns ON and OFF street lights when it detects a person and also when ambient light falls below a specific intensity. The manpower required for controlling the light cuts a huge cost, so using this system we can also reduce the cost of manpower and reduce unnecessary power consumption. We also know that during day time there is no essence of street light this problem is solved by LDR sensor. LDR sensor keeps the street light OFF in day time. When the light intensity is low then the LDR is stared working and the light is switched on. [1]

The main aims of this project are to implement an auto-intensity control of LED-based on LDR and PIR motion sensor. PIR motion sensor detects the human presence and turns ON/OFF LED light. LDR and PIR motion sensor interface with a microcontroller, as the surrounding light decreases LDR sensor turn on the LED light and also when PIR sensor detects motion it turns ON lights.

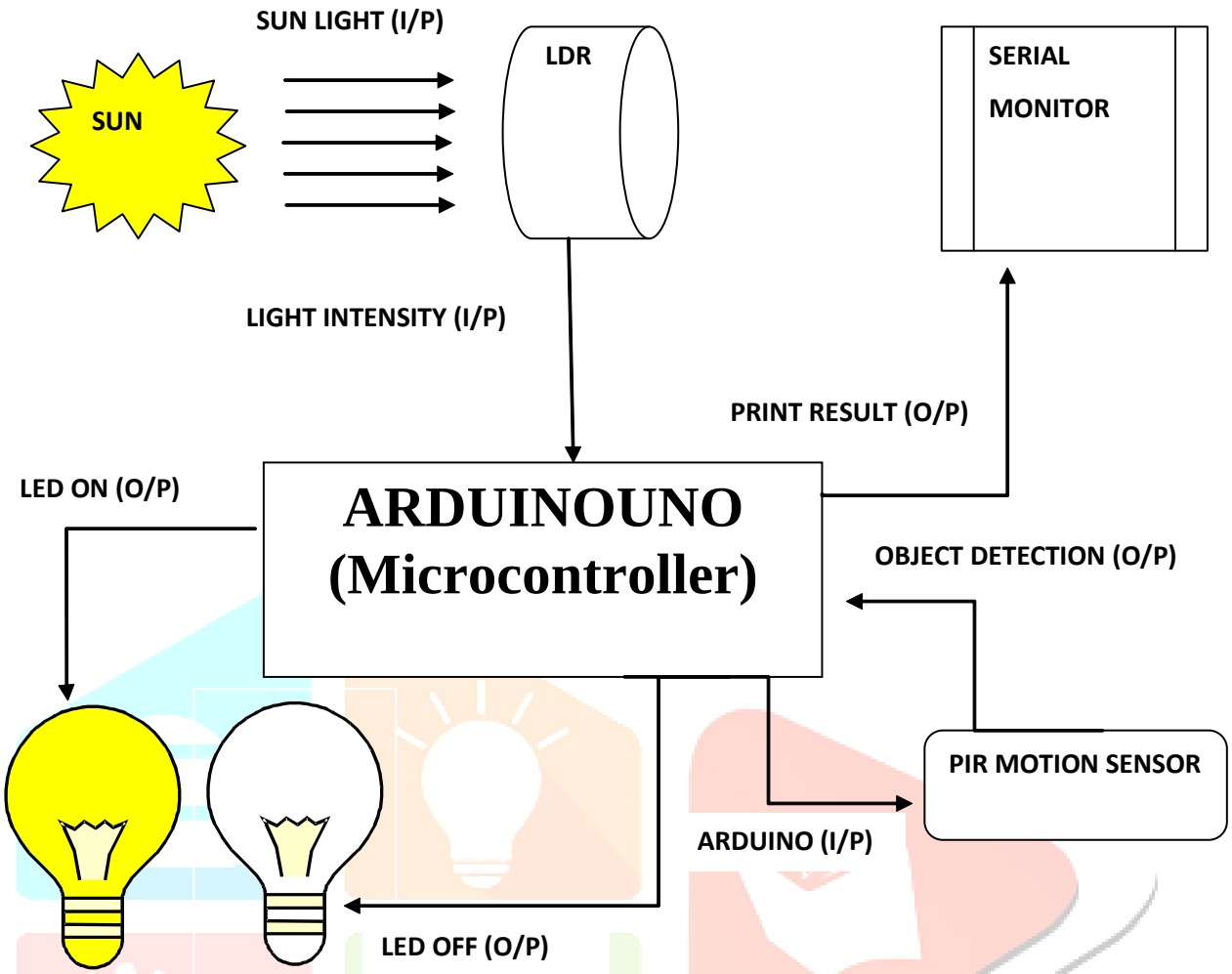

Figure 1: The architecture design of the automatic street light control system.

2. SYSTEM COMPONENTS:

An automatic streets light control system consists of Arduino, LDR sensor, PIR motion sensor, LED, resistor, breadboard, jumper wire, and 9v battery for external power.

Table 1: Specification of electronic components used to design the proposed system.

S. No.	Components	Specification
1	Arduino Uno	22pins, operating voltage 5-20V
2	LDR sensor	Voltage: DC 3-5V, 5mm, 1.8gm
3	PIR motion sensor	Voltage: 4.5V to 20V, Range: 3-7meters,Angle:110 degree
4	Resistor	220ohm, 10kohm
5	LED	5mm, operating voltage 5V
6	9V battery	Voltage:9V, weight:45gm

2.1 Arduino Uno:

Arduino is an open-source microcontroller board that has an ATmega32 series controller and an IDE (Integrated Development Environment) used for writing and uploading codes to the board. Arduino operating voltage is 5 volts and input voltage 7 to 20 volts. It has Universal Serial Bus (USB) for loading and power from a personal computer. We can also give electric power to the microcontroller by 9v battery, USB cable A to B, and another power source such as power bank, etc. A microcontroller is the brain of the project which controls all the components connected to it. It takes the input signal from the sensor and takes action according to the code uploaded in ATmega32. Arduino IDE support programming language such as C and C++. The microcontroller has 14 digital input/output pins out of these 14 pins six pins are capable of PWM output, six analog input/output pins from A0 to A5, 16 MHz ceramic resonators, USB connection jack, external power supply jack for 9v, and In-Circuit Serial Programmer (ICSP) header. It also has 32 kb flash memory where 0.5 kb used by the boot loader.

The microcontroller takes the input from the LDR sensor and PIR motion sensor, processes the sensor data, and gives the output to LEDs. [2]

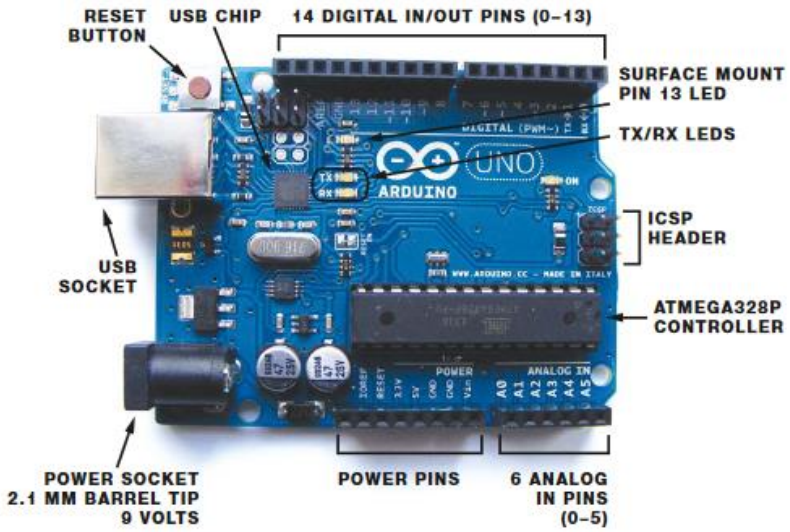

Figure 2: Arduino Uno Board description

Table 2: Specification of Microcontroller Arduino

S. No.	Specification	Values
1	Microcontroller	Microchip ATmega32
2	Operating Voltage	5 volts
3	Input Voltage	7 to 20 volts
4	Digital I/O Pins	14 (6 pins provide PWM output)
5	DC Current per I/O Pin	20mA
6	DC Current for 3.3v Pin	50mA
7	Analog Input Pins	6 (A0 to A5)
8	Flash Memory	32kb (0.5kb used by the boot loader)
9	SPAM	2kb

2.2 Light Dependent Resistor (LDR):

The light-dependent resistor is also known as a photo resistor or photocell. It is a light-controlled variable resistor. In photo resistor resistance decreases when light intensity increased and resistance increases with light intensity decreased. So that we can say that the resistance of the photo resistor is maximum at low light and minimum as light increases. LDR is mainly used for the detection of day and night. It can turn ON/OFF street light according to the change in light intensity or day/night time.

2.3 PIR motion sensor:

PIR sensor is also called Passive Infrared sensor which is used to detect the presence of human or animal. It is open-source hardware used in tons of projects. The PIR sensor receives infrared radiation from the human body and turns ON and OFF the street light. We can say that when a person crosses the PIR sensor then it can detect the human presence and make LED HIGH and when a person not in the range of the PIR sensor LED is set to LOW. As we know that any object with temperature is constantly radiating infrared rays to the outside environment. The temperature of the human body is 27-36^{0}C in normal condition.

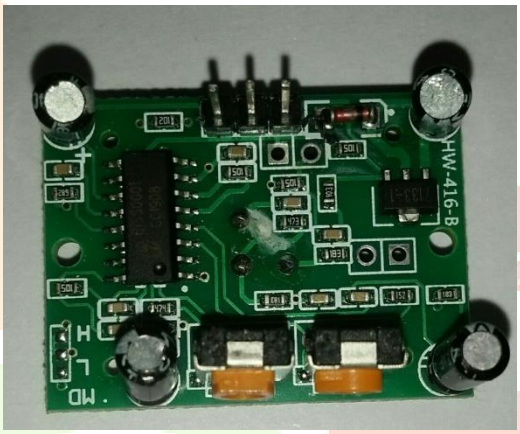

Figure 3: Passive Infra-Red (PIR) Sensor

Table 3: Pin description of PIR motion sensor

S. No.	Pin or Control	Function
1.	Delay Time Adjust	Output remains high 5 sec to 5 min after detecting human body
2.	Sensitivity Adjust	Sets the detection range between 3 meters to 7 meters
3.	Ground pin	Ground input
4.	Digital Output Pin	Low when no motion is detected High when motion is detected.
5.	Power Pin	4.5 to 20 VDC Supply input

2.4 Resistor:

A resistor may be a passive electronic part, used with different electronic parts like LEDs and sensors to forestall or limit the flow of electrons through them. Resistors limit the amount of current flow through a circuit. They give the impression of being like cylinders with colored bands and a wire from either finish. Check this carefully, as it can be easy to choose the wrong value. Resistors come in two, four, and five-band varieties. We can use a 220ohm resistor with LED and a 10k ohm resistor with an LDR sensor in the automatic street light control system.

2.5 Light Emitting Diode:

A light-emitting diode (LED) emits light when a small current is passed through it. It looks sort of a little lightweight bulb with 2 legs. The longer leg is the positive connection and the shorter leg is the negative connection. In our project, we can use LED as output. LED gets turn ON/OFF according to sensor data. In LEDs current flows only in one direction. An LED is a two-terminal device known as Cathode and Anode. The long terminal is termed Anode, and therefore the shorter terminal is termed Cathode. You can not directly connect the LED to a battery or voltage source. An LED should be used with an electrical device to limit the number of current flowing through the LED.

3. PROPOSED SYSTEM:

The main objective of the automatic street light control system is to provide an efficient and energy-saving lighting system by evaluating the outside environment lighting condition and motion detection, and then control the lights accordingly.

The system mainly consists of two sensing elements PIR motion sensor and LDR sensor. These sensors are followed by a processing unit Arduino that takes input from sensors and gives its output to the LED through a resistor for a higher voltage supply. Here we can use two resistors, the first 220-ohm resistor with LED and the second is 10k ohm with LDR sensor. [3]

4. COST ANALYSIS:

In is paper we can analyze the cost of electricity based on Indian parameters, so let's take a scenario where if the daytime is 12 hours and the hundred lights are operating under 220 volts, and therefore the power of the light is sixty watts. The road distance considers 1 kilometer, the unit is calculated below.

$$Unit = P*T/1000$$
$$60*12/1000$$
$$0.72 \text{ Unit per day per lamp}$$

Let's take the average cost of electricity per unit in India is 5.43 rupees than the total cost per month = 0.72*5.43*30 = 117.28 rupees per month per light. The total amount for all light in 1 kilometer is = 117.28*100 = 11728 rupees. So using the Automatic Street light system we can automatically On/OFF light according to day and night time by measuring the light intensity using an LDR sensor and also by detecting human presence we can also turn ON/OFF light. It can save a huge amount of our money as well as reduce electricity consumption. Here we can only calculate for only 1 kilometer but in the real road are hundreds and thousands kilometer long and several street lights are more. So that we can say that the automatic street light system is capable of saving electricity.

5. BLOCK DIAGRAM AND DESCRIPTION:

As described in the introduction two parameters are to be considered in this system. One, the street light is controlled when the intensity of light in the surrounding environment is below the given value and another one is detected human presence. These tasks are done by using LDR and PIR motion sensors respectively.

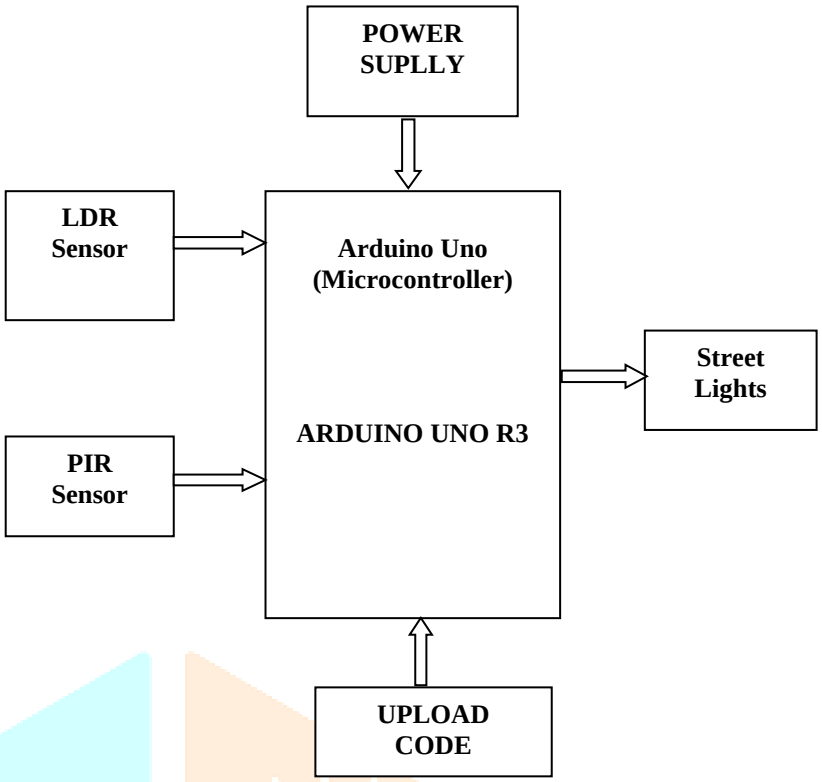

Figure 4: Block diagram for Automatic Street Light System

In this block diagram of the project, we can use LDR and PIR motion sensor as input and street light or lead as output for the project. The sensor can take data from the outer environment and give it to the microcontroller here we can use Arduino Uno R3 as a microcontroller. The microcontroller process the data come from the sensor and take action according to the input data. Arduino is the central unit or brain of the project it can control sensor and light.

5.1 Power Supply:

In this block diagram, we can use two kinds of power supply because every component in the system required a power supply. One is an external power supply and another is an internal power supply. The internal power supply is given from the controller. The sensor takes operating voltage from the controller; we can say that controller provides the internal power supply to the sensor. Generally, the controller provides a DC power supply of 3.3V and 5V to the sensor. [4]

6. FLOW CHART:

In this project we can use two sensors for controlling the street light one is LDR and another is a PIR sensor so that now we can see the flow or working of both sensors separately for a better understanding of the system.

6.1 Object Detection:

The first flow chart shows the PIR sensor working processor where initially the process is started. Then if any person passes in front of the PIR sensor, it detects the person and sends the PIR value to the microcontroller and the microcontroller turns ON the light and if the person does not present the light OFF, Finally the process is stopped.

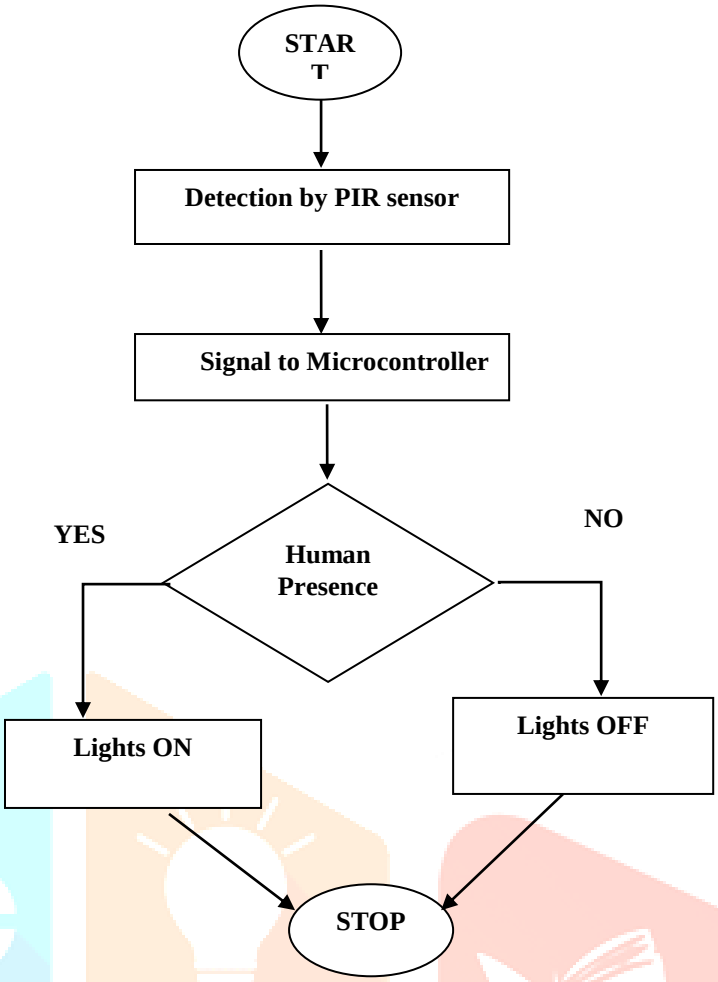

Figure 5: Flow chart for object detection

6.2 Light Detection:

In the LDR flow chart initially, the process is started if the LDR sensor detects the light it sends the signal to the microcontroller and if the environment light intensity match to give value microcontroller turn ON the light and if the sensor read value is not matched to set value the light remains low. At the last step, the process is stopped. [5]

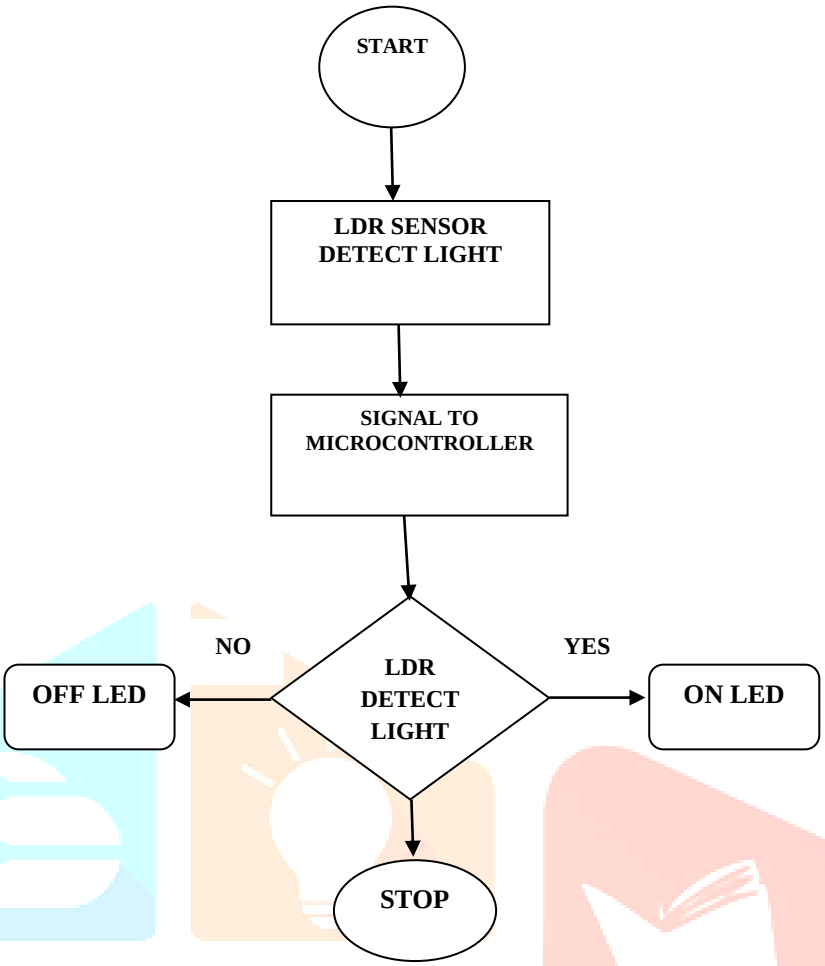

Figure 6: Light intensity detection flow chart

7. SCHEMATIC DIAGRAMS:

1. Insert your LDR sensor into the breadboard. Connect one leg to the +5v of Arduino using a jumper wire. Connect the other leg of the LDR to A1 (analog pin of the Arduino) and one pin of the 10k ohm resistor. Connect the other pin of the 10k-ohm resistor to the GND of the Arduino pin.

LDR Sensor	**ARDUINO PINS**
Leg 1	+5v
Leg 2	Analog pin (A1) via 10k-ohm resistor and GND

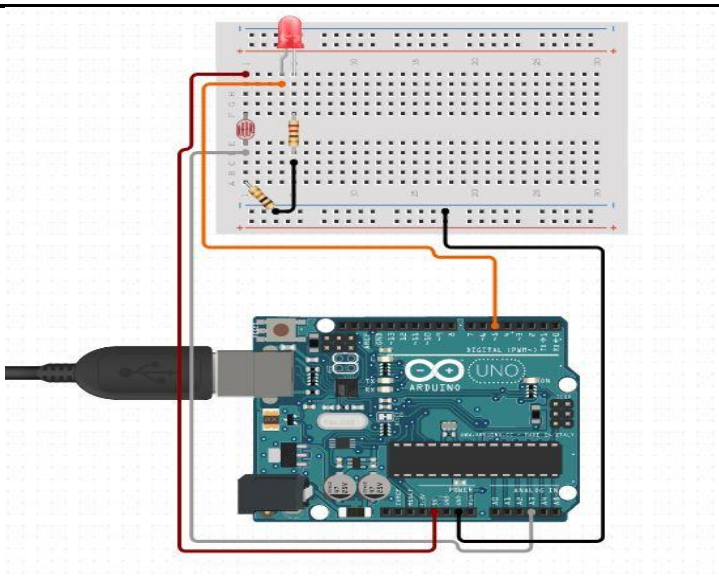

Figure 7: Semantic diagram of LDR and Arduino

2. Connect the PIR sensor +5V and GND wires to the +5V and GND rails on the breadboard, and connect these rails to the Arduino. Connect the PIR sensor's output wire to Arduino pin 2.

PIR SENSOR	**ARDUINO PINS**
VCC	+5V
GND	GND
Output	Pin 2

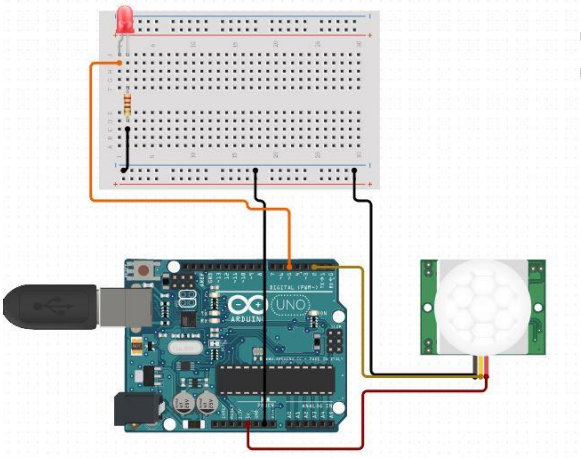

Figure 8: Semantic diagram of PIR sensor and Arduino

3. Insert an LED into the breadboard and connect the long, positive leg to Arduino pin 3 via 220-ohm resistor, and the short, negative leg to GND.

LED	**ARDUINO PINS**
Positive leg	Pin 3 via a 220-ohm resistor
Negative leg	GND

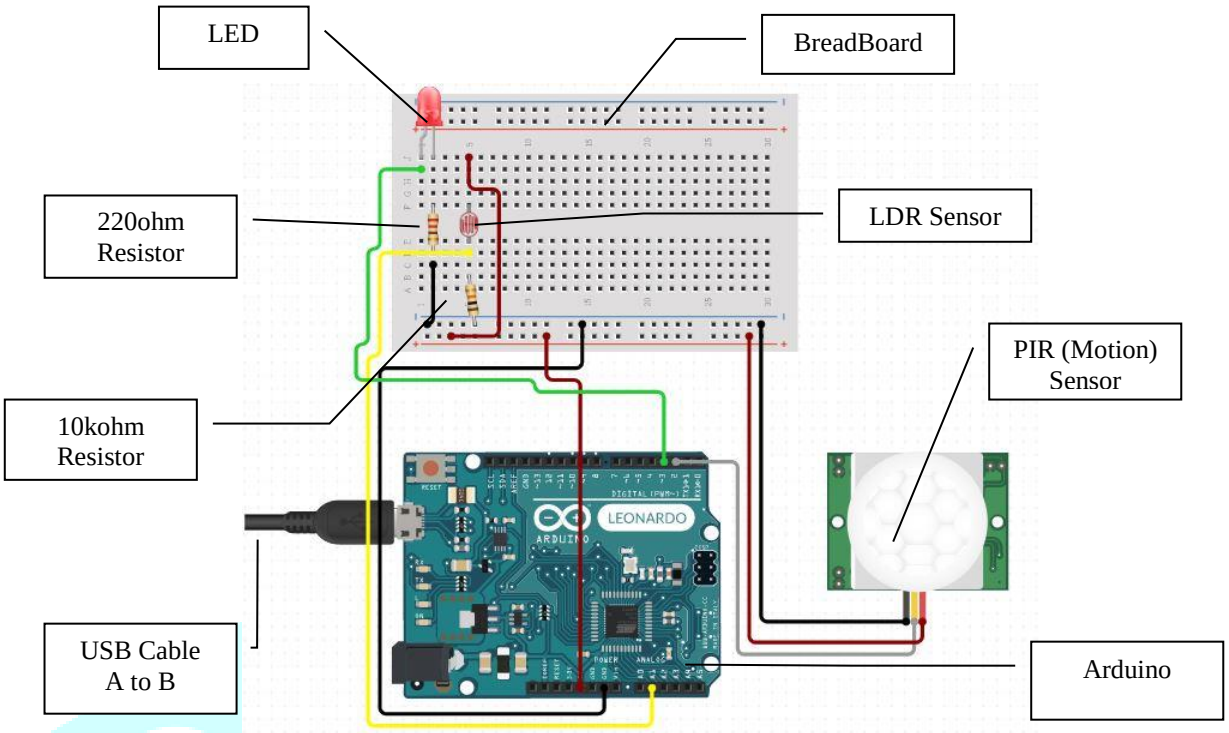

Figure 9: Pin configuration for final project components

4. Connect the USB port of Arduino with a computer for uploading code and power. Once you upload the code into the controller once your program is uploaded that you can power it with an external power source such as a 9v battery by power jack.

```
int led=13; // the pin that the LED is atteched to
int pir=2;  // the pin that the PIR sensor is atteched to
int ldr_value;
int pir_value;
void setup() {
  pinMode(led, OUTPUT); // initalize LED as an output
  pinMode(pir, INPUT);  // initialize sensor as an input
  Serial.begin(9600);   // initialize serial
}

void loop() {
  ldr_value=analogRead(A0); //Reads the Value of LDR and Set A0(Analog Input) for LDR
  pir_value=digitalRead(pir); //Reads the Value of PIR sensor
  if(ldr_value<200 || pir_value == HIGH)  //Check if the PIR sensor is HIGH and LDR value is less than 200
  {
    digitalWrite(led, HIGH);  //Turn ON LED
    Serial.println("Motion detected!");
    delay(100); //Give 100 milisecond delay
  }
  else
  {
    digitalWrite(led, LOW); //Turn OFF LED
    Serial.println("Motion stopped!");
    delay(100);
  }
  Serial.print("LDR value is :");   //Prints the value of LDR to Serial Monitor.
  Serial.println(ldr_value);
  delay(100); //Give 100 milisecond delay
}
```

Figure 10: Code for the project

8. LITERATURE REVIEW:

Controlling lighting systems using LDR and PIR motion sensors using Arduino together is a new concept. After analyzing many research papers and study which were related to the Automatic Street light control system, I found that there are papers that only consider one sensor it may be LDR or PIR motion sensor but combining both sensors to make such a system which can control light by detecting human presence and light intensity is new. So that we can rarely find such research works which coin all the lighting systems under one umbrella and use LDR and PIR motion sensor with microcontroller.

9. RESULTS AND DISCUSSIONS:

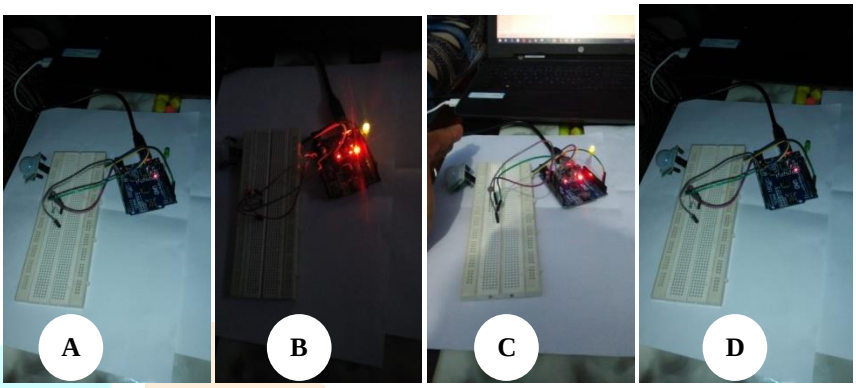

Figure 11: (a). Initially LED value LOW due to no motion and the LDR value is high **(b).** LED value HIGH because LDR value is less than set value **(c).** LED value HIGH because motion is detected by the PIR sensor. **(d).** Now motion is not detected by the PIR sensor and the LED value LOW again.

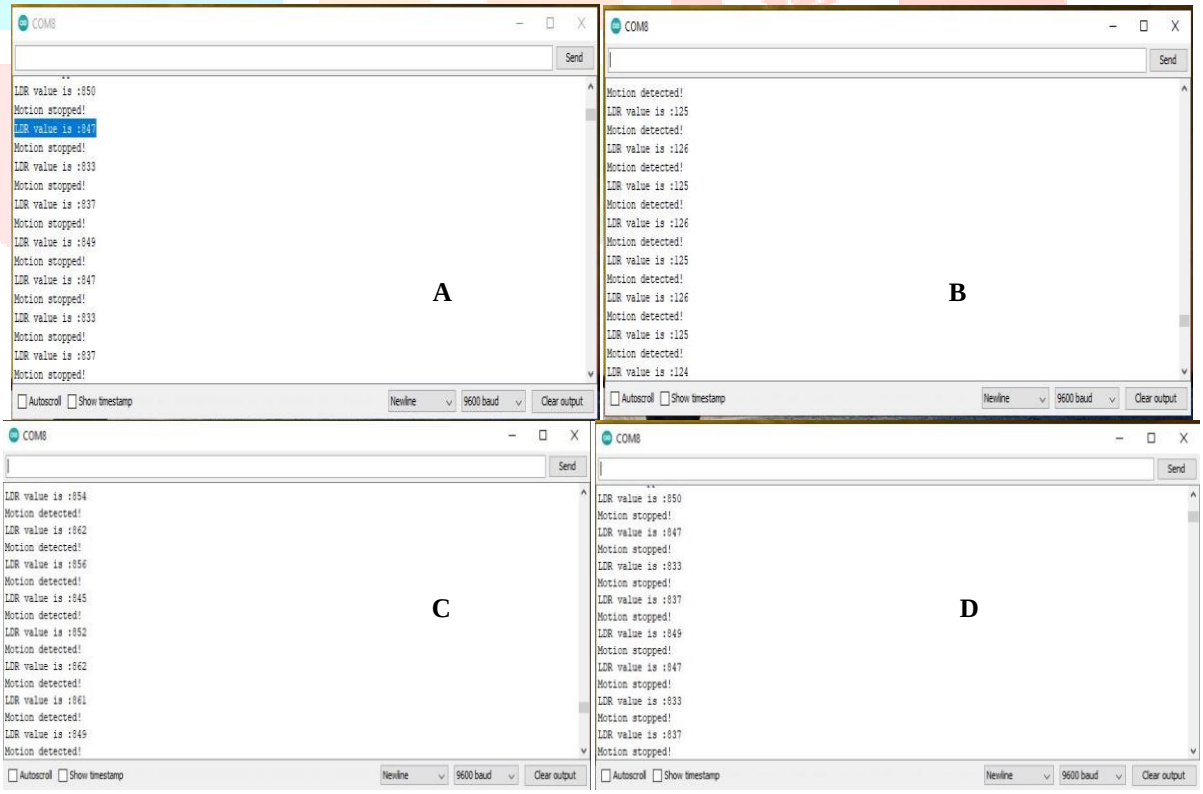

Figure 12: (a). Initially, the LDR value is more than the set value and the PIR sensor detects no motion. **(b).** LDR value is less than the set value **(c).** Motion is detected by the PIR sensor **(d).** Now motion is not detected by the PIR sensor.

Table 4: Derived results after implementation

S. No.	Component	Input Data	Verified Result	Remarks
1.	Microcontroller Testing	Digital Signal	LED ON/OFF on sensors condition changed	Component is accurate
2.	Light Dependent Resistor	Outside environment intensity Values	HIGH/LOW LED according to outside light intensity and print on the Serial monitor	Component works accurately
3.	PIR motion sensor	Object detection such as human and animal	HIGH LED when it detects motion	Object detection is accurate

11. FUTURE WORK:

In the proposed system decision are taken based on outside light intensity and the presence of the human. We can interface LDR (light-dependent Resistor) along with a PIR motion sensor and control a LED but we can also use it with a relay for controlling the AC because in the proposed system we can only control a 5mm LED. In the future, this system can also implement in a solar-based street light system. In the future, we can also control a 5 watt light using a relay. This system can also be interfaced with the Bluetooth module so the whole system can be controlled from the Smartphone with just a single click.

12. CONCLUSION:

In this automatic street light system, we can try to reduce manual work to ON and OFF switches. The system itself detects whether there is a need for light or not. When darkness rises to a certain value and a person is detected. The proposed streetlight automation system is cost-effective and the safest way to reduce power consumption. It helps us to get rid of today's world problems of manual switching and most importantly, primary cost and maintenance can be decreased easily. It reduces the unnecessary use of electricity. It provides an efficient and smart automatic streetlight control system with the help of LDR and PIR sensors. It can reduce energy consumption and maintains the cost. This system is very versatile, extendable, and adjustable to user needs. We do not have to manually turn on and off these street lights as they turn on and off all by themselves according to the intensity of the surrounding's light. The main purpose of this project is to prevent the loss of electricity unnecessarily during the daytime and in absence of any person to make the system more efficient than before. This system can be easily implemented in street lights, smart cities, home automation, agriculture field monitoring, forest animal monitoring, parking areas, and other public and privates places.

REFERENCES:

[1]. Md. Sazol Ahmmed "Automatic Street Light Control System using Light Dependent Resistor and Motion Sensor Global Journal of Researches in Engineering: A Mechanical and Mechanics Engineering Volume 18 Issue 1 Version 1.0 the Year 2018.

[2]. M. A. Kamthe "Automatic Room Light Controller using Arduino and PIR Sensor IJESC " Volume 10 Issue No.5.

[3]. Gaurang Tandon, Dr. Devesh Katiyar "IoT And Security Issues Faced In IoT", International Journal of Scientific Research in Engineering and Management (IJSREM), VOLUME: 04 ISSUE: 04 | APRIL -2020

[4]. M. Palani Kumar, "Automatic Street Light Control using Arduino" IJESC Volume 9 Issue No.3 2019.

[5]. Bhawna Tripathi, Dr. Devesh Katiyar, Gaurav Goel"A Study Of Mobile Computing Devices", International Journal of Scientific Research in Engineering and Management (IJSREM), ISSN: Volume: 04 Issue: 05 | May -2020

[6]. Deepak Kumar Rath "Arduino Based: Smart Light Control System" International Journal of Engineering Research and General Science Volume 4, Issue 2, March-April, 2016.