Netaji Subhash Engineering College

Topic: Electronic system design employing microcontrollers.

Experiment No. : 5

Sub: Instrumentation System Design Lab

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Objective: Auto Intensity Control of Street Lights.

Theory: Street lights are controlled manually in olden days. These days automation of streetlights has emerged. But one can observe that there is no need of high intensity in peak hours i.e., when there is no traffic and even in early mornings. By reducing the intensity in these times, energy can be saved to some extent.
There are many methods to save the power like switching the street light on detecting vehicle , Street light controlling using LDR and relays etc. The proposed circuits control streetlight intensity by calculating the peak hours. The circuit shown in this article, explains the streetlight control using ATmega328P microcontroller. Most found streetlights are HID or High Intensity Discharge lamps, which consume a lot of power. In order to save energy, the circuits are designed with high intensity LEDs in place of HID lamps.

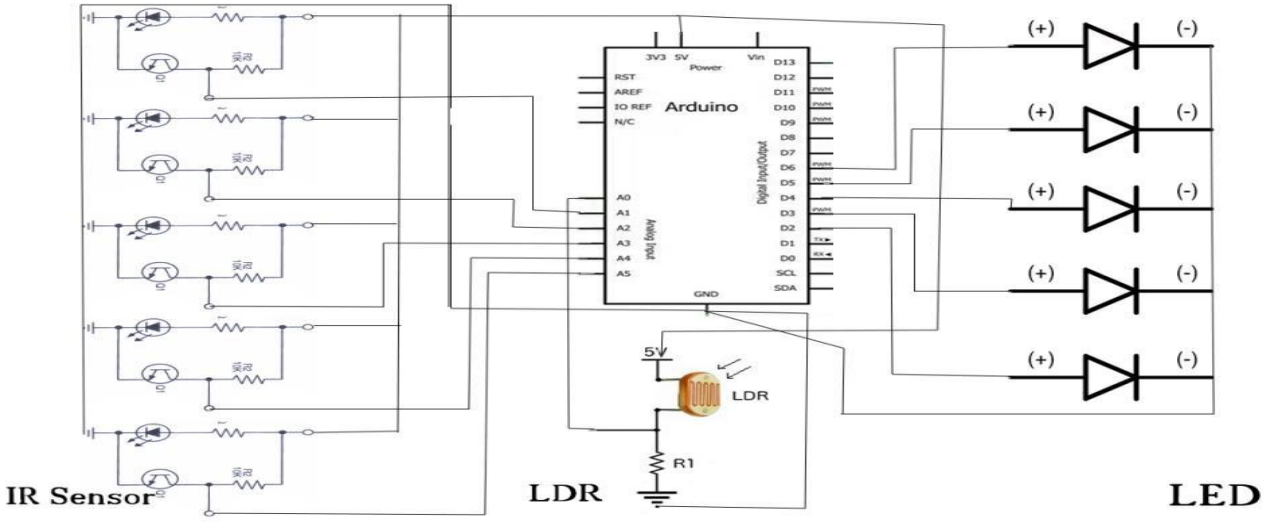
The auto intensity control of streetlights circuit is simple, but it requires more coding part. This circuit consists of microcontroller, LDR, IR sensor and LEDs.

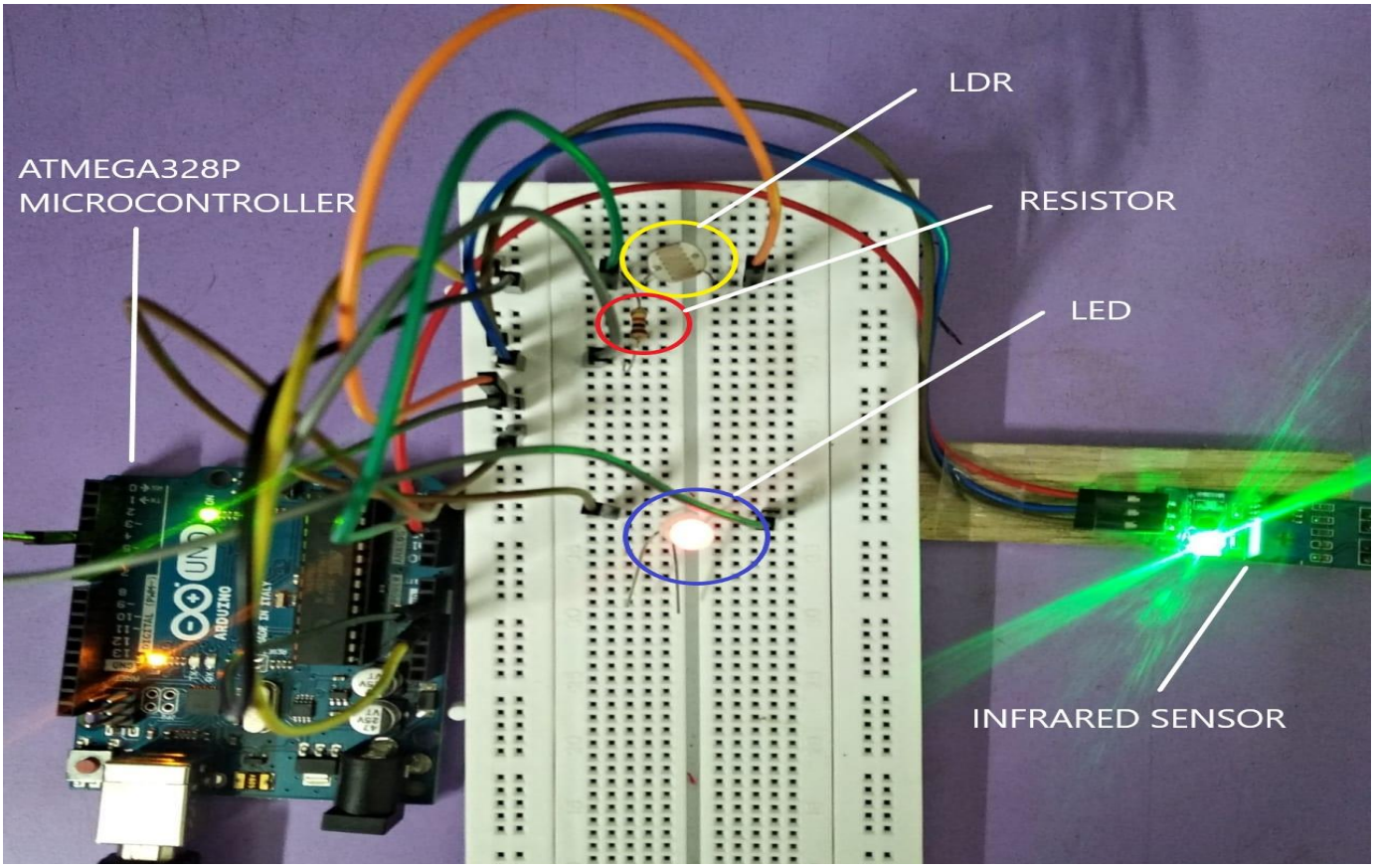
- **LDR:** LDR is used for calculating the light intensity of the environment. The light dependent resistor is connected to ADC1 (PC1) pin of the micro controller. The analog light value is converted to digital value using ADC.

- **LED Array:** LED array is number of high-power LEDs connected in series. It is connected to PWM pin of the microcontroller.

- **IR Sensor** : An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.

Circuit diagram:





Circuit Components:

- ATmega328P micro controller
- Light Dependent Resistor
- LED array.
- IR sensor
- 10K ohm resistor

Circuit Principle:

When it is dark the LDR will switch on all the LED's and their brightness will be full / 5 (255 / 5) and when any obstacle is detected by the IR sensor the respected LED will glow with full brightness for 3 sec.

These peak hours can be calculated by considering parameters like traffic density, time, light intensity of the environment.

Procedure:

1. Initially power the circuit.
2. Place the LDR in darkness as the streetlights switches on only when there is no light on LDR.
3. At traffic less hours, the streetlights are kept in an optimum level for pedestrians and other wild animals to avoid accidents.
4. When at signal stoppages or when at a traffic jam, the streetlight intensity will increase to allow the drivers ample light to watch roads ahead.
5. When at a signal, the light stays on for another some time after the car leaves the point.
6. The LDR switches off streetlights in the morning when ambient light is enough.

Code:

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Smart_light

```
int ldr = A4;

int ir = A3;

void setup()
{
  Serial.begin(9600);
   pinMode(led,OUTPUT);

   pinMode(ldr,INPUT);

   pinMode(ir,INPUT);

}

void loop()
{
    Serial.println(analogRead(A4) );
    int ldrstatus = analogRead(ldr);
    if (ldrstatus <= 500)
      {
```

Fig. (1)

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Smart_light

```
      {

        digitalWrite(led, HIGH);
        analogWrite(led,100);

        if (analogRead(A3)<300)
         {
           digitalWrite(led, HIGH);
           analogWrite(led,225);
             delay(1000);
         }
           else
           {
             digitalWrite(led,HIGH);
             analogWrite(led,100);

           }
      }

        else

            {
```

Fig. (2)

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Smart_light

```
        analogWrite(led,100);

        if (analogRead(A3)<300)
         {
           digitalWrite(led, HIGH);
           analogWrite(led,225);
             delay(1000);
         }
           else
           {
             digitalWrite(led,HIGH);
             analogWrite(led,100);

           }
      }

        else

            {
              digitalWrite(led,LOW);
            }
}
```

Fig. (3)

Project:

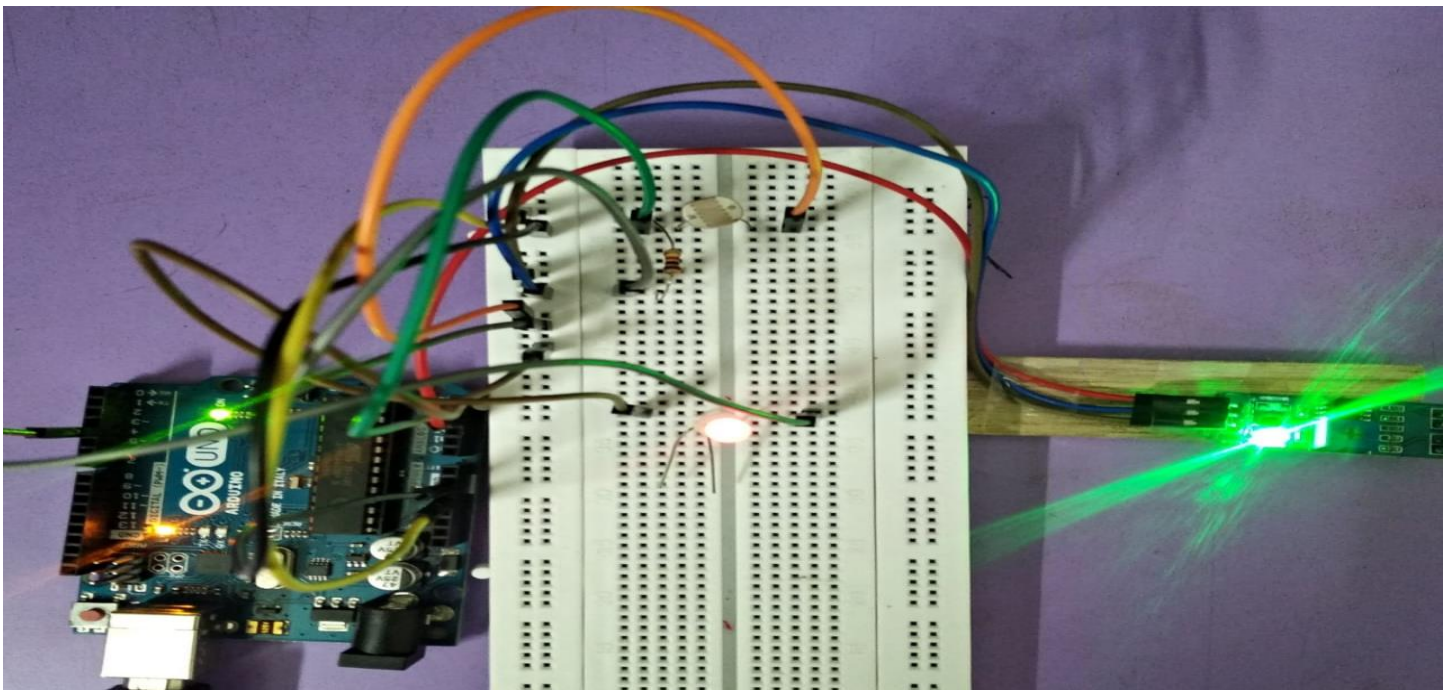

Fig. (4): When LDR value < 500 ohms

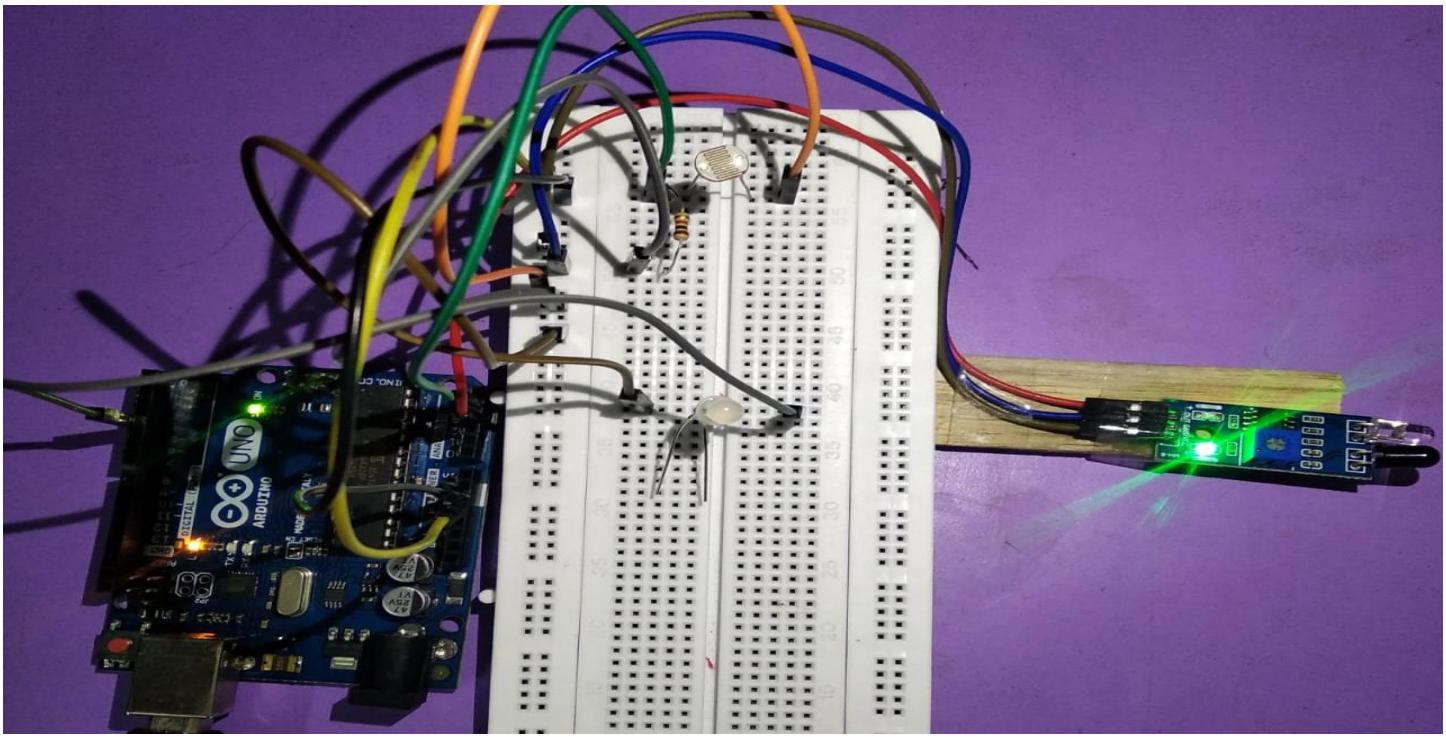

Fig. (5): When LDR value > 500 ohms

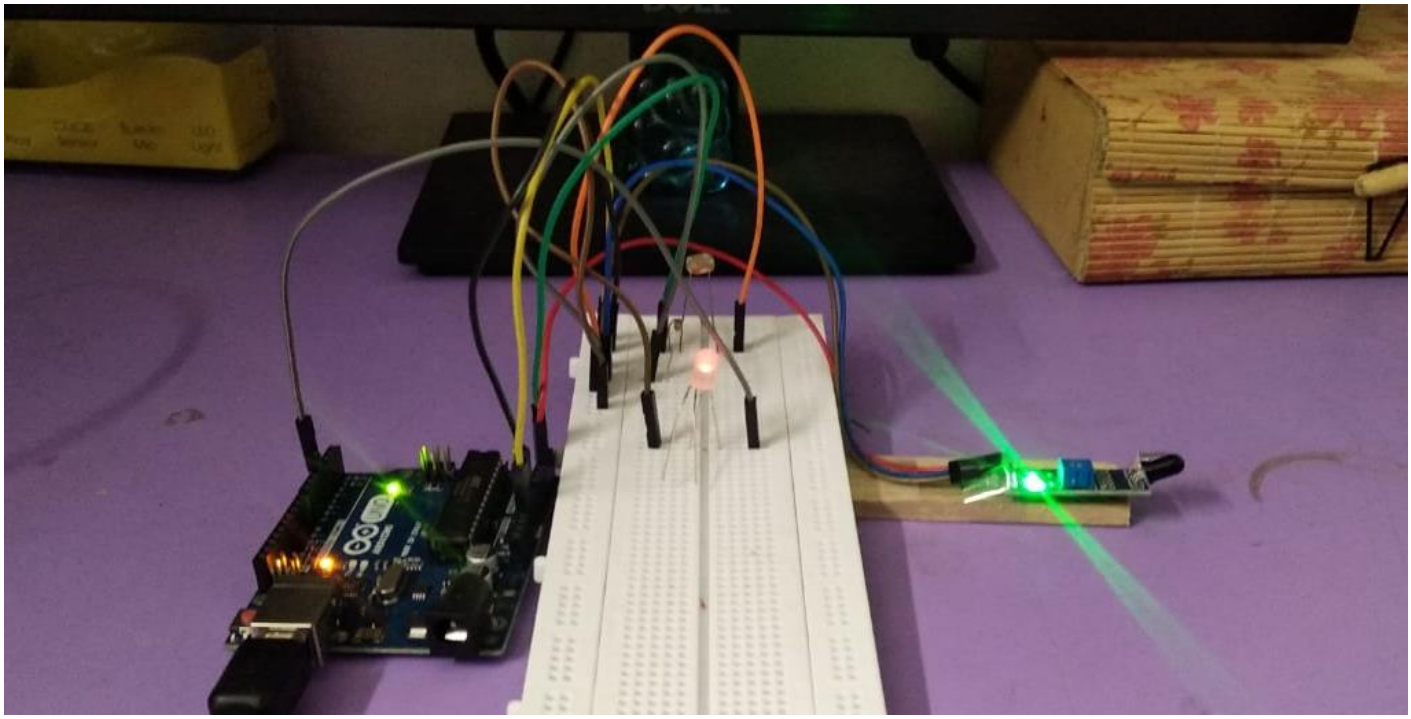

Fig. (6): When IR sensor value > 300 nm

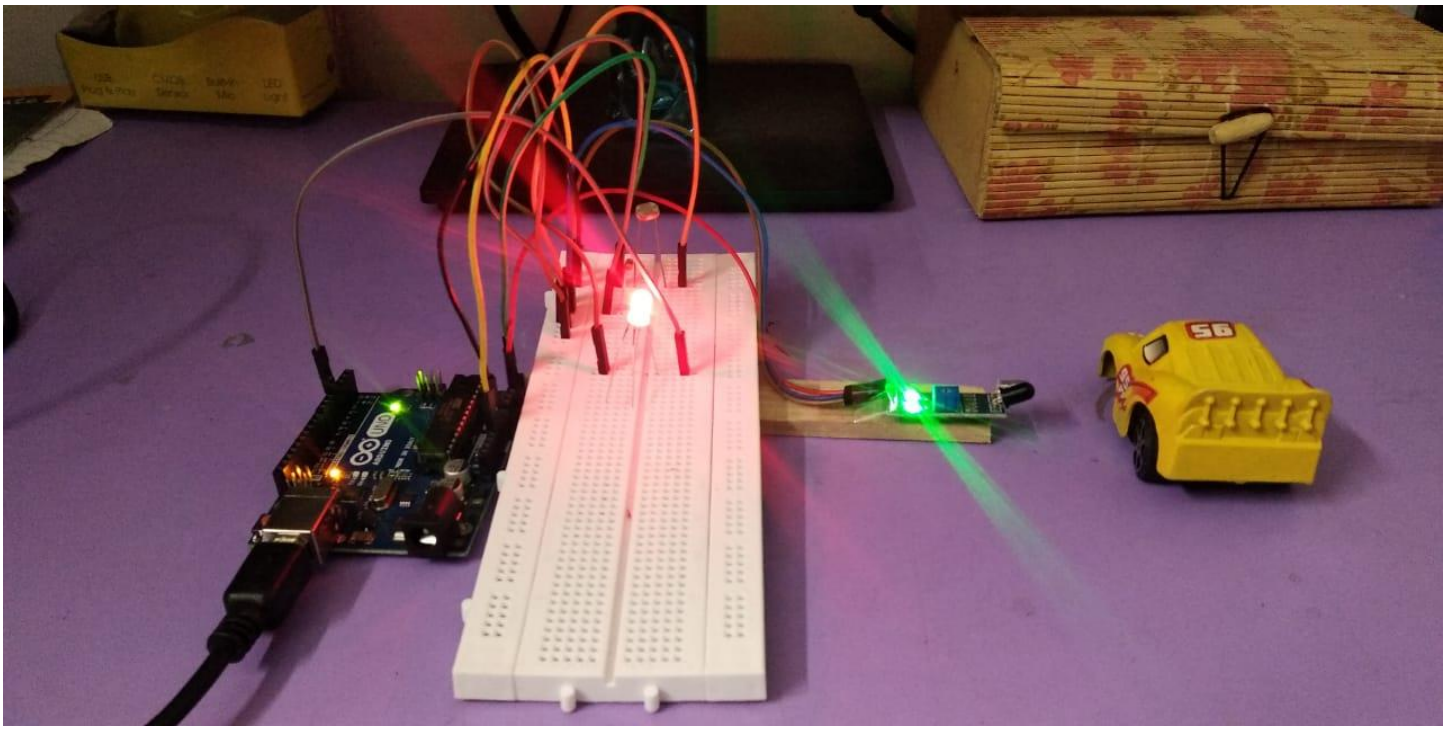

Fig. (7): When IR sensor value < 300

Limitations of this Circuit:

- Even though energy is saved if there are any vehicles after fixed time, intensity of the light is low.
- Maximum energy cannot be saved.

Conclusion:

- Power wastage can be reduced.
- Using LED array reduces the cost.
- Using of RTC and LDR produces accurate results.

Reference: https://www.electronicshub.org/