AUTO INTESITY CONTROL OF STREET LIGHT USING ARDUINO

Project Stage-II
Report submitted
in
partial fulfillment of requirement
for the award of **degree of**

Bachelor of Engineering
in
Electrical Engineering

Submitted by

ANSARI MOHAMMED ADIL	**16EE09**
FITWALA ASAD AHMED	**16EE13**
KHAN AQUIB IRSHAD	**16EE17**
KHAN USAID MINSAR	**16EE20**

Under The
Guidance Of

PROF.TANVEER HUSAIN KHATIK

Department of Electrical Engineering
Anjuman-I-Islam's Kalsekar Technical Campus, Panvel
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CERTIFICATE

This is to certify that the dissertation titled **"AUTO INTENSITY CONTROL OF STREET LIGHT USING ARDUINO", w**hich is being submitted herewith for the award of the, **'Bachlor of Engineering'** in **Electrical Engineering** of Anjuman-I-Islam's Kalsekar Technical Campus, New Panvel (M.S, India). This is the result of the original research work and contribution by **'Mr. ANSARI ADIL, Mr. FITWALA ASAD, Mr. KHAN AQUIB, Mr. KHAN USAID'** under my supervision and guidance. The work embodied in this dissertation has not formed earlier for the basis of award of any degree or compatible certificate or similar title of this for any other diploma/examining body or university to the best of knowledge and belief.

Place:panvel

Date: / /2020

Prof. Tanveer Husain Khatik
Guide

Prof. Kaleem Syed
H.O.D.

Dr. Abdul Razzak Honnutagi
Director

Acknowledgement

It is indeed a matter of great pleasure and proud privilege to be able to present this project on **AUTO INTENSITY CONTROL OF STREET LIGHT USING ARDUINO** The completion of the project work which is partial fulfillment of Degree academic works is a milestone in student's life and its execution is inevitable in the hands of guide. I am highly indebted to the project guide Prof. Tanveer Husain Khatik for their invaluable guidance and appreciation for giving form and substance to this report. It is due to their enduring efforts, patience and enthusiasm which has given a sense of direction and purposefulness to this seminar report and ultimately made it success.

I would also like to express my deep regards and gratitude to my director, Dr. Abdul Razzak Honnutagi and Head of the Electrical Engineering Department, HOD Prof. Sayed Kaleem for moral support and considerate attitude towards my short comings if any.

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CONTENTS

ABSTRACT

Our aim is to develop a system which will lead to least energy consumption, the proposed work will be accomplished by using Arduino microcontroller and sensors that will control the electricity based on night and objection's detection. We will use RTC (Real Time Clock) for perfect time operation of light. The beauty of this project is that the wastage of unused energy can be reduced, lifetime of the streetlights gets enhance because the lights do not stay ON during the whole night, and also helps to improve energy efficiency of the system, and will increase the product life.

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LIST OF ABBERIVATION

LDR	Light Dependent Resistor
BJT	Bipolar Junction Transistor
LED	Light Emitting Diode
NO	Normally Open
NC	Normally close
IR Sensor	InfraRed Sensor
ASLC	Automatic Street Light Control
AIT	Asian Institute of Technology
TX	Transmit
RX	Receive
IEEE	Institute of Electrical and Electronics Engineers
RTC	Real time clock

1. INTRODUCTION

1.1 Introduction

Automation plays an increasingly very important role in the world economy and in daily life. Automatic systems are being preferred over any kind of manual system. We can also call it an "**Auto Intensity Control of Street Light**". Intelligent light sensing refers to public street lighting that adapts to movement by pedestrians, cyclists and cars. Intelligent street lighting, also referred to as adaptive street lighting, dims when no activity is detected, but brightens when movement is detected. This type of lighting is different from traditional, stationary and illumination, or dimmable street lighting that dims at pre-determined times.

The research work shows automatic control of streetlights as a result of which power is saved to some extent. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist the users with muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Basically, street lighting is one of the important parts. Therefore, the street lamps are relatively simple but with the development of urbanization, the number of streets increases rapidly with high traffic density. There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and road users, provide public lighting at cost effective, the reduction of crime and minimizing it is effect on the environment.

At the beginning, street lamps were controlled by manual control where a control switch is set in each of the street lamps which is called the first generation of the original street light. After that, another method that has been used was optical control method done using high pressure sodium lamp in their system. Nowadays, it is seen that the method is widely used in the country. The method operates by set up an optical control circuit, change the resistance by using of light sensitive device to control street lamps light up automatically at dusk and turn off automatically after dawn in the morning. Due to the technological development nowadays, road lighting can be categorized according to the installation area and performance, for an example, lighting for traffic routes, lighting for subsidiary roads and lighting for urban center and public amenity areas. The WSN helps in improving the network sensing for street lighting.

Meanwhile, street light system can be classified according to the type of lamps used such as incandescent light, mercury vapor light, metal halide light, high pressure sodium light, low pressure sodium light, fluorescent light, compact fluorescent light, induction light and LED light. Different type of light technology used in lighting design with their luminous efficiency, lamp service life and their considerations. The LED is considered a promising solution to modern street lighting system due to its behavior and advantages. Apart from that, the advantages of LED are likely to replace the traditional street lamps such as the incandescent lamp, fluorescent lamp and high-pressure Sodium Lamp in future but LED technology is an extremely difficult process that requires a combination of advanced production lines, top quality materials and high-precision manufacturing process.

1.2 Objectives

This project aims to design an automatic streetlight that works in both conventional (electrical) as well as non-conventional (solar) energy resources. Using LDR we control the street light, when the LDR value falls above the threshold value the lights are switched on and when the value falls below the threshold value the lights are switched off. In order to save and conserve energy in an efficient way an intensity controller, based on movement detection is used. This is done using a pair of sensors (IR transmitter and IR receiver), whenever the value obtained at the receiver is above the previously set threshold value, an obstacle is identified and the LED connected to the receiver will be switched on.

2. METHODOLOGY AND LITERATURE SURVEY

2.1 METHODOLOGY

This report proposes an effective scheme for controlling the wastage of electricity due to streetlights. It reduces the manual effort by automating the streetlight on the basis of light intensity. The electricity wastage can be reduced by glowing the light on the basis of movement detection. Here three parts have been included under this topic for completed this study. Design architecture is the main block function for the proposed design. While, the hardware specification will detail out the components involved in this design from the sensor components until the controller selection. Software development based on the proposed design will be detail out in software part where the flow of the system operation will be detailed out elaborated.

2.2 LITERATURE SURVEY

Hengyu Wu, Minli Tang, propose about The core technology of the street light control system is an ATMEGA328P single-chip microcomputer. It integrates a power circuit, a fault detect circuit, a photosensitive detection circuit, an infrared detect circuit, an LCD display circuit, a street light control circuit, an a1ann circuit, a pressed key control circuit and so on. This system cans automatically turn on or off the lights and controls the switches according to traffic flow. It expands the fault detect circuit and the corresponding a1arm circuit. It also has a convenient and flexible button control circuit to switch on and off fictions mentioned above. Main weakness is that they didn't say about the working principle behind the system. It also said to use fault detection circuit which when it is damaged, the voltage is zero, so it will create a problem.

This paper is and theoretic proof and shows only simulation result but not as a real time set up experiments. The focus of this paper to build a way for the framework which may leads to many follow up research activities in the Low – rate and also plan to investigate the applicability of this proposal to detect performance. GongSiliang describes a remote streetlight monitoring system based on wireless sensor network. The system can be set to run in automatic mode, which control streetlight according to Sunrise and Sunset Algorithm and light intensity. This control can make a reasonable

adjustment according to the latitude, longitude and seasonal variation. Also this system can run in controlled mode. In this mode, we can take the initiative to control street lights through PC monitor terminal. In addition, the system integrates a digital temperature – humidity sensor, not only monitoring the street light real – time but also temperature and humidity.

The system is equipped with the high – power relay output and can be widely applied in all places which need timely control such as streets, stations, mining, schools, and electricity sectors and so on. But in this work a wireless network for street light remote control is discussed. In particular, the novelty of the proposal is in the location awareness of nodes, which cannot self - localize themselves. Prototypes have been built using costly hardware. The capability of the ranging measurements, the basis for localization, is not characterized and Showing some problems on the order of one meter. In near future, location aware routing algorithms will developed that will improve the efficiency of the network. Street lighting system Gustavo W. Denardin deals about a control network for a LED street lighting system. The use of LEDs is being considered promising solution to modern street lighting systems, due to their longer life time, higher luminous efficiency and higher CRI.

The proposed control network enables disconnection of the street lighting system from the mains during peak load time, reducing its impact in the distributed power system automatically consumption, decrease the management cost and monitor the status information of each street lighting unit. In order to meet the system requirements, a wireless sensor network based on IEEE 802.15.4 TM standard is employed. Its network layer is implemented using geographic routing strategy, which provides slow overhead and high scalability features.

However, due to well - known drawbacks of the existing techniques, a novel routing algorithm is proposed. Simulations show that this algorithm leads to a significant improvement of routing performance when applied to sparse large scale scenarios, which is the case of street lighting system. Field tests have been performed on IEEE 802.15.4- compliant wireless control units. The obtained experimental results show that the proposed control network is able to meet the requirements of a LED street lighting system. It mainly deals about safer roadways with intelligent light system to reduce power consumption. This system has automatic street light intensity control

based on the vehicular movement and switching ON and OFF of street lights depending on the light ambiance.

This will help in reducing the power consumption during hours of meager road usage. The street light module is installed consequently for every certain distance. This paper also aims at reducing road accidents by detecting consumption of alcohol by the driver. This can be implemented using alcohol sensor module which contains skin sensor, breath alcohol sensor and proximity sensor. The skin sensor and breadth alcohol sensor detects the presence of alcohol content and the proximity sensor helps in detecting any kind of malpractice. The novelty of this paper is to effectively reduce the energy consumption of the street lights by controlling the street light's intensity, sensing both human as well as vehicular movement and injury and death caused by drunk driving can be prevented by prior sensing of the alcohol content in drivers by a simple.

Somchai Hiranvarodo describes a comparative analysis of photovoltaic (PV) street lighting system in three different lamps. Namely, a low pressure sodium lamp, a high pressure sodium lamp and a fluorescent lamp have been used for installation in each mast to determine the suitable system to install in a typical rural area of Thailand. All three systems have been mounted with the same module type and wattage in different places within the Rajamangala Institute of Technology, Thanyaburi district, Pathumthani province of Thailand. An operation of solar street lighting system can be divided into 2 period of time, namely, at 18.00-22.00 hours and 05.00-06.00 hours.

The design of a control circuit was experimentally done in this work. Protection of the battery from damage for deep discharge and overcharge by a controller was also considered. The life cycle cost analysis (LCCA) is the appropriate method for comparing three different lamps. The present worth of each system can be compared and the least cost option selected. LCCA was based on the key assumptions (year 2002). The results of comparative analysis of the PV street lighting systems with a fluorescent lamp have been the appropriate system for installation in a typical rural area of Thailand when the cost of lamps, system performance and possibility for purchasing the components of the system have been considered.

The results of this work can he stated that the average luminance in lux of the fluorescent lamp at design location Pathumthani province of Thailand, has a highest value compared to the low- pressure sodium and high-pressure sodium. On the other

hand, the lifetime of the fluorescent lamp has a shortest time compared to other lamps. Nevertheless, the aim of this work is to determine the appropriate system to install in a typical rural area or a typical rural village of Thailand when the cost of lamps and system performance and possibility for purchasing the components of the system are compared. While considering in other areas it is difficult. A.C.Kalaiarasan deal about solar energy based street light with auto- tracking system for maximizing power output from a solar system is desirable to increase the efficiency.

In order to maximize the power output from the solar panels, one needs to keep panels aligned with the sun. As such a means of tracking the sun is required. This is a far most cost effective solution than purchasing additional solar panels. It has been estimated that the yield from solar panels can be increased by 30 to 60 percent by utilizing a tracking system instead of a stationary array. This paper describes an automatic tracking system which will keep the solar panels aligned with the sun in order to maximize efficiency. The sun tracking sensor is the sensing device, which sense the position of the sun at the time to time continuously and it gives the sensing output to the amplifier based on light density of the sun. Here the sun tracking sensor is LDR (light dependent resistor). The amplifier unit is used to amplify the LDR signals, which makes the low level signal into high level signals and this output is given to the comparator. The LM324 IC is used as an amplifier. Comparator compares the signals and gives the command to the AT89C51 microcontroller.

The system presented in this paper will be an efficient method to use the solar energy in remote areas. This system consumes very low power and high efficient lightning. We employ the auto sun tracking system; this can improve the energy stored in battery. This system does not affect the environment because it is pollution free. Our system also consisting of automatic ON, OFF control of the LED lamp, so there is no manual operation and it is not required operators. Radhi Priyasree explains a system to reduce the power consumption of streetlights by avoiding inefficient lighting which wastes significant financial resources each year. This is done by dimming the lights during less traffic hours. For this purpose PIR sensor is used which detects any movement.

This work also aims at reducing the fatal crashes and road accidents caused due to alcohol consumption. This is done using skin sensors placed in vehicle doors and also using breadth sensors inside the vehicle. By implementing this death rates due to

drunk driving can be reduced to a great extent. The prototype has been implemented and works as expected and will prove to be very useful and will fulfil all the present constraints if implemented on a large scale. It also aims at detecting consumption of alcohol by the driver and if it exceeds certain level it impairs the driver from entering into the vehicle. This prevents occurrence of accidents or any fatal crashes.

This initiative will help the government to save this energy and meet the domestic and industrial needs. S.H. Jeong describes about the development of Zigbee based Street Light Control System which control and monitor status of street lights installed alongside load. Lights are switched to ON/OFF by this system's control command. Its local status information is also monitored by control system via communication channel. Status information which is monitored are on/off status information , energy saving mode status, control group status information and safety related information, etc.

To transfer control command and status information between streetlight control system and remote street light control terminals which installed at each light pole, various communication media and communication protocols are using. As communication media, wireless or power lines are used generally. Various frequency bands from tens of MHz to Rebrands are used for wireless case. This Street light control system can save maintenance time and costs and which can improve safety level.

3. SYSTEM DESIGN

The traditional lighting system has been limited to two options ON and OFF only, and it is not efficient because this kind of operations meant power loss due to continuing working on maximum voltage. Hence, wastage of power from street lights is one of the noticeable power loss, but with the use of automation, it leads to many new methods of energy and money saving. In this regard, controlling lighting system using Light Dependent Resistor (LDR) , IR obstacle detector sensor and Arduino together is proposed in the past . In the meanwhile, the importance of smart light system has motivated a lot of studies and the series of research work has been done.

In previous works, the street light systems are based on LDR , and most of them are passive infrared receiver based systems that are controlled with timers and analog circuits. Sun tracking sensors are also utilized to power OFF the street lights by the detection of the sunlight luminance. Furthermore, street light control with the use of solar energy , and ZigBee based system to control street light have also been implemented. Distinguished from turning ON/OFF the electricity, another approach is introduced to dim the light in fewer traffic hours that might be useful to reduce the power consumption, but the electric bulbs are in continuous usage condition.

To the best of our knowledge, a need is still existed to design a system that controls the dim light, connect the power ON/OFF with the vehicle's motion detection, calculate the total number of vehicles passed through the road, and control the entrance gate at night to reduce criminal activities.

The most natural solution is to control the street lights according to the outside lighting condition. This is what our paper is aiming for in smart lighting system in which the street lights will be turned OFF when there are no motion detections or day-time, otherwise the lights will be remained Dim/ON. Our proposed design is aimed at efficiently replacing any light systems that are manually controlled, and this is accomplished with the properly arrangements of microcontroller Arduino Uno, IR obstacle avoidance sensor, LDR, and Resistors.

In this scenario, when the intensity of sunlight impinges with LDR, street lights can be further controlled as per the desired requirement, automatically. Most

importantly, a counter is set to count the number of vehicles/objects passing through the road, which will be displayed on the serial monitor of Arduino IDE . Moreover, the high-intensity discharge street bulbs are replaced with LEDs to further reduce the power consumption. An automatic street light system does not help us in reducing the power consumption only, but also to reduce accidents, criminal activities and maintenance costs.

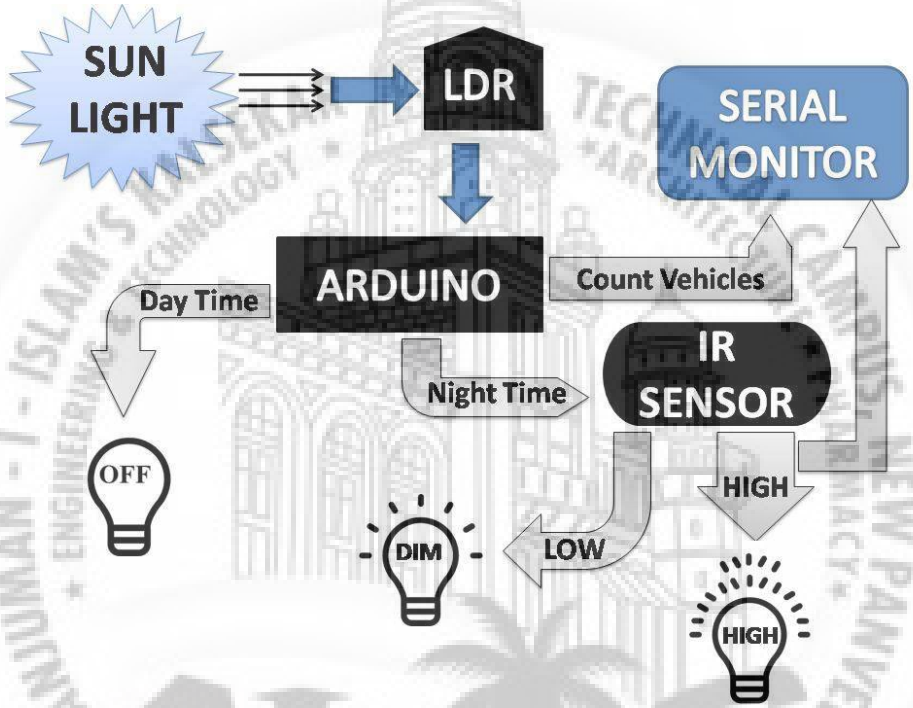

Figure 1. The architecture design of automatic street light control system.

For the simplicity of discussion, Fig. 1 illustrates the overall working mechanism and the features of the proposed lighting concept. Firstly, LDR will sense the intensity value of sunlight and send it to Arduino. Arduino will judge if the received value is above the threshold level (which is set independently by the user from the discrete value: 0-2023), then it will consider it as day-time and LEDs will remain OFF, or if the received value below the threshold level, Arduino will consider it as a night-time. In the night-time, if the value of IR obstacle detector sensor is LOW and detects no object, then DIM LEDs (half of its maximum voltage) will glow, or if IR obstacle

detector value is HIGH and detects any object, then HIGH LEDs (full of its maximum voltage) will glow.

Arduino will also count the total number of vehicles that crossed the street in the night-time with the help of IR obstacle detection sensor and will demonstrate it to the serial monitor.

Multiple electronic components are used for building electronic circuits. Our proposed circuit designs contain these components that are described below in table 1:

Components	Specifications
1. LDR	Voltage: DC 3-5V, 5mm,1.8 gm.
2. Arduino Uno	22 pins, operating voltage 6-20V
3. LEDs	5 mm , operating voltage 5V
4. IR obstacle avoidance sensor	Voltage: DC 3-5V, Range 2-30cm, Angle 35
5. Resistors	100 ohm, 220 ohm

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

3.1 Components

3.1.1 Light Dependent Resistor (LDR)

LDR is a Light Dependent Resistor whose resistance is dependent on the light impinging on it. The resistance offered by the sensor decreases with the increase in light strength and increases with the decrease in light strength. This device is used for detection of day-time and night-time because when sunlight falls on it, it will consider as day-time, and when there is no sunlight falls on it, it will be regarded as a night, as shown in Fig. 2b. These are very beneficial, especially in light/dark sensor circuits and help in automatically switching ON /OFF the street lights.

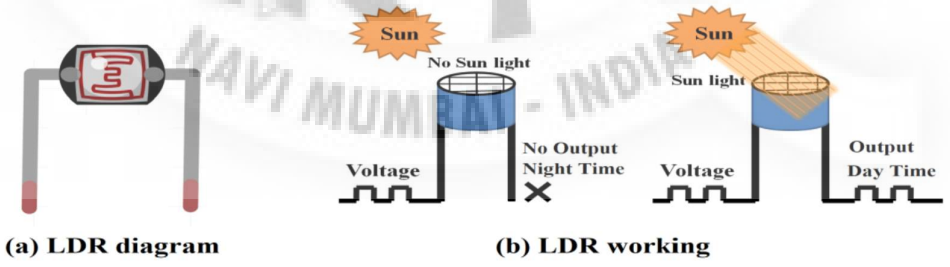

Figure 2. LDR symbol and its working phenomenon

3.1.2 Arduino Uno

As shown in Fig. 3, the Arduino Uno is a microcontroller board which is based on the ATmega328 series controllers and has an IDE (Integrated Development Environment) for writing, compiling and uploading codes to the microcontroller. It has 14 digital input and output pins (of which 6 are PWM) and 6 analogue inputs for communication with the electronic components such as sensors, switches, motors and so on. It also has 16 MHz ceramic resonators, a USB connection jack, an external power supply jack, an ICSP (in-circuit serial programmer) header, and a reset button. Its operating voltage is 5v, input voltage 7 to 12v (limit up to 20v).

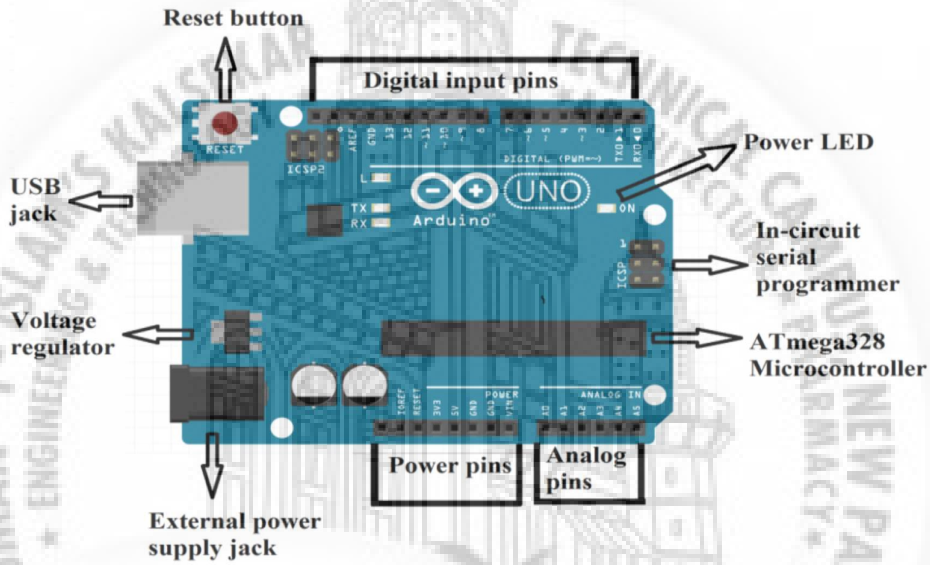

Figure 3. Arduino Uno board description.

3.1.3 LEDs

A LED (light-emitting diode) is a PN junction diode which is used for emitting visible light when it is activated, as presented in Fig. 4. When the voltage is applied over its elements, electrons regroup with holes within the LED, releasing energy in the form of photons which gives the visible light. LEDs may have the Dim/full capability.

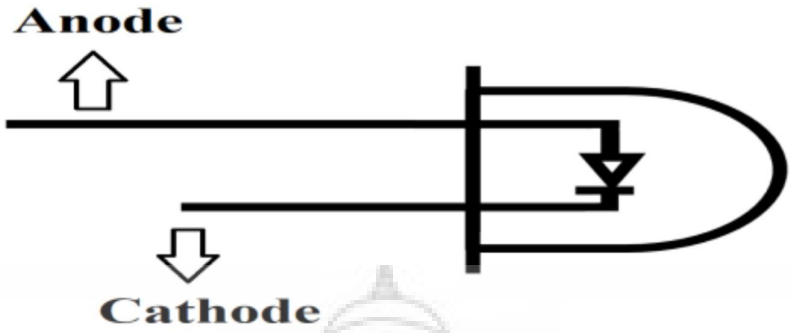

Figure 4. LED circuit diagram

3.1.4 IR Obstacle Avoidance Sensor

An obstacle avoidance sensor consists of an infrared-transmitter, an infrared-receiver and a potentiometer for adjusting the distance, shown in Fig. 5a. Whenever an object passes in front of a sensor, the emitted rays hit the surface of an object and reflect to the receiver of the sensor so it will consider this as a motion (as shown in Fig. 5b). It is a heat sensitive sensor and used for detection of motion.

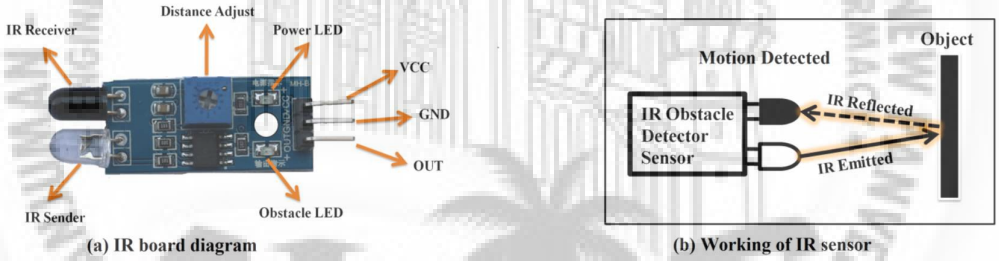

Figure 5. IR obstacle detector sensor diagram and working

3.1.5 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. 6. It works on the principle of Ohm's law which prevent

overflow of voltage.

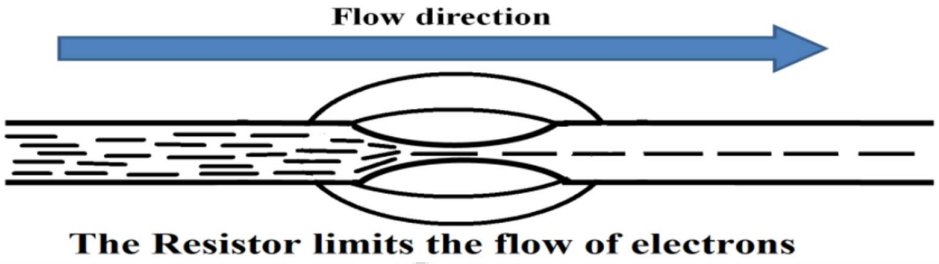

Figure 6. Working principle of resistor

3.2 DESIGNING

3.2.1 Object Independent Automation System

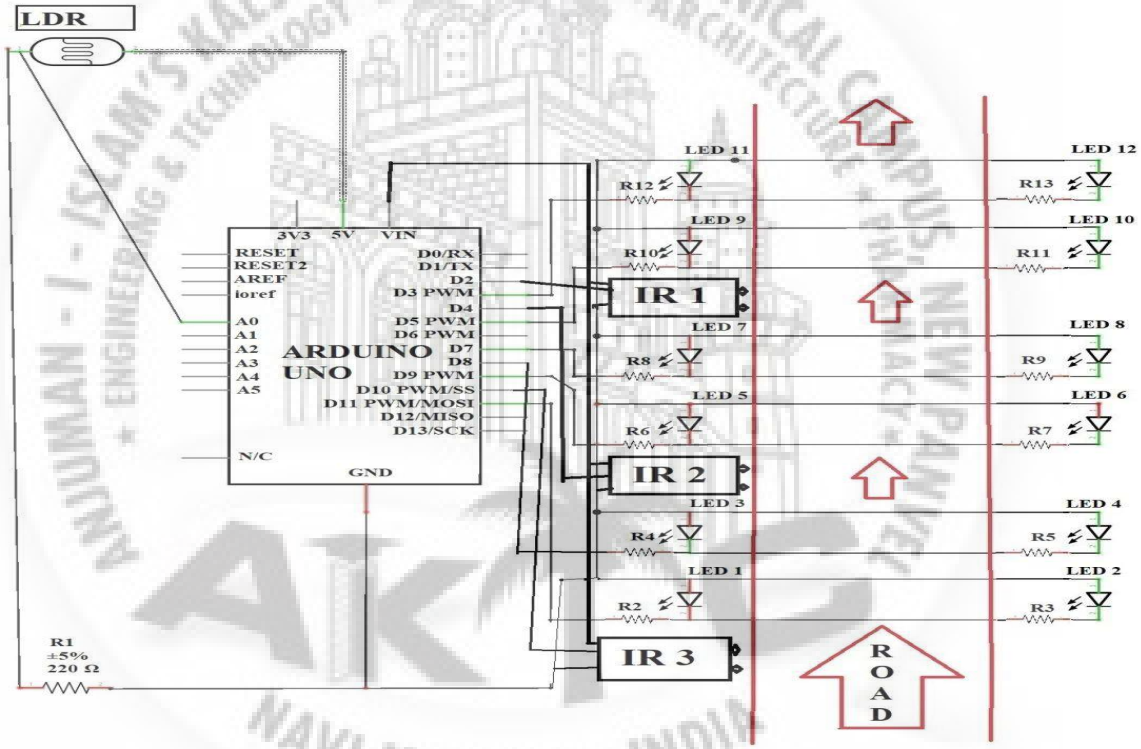

Figure 7. Circuit design of automatic street light control system with the Dim light capability.

Fig. 7 shows the circuit design of automatic street light control system based on vehicle detection using Arduino Uno having feature of Dim light capability. In this task, 01 LDR sensor, 12 LEDs, 13 resistors, 03 IR obstacle detector sensors and 01 Arduino UNO have been used.

One leg of LDR sensor is connected to Arduino analog pin number A0 and another leg to VCC pin and same with a resistor to the ground port of Arduino. In addition, the threshold value is adjusted to 10 from the discrete values (0-1023) for understanding whether it is day or night. After that, all the positive terminals of the LEDs are connected with resistors to pin number 3, 5, 7, 8, 9 and 11, depicting the streetlights as the outputs of the Arduino signals. Furthermore, connected the ground of all the LED's to Ground port as per the circuit diagram shown in Fig. 7. The IR obstacle avoidance sensors are connected to the Arduino port from pin number 2, 4 and 10, respectively, which is the input signal to the Arduino board. Similarly, the ground of all the IR obstacle avoidance sensors are connected to GND port and all VCC of IR obstacle avoidance

sensors are attached to Arduino 5V pin. Initially, set the IR obstacle avoidance sensors to HIGH at the start if there is no motion.

After connecting all these devices to the corresponding pins in Arduino according to Fig. 7, the Arduino Software from the official website "www.arduino.cc" is downloaded and installed. Then Arduino Uno is connected to the computer using the USB cable and installed the driver software on the computer to write, compile and run the software code on Arduino software

3.2.2 Results & Discussions

In the beginning, the LDR sensor will sense the light intensity in the atmosphere at that time and consequently sends the data to Arduino. After receiving the data, Arduino will convert it into different discrete values from 0 to 1023 (In which 0 represents maximum darkness and 1023 represents maximum brightness) and then it will adjust the output voltage accordingly from 0 to 2.5v/5v (Dim/High) depending upon the received value (0-2023) by comparing with threshold value. So, the output will be 2.5v in the complete darkness (night time) if the received value is less than the threshold value. As a result, Dim LEDs will glow that is the half of maximum brightness, and when there is completely shine (daytime), the received value will be higher than the threshold value, and the output voltage would be 0v resulting the LEDs to be entirely switched OFF.

Initially, the IR obstacle detection sensor will be HIGH. So, when there is no vehicle/obstacle in-front of the sensor, IR Transmitter does continuously transmit the

IR light. Whenever, a car or any other object blocks any of the IR sensors, then the emitted rays will reflect the IR receiver after hitting the object, then microcontroller will sense it as a motion. In simple words, when any object passed in front of the first IR sensor, the corresponding LEDs will be turned from DIM to HIGH (5v) by the microcontroller. As the object moves forward and blocks the next IR sensor, the next three LEDs will be turned to HIGH from DIM, and the LEDs from the previous set is switched to DIM from HIGH. The process continues this way for the entire IR obstacle detector sensors and LEDs. These kinds of application can be implemented in the headlights of vehicles, street lights, parking lights of hotels, malls and homes, and it can be very beneficial.

Fig. 8 shows the result diagrams of automatic streetlights that turn to DIM at night and HIGH on vehicle movement using Arduino Uno. Fig. 8a represents the daytime with no LEDs are glowing after measuring the sensed intensity value of sunlight with the threshold value by the LDR sensor. In the meanwhile, Fig. 8b shows the nighttime because the sensed intensity value of

sunlight by LDR is below than the threshold value (10) and there is no motion detected by any of IR sensors, so as a result, the DIM LEDs are glowing. Moreover, the beauty of the proposed model can be seen in Fig. 8(c-d) with the motive that only those LEDs will glow higher whose will detect the object's presence and the remaining LEDs will keep maintain their DIM state. As an example, in Fig. 8c, the first set of LEDs are glowing HIGH and remaining are in DIM mode because the sensed intensity value of sunlight by LDR is below then the threshold value so, it considered nighttime and, there is an object detected by the first IR sensor. Moreover, when the object moved to the second IR obstacle detector sensor, the second set of High LEDs are glowing and the first set again turns to DIM state (Fig. 8d). These results show the efficiency of proposed idea and gives the immediate validation of the proposed model.

In addition, Fig. 9 illustrates the total number of objects / vehicles passed through the road and the derived results of Fig. 8 are summarized in table 2.

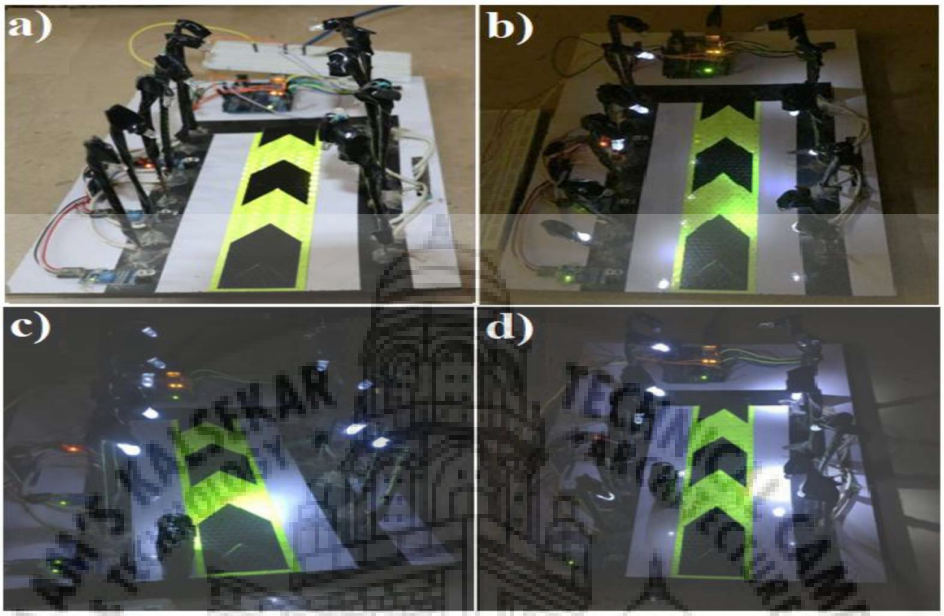

Figure 8.

Result diagrams of automatic streetlight control system that turn to DIM at night and HIGH on object detection. (a) Shows it is a day-time, so LEDs are not glowing. (b) Shows it is a night-time and Dim LEDs are glowing. (c) Shows object in-front of first IR sensor and first set of High LEDs are glowing while remaining are in DIM mode. (d) Shows motion in-front of second IR sensor so, only second set of LEDs are glowing HIGH and others are in DIM state.

3.2.3 Program

```
#include <SoftwareSerial.h>

int sensorPin = A0; // select the input pin for the LDR

int sensorValue = 0; // variable to store the value coming from
the sensor

int led = 3;

void setup() { // declare the ledPin as an OUTPUT:

pinMode(led, OUTPUT);
```

```
Serial.begin(9600); }

void loop()
{

Serial.println("Welcome to TechPonder LDR Tutorial");

sensorValue = analogRead(sensorPin);
Serial.println(sensorValue);

if (sensorValue < 100)
{
Serial.println("LED light on");
digitalWrite(led,HIGH);
delay(1000);
}
digitalWrite(led,LOW);

delay(sensorValue);
}
```

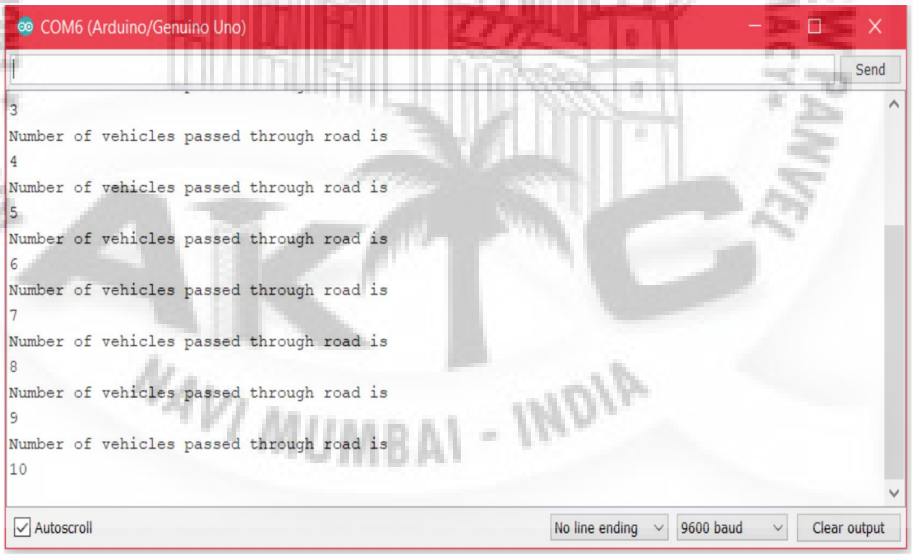

Figure 9. Serial monitor output according to traffic flow

Device Name	Input Data	Verified Results	Remarks
Arduino Board testing	Digital Signal	Switching of LEDs at different intervals	Hardware is accurate
Light Dependent Resistor testing	Outside light intensity values	Dim/High LEDs glows according to light intensity and noted on the Serial monitor	Hardware is accurate
IR Obstacle Senor testing	Sense Motion	High LEDs glows whenever it detects motion	Hardware is accurate

Table 2. Derived results after implementation.

3.2.4 Object Dependent Automation System

As per our motive, the idea of this paper is to create such innovation for our current street light system so that the power consumption can be saved. As presented in Fig. 8, when there are no vehicles on the road at night-time, still the dim light continuously glows, and it wastes energy. So, we enhanced our task with the switching of the street lights based on the IR Obstacle detection sensor. In which when the object is detected at night then the LEDs will switch ON automatically, otherwise the lights will remain OFF. This task is implemented on another board and the circuit design can be seen in Fig. 10. In addition, there is also an automatic door system in this design that will operate with motor and IR obstacle detector sensor. The motor will automatically open the door when IR sensor detects an authorized vehicle in front of the door and shut it when no vehicles are detected.

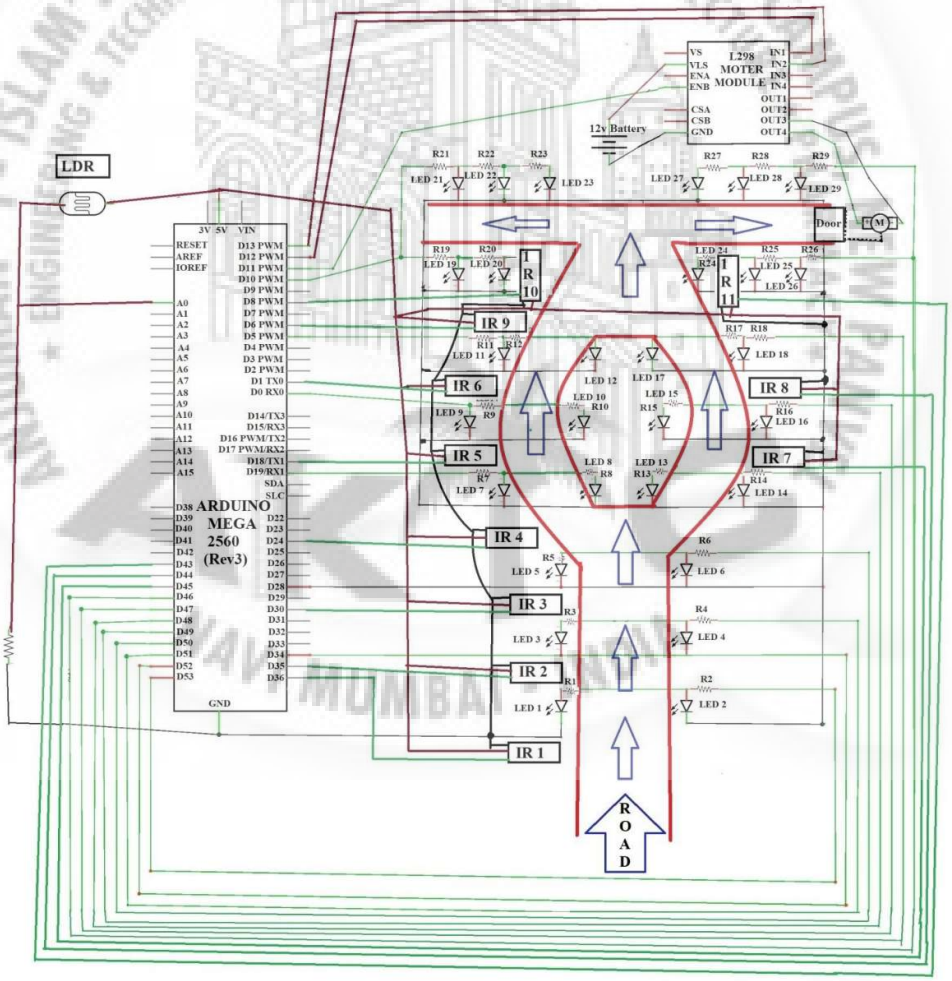

Figure 10. Circuit design of enhanced project with no Dim LEDs capability and having automatic door system.

Fig. 10 shows circuit design of automatic streetlight control system without Dim LEDs capability based on Vehicle Detection Using Arduino Mega with an automatic door system. In this, 1 LDR sensor, 29 LEDs, 30 resistors and 11 IR obstacle detector sensors, 1 DC Motor, 1 L298 Motor Module and 1 Arduino Mega have been used. In this method, one leg of LDR sensor is connected to Arduino analog pin number A0 and another leg to VCC pin and same with a resistor to the ground port of Arduino.

The threshold value is adjusted to 10 from a discrete value (0-1023) for understanding whether it's DAY or NIGHT. All the positive terminals of the LEDs are connected along with resistors to pin number 0, 5, 10, 19 and 46 - 53as per the circuit diagram given in Fig. 10. In addition, the ground of all the LEDs are connected to Ground port.

The IR obstacle avoidance sensors are connected to the Arduino port from pin number 1, 6, 8, 18, 24, 30, 35, 36 and 43 - 45 respectively, which is the input signal to the Arduino board. The ground of all the IR obstacle avoidance sensors are connected to GND port and all VCC of IR obstacle avoidance sensors are directed in Arduino 5V pin. Initially, set the IR obstacle avoidance sensors to HIGH at the start if there is no motion. Finally, the OUT-pin3 is connected with the L298 motor module with one side of DC motor and OUT-pin4 to another side. In this regard, pin B is enabled and IN-pin 1, 2 is further attached to pin number 11, 12, 13 of Arduino respectively. To supply the motor, 12v pin to the positive terminal and GND to the negative terminal of a 12v battery.

Fig. 11 shows the result diagrams of automatic street lights that turn to ON/OFF only without Dim capability on vehicle movement at night-time and having an automatic door system using Arduino Mega. In this way, Fig. 11a is represented the day-time with no LEDs are glowing. On the other hand, in Fig. 11b, the first set of High LEDs are glowing in the nighttime because there is a motion detected by the first IR sensor. Similarly, when the object moved forward from second IR obstacle detector sensor then the third IR obstacle detector sensor detect motion and third set of High LEDs are glowing, last set and remaining LEDs are turned OFF (Fig. 11c). In this task, when a vehicle is detected in front of the door by IR obstacle detection sensor, it will automatically open and corresponding lights will turn ON, can be seen in Fig. 11d.

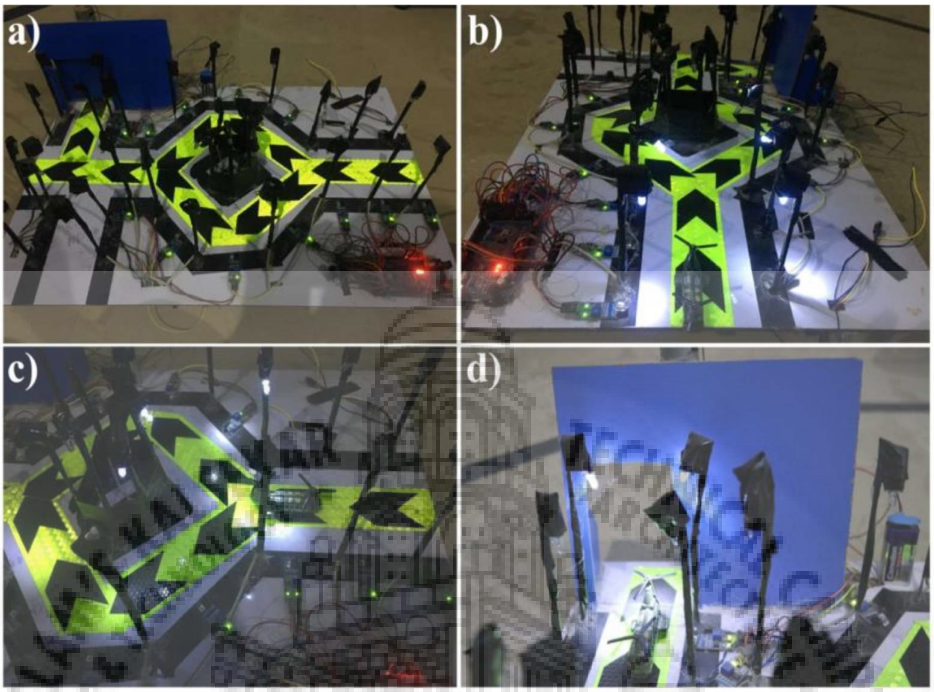

Figure 11.

Result diagrams of enhanced work with automatic door system and only ON/OFF capability. (a) Shows it is a day-time, so LEDs are not glowing. (b) Object in-front of first IR sensor so, High LEDs are glowing there. (c) Shows motion in-front of third IR sensor so, third set of LEDs are glowing. (d) Shows a vehicle detected in-front of the door, so it is automatically opened and concerned LEDs are glowing.

4. CONCLUSION

4.1 Conclusion

The proposed streetlight automation system is a 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. The LED consumes less energy with cool-white light emission and has a better life than high energy consuming lamps. Moving to the new & renewable energy sources, this system can be upgraded by replacing conventional LED modules with the solar-based LED modules. With these efficient reasons, this presented work has more advantages which can overcome the present limitations. Keep in mind that these long-term benefits; the starting cost would never be a problem because the return time of investment is very less. This system can be easily implemented in street lights, smart cities, home automation, agriculture field monitoring, timely automated lights, parking lights of hospitals, malls, airport, universities and industries etc

4.2 Future Scope

This project has scope for improvement and many enhancements can be done to make it more reliable and interesting. *For example*, when a vehicle or a person meet with an accident street light remains on , a system can be introduced to inform the respective authorities. Similarly, a system can be introduced to inform the technicians about the default. All this will be possible, however, only through innovation, hard work and above all proper use of technology.

4.3 ADVANTAGES

Photo resistors convert light into electricity and are not dependent on any other force. LDR's are sensitive, inexpensive, and readily available devices. They have good power and voltage handling capabilities, similar to those of a conventional resistor. They are small enough to fit into virtually any electronic device and are used all around the world as a basic component in many embedded systems. LDR may be connected either way round and no special precautions are required when soldering.

4.4 DISADVANTAGES

Can be more complicated to align detector pairs (IR transmitter and IR receiver). Prescribed system is sensitive to ambient light and require careful shielding. Photo resistors are only sensitive to light and no other force can power it without risking damage. Also, they are unable to detect low light levels and may take a few seconds to deliver a charge while their electrons build up momentum.

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