Designing and Modeling of Arduino Based Light Sensor

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Abstract- *A Light Sensor is a device that detects light. It generates an output signal that is proportional to the intensity of light. A light sensor measures the radiant energy present in the wide range of frequencies in the light spectrum. Some of the common frequencies are infrared, visible and ultraviolet. There are different types of light sensors for different applications. A Photocell or Photo Resistor is the common type of light sensor.In this project,we have made an arduino light sensor circuit in which if any light is incident on it, it senses light and gives signal to the buzzer and the buzzer blows.*

Keywords- Arduino, Light , Sensor , Signal , Buzzer

I. INTRODUCTION

A Light Sensor is a device that detects light. It generates an output signal that is proportional to the intensity of light. A light sensor measures the radiant energy present in the wide range of frequencies in the light spectrum. Some of the common frequencies are infrared, visible and ultraviolet.A Light Sensor is also called as Photo Sensor or Photo electric Sensor as it converts light energy or photons in to electrical signals.There are different types of light sensors for different applications. A Photocell or Photo Resistor is the common type of light sensor.A photo resistor changes its resistance when light is incident on it. Hence, a photo resistor is also called as Light Dependent Resistor or LDR. When there is no light, the resistance of LDR is very high. When there is light incident on the LDR, its resistance decreases. There are a wide range of applications of light sensors. The applications include scientific research to everyday residential applications like security systems, burglar alarms garage door openers, solar tracking systems etc.

II. LITERATURE REVIEW

Deepak Kumar Rath [1] explained that Controlling lighting system by means of LDR and Arduino together is relatively a new concept. After going through many research papers which were related to field of lighting system, I found that there are papers only about street light system and that too most of them are Passive Infrared receiver based and few are LDR based but they are controlled by means of timers and analog circuits. Some were controlled by wireless GSM/GUI networks .That being said they are no papers which coin all the lighting system under one umbrella and use LDR and Arduino system as their fundamental architecture to control it. Ancient Lighting system have been confined to two options on and off, due to it had their own share of disadvantage. This kind of operation meant energy loss due to continuous operation at maximum voltage though actual requirement might be less depending upon the outside lighting condition. The simplest solution to it is by calibrating the lights according to the outside lighting condition. This is what we are aiming for in our smart lighting system.

Sanal Malhotra, Shiv Taneja [2] explained that automatic brightness light based embedded system using LDR sensors which can be used at rooms, companies, personal places, petrol pumps and banks etc. In this system brightness is controlled using LDR sensors and array of LED's which are interfaced with the microcontroller. According to the value of LDR sensors the brightness is controlled .At the daytime, when there is a need of less light, LDR sensors sense the light and accordingly the programmed LED's glows, but when there is a need of more light LDR sensors sense the light in nearby area and based on the amount of light required the Led's are turned on. This system is better than any other system as intensity of light is controlled according to the amount of light needed in the room. Based on the amount of light required the number of LED's turn on and off, during night time when highest amount of light is needed, all the LED's will glow, during the time when some of the light is required in the room, only some of the LED's glows based on the amount of light needed. Keywords: Microcontroller, LED, LDR Sensors, LCD display.

Pravin Kumar Singh [3] introduced a Robot which chases the light. This type of Robot is best suitable for military application. Light can be chased using a light sensor. The Photovore is a robot that chases light, for this to work, robot needs at least two light detecting sensors, typically photoresistor or IR emitter/detectors, out in front and spaced apart from each other. One on left side of robot, the other located on the right side. Arduino Board is used for

implementing the Robot. The analog pins of Arduino board read the analog value from both sensors. Then do a comparison - the sensor that reads more light is the direction robot should turn. For example, if the left photoresistor reads more light than the right photoresistor, robot should turn or tend towards the left. If both sensors read about the same value, meaning the both get the same amount of light, then robot should drive straight.

Shreesh Mishra , Shivakant Gupta , Santosh Singh, Tripuresh Tiwari , Anand Mohan [4] describes the main aim of this project is to utilize the application of the Arduino board to control the intensity of street light. As the traffic decreases slowly during late-night hours, the intensity gets reduced progressively till morning to save energy and so, the street lights switch on at the dusk and then switch off at the dawn, automatically. The process repeats every day. White Light Emitting Diodes (LED) replaces conventional HID lamps in street lighting system to include dimming feature. The intensity is not possible to be controlled by the high intensity discharge (HID) lamp which is generally used in urban street lights. LED lights are the future of lighting, because of their low energy consumption and long life. LED lights are fast replacing conventional lights because intensity control is possible by the pulse width modulation.[1] This proposed system uses an Arduino board and a rectified-power supply. String of LED are interfaced to the Arduino board with a MOSFET device.The intensity control of the LED light is possible by varying duty cycle from a DC source. A programmed Ardunio board is engaged to provide different intensities at different times of the night using PWM technique. This project is also enhanced by integrating the LDR to follow the switching operation precisely.

Subhankar Chattoraj [5] describes that the popularity of home automation has been increasing vastly in recent years due to much higher affordability and simplicity. Being able to control aspects of our houses, and for having the feature to respond automatically to events, it is becoming more and more popular and necessary due to security and cost purposes. We propose to implement an integrated home automation and security system. Our project proposes a low cost solution using off the shelf components to reduce cost and open source software to get around licensing requirements of software. An Arduino controls sensors and actuators that monitor a defined location and take action based on specified parameters like ambient light, temperature etc. The Arduino can also send alerts if it detects an abnormality. The voice recognition schema allows the user to use voice commands to control his house.

III. PROBLEM FORMULATION

The controlling of street lights, make a light sensor circuit outdoor lights, a few indoor home appliances, and so on are usually maintained and operated manually on several occasions. This is not only risky but also results in wastage of power with the negligence of personnel or unusual circumstances in controlling these electrical appliances on and off. Hence, (based on the requirement) we can utilize the light sensor circuit for automatic switching of the loads based on daylight's intensity by using a light sensor.

IV. MOTIVATION

The motivation behind making this project is to make the life of people easier as much as possible. A light sensor may be part of a safety or security device like a garage door opener or a burglary alarm. These devices often work by shining a beam of light from one sensor to another. If this light is interrupted, the garage door won't close or the alarm will sound. Several modern electronics, including TV's, computers and wireless phones use ambient light sensors in order to automatically control the brightness of a screen in situations where light intensity is high or low. These light sensors can detect the amount of light in a room and raise or lower the brightness to a more comfortable level. Light sensors can also be used in order to automatically turn on lights outside or inside a business or a home at night. Also, barcode scanners work using light sensor technology.

V. OBJECTIVES

- A light sensor may be part of a safety or security device like a garage door opener or a burglary alarm.
- These devices often work by shining a beam of light from one sensor to another. If this light is interrupted, the garage door won't close or the alarm will sound.
- Several modern electronics, including TV's, computers and wireless phones use ambient light sensors in order to automatically control the brightness of a screen in situations where light intensity is high or low.
- These light sensors can detect the amount of light in a room and raise or lower the brightness to a more comfortable level.
- Light sensors can also be used in order to automatically turn on lights outside or inside a business or a home at night.
- Also, barcode scanners work using light sensor technology.

VI. METHODOLOGY

A Light Sensor is a device that detects light. It generates an output signal that is proportional to the intensity

of light. A light sensor measures the radiant energy present in the wide range of frequencies in the light spectrum. Some of the common frequencies are infrared, visible and ultraviolet.A Light Sensor is also called as Photo Sensor or Photo electric Sensor as it converts light energy or photons in to electrical signals[7-8].There are different types of light sensors for different applications. A Photocell or Photo Resistor is the common type of light sensor.A photo resistor changes its resistance when light is incident on it. Hence, a photo resistor is also called as Light Dependent Resistor or LDR.When there is no light, the resistance of LDR is very high. When there is light incident on the LDR, its resistance decreases.There are a wide range of applications of light sensors. The applications include scientific research to everyday residential applications like security systems, burglar alarms garage door openers, solar tracking systems etc.In this project, a simple light sensor is designed using LDR. The project is built around Arduino. The circuit, components and working are mentioned in the following sections.

A. HARDWARE REQUIRED

Connections among components are done on breadboard, the major components are :-

- Arduino UNO
- Light Dependent Resistor (LDR)
- 100 KΩ Potentiometer (POT)
- Buzzer

B. COMPONENT DESCRIPTION

- ***Arduino UNO***

It is the main controlling part of the project. It has both analog and digital pins. It has 6 analog input pins and 14 digital I/O pins.

- ***Light Dependent Resistor (LDR)***

An LDR is a type of variable resistor that change its resistance according to intensity of the light incident on it. Generally, when the intensity of light is less i.e. in dark conditions, the resistance of LDR will be in the order of Mega Ohms (MΩ).As the intensity of the light increases, it resistance decreases and falls down to few Ohms at maximum intensity of light.Photo Resistors are semiconductor devices with photo sensitive cells. Photo cells are made with different compounds depending on the frequency of the light and application they are used. Cadmium Sulphide cell based photo resistors are most common in consumer applications as they are inexpensive. Some applications are night lights, alarm systems, solar tracking systems etc. Lead Sulphide and Indium Antimonide cell based photo resistors are frequently used for low to mid infrared frequencies. Germanium Copper cell based light dependent resistors are used in far infrared frequency applications and they are used in infrared based astronomy and spectroscopy.

- ***100 KΩ Potentiometer***

This is a variable resistor whose resistance can be varied from 0Ω to 100 KΩ.

- ***Circuit Design of Light Sensor***

As the photo resistor or LDR is a variable resistor, a voltage divider network must be used to gets the analog equivalent output from it.A 100 KΩ POT and the LDR form a voltage divider and the output of the voltage divider is given to the analog input A0 of Arduino.A buzzer is connected to pin 11 of Arduino.

C. WORKING OF ARDUINO LIGHT SENSOR

Light Sensors are very useful devices in wide range of applications. One of the common application is an automatic night lamp, where a light bulb is automatically turned on as soon as the sun sets down.Another good application is solar tracker, which tracks the sun and rotates the solar panel accordingly.All these applications use a simple photo resistor or an LDR as the main sensing device. Hence, in this project, we designed a simple light sensor that indicates when the light is indicated. The working of the project is very simple and is explained below.All the connections are made as per the circuit diagram. The code for Arduino is written and dumped in the board. When the LDR detects a light over certain intensity, the Arduino will trigger the buzzer.When the intensity of light decreases, the buzzer is turned off. The 100 KΩ POT used in the voltage divider network can be used to adjust the intensity levels at which the buzzer is triggered as shown in figure 1.

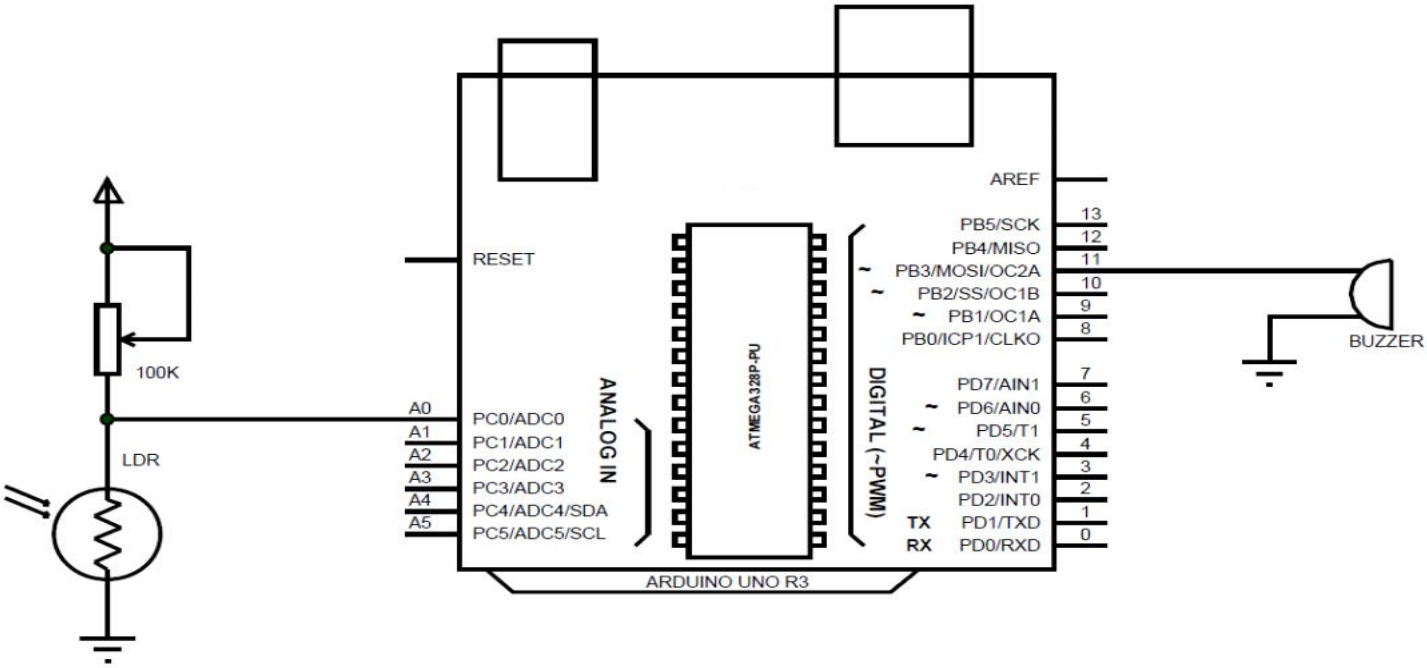

Fig. 1 Circuit Diagram Of Arduino Uno R3[6]

D. SOFTWARE

Software is written in Arduino programming language. Arduino Uno Board1 is programmed using Arduino IDE software.ATmega328P on Arduino Uno board comes with a pre-programmed bootloader that allows you to upload a new code to it without using an external hardware programmer.

- Connect Arduino board to the PC and select the correct COM port in Arduino IDE. Compile the program/sketch (TCS3200.ino).
- Select the correct board from Tools→Board menu in Arduino IDE and upload the sketch. Load the program to the internal memory of the MCU. The sketch is at the heart of the system and carries out all major functions. It is compiled and uploaded using Arduino IDE 1.6.4.

- CODING

```
int sensorPin = A0;    // select the input pin for the
potentiometer
//int ledPin = 13;      // select the pin for the LED
int sensorValue = 0;  // variable to store the value coming from
the sensor
void setup() {
  // declare the ledPin as an OUTPUT:
  Serial.begin(9600);
  pinMode(ledPin, OUTPUT);
  pinMode(11,OUTPUT);
}
/*void loop() {
  // read the value from the sensor:
  sensorValue = analogRead(sensorPin);
  // turn the ledPin on
  digitalWrite(ledPin, HIGH);
  // stop the program for <sensorValue> milliseconds:
  delay(sensorValue);
  // turn the ledPin off:
  digitalWrite(ledPin, LOW);
  // stop the program for for <sensorValue> milliseconds:
  delay(sensorValue);
}*/
void loop()
{
  sensorValue=analogRead(sensorPin);
  if(sensorValue <= 14)
  digitalWrite(11,HIGH);
  else
  digitalWrite(11,LOW);
  Serial.println(sensorValue);
  delay(2);
}
```

VII. APPLICATIONS

- Light Sensors are used in variety of applications.
- They can be used in security systems like burglar alarm systems where an alarm is triggered when the light falling on the sensor is interrupted.
- Another common application of light sensor is night lamp. As long as the sun light falls on the light sensor, the

lamp will be switched off. When the sun light starts decreasing and is completely off, the lamp will be turned on automatically.

- One of the important applications of light sensors is in generation of efficient solar energy. Light sensors are often used in Solar Tracking systems. The solar panel will be rotated according to the movement of the sun and its intensity.

VIII. RESULT

The LDR (Light Dependant Resistor) will sense light incident on it and hence gives a signal to arduino UNO and it gives signal to the buzzer and hence the buzzer sounds.

IX. CONCLUSION

Thus we have developed LDR based light sensing system. This is a user friendly model which uses an Arduino Uno and LDR for sensing results in buzzer alarm sounds.

X. ACKNOWLEDGEMENT

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REFERENCES

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

[2] Sanal Malhotra[1] , Shiv Taneja[2] , Automatic Brightness Control Using LDR Sensors Advanced Research in Electrical and Electronic Engineering Print ISSN: 2349-5804; Online ISSN: 2349-5812 Volume 1, Number 2 (2014)

[3] Pravin Kumar Singh , Arduino Based Photovore Robot International Journal of Scientific & Engineering Research, Volume 4, Issue 4, April-2013

[4] Shreesh Mishra, Shivakant Gupta, Santosh Singh, Tripuresh Tiwari, Anand Mohan[5] ARDUINO BASED LED STREET LIGHT AUTO INTENSITY CONTROL SYSTEM International Journal of Advanced Research in Engineering ISSN: 2394-2819 Technology & Sciences April-2016 Volume 3, Issue-4

[5] Subhankar Chattoraj Smart Home Automation based on different sensors and Arduino as the master controller International Journal of Scientific and Research Publications, Volume 5, Issue 10, October 2015.

[6] http://www.electronicshub.org/arduino-light-sensor/ .

[7] Mridul Nayyar,Harpreet Kaur Megha Rathor, Chandani Balli Harpreet Kaur Channi, “Modeling And Simulation Of Automatic Street Light Controller Using LDR And Micro-Controller” International Journal for Scientific Research & Development (IJSRD) ,Vol. 5, Issue 08, 2017,ISSN (online): 2321-0613.pg.no 274-277.

[8] Amandeep Kaur, Goma Chhetri,Narinder Singh, Asif, Sunil Kumar,HarpreetKaur Channi, “Designing of Solar Tracking System using AT89C51 Microcontroller", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 2, Issue 5, pp.709-712