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Control Your Lights Intelligently with an Arduino Board

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Abstract

This world is full of different kind of light sources some are natural ones while others are man-made light sources. Theman-made light sources have only two modes of operation that is switch on and switch off there is no intermediate level that can be setaccording to the surrounding lighting condition and at the end everything needs to be controlled manually. These lead to wastage ofelectricity and at the same time a manual control is not effective in the modern era. In this paper, we purpose an advanced light controlsystem which is capable of replacing the old generation light control system. The system is implemented on an embedded platform &is equipped with a photo sensitive detector (LDR) which gives the required input for operation.The working of our light controlsystem is based on the amount of luminous energy in the environment at that moment of time. Depending upon the light intensity atthat instant the lighting of the lighting system is adjusted. The embedded main board including the Microcontroller chip, memory(flash), and communication port are used as a processing module for the input that we get from peripheral devices (LDR).Applicationof such a system can be implemented in workstations, park lights, street lighting system, head lights of automobilesand much more.

Keywords—Arduino Uno, LDR, Relay, Lighting Units Arduino Programming, Automatic Control, Energy Efficient

INTRODUCTION

We are living in the world where everything goes to be automatic from your washing machine to your ceiling fan. The world revolvesaround the word automation and the ones that are automated are said to be of next generation because they limit the involvement ofhumans. They are self-sufficient to operate on their own and thereby, saving time and cost by being more efficient than the manualones. But lighting systems have yet to make its move in these automated crusade. We have just started the crusade inour attempt here.

The main objective of this project is to implement an auto-intensity control of LED-based on LDR which is interfaced to an Arduinoboard. As the surrounding light decreases slowly from evening to night, the light
intensity gradually increases and then gets graduallydecreased from night to early dawn hence saves energy .Thus, the lights switch on at the dusk and light intensity increases tillmidnight and regressively decrease till dawn and then finally switch off automatically. The process repeats every
day. As statedearlier, application includes: park lights, street lights, head light in automobile and many unexplored options. Relay is used to
provideisolation between Arduino and 220 volt AC supply.The goal is to reduce the amount of energy consumed and thereby reducing the cost incurred due to energy loss thus proving to be acost-effective strategy.

LITERATURE REVIEW

Controlling lighting system by means of LDR and Arduino together is relatively a new concept. After going through many researchpapers which were related to field of lighting system, I found that there are papers only about street light system and that too most ofthem are Passive Infrared receiver based and few are LDR based but they are controlled by means of timers and analog circuits. Somewere controlled by wireless GSM/GUI networks .That being said they are no papers which coin all the lighting system under oneumbrella 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 ofoperation meant energy loss due to continuous operation at maximum voltage though actual requirement might be less dependingupon 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

PROPOSED SYSTEM

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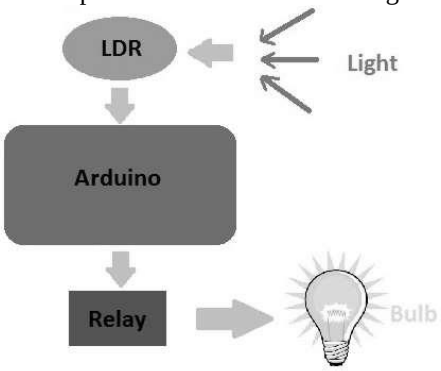
As stated earlier our main objective is to provide an efficient & energy saving lighting system by evaluating the outside lightingcondition and then adjusting the lights accordingly. The circuit mainly consists of a sensing element known as LDR,which isfollowed by processing unit Arduino which takes input for sensing element and gives its output to the LEDS (lighting units).Thoughother units like relays, transistors are also be used for higher voltage supply.
The LDR senses the light and sends the data to Arduino. The Arduino analyse the data and gives its response to the LEDS through therelay mechanism. The Arduino is programmed in such a way it automatically adjusts the lights to give most accurate result possible.

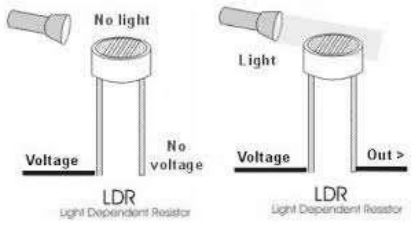
ARCHITECHTURE DESIGN

The pictorial representation of our model is given below:



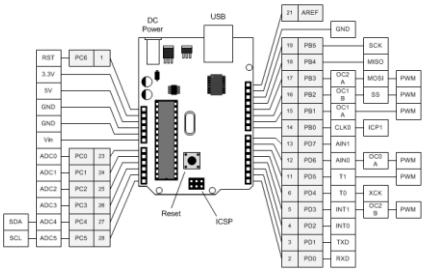
CIRCUIT COMPONENTS:

1) LIGHT DEPENDENT RESISTOR (LDR) SENSOR



Light Dependent Resistor as the name suggest the resistance is dependent upon the light incident on it. The light dependentresistor resistance changes with intensity of light, with increase in light intensity the resistance offered by the sensordecreases and with decrease in light intensity the resistance offered by the sensor increases. Hence it acts as variable resistorwith change in light intensity. These helps in finding the amount of light intensity at that instant of time and thus helping inregulating the lighting of our lighting system accordingly.

2) ARDUINO UNO



Arduino is an open-source physical platform based on microcontroller board having the ATmega32 series controllers andIntegrated Development Environment for writing and uploading codes to the microcontroller. It has input and output pins forinteraction with the outside world such as with sensors, switches, motors and so on. To be precise it

has 14 digitalinput/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, apower jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.It can takesupply through USB or we can power it with an AC-to-DC adapter or a battery Arduino acts as the processing module of thesystem. It takes input from the LDR, process the data and gives the output to LEDS directly or through a relay and atransistor mechanism

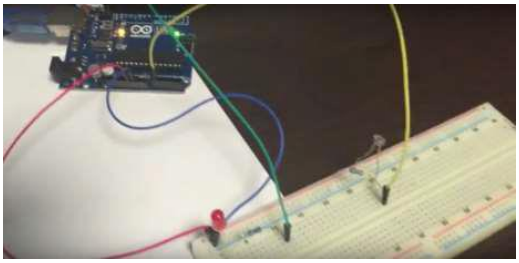
LEDS

A light-emitting diode (LED) is a pn junction diode, which emits light when activated. When we apply voltage across itsleads, electrons are able to recombine with holes within the LED, releasing energy in the form of photons which gives thelight. Hence, it is a two-lead semiconductor light sourceLight emitting diodes represents our lighting system and the amount of light emitted by it is directly related to the amount oflight in the environment that is when outside light is less than the light given by LEDS is more and visa-versa.

RELAY

In this project whenever high voltage supply has to be used then relay is used to provide isolation between low voltagecircuitry and high voltage circuitry. Arduino is also used to provide control signal to relay whenever intensity of light fallsbelow a certain level. Control signal generated from pin 13 of Arduino which is used as an output pin was given to relaywhich is finally given to the lights

WORKING PRINCIPLE



The working of our model is very simple. The supply is given through the power jack. From the Arduino we take 5v supply andconnect it to one of the terminal of photo resistor and other end is connected to a resistor of 10k which acts as a voltage divider andthen final connected to ground. The output is given by output pin 13 of the Arduino which is connected to the led through a 220ohmresistor. The other end of LED is perfectly grounded. As this is a working porotype here, we haven't shown the usage of relays but ifrequired they can be connected just before the lights (LEDS) for isolation purposes.

The LDR senses the amount of light in the atmosphere at that moment of time and accordingly sends the data is to Arduino .TheArduino converts the data received into various discrete levels .For example from 0 to 1023 discrete levels for a given data then 0represents maximum darkness and 1023 represents maximum brightest so light is received is converted into one of the discrete valuefrom 0 to 1023.Now depending upon the discrete value that we get (0 to 1023) we adjust the output voltage accordingly from 0 to5v.So,when complete darkness (night time)that is discrete level 0 than the output is 5v as a result LED is brightest or when partiallydark(dawn/evening) that is discrete level of 512 then the output is 2.5 v as a result LED is half of the maximum brightest or whencompletely bright that is discrete level 1023 then the output voltage is 0v as a result LED switched off. Thus, the LED not only justautomatically switches on and off but also adjust the amount of light emitted according to the outside condition. The usage of suchkind of application in the headlights of cars, park lights, street lights is very useful.

SCHEMATICS VIEW:

The schematic diagram of the smart lighting system is given below:

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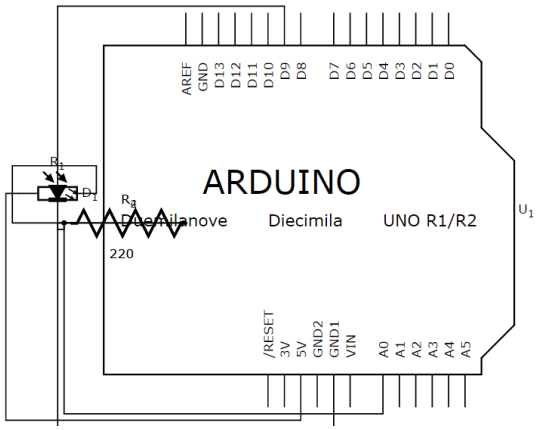
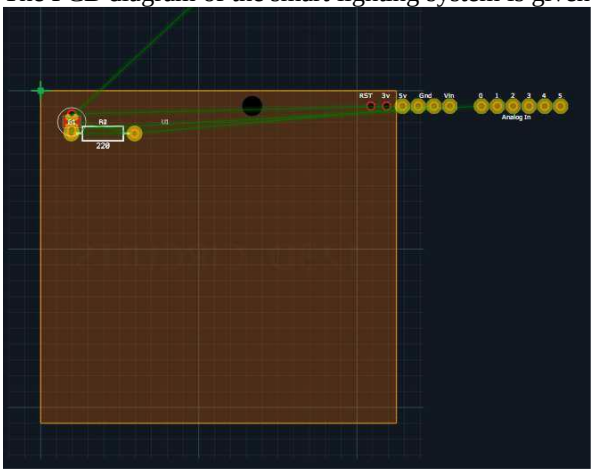


PCB VIEW:

The PCB diagram of the smart lighting system is given below:



The relays and transistors are externally connected and are not give in the above views as it is only required when with a higher ACvoltage supply is used as a supply. These can be used in the case of street lighting and park lighting system where isolation isimportant for safety.

CONCLUSION

This Arduino based project will provide a competent method for lighting systems and make the whole process of energy saving easierand efficient. With a capability to change the amount of light emitted depending upon the outside condition is no doubt an innovationwith many future application apart from the fact that it can also be used in many present day tech such as head lights, street light, parklights, industrial lights and many more. The usage of the smart lighting system will undoubtedly change the worldthat we see today

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