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Street Light Automation using LDR and Arduino

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Abstract: ***This purposed work is about Energy crisis as a major problem in India. Presently, most of our street lighting systems are manually operated and it leads to energy loss. This research deals with the design and implementation of simple yet cost effective automatic street lighting system. In our work we are using sensors as light detectors (input) which in turn is controlled by microcontroller board. Light (output) is turned ON or OFF if the conditions are met in the program coded in the microcontroller board. The proposed work does not only achieve energy efficient but also extend the life expectancy of street lights. This work can be implemented in large scale in near future using power or smart grid.***
Keywords: LED, Energy, Power, Efficiency, Arduino UNO, Photo-resistor, Relays

I. INTRODUCTION

Flow of power or charge is called electricity and it is secondary energy sources, which convey that we get electricity from transformation of other sources of energy like coal, natural gas, oil, nuclear power and other natural sources like sun, tidal, hydro and wind. It can either be renewable or non-renewable energy sources to make electricity but we need to save or conserve energy because most of the non- renewable energy sources we depend on, like coal and natural gas cannot be replaced once we use them up, they are gone forever. Saving electricity is very essential for the coming generation since it relies on natural sources of energy. In towns and cities, people have grown accustomed to driving the streets, rural roads and busy urban thoroughfares, relying on improved visibility and safety afforded to them by generous lighting conditions provided by several street lights of the roadways. Similarly, the safety and ability to manoeuvre along sidewalks and walkways, in both congested and remote areas, is tremendously enhanced by street lights for pedestrians and cyclists at night. There are street lights on every street, but some of them don't work or really far apart, one of the reasons is that they continuously glow even in day time shortening the lifespan of the bulb. We think that all the street lights should be in working condition, and on when its gets dark outside. So, in this project we are concerned about and learning to promote the approach of energy efficient street lighting technologies for grid-connected or off grid connected system. This approach is initiated to evaluate the economic, technical, and operational practicality of replacing the existing street lamps with automatic street lights which switch on or off depending on the sunlight intensity falling on the sensors. In many cities ,street lights is one of the major power consuming factors, too often most of the street lights we see are still on even after sunrise thus wasting lot of energy. So keeping that in mind, we are trying to solve the problem by having an automation system which turns on or off the street lights when sunlight falls below a specific intensity. Light Dependent Resistor is used to detect the ambient light. [1] If the ambient light falls below a specific value tuned on photo-resistor it trips the relays to function and lights are turned on.

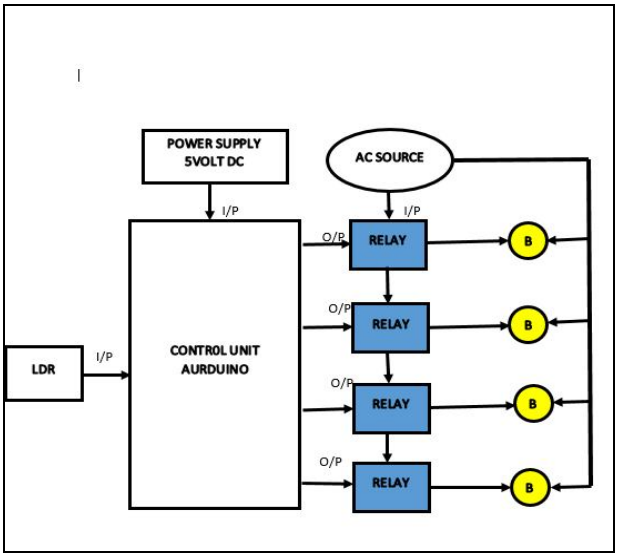


Fig: I Block diagram

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II. BLOCK DIAGRAM OPERATION

A light dependent resistor is interfaced to the Arduino UNO microcontroller board which is used to track the sunlight and when sensors goes dark the led will be made on and when the sensors finds light the led will be made off. [2] Along with photo-resistor relays are also interfaced with Arduino UNO which had been programmed to react to sensor signals to act as an automatic switch for street light. When the sunlight is too dim to be detected by the light dependent resistor it sends a signal to the Arduino board, which in turn sends an instructions to the relays to close the circuit allowing the current to flow in the street light. [3] Thus, switching on the bulb, and when the sensors starts detecting sunlight it sends the signal to the Arduino Board which has been already programmed to instruct the relays to open the circuit so as to switch off the street lights.

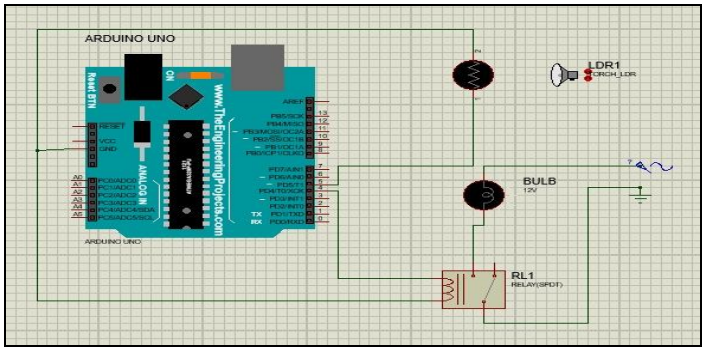


Fig-2: Circuit

III. HARDARE DESCRIPTION

1) *Arduino UNO*: Variation of open source platform device that can be used to design various electronic projects is called Arduino UNO microcontroller board. We are using Arduino UNO hardware which is based on microcontroller Atmega 328P. This microcontroller board consists of 14 digital input and output pins in which 6 can be used as Pulse Width Modulation outputs pin. Board also includes 6 analog inputs pin, 16 MHz quartz crystal, a USB connecting pin, a power jack, ICSP header and a reset button.
2) *Light Dependent Resistor (LDR):* A photo resistor (or light-dependent resistor, LDR, or photocell) is a light-controlled variable resistor. With the increase of incident light intensity the resistance of the LDR increases proportional to it. LDR we are using is a LM393 Photosensitive Light-Dependent Control Sensor Module having three pin namely VCC (+ve power supply), GND (Ground), DO (Digital output signal). This module is very easy to install and it comes with Mounting Hole Screw feature. Device also has a blue digital potentiometer used as adjustable sensitivity for ambient Brightness and light intensity. [5]
3) *Relays*: Relays are used to control the switching of any equipment electronically. Such an automatic street light is monitored by some sensor and the light is switched on or off automatically if tripped on relay by sensors. Relay is one great step towards automation. There are many types of relays but all are steps to control equipment automatically. Relay can control potentially dangerous machine which uses high voltage power by using low power control circuit. Therefore avoiding risk of accidents.
4) *Street Light*: A Street light is a raised source of light on the edge of a road or path. Many street lamps have light sensitive photocells that activate automatically when light is or is not needed: dusk, dawn, or the onset of dark weather. The function in older lighting system could have been performed with the help of a solar energy. In most of the street lights underground wiring is mostly preferred rather than are wiring from one utility post to another. We are avoiding the older traditional lamps by using LED which is more cost efficient and effective.



Fig-3: Comparative

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5) *Jumper Wires*: The Jumper wires are wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in other to make it easy to change a circuit as needed.
6) *Electrical Wires*: It is single, cylindrical, flexible strand or rod or metal. Wires are twisted and are manufactured with or without insulation depending upon the application.

IV. PROCESS METHODOLOGY

A. Brief observation and research on the topic "Arduino Interfacing with LDR sensors".[6]
B. Identifying of all the required components and devices for the project accomplishment.
C. Rough designing of different blocks of the project to be done.
D. To prepare circuits as per the blocks.
E. Writing program inside the software Arduino IDE for the operation of the system that is to be uploaded inside Arduino UNO.
F. Now select the board used i.e. Arduino UNO.
G. Connect the USB cable from Arduino board and pc.
H. Select the port]inside the software Arduino IDE
I. Now upload the program written in the software to Arduino.
J. Verify the output and observe it whether the circuit is performing according concept of the project discussed above.

V. ANALYSIS

A. Smart home Automation system has been adopted in their paper, increasing efficiency, reliability and minimizing the usage of electrical energy to save energy. They have presented a streetlight automation system which is controlled on the basis of solar light intensity and object detection sensors. In their project smart lighting system will be turned on or off on the dependency of motion sensors incorporated with photo-sensors. Theirs proposed work include IR sensor, photo-sensors and L294 motor module which is interfaced with Arduino UNO for controlling the street lights.
B. This proposed work concept use specific sensors to sense the motion of objects and according to that it will control the flow of light intensity of output bulb. Their project is designed to be cost efficient, practical, ecofriendly and the safest way to save energy.
C. This paper is similar in approach like our paper, simple yet powerful concept by incorporating LDR sensor effectively as a switch. Arduino is used to decode the inputs from the sensor and to send instructions to the relays to make a closed circuit if the conditions are met as program coded in the Arduino microcontroller board

VI. RESULT

This proposed work has been simulated and tested in Proteus simulation software and outputs are identified to be working technically fine. The street lights are glowing according to the instruction coded in the Arduino Board with the help of sensors (LDR). This work has been implemented in small scale and it has been running successfully well.



Fig-4: Output

VII. FUTURE WORK

Arduino UNO is a multi-functional and much versatile so, this proposed work can be upgraded, molded into any form by adding more efficient features in it for more efficiency. Solar powered backup can be used to support the proposed work, with some added intelligence you can even extended the life expectancy of Street light by adding softer startup and production increasing features. In near future this work will be implemented on a large scale controlled by Regional Grid systems for more automation and efficiency. [6]

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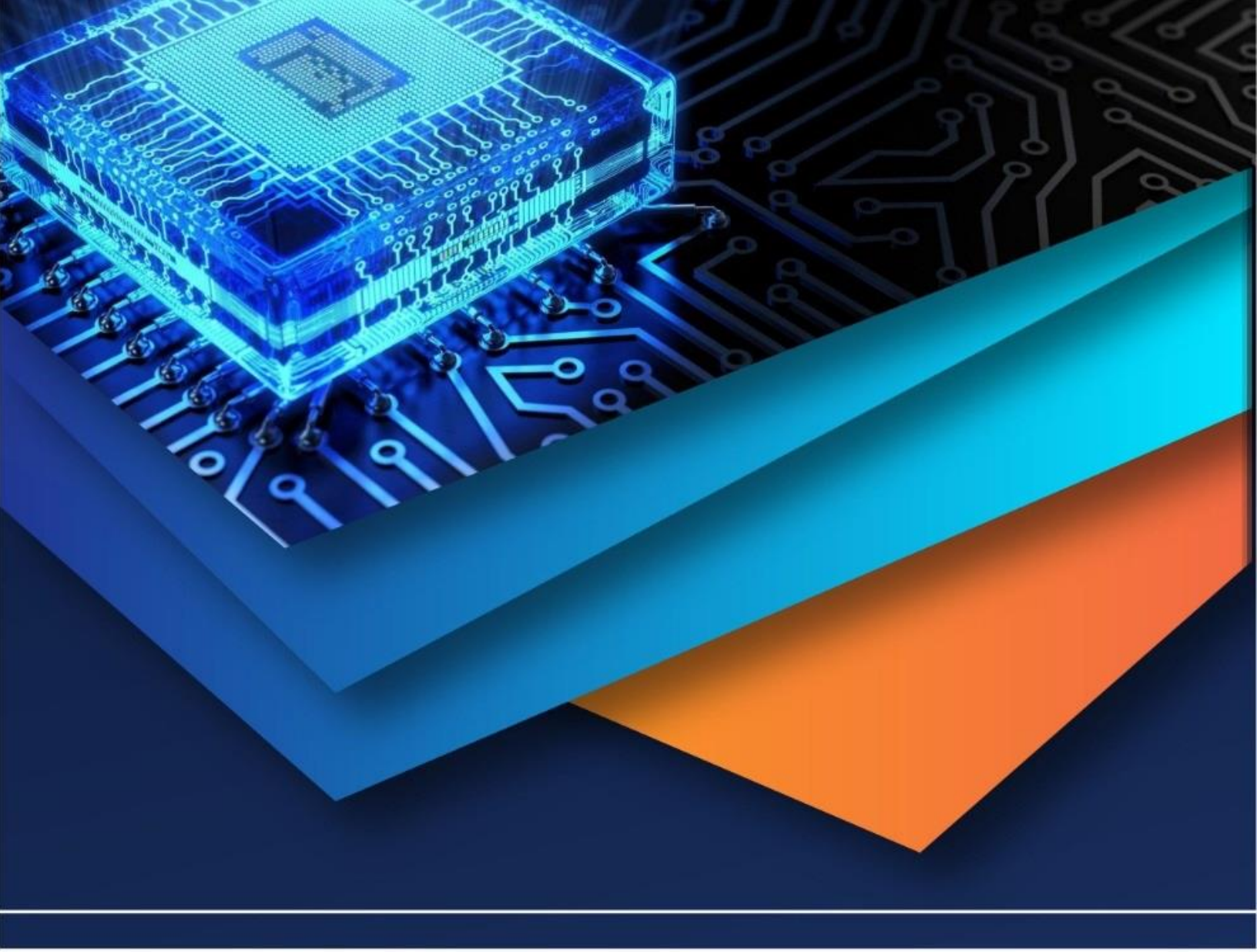
VIII. CONCLUSION

This proposed real time project has been implemented for controlling a street light system bases on Arduino UNO microcontroller board. In this research, a design scheme for upgrading the automatic street light has been demonstrated, which can be programmed to react to events (based on day and night) and to cause corresponding actions. [9] The proposed scheme is a real time based scheme which increases the efficiency and saves electricity in long run. Meanwhile, it has been presented that the proposed automatic systems have capabilities to handle more than four street lights. The proposed project has been carried out at a lab-scale prototype to verify simplicity, flexibility, versatility, reliability and low cost of the proposed scheme. As a lesson learned, we found out that this proposed scheme can be tested under real time conditions at large scale in near future, and it can be easily implemented in towns, cities, home automations, transports, parking lots, etc. through solar or grid supply.

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