Smart Street Light Control & Energy Saving System

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Abstract— The main objective of this paper is to develop a system for energy saving of street light. Nowadays, human life have become too busy that they are unable to switch off the lights wherever not necessary. In this system Street light is to be switch on automatically in the night and lights are automatically off in the day night. This system also allowed us to control the intensity of the street light as per the density of vehicles on the road. This will help to save electrical energy. The paper basically uses LDR (Light Dependent Resistor), IR (Infrared Sensor), & Arduino Circuit board.

Key words: LDR, Street Lights, Arduino, IR Sensors, Energy Saving

I. INTRODUCTION

For designing new system for the streetlight that does not consume huge amount of energy & provides sufficient light is a big challenge for any engineer. Street lighting is the main component of power consumption worldwide. Around 18-38% of the total energy bill is consumed by street lighting. Therefore this is one of the major concern of thinking to improve efficiency of power consumption by saving the energy.

In this paper we switch on the street light in night in half mode. Half mode means all the lights are to be on in 50 percent on/off mode. Rest of lights are to be on if the traffic is on the road. If the road is with traffic then all the lights are on. If the road is without traffic then 50 percent lights are again off.

For road sensing, we use two pair of IR sensor on the road. When any car cross the road then IR beam is interrupted and signal is connected to the controller. In the night lights are automatic on with the help of LDR. But all lights are not on, only half-light are on. Other half lights switch on automatically when any vehicle move on the bridge, when there is no vehicle on the bridge then lights are off automatically. We use two infra-red sensors to check the movement of vehicle. When first infra-red sensor is on then lights are on and when second sensor is interrupt then lights are off.

II. MATERIAL REQUIRED

A. Light Dependent Resistor (LDR)

A light-dependent resistor, alternatively called an LDR, photoresist or, photoconductor, or photocell, is a variable resistor whose value decreases with increasing incident light intensity. An LDR is made of a high-resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

B. Infra-Red Sensor (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. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

C. LM339

The LM139 series consists of four independent precision voltage comparators with an offset voltage specification as low as 2 mV max for all four comparators. These were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage. Application areas include limit comparators, simple analog to digital converters; pulse, square wave and time delay generators; wide range VCO; MOS clock timers; multi venerators and high voltage digital logic gates. The LM139 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, they will directly interface with MOS logic— where the low power drain of the LM339 is a distinct advantage over standard comparators.

D. Uno Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

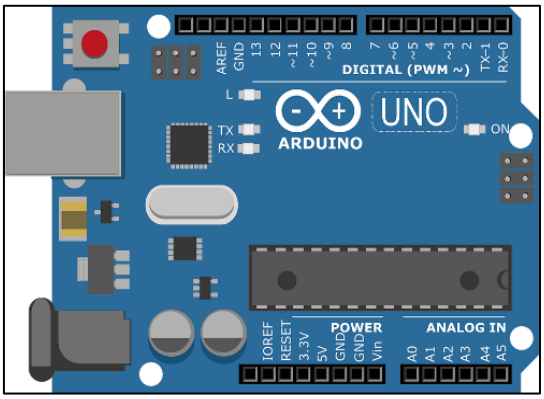

Fig. 1: Circuit Design

In this paper we use Arduino Uno as a main controller board. We use LM339 IC as a comparator in this paper. LM339 have a 4 comparator inside. We connect four infra-red photodiode sensors with this comparator circuit. All the infra-red and photodiode pair sensors are connected to the input of the Arduino UNO board. We connect all these sensors to A1, A2, A3, A4. LDR is connected to the A0 pin of the Arduino board.

Six led's as a output is connected to the pin no 2,3,4,5 of the ARDUINO BOARD. Here we use four infra-red photodiode pair. Out of these four sensor's two pair is on one road and other two on the second road.

We use active low logic in paper. Output from the ARDUINO BOARD is active low and negative output from the board is connected to the cathode of the led/s

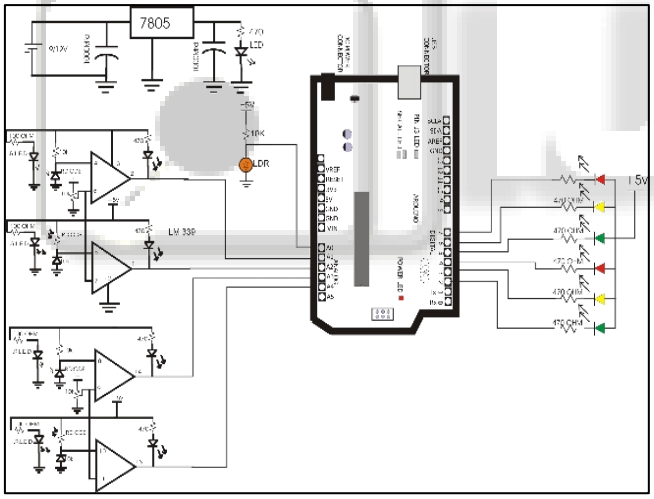

Fig. 2:

LDR is connected to the A0 pin of ARDUINO board. One resistor 10 k and LDR converts change of resistance in to voltage and this voltage is measure by the A0 pin. Ao is analogue pin of the ARDUINO board. Infra-red led is connected to the positive 5 volt via 270 ohm resistor and photodiode is reverse biased through 10 k ohm resistor. Each comparator voltage is compare with the voltage set of variable resistor. When any car cross the infra-red pair the comparator sense the interruption and opamp provides a low output. This low output is visually monitor by the connecting led and connected to the Arduino board.

III. Result & Discussion

The paper was aimed to reduce the power wastage which is created by human errors in switching ON & OFF the street lights. The prototype has been implemented and works as expected and will prove to be very useful and will fulfill all the present constraints if implemented on a large scale.

IV. Conclusion

This paper elaborates the design and construction of smart street lighting system. The paper also provides a way to save electricity of the street light. The whole functioning of the circuit depends upon LDR & Arduino UNO circuit board. The street light has been successfully controlled using Arduino. This system can be used in place like long roadways, highways and city as well.

References

[1] MSP430 5xx and 6xx User Guide, Texas Instruments
[2] MSP-EXP430F5529 Experimenter Board User Guide, Texas Instruments
[3] Matvoz D. and Maksic M., "Comparison of LED and CFL Lamps and their impact on Electric Power Network", 2012 IEEE 15th International Conference on Harmonics and Quality of Power(ICHQP).
[4] H. Fussler, S. Schnaufer, M. Transier and W. Effelsberg, "Vehicular Ad-Hoc Networks: From Vision to Reality and Back," 4th Annual Conference on Wireless on Demand Network Systems and Services, Oberguyrgl, 24-26 January 2007, pp. 80-83. doi:10.1109/WONS.2007.340477

