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Automatic Street Light Control System using Relays and LDR

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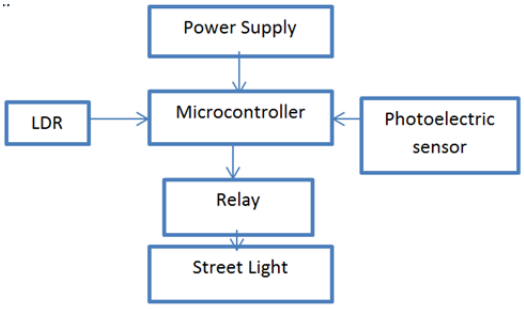
Abstract—*Automatic Street Light Control System is a simple and powerful concept, which uses transistors as a switch to switch ON and OFF the street light automatically. By using this system manual works re removed. It automatically switches ON lights when the sunlight goes below the visible region of our eyes.it automatically switches OFF lights under illumination by sunlight. This is done by a senor called light dependent resistors (LDR) which sense the light actually like our eyes.*

1. INTRODUCTION

Street lights are the major requirements in today's life of transportation for safety purposes and avoiding accidents during night. Despite that in today's busy life no one bothers to switch it OFF/ON when not required. The project introduced here gives solution to this by eliminating manpower and reducing power consumption.



Block diagram of Street light controller

This requires three basic components i.e. LDR, Sensors and Microcontroller. During daytime there is no requirement of street lights so the LDR keeps the street light OFF until the light level is low or the frequency of light is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistor. Thus the street lights do not glow. As soon as the light level goes high or 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. Now the circuitry goes in ON condition and the block diagram represented here starts working.

2. AUTOMATIC STREET LIGHT SYSTEM CIRCUIT DESIGN

The system basically consists of a LDR, photoelectric sensor, power supply relays and microcontroller.

2.1 LDR

An LDR (light dependent resistor), as its name suggests, offers resistance in response to the ambient light. The resistance decreases as the intensity of incident light increases, and vice versa. In the absence of light, LDR exhibits a resistance of mega-ohms which decreases to few ohms in the presence of light. It can act as sensor, since a varying voltage drop can be obtained in accordance with the varying resistance. It is made up of cadmium sulphide (CdS).

An LDR has a zigzag cadmium sulphide track. It is a bilateral device i.e. conducts in both directions in same fraction.

2.2 Photoelectric Sensor

To detect the movement in the street, the photoelectric sensors have been used in this paper, where emitter and receiver are in one unit as shown. In Fig 3. Light from the emitter strikes the target and the reflected light is diffused from the surface at all angles. If the receiver receives enough reflected light the output will switch states. When no light is reflected back to the receiver the output returns to its original state. In diffuse scanning the emitter is placed perpendicular to the target. The

receiver will be at some angle in order to receive some of the scattered (diffuse) reflection. The photoelectric sensor specifications are illustrated in table 1.

Table 1: Photoelectric sensor specifications

Photoelectric Sensors(MC005)	
Sensing range	3-80cm
Sensing object	Translucency, opaque
Supply voltage, current	DC 5V, 100mA
Output operation	Normally open
Output	DC three-wire system (NPN)
Diameter, Length	18mm , 45mm
Ambient Temperature	-25_70

2.3 Regulated Power supply

Usually, we start with an unregulated power supply ranging from 9 volt to 12volt DC to make a 5volt power supply, KA8705 voltage regulator IC as shown in fig. 4 has been used.

Fig. 4 Power supply regulator

The KA8705 is simple to use. simply connect the positive lead from unregulated DC power supply anything(anything from 9VDC to 224VDC) to the input pins, connect the negative lead pin to common pin and then turn on the power, a 5V supply from the output pin will be gotten.

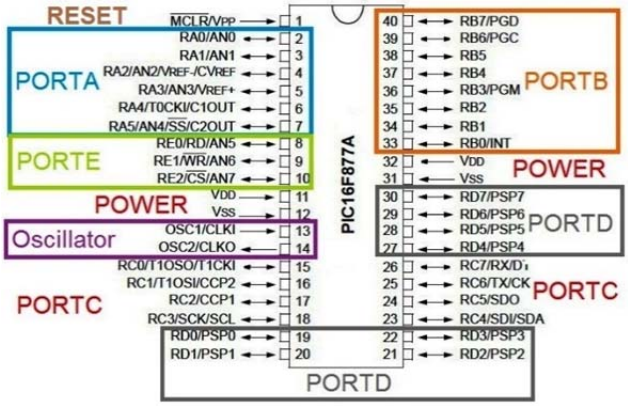
RELAY: It provides isolation between controller and the device because as we know devices may work on AC as well as DC but they receive signals from microcontroller which works on DC. Hence we require a relay to bridge the gap. The relay is extremely useful when you need to control a large amount of current or voltage with the small electrical signal.

Factors for selecting an appropriate relay:

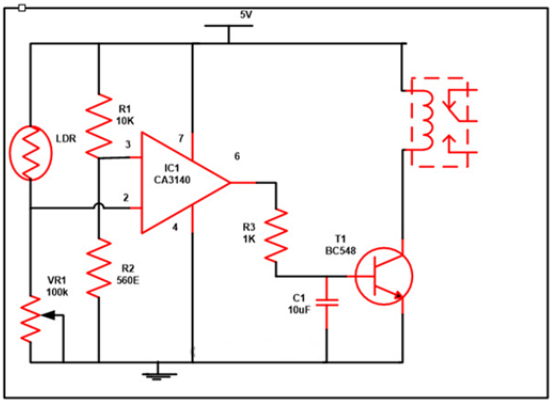
- The voltage and current required to strength in the coil
- The utmost voltage which we will acquire in the output.
- Amount of the armature.
- Amount of the contacts for the armature.
- Number of electrical associates (N/0 and N/C).

2.5. PIC16F877A Microcontroller

A Microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decide written instructions and convert them to electrical signal. The microcontroller will thenstep through this instructions and execute one by one. As an example of this a microcontroller we can used it to controller the lighting of a street by using the4 exact procedure. Microcontroller are now changing electronic design instead of hard wiring a number of logic gates together to perform some function we now use instructions to wire the gates electronically. The list of this instructions given to the microcontroller is called program. There are different type of microcontroller, this project focus on only the PIC16F877A microcontroller where its pins as shown in Fig.6.



Automatic street light controller circuit using relays and LDR



The working of circuit is very much easy to understand. In this circuit, we used IC CA3140 which is basically an operational amplifier. Pins 2 and 3 of these IC are used to compare the voltage and give us the output in return i.e. it works as a potential divider in its inverting and non-inverting inputs (pins 2 and 3). In this LDR and VR1 from one potential divider which is used to provide a variable voltage at the inverting input (i.e. 2) and the second potential divider is built around non-inverting input(pin 3) with the help of R1 and R2 which will grant half of the supply voltage to non-inverting pin.

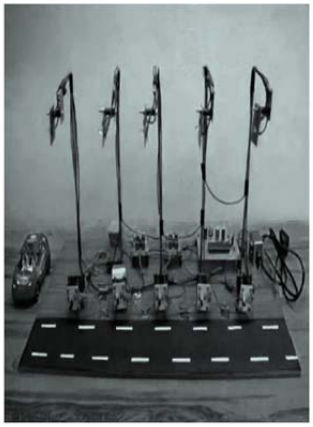
As we know property of LDR that during the time of day resistance is low therefore voltage at the inverting input (i.e. pin 2) higher than the voltage at the non-inverting input(pin 3) hence the output at the pin 6 is low so that transistor goes in to the cutoff state which means LED and bulb I not glow.

But in dimness or in night we know the resistance of LDR is high hence the voltage at inverting input pin 2 of the IC CA3140 decreases than to non-inverting input pin 3 as a result output pin move to high state which makes transistor to conduct and the LED or the bulb associated to it start simmering.

We need to pay attention connecting relay with bulb. As different bulbs have different wattage, so it must support the relay or else the relay will not energize.

3. RESULTS AND DISCUSSIONS

The project aims were to reduce the side effects of the current street lighting system and find the solution to save power. In this project the first thing to do, is to prepare inputs and the outputs of the system to control the light of the street. The prototype as shown in fig. 9 as we implemented and the works as expected and will prove to be very useful and will fulfill all the present constraints if implemented on a large scale.



4. CONCLUSION

This paper elaborates the design and construction of automatic street light control system circuit. Circuit works properly to turn street lamp on/off. After designing the circuit which controls the light of the street as illustrated in the previous sections. LDR sensor and the photoelectric sensor are the two main conditions in working the circuit if the two conditions have to be satisfied this circuit will do the desired work according ti specific program. Each sensor controls the turn off/on the lighting column. The street light has been successfully controlled by microcontroller with commands from the controller the lights will be ON in the places of the movement when it's dark. Furthermore the drawback of the street light system using timer controller has been overcome, where the system depends on photoelectric sensor. Finally this control circuit can be used in long roadways between the cities.

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