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Design and Implementation of Automatic Street Light Control Using Arduino and Solar Panel

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Abstract

Solar photovoltaic panel based street lighting systems are becoming more common these days. But the limitation with these ordinary street light systems is that it lacks intelligent performance. It is very essential to automate the systems so that we can conserve energy as well as to maximize the efficiency of the system. In this paper a new model is suggested so as to maximize the efficiency of street lighting system and conserve the energy usage the LED lights sensors. Here automation of street lights is done by LDR sensor.

Key words: Solar Power, LED, LDR, Street light control systems, Automation.

1. INTRODUCTION

The Street lights are the major requirements in today's life for safety purposes and avoiding accidents during night. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10-38% of the total energy bill in typical cities worldwide. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. The fixtures of street lights indirectly have assisted the public and government in reduction of crime rate and accidents in the area. It also encourages social inclusion by providing an environment in which people feel they can walk in hours of darkness. Despite that in today's busy lifestyle no one bothers to switch it OFF/ON when not required. Inefficient lighting wastes significant financial resources each year, and poor lighting creates unsafe conditions. Energy efficient technologies and design can cut street lighting costs dramatically. The main consideration in the present field technologies are Automation, Power consumption and cost effectiveness. Automation is intended to reduce man power with the help of intelligent systems. Power saving is the main consideration forever as the sources of the power are getting diminished due to various reasons. Designing a cost efficient system is very important as the requirement is more. In order to overcome this problem, automatic street light control methods are introduced. The main objective of our project is to provide a better solution to minimize the electrical wastage in operating street lights, in this era of automation humans are restless and are not in a position to regulate the manual operations in any field, a rapid advancement in embedded systems has paved path for the design and development of microcontroller based automatic control systems. Our project presents an automatic street light controller using light dependent resistor (LDR).

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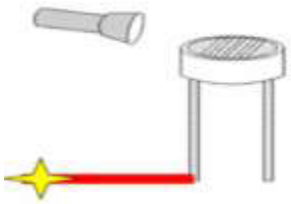

Fig;1, Light dependent resistor

The step down transformer, converts the AC input 230V, 50Hz to 5V. The alternating voltage from secondary terminal of the transformer is given to a bridge rectifier. The bridge rectifier converts alternating voltage to unidirectional voltage with the switching action of diodes. This voltage is finally fed to a 5V regulator IC through a 470uF, electrolytic capacitor, which eliminates the ripples and make the output stable. After regulation we get a 5V DC voltage at the output of 7805 IC. The ATmega8 provides the following features: 8Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 512 bytes of EEPROM, 1 Kbyte of SRAM, 23 general purpose I/O modes, internal and external interrupts, a serial programmable USART, a byte oriented Two wire Serial Interface, a 6 channel ADC with 10 bit accuracy, a programmable watchdog timer with internal oscillator, an SPI serial port, and five software selectable power saving modes. The idle mode stops the CPU while allowing the SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power down mode saves the register contents but freezes the oscillator, disabling all the other chip functions until the next interrupt.

2. LITERATURE REVIEW

Lighting can account for 10-38% of the total energy bill in typical cities world wide . Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources each year, and poor lighting creates unsafe conditions. Energy efficient technologies and design can cut street lighting costs dramatically (often by 25-60%). The main consideration in the present field technologies are Automation, Power consumption and cost effectiveness. Automation is intended to reduce man power with the help of intelligent systems. Power saving is the main consideration forever as the sources of the power are getting diminished due to various reasons. The busy lifestyle of humans has led to untimely switching of street lights. As a result lot of power is being wasted.

The advanced development in embedded system has set a platform for designing energy efficient systems. Electrical Power wastage can be reduced by using two light dependent resistors as light sensing devices or light sensors to indicate day or night time. A photoelectric sensor has been used to detect the movement of humans and vehicles on the streets. However in this era advancement in Embedded systems, Automatic street light controlling can be achieved using microcontrollers and light dependent resistors. The supply to the control unit and to light the street light is being achieved by the implementation of solar panels. Again the LDRs are used to differentiate between day and night light. The discrete analog signals sensed by LDR due to variation in its resistance are converted to digital signals. The Microcontroller is programmed in such a way that during morning and evening as the intensity changes according to which street light intensity is programmed with five intensity levels. This system is basically street light

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intensity control as well as switching control. A lot more amount of power is conserved as the power is conserved as the power utilization depends on the light in the streets.

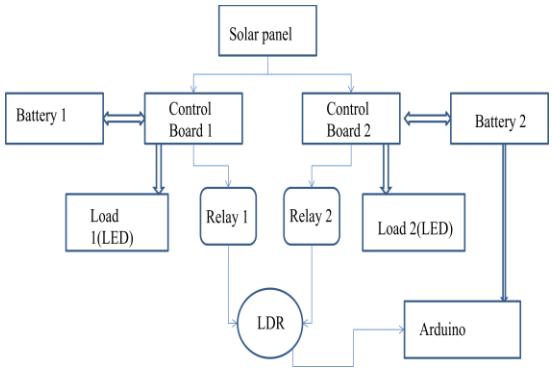
3. EXISTING SYSTEM

The automatic streetlight control system operates on 12 V DC supply. The automatic streetlight controller has a photoconductive device whose resistance changes proportional to the extent of illumination, which switches ON or OFF the LED with the use of transistor as a switch. Light dependent resistor, a photoconductive device has been used as the transducer to convert light energy into electrical energy. The central dogma of the circuit is that the change in voltage drop across the light dependent resistor on illumination or darkness switches the transistor between cut-off region or saturation region and switches OFF or ON the LEDAs we know property of LDR that during the time of day resistance is low therefore voltage at the inverting input (IE pin 2) is higher than the voltage at the non-inverting input (pin3) hence the output at the pin6 is low so the transistor goes into the cut off state which means LED or bulb will not glow.

Design and Development of Intelligent wireless street light control and Monitoring system along with GUI" discussed that Now a days it became essential for people work during nights and returning back to homes late nights; also increasing crime rate during night times . This can be best achieved by implementation proper solar based lighting system on streets. The efficient monitoring and controlling of this lighting system must be taken into account. We will get more power consumption, saving money through solar panel. Also saving precious time, decrease the huge human power through from the LDR,IR sensor . The street lights are controlled through a specially designed graphical user interface (GUI) in the PC. The Zigbee technology can be used for street lights monitoring and controlling at the PC end.

4. PROPOSED SYSTEM

The working of the entire system is mainly with the sensor present. The main idea behind the system is that the LED array will be in off position at day time. Even at day time if the intensity of light is lower due to the weather conditions like fog, thunderstorm etc. Then the array will get turned on



Fig; 2, Block Diagram

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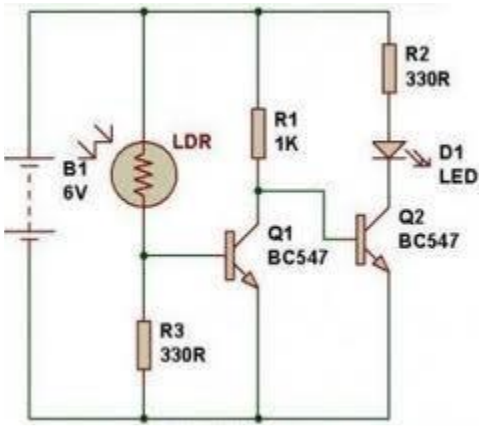

Fig: 3, Circuit diagram of automatic street light controller

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically. When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the LED does not light.
Circuit of a compact and true solid-state automatic lawn light is described here. The circuit can be used to switch on incandescent garden light bulbs at desk and switch off them at dawn. A 10 mm encapsulated light dependent resistor (LDR) here works as the twilight detector. The whole circuit can be housed in a very small plastic cabinet. For powering the circuit AC household supply is needed. With a little skill and patience, you can easily modify this circuit to drive a number of white LED strings, instead of the incandescent bulb load at the output. When ambient light is normal, transistor T1 is reverse biased by the low resistance of LDR. Multi-turn plastic trimpotP1 sets the detection sensitivity. If ambient light dims, transistor T1 turns on to drive the triac T2. Now the lamp load at the output of T2 energises. When the ambient light level restores, circuit returns to its idle state and light(s) switched off by the circuit

Now days human has become too busy and is unable to find time even to switch the lights when ever not necessary. PWM is required mainly intensity controlling of Led, LDR is a light dependent resistor which is having very high resistance. Whose resistance decrease when light impinges on it. This kind of sensor is commonly used in light sensor circuits in open areas to control street lamps. This LDR mainly used to different between day and night light. LDR gives the discrete output of the resistance instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer.value this analog should be converted into digital so an analog should be converted into digital so an analog to digital converter is required which is interface with arduino controller. Arduino is programmed in such a way that it during morning and evening intensity increases or decreases so according to that intensity it is programmed with 5 level intensity so we can conserve power here.

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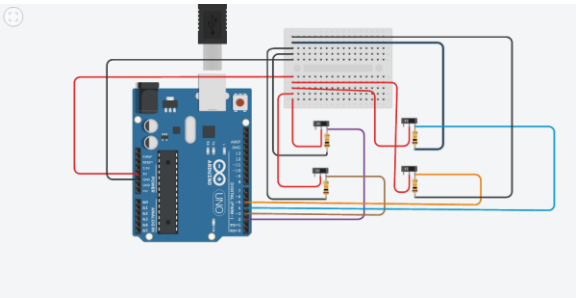
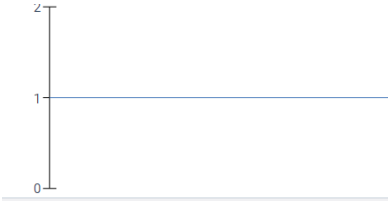
5. SIMULATION RESULT

The control circuit requires 5V DC to operate which is obtained from the rectifier circuit which also includes a step-down transformer and a voltage regulator. The light dependent resistor used as a light sensing device senses light intensity and sends analog signals to the microcontroller. The timer concept is employed along with light dependent resistor. The real time, ON time and OFF time settings is done using the four button keyboard and liquid crystal display. A tolerance of one hour is provided for the efficient operation of the streetlight.

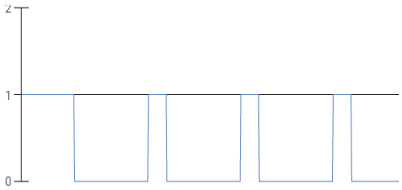


Fig; 4, Simulation Diagram



Fig; 3, Continuous off

Fig; 4, Periodic Off and ON



Fig; 4, Periodic Off and ON time delay

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6. HARDWARE RESULT

This prototype has been tested in variable real life conditions to verify the overall functionality and seek better performance. The measurement collected during the test phase allow calculation energy saving so that's possible to estimate cost

Fig;5, Hardware Kit

CONCLUSION

A new model is presented in this paper which will reduce the power consumption of the street lightning system about 20-30 % compared to savings also for larger systems using approximations. Intensity of the street light can be controlled and we can conserve power effectively. We automated the street lights. It reduce the labor charge switching is done manually there is no need of human resource. Convectional design. Here we are saving lot of power without any wastage by these advanced technologies we can design many more systems which can be done done by solar light through these solar lights we can have a vast usage at the same time we can do automatic systems instead of doing it manually like with LDR's. Secondly highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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FUTURE SCOPE

Wireless is the buzz of communication industry today. The field of wireless communication is growing leaps and bounds day by day. There have been advancements taking place in the semiconductor industry leading to more and more advancements in wireless technology The main aim of project is to save the power by using effectively we can save more power, as we know that there is shortage of power now a days in everywhere mostly in village's etc. So to overcome that we can provide street light automatically with the centralized intelligent systems. So in future we can design many more advanced technologies to save power.

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