Solar powered LED street lighting with auto intensity control

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Abstract **- As we all know that energy consumption has increased a lot and sources of energy are limited so in order to meet the increasing demand of energy use of renewable sources of energy is a must Keeping this in mind in this paper, we are discussing about SOLAR P0WERED LED STREET LIGHT WITH AUTO INTENSITY CONTROL. The project is designed for LED based streetlights with an auto-intensity control that uses solar power from photovoltaic cells. A charge controller circuit is used to control the charging of the battery, and an LDR is used to sense the ambient light on daytime. We have also attempted to measure the solar cell parameters through multiple sensor data acquisition. This streetlight is driven by solar energy and apart from this it also controls its intensity from dusk to dawn depending upon the brightness. In this system, different parameters of the solar panel like light intensity, voltage, current and temperature are monitored using a microcontroller of the PIC16F8 family. A case study is also done to show advantages of solar led streetlight compared to that of traditional streetlight. The intensity of streetlights is re-quired to be kept high during the peak hours. This streetlight can save a large amount of electricity compared to the tradition one which are alight to their maximum intensity at all times after they are switched on.**

Index Terms **- Solar energy, LED based solar street lighting using microcontroller 8051, charging of battery controlled by charge controller circuit; measurement circuit senses 4 parameters.**

1.INTRODUCTION

Problem Definition:

To design and build a simple but effective circuit called Auto Intensity Control of Street Lights using Arduino. Since the concept of this project is to consumption of energy, using LEDs as the Street Lights would be the obvious choice.

Description:

Street Lights have become an essential part of our lives as they are an important source of light at evening and night time. The main advantage of street lights is that they increase safety and prevents accidents and collisions. Auto Intensity Control of Street Lights is a simple project where the intensity of the street lights is automatically controlled based on the sunlight conditions. Generally, street lights are turned on during evening time and will continue to glow till morning. This might result is unnecessary usage of power as the lights will be glowing at full intensity all the time. But using the Auto Intensity Control of Street Lights using Arduino project, you can control the intensity based on the ambient lighting conditions. As an additional power saving feature, we have used LEDs for streetlights. The different type of micro controller also we can use in this model it will improves sensitivity of the system. In this project we used Atmega328 microcontroller a microcontroller is the heart of an embedded system. Most communication, digital entertainment, and portable devices, are controlled by either of them.

2.COMPOENTS

A. Arduino Uno:

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

B. ATmega328:

The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts ,serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

C. Solar Panel:

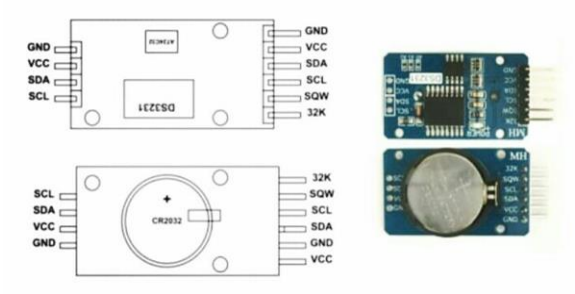
A solar panel is a device that collects and converts solar energy into electricity or heat. It known as Photovoltaic panels, used to generate electricity directly from sunlight. A solar power technology that uses solar cells or solar photovoltaic arrays to convert light from the sun directly into electricity. Photovoltaics is in which light is converted into electrical power. It is best known as a method for generating solar power by using solar cells packaged in photovoltaic modules, often electrically connected in multiples as solar photovoltaic arrays to convert energy from the sun into electricity. The photovoltaic solar panel is photons from sunlight knock electrons into a higher state of energy, creating electricity. Solar cells produce direct current electricity from light, which can be used to power equipment or to recharge a battery. Photovoltaic devices are also used to produce electricity in optical wireless power transmission.

D. The Light Dependent Resistor (LDR):

LDR is just another special type of Resistor and hence has no polarity. Meaning they can be connected in any direction. They are breadboard friendly and can be easily used on a perf board also. The symbol for LDR is just as similar to Resistor but adds to inward arrows as shown above. The arrows indicate the light signals.

E. DS3231 RTC Module:

It is a six-terminal device, out of them two pins are not compulsory to use. So, we have mainly four pins. These four pins are given out on other side of module sharing the same name.



F. Battery:

In our project we are using secondary type battery. It is rechargeable type. A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy

to electrical energy. Primary batteries can only be used once because they use up their chemicals in an irreversible reaction. Secondary, also called rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled.

3. WORKING

After making the connections and uploading the code to Arduino, turn on the Power supply to the project. Initially, the Arduino runs in LDR Mode. In this mode, the Arduino reads the value of the LDR from A3 and based on the value, it adjusts the intensity of the LED. During anytime of this operation, if the button (connected as an external interrupt to Pin 2) is pushed, the Arduino enters RTC Mode where there are two times set in the code: the ON TIME and the OFF TIME. Arduino compares the ON TIME with the time from RTC Module and when they match, the LED is turned ON. After this, the Arduino waits for the OFF TIME and once the time from RTC Module reaches the OFF TIME, the LED is turned OFF. In order to switch back to LDR Mode, all you have to do is push the button.

4.CONCLUSIONS

A simple project for saving power is implemented using Auto Intensity Control of Street Lights using Arduino. With slight modifications and enhancements, this project can be applicable for real time use.

In this paper, auto intensity controlled solar power-driven LED streetlight is implemented. As a conclusion, around 30% to 45% of power utilization can be saved by using this system as compared with existing LED streetlights with any control. This is best solution to current street lighting system to save energy. Furthermore, the streetlight can be operated with free of running cost providing efficient solar panel and battery. The solar powered LED streetlight system provides better illumination, optimum usage of electricity with reducing operational and maintenance cost after installation compared to high pressure sodium lamp and others.

5.FUTURE SCOPE

[1] To send light intensity data on cloud for weather analysis.

[2] To send number of working hours of lamp to user account.

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