

Design of Intelligent Solar Street Light Which Sends SMS When Solar or Battery Not Operating

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Abstract— The project works as follow: Smart Solar Street Light is the fully automated street light, which aim is to reduce the power consumption by automatically switch on/off the lights .Battery get charged from solar panel and battery gives power supply to the system. The data from temperature sensor is also programmed in wemos. The wemos initially connected in the wifi network via mobile hotspot. The IP address is assigned by the hotspot to the wemos and we can access it from the wifi network. The wemos initially connected in the newton given the output of battery voltage and the current temperature on the website. If the battery got stolen or if it goes zero volt then SMS will send to the respective maintenance team to look for this matter. Aslo The solar plate is having sensor switch, if someone try to remove it from the pole it gives signal to wemos and SMS will send to the maintenance or police.

Keywords: Smart LED Street Light; Solar panel; GSM Module; Wemos Controller; IR Sensor; Battery

I. INTRODUCTION

Street light controllers are smarter versions of the mechanical or electronic timers previously us for street light ON-OFF operation. They come with energy conservation options like twilight saving, staggering or dimming. Automatic Street Light Control System is a simple and powerful concept, which uses transistor as a switch to switch ON and OFF the street light automatically. About India, India consumes 18% of electricity for street lighting and residential lighting in which street lighting takes major part, while India is facing shortage of electricity. In December 2014, Government of India proposed and started to use LED luminaire in streetlights. If all existing streetlight replaced with LED lights then India will be benefited by 5,500 crore of rupees every year and reduction in CO2 emission. This is beneficial by many aspects like economic, environmental, lighting performance, reduction in road accidents, thief and crime. The light consist of the sensor mechanism to inform authorized person that the panel or the battery is not working or stolen. The main issue of the solar LED street light is the battery and the panel get stolen or damaged or faulty, after few days of the installation specially by the government. To solve the issue we made this project which is intelligent smart street light operated by solar panel.



LED is a solid state semiconductor device which can convert electrical energy into visible light. It is characterized with small size, low power consumption, long service life, environmental protection and durance. The spectrum of the LED is almostly concentrated in the visible light spectrum, so it has a high luminous efficiency which can be described as the great reform in the solid light source. This essay briefly describes the solar led street lighting system. It uses the solar radiation energy to charge the battery with the solar panel during day time, and offer energy to the LED light equipment at night. This system has a double advantage in both utilization of new energy and energy-saving.

II. LITERATURE

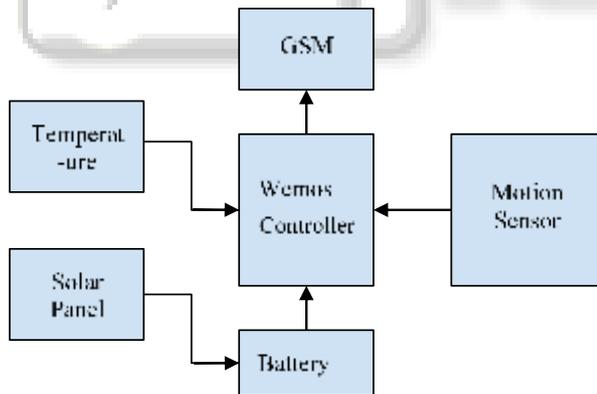
A Survey on Smart Street Using Solar and IOT based Light Management [1], The main goal of smart street light systems is that lights turn on when needed and light turn off when not required. The smart street light system contains of LED lights, brightness sensors, motion sensors, Arduino and short-distance communication networks. The lights turn on before pedestrians and vehicles come and turn off when there is no one. The system is programmed to automatically turn off during the hours of daylight and only operate during the night and heavy raining or bad weather. It can be operated free of cost by using automatic controlled, self-powered, efficient solar LED street light. In this paper we also added the solar concept which is use to recharge the battery to produce energy to turn on the street lights. Automated street lighting system using IoT [2] , Here author propose an IOT based street light monitoring and controlling system to ensure, low power consumption, instant faulty light detection and light dimming as per external lighting conditions. Our proposed system consists of smart street lights that have external light sensing that automatically turns on at the desired intensity based on an amount of lighting needed. Iot Based Smart Led Street Lighting System [3], A method for modifying street light illumination by using sensor at minimum electrical energy consumption, when object presence is detected, street lights glow at their brightest mode, else they stay in the dim mode during night time Internet of things (IOT) is used to visualize the real time updates of street processing and notifying the changes occur. This shall reduce heat emissions, power consumption, maintenance and replacement costs and carbon dioxide emissions.

IoT Based Smart Street Light System [4] , Intelligent Street light control system can switch lights reasonably, regulates voltage according to degrees of shine and runs in lower voltage in night .As a result, it saves electricity costs largely, prolongs the service life of street lamps and equipments, and saves labour costs of maintenance and materials significantly. Street light control and management system is made up of the network systems to

report the status of the system. Smart Solar-Powered LED Outdoor Lighting System Based on the Energy Storage Level in Batteries[5] , A newly designed controller, that continuously monitors the energy status in the battery and, accordingly, controls the level of illumination of the LED light to satisfy the lighting requirements and/or to keep the light “on” the longest time possible, has been developed. The use of such a reliable solar energy-driven lighting system, with maximum time when the light is “on”, will eliminate the sudden-death of light problem present in conventional photovoltaic (PV) outdoor lights and, therefore, will enhance the natural surveillance and feeling of safety in sustainable buildings and cities. Furthermore, the new smart control eliminates the overdischarge of the system battery and, thus, ensures a longer lifetime of the system battery

[6] developed the smart street light system consisting of LED lights, brightness sensors, motion sensors and communication networks. The driver or pedestrians cannot distinguish from the normal street lights and smart lights because when they come before that the lights on and after that the lights off. [7] developed the smart street lights based on Malaysian environment. They integrated the Wireless Sensor Network, Servers, Sensors to implement the Smart light system and controlling the light intensity using Pulse Width Modulation (PWM) technique. [8] presented circuit model that can analyse the behavior of Power Line Communication(PLC) for the street light control. Their approach is capable to evaluate the quality of PLC signal in huge network of different technology. The consequences of a few reproductions, with signals in the recurrence extend 95-148.5 kHz, have been contrasted and the results of some lab explores over a test line.

III. BLOCK DIAGRAM



The battery get charged from solar panel and battery gives power supply to the system. The Wemos is programmed to get the data from Battery and solar voltage and compare it periodically. The data from temperature sensor is also programmed in wemos, the wemos initially connected in the wifi network via mobile hotspot. The IP address is assigned by the hotspot to the nodemcu and we can access it from the wifi network

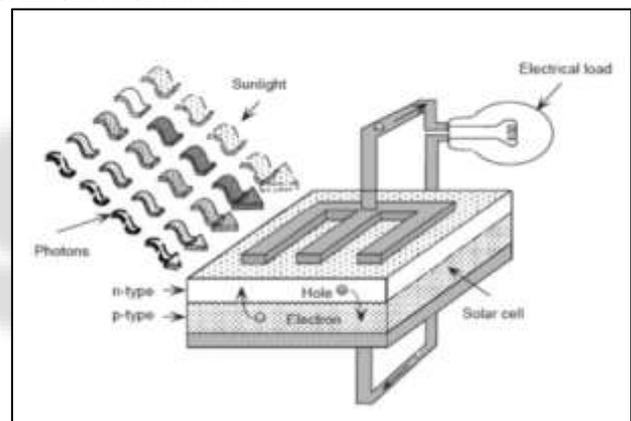
When we type that ip in the web browser then we get the output like below. The wemos initially connected in the newtok given the output of battery voltage and the current temperature on the website. If the battery got stolen or if it goes zero volt then SMS will send to the respective

maintenance team to look for this matter. Aslo The solar plate is having sensor switch, if someone try to remove it from the pole it gives signal to wemos and SMS will send to the maintenance team or police

IV. HARDWARE REQUIREMENTS

A. Solar panel:

Solar panel is one of the most important parts of a solar street lights. It converts the solar energy into electricity in DC form. As the name implies, these are cells that are grown from a single crystal. The Monocrystalline solar PV panel is more efficient than polycrystalline panel. Efficiency is about 18%. High Efficient Monocrystalline solar panel generates electricity during day time and it is stored in battery. The Photovoltaic (PV) cell is composed of at least two layers of the semiconductors which have been “doped” with different impurities. This makes an excess of free electrons (n-type) on one side of the junction, and a lack of free electrons (p-type) on another side. When the photovoltaic cells are irradiated with sunlight, some photons are reflected and the others are absorbed by the solar cell. When the photovoltaic cells keep enough photons, the negative electrons are released from the semiconductor material.



B. Battery:

Selection of Battery the requirements of the battery on the solar street light is: slower discharge rate and the long discharge time, it was decided that we usually chose the large-capacity lead-acid batteries, thus the high-energy and maintenance free valve-regulated lead-acid batteries (VRLA) is a better choice. The VRLA battery has a one-way exhaust valve (also called a valve-regulated cap) on the battery cover which can vent surplus gas in case of unusual circumstances. The so called "maintenance-free " is regularly compared with maintenance of the traditional lead-acid battery. The quality of the battery is directly related to performance of the streetlights.

C. LED (Light Emitting Diode):

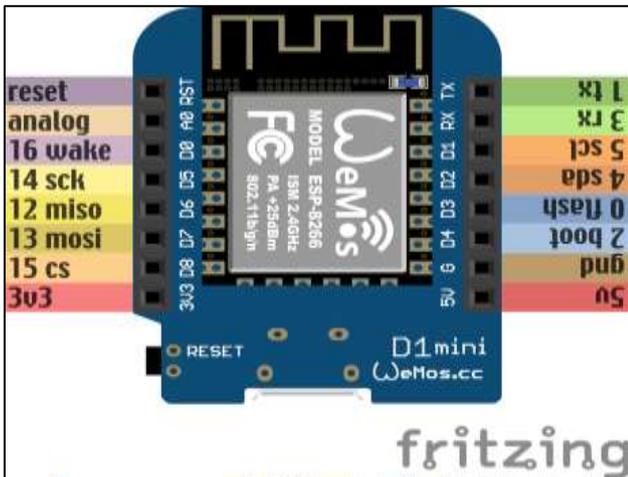
A light-emitting diode (LED) is a two-lead semiconductor light source that resembles a basic pn junction diode, except that an LED also emits light. When an LED's anode lead has a voltage that is more positive than its cathode lead by at least the LED's forward voltage drop, current flows. Electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called

electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. With the technological advancement in semiconductor material, LED lamps produces light within visible range spectrum, therefore it has highest efficiency than incandescent, sodium vapour and other lamps. Therefore LED lamps world widely accepted for many lighting applications along with for Street lighting purpose. LEDs are semiconductor devices. Like transistors, and other diodes, LEDs are made out of silicon. What makes an LED give off light are the small amounts of chemical impurities that are added to the silicon, such as gallium, arsenide, indium, and nitride.



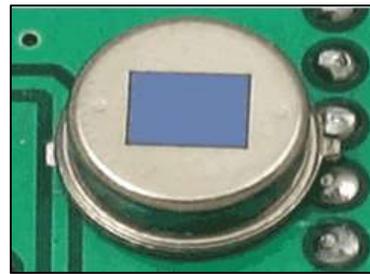
D. WEMOS Microcontroller ESP8266:

The board we are using is called “WeMos D1 Mini” and has an ESP8266 module on it, which we will be programming. It comes with the latest version of MicroPython already setup on it, together with all the drivers we are going to use. The board we are using is called “WeMos D1 Mini” and has an ESP8266 module on it, which we will be programming. It comes with the latest version of MicroPython already setup on it, together with all the drivers we are going to use. The D0, D1, D2, ... numbers printed on the board are different from what Micropython uses – because originally those boards were made for a different software. Make sure to refer to the image below to determine which pins are which. It has a micro-USB socket for connecting to the computer. On the side is a button for resetting the board. Along the sides of the board are two rows of pins, to which we will be connecting cables.



E. IR Motion Sensor:

PIR (Passive Infrared sensors) enable you to detect movement, quite often used to identify whether a human has moved in or out in the range of sensors. They are little, cheap, low-control and simple to utilize. Hence they are generally found in Home or Office appliances. This sensor can sense the motion as well as measure the heat of an object. Passive IR sensor can measure only infrared radiation rather than emitting it. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.



F. GSM SIM300:

The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial Port. This GSM/GPRS RS232 Modem is having Internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as Well as DATA transfer application in M2M interface .The modem needed only 3 wires (TX, Rx, and GND) except Power supply to interface with Microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to Connect wide range of unregulated power supply (4.2V -13V). Using this modem, you will be able to send & Read SMS, connect to internet via GPRS through simple AT commands.



V. CONCLUSION:

An intelligent wireless street light system designed in this paper, will ease the system fault detection and thereby maintenance and offers power saving. This will be achieved by the use of highly economical LED technology that are illuminated by renewable source of energy provided by the solar panels. Due to the use of Wi-Fi, the street lights can be controlled by the control room as well as keep track of the faulty lights, life of battery and working status of the solar panel. The smart solar LED streetlight system will provide better illumination, optimum usage of electricity with reducing operational and maintenance cost after installation compare to high pressure sodium lamp and others. The main issue of the solar LED street light is the battery and the panel get stolen or damaged or faulty, after few days of the installation specially by the government. To solve the issue we will make this project which is intelligent smart street light operated by solar panel.

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