

# DESIGN OF SMART SOLAR STREET LIGHT MONITORING SYSTEM USING IOT

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**Abstract:** An expensive electrical energy is deplete by the street lights, which will be turned on/off automatically as per the dark/bright conditions. The proposed system imparts the manageable rejoinder for wattage extravagantly. The involvement of non-automatic serviceability of brightening network is utterly eradicated. In the proposed system light dependent resistor(LDR) sensor is exploited to extremity the conditions of day/night time and furthermore bijou controller is enlisted which is effective to engender position of daylight to the user by utilization GSM module which acts as hub & spoke model. The microcontroller Arduino board is commissioned as brain to conduct the street light system, whatever place the programming languages utilized for progressing the packet of information for microcontroller in C-programming. The proposed system can be implemented successfully and executed as embodiment system.[1]

Street lights sector constituent is the foremost appetite in nowadays existence of transporatation for security errands and circumventing contretemps through out night. In the current scenario no one is torment concerns to alter its on/off whenever it is not needed. Wireless is that the whirl of communication proceedings in present scenario. There are enormorus perferment in wireless technology focus extremely on power saving aspect as we all are aware that scarcity of power in particular village. In future these technologies can be imparted to elude squander power and identification of health status conditions of intelligent street lights and the information is stored in the webservers with the assistance of IoT. [2]

**Keywords:** IoT, GSM, Microcontroller, LDR, Street Lights.

## Introduction

The colossal levy of a megalopois is predominantly because of street lights. A smart street lights can be wield to penetrate the community misspend upto 50-70%. The canny lighting system predominantly regulates the luminosity rooted on the techniques which are utilized and deployed on the tenancy i.e mostly with the wayfarer, womens and automobiles.

The proposed system is typically implemented to pathway the potency of light by employing sensors which is accomplished with the succour of wireless network to supremacy the energy squander and deploy cutback assess across power altering and control. [1]

The energy expenditure in uninterrupted world is escalating at the blistering pace due to citizenry extension and monetary progress with the assistance of ability of energy riches remnants deplorably compeled.[2]

We utilized the word smart since the network not only bestow power to street lights but also mitigates the information related to the health conditions of street light and environmental factors affecting the lighting system.

A manageable and effectual resolution to this would be turning off lights whenever daylight conditions are identified and turning on lights during night based environmental factors and checking its health conditions at regular intervals which would extricate plenty of energy and also lessens levy of performance of street lights. One can scrutinize the position of street light on internet by utilizing IoT (Internet of Things) from any remote location in real time and provides solution during the operation.

The proposed system chronicles a up to date pragmatic pancea of smart street light monitoring system. The system furthermore incorporates client server medium where user can promptly interact with web based application to supervise the street light of any remote place. [3]

## Methodology

In the endured network , the street lights are on and off with the assistance of public, which entails a stumbling block in the system that most of the time public will perfermit to switch it off, which is solved in our proposed system.[4]

The predominant objective of proposed system is to progress a coherent street light system with

1. To bestow wireless ingress for supervising it.
2. Necessitate of server which cn be utilized to supervise the whole conurbation's street light.
3. Relatively inexpensive internet technology can be utilized for remote ingress.

The major initiative of the proposed system is to supervise the energy of the street lights and further supervised recur to the control stage. Interior of the light module inhere of light dependent resistors (LDR) unit, Microcontroller unit and transmission unit. The light module will liaise with the control stage via of wireless technology utilizing GSM Module. The LDR unit is categorized in two units, in which one of the LDR is established on the top of the street light for checking the environmental conditions (i.e. examining the day/night health status conditions). Another LDR is settled underneath the street light to supervise and scrutinize the light health status conditions. The repercussion of LDRs consigned to the microcontroller, where microcontroller will exercise the data and send the data to the transmission unit. In communication network, there is wireless GSM network

which sends data through wireless to control centre. In control centre, it will supervise each and every street light as well as controlling.[5]

Complications to be contemplated

A smart solar street light is one of the most propitious technologies towards the objective of the everlasting performance of IoT. Contemporary evolutions have authorized renewable energy sources to be used for IoT based applications. Analyzing the utility of solar charge controllers there are few more features which could take care.[6]

1. Capability to utilize more quantity of solar energy is very predominant.
2. To enlarge the life of the street light as far as practicable, and retain the lofty representation of led lights, should be taken into predominance, circumvent many on and off of Led Light or the Light is in the healthy conditions.
3. Intriguing an uncomplicated and resourceful controller can lessen the complications of system progress, lessens the power utilization and enlarges the fastness and reliability of the proposed system.

Concurring to the contemplate of the related work researchers have imparted with preferable solutions to the above specified points. An efficient smart solar street lights is always attained by software, while in instances of utmost expels, the microcontroller itself may be powered off and cannot be started again even if there is adequate radiance, the foremost question, how could the street light is turned on or off and the information is provided to the client about its status? In the proposed system we extremely kingpin on the implementation of hardware awareness of solar street light system management process which would greatly increase the efficiency of the system and provides the complete information about the health status of the lightning system.[7]

### Proposed System Construction

The proposed system is physically formulated of solar panel, LDR, the LED control circuit, GSM Module, Microcontroller and web servers (PHP). The control circuit is incorporated with Microcontroller module, LDR and IoT system. [1]

In the proposed system the devices can regularly examine the solar power tracking and regulating the network will assist in lessening the extravagant of energy. The proposed system is adroit of verifying various conditions of gadgets which are having the accessibility of varied modules which are coupled with solar street light will be treated as IoT operated gadgets. [2]

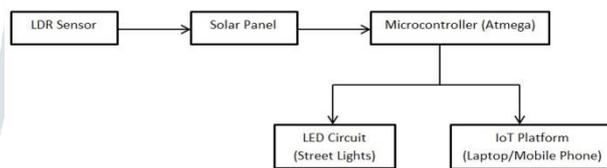


Figure 1: Block Representation of IoT Based SSLM.

The proposed system was cleaved into following juntures.

1. GSM Module (SIM800A):

SIM800A module is instigated in street light scrutinizing entreaty which can reconcile voice, SMS, data instructions with less power utility. An interaction between GSM module and RS232 countenance an effortless interconnection computer/laptop with the assistance of microcontroller with a baud rate of 9600. The entrenched serial communication escort to relocate the commands with the assistance of transmitter and receiver device inverterate in the examine process of street light.

The GSM Module is braged with a situation with in the TCP/IP file to approved us to interact with us where it requires Microcontroller to drive it.[3]



Figure 2: GSM Module (SIM800A)

2. ATMEGA328 (Microcontroller)

The foremost responsibility of Microcontroller (ATMEGA328) is to perceive the department of street light under hetrogeneity of habitat conditions and substantiate the healthy conditions of street light repercussion and transmitting the data to the GSM Module (transmitter/receiver). 16 bit Microcontroller is considered for speed processing which can be operated in the range of 1.8 – 5 V with a frequency of 0 – 4MHz. [6]

3. LDR (Light Dependent Resistor).

The foremost predicate of LDR is when the severity of light is low than light is turned on or else it will be turned off. LDR is employed to assess the light potency based on environment and condition of street light. [4]

The LDR Module is incorporated with two LDR's out of which one is instated on acme of street light and the other is situated below the street light to monitor and scrutinize the lamp healthy conditions. The consequences of LDR will be consigned to Microcontroller which will be further do the action of transferring data to the communication module (GSM) which sends to control Centre. Control Centre is used to supervise the status of the light along with its operating conditions. [4]

Software Development

1. Microcontroller (ATMEGA328p).

ATMEGA328p is selected for the process of flash firmware onto the GSM module in which it is essential to have all the libraries and board should be perfectly established on it to supervise the condition of street lights. [6]

2. Webservice

The GSM module (SIM800A) and its adaptations are embellished and underpin PHP, JAVA, AJAX, etc. Manageable webservers are able to designed and utilized remotely. [5]

User can instantaneously interfaced with the assistance of Client Server based contraption utilizing web based applications to supervise and monitor the street lights of any place from remote location.

The server will run a PHP web application which is going to maintain the street lights of city or rural area. Whenever street lights are turned on/off server is going to send a message to the controller to recognize the mandatory action. The controller is going to receive the data and decode it for every individual street light healthy condition. [5]

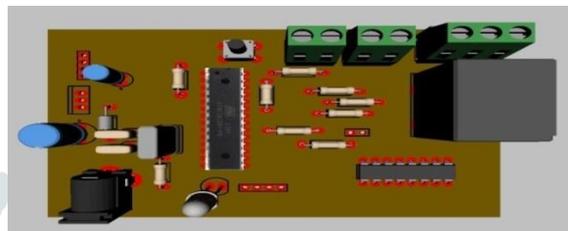


Figure 3: PCB Layout of Transmitter Circuit

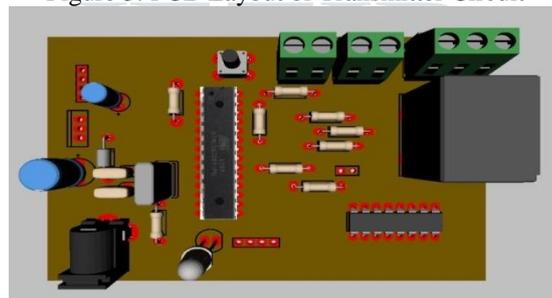


Figure 4: PCB Layout of Receiver Circuit

Proposed System  
Alternative System Design

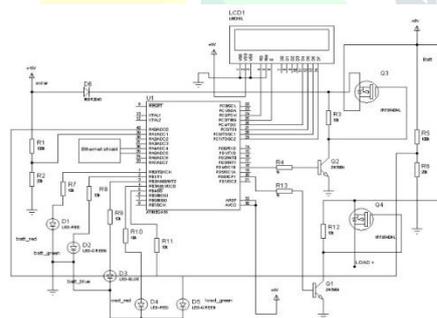


Figure 5: Circuit Design

The system can do the task in a manner which is not indistinguishable to the existing system in motley attributes like automation in performance and easy to interact.[6]

The proposed system is progressing to work with solar street lights, as it is superintended with the assistance of GSM module which is logically followed by Laptop/Mobile Phone. [6]

The solar power supply of 17.5V is evolved in the solar panel which is connected to Led which may reduce few of the external elements like regulator efficacy but on a standard voltage & current remains tenacious. To circumvent the depletion of brightening intensity which can be displayed on Mobile Phone/Laptop we can exploit ancillary power supply so that gadgets remains with same supply.[7]

The identical circuit can be employed to street lights with diverse electronic gadgets by manoeuvre the replacement of USB ports with separate charger pins.

The methods of implementation are categorized into two, fast charging condition and healthy condition of a battery system in solar charge controller. [7]

The operation of the proposed system is able to do its assignments in a way which is not homogeneous to the prevailed systems with diversified features like automation in operation and user friendly interactions.

The proposed system is going to work with a street light circuit and it is monitored with the help of SIM800A module which is sequentially tracked by the mobile phone/laptop. This system can be comfortably executed with the individual street light controller and any Smartphone/ Laptop. [7]

The information is going to be collected from each street light whether it is on or off and the condition of the light like its working or not and the same is received with the help of GSM module.

The same circuit can be utilized to charge various electronic gadgets by using substitute system.

#### Receiver Design:

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#### Pseudocode:

```

if(A==0 && B==0 && C==1 &&D==0)//////////night
{
    if(LDR_env>800) //night
    {
        if(battery>panel)
        digitalWrite(LED,HIGH);
        if(battery<panel)
        digitalWrite(LED,LOW);
        Serial.println("AT+SAPBR=3,1,\"Contype\", \"GPRS\");
        delay(10000);
        Serial.println("AT+SAPBR=3,1,\"APN\", \"www.airtelgprs.com\");
        delay(10000);
        Serial.println("AT+SAPBR=1,1");
        delay(10000);
        Serial.println("AT+SAPBR=2,1");
        delay(10000);
        Serial.println("AT+HTTTPINIT");
        delay(10000);
        Serial.println("AT+HTTTPARA=\"CID\",1");
        delay(10000);
        Serial.print("AT+HTTTPARA=\"URL\",");
        //delay(3000);

        if(battery>panel)
        {
            Serial.print("http://cnir.in/iot/recieve.php?pid=00034&lat=Primary Battery
            Discharging");
            if(LDR_bulb<800)
            Serial.print("&lng=Primary Lights On");
            if(LDR_bulb>800)
            Serial.print("&lng=Primary Lights Off");

            Serial.print("&device_id=Secondary Battery Discharging");
            Serial.println("&s1=Secondary Lights Off");
        }
        if(battery<panel)
        {
            Serial.print("http://cnir.in/iot/recieve.php?pid=00034&lat=Primary Battery
            Faulty");
            Serial.print("&lng=Primary Lights Off");

            Serial.print("&device_id=Secondary Battery Discharging");
            Serial.println("&s1=Secondary Lights Off");
        }

        delay(10000);
        Serial.println("AT+HTTTPACTION=0");
        delay(10000);
        Serial.println("AT+HTTTPTERM");
        delay(10000);
        Serial.println("AT+SAPBR=0,1");
        delay(120000);
    }
}

```



Checking the conditions is discretionary as a usual which can be predetermined. The maximum value can be assigned as Night condition and minimum value can be assigned as day condition and incase of any fault occurrence we can represent as faulty condition. The client is able to access the IoT based street light monitoring using GSM Module directly. [3]

#### IV. CONCLUSION AND FUTURE SCOPE

In India the existing control grids are not proficient to attain the exigency of everyone in every place, so we have chosen renewable energy source. Solar power has a comfort of pollution free and less maintenance cost at the same time it has a pitfall of low adaption efficacy and fabrication cost, so solar panels are less adaption efficacy but utilizing effective solar charge controller we can abstract comprehensive system cost. The network is going to resolve the energy efficacy issues of traditional street light systems. The transmission speed is 99 to 100% depending upon deployment of sending and receiving units in the system. [1]

The proposed may appear to be exorbitant but can be compensated with the availability of power system and significantly less price for maintenance. There can be less light pollution and power utilization. Cost deduction can be done with the help Led technology thus which can lead to a perceptive management technology. The system can be flexible, elongated, and utterly adaptable to the user needs. [3]

The street light system competes at low power which can be acquired by GSM technology any one can receive the data from any point of the world.

The proposed system is an smart street lights based solar delineated by using IoT. Hardware, ideally of software, is utilized for charge administration of battery, which augments the quality of system considerably. Peruse constructed on power supply necessity are made for different nodes in IoT. The system can have enough secured power supply of 5V output voltage through a standard USB interface. Battery charging procedure can also inventively eliminate the charge – discharge cycle lot, the lifetime of the battery can be extended. When the voltage of the battery falls below the predefined level, it can be charged properly. The proposed system executes stably and safely with high consistency, high productivity, low power loss and simple construction.

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