

## SOLAR SMART STREET LIGHT SYSTEM USING IOT

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### ABSTRACT

The electric power in most useful of the countries in the world is utilized in lighting the streets. In the present scenario, a large amount of electricity is used in the street lights, which are turned on around 6 in the evening and continue to glow till 5 or 5:30 a.m. in the morning. The main aim of smart street light systems is that lights turn on when needed and turn off when not required. The system comprises of LED lights, LDR sensors, PIR motion sensors, [5] arduino- which acts as a microcontroller and short-distance communication networks. The PIR sensor detects the motion and 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 when its dark. In this paper, the proposed system makes use of the solar energy to glow up the LED solar lights instead of the conventional electrical energy.

**KEYWORDS:** Arduino, Wi-Fi Module, LED lights, Solar Panel, Battery, PIR sensor, LDR sensor, GPRS module, Voltage Controller, Webserver and Relay Switch.

### I. INTRODUCTION

As the world is progressing towards the smart energy management, the system will require advancements not only in the way the energy is supplied but also about how efficiently the resources and energy are being utilized. The development and smart systems are to be built ensuring the safety of people at streets as well, in order to avoid accidents to take place.

This proposed system is based on the smart and weather adaptive automatic street lighting and management. Nowadays, there are more than 300 million of street lights in the entire worlds, which give off 100 million of tons of carbon dioxide per year and then 40% of energy waste which the costs around 20 billion dollars.

They use the latest technology, in [2]LED the source of light to restore the conventional street lamps such as HID lamps or High Pressure Sodium Lamps etc. Therefore we perform the economical operation of street lights and reducing the carbon footprints, so we are using the High efficient [2]LED which means a complete electric light unit called [2]LED luminaire with smart control of lightness level is the demand and need of time.

The adoption of [2]LED lights are because of its various type of advantages and over existing technologies like power saving due to increased current brightness efficiency, low power maintenance cost, high color rendering index, accelerated start-up, and durability. A lot of challenges are faced when it comes to the selection and use of proper LED's and Sensors to as to avoid any sort of commune or system failure. Flexibility is yet a factor that plays a role in fitting the system with the required hardware.

### II. RELATED WORK

In [1] the paper, the system has circuit that controls the switching in correspondence to the vehicle movement. The GSM technology is used in the manual change of the switching values. The weight also plays a role, where the system controls all the switching activities by taking a note of the weight on the road and correspondingly controlling the brightness and the intensity.

In [2] concentration has been laid more on a machine driven system to stimulate the intensity control. Rather than using a IR sensor, an electrical device is used to detect the movement of a person or a vehicle. A microcontroller (msp430) is used to manage all the changes related to intensity control and movement detection. This paper focuses on the dominance of the solar energy considering the motion on the streets and roads.

In [3] the project is meant to serve basically for the highways. Where there is a block of road, that remains illuminated much before any vehicle passes by. The system focuses on this problem so as to avoid the wastage of electrical energy. The observation that was made was that throughout the entire night, the street lights are switched on even if there is no vehicle, or a person to pass by that ultimately is a reason for high wastage of electricity. In this paper, two kinds of devices are used primarily which are: the lightweight sensor, and the icon electrical device.

In [4], the Automatic Street lightweight system isn't solely best technique. Though, it is powerful but there are loopholes that come along with this system. To improve on this, Relay Module is used as a automatic switch. It reduces the manual effort by almost 99% and it credible to be used for the automatic switching on and off purposes. The LDR sensor is used which is indeed a Lightweight Dependent Resistor, that actually controls the intensity of light and is used to sense the sunlight and control the dimming or turning off the lights, as there is no need for the lights to be turned on when there is sufficient amount of sunlight that falls off.

### III. METHODOLOGY

Programmed to be an intelligent and automatic system, our solution is designed in a way such that the street lights automatically turn their states to glowing and glowing off depending on the sunlight and the movement detection.

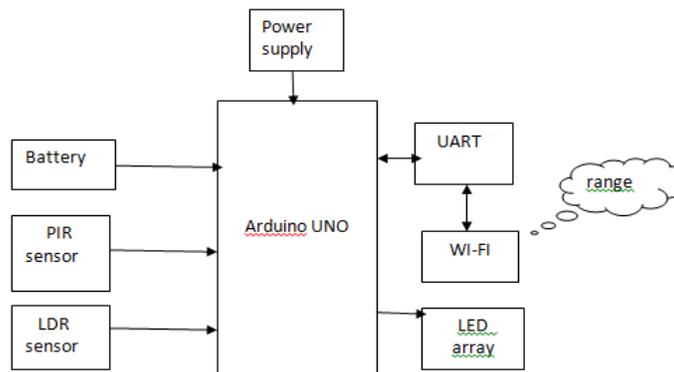
To detect the amount and intensity of sunlight a very common light sensor- the LDR (Light Dependent Resistor) sensor is used. Not only to detect the presence of light, the LDR can also be used to detect and fault in the system, or if there is any faulty light that is present in the system and send the message for the same to the control centre by making use of the GSM/GPRS wireless mode of communication.

Along with the detection of sunlight, another feature that has been added is to control the intensity(the brightness) of the LED's, by making use of the PIR (Passive Infrared) motion sensors. These sensors are used to detect any motion whether it be a person or a vehicle, by sensing the heat radiations, and if a motion is detected, the brightness or the intensity of the lights automatically increases and in case if no motion is detected then the brightness either is dim or the lights re turned off, depending on how the system is programmed by making used of the code and the values that are provided during the building of the source code.

The present system basically makes use of power delivery via a single phase line to the streetlight. The proposed system involves five more components to regulate the power delivery. An Infra-Red Proximity Sensor at the base of the street light that detects the presence in a small area around the street light. The data from the sensor is sent to the Arduino which forms brain of the circuit and is the microcontroller that is programmed and is loaded with the source code that is written in the Arduino Software. The Arduino then commands to switch between dim and bright modes of the LED's depending upon the requirements and the output values from the LDR and the PIR motion sensors and hence control the brightness of the street light. A battery eliminator, also powered by the single phase line, is used to supply 5V inputs to the sensors and Arduino.

The design basically includes three working modes:-

- **OFF mode :** When there is enough natural light in the surrounding i.e. during the daytime, the entire system is switched off and the batteries are charging.
- **Active mode :** When the natural light drops below a certain level the system automatically turns on and the motion sensors are powered.
- **ON mode :** On the presence of pedestrians, the sensors turns on which in turn switches on the LED lights. These lights turns off after a period of time.



#### IV. RESULTS AND DISCUSSION

The project aims were to reduce the side effects of the current lighting system and find a solution to save power. In this project the first thing to do is to prepare the inputs and outputs of the system to control the lights. The project shown in the figure has been implemented and works as expected and will prove to be very useful.





## V. CONCLUSION

The use of power electronics is increasing exponentially across various sectors of human life. The components used in the project, like Arduino and Sensors are gradually becoming an indispensable part of our daily routines and the world is acting its march towards automation. It is the combination of Software and the Hardware that is promising. So, it is only fitting that we use them to improve efficiency in every walk of life. Keeping in mind the urgent need for energy conservation, Solar Smart Street Light System with IoT is an excellent and effective solution. It combines safe lighting protocols with consumption of minimal amount of power. The energy savings, as discussed before are phenomenal. The future scope of this project expands into speed detection and customizable area of illumination. An additional component which would lead to better functioning of the concept would be the use of LED bulbs. Despite their high initial costs, they are a viable option as they drastically reduce the power consumption. They will aid in further saving of energy and reduction in operational costs.

Hence, by using the technologies of IOT, microcontroller this smart street light automation system is developed. This system controls the smart lights automatically which conserves manual power, electricity consumption. Also, the defective street lights tweets to the controller about the fault and replacement. These smart street lights can be controlled from any remote area.

## FUTURE SCOPE

As we are moving with the new, advanced & renewable energy sources, this system can be upgraded with the many improvements of street lighting system. They can be upgraded by replacing the ordinary LED modules with the solar LED module as compare to Sodium Vapour Street Lamps, Zigbee module and GSM modules. With make use of advanced technology and latest sensors, we should improve more problems happening in the street light and easily controlling the street lights much more effectively both by cost and manpower. The main aim of the project is to save the electricity & energy and by doing so we would be able to lighten few more houses.

## FUTURISTIC USE

- 1) Smart cities
- 2) Home automation
- 3) Agriculture field monitoring
- 4) Timely automated lights
- 5) Hospitals, Malls, Airport, Industries etc.

Moving with the new & renewable energy sources, this system can be upgraded by replacing ordinary LED modules with the solar based LED modules. With utilizing the latest technology and advance sensors, we could serve the same purpose of automatically controlling the street lights much more effectively both by cost and manpower. The

main objective of the project is to save the energy, and by doing so we would be able to lighten few more houses. This model could be implemented with few modifications as a source of revenue; as charging station for battery operated vehicles.

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