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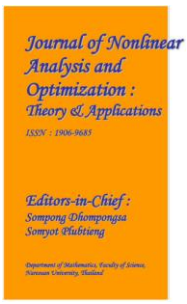

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SOLAR BASED SMART STREET LIGHT WITH HUMAN RECOGNITION

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ABSTRACT: The street lighting is one of the largest energy expenses for a city. Streetlights helps in giving better vision of roads and streets at night time, Streetlights are an important part of a city. An intelligent street lighting system can cut municipal street lighting costs as much as 50% - 70%. The present system is like the lights will be switched on in the evening before the sunset and they are switched off next day in the morning after there is sufficient light on the outside. But the actual timing for these lights to be switched on are when there is absolute darkness. With this, the power will be wasted up to some extent. In sunny and rainy days, ON and OFF time is different which is one of the significant hindrances of the present street lights systems. To Reduce This Wastage of Electricity, We Need an Automated Street Light Monitoring System Using human recognition. The main aim of the project “Solar Street Lightning Monitoring System" is to provide a power with solar energy during night time. The energy consumption in entire world is increasing at the fastest rates due to population growth and economic development and the availability of energy sources remains woefully constrained. We use the world “smart” because the system not only provide power to the street lights but also helps in detecting the direction of movement of the pedestrian and helps him by means of illuminating the path of movement till the near next street light. A simple and effective solution to this would be dimming the lights during off peak hours. Whenever presence is detected, the lights around it will glow at the normal (bright) mode.

To solve this problem, continuous monitoring of the solar and battery voltage needs to be done. With the implementation of this work, precautionary alerts can be given to the service department on the designed website. Arduino Uno module is employed as the main

controller of the system. A relay is employed to switch ON and OFF the LED. The prototype is designed and found excellent results.

I. INTRODUCTION

The Internet of Things (IoT) is a progressive correspondence technology that expects to deliver an undetectable and inventive structure to associate a plenty of digital gadgets with the Internet. Hence, it plans to make the Internet more immersive furthermore, unavoidable. The rising IoT advertise is continuously picking up energy as administrators, merchants, producers, and endeavours start to perceive the open doors it offers. Concurring to the most recent forecast by markets and markets, the overall IoT market expected to grow from USD 170.57 Billion (2017) to USD 561.04(2022), with the compound annual growth of 26.9%. This more noteworthy level of the income in 2022 is normal through application S/W, building IoT platforms, service-based opportunity.

A smart city is a perplexing or complex system described by the escalated utilization of Information and Communication Technology (ICT), meaning to make urban communities more appealing and more supportable, and exceptional spots for advancement and entrepreneurship. The real partners incorporate application designers, specialist co-ops, residents, government and open specialist organizations, the exploration network, and stage developers. Furthermore, the smart city cycle comprises of various ICT advances, improvement platforms, maintenance, and supportability, applications for developing nationals, and specialized, social, and also financial key execution pointers. Therefore, IoT frameworks will assume a crucial part in the arrangement of substantial scale heterogeneous infrastructure. Computerization/Automation assumes an undeniably critical part on the world economy and in day-by-day life. Programmed frameworks are being favoured over manual framework. The research work indicates programmed control of streetlights can save an energy/power for reuse in other devices.

For the smart city, street lights are one of the important components. The street lights are not a complex thing but due to the urbanization, the numbers of street lights are going to increase day by day, so the saving of power consumption is the challenges for the government.

Earlier road lights were controlled manually where a control switch is fix in every pole of the road lights. From that point onward, another technique that has been utilized was optical control strategy done utilizing high weight sodium light in their framework. So, due to the lots of power consumption smart solar light is the only option in future but at the same time cost of Smart pole should be reduced. This paper considers the LED street lights for the smart solar street lights.

The setup of solar lights is quite expensive, so there is a requirement of using the maximum natural energy in minimum cost.

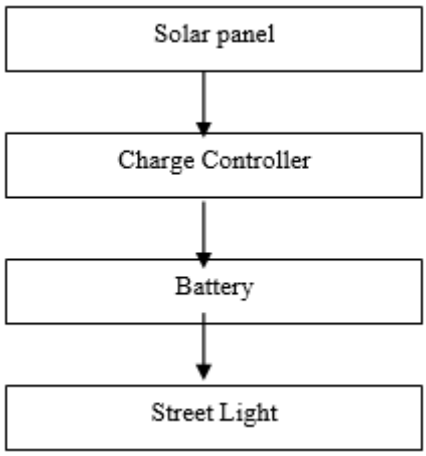


Fig. 1: Abstract of Connectivity

II. SURVEY OF LITERATURE

Y.K.Tan et al[1] explored the use of smart sensors for controlling the dc grid LED lighting. The experimental work of this paper shows the saving of energy in comparison to similar lighting performance. According to their result, 44% energy was saving as compared to the ac fluorescent system. Mustafa et al[2] gives the solution for the automatic on/off the street lights according to the day or night. They used the microcontroller PICI16F877A for controlling the street lights.They used the C Language for the programming.

Noriaki Yoshiura et al[3] 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.

Yusnani Mohd Yusoff et al[4] 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.

Adele Sittoni et al[5] 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. Fares S. El-Faouri et al[6] developed the prototype for the smart-street lighting system based on the photo voltaic(PV) source. These street light alone working as a standalone off grid system and in future connected to the other grid for a larger system.

Omkar Rudrawar et al[7] proposed the smart system which can efficiently control the street light's intensity. This paper used the intensity control system that is based on the TRIAC. The intensity of lights are controlled based on the load of traffic on the road measured by the sensors and then light automatically switched on/off. The system can also be monitored through some Graphical User Interface.

III. PRESENT SCENERIAO OF OUR STREETS

In India, 27 millions street lights are glow at night. These street lights consume 20% to 30% of the energy produced by country. Only some of the street lights of Delhi and Mumbai are smart but not completely. The main problems of the street lights in India are :

- ✓ Defective Lights
- ✓ Less use of LED Lights
- ✓ Wastage of energy
- ✓ Unauthorized usages of electricity
- ✓ Very difficult to identify the fused lights
- ✓ Not controlled by central server

Most of the streets are manual in Metro cities, Urban areas and villages also. Some streets lights of metro cities and urban areas are solar and battery based but they worked manually or can sense only day and light not complete automatically (Most of the cases motion sensors are not there). There is no any street lights in India which is WiFi enabled and controlled by the central places.

So, there is a lot of scope or opportunities for the smart light system in the different places of India like metro cities, urban areas and villages also. Now the selected smart cities can implement the smart street lights by using these devices and sensors.

IV. CURRENT SCENERIAO OF GLOBAL STREETS

Upto 2016, 50-55% of the world's population lives in Metro Cities and Urban areas which will increase to 62-65% by 2050[8]. According to statista [9] $34.35 is to be spend by 2020 in the smart cities worldwide, the figure was $14.85 in 2015. At the same time the implementation of street lights will increase due the investment in smart cities. As we know there are not a specific criterion to identify the smart cities in world, but only hundreds of city in world are declared as a smart city. So, the current scenario of global is that not more than 4-5% of the cities are smart. Hence globally also there is a lot of opportunity for the implementation of smart solar street light system. Some cities in the world are not smart but they implemented the smart street light system. Sometime the street lights replace with LED light also considered being the smart.

The biggest players who responding for Smart Street light
systems are:

- ✓ IBM
- ✓ Panasonic
- ✓ Cisco

V. PROPOSED METHOD

The traditional streets lights are power consuming as well as sometimes they are on in day time also due to the negligence of the department of electricity. And also due to the rapid growth in the urbanization, the electric poles, street lights are increasing day by day. So, now

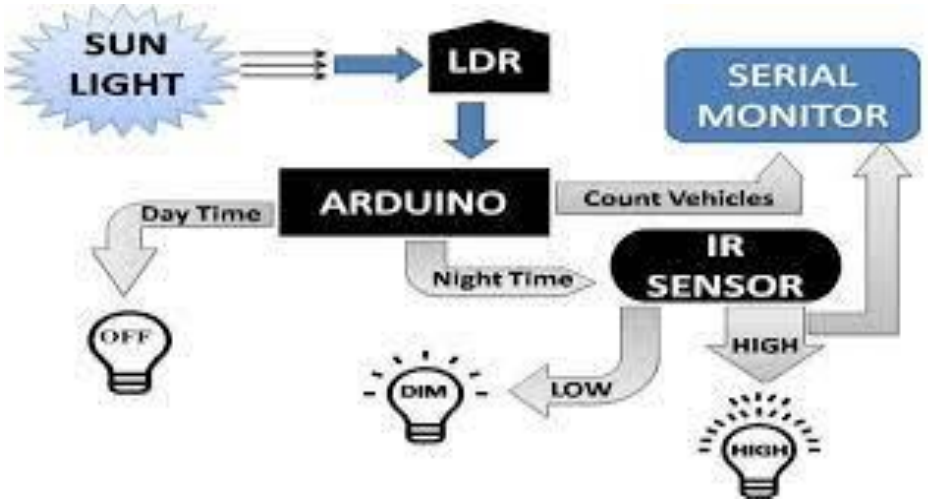
a time to save the energy/power and utilize that power to the residential and commercial areas.

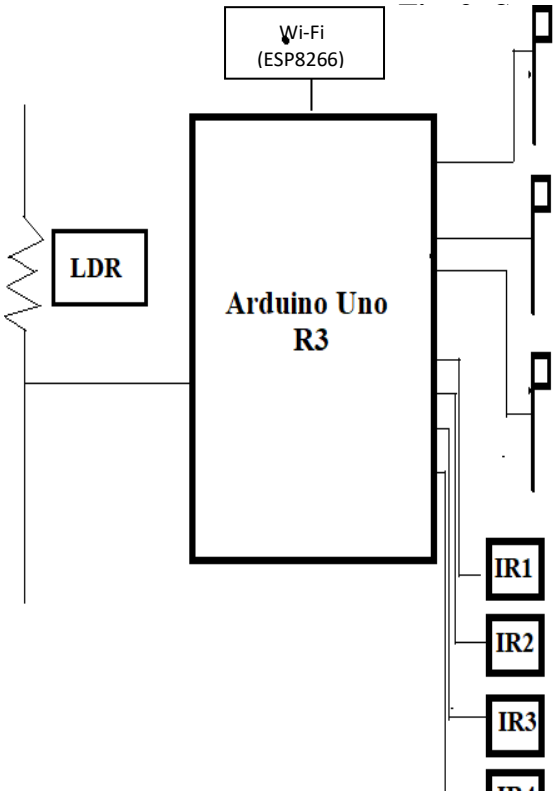
So for saving the power/energy, this paper proposing the smart solar street light system to utilize the maximum natural energy by minimizing cost. Figure 2 depicts the proposed model to implement the smart solar street lights system.

A. Working of proposed model

Arduino Uno R3 is a microcontroller, which takes input from the IR Motion sensors and LDR (Light Dependent Resistor), than accordingly gives the output to different street lights(equipped with LED lights , Solar Panel and Battery) which is connected to the 7,8,9,10,11 pin number of the Arduino Uno R3.

Wi-Fi (Used ESP8266 due to very low-cost Wi-Fi microchip) is also used to send or receive the information to or from the server or control room, so that lights can be also controlled from server. Status of different street lights can be tracked by using Wi-Fi module connected to Arduino Uno R3.





light proposed method

owing way:

e natural light (Day or night) and accordingly gives r on or off. LDR will give the value within the range tkness and 1023 represents the maximum light or R will be connected to the pin of the Arduino Uno

to the vehicle running or any person walking on the the road and accordingly send the signals to the LED are connected with the pin number 2,3,4,5 of the the IR send the value 0 or 1 according to the vehicle ese values the street lights will glow or not and how s. The controller used for phase wise street lights as

well as individual lights. For this WiFi technology can be used to track the lights status. The Wifi technology is the most cost-effective solutions for this type of projects.

B. Optimized use of Battery equipped with the Smart Solar Lights

Now this paper proposed that there is no all-street lights will be equipped with Battery lights and solar panel. The battery charged by the single smart solar light pole will be distributed to another 4-5 neighbour pole, so that the investment on infrastructure will be less compared to existing systems. The smart systems also send the information to server or control room about the charge or life of battery.

C. Sample code for controlling the LED lights using Light Dependent Resistor (LDR)

```
int ldrPin = A0;
int sensorValue = 0;
void setup()
{
pinMode(7,OUTPUT); Serial.begin(9600);

}
void loop()
 {
sensorValue = analogRead(ldrPin);
Serial.println(sensorValue);
if (sensorValue<500)
digitalWrite(7,HIGH);
else
digitalWrite(7,LOW);
delay(100);
}
```

In the above code, 500 is taken as a threshold value. But the threshold value can be increased or decreased according to the location of smart street lights. If the smart street lights is within the society or colony, then there are some lights are already there due to the residential lights , so in this case the threshold value will be different.

VI. CONCLUSION

By utilizing Smart Solar Street light, the electricity department can save the energy in four ways:

- ✓ By using solar system for the power generation.
- ✓ Save the accumulated energy by optimized utilization of the street lights due to the use of sensors and programmed Arduino Uno R3.
- ✓ The accumulated energy can be utilized by the neighbouring poles.

- ✓ The cost of Smart Street light will be reduced due to the sharing of the Solar panel and batteries.

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. By using these poles and Wi-Fi module, the electricity department can help the people by sending the accident information to the concerned department for quick help to the citizens.

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