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Smart Energy Efficient System and Fault Detection in Street Lights

Parikshit Gothwal[1], Akshay Jadhav[2], Darshan Harode [3], Rohan Dhakne [4]

U.G. Student, Department of Computer Engineering, B.R.A.C.T's VIIT Engineering College, Pune, Maharashtra, India[1]

U.G. Student, Department of Computer Engineering, B.R.A.C.T's VIIT Engineering College, Pune, Maharashtra, India[2]

U.G. Student, Department of Computer Engineering, B.R.A.C.T's VIIT Engineering College, Pune, Maharashtra, India[3]

U.G. Student, Department of Computer Engineering, B.R.A.C.T's VIIT Engineering College, Pune, Maharashtra, India[4]

ABSTRACT: In this Paper, We have provided surveys done for Traffic density during Night time, Maintenance time, Pollution levels and Power consumption of various street lights in India. It was found that the energy loses and pollution done by the current traditional system is very high. As a solution to this system,We have provided one of the state of the art solution for power saving technique of LED street lighting by varying the intensity of light.

KEYWORDS: Energy Efficient System, LED, HPS, Arduino, PIR, LDR, Survey, Street lights.

I. INTRODUCTION

Street Lights play an important role in our day to day life. There are various types of Street lights that are installed by the government across the country. High Pressure Sodium Vapour Lamp (HPS) were mostly used before, however Government is replacing them with more power efficient LED street lights. This step has helped decreasepollution caused by the street lights and also there is a decrement in power consumption.

LED street lights have higher working hours than HPS lamps. There are various factors that affect the working and efficiency of street lights. The surveys conducted and examined gives a brief idea of energy saving solution for the street lights.

The main purpose of these surveys is to find an efficient way of using the street lights during working hours. This new system maximizes the life time of working hours of street lights and also helps in efficient use of electricity.

II. RELATED WORK

[1]A survey of manual operation of street lights has been done which includesLDR sensor for detection of intensity of light and PIR sensor for motion detection of vehicles and humans. During late night when the density of traffic is reduced, the intensity of street lights are reduced by the use of PWM(Pulse Width Modulation) signal,that is generated by the microcontroller. A table for Variation in Power Consumption at different intensity level is given below that shows the saving of power when the street lights are operated at 50% intensity. [2]The paper provides alternate power sources for the system, other than non-renewable sources of energy. Piezoelectric material,Solar energy,Wind energy can be used to provide the power input to the system in the future. [3]This paper provides the validation for the proposed system by using SUMO and OMNET++ tools for simulation. The paper also contains survey of traffic density on roads from 3pm to 9am. It can be clearly seen that traffic density reduces after 11pm in night to 6am in the morning.

Results from the papers are shown below:

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Intensity Level	Input Voltage (V)	Input Current (A)	Power Consumed (W)
0	45.5	0.007	0.318
1	45.4	0.073	3.314
2	47.4	0.147	6.967
3	48.0	0.168	8.064
4	47.0	0.255	11.985
5	45.1	0.327	14.747
6	46.2	0.421	19.452
7	44.8	0.773	34.630
8	44.5	1.071	47.695
9	45.4	1.433	65.085

+

TABLE II. VARIATION IN POWER CONSUMPTION AT INTENSITY LEVEL

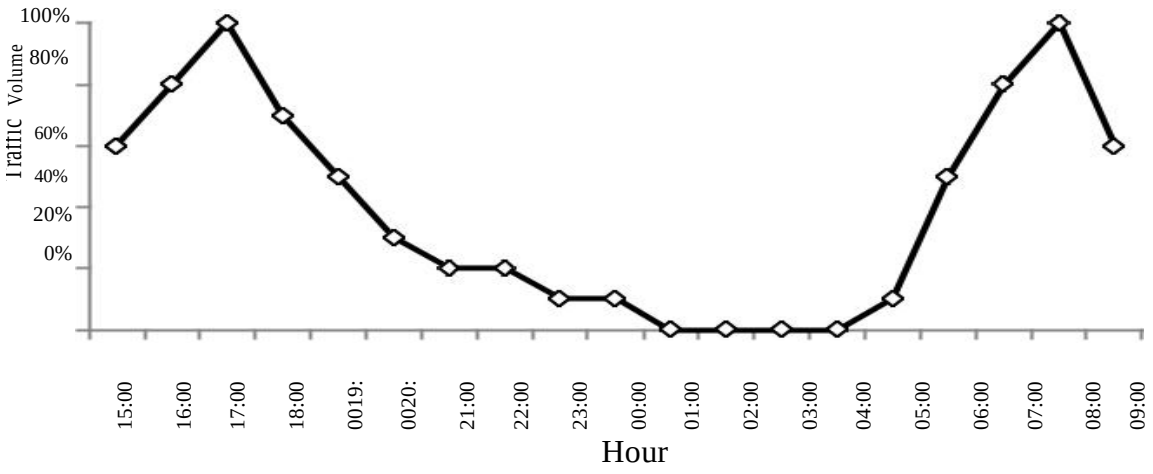

Figure 3. Traffic Density from 15:00 to 09:00.

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III. PROPOSED ALGORITHM

A. *Design Considerations:*

- Average distance between two light poles is 50 meters.
- Traffic density decreases after 11pm so,the light intensity can be reduced.
- LDR will respond to change in resistance only at night times and not in rainy and cloudy days.
- Average delay between two vehicles after 11pm is considered to be 15-20seconds.
- Open air and clear environment for serial communication of two HC-12.
- Sensors calibrates with surroundings accordingly.

IV. PSEUDO CODE

```
Step 1: LDR activates once timer reads 6pm and will glow the street light after the lights intensity reduces.
Step 2:  If (time >=6pm)
                Activate the LDR
                If (light intensity < threshold value)
                        Glow the LED street lights
                        Send signal to slaves
                End
        End
Step 3:  Check the below condition for PIR motion detection
             If (time >= 11pm)
  reduce the light intensity
        If(motion detection == True)
                        glow street lights with full intensity
\                       Send signal to slaves
                end
            end
Step 4: If (light does not glow)
                Send fault detected message through GSM module

Step 5:If(time>=6am)
                If(light intensity>threshold value)
                        Turn off street lights and send message to slaves
                End
        end
Step 6:Goto Step2
Step 7: End
.
```

V. SIMULATION RESULTS

The Studies shows that the proposed system decreases the power consumption of street lights by a huge amount. The proposed system is more efficient that the current system and hence increases the current working hours of LED street lights. A table with the power consumption rating of the different street lights is shown below. It can be clearly seen that the proposed system saves upto 28Kwh per month per street light when it is considered to be working for 12 hours each day.

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Type	Power Rating(W)	Working hours	Power consumed/Day(Kwh)	Power consumed/Month(Kwh)
HPS	400	12	4.8	144
LED	200	12	2.4	72
LED with reduced intensity	200	12	1.47	44

VI. CONCLUSION AND FUTURE WORK

The implementation of this systemshows that large amount of electrical energy can be conserved, which can be used for areas that are still deprived of electricity such as rural areas. Automation of street lights reduces manual efforts and use of serial wireless communication reduces the cost and efforts of wiring light poles. Error detection in the system makes detection of faulty street lights easy and helps in speeding up the maintenance of these poles. Hence, the system enhances the life and functioning of LED street lights and it can be monitored so that its efficiency can be improved in future.

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