Advanced Street Lights

Nitish Kumar Jha
Instrumentation and electronics department,
College of engineering and technology,
Bhubaneswar, India

Anustup Biswal
Instrumentation and electronics department,
College of engineering and technology,
Bhubaneswar, India

Abstract- **This paper is an endeavor to ensure energy saving and accident identification through Smart Street Lights. This paper strives towards mitigating the manual error of not being able to switch ON the lights in the evening and switching it off in the morning. In this paper usage of automated Solar Voltaic is suggested which can not only conserve energy but also maximizes efficiency through LED lights. The GPRS/GSM module is used in this project to establish a wireless communication between the poles and main server. It will send information about the faulty lamps in the form of SMS. Our smart street lights can be used to identify the accident and can alert the nearest fire station with the help of Fire detector and GPRS/GSM module.**

Keyword - Led; Solar panel; IR sensor; LDR; flame detector; GPRS/GSM

I. INTRODUCTION

Street lights are indispensible part of our lives because they light our path during the dark. They make the society better and safer. With depleting fossil fuels it is high time we switch to energy efficient renewable power sources. And using the non-conventional power sources for lighting the streets is a smart solution to the global energy crisis. In the world of energy crisis the need for automation of street lights is inevitable. Due to manual errors street lights are not being switched OFF during the day time. According to surveys it was found that 18-38% of the total energy bill is due to the street lights, so if we concerned about saving of energy then street lights is one of the important domain that needs to be considered. Replacing of HID lamps with LED lamps offers around 60% of power saving. It becomes necessary that we automate our street lights and power them up using solar panels to maximize our energy saving output. Moreover a street light is the viewer to most of the accidents. WHO in its Global Status Report on Road Safety reveals that in India about 130,000 road accident deaths occurs every year. Out of them more than 40% deaths are due to negligence in help to the injured person. So the use of street lights can be used to locate the exact place of occurrence of accidents. Hence fast medical assistance can be reached to the people and this can be a beginning to reduce the death counts due to negligence in road accidents.

II. OBJECTIVE

The objective of this system is to design a smart street lighting system which is not only energy efficient and economical but also helps the government in minimizing the losses done by the big accidents which results in flame storm. This paper suggests a system in which street lights automatically switches itself OFF during day light and dims itself in the night when no vehicle is in its proximity. There are more than 35 million street lights in India. So this will take a lot of time to check manually the functioning of each street light. But our system provides an automatic fault detector sensor which will detect the faulty street lights and will report to the authority through GSM/GPRS module.

III. SYSTEM AND METHODS

This paper not only deals with the saving of energy but also to minimize the death due to negligence in big accidents. Energy saving is done by the replacement of HID lamps with the LED, Use of sensors like LDR, PIR sensor and use of Solar Voltaic cell. The deaths can be minimized by the help of flame detector and GSM/GPRS module. The maintenance of street lights can be done using LDR and GSM/GPRS module.

A. LDR Sensor

The **Light Dependent Resistor** (LDR) is used as a sensor whose resistance depends upon the amount of electromagnetic radiation falls on them. The resistance of a light dependent resistor will be high if it is kept under dark surrounding. And its resistance will decrease drastically if it is allowed to absorb light of increasing intensity keeping the voltage constant.

In this system there are 2 LDR sensor used. First LDR is used to automate the switching of light i.e. it can easily detect the difference between the day and night and so that it switches light ON during night and switches OFF during the day time. The second LDR is used to detect the faulty lamps. This second LDR is placed below the lamp. This LDR continuously sends signals to the microcontroller. When the LDR receives lights its resistance decreases and allows more current to pass through the microcontroller. Microcontroller compares the signal received to the threshold value set by the user at the installation time. If the magnitude of signal is less than the threshold value then the microcontroller sends a command to the GSM/GPRS module to send an SMS to the Maintenance Department. The message which will be sent by that particular pole will contain the pole name and area so that the maintenance department can send their men to repair that faulty lamp. This will save the time and energy and the efficiency will be increased drastically.

cadmium sulphide track

LDR Sensor

circuit symbol
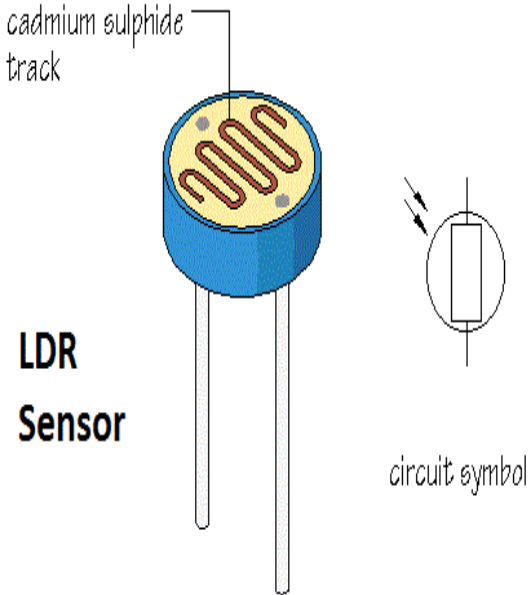
B. LED Lamps

The existing system in India includes the use of HID lamps as the street light. The alternative to this is the use of LEDs as the street light. With the use of LEDs in place of HID lamps can save power by more than 60%. For example, in Ooty almost all the HID lamps in street lights are replaced by LEDs. The result of that change comes out to be very beneficial i.e. around 72% of power was saved within 3 months. In the table below comparison between the HID lamp and LEDs are figured out.

	HID	LED
Lifetime	14000-24000 hours	Around 100,000 hours
Performance	Requires 5-10 minute warm-up time	Turns on instantly, no flickering
Durability	Fragile- has moving parts, glass bulbs and filaments	Heavy-duty : has no electrode, shock and vibration resistance
Color Temperatures	Few Options (3000 to 5000 Kelvin)	Multiple Options (2700 to 6500 Kelvin)
Maintenance	Regular replacement of parts	Virtually no maintenance cost
Dimming	No	Possible
Warranty	Usually 1-2 years	Around 5 years

C. PIR sensors

The Passive Infrared Rays sensors act like the eyes of the poles. It detects the presence of any vehicle or pedestrians. Infrared Sensor continuously emits an infrared ray. Whenever any obstacle comes in the way of IR rays, it gets reflected back. It continuously sends signals to the microcontroller. Microcontroller compares the received signal with the threshold value. When IR sensor detects any obstacle it will send a signal which will be considered as HIGH otherwise LOW. When the microcontroller receives a HIGH signal it informs LED to glow with full potential otherwise the LED is instructed to glow in a dimmed mode.
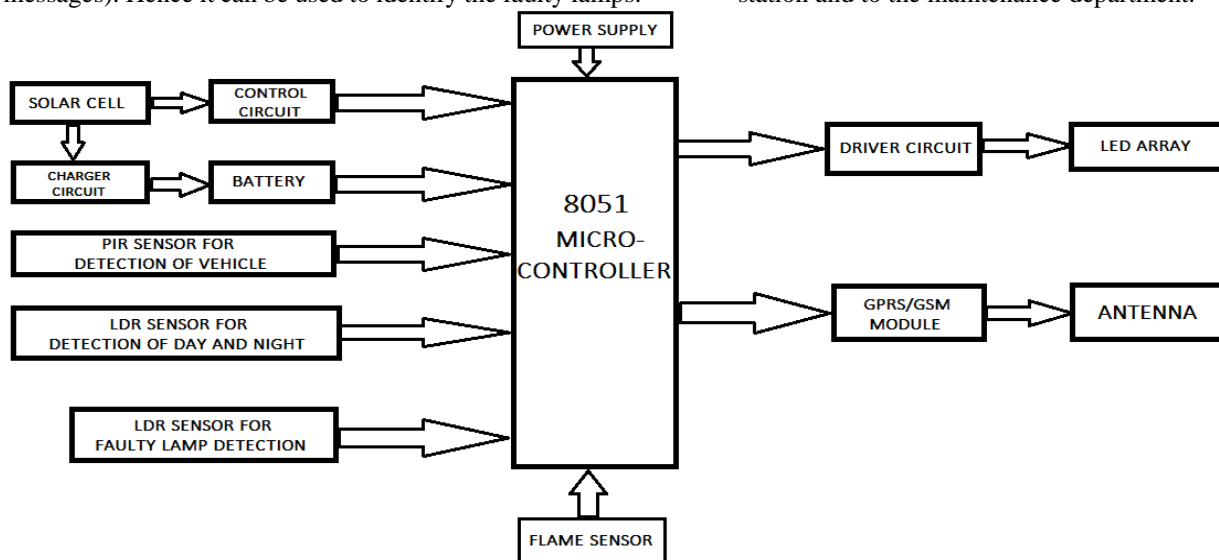

IR SENSOR

Output supply

1k   10k

IR TRANSMITTER   RECEIVER
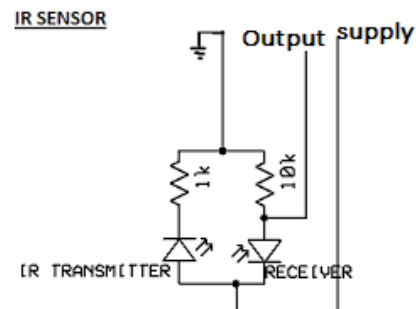
D. Solar Voltaic Cell

Solar photovoltaic systems can convert light energy into electricity and can minimize the pressure on conventional sources of electricity. The current produced by the solar panel are in DC form. A typical silicon PV cell produces

about 0.5 volt DC under open-circuit, no-load conditions. A commercial PV cell under peak sunlight with a surface area of 150 cm^2 will produce about 2watts. An LED requires about 0.75W power per day. So with the help of 2 PV cell around 6 LEDs can be light up which is well enough for a single street lamp. The electricity produced by the PV cells will be used to charge a battery of 12V. So during night when there will be no sunlight, the charging of battery comes to halt and battery is used as a power supply to the LEDs.

E. GSM/GPRS Module

GSM/GPRS Module is used to communicate between the street lamps and the main server. Whenever lamp will not glow on time, the LDR sensor will send a signal to the microprocessor and then microprocessor will command GSM/GPRS module to send a message to the maintenance department (GPRS/GSM module uses AT command to send messages). Hence it can be used to identify the faulty lamps.

In this system it has been proposed that the street light will detect the big accident with the help of fire detector signal. Fire detector sensor sends signals to microprocessor which in turn orders GSM/GPRS module to send a message to the fire station as well as maintenance department.

F. Fire Detector Sensor

Fire detector sensor can be used to detect the unwanted presence of fire by continuously monitoring the changes in environment associated with combustion. Automatic fire alarm systems are designed to notify the event of a fire or other emergency to the proper department so that immediate necessary steps can be taken to control the spread of fire and smoke and lives of the localities can be saved. Whenever there will be fire on the road, the microprocessor will get inputs from this sensor. Then the microprocessor will command GPRS/GSM module to send message to the fire station and to the maintenance department.

IV. SCOPE

Automation is the need of the hour thus this paper targets to solve the energy wastage due to manual inefficiency and unforced error. This automation of the street lights is much awaited also, action plan for fast servicing and repairing of any faulty street lights. The use of solar cell is a step into harnessing renewable energy and a next step towards the energy efficient future. The foremost idea of using fire alarms in street lights is to minimize the deaths due to negligence in steps taken immediately after accident by coordinating the exact the location of the mishaps. Reportedly, in all over India there are 35 million street lights which requires a total demand of 3,400 MW. With the use of LED in place of HID lamps it is brought down to 1,400 MW. Hence annually 9000 million KWh of electricity (worth over $850 million) can be saved. The World Health Organization (WHO) revealed that the death toll in India rose to 14 per hour in 2009 and it will keep on increasing in the near future. With the application of this system the annual saving of the electricity will be increased and the death toll rate due to negligence will be decreased drastically.

V. CONCLUSION AND FUTURE SCOPE

In this paper low cost, better efficiency solution for automation has been introduced. The methods discussed in this paper will bring a revolution in the field of automation of street lights. This has achieved the target to save electricity as well as using the renewable resources to control the mechanism of each street lights. This can sense the difference between day and night and accordingly switch on its lamps. The automated faulty lamp detector is one of the attracting features of this system. The GPRS/GSM technology in collaboration with fire detector will help to save the lives of the people due to negligence in immediate care. This system has all the necessary features to be an advanced street light.

In the coming future, this system can include electricity theft detector circuit which will inform the authorities regarding the theft of the electricity. The GSM/GPRS system can be password protected so that it would not be mistreated by the others.

VI. REFERENCES

[1] D. A. Devi and A. Kumar, Design and Implementation of CPLD based Solar Power Saving System for Street Lights and Automatic Traffic Controller, International Journal of Scientific and Research Publications, Vol. 2, Issue11, November 2012

[2] Design and fabrication of automatic street light control system, M. A. Wazed, N. Nafis, M. T. Islam and, Vol. 5, No. 1,June 2010, pp 27-34

[3] Intelligent Wireless Street Lighting System S. Sugapriya, Prof. A. Natarajan, IJIRCCE ,Vol.2, Special Issue 1, March 2014

[4] GSM Based Smart Street Light Monitoring and Control System Omkar Natu, Prof. S.A.Chavan International Journal on Computer Science and Engineering (IJCSE),ISSN : 0975-3397, Vol. 5, No. 03 Mar 2013

[5] Survey on Street Lighting System Based On Vehicle Movements K.Santha Sheela , S.Padmadevi2 , IJIRSET Vol. 3, Issue 2, February 2014

[6] Smart street lighting management ,S. Pizzuti & M. Annunziato & F. Moretti,8 February 2013 # Springer Science+Business Media Dordrecht 2013

[7] Carlos H. BarriqueLlo, Alexandre Campos, Gustavo W. Denardin, , Rafael A. Pinto, Control Network for Modern Street Lighting Systems, IEEE symposium on Industrial Electronics (ISIE), (2011), pp. 1282 – 128

[8] Fabio Leccese, "Remote-Control System of High Efficiency and Intelligent Street Lighting" IEEE trans. on power delivery, Vol. 28, No. 1, Jan. 2013

[9] M. Popa, C. Cepişcă, Energy Consumption Saving Solutions Based on Intelligent Street Lighting Control System. U.P.B. Sci. Bull., Vol. 73, April 2011, PP. 297-308