International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 3 (2015) pp. 5427-5434

http://www.ripublication.com

A Smart Energy Efficient Lighting System Based On Intelligent Controller And Sensors

K. Yasodha[1], Dr S.Sumathi[2], P.Sheela[3]

[1]P.G. Scholar, Department of EEE, Centre for Research in Energy Systems, Mahendra Engineering College, Namakkal, India. sensek75@gmail.com.
[2]Professor Department of EEE, Centre for Research in Energy Systems, Mahendra Engineering College, Namakkal, India. drssumathiphd@gmail.com
[3]P.G. Scholar, Department of EEE, Centre for Research in Energy Systems, Mahendra Engineering College, Namakkal, India. sheelachawla@gmail.com

Abstract

This paper proposes smart energy efficient lighting system based on intelligent controller and sensors. This present project target at designing and executing the advanced development systems for energy saving of street lights with light depending resistor (LDR). This project is designed to detect vehicle movement on street ways to switch ON only a block of street lights ahead of it (vehicle), and to switch OFF the tracking lights to save energy. This project gives the best vital for electrical power distribution. This is achieved by sensing an impending vehicle and then switches ON a block of street lights ahead of the vehicle. Further the project can be assisted by using appropriate sensors for detecting the failed street light and then sending an Sending Message Service (SMS) to the control department via Global System For mobile Communication (GSM) modem for appropriate action. This present systems are once implemented on a large scale can bring powerful reduction of the power consumption caused by street lights. This firm will help the government to save this energy and meet the domestic and industrial needs.

Index Terms— Lamps, LDR, motion sensor, Microcontroller, IR Sensor

I. Introduction

Light Emitting Diodes (LED) is a highly energy efficient lighting technology, and has the inherent to fundamentally change the future of lighting. Energy efficiency (EE) is at the heart of the EU's transition to a resource-efficient economy and the realisation of its 2020 strategy for smart, continuous and inclusive growth. The main objectives of this research were to identify best practices and leading technologies for energy

efficient street lighting and street lighting practices. Previously, the number of streets in the metropolis and urban is very small. Therefore, the street lamps are almost not difficult but with the development of urbanization, the number of streets increases abruptly with high density. There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and road users, provide public lighting at profitable, the reduction of criminality and minimizing it is effect on the environment. At the beginning, street lamps were controlled by manual control where a control switch is set in each of the street lamps. It is called first origination of the original street light. After that, second method that has been used was visual control method. This method is using immense pressure sodium lamp in their system. Nowadays this method is extensively used in the country. This method operates by set up an optical control circuit, which turn over the resistance by using of light t sensitive device to control street lamps light up automatically at sundown and turn off automatically after daybreak in the morning. Due to the scientific development, road lighting can be categorized according to the installation area, performance and their usage. LED are parts of a class of lighting called Solid State Lighting (SSL). Unlike incandescent or compact fluorescent lamps (CFLs), LED are small electronic peripheral that convert electricity into light intelligent control systems create additional savings potential as the street lighting level can be reduced in line with requirements, thereby providing further generous energy savings. LED require low direct current voltage and low power to operation resulting in energy savings potential of 50 to 90% compared to conventional street lighting. Basically, LED are just microscopic light bulbs that fit easily into an electrical circuit. LED is a highly energy efficient lighting technology, and has the inherent to fundamentally change the future of lighting The hasty development of LED technology leads to more products and improved manufacturing efficiency, which also results in lower prices. LED sources also allow for interesting new design forms.LED is considered an auspicious solution to modern street lighting system due to it is behavior and advantages as emphasized. Apart from that, recent developments in LED permit them to be used in industrial and Commercial Lighting, Kitchen Under-Cabinet Lighting, Recessed Down lights and Holiday Lights. The same LED string could still be in use 40 holiday seasons from now. In the last few years, software has been developed to merge lighting and video by enabling lighting designers to stream video content. Therefore, this paper highlights the energy efficient of street lighting design using LED lamps through intelligent sensor interface for controlling and managing. The improvement of this thesis is to save the energy based on the movement of person or vehicles.

Type of Lamp	Luminous Efficiency (lm/W)	Color Rendering Properties	Lamp life in hrs	Remarks
High Pressure Mercury Vapour (MV)	35-65 lm/W	Fair	10,000-15,000	High energy use, poor lamp life
Metal Halide (MH)	70-130 lm/W	Excellent	8,000-12,000	High luminous efficiency, poor lamp life
High Pressure Sodium Vapour (HPSV)	50-150 lm/W	Fair	15,000-24,000	Energy-efficient, poor colour rendering
Low Pressure Sodium Vapour	100-190 lm/W	Very Poor	18,000-24,000	Energy-efficient, very poor colour rendering
Low Pressure Mercury Fluorescent Tubular Lamp (T12 &T8)	30-90 lm/W	Good	5,000-10,000	Poor lamp life, medium energy use, only available in low wattages
Energy-efficient Fluorescent Tubular Lamp (T5)	100-120 lm/W	Very Good	15,000-20,000	Energy-efficient, long lamp life, only available in low wattages
Light Emitting Diode (LED)	70-160 lm/W	Good	40,000-90,000	High energy savings, low maintenance, long life, no mercury. High investment cost, nascent technology

Table 1 Light technology comparison based on luminous efficiency, lamp service life and their consideration

II. Objectives

The objectives for this project is to design a smart lighting system which targets the energy saving and autonomous operation on economical affordable for the streets. Here we are using a sharp lighting system with intelligent sensors and controllers. We solve the current problems in an energetic manner at low cost is the main motive of this project.

III. Methodology

The street lights are operated in two modes: AUTO & MANUAL Operations.

AUTO: In this automatic mode operation we are using LDR Sensor for measuring light intensity for switched ON or OFF the street light. If any human or vehicle movement is observed, the motion sensor prompts the microcontroller to turn the LED to their full brightness and it gets restored back to alternate brightness. The main

principle of LDR is when the light intensity is low; light is going to be ON otherwise it's going to be OFF.

MANUAL: In this manual mode, the street lights are controlled through a specially designed Graphical User Interface (GUI) in the PC. The GSM technology can be used for the street lights monitoring and controlling at the PC end. The framework has a group of measuring stations in the street. (One station is located at each lamppost) and a base station located nearby. The LDR Sensors are used to observe street conditions as the light intensity of daylight and, build upon on the conditions they activate or off the lamps. For these reasons every lamp is designed independent to decide about the activation of light. Turn on / Turn off can be controlled also manually from EB station through the same wireless medium.

IV. General Concept Of The System

In this proposed system consists of LDR sensor, IR sensor, current sensor, comparator, micro controller and LCD are used.GSM is used to intimate the status of light intensity and street light ON/OFF status to avoid wastage of energy by glowing street lights in unwanted areas. Automatic Street Light Control System is a simple and energetic concept, which uses transistor as a switch ON and OFF the street light automatically. The IR and LDR sensor senses the persons and light intensity of a particular place and transmits the data in wireless to the EB section with GSM. This action is performed by a sensor called LDR which sensibility the light actually likes our eyes.

The proposed system consists of following sensors:

LDR sensor:

LDR is a special type of resistance whose value depends on the brightness of the light which is falling on it. LDR are highly sensitive and cost effective voltage conduct capabilities with high accuracy.

IR sensor:

IR Sensors are used to detect light wavelength in the Infra-Red (IR) spectrum when an object is close to the sensor, the light from the LED rebound the object and into the light sensor. It has wavelengths longer than visible light wave, but smaller than microwaves. Infrared waves are invisible to human eyes.

LED:

LED are used indicate the status of the street light whether it is in ON or OFF state.LEDs are mainly used because of lower energy consumption and low cost. It is also used in all communication techniques.

LCD:

LCD is a Liquid Crystal Display unit, used to display the image. LCD does not emit the light directly .LCD is more efficient than the CRT.

FAULT DETECTION:

Fault detection is also implemented in this system. If any street light is impaired, the serial number of the particular light is displayed on the LCD screen so that it is easy to repair the fault light. It reduces manual operation.

V. Technical Details

Software required is

i. Microchip MPLAB integrated development environment IDE
ii. Embedded C for microcontroller chip
iii. Proteus 7.7 sp2
iv. PIC kit 3 programmer and its driver

The programming language used here is embedded C, the above modules are assert for any other devices of hardware section. MPLAB IDE integrates a compiler, an assembler, an editor a debugger, a simulator and an array of other tools with one window application. This software runs on PC to develop the micro controllers and digital signal controllers.

VI. Results And Discussion

The simulated results of various situations are studied and the system is implemented shown in the following figures, to check the effectiveness and performance of the system.

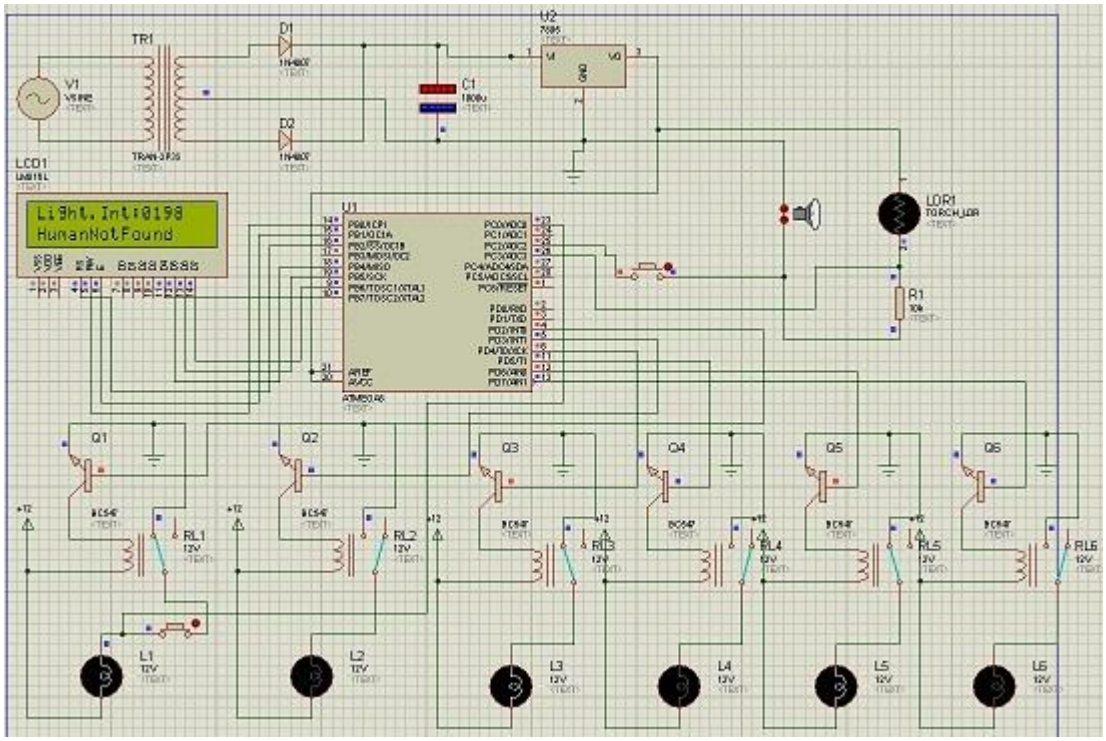

Fig. 1: Simulation results when there is no vehicle movement

The above results in Fig.1 indicate that when there is no vehicle, the alternate LED light will turn ON. In this we are using LDR, which varies according to the amount of light falling on its surface. IR sensors are controlled by Micro controller (AT mega 8).The IR‘s will be activated only on the night time. The alternate LED

will turn on when there is no vehicle movements and the intensity will also be decreases.LCD is used to display the intensity of light and the movements of vehicles. LED1, LED3 and LED5 will be in ON position. Remaining LED2, LED 4 and LED6 will be in OFF state.

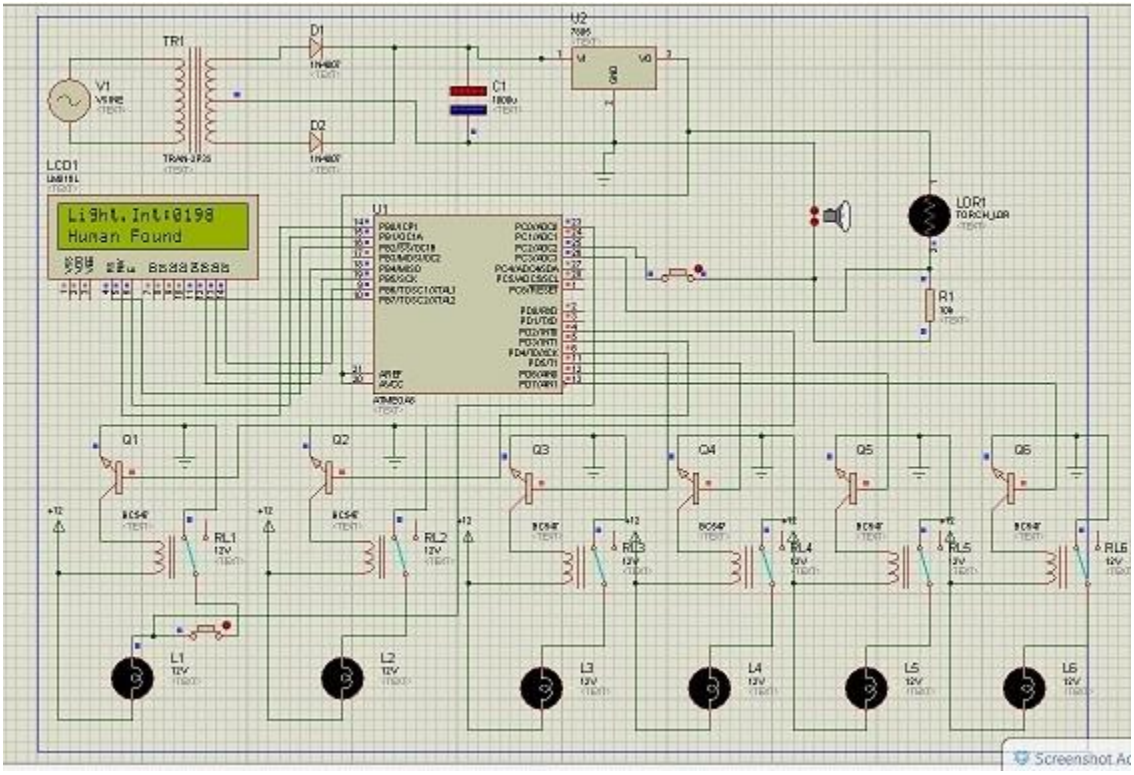

Fig. 2: Simulation results when there is Vehicle movement

The above results in Fig.2 indicate that when there is vehicle, all LED lights will automatically turn ON simultaneously. If any obstacles crosses all the LED lights will turn on for a fewer seconds and then when it crossed a particular distance, the alternate LED light will be turn OFF. For detecting the presence of a person or vehicle in the detection range it is accomplished by using IR motion sensors. Here light intensity and movements also displayed in LCD. From this we can save a huge amount of energy.

VII. Conclusion

A new model of the system is presented in this paper which will reduce the power consumption of the street lighting system. This paper describes a new intelligent street lighting system which integrates new technologies available to offer higher efficiency and considerable savings. This can be concluding using the highly efficient LED technology .The system maintenance can be easily and efficiently planned from the

central station, allowing additional savings. Furthermore efficient power management street lights can be obtained by using wireless power transmission which would further reduce the maintenance costs and power thefts of the system. The scheme and authentication of Automatic Street light is done successfully. The main advantage of the proposed system is power and energy saving. It requires only the initial cost for designing and installation and not for utilization. Hence, such systems are very much more effective for the government to reduce the utilization of conventional power .Therefore, such systems are once implemented on a large scale can bring powerful reduction of the power consumption caused by street lights. This firm will help the government to save this energy and meet the domestic and industrial needs.

After having implemented this Intelligent System Firstly, we could directly go for Wireless Power Transmission which would further reduce the maintenance costs and power thefts of the system. Furthermore, attempts can be made to ensure that the complete system is efficient on non conventional energy resources like tidal waves, bio-fuel, wind power, etc. In future we hope that these advancements can make this system completely robust and totally decisive in all respects.

VIII. References

[1] Fabio Leccese., January 2013. **"**Remote- Control System of High Efficiency and Intelligent Street Lighting Using a ZigBee Network of Devices and Sensors", IEEE transaction on power delivery, vol. 28.

[2] M. A. D. Costa, G. H. Costa, A. S. dos Santos, L. Schuch, and J. R. Pinheiro., 2009, "A high efficiency autonomous street lighting system based on solar energy and LEDs,"in Proc.PowerElectron. Conf., Brazil, pp. 265–273.

[3] W. Yue, S. Changhong, Z. Xianghong, and Y. Wei., 2010 "Design of new intelligent Street light control system," in Proc. 8th IEEE Int. Conf. Control Autom., pp. 1423–1427.

[4] B. K. Subramanyam, K. Bhaskar Reddy, PAjay Kumar Reddy., 2013 "Design and Development of Intelligent Wireless Street Light Control and Monitoring System Along With GUI",IJERA, Vol. 3, pp.2115- 2119.

[5] Po-Yen Chen; Yi-Hua Liu; Yeu-Torng Yau; Hung-Chun Lee.,2008 ,"Development of an energy efficient street light driving system.,2008,"Sustainable Energy Technologies, IEEE International Conference pp.761-764.

[6] Wu Yue; Shi Changhong; Zhang Xianghong; Yang Wei; "Design of new intelligent street light control system ",, 8th IEEE international Conferences on Control and Automation (ICCA), Page(s): 1423 – 1427.

[7] R. Caponetto, G. Dongola, L. Fortuna, N. Riscica, and D.Zufacchi.,2008, "Power consumption in a remote street lighting system," in ProcInt. Symp. Power Electron.Elect. Drives, Autom. Motion.

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

[9] Deepak Kapgate., 2012, "Wireless Streetlight Control System", IJCA, Volume 41– No.2,

[10] R.Kavitha, N. Thiyagarajan., 2014 "Distributed Intelligent Street Lamp Monitoring and Control System Based on Zigbee", IJSR, Volume 3 Issue.

[11] Dhiraj Mani Chaurasi., 2014 "A smart automatic energy saving system for Libraries and institutions", IJERT, Vol.3.

[12] Prof. A. B Jirapure Rohini T. Gulhane., 2013,Zigbee Based Automatic Street lighting System", IJERT, Vol. 2 Issue 6.