



Intelligent Street Light System

Udit Patel¹, Karan Shah²

B.E Student^{1,2}

Department of Electronics Engineering

Birla Vishvakarma Mahavidyalaya, Vallabh Vidyanagar, Anand, India

Abstract:

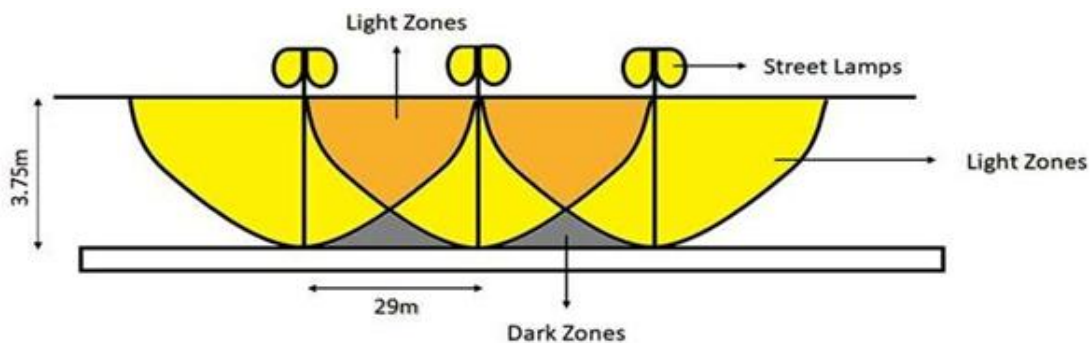
This paper aims at designing and executing the advance development in embedded systems for energy as well as cost saving of street lights. Nowadays, due to scarcity of electricity, government has increased the distance between two consecutive street poles to reduce energy consumption, and that distance is greater than calculated limits adversely creating dark zones between two neighbouring street lights. The present is like, the street lights is rotate at certain angles on left and right which is symmetric to y-axis. Thus illuminating the required areas eliminating dark zone effectively. In addition, discussed system will help to increase the distance between two consecutive street poles leading to decrease in number of poles required. Moreover, system is solar powered and having LDR (Light Dependent Resistor) to automatically decide when to turn on/off street lights. It will have a surveillance camera to monitor the night activities at an interval of 5 street poles. Zig-bee Module is been used for synchronous movement of street lights at predefined angles and brain of the system is PIC16F877A microcontroller where the programming language used for developing software to the microcontroller is C-language.

Key words: Intelligent Street Light, Solar powered

I. INTRODUCTION

The idea of designing a new system for the street light that do not consume huge amount of electricity and illuminate large areas with highest intensity of light, which tends to reduce the huge amount of accident at night, is concerning each engineer working in this field. Providing street lighting is one of the most important and expensive responsibilities of a city. Light can account for 10%-38% of total energy bill in typical cities world-wide [1]. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for its economic and social stability. Poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically. Static street lights with a greater distance between two consecutive street lights creates dark

zones at night which leads to higher risk of accidents. The current trend is the introduction of automation and remote management solutions to eliminate dark zones and to control movement of street lights. In this system light sensors is used which detects the intensity of light and if light drops below or rise above a threshold intensity it will automatically turn on/off street lights respectively [2]. A servo motor to control the movement of light along y-axis with appropriate area coverage. In Fig1 shows the static street lights which are prevalent currently in society. It showed the current situation of roads in pedestrian areas. Dark zones and Light zones are mentioned in figure1. Zig-bee Module is used to synchronize all the motions of the lamp [3]. System is solar powered which will reduce the burden on the city or state as it is cheaper and renewable source of energy [4].



II. LITERATURE SURVEY:-

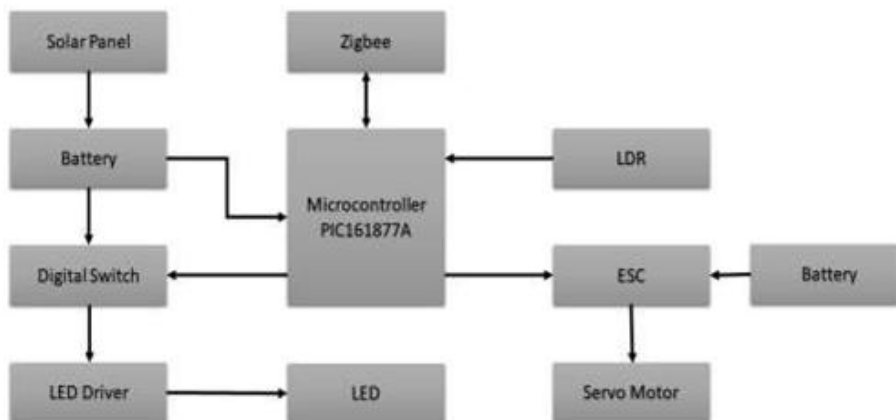
In this project, the street light system, in which lights on when needed and light-off when not needed. Currently, in the whole world, enormous electric energy is consumed by the street lamps, which are automatically turn on when it becomes dark and automatically turn off when it becomes bright. This is the huge waste of energy in the whole world and should be changed [5]. Our smart street light system consists of a LED light, a brightness sensor, a motion sensor and a short-distance

communication network [6]. The lights turn on before pedestrians and vehicles come and turn off or reduce power when there is no one. It will be difficult for pedestrians and drivers of vehicles to distinguish our smart streetlamps and the conventional street lights, since our street lamps all turn on before they come. The present status and the future prospects of our smart start light project will be reviewed. A novel scheme for a Zig-bee based street light control is proposed with an aim to reduce the human error in the operation of street lights, decrease the energy consumption of the system, and

ease the maintenance of the street light network [7]. These objectives are achieved by creating a wireless Zig- bee network of street lights that can be monitored from a base station. A new scheme that provides for the operation of alternate lights during low traffic hours, dusk and dawn has been devised. Additionally, an automatic mode of operation that utilizes light sensors to automatically switch ON Street lights when light intensity falls below a certain level, has also been incorporated. The scheme was implemented, and a small scale working model was developed [8]. This project is based on the idea of maintaining maximum utilization and minimum loss of available energy. The plenty of solar energy available during the day time is stored in a solar cell and the stored

energy is used to glow the street lights during the whole night [9]. Also the system provides a power saving mode of operation by adapting the method of automation. A dark sensor and a light sensor provides the automatic “ON”/” OFF” facility to the street lights, so that it will glow automatically when it is required(i.e. when the surrounding will be dark) and it will be turned “OFF” automatically if sufficient light is available in the surrounding. Again the auto intensity control mechanism has been applied by the help of a microcontroller to control the light intensity of the luminaries as per the requirement [10]. Hence the loss of energy due to unnecessary glow of the street lights can be avoided.

III. GENERAL BLOCK DIAGRAM



In the day time solar panels is convert the solar energy into electric energy and the charged particle is store in battery. Battery is continuously provides 5V to microcontroller for its functioning. Micro controller is continuously monitor the voltage level of LDR if the level drops below the threshold level microcontroller is turn ON the switches and hence the LEDs. LEDs is growth rough current driving integrated circuits which is assure the safety and the required current level of LEDs. Meanwhile motors are also initiated for rotation of street lamps. Motors are driven by ESC (Electronic Speed Controller] which maintains the speed of motor and is protecting it from heavy current damages. Zig- bee Module is used to communicate between street poles and the movement of lamps will be synchronized by it.

light its resistance will get decreased, thus if it detects darkness its resistance will increase.

Micro-controller (PIC16F877A):-



IV. HARDWARE DESCRIPTION:-

LDR (Light Dependent Resistor):-



The theoretical concept of the light sensor lies behind, which is used in this circuit as a darkness detector. The LDR is a resistor as shown in Fig, and its resistance varies according to the amount of light falling on its surface. When the LDR detect

A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. As an example of this a microcontroller we can use it to controller the lighting of a street by using the exact procedures. Microcontrollers are now changing electronic designs. Instead of hard wiring a number of logic gates together to perform some function we now use instructions to wire the gates electronically. The list of these instructions given to the microcontroller is called a program. There are different types of microcontroller, this project focus only on the PIC16F877A Microcontroller where it's pins as shown inFig.

Zig-bee:-



Zig-bee was developed by Zig-bee alliance comprising many members (Chip-con, Mitsubishi, Ember, Freescale, AMI Semiconductor, Invensys, CompXs). Zig-bee is a specification for a suite of high level communication protocols supported solely by Zig-bee Alliance that uses communication services based on the IEEE 802.15.4 standard for personal area networks. Zig-bee is targeted at applications that require a low data rate, long battery life, and secure networking using small, low-power digital radios. The maximum data transfer rate of Zig-bee devices is 250 Kbps with a 2.4 GHz oscillator. The approximate power consumption is of 60 mW. Zig-bee devices employ the technique of Direct Sequence Spread Spectrum (DSSS), which ensures the reliability of signal transmission, avoiding interference from other signal sand thus extending the maximum operating range of upto 100m. Zig- bee net work can have upto 65336 devices, and each no de can interact with every other node, which ultimately results in every bignetwork.

Solar panel:-

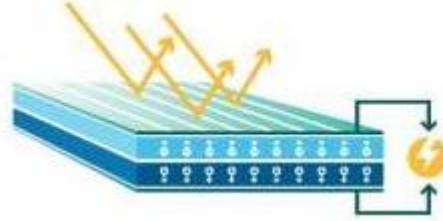


Photo-Voltaic (PV) is the method of generating electrical energy from solar radiation. Photovoltaic energy generation involves a PV module which is constructed from the semiconductor material showing photo voltaic effect. These modules become more and more attractive for obtaining “green” electricity because of their flexibility, ease of installation, constant reduction of production costs and continuous increase of performance. Solar radiation is the most important and major renewable energy source. During the whole day plenty of solar energy is radiating being unused. If this energy can be stored in a battery in form of electrical energy by using these PV modules and later can be used to run the electrical appliances (such as street light) then no doubts this is the best utilization of the available solar energy. Energy conversion is done by energy by the PV panel. During the day time the solar PV module absorbs the solar radiation of high intensity to convert it into electrical energy. Energy inversion and conditioning is done to achieve the requirement of the load.

Servo motor:-



A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

Size	D36mm*L57mm+gearboxlength
voltage	6-24v Unload Speed1-1141rpm
Torque	0.5-75kg.cm
Wattage	5-100w
Ratio	4/11608/1

Application Electronic Curtain, Auto Shutter, Pan Camera, Slot Machine, Manny Detector, Coin Refund Equipment, Automatic Doors, Peritoneal Machines, Automatic TV Stands, Office Equipment, Home Appliances.

ESC (Electronic Speed Controller):-

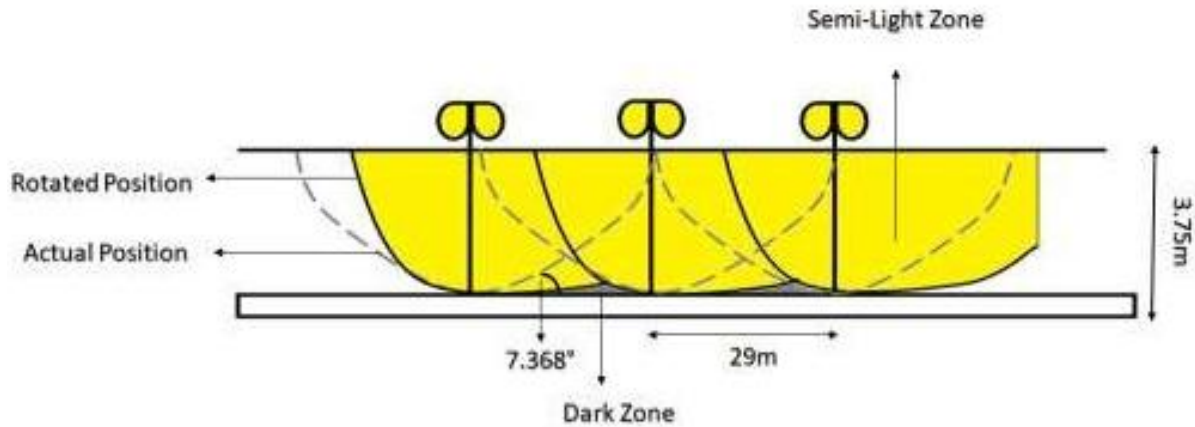


ESC controls the speed of the motors spin of a system. It helps the similar purpose as the throttle servo of a glow powered system. It is an edge between the radio receiver of a system and the power plant. An electronic speed control will have 3-sets of wires. One wire will plug into the main battery of a system. The second wire will have a typical servo wire that plugs into the receiver’s throttle channel. And lastly, a third of wire is used for powering the motor. The main features of an electronic speed control include battery eliminator circuit, low voltage cut-off, and brake.

V. RESULTS AND DISCUSSIONS

By rotating lamps continuously at around 7.368 degrees to the left and right respectively as shown in Fig2. It will cover more area and will light up the dark zones. Also it will help to increase the distance between two consecutive light poles by 0.241(m) as calculated considering arc as straight line and applying laws of trigonometry. So this is the minimum distance which can be increased. As all light lamps movement

are synchronized by Zig-bee module, hence will rotate with respect to each other. Bus topology is used for the communication between the poles. The advantage of this topology is that communication is simple and if any fault occurs in the any street lamp movement, system working will remain unaffected. Thus the result will remain same. First and Last Street poles are taken as static (without any rotation) consisting of two Lamps make an angle of 100 degrees with each other.



VI. CONCLUSION:-

In general this street lamps will rotate nearly 14 degrees (7 degree on right hand side and 7 degree on left hand side) making an arc which will cover the entire road. Due to rotating nature the number of street lights will be reduce and they will be solar powered and also nowadays static street lights do not cover entire area of particular road so this rotating street lamps will overcome that flaw. This system will be synchronized with Zig-bee module. In addition, a camera will be fitted on one of the street light amongst 5 consecutive street lights to monitor the night activity.

VII. BIBLIOGRAPHY

- [1]. S. Deo, S. Prakash and A. Patil, "Zig-bee based intelligent street lighting system," *second international conference on devices, circuits and systems(ICDCS)*, 2014.
- [2]. R. a. K. A. Velaga, "Techno-economic evaluation of the feasibility of a smart street system: A case study of rural India," *Procedia Social and Behavioral Sciences*, pp. 62, 1220-1224, 2012.
- [3]. N. Y., T. a. N. O. YusakuFujii, "Smart Street Light System with Energy Saving Function," (2013).
- [4]. M. & F. A.& S. A. & A. A. Khalifa, "Automatic Street Light Control System Using Microcontroller," (2013).
- [5]. A. A. A. K. C. A. a. S. S. B. K. S. Sudhakar, "Automatic Street Light Control System," *International Journal of Emerging Technology and Advanced Engineering*, vol. Vol. 3, May 2013.
- [6]. P. S. ChetnaBadgaiyan, "Smart Street Lighting System," *International Journal of Science and Research (IJSR)*, vol. 4, no. 7, July 2015, (2013).
- [7]. B. Mohapatra, "Power Saving Solar Street lights.," *International Journal of Emerging Technologies in Engineering Research (IJETER)*, vol. 05, p. 105., (2017).

[8]. H. P.-w. YU Xiao-xiang, "Intelligent Road Lamp Control System Based on Lonworks(J)," *Computer Technology and Development*, 2007.

[9]. J. Lee, K. Nam, S. Jeong, S. Choi, H. Ryoo and D. Kim, "Development of Zig-bee based Street Light Control System," *Power Systems Conference and Exposition (PSCE)*, pp.2236, 2240, 2006.

[10]. C.-I. Fan and Y. Guo, "The application of a Zig-bee based wireless sensor network in the LED street lamp control system," *Image Analysis and Signal Processing (IASP)*, pp. 501, 504, 2011.