Review on Optimal Light Power Consumption of Street Light Using PSoC Mixed Signal Array

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Abstract— In this paper, the method is aimed at creating safer roadways with intelligent light system to reduce power consumption. This system has automatic street light intensity control based on the vehicular movement and switching on and off of street lights depending on the light ambiance. This will help in reducing the power consumption during hours of meager road usage. The street light module is installed consequently for every certain distance. In this paper by using PSoC the object such as vehicle, bicycle, human beings animal are detected with the help of motion sensors or Light sensor like LDR. According to the movement or light, the light of street will be switch on or off. Sensors sense the motion from certain distance or sense light from the vehicle and turn light on or off. This paper is based on PSoC .This project is very useful for street lights for automation lighting system. This system switches on the lights only in darkness. No battery back-up is required. This is a simple, fit and forget system.

Key words: Programmable system on chip (PSoC), Light Dependent Resistor (LDR), Passive Infrared Sensor (PIR)

I. INTRODUCTION

Generally, street lights are switched on for whole night and during the day they are switched off. But during the night time, street lights are not necessary if there is no traffic. Energy resources are getting reduced day by day so saving of energy used in the street light is very important factor. Alternatives for natural resources are very less and our next generations may face lot of problems because of lack of these natural resources.

Nowadays, human has become too busy and they are unable to find time even to switch off the lights wherever not necessary. This can be seen more effectively in the case of street lights. The present system is like, the street lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the roads. But the actual timings for these street lights to be switched on are when there is absolute darkness or lights to be switched on when where there is need. With this system of switching light on at the evening and switching off the light in morning the power will be wasted up to some extent.

In this paper, the automation of street light i.e., automatic switching off and on the street light, is done using PSoC. Here, the lights on the street will be on at the evening at absolute darkness and will be off at night when there no traffic. And when any vehicle arrives or human activity takes place then the lights on the street will turn on automatically and after some defined time the lights will be off. And at the morning at defined time the lights will on and when there is absolute brightness the lights will off. In this way the street lights will turn on only when there is absolute darkness or when there is need. So the energy is consumed using this technique. As PSoC is used, this is fast, accurate and cheap system for optimal power consumption of street light.

II. SYSTEM SETUP

A. Programmable System on Chip (PSoC)

PSoC is a family of microcontroller IC developed by Cypress Semiconductor. CPU core and mixed-signal arrays of configurable integrated analog and digital peripherals are included in PSoC. PSoC IC is composed of a core, configurable analog and digital blocks, and programmable routing and interconnects. By using these block designer can create and modify mixed-signal embedded applications. PSoC mixed signal array's routing allows designer to freely route signals to I/O pins and vice versa.

PSoC has three separate memory spaces, SRAM for data, Flash memory for fixed data and instructions and I/O registers for control and access the configurable logic block and functions.

PSoC resembles an FPGA in that at power up it must be configured, but this configuration occurs by loading instructions from the built-in Flash memory.

PSoC most closely resembles a microcontroller combined with a PLD and programmable analog. Code is executed to interact with the user-specified peripheral functions (called "Components"), using automatically generated APIs and interrupt routines[1-3].

B. Sensors

1) Passive Infrared Sensor (PIR)

A PIR sensor is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.
The PIR motion sensor is based on the piezoelectric effect, where certain materials generate a voltage when exposed to infrared radiation. This radiation is the portion of the electromagnetic spectrum that falls between microwaves and visible light. Infrared radiation has wavelengths longer than the visible light but shorter than microwaves. Humans at normal body temperature radiate strongest in the infrared at an approximate wavelength of 10 μm.

The PIR motion sensor uses infrared sensitive materials as the sensing elements. It is packaged with a field effect transistor (FET) in the source follower mode. The sensor element is exposed to infrared radiation, a voltage is generated across the element[7-8].

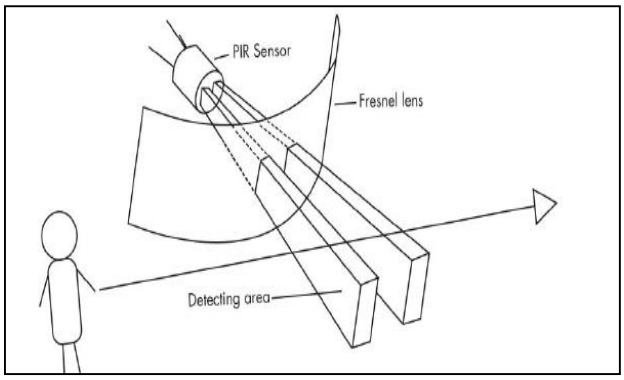

Fig. 1: PIR Motion Sensor

2) Lights Dependent Resistor (LDR)

A photoresistor (LDR or photocell) is a light dependent variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity that means it exhibits photoconductivity.

Photoresistor can be placed in streetlights to switch the street light on and off. Ambient light falling on the photor-esistor causes the streetlight to turn off. Thus energy is saved by ensuring the light is only on during hours of darkness [6].

III. MONITORING SYSTEM BLOCK DIAGRAM

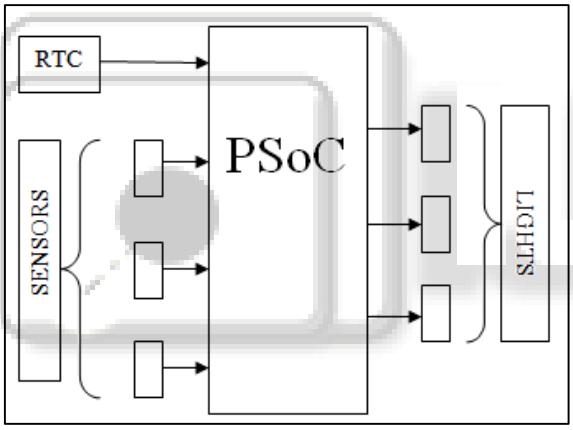

Fig. 2: Block Diagram

Street lights are switched on depending on the intensity of the Sun light on LDR. If the intensity of Sunlight on light dep-endent resistor is low, its resistance value is high. This value increases and becomes high when it is completely in dark. This resistance value decides when the street lights are requ-ired to switch ON.

As the resistance value of LDR is maximum in the midni-ght, real time clock comes into the play. The PSoC checks pe-ak time during which there is no traffic and switch OFF the lights. When there is any vehicle on the road, it is detected by the PIR sensor.

Whenever any vehicle is detected by PIR sensor, it indicates the PSoC to switch on the street lights. Then lights are swit-ched on for some time and switched off automatically.

Another way to this approach is, one can maintain minim-um intensity without completely switching off the lights by us-ing PWM and switch them on to maximum intensity whenever it detects the vehicle.

IV. SETUP PROCEDURE FOR PSOC CREATOR

In PSoC there are four families of devices like PSoC1, PSoC3, PSoC4 and PSoC5/5LP. In PSoC there are two softwares named as PSoC Designer and PSoC Creator. For PSoC1 PSoC Designer is used. And for PSoC3/4/5/5LP PSoC Creator is used. Following are the step regarding how to use PSoC Creator

1) Select Target Device
2) Start With Schematic Entry
   a) Select Components for the design
   b) Select Pins
3) Configure Components and pins
4) Map design pins to physical ports of the PSoC
5) Microcontroller Programming
6) Build Design
7) Program PSoC device
8) Test and Debug

V. RESULT AND DISCUSSIONS

Global trends in street lighting show that 19-37% of the total energy bill goes towards street lighting. Considering the energy sources and capacity of generation of energy, the use of energy in street light is very high. From this system, the lights are turning off in the night and turning on when there is requirement. If this system manages to switch off the lights for 5-6 hours at night then it saves or consumes energy up to 6-13%. The percentage will vary depending upon the location, cities and area

VI. CONCLUSION

In this paper, Lights on the street is controlled with respect to the vehicle movement. As vehicle arrive the sensors used in this paper sense the motion of the vehicle or light of the vehicle from a particular distance. The light on the street light will be on or off depending on the sensed signal. Large amount of energy can be saved from this concept. This paper gives the best solution for electrical power wastage. Also the manual operation of the lighting system is completely eliminated.

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