Design of Automatic Intensity Varying Smart Street Lighting System

Ashutosh Gupta, Shipra Gupta
Department of Electronics and Communication Engineering,
Amity University Uttar Pradesh, Noida, India
agupta5@amity.edu, shipragupta2013@gmail.com

Abstract- The paper is proposed with an aim of power conservation. In this era of development, it is essential to develop a streetlight that turns on and off automatically without human interference. To achieve this light sensor have been placed in each panel which turns the street light on and off automatically. For energy conservation cool-white LED’s have been used in street light panel and dimmer modules have been installed which changes the intensity of the streetlight depending on the darkness.

Keywords- Led Street light, LDR, Current Sensor, Microcontroller, Light dimmer, current sensor

1. INTRODUCTION

The word is developing with a pace it has never witnessed before but most of the streetlights in small and big cities are controlled manually [1]. Due to lack of management and poor administrative methods, somewhere the lights are not turned off in the morning. This leads to power wastage, and the life expectancy, of the materials is also reduced. There are times when streetlights are not turned off due to strike or lack of labor. This leads to increase in motor accidents and the roads become unsafe. Material cost and reliability are also the factors which have to be addressed. [2]

Adding to the worries, power is generated using non-renewable resources in this country and we are still far away from realizing the full potential of renewable energy [3-4]. Therefore, optimization is of key importance. With the research and development, it has become easier and cost effective to introduce embedded and automation in light systems. In this paper, all the problems have been addressed.

The first one is the use of new technologies for the source of light, i.e., light-emitting diodes (LED). Initially they were used in headlights and headlights but with the advancement of technology they can be used in street lights too. It’s lumen per watt is far greater than conventional luminaries thus giving it an edge over other sources of light. We have proposed the use of cool white LED’s.
Manual operation is a serious issue, thus to overcome that, use of Light Dependent Resistor (LDR) has been proposed. The light switches ON and OFF automatically without human intervention. Thus, making the lights automatic.

![Graph showing luminous efficiency increases over time](image)

**Fig. 1:** Past history and projected expansion of the LED applications based on anticipated luminous efficiency increases.

The third proposed solution is to use a light dimmer to control the intensity. Due to change of intensity the shell life of the light will increase and energy will also be conserved. This paper combines all the three solutions and presents a variable intensity smart street lighting system.

## 2. PROMISED ARCHITECTURE

The microcontroller acts as a bridge for the communication between all the other components. LDR and current sensors have been used in this proposed architecture. Light dimmers have also been employed. All of the components are interfaced serially with the microcontroller. A microcontroller has been used for this purpose. In this proposed model, the LDR and the current sensor are connected serially to the microcontroller. The Street light is connected to the dimmer which changes the intensity of the LEDs used in the street light depending on the values received from the microcontroller.

For the automatic ON and OFF of the streetlight, Light Sensor (LDR) has been employed. Its resistance changes with the change in intensity of the light falling on it. The light dimmer has been set for ranges of the LDR. As the darkness sets in, the values of the LDR start to fall in the range and the streetlight switches ON depending on the intensity of the light falling on the LDR. The current sensor is used to measure the current.
Fig2: The block diagram of the proposed architecture

Table1: Dimming level corresponds to input signal level

| Input value | D3 | D2 | D1 | D0 | Dimming Level  |
|-------------|----|----|----|----|----------------|
| 0           | 0  | 0  | 0  | 0  | 100% = ON      |
| 1           | 0  | 0  | 1  | 0  | 80%            |

3. SYSTEM IMPLEMENTATION AND RESULT

A prototype of automatic intensity varying smart streetlight has been designed in this paper. Outputs have been shown in the figures below.

Fig3: Shows the LED glowing with its full intensity as there is no light
Fig.4: Shows the led glowing at 80% of its intensity as it will be glowing before dusk or after dawn

As the sun sets in, the LDR sends the corresponding value to the microcontroller. The microcontroller sends it to the dimmer and depending on the signal received; the intensity of the LED is changed. The luminary used is of 100 W and its efficacy is 100 lumens per watt. In total dark, when it glows at its full intensity the efficacy of the luminary is 100 lumens per watt. Around dawn the efficacy is reduced to 80 lumens per watt. The prototype of the automatic intensity varying streetlight has been designed successfully. Different levels provide different intensity to the streetlight, thus saving the power. The data collected from the current sensor allows us to calculate the energy saved due to varying intensity of the light. This also reduces the human intervention.

4. CONCLUSION

The proposed model is successful in solving the problem of manual operation. With the use of light dimmer and other sensors approximately 15%-20% of the energy has been conserved. As the human interference has been reduced the streets have become safer. With the use of LED the cost of maintenance and rapid change of conventional lights has also been reduced. The current sensor measures the change in current and a comparative study has been done for a single street light.

With the exhaustion of non-renewable resources, negative impact on the environment and need of automation, there is need of new range of Smart LED Street lights. The model proposed here is just the beginning. To use clean energy a solar panel can be added which will supply power when the power is down. We can switch to solar panels to provide energy during nights. A central monitoring system can also be introduced where all the data from the sensors can be saved and used.

5. REFERENCES

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