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An Approach to Intelligent Road Lighting System with Renewable Energy Based Power Supply

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Abstract

This paper presents the approach and study of an intelligent electrical consumer, in the analyzed case a road lighting system, powered by renewable energy sources, to achieve energy efficiency. The consumer is equipped with sensors, controlled by a microcontroller unit and can autonomously working. If one of the main objectives is to achieve a better energy efficiency for the electrical consumer, the supply from a renewable energy source makes the consumer environmental friendly. The first aspect of the study is to present the lighting system and the working principle. The LED based lighting modules represents in the modern days the most efficient and reliable lighting system. The renewable energy power system is based on a solar photovoltaic system and represents an alternative supplying way for the lighting systems. Between these two systems, the lighting and the power supply system, a command and control unit has to operate to ensure an accurate system management. The command and control unit has to monitor the available or stored energy from the solar PV system, to read the sensors values that supervise the environment and traffic behavior, and to command the switching of the lighting system for an optimal lighting level and for energy efficiency.

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1. Introduction

The paper presents an approach to a modern road/street lighting system supplied by renewable energy. Purpose of the paper is to illustrate an interdisciplinary method, combining studies in automation and intelligent control systems with renewable energy power systems issues. The main subjects are the electrical consumer (lighting system), the renewable energy based on solar photovoltaic power system and the management control units.

The road lighting system can be assimilated to a street lighting system, which has similar structure, but slightly different working principle [1]. The main objective of the paper was developed around the idea of solving the problems that can occur on unlighted, dangerous and undeveloped infrastructural road.

2. Proposed approach

The paper illustrates two major approaches:

- First approach is related to the design of the modern road/street lighting systems which has to be adaptable and compatible with the proposed power supply.
- The second approach regards the power supply, in this case based on a renewable energy source, more specific a solar photovoltaic application with a DC power bus to supply energy to the electrical consumers.

To be more energy efficient than the classical lighting systems and to be compatible with a DC power system, the LED based lighting modules are considered for this application [2]. The LED modules can be easily controlled with PWM (pulse width modulation) dimmed through a solid state MOSFET (metal-oxide semiconductor field effect transistor) switching system, by taking into account the momentary sensors states. As the vehicle enters in the automated lighting sector, Fig. 1 illustrates the system functioning sequences starting from the “switched on” step at the entrance and continuing until the “switched off” step when the vehicle leaves the sensor area.

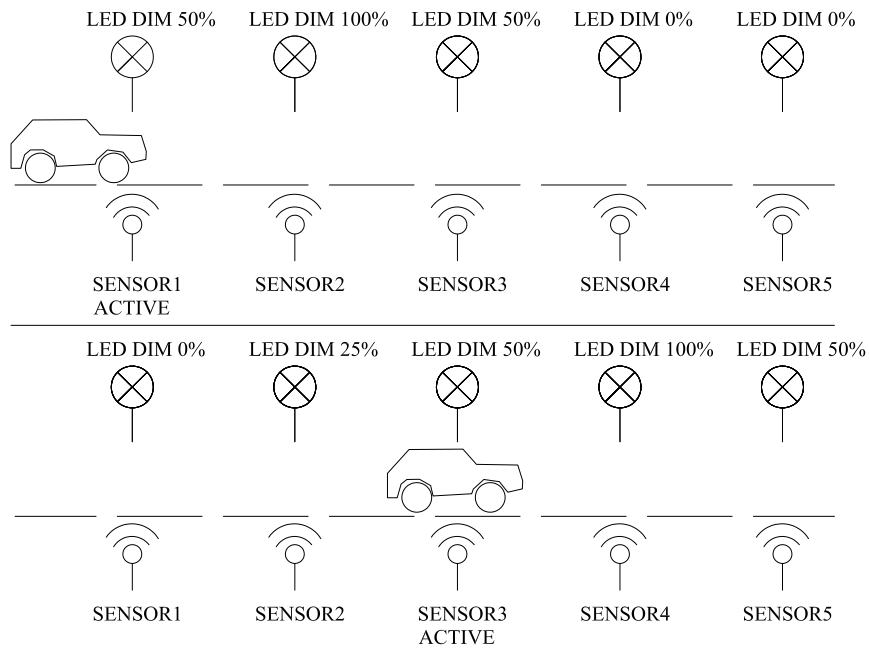


Fig. 1. Illustration of the intelligent road lighting system working principle

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