Sensor Fusion based Energy Efficient and Sustainable Smart Parking System

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***Abstract*— With the rapid increase in urban population and hence the automobiles, parking has emerged as a resource with fair amount of energy consumption, air pollution and traffic congestion in almost every major city around the globe. Therefore, its efficient management in terms of both energy and space is not only necessitated to save a lot of energy, but also plays a pivotal role to obtain environment friendly green cities. In this article, we proposed a smart energy efficient parking system, which integrates the image recognition techniques for license plate recognition, infrared sensor for group control and wireless sensor network (WSN) for intelligent light emitting diode (LED)lighting. The system offers better guidance to parking position, controls LED lights based on traffic distribution for maximum energy efficiency, and offers enhanced security as compared to its counterpart conventional system. The system is built on ZigBee based Wireless Mesh network (WMN) nodes equipped with image sensor and RF module. The vehicles in the parking lot are detected and recognized using the grid based algorithm and license plate image recognition. The concept of zoning or lighting group control algorithm is integrated with moving object tracking algorithm to control the array of lights to attain the maximum energy efficiency and reduced Greenhouse gases (GHG) emissions. In comparison to conventional parking and normal lighting, the proposed system presents the substantial amount of energy savings, less environmental pollution and enhanced surveillance. Moreover, the embedded advantage of improved reliability, reduced maintenance and low cost due to smart control suggests very satisfactory and optimistic results for future implementation of the system as an integrated part of smart cities.**

***Keyword*—Energy Efficiency, Group control, Image recognition, Smart parking, LED Intelligent lighting, Wireless sensor, ZigBee**

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