Monitoring Parking Space Availability via Zigbee Technology

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Abstract—**With the rapid growth of vehicle availability and usage on the road in recent years, finding a vacant car parking space is becoming more and more difficult which resulting in a number of conflicts such as traffic problems. In this paper, a prototype of Monitoring Parking Space Vacancy System is introduced using wireless technologies to alleviate the traffic problems. The system includes two modules, parking lot vacancy monitoring module, and master module. Parking lot vacancy monitoring module consists of digital infrared sensor, liquid crystal display (LCD), and Zigbee module which are interfaced with PIC microcontroller. Master modules include laptop GUI display, and Zigbee modules. The user can get the status of parking lot vacancy through the LCD of monitoring parking vacancy module. The Zigbee transceiver on monitoring parking vacancy module which interfaced with microcontroller is to transmit the infrared sensor data when the digital infrared sensor detects the presence of vehicle in the parking areas and thus provide the status of the parking lot to be displayed in master module with Graphical User interface (GUI).**

Index Terms—**Parking monitoring, Zigbee, graphical user interface (GUI).**

I. INTRODUCTION

Recent years there has been a growing credit of the importance of parking issues in the urban area parking lots [1]. With the fast pace development of national economy and living standards, the automotive industry and population is becoming more and more demanding [2]. This is thus leads to the rapid growth of vehicles in recent years. Therefore, finding a vacant car parking space becoming daily concern for most drivers and it is time consuming. For instance, a survey [3] shows that during rushing hours in big cities, the traffic generated by cars searching for parking lot vacancy takes up to 40% of total traffic. In other word, with the increasing of vehicle population in Malaysia, the demands of parking spaces in large areas are increasing too.

Finding a vacant space in a multilevel parking lot is difficult, especially on weekends or public holidays. A study showed that finding spaces during weekends or public holidays can take more than 10 minutes for about 66% of visitors. Stadiums or shopping malls are crowded at peak periods, and difficulties in finding vacant slots at these places are major problem for customers [4]. Therefore, insufficient car park spaces lead to traffic congestion and driver frustration [5].

Recently in Malaysia, there are various methods used in parking lot to detect the presence of car as in [6], the authors proposed a Secure Parking Reservation System where GSM technology is used to send the data-base password to those drivers enquiry for a reservation of parking lot. The password is needed in order for the drivers to enter and exit the parking lot. Other than that, image processing technique is applied in parking to detect the presence of vehicles rather than using sensor [7]. This algorithm works in acquire the image of parking lot and calculate the occupancy of the vehicles pixel area and thus provide an accurate number of available parking lot to the users [7], [8]. Moreover, ultrasonic sensor is used in Smart Parking System(SPS) [9] to detect the presence of vehicles in parking lot and shows a green LED if there is no vehicles detected and red if there is occupancy of vehicles in that certain parking lot. The LED is installed at the top of every parking lot.

In foreign country, more techniques are applied in parking lot detection of vehicles, one of is Zigbee and GSM based secure vehicle parking management and reservation system where reservation can be made by drivers through Zigbee [10]. Furthermore, in [10] there is also a GUI display in the access and control unit that can shows the reception of the user request for lot reservation. For this project, it is proposed so to assists drivers to search the available parking space in parking area. But at first consideration, driver should know there consist of how many empty parking space before they can make choices [11]. For this reason, a simple but efficient system is required to monitor the parking space in order to ease the drivers in finding available parking space and display in LCD which located at entrance of parking lot. The Zigbee and LCD module is interfaced with microcontroller to do the wireless data transmission to the master module and master module consist of GUI display and Zigbee module as shown in Fig. 1.

II. WORKFLOW

A. *Parking Lot Vacancy Monitoring Module*

The parking lot is provided with digital infrared sensor and is permitted to sense the parking lot continuously. Whenever it detects the presence of vehicles in parking lot, it will generate event on presence of vehicles to the microcontroller to which it is interfaced. Then, microcontroller will send the information get from digital infrared sensor to both LCD and Zigbee module. The Zigbee module transmits the status data