

ZMART PARK – A Smart END to your PARKING WOES

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Abstract—Searching for a vacant parking space to park your vehicle is a job in itself in a modern metropolitan city like Mumbai, Bangalore etc. During rush hours there is a scramble for parking space which adds to traffic jams and a lot of stress to the commuters. To provide information of the available parking slots in an area is the need of the hour.

Our aim is to create a knowledge base of available parking slots which is accessible through Internet, on mobile phones or on computers so that commuters can make informed choices regarding parking. This database will be updated dynamically displaying available parking areas along with the vacancies in each area and the parking charges involved. This digital vehicle management system will enhance the utilization of parking space and help user check the availability of the parking space remotely since the system is connected to the Internet. The proposed scheme consists of IR sensor networks, Zigbee modules, embedded web-server and a mobile phone application. In the system, each parking slot is equipped with one sensor node. The state of the parking lot is detected by the sensor node and is reported periodically to embed web server via the Zigbee module. The data is uploaded from microcontroller to the Ethernet network. To keep track of vacancies and to enable the vehicle driver to find vacant parking lots in real time, a standard mobile device and Android app is used.

Index Terms- IR Sensor, Zigbee S2 Module, Android Application, Parking Slot, ARM Processor M0+

1. INTRODUCTION

A review of 11 International cities estimated that cruising for open parking spaces accounts for 30% of the total vehicular volume, causing significant congestion in central business districts and elsewhere. Parking surfaces account for up to 40% of a typical city's land area, dramatically affecting efficient land usage. Parking consumes a considerable amount of resources while contributing to the environmental costs of passenger vehicle use. If we take a look at the present world scenario, there is a crucial necessity for saving the parking space in big companies, apartments etc. More and more multi-storey buildings are springing up every day, thus giving rise to parking problems [1]. IR sensor network mote is a tiny device which usually consists of a low cost-sensor module, a microprocessor module and a communication module, and provides a powerful consortium of distributed sensing, computing and communication. These modules can rapidly and easily be deployed to collect, process, and transmit information. We have designed and implemented a prototype system of smart parking services that allows vehicle drivers to effectively find the vacant parking spaces. The proposed smart parking system consists of IR sensor networks, Zigbee module, embedded web-server and Android mobile phone application [2]. In this system, low-cost IR sensors network modules are deployed into each parking slot equipped with one sensor node. The state of the parking lot is detected by sensor node and is reported continuously to the embedded web-server via deployed IR sensor network. This information

is sent to Android app in real-time, and thus vehicle driver can find vacant parking lots using a mobile phone or a tablet [8].

This paper is organized as follows. The Design Consideration is in Section II. In Section III it gives the control flow diagram of parking. In Section IV, the prototype implementation of the smart parking systems are introduced. The development of Android app is in Section V. Finally, we conclude this paper in Section VI.

2. DESIGN CONSIDERATION

I. IR Sensor

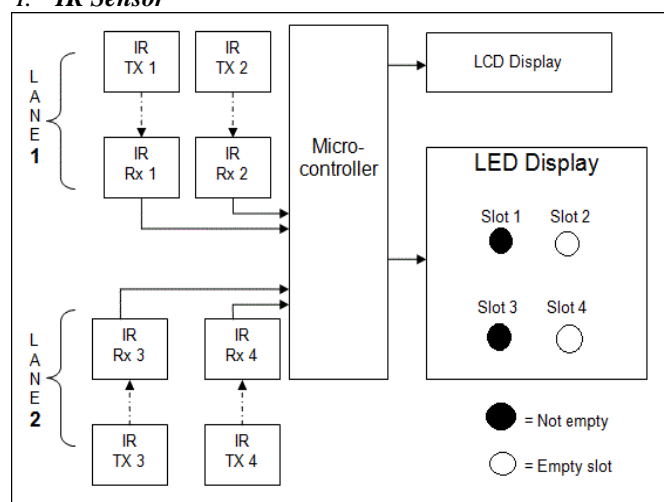


Fig. 1 Block Diagram of Zmart Park

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation [2]. It is also capable of measuring heat of an object and detecting motion. Infrared waves are not visible to the human eye. We are using an IR sensor which indicates whether the slot is filled or not. The output from the IR sensor circuit will be connected to pins of a microcontroller and the microcontroller will regard it as digital input to read either 1 or 0. According to the output from the IR sensor module, the microcontroller will respond by glowing LED. Since we just want to read some voltage in the microcontroller as input (either High or low) hence we are going to configure input pins as digital to read just 1 or 0 from the sensor. This glowing LED is nothing but the number of filled parking slot. And this data is send to the LCD display. So LCD shows the how many parking slots are available. The fig. 1 below shows the working of IR sensor which are connected with microcontroller and gives the output to LCD display.

II. Zigbee Network

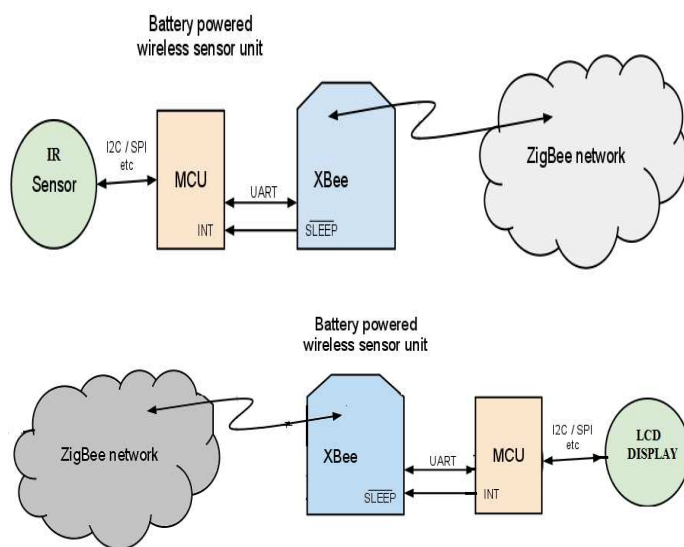


Fig. 2 Wireless Zigbee Module

Zigbee is a standard for wireless communication based on IEEE 802.15.4 [5]. It is characterized by low power consumption what is good for long life in battery powered systems. It is build as low data rate device and speed is fast. ZigBee is considered a PWAN (Personal Wireless Area Network.) ZigBee can work in the ISM bands of 915 MHz and 2.4 GHz. The maximum data rate that ZigBee can achieve is 250 Kbits/s. ZigBee can operate at different maximum distances depending on the environment and components used [5]. One of Zigbee's main characteristic is that a large network is possible. RFID or Bluetooth cannot make many nodes because this kind of network is not supported. But, it is possible for Zigbee to do network such as Peer to Peer, Star, Tree, Mesh by several Topologies and if there a lot of parking areas, Zigbee can be used effectively as scaling is easy.

3. FLOW OF PARKING SYSTEM

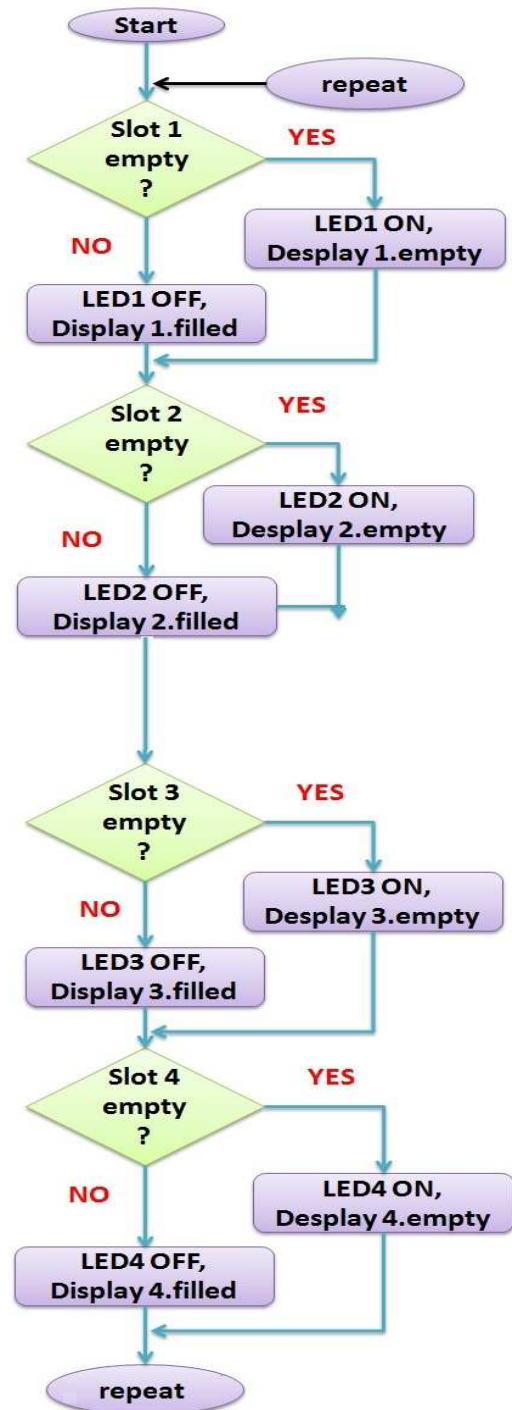


Fig. 3 Parking Flow Chart

Slot is checked for parked cars by updating a flag. When IR sensor is checked, flag is updated with value of '0' for not parking and value of '1' for occupied delivered to Zigbee (Router) via ARM processor. So, it transmits to microcontroller with Tag's information that was parked if value of '1' is kept at 10 seconds interval. At evacuation time, IR sensor's value is delivered to Zigbee (Router) and is sent to

packet by controller if value changes from '0' to '1'. Parking management system implementation in this study has long distance than other wireless communication so that communication is available in distance of 70 - 100 m in open space and it is profitable for big parking system implementation because it can consist a large number of parking lot [5].

4. FINAL SYSTEM



Fig. 4 A Sample of Zmart Park System

Figure above shows the final prototype system. At the bottom it shows the working of IR sensor and at each slot it gives the indication through LED (i.e. Red for full and Green for vacant). The number of available vacant slots is displayed on LCD panel.

5. ANDROID APP DEVELOPMENT

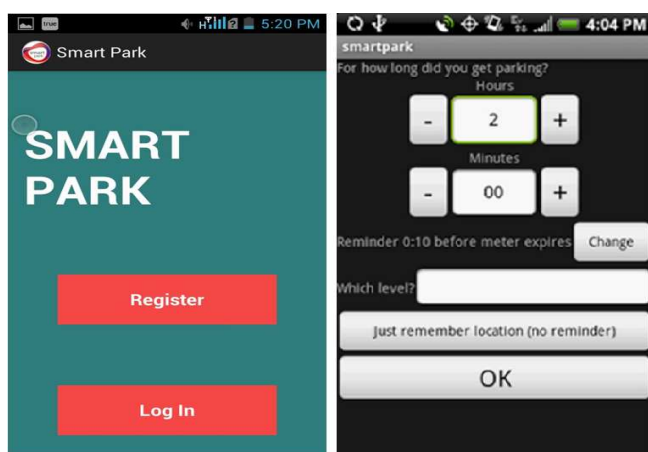


Fig. 5 Zmart Park Android App

Android is an operating system, developed for mobile devices like smart phone's and tablet, which is based on Linux operating system [7]. It was developed by Google in the year 2005. The android is multitasking system. This application is expected to provide an efficient and cost-effective solution to the increased vehicle parking problems. The user needs to have an Android enabled device to reap the benefits of this application. The application is open source. After installing the "Zmart Park" user can find the number of vacant slots in the nearby area [8]. The application will then display the status according to the availability of the vacant slots. The user also gets notifications about updated version of the App.

6. CONCLUSION

This paper proposes smart parking services based on IR Sensor and Zigbee module Networks [2]. We will design and implement a prototype system that allows vehicle drivers to find vacant parking spaces. This system can overcome all the hurdles while parking vehicles and can be globally expanded. The user can take decisions according to his convenience or budget. This will in turn lead to reduced traffic jams and reduced stress for the commuter who is able to decide beforehand where he/she may park their vehicle.

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