Parking Guidance And Information System Using RFID And Zigbee

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Abstract

Due to advancement in technology the number of the vehicles on the road is increasing, these increased vehicles leads to parking problems, traffic congestion, and pollution. The numbers of vehicles are bound to increase. A solution has to be found out to manage the traffic on road by providing the sufficient parking space; the price of expansion of the existing parking lots is very high. The traffic can be managed smartly by using smart parking methods which provides a reliable and low cost and easy accessible solution. Parking guidance and information system helps the driver to find the parking space easily reducing the driver frustration and secured and easy check in and check outs are possible using the RFID technology. RFID is the effective identification technology for variety of vehicles. The wireless connectivity can be obtained from the low cost, low data rate ZigBee which is quite reliable.WSN can be used for variety of applications such as military, forecasting, healthcare, intelligent home, intelligent transport vehicles,etc;.

1. Introduction

The parking problems are increasing in all the major cities, it is due advancement in technology and the vehicles are available at such rates that common man can afford. The number of vehicles purchased during the period of 2003 to 2011 was 17,852,489, out of which the number of cars were 2,430,105. The number vehicles increase from lacs to crores in past 8 years from the report of road transport year book of Indian Government. [1].The parking problem includes the traffic congestion, pollution, driver frustration etc, these problems are going to increasing due to numbers of increasing vehicles on the road. It can be reduced by applying smart parking techniques to the lots. These smart parking techniques manages the garage efficiently using various technologies [2].The categories of smart parking systems are Parking Guidance Information Systems, Transit-Based Information Systems, Smart Payment Systems E-Parking, Automated Parking [3].The Parking Guidance and Information System provides the driver the information about the occupied and unoccupied spaces in parking area. The WSN consists of a large numbers of sensing nodes deployed in the area of interest, to collect, process the information It consists of sensing, computing and communication elements. A sink node aggregates all the information. Router nodes are deployed in sensor field to forward data from sensor nodes to remote sink node [4].RFID technology is an automized vehicle identification system. Vehicles are identified and parking-lot fees are collected automatically. It enables vehicles to check-in and check-out under easily in secure conditions [5].The wireless connectivity can be obtained by using the ZigBee is a networking protocol featured with low data rate, power consumption, low cost, used for remote control and automation applications. ZigBee provides low cost, power connectivity for equipment which needs long battery life from several months to years ZigBee devices transmit 10-75meters, depending on the RF environment [6].

2. Related Work

A literature review on traffic management systems and parking lot applications using wireless sensor networks is seen in this section Smart Parking Applications Using RFID Technology [5] proposed a system which helps to easy check in and check out of the vehicles at the parking lots, in which RFID readers, labels, USB cables, toy cars, barriers with USB port connection and laptop computers have been utilized for hardware requirements. To store and manage the vehicle tracking data, a database management system has been used as software requirements. A visual programming language

has been used for operating the parking-lots and to reach the collected data. This makes the parking lot a secured parking and without stopping the car to check in or check out.

The Parking Space Finder Application proposed a architecture of a wide-area sensor network which detects the parking spaces are vacant or filled by using video cameras, motion detectors microphones, and web technologies, helps the users to acquire the processed data which is published on the web and generated by feeding all these sensor-data. The data generated by the video cameras acquire large amount of energy, bandwidth, these both are limited in sensor networks.

In [6], an intelligent car parking system using wireless sensor networks is proposed, where each parking space is equipped with one sensor to detect its occupancy. The prototype implementation is based on remote controlled toy cars and uses Crossbow motes [8] that have light, temperature, and acoustic sensors. However, it is not mentioned how to detect a car with those sensors. It is argued that the proposed three layered system architecture will reduce the cost of manpower and minimize human operations, however, as we show in this paper through real world experiments that it is hard to even detect cars with those sensors; especially temperature and acoustic sensors might be useless. Light sensors malfunction under the shadows It is difficult to manage large number of sensors in a network and it becomes too expensive.

A traffic surveillance system is described in, magnetometers re used to detect the presence of vehicles and calculate the speed of vehicles near street intersections and parking lots. Magnetic signatures are used to classify and re-identify vehicles. Wireless magnetic sensors are applied to transportation applications like MIT Intelligent Transportation System and Responsive Roadways .The sensor nodes are placed just under the road surface or need to be glued on the pavement or where vehicles are to be detected. This is only suitable for the roads having intersection and not suitable for parking lots because vehicles could move anywhere inside a parking which could possibly damage sensors [7]

3. PGIS using WSN and RFID

Parking guidance and information system is a system which provides guidance and information to the drivers/the car owners to find the parking space quickly and easily. The PGIS we developed contains the sensor nodes which are deployed in the parking area. These sensors are interfaced with the controller which process the information and displays the vacant slot /full slot data on the LCD displays. The LCD displays are present on the main entrance and on the turn offs of the road, so that the driver could get the information about each free slot in each lane. The PGIS designed here is divided into two sections:

i. Monitoring Section
ii. Controlling Section

3.1 Monitoring Section

The monitoring section has the sensor network which is present in each of the parking slot to detect its occupancy. Different types of sensors like the ultrasonic, radar, image, acoustic sensor etc; can be employed to get the information about the vehicles. The sensors used in our PGIS contain the IR sensors to get the occupancy information about the parking lots. These sensors have an operational range of 15cm to 150 cm, are low cost and effective, but are sensitive to environmental conditions such as fog or snow [3]. These sensors are interfaced with the Ports of the LPC controller which process the information obtained from the sensors, the obtained information is displayed on the LCD screens which are present at entrance and at the main turn offs so that the car driver can get the information about the vacant slot present nearby. The block diagram of the monitoring section is as follows

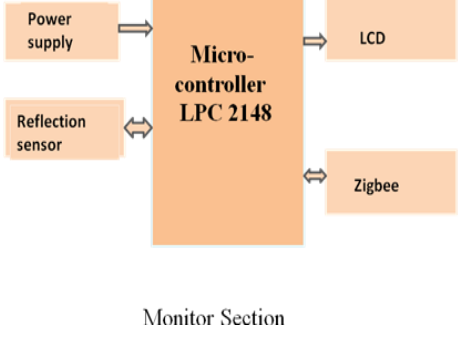

Fig I. Monitoring Section

Zigbee is used for wireless connectivity; it consumes less power, low cost and has a data rate of 250kbps at 2.4GHz, which is sufficient [6].The communication between the monitoring section and the control section is a maintained by the Zigbee.

The sensor node interfaced with the microcontroller can be shown as:

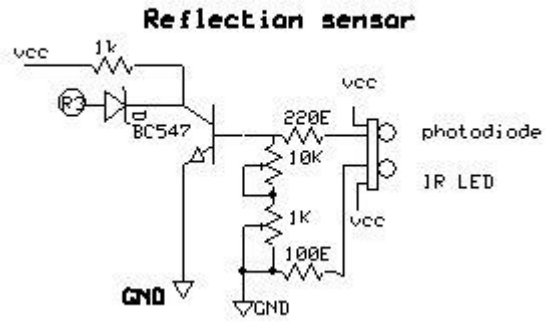

Fig II: IR sensor

Transmitter and the receiver are incorporated in a single housing. The modulated infrared light of the transmitter strikes the object to be detected & reflected. Part of the reflected light strikes the receiver and starts the switching operation. The two states – i.e. reflection received or no reflection – are used to determine the presence or absence of an object in the sensing range.

3.2 Control Section:

This is the control section present at the entrance of the parking lot, which maintains a database of status all parking slots present. All the information about the vacant or occupied area can be understood at the entrance only. This control section has the following components:
The block diagram of the control section is:

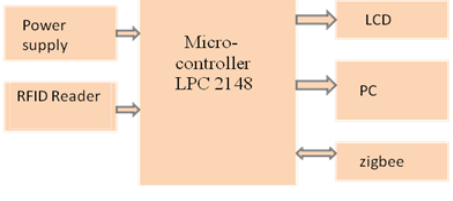

Fig III. Control Section

The control section consists of controller interfaced with RFID reader, LCD display, ZigBee and personal computer. The wireless connectivity is maintained using the Zigbee .The RFID is used to identify the cars entering the parking area. The users are provided with the RFID tags to maintain a secured, quick and easy check –in and check-outs.

The controller used here is LPC 2148 which is as shown:

Fig IV: LPC 2148 ARM board

The LPC 2148 is a16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package. It has 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory. It also provides 8 kB of on-chip RAM accessible to USB by DMA. Two 32-bit timers/external events counters channels, multiple serial interfaces including two UARTs, two Fast I2C-bus, and Vectored interrupt controller with configurable priorities and vector addresses.45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package. Up to nine edge or level sensitive external interrupt pins available.

4. Algorithm of the Project

The algorithm for both the sections i.e. monitoring section and the control section can be explained here.

4.1 Algorithm for monitoring section

In this the all the hardware components are initialized / all the header files are included. The interrupts are enabled to receive the data, the raw data is collected from the sensors placed in the parking lot, and the collected data is further processed by using the controller. The data is maintained at the controlled section and transmitted using Zigbee if it is ready to transmit.

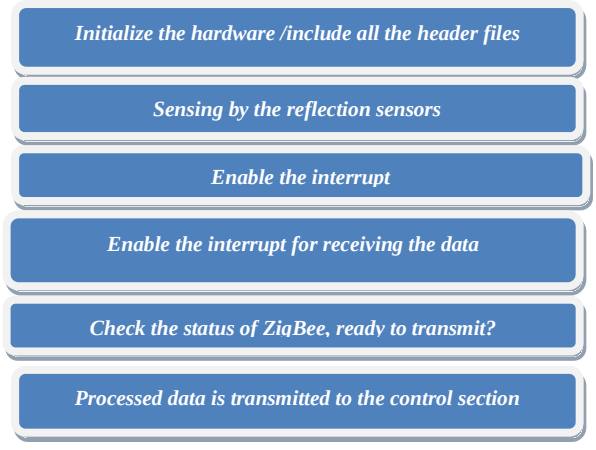

Figure V: algorithm for monitoring section

4.2 Algorithm for the control section

In the control section, all the hardware is initialized by including all the header files. The interrupts are enabled to receive the data. The RFID Reader receives an interrupt when a vehicle checked in, the RFID stores the ISR at a location. It compares the enters the RFID tag number with the database, to allow the authenticated vehicles in parking lots and prevent the unauthorised used. The communication between the monitoring and the control section is maintained using the ZigBee module.

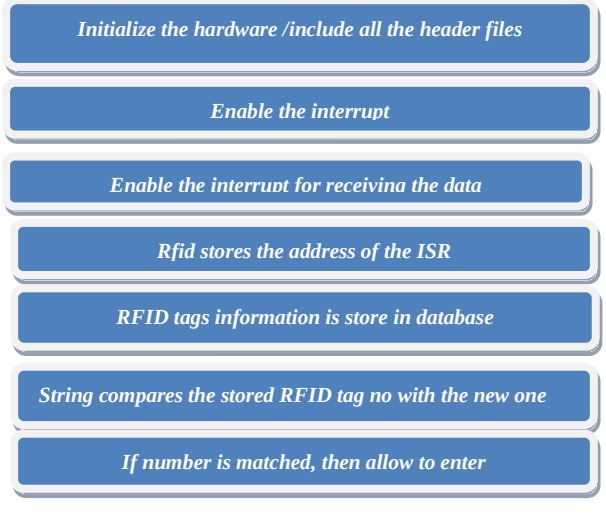

Fig VI. Algorithm of the control section

5. Conclusion

This paper introduces a PGIS based WSN and the RFID.A sensor network is developed which carries all information about the parking space from the sensor node to the control section using ZigBee. The sensor network and the information and management centre constitute a PGIS. The experimental results determine that the PGIS we developed can satisfy the application. This system can be conveniently installed in the parking lots. There is no need to change the existing parking system and it is compatible with the existing wired networks.

10. References

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