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DESIGN OF INTELLIGENT SWIFT PARKING SYSTEM (SPS) USING ULTRASONIC DETECTORS AND ZIGBEE

S. Arun*

P. Immanuel Dinesh*

Vinson Joshua*

Ananda Saravanan*

Abstract: *The numbers of vehicles are increasing day by day and the parking gets more and more complicated. This leads to a lot of problems in parking , vehicles traffic and air pollution. Hence to avoid all this problems, in this paper we have proposed and Intelligent Swift Parking System(SPS) which identifies the vacant parking slots and directs the users to park their vehicles in appropriate parking spaces. The system include three modules- Monitoring module, controlling module and the displaying one. This systems uses ultrasonic sensors to identify free parking spaces, and wireless connectivity between the control units and sensors are obtained by ZIGBEE. SPS is time consuming and cost effective too.*

Key words: *SPS, ultrasonic sensors, zigbee*

*Assistant Professor, ECE Department, Veltech University

1 .INTRODUCTION:

The vehicles are increasing day by day throughout the world and as a result the total amount of traffic is increasing rapidly and hence the parking spaces are getting fewer and smaller day by day.. In 2008 Indian automobile industry was the 9th largest in the world with an annual production of around 2.3 million units.in 2009 monthly sales exceeded 100,000 units.it has been predicted that Indian automobile will be third largest in the world. This led to the lots of problems including increase in traffic, drivers frustration and its consequent problems in parking.[1]

For the past years, innovation within the automotive sector has brought a major technological advances leading to safer, cleaner and affordable vehicles. In our proposed one, intelligent Swift Parking System(SPS) is used which monitors the availability of free parking space and makes the information available to the customers which might be very useful in shopping malls, residential buildings, complexes .etc.

The Swift Parking System include three modules-Monitoring module, Control module and a displaying unit. The monitoring module includes ultrasonic sensors which identifies the free parking spaces and transmits the information to control unit through zigbee. The sensors and the zigbee are interfaced to the PIC microcontroller. The control units processes the information and makes the information available to the users. It also maintains the database about the information of the vehicles. The displaying unit is responsible for displaying the information to the users at the entrance and at each level.[2] The directional board is provided to direct the users to the appropriate parking lot. Hence the overall system is an easy accessible solution and user effective too. This system is well suited for multilevel and underground car parking systems.

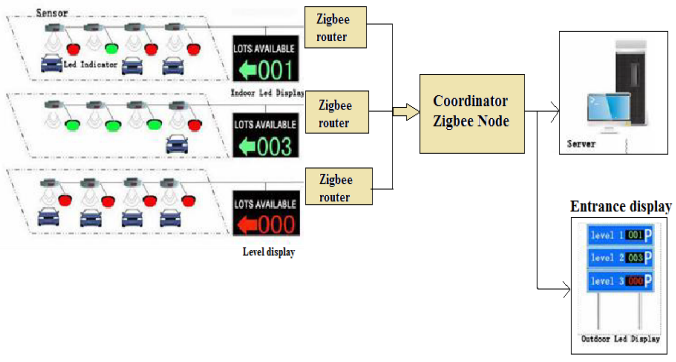

Fig 1 Prototype of Intelligent SPS

2. WORK REVIEW: SWIFT PARKING SYSTEM (SPS)

[A]MONITORING SECTION

The monitoring section consists of ultrasonic sensor which senses the parking area 24x7.If any vehicle is detected in the respective area , then it sends the signal to the microcontroller to which it is interfaced. The microcontroller will in turn send the status information to the Zigbee node which is also interfaced with the microcontroller. The Zigbee node in turn transmits the status information to the end Zigbee node which is interfaced with a control unit at the entrance of the parking bay. Then the parking lot status is updated in the main database system.[3] Continuous update will take place as the system works continuously for 24x7. A display device is provided at the entrance of the parking bay which helps the users to identify whether the parking lot is available or not. For multilevel parking system multiple Zigbee nodes will be used one for each level and a network is formed between the Zigbee nodes.

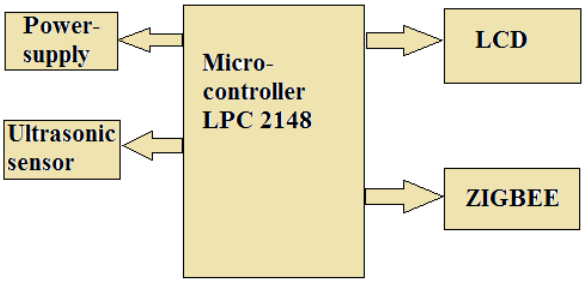

Fig 3 Monitoring Section

[B] CONROL SECTION

The control section takes charge of managing and maintaining the whole system. All the information about the vacant or occupied area can be understood at the entrance only . [5]

It processes the data received from various sensors and maintains the data and processes the data and displays the necessary information for the customers on the screen and updates the display screen at the entrance of the parking lot. It also maintains the database of information. The LCD panels are used for displaying the information.

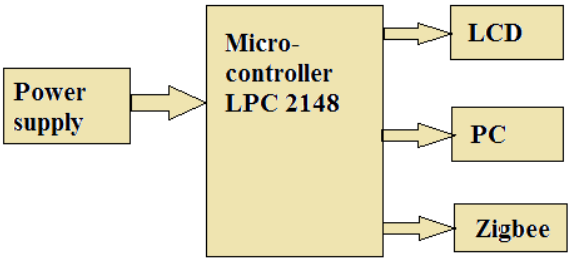

Fig 2 Control Section

The control unit consists of the microcontroller which is interfaced with the Zigbee, LCD display and personal computer. This control section has a zigbee module to get the data from the monitoring section. This data is processed by the controller and then displayed on the screen.

[C]DISPLAY UNIT

The display unit is responsible for displaying the information to the users .All the necessary information is available to the users at the entrance and also at each levels of parking. The display unit is connected to the control unit. The directional board is also provided to direct the users to the parking lots.[7]

Fig 4 Display Screen

In addition several LCD displays are available at main turnoffs which helps the users find the parking space with less time.

Fig 5 Directional board

3. DESIGN OVERVIEW

[A] ULTRASONIC SENSORS

Ultrasonic sensor is a non-intrusive type of sensor. ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.[9]

The sensor has a ceramic transducer that vibrates when electrical energy is applied to it. The vibrations compress and expand air molecules in waves from the sensor face to a target object. A transducer both transmits and receives sound. The ultrasonic sensor will measure distance by emitting a sound wave and then "listening" for a set period of time, allowing for the return echo of the sound wave bouncing off the target, before retransmitting

Fig 6 Ultrasonic sensors

[B] ZIGBEE

IEEE 802.15.4 defines the physical & medium access control (MAC) layer of the zigbee protocol. The basic channel access mode employees “carrier sense multiple access with collision avoidance” (CSMA/CA). There are 16 zigbee channels in the 2.4 GHz band with each channel occupying 5 MHz of bandwidth. Zigbee uses binary phase shift keying (BPSK) modulation for both 868 and 915 MHz bands and offset quadrature phase shift keying (OQPSK) modulation for 2.4Ghz band. Transmission range is between 1 and 100m and it is heavily dependent on the deployment environment and zigbee radio transmission power capability.[10]

Each zigbee network contains only one zigbee coordinator. Routers are used to connect between coordinators and other nodes. Routers and coordinators can communicate with all the devices on the network.

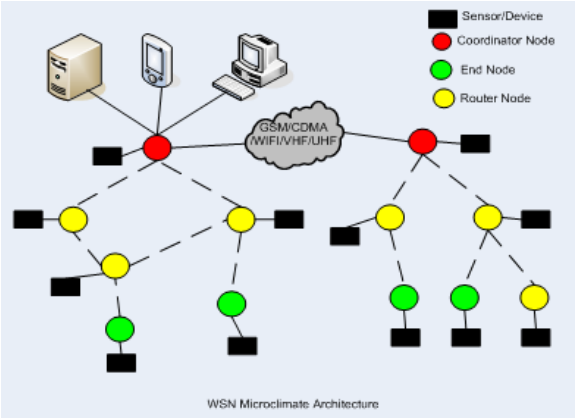

Fig 7 Connection between Sensors

4. OVERVIEW OF SPS

As the users enters the parking lot ,they look at an LED display board at the entrance which shows how many vacant spaces are available at each level at that time and chooses the desired level and moves towards it. After navigating to the desired parking level, drivers look at internal sign LCD boards hanging from the ceiling at the each end. Each internal board shows two parts: the number of available spaces in the respective level and the direction (left, right or forward) of the aisle which has a vacant space. By following the sign board the user can park their vehicle easily and safely.[12]

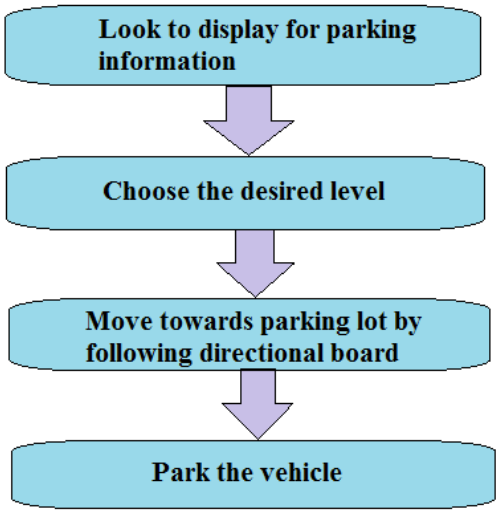

Fig 8 Overview of SPS

4.1 FEATURES OF SPS

The proposed Swift Parking System(SPS) has various primary and secondary features.[13]

The main features are:

- Detect the empty parking spaces by ultrasonic sensors
- Wireless connectivity between various sensor nodes and control unit through ZIGBEE.
- Display the number of parking spaces at the entrance ,each level of parking at main turn offs
- Efficient Parking monitoring and maintaining the database.
- Directional board to direct the users to parking lot.

5. CONCLUSION

Almost in all the countries including INDIA, parking is a major problem and to park a vehicle properly in a place is also a difficult task and lots of time, money is wasted on it.

We have done a study and proposed an intelligent SPS(Swift Parking System) which uses ultrasonic sensors to identify the parking spaces and passes the information to the control unit through Zigbee and display it to the users. This could be cost and time effective. This system is an easy accessible solution and can be adapted and would be energy efficiency too.

6. REFERENCES

1. Hamzah Asyrani Bin Sulaiman, Mohd Fareez Bin Mohd Afif "Wireless based Smart Parking System using Zigbee" International Journal of Engineering and Technology (IJET) ISSN : 0975-4024.
2. "INRODUCTION TO EMBEDDED SYSTEM" By SHIB
3. Manjusha Patil " Wireless Sensor Network and RFID for Smart Parking System" International Journal of Emerging Technology and Advanced Engineering .
4. Skabardonis, A., P. Varaiya, and K. F. Petty. "Measuring recurrent and nonrecurrent traffic congestion." *Transportation Research Record*. 1856, 118-124, 2003.
5. "Smart grid infrastructure and networking" by krzysztop (kris) Iniewski.
6. Jianpo, L., et al. Study on ZigBee network architecture and routing algorithm. in Signal Processing Systems (ICSPS), 2010 2nd International Conference on. 2010.

7. Sheng-Fuu Lin Nat. Chiao-Tung Univ.et,al., "A Vision-Based Parking Lot Management System", International Conference on Systems, Man and Cybernetics (SMC), Vol 4, 2006, pp 2897 – 2902.
8. S.V. Srikanth, Pramod P. J, Dileep K. P, Tapas S, "Design and Implementation of a prototype Smart PARKing (SPARK) System using Wireless Sensor Networks", International Conference on Advanced Information Networking and Applications Workshops, 2009, pp 401 – 406.
9. R Vishnubhotla, PS Rao, A Ladha, "ZigBee Based Multi-Level Parking Vacancy Monitoring System", IEEE International Conference on Electro/Information Technology (EIT), 2010, pp 1 – 4.
10. Jianpo, L., et al. Study on ZigBee network architecture and routing algorithm. in Signal Processing Systems (ICSPS), 2010 2nd International Conference on. 2010.
11. Seong-Hoon, K., et al., UPnP-ZigBee internetworking architecture mirroring a multi-hop ZigBee network topology. Consumer Electronics, IEEE Transactions on, 2009. 55(3): p. 1286-1294.
12. Hyun-Woo, O., J. Jong-Hyun, and P. Kwang-Roh. A ZigBee and ZigBee-to-IR device control scheme for Single Media Multi Devices. in Consumer Electronics, 2009. ISCE '09. IEEE 13th International Symposium on. 2009.
13. Nia-Chiang, L., et al. Impact of Node Heterogeneity in ZigBee Mesh Network Routing. in Systems, Man and Cybernetics, 2006. SMC '06. IEEE International Conference on. 2006
14. Divyabharathi, R., C.A. Hakeem, and A.M. Mian. Design and simulation of Zigbee Transmitter using Verilog. in Information Communication and Embedded Systems (ICICES), 2013 International Conference on. 2013.
15. Hirakata, Y., et al. Navigation system using ZigBee wireless sensor network for parking. in ITS Telecommunications (ITST), 2012 12th International Conference on. 2012.