

# **A Time and Energy Efficient Car Parking System Using ZIGBEE Communication Protocol**

Karthick Raja<sup>1</sup>, Kavin<sup>2</sup>, Kavitha<sup>3</sup>, Keerthipriya<sup>4</sup>, Sindhu<sup>5</sup>

U.G. Student, Department of Electronics and Communication Engineering, Sri Eshwar Engineering College,  
Coimbatore, India<sup>1234</sup>

Assistant Professor, Department of Electronics and Communication Engineering, Sri Eshwar Engineering College,  
Coimbatore, India<sup>5</sup>

**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. One of main issues of developing big parking space for shopping complexes, office complexes and other types of building that requires large parking space is to notify the visitors of occupied and non-occupied parking space. Most of the visitors might spending up to 30 to 45 minutes just to find an empty parking space. In most recent technology, some parking lot system offered a system that could automatically count when the car entering the empty car space and blocking an infrared signal thus notify the system to count for it. The implementation of this project save the time by displaying the information about where the empty space is available.

**KEYWORDS:** Automatic, time saving, empty space information

## **I. INTRODUCTION**

Microcontroller is the heart of the device which handles all the sub devices connected across it. We have used PIC16F877A controller. A study on the existing systems reveals that there are automated systems based on sensor networks or video based systems that track the presence of cars and availability of free spaces in parking areas. They lack the advantage of allotting a unique slot to every car thus creating confusion when many cars arrive simultaneously.

This system displays the information about the available spaces through Liquid Crystal Display (LCD), while the car enters the parking place. It uses ZigBee wireless module which is faster than Bluetooth and Wi-Fi.

## **II. RELATED WORK**

In this paper, "Automatic Car Parking System"[1], we have built a system which will automatically sense the entry and exit of cars through the gate and then display the number of cars on the LCD. In this paper we have taken a model of eight number of car parking system. A microcontroller has been used to sense the movement of cars and check whether there is a capacity for cars to park [2]. We use two dc motors, one is for gate and other is for lifting the lifter carrying the car. Gate is open when motor is rotated clockwise and closed when motor rotated in anticlockwise. It is also possible to open a gate when any car enters in the parking lot or close the door when a car exits from it. We use 8 Infra-red sensor, which are mounted as two on each floor. We built a project with a Parking of two floor. Simultaneously, it will display the number of cars present in the parking lot on a LCD screen and opens the gate if there is a space for the car to park. When all the spaces are occupied then LCD displayed NO vacant space and the gate is not open. The sensing of entry and exit of cars is done through infrared transmitters and receivers. The infrared transmitter is mounted on one side and the receiver is placed directly against the transmitter [3]. When a car arrives, the infrared

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

beam is blocked by the car and the receiver is devoid of infrared. Message is sent to the microcontroller according to it the car is parked. The procedure for the exit of cars is much similar to that of entry. We use RFID card [4] and RFID card reader. Whenever the car get enter in the parking area it must show the card to the card reader and detect the card. Then the gate is open car enter into the parking area, gate is closed after some delay.

Gongjun Yan et.al, (2011) describes a novel, secure, and intelligent parking system (Smart Parking) based on secured wireless network and sensor communication [5]. High parking space utilization and fast free spot finding time are the result of proposed research. Soh Chun Khang et.al, (2010) presents a parking system in which driver comes to know about the space availability in the parking lot with the help of SMS service. Driver can resend SMS in order to request new space if the previous one is filled. Driver can find nearest space for parking using wireless mobile based car parking system. Results, shows that the system efficiently allocates the slots and utilizes the full parking space [6]. Ankit Gupta et.al, (2010) describes an efficient car parking algorithm for Ackerman steering configuration. This algorithm uses geometric calculations for path planning. Result shows a fast, efficient and safer parking system. Huachun tan et.al, (2009) proposed an efficient car searching technique for larger parking lot. In this paper, cameras are installed in roads nearby parking lot and information regarding car like colour and license plate recognition is captured and saved in the database. S. V. Srikanth et.al, (2009) proposed a parking system which eliminates problems regarding finding vacant slot for parking. Author uses wireless technology to enhance parking efficiency. Gongjun Yan et.al, (2008) proposed NOTICE based parking system. In this parking system, drivers can check and reserve the slot for parking. For security purposes encryption/decryption techniques are used. Simulation results are highly efficient.

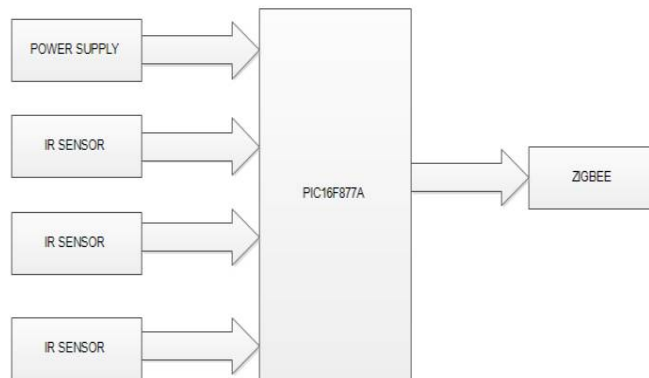
### III. MICROCONTROLLER AND ZIGBEE PROTOCOL

PIC has only 35 single word instructions. All are single cycle instructions except for program branches, which uses two-cycle. The Operating speed of PIC in DC is 20 MHz and clock input in DC is 200 ns instruction cycle. The PIC has 8K x 14 words of flash Program Memory, 368 x 8 bytes of Data Memory (RAM). It has a Capture, Compare, PWM (CCP) module. Capture is of 16-bit and it has a maximum resolution of 12.5 ns. Compare is of 16-bit and it has a maximum resolution of 200ns. Pulse Width Modulation has a maximum resolution of 10-bit. It has a Synchronous Serial Port (SSP) with SPI (Master/Slave) and I2C, USART with 9 bit detection. It also has a Brown-out detection circuitry for Brown-out Reset (BOR). PIC has a Low power, high speed CMOS FLASH technology with a fully static design. It provides a wide operating voltage range of 2.0V to 5.5V. It has Low power consumption and used in commercial and industrial temperature ranges. There are three memory blocks in the PIC16F87XA device. The program memory and the data memory have separate buses so that concurrent access can occur. The PIC16F87XA devices have 13 bit program counter capable of addressing an 8K x 14 bit program memory space. The data memory is partitioned into multiple banks which contain the general purpose registers and the Special Function Registers (SFRs).

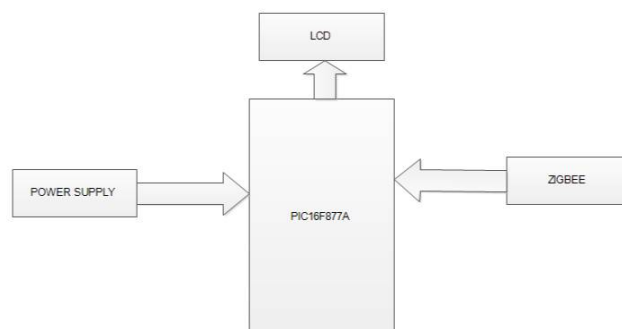
Wireless sensor networks are becoming necessary and seen as indispensable in various medical and telecommunication equipment's, smart energy resources, home automation products etc., which require monitoring and control. ZigBee is a wireless technology, which communicates on the principle of IEEE 802.15.4 standard. IEEE 802.15.4 is a standard that states the details for the lower layers of the communication. This standard focuses on the low-cost and low power communication. Because of ZigBee low cost, low power consumption and ability to connect in a mesh network, it is becoming more optimum solution for monitoring and control applications. Ability to connect in mesh network allows ZigBee to provide more range compared to other wireless technologies such as "INFRARED", "BLUETOOTH" etc. In addition, it also provides high reliability of the data reproduced at receiver. It also consumes less power in communicating data between its transmitter and receiver, which means longer life with smaller batteries. The primary reason for low power consumption in ZigBee devices is that they work on very small duty cycle that helps them to have a longer life span. Variation in duty cycle depends upon the application usage, for example, some applications need data more frequently like in health centres compared to others such as home automation systems. The ZigBee Mesh topology does ZigBee network initialization. As soon as the network is powered up, the coordinator starts the network initialization sequence. After that, the coordinator starts a search for the full function devices and reduced function devices to establish a network.

**IV. BLOCK DIAGRAM**

**TRANSMITTER BLOCK**



**RECEIVER BLOCK**



The operation of power supply circuits built using filters, rectifiers and then voltage regulators. Starting with an AC voltage, a steady DC voltage is obtained by rectifying the AC voltage, then filtering to a DC level, and finally regulating to obtain a desired fixed DC voltage. The regulation is usually obtained from an IC voltage regulator unit, which remain the same if the input DC voltage varies or the output load connected to DC voltage changes.

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. An LCD is made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh time.

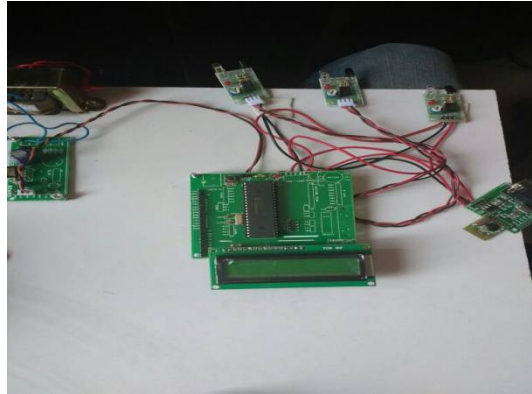
**V. EXPERIMENTAL RESULTS**

[1] Transmitter consists of power supply, pic controller, IR sensor and ZigBee communication protocol. The program is fed into the pic controller. IR sensor is placed in the columns of the car parking.

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

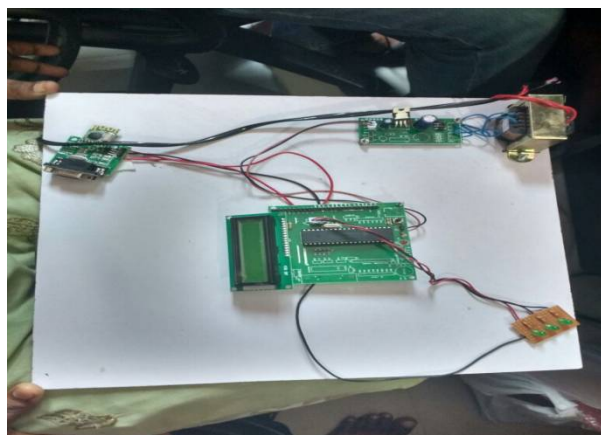
Vol. 5, Issue 3, March 2016



[2]When the car enters the parking slot, it interrupt the signal send by the IR sensor. Finally, information displayed in the LCD screen that this column is full. Apart from the LCD display, it also has a LED setup. When the column is occupied, then the LED will glow.



[3]Receiver consists of pic controller, power supply,LCD and ZigBee communication protocol.

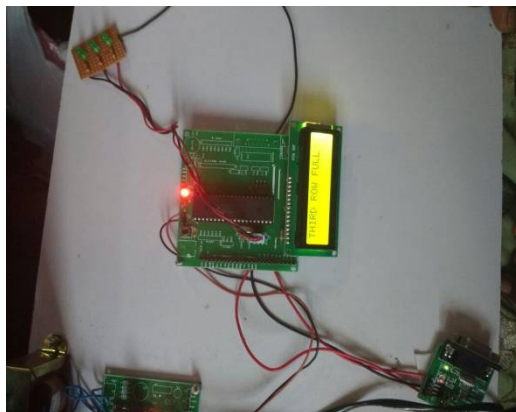


[4]The signal from the transmitter send to the receiver through the ZigBee communication protocol. When the signal is received the output was displayed in the LCD screen.

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016



### VI. CONCLUSION

This paper proposes a set of smart parking services based on ZigBee which overcome the drawbacks of the existing system. We designed and implemented a prototype system that allows vehicle drivers to effectively find the vacant parking spaces. The proposed system consists of PIC16F877A, IR sensor, LCD, LED, power supply and ZigBee communication protocol. In this system the state of parking slots is detected by IR transmitter and receiver and reported periodically to PIC controller through ZigBee wireless module. The state of parking slot in particular area is also displayed on LCD.

### VII. ACKNOWLEDGEMENTS



We thank Ms.Sindhu.D,ME, our project guide for helping and guiding us throughout the entire project and also providing us information about the statistical reports.

### REFERENCES

- 1]Ankit Gupta, Ankit Jaiswar, Harsh Ag5arwal and Chandra Shankar, "Automatic Multilevel Car Parking", International Journal of Electrical and Electronics Research ISSN 2348-6988 (online) Vol. 3, Issue 2, pp: (438-441), April - June 2015
- 2] R. Mithari, S.Vaze , and S. Sanamdikar, Automatic Multistoried Car Parking System, IJITAM ,Volume-1, Issue-6 , March, 2014.
- 3] M.A.Mazidi,Janice, GillispieMazidi, The 8051 Microcontroller And Embedded System
- 4] J. Lim, S.Kim, H. Oh, and D.Kim, A Designated Query Protocol for Serverless Mobile RFID Systems with Reader and Tag Privacy, TSINGHUA SCIENCE AND TECHNOLOGY.
- 5] Gongjun Yan; Weiming Yang; Rawat, D.B.; Olariu, S.,(2011) "SmartParking: A Secure and Intelligent Parking System," Intelligent Transportation Systems Magazine, IEEE , vol.3, no.1, pp.18- 30.
- 6] Soh Chun Khang; Teoh Jie Hong; Tan Saw Chin; ShengqiongWang;(2010) , "Wireless MobileBased Shopping Mall Car Parking System (WMCPS)," Services Computing Conference (APSCC), 2010 IEEE Asia-Pacific , pp.573-577.

### BIOGRAPHY



**KarthickRaja.N** was born in Pollachi, India on 17.05.1995 and completed his schooling in Palaniammal Higher Secondary School, Pollachi in the year 2012. Currently pursuing the under graduate course, B.E (Electronics and Communication Engineering) in Sri Eshwar College of Engineering, Coimbatore, India. His areas of interests include Networking and Control systems.

## International Journal of Innovative Research in Science, Engineering and Technology

*(An ISO 3297: 2007 Certified Organization)*

Vol. 5, Issue 3, March 2016



**Kavin.K** was born in Namakkal, India on 15.04.1995 and completed his schooling from Sri Renga Vidyalaya Higher Secondary School, Namakkal in the year 2012. Currently pursuing the under graduate course, B.E (Electronics and Communication Engineering) in Sri Eshwar College of Engineering, Coimbatore, India. His areas of interests include Networking and Embedded systems.



**Kavitha.N** was born in Pollachi, India on 21.11.1994 and completed her schooling from Mariammal Girls Higher Secondary School, Pollachi in the year 2012. Currently pursuing the under graduate course, B.E (Electronics and Communication Engineering) in Sri Eshwar College of Engineering, Coimbatore, India. Her areas of interests include Digital Signal Processing and Control systems.



**Keerthipriya.M** was born in Kumbakonam, India on 08.05.1995 and completed her schooling from Mariammal Girls Higher Secondary School, Pollachi in the year 2012. Currently pursuing the under graduate course, B.E (Electronics and Communication Engineering) in Sri Eshwar College of Engineering, Coimbatore, India. Her areas of interests include Electronic circuits and Embedded systems.