ISSN 2250-3153

Comparative Implementation of Automatic Car Parking System with least distance parking space in Wireless Sensor Networks

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Abstract- Recently, with the rapid development of micro electronics technology, wireless communication technology and embedded system, the technology of wireless sensor network (WSN) has been advanced a lot. At the meanwhile, more and more producers and international organizers want to make the mote more intelligent and standard. Sensor Networks being considered as an emerging area of research in recent years has evolved in itself a large potential to counteract the ongoing system. By networking large numbers of tiny sensor motes, it is possible to obtain data about physical phenomena that was difficult or even sometimes impossible to obtain in conventional ways. Automatic multi-stored car parking system is very good substitute for car parking area. Since in modern world, where space has become a very big problem and in the era of miniaturization its become a very crucial necessity to avoid the wastage of space in modern, big companies and apartments etc. For example, in a space where more than 100 cars need to be parked, it's a very difficult task to do and also to reduce the wastage of area, this system can be used. This Automatic Car Parking enables the parking of vehicles-floor after floor and thus reducing the space used. Here any number of cars can be park according to requirement. These make the system modernized and even a space-saving one. This idea is developed using AVR Microcontroller. Here program is written according to this idea using AVR ATMEGA 16 microcontroller. This Automatic Car Parking enables the parking of vehicles-floor after floor and thus reducing the space used. Here any number of cars can be park according to requirement. These make the system modernized and evens a space-saving one. This idea is developed using AVR Microcontroller. Here program is written according to this idea using AVR ATMEGA 16 microcontroller. Mathematical modeling is also done to identify the least car parking space available among the difference parking places in a city. The car parking system is already developed with the 8051 microcontroller, we have implemented multistory car parking using AVR ATMEGA 16 microcontroller with Zigbee wireless transceiver module.

Index Terms- Alfa Vizad RISC (AVR) Microcontroller, Institute of Electrical and Electronics Engineering (IEEE), ZigBee module, Wireless sensor networks (WSN), Wireless personal area Network (WPAN).

I. INTRODUCTION

With the rapid proliferation of vehicle availability and usage in recent years, finding a vacant car parking space is becoming more and more difficult, resulting in a number of practical conflicts. Parking problems are becoming ubiquitous and ever growing at an alarming rate in every major city. Wide usage of wireless technologies with the recent advances in wireless applications for parking, manifests that digital data dissemination could be the key to solve emerging parking problems. Wireless Sensor Network (WSN) technologies have attracted increased attention and are rapidly emerging due to their enormous application potential in diverse fields [4]. This field is expected to provide an efficient and cost-effective solution to the effluent car parking problems. This paper proposes a Smart Parking System based on wireless sensor network technology which provides advanced features like automated guidance. The paper describes the overall system architecture of our embedded system from hardware to software implementation in the view point of sensor networks. This paper also shows that the pre existing security surveillance (CCTVs) will be used as a sensing nodes to identify vacant parking space. The captured image will be processed through the AVR Microcontroller and the processed data will be transmitted via ZigBee to a central computer to store and update the occupancy status of available parking space vacancies in the database. The performance of this WSN based system can effectively satisfy the needs and requirements of existing parking hassles thereby minimizing the time consumed to find vacant parking lot, real time information rendering, and smart reservation mechanisms. ZigBee [1,2] defines the higher layer communication protocols built on the IEEE 802.15.4 standards for LR-PANs. ZigBee is a simple, low cost, and low power wireless communication technology used in embedded applications. ZigBee devices can form mesh networks connecting hundreds to thousands of devices together. ZigBee devices use very little power and can operate on a cell battery for many years. There are three types of ZigBee devices: Zig Bee coordinator, ZigBee router, and ZigBee end device. Zig-Bee coordinator initiates network formation, stores information, and can bridge networks together. ZigBee routers link groups of devices together and provide multi hop communication across devices. ZigBee end device consists of the sensors, actuators, and controllers that collects data and

communicates only with the router or the coordinator. The ZigBee [3] standard is publicly available from June2005. 2.1.1 IEEE 802.15.4 Protocol.

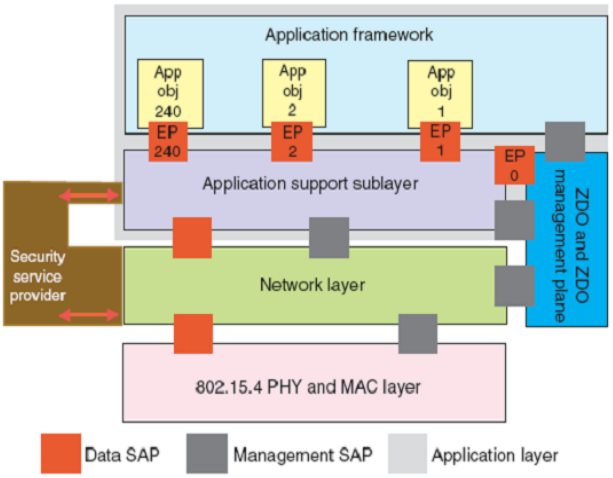

Figure 1: ZigBee Stack Layer [9]

The IEEE 802.15.4 is a part of the IEEE family of standards for the physical and link layers for Wireless Personal Area Networks (WPANs). The main focus of IEEE 802.15.4 is low data rate WPANs, with low complexity and low power consumption requirements. IEEE 802.15.4 uses device classification to reduce the complexity of the nodes. The standard classifies two types of devices to reduce complexity, a full function device (FFD) and a reduced function device (RFD). The RFD can only communicate with FFDs, but the FFD can communicate with both FFDs and RFDs. The IEEE 802.15.4 supports two Physical Layer (PHY) options. The 868/915MHz PHY known as low-band uses binary phase shift keying (BPSK) modulation whereas the 2.4 GHz PHY (high band) uses Offset Quadrature Phase Shift Keying (O-QPSK) modulation. The ZigBee network layer stack sits on top of IEEE 802.15.4 standard Medium Access Control (MAC) and PHY layers *(refer to figure 1).* The MAC and PHY layers contain the RF and communication components that communicate with other devices. The ZigBee stack contains the networking layer, an application support sub-layer and a security service provider (SSP) [8].

II. OLD CAR PARKING SYTEM

Old car parking system [18] was developed using 8051 microcontroller. It has the sections: Display section, Keyboard, indicator & Beeper section, Lift & motor section, Sensor section, LCD section. Program is written using 8051 microcontroller. Two 8255 IC's are connected to 8051. All circuits are interfaced with 8255. The display section displays the floor number along with the number of cars which has been already parked in that particular floor. So whenever a car is ready to either come down or go up, the program either decrements the count or increments the count automatically according to the going up or coming down of a car. Display section is done by interfacing with 8255(PPI) of 8051.Here 3 ports of 8255 are connected to three 7-segment display. Block diagram of this section is shown. 12 switches are connected in matrix form and it has three LED's, RED, GREEN &YELLOW. The person, needed to enter the password has to wait until the GREEN LED glows and when it glows, he has to press the "START" button first. This time the RED LED glows. Then the person has to enter the password. As soon as it is entered, the program checks it with the already stored passwords. If it is correct, YELLOW LED glows.

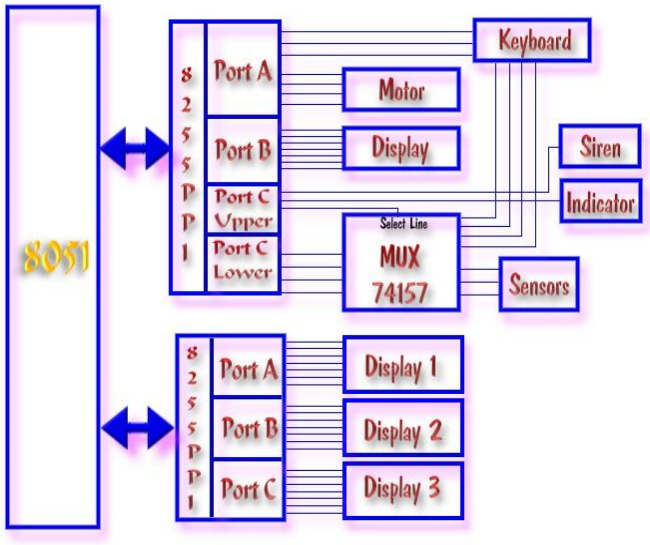

Figure 2 Car Parking System using 8051 Microcontroller

If the entered password is wrong, beeper starts beeping signifying the incorrectness of the password entered. The indicator section contains 2 LED's, RED & GREEN which are present in all the floors. RED LED signifies that the lift is presently busy and shall not entertain any car to enter but if GREEN LED glows, it suggests that the lift is ready and the car can enter the particular floor. Beeper and LED's are connected to port C upper of 8255. One more advantage of beeper is that; when a person tries to enter the lift irrespective of finding the display section to be FFF (means the floors are already filled), program sends a signal to Beeper section and it starts beeping indicating that he is not supposed to enter the lift since all the floors are already filled. In lift and motor section, there is a light beam and LDR to know whether a car has entered the lift or not. When the GREEN LED of indicator section glows, that means the lift is ready for the car to enter. When the car enters the lift, the light beam falls on LDR present in the lift gets cut and it gives a signal that a car has entered the lift. Then program decides which floor lift has to go and gives a signal to motor section. The motor section is a mechanical part of the model which is used for taking the lift up/down. When the lift has to go up, program gives the signal and the motor rotates clockwise and if it has to go down, it rotates anticlockwise. First 4 pins port A is connected to motor. Power transistors must be connected to drive the motor. Circuit diagram of this section is shown bellow. Sensor section contains LDR's .These LDR's are connected to each floor to give information if any car has to come down. When a person needs to come down from a particular floor to ground floor, he is expected to focus the headlight the car onto the LDR placed in that floor. When light

falls on LDR its resistance decreases. Hence IC 555 triggers and gives a signal. Program identifies that signal and gives a signal to motor section.

III. IMPLEMENTATION OF PARKING SYTEM USING ATMEGA 16

The implementation of automatic car parking system is shown in figure 3 which consists of the following parts.

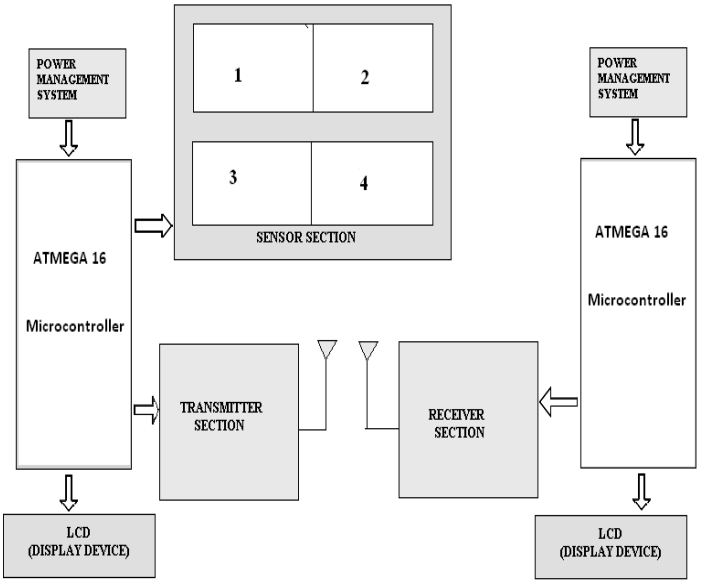

Figure 3 Automatic car parking system

ATMEGA-16 Microcontroller, LCD for Display system, Digital Sensors, Transmitter section, receiver section, Power supply management system. Power supply management system provides the 5V supply to the microcontroller. Digital sensor senses the cars and displays the corresponding floor information on the LCD display. Here are two LCD displays, one is for transmitter section and another is for receiver section. A display is provided at the ground floor which is basically a counter that displays number of cars in each floor. It informs whether the floors are fully filled with the cars or is it having place in a particular floor or not. There is facility of lift to carry the car to up and down. Movement of Lift is controlled by dc motor. In this project we have provided three floors of a building for car parking. Maximum storage capacity of each floor is given as ten. Storage capacity can be changed according to the requirement. When the lift reaches the first floor, the processor compares the filled amount to that of the already fed capacity of that floor, and if it finds that the first floor is fully filled, it goes to the second floor and thus the procedure stops here. As soon as a car is placed in a particular floor, the display counter at the ground floor increments as to indicate the floor capacity has decreased by one. After the lift places the car in a particular floor, it comes back to its normal position and that time, the motor that drives it, also stops.

IV. IMPLEMENTATION SCENERIOS

We have implemented the car parking for Ground floor to third floor. In the diagram the IR sensor is place by switch, 16 × 2 LCD display is used to display the information for Transmitter as well as Receiver. A lift mechanism is used in the implementation. If the status of Ground floor is full then lift moves towards first floor and returns to ground. Similarly if the first, second floors are full lift moves upward and returns to ground. A DC Motor is used for lift mechanism. ATMEGA 16 Microcontrollers works on the 5 V Power supply and dc motor works on 9 V. So, motor driver IC L 293 D is used to drive the motor and interfaced with ATMEGA 16 microcontroller.

Case1: Ground Floor car parking using one IR sensor, it can sense the status of Ground floor only it has the limitations to park the car on GND. If IR Sensor =1, Car parking is full and IR Sensor = 0 car parking has "VACANT SPACE".

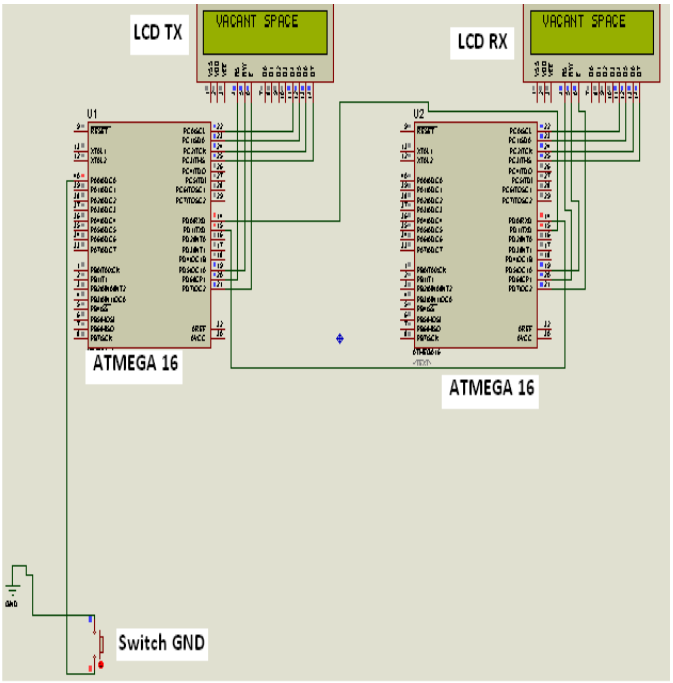

Figure 4 Car parking for ground floor

Case 2: If the Ground floor is full, A lift mechanism is used to park the car on first floor which is implemented using motor as in the simulation diagram. If it rotates in clock wise direction means the lift is moving upward, if it rotates in anticlockwise direction, it means lift rotates in downward direction. Two IR sensors are used in this IR1 for ground floor and IR2 for First Floor.

Table 1: Operation of first floor car parking

IR1	IR2	Operation
0	0	VACANT SPACE
0	1	1 VACANT, 2 FULL
1	0	1 FULL, 2 VACANT
1	1	ALL FULL

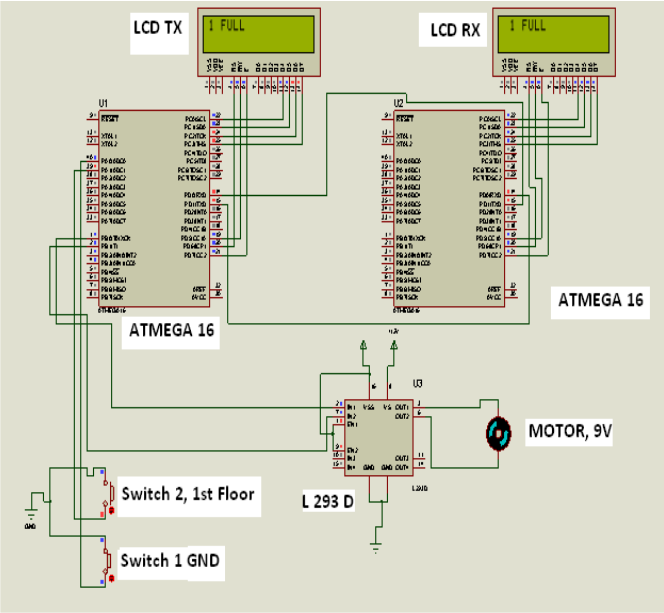

Figure 5 Car parking for first floor

Case 3: If the Ground floor is full, similar lift mechanism is used to park the car on first floor and second floor which is implemented using motor as in the simulation diagram. If it rotates in clock wise direction means the lift is moving upward, if it rotates in anticlockwise direction, it means lift rotates in downward direction. Three IR sensors are used in this IR1 for ground floor and IR2 for First Floor and IR 3.

Table 2 Operation of second floor car parking

IR1	IR2	IR3	Operation
0	0	0	VACANT SPACE
0	0	1	1 VACANT, 2 VACANT,3 FULL
0	1	0	1 VACANT, 2 FULL ,3 VACANT
0	1	1	1 VACANT, 2 FULL , 3 FULL
1	0	0	1 FULL, 2 VACANT, 3 VACANT
1	0	1	1 FULL, 2 VACANT, 3FULL
1	1	0	1 FULL, 2 FULL, 3 VACANT
1	1	1	ALL FULL

Case 4: If the Ground floor is full, similar lift mechanism is used to park the car on first floor an, second floor and third floor which is implemented using motor as in the simulation diagram. If it rotates in clock wise direction means the lift is moving upward, if it rotates in anticlockwise direction, it means lift rotates in downward direction. Three IR sensors are used in this IR1 for ground floor and IR2 for First Floor, IR 3 for second floor and IR4 for third floor.

Table 3 Operation of Third floor car parking

IR1	IR2	IR3	IR4	Operation
0	0	0	0	VACANT SPACE
0	0	0	1	1 VACANT, 2 VACANT,3 VACANT,4 FULL
0	0	1	0	1 VACANT, 2 VACANT ,3 FULL,4 VACANT
0	0	1	1	1 VACANT, 2 VACANT , 3 FULL,4 FULL
0	1	0	0	1 VACANT, 2 FULL, 3 VACANT,4 VACANT
0	1	0	1	1 VACANT, 2 FULL, 3 VACANT,4 FULL
0	1	1	0	1 VACANT , 2 FULL, 3 FULL,4 VACANT
0	1	1	1	1 VACANT , 2 FULL, 3 FULL,4 FULL
1	0	0	0	1 FULL,2 VACANT,3 VACANT,4 VACANT
1	0	0	1	1 FULL,2 VACANT,3 VACANT,4
1	0	1	0	1 FULL,2 FULL, VACANT,3,4 VACANT
1	0	1	1	1 FULL,2 VACANT,3 FULL,4 FULL
1	1	0	0	1 FULL,2 FULL,3 VACANT,4 VACANT
1	1	0	1	1 FULL,2 FULL,3 FULL, VACANT,4
1	1	1	0	1FULL, 2 FULL,3 FULL,4 VACANT
1	1	1	1	ALL FULL

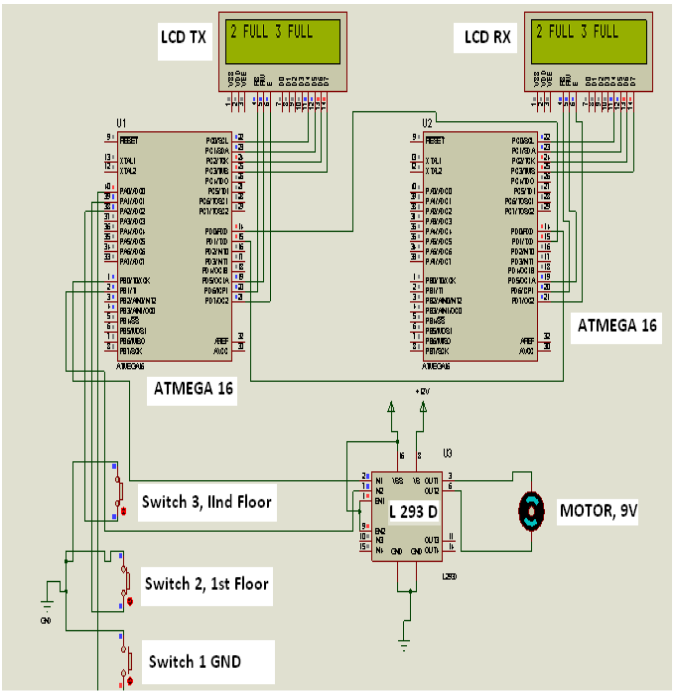

Figure 6 Car parking for second floor

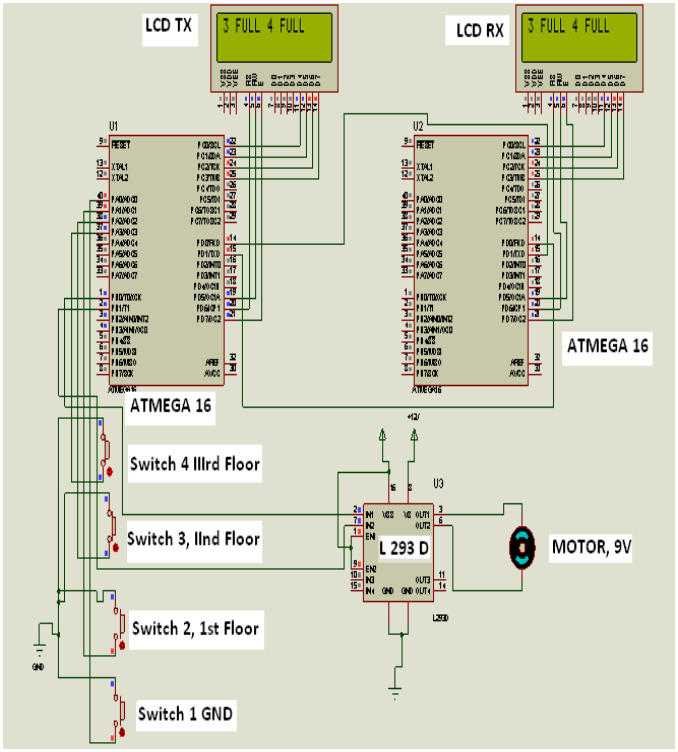

Figure 7: Car parking for Third floor

V. MATHEMATICAL MODELING & ALGORITHM OF LEAST PARKING

Let us consider a case of four parking spaces available in different buildings named as parking 1, parking 2, parking 3, and parking 4. All parking are using gyro having the coordinates (x_1, y_1, z_1) for parking 1, (x_2, y_2, z_2) for parking 2, (x_3, y_3, z_3) for parking 3, and (x_4, y_4, z_4) for parking 4. Gyro is giving the coordinates. Gyros are connected in all parking entrance and inside car also. Gyro connected inside car having the coordinate(x_5, y_5, z_5).

A switch mechanism is inserted in the car because the car will pass by many paths and it will take many coordinates as garbage values. When this switch will on inside the car, coordinates of car will be generated using gyro 5 (x_5, y_5, z_5). If the switch is not pressed, the car will not get any information because switch is programmed for fixed coordinates only. We will program the switch for car parking coordinates (x_1, y_1, z_1) for parking 1, (x_2, y_2, z_2) for parking 2, (x_3, y_3, z_3) for parking 3, and (x_4, y_4, z_4) for parking 4, so that it will accept the information for those parking spaces only. As the coordinates of gyro 5 will match to the coordinates of any gyro 1, gyro 2, gyro 3, gyro 4, the information will display in the car about that particular parking area. Let P1, P2, P3, P4 and P5 is the data received in gyro 1, gyro 2, gyro 3, gyro 4 and gyro 5. Data received i.e. coordinates of all parking P1 = Gyro 1, P2 = Gyro 2, P3 = Gyro 3, P4 = Gyro 4 and P5 = Gyro 5. Now calculate the distance from P1, P2, P3, and P4 from P5. Calculating the distance from all parking area using formula

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

and display in car. Compare distances from all parking area, which is the shortest distance will display in our car

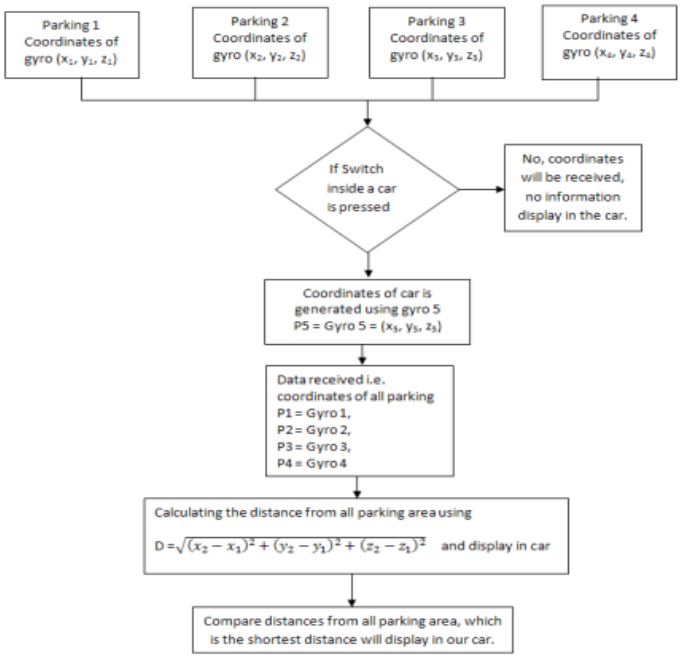

Figure 8 Algorithm of least parking space

Let us consider

d1 = Distance of car from parking 1 or distance between gyro 1 and gyro 5

d2 = Distance of car from parking 2 or distance between gyro 2 and gyro 5

d3 = Distance of car from parking 3 or distance between gyro 3 and gyro 5

d4 = Distance of car from parking 4 or distance between gyro 4 and gyro 5

We are using gyro which is giving the coordinates, gyros are connected in all parking entrance and inside car also

P1 = Gyro 1 = (x_1, y_1, z_1),

// Coordinates of parking 1 from gyro in car

P2 = Gyro 2 = (x_2, y_2, z_2),

// Coordinates of parking 2 from gyro in car

P3 = Gyro 3 = (x_3, y_3, z_3),

// Coordinates of parking 3 from gyro in car

P4 = Gyro 4 = (x_4, y_4, z_4) and

// Coordinates of parking 4 from gyro in car

P5 = Gyro 5 = (x_5, y_5, z_5)

// Coordinates of gyro in car

If (switch pressed)

{

USART read ( ) ;

// USART in microcontroller is receiving the data i.e coordinates of all parking area

$$d_1 = \sqrt{(x_5 - x_1)^2 + (y_5 - y_1)^2 + (z_5 - z_1)^2}$$

// distance of car from parking 1

$$d_2 = \sqrt{(x_5 - x_2)^2 + (y_5 - y_2)^2 + (z_5 - z_2)^2}$$

// distance of car from parking 2

$d_3 = \sqrt{(x_5 - x_3)^2 + (y_5 - y_3)^2 + (z_5 - z_3)^2}$
// distance of car from parking 3
$d_4 = \sqrt{(x_5 - x_4)^2 + (y_5 - y_4)^2 + (z_5 - z_4)^2}$
// distance of car from parking 4
{
$If((d_1 < d_2)\&\&(d_1 < d_3)\&\&(d_1 < d_4))$
$printf(Distance\ of\ carprking\ 1\ is\ nearest);$
$elseif((d_2 < d_1)\&\&(d_2 < d_3)\&\&(d_2 < d_4))$
$printf(Distance\ of\ carprking\ 2\ is\ nearest);$
$elseif((d_3 < d_1)\&\&(d_3 < d_2)\&\&(d_3 < d_4))$
$printf(Distance\ of\ carprking\ 3\ is\ nearest);$
$else\ \ printf(Distance\ of\ carprking\ 3\ is\ nearest);$
}
}
The proposed algorithm is for finding the information of shortest car parking available in our city.

VI. SOFTWARE DEVELOPMENT

Microcontroller, when it is used to operate as a wireless network involves following steps [10]

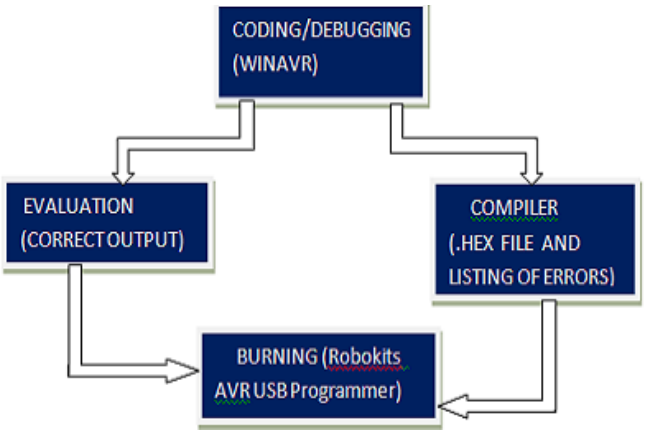

Figure 9 Steps for software development [10]

(1) Coding / Debugging- Coding or debugging is one in a high-level language (such as c or java). Compiler for a high-level language helps to reduce production time. To program the microcontrollers Win AVR [11] was used using C language. The source code has been commented to facilitate any occasional future improvement and maintenance. Win AVR is a suite of executable, open source software development tools for the Atmel AVR series of RISC microprocessors hosted on the Windows platform. It includes the GNU GCC compiler for C and C++. Win AVR contains all the tools for developing on the AVR. This includes AVR-gcc (compiler), AVR-gdb (debugger) etc.

(2) Compiling- After compiling the program, it is converted to machine level language in the form of o's ans1's.This file is called as the Hex file and is saved with the extension (.Hex). The compiler also generates errors in the program which should be removed for proper execution of the program.

(3) Burning- Burning the machine language (hex) file into the microcontroller's program memory is achieved with a dedicated programmer, which attaches to a PC's peripheral. PC's serial port has been used for the purpose. For this purpose Ponyprog programmer was used to burn the machine language file into the microcontroller's program memory. Ponyprog is serial device programmer software with a user-friendly GUI framework available for Windows95/98/ME/NT/2000/XP and Intel Linux. Its purpose is reading and writing every serial device. It supports I²C Bus, Micro wire, SPI EEPROM, and the Atmel AVR and Microchip PIC microcontroller. The microcontrollers were programmed in approximately two seconds with a high speed-programming mode. The program memory, which is of Flash type, has, just like the EEPROM, a limited lifespan. On AVR microcontroller family it may be reprogrammed up to a thousand times without any risk of data corruption Atmega16 Programmer (ISP) which is used to burn the program into AVR microcontrollers.

(4) Evaluation-If the system performs as desired by the user and performs all the tasks efficiently and effectively the software development phase is over and the project is ready to be installed in any of the industrial sites as a personal area network. If not, the entire process is repeated again to rectify the errors. One of the difficulties of programming microcontrollers is the limited amount of resources the programmer has to deal with. In PCs resources such as RAM and processing speed are basically limitless when compared to microcontrollers. In contrast to a PC, the code on microcontrollers should be as low on resources as possible, but being cost effective and power efficient makes it a better option. In the programming of the proposed system is used the following .c and .h file

(1) lcd.c -This c file contains the code for control of functionality of the attached LCD module. The code controls the initialization of the LCD, data writing on the LCD, and also the movement, characteristics and location of the cursor. It offers the facility to write data on the LCD character-by-character or string-wise. The command set used in the software is based on the command set used in the LCD based on Hitachi HD44780 ICs. This file contain InitLCD ( ),
LCDClear ( ), LCDWriteString ( ) and LCDWriteInit ( ).

(2) lcd.h- This header file contains all the constant variable values and names of the subroutines used by various files used in the software. It clearly indicates which variable can be used as a global variable and which of the subroutines can be used across the software files.

VII. COMPARISION

In our implemenation we have used the AVR ATMEGA 16 microcontroller which has the more advantages in comparision to 8051. By the survey of ATMEGA 16 it has been proved that it is the best controller for interfacing . There is added an EEPROM to store data over a power off time. In 8051 it is not there. An internal oscillator and an internal power on reset make the AVR working without any other components , we can extend the frequency from (1 MHz to 25 MHz) by external crystals but in 8051 microcontroller crystal frequency is fixed (11.0592 MHz) A watchdog to handle hanging software states is added. This is not usable for electrical influence, since it must enable after reset

and can be disabled. For this task it must be enable by programming a fuse and not be disable. .The divider between XTAL and cycle time is reduced from 12 to one. So the instruction time is many times faster than the 8051.e.g. you can realize an I2C-interface fully in software without reduced clock speed (at fully 100 kHz). In 8051, the data transfer rate after 9600 kbps baud rate is very slow and in AVR microcontrollers it is faster than 10 times. In 8051 if the program size is larger than 1 Kb, then there will be the problem to debug in real time environment. In AVR there is no limit of program, hence it has been proved the best controller for real time interfacing in real time operating systems (RTOS).

Automatic car parking systems developed using 8051 microcontrollers are using extra peripherals such as keyboard, indicator, siren, LDR. Whenever we are designing any electronic system then Area, speed, power consumption and cost are the main parameters. In our design, based on AVR microcontroller we can optimize the hardware and power consumption. The data transmission rate is high in comparison to 8051 microcontroller based system, and then system performance will increase. AVR is the best controller to interface with various wireless technologies (GSM, Wifi, Bluetooth, Zigbee e.t.c) because we can achieve the higher baud rate with this controller. UBRR (UART bit rate recorder and % error) is shown in the figure 10. This data is taken from AVR data sheet and http://www.wormfood.net/avrbaudcalc.php.

Table 4: Baud rate of ATMEGA 16 with % error

20 MHz		
Baud Rate	**UBRR**	**% of error**
300	4166	0.0
600	2082	0.0
1200	1041	0.0
2400	520	0.0
4800	259	0.2
9600	129	0.2
14400	86	0.2
19200	64	0.2
28800	42	0.9
38400	32	1.4
57600	21	1.4
76800	15	1.7
115200	10	1.4

Table 5 baud rate for 8051 Microcontroller

11.0592 Mhz		
Baud Rate	**UBRR**	**% of error**
300	570	0.0
600	282	0.1
1200	205	0.1
2400	180	0.0
4800	119	0.2

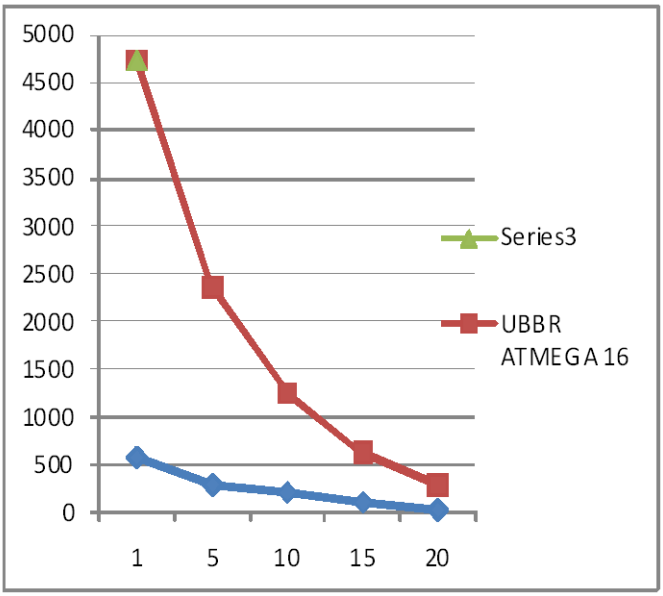

Figure 10 Comparison of performance of ATMEGA 16 and 8051 microcontroller in automatic car parking in terms UBBR (UART bit rate receiver)

Our Parking system is best suited to find out the nearest parking area among many parking places available in a city. We have used gyro mechanism in our parking system, which shows the nearest distance to park. A switch mechanism is inserted in the car because the car will pass by many paths and it will take many coordinates as garbage values. When this switch will on inside the car, coordinates of car will be generated using gyro inside the car. If the switch is not pressed, the car will not get any information because switch is programmed for fixed coordinates only. We could implement this system with 8051 microcontroller also but to achieve the good data transmission rate at least 9600 kbps baud rate is required, to achieve this baud rate the crystal frequency should be 20 MHz, which is fixed in 8051 microcontroller (XTAL = 11.0592 MHz).

VIII. CONCLUSION & FUTURE SCOPE

Automatic multi-stored car parking system is very good substitute for car parking area. Since in modern world, where space has become a very big problem and in the era of miniaturization its become a very crucial necessity to avoid the wastage of space in modern, big companies and apartments etc. In space where more than 100 cars need to be parked, it's a very difficult task to do and also to reduce the wastage of area, this system can be used. This Automatic Car Parking enables the parking of vehicles-floor after floor and thus reducing the space used. Wireless car parking system implementation is really very challenging; we have implemented our system of car parking upto three floors. Zigbee transceiver module is used as wireless

technology and the implementation of such system we have following advantages.

Parking Space Monitoring: Monitoring Parking space from a remote location and controlling of pumps can be done.
Better Utilization of space available: parking space better utilization efficiency saves time and more no of vehicles can be parked simultaneously.

Security Gates: Since through a specific access codes we could utilize the parking for a registered users. Deployment of a security barrier or tyre puncture strip if gate is breached.

For over 25 years, Remote Control Technology has been a leader in innovative applications of wireless Radio Frequency (RF) remote control and telemetry devices. These Technologies is continually expanding its product offerings and services to meet emerging customer needs, and its implementation using wireless modules is the next future which will be implemented in malls, buildings and cities.

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