

# A Secured Vehicle Parking Management and Reservation System using Zigbee and GSM Technology

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## ABSTRACT

Now a days, the main problem that the vehicle users finding is to find empty parking space to park the vehicles and security to the parked vehicle. This paper describes a solution to this problem, a secured vehicle parking management and reservation system. It includes access control unit and vehicle parking lot monitoring unit. Each parking lot is provided with infrared sensor, whose function is to monitor the parking field 24x7. The lot status is continuously monitored and transmitted to the access control unit. The user can request to reserve the parking lot by sending a SMS. Based on the status of parking lot monitoring unit the confirmation or acknowledgement SMS is sent to the user. User has to reach the parking bay within the time given or the reservation will be cancelled. A barrier gate is provided to each level of parking bay where the user has to enter the password to open the gate.

**Keywords:** GSM, GPS, Zigbee, Car Parking

## I. INTRODUCTION

Now a day, the number of vehicles and its usage is increasing rapidly. Finding vacant parking space is becoming more and more difficult. Parking problems are growing and becoming intolerable. As the number of vehicles increasing vehicle theft is also increasing[1]. Therefore there is a need for vehicle parking management and to provide reservation to park the vehicle and security for the parked vehicle.

## II. LITERATURE REVIEW

Present smart parking system uses camera and load cell based vehicle-monitoring system, which is not cost effective and does not provide full-scale security to the vehicles. This project allows the user to find vacancy in parking lots prior to entering the parking bay. The user can reserve the parking lots and also

he/she can ensure his/her car safety by entering password generated by the security module of this system.

The vision-based car parking systems [4] has human supervision to find the empty parking space and total parking space available. In addition, it uses sensor-based supervision whose installation and maintenance cost is high.

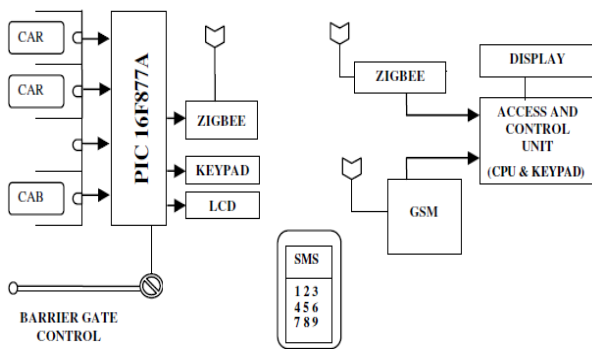
A comparative study is made where Smart Parking System based on Wireless Sensor Network [5]

(WSN) technology. In this work CCTV is used for security surveillance. The camera will capture the image and it is processed by AVR microcontroller and transmitted to central computer via zigbee node. In central computer database is maintained for

parking service. Since CCTV installation is there in the system the cost to implement this is high. Finding nearest parking space is implemented in the paper [9], demonstrates the design and implementation of Wireless Mobile-based Car Parking System (WMCPS). It uses SMS service to find the nearest parking space for the drivers. More work can be found on frameworks on parking system [10] and smart parking system [11].

### III. METHODS AND MATERIAL

Figure 1 shows the secured car parking and reservation system which consists of three modules, parking lot monitoring module, parking lot reservation module and security module.



**Figure 1.** Block Diagram of Secured Vehicle Parking Management and Reservation System

#### A. Parking Lot Monitoring Module

The parking lot is provided with infrared sensors and is allowed to sense the parking area continuously 24x7. If it detects any vehicle in the parking lot, it will indicate the presence of vehicle 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 coordinator system at the entrance of the parking bay when the access control requests the lot status. Then the parking lot status is updated in the database system. This scenario suits well for single level

parking system. For multilevel parking system multiple Zigbee nodes will be used one for each level and a network is formed between the Zigbee nodes. In this proposed system, PIC 16F877A series controller and CC2500 RF modules are used.

#### B. Parking Lot Reservation Module

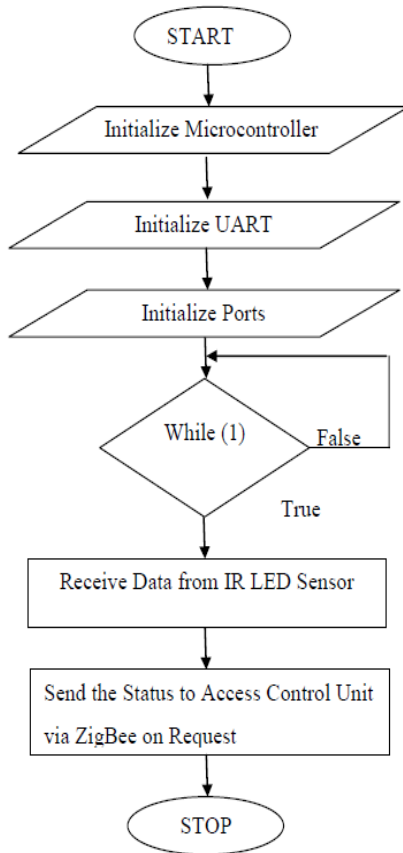
When the user wants to reserve a parking lot in advance, user has to send a reservation SMS. When the coordinator system receives the SMS from the user, it will start to check whether there is any vacancy in the parking lot. If lot is available means the control unit will send an acknowledgement message along with the entry password to the respective user who has requested for parking lot reservation. A timer will be started for that reservation. Before the timer expires the user has to reach and enter the password, if not the reservation will get expired and the expiration message will be sent to the user. If lot is not available, 'lot not available' SMS will be sent to the user. If user reaches on time, he has to enter the entry password in order to access the parking lot. An access system which is available at the entry of the parking bay is used to provide the password. If the password is correct means the barrier gate will get open and allow the user to enter the parking level. Once the user parked the vehicle in the respective parking lot allotted, the user has to press a key, which is available in the parking lot which enables the security monitoring of the vehicle.

#### C. Security Module

The user parks their vehicle in the parking lot; the sensor will sense the presence of vehicle in the parking lot. If the vehicle is taken out from the parking lot by the user means the user has to enter the exit password which is same as he entered to enter the parking bay. If the entered password is incorrect he/she is not allowed to get out of the parking bay as the barrier gate will not get open until correct exit password is entered.

### D. Flowchart of Vehicle Monitoring Module

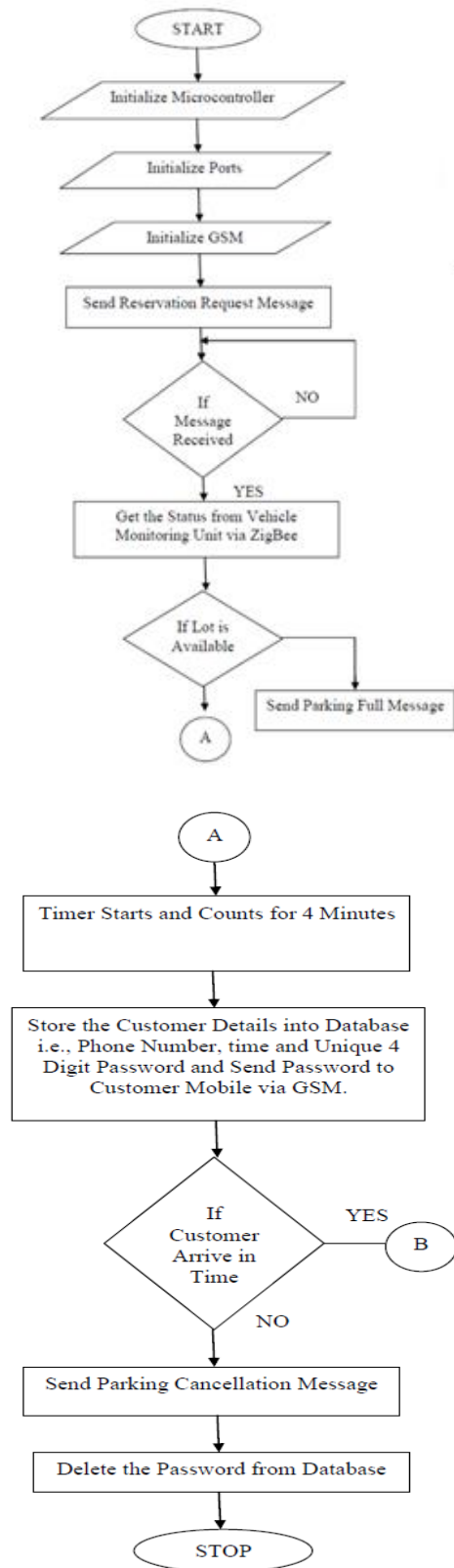
Figure 2 shows the flowchart of vehicle monitoring module. On power ON the microcontroller ports, interrupt registers, Zigbee device are initialized.

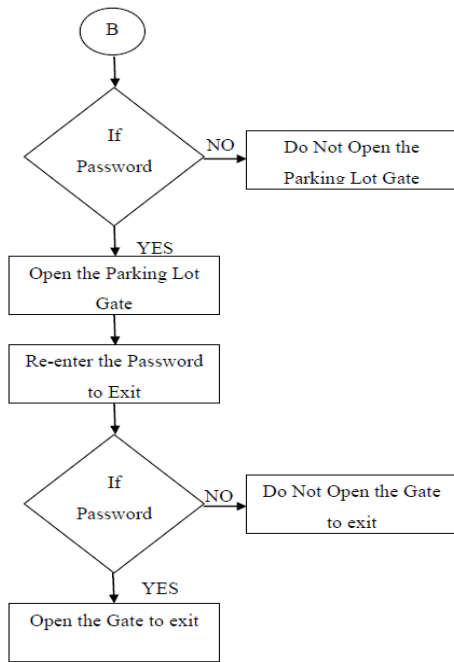


**Figure 2.** Flowchart of Vehicle Monitoring Module

### E. Flowchart of Reservation and Security Module

Figure 3. shows the flowchart of vehicle reservation and security module. On power ON the microcontroller, UART, ports, registers and Zigbee device are initialized.

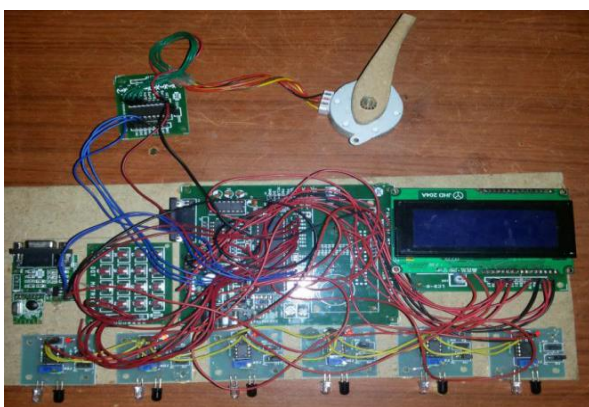




**Figure 3.** Flowchart of Vehicle Reservation and Security Module

#### IV. RESULTS AND DISCUSSION

This chapter provides details about the results obtained from the work done and output of the project under various conditions. The Figure 4a shows the snapshot of “A Secured Vehicle Parking Management and Reservation System using Zigbee and GSM Technology”. The communication between vehicle monitoring unit and access control unit is through Zigbee device. On power on the Zigbee modules of both the unit, microcontroller, GSM and LCD are initialized.



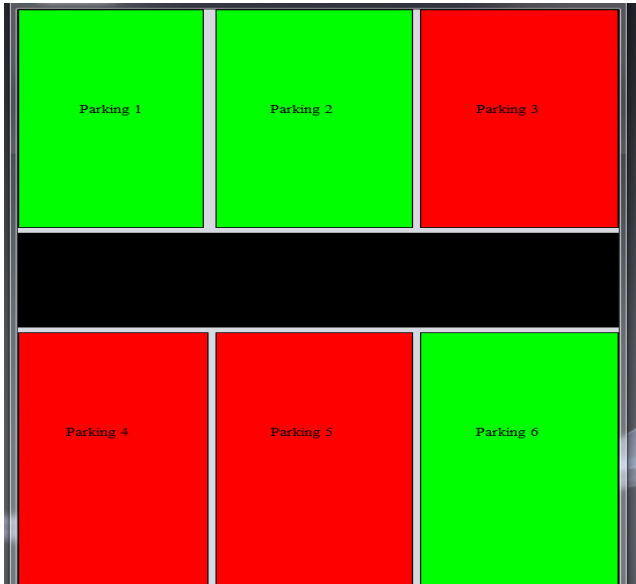
**Figure 4(a).** Snapshot of Vehicle Monitoring Unit



**Figure 4(b).** Access Control Unit

When the access control unit receives the reservation request message (“book”), it reads the parking lot status from the vehicle monitoring unit via Zigbee. If lot is available the control unit sends an acknowledgement message along with entry password i.e., “Your parking has been booked, Please enter “+password+” at the venue!” to the respective user who has requested for parking lot reservation. Four minutes of time will be allotted for that reservation. Before the timer expires, if the user reaches parking bay and enters the correct password the gate opens. It is done by use of stepper motor. To exit from the parking bay the user has to enter the same password or else the gate does not open hence the security is achieved. If the user does not reach before time expires, the “your reservation has been cancelled as you have delayed your arrival time” message will be sent. If the lot is not available, the “Parking full, Sorry for the inconvenience caused” message will be sent.

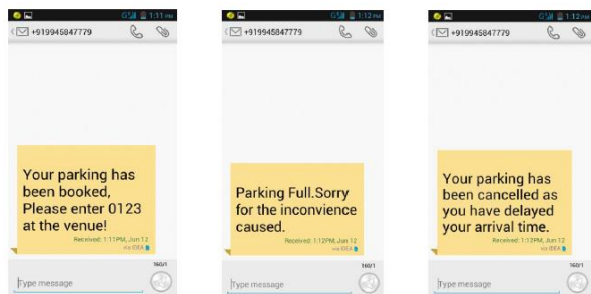
Figure 5 shows the front panel which gives the information about vacancy in the parking lot. And also it shows the unique password generated to each users, the time of message received. The flag indicates the status of user whether the user entered the parking bay or not. Shows the screenshots of mobile showing the different output of the project. Figure 6.



**Figure 5.** Front Panel of Vehicle Monitoring Unit

**Table 1.** shows the database of the users requested for parking lot reservation.

	phone_number character varying(15)	password character varying(5)	date_time timestamp without time z	in_flag integer	milli_second bigint
1	9731134442	4532	2014-05-19 12:24:37.594	0	1400482477672
2	9945047779	5032	2014-05-19 12:24:56.314	1	1400482496392
3	9945047779	2150	2014-05-19 12:26:08.059	0	1400482568137
4	9731134442	2415	2014-05-19 12:25:57.607	1	1400482557669
5	9945047779	1234	2014-05-19 12:26:55.187	0	1400482615265
6	9731134442	5230	2014-05-19 12:27:08.181	0	1400482628244
7	9945047779	1245	2014-05-19 12:28:31.693	1	1400482591787



**Figure 6.** Screenshots of Mobile Showing the Output

The above figure describes the output of the project under three different conditions. To reserve the parking lot the user has to send the message. On receiving the SMS the access control unit requests the vehicle monitoring unit for the parking lot status. Vehicle monitoring unit checks for vacancy by the status of IR LED sensors. If there is vacancy it sends that information to access control unit via Zigbee. Then access control unit sends the confirmation

message regarding the reservation with unique password. The second screen shot shows if there is no vacancy the user receives parking full message. If the reservation is done the access control unit will all some time to reach the user to parking area. If the user do not that area and enter the password then the reservation will be cancelled and he receives the acknowledgement SMS for the same as shown in third screenshot. This paper is mainly designed to make easy for the public to find empty parking lot easily in their busy schedule. This allows the user to reserve their parking lot in prior. The user sends an SMS regarding the requisition to reserve the parking lot. On receiving SMS it checks for the vacancy in the lot. In the above table first and third condition shows the result for this. The table 2 shows the results of this project under various conditions.

**Table 2.** Result of This Project under Various Conditions

	CONDITIONS	OUTPUT
Under Dark	If vacancy available	Your parking has been booked. Pls enter **** at venue
	If timer expires	Your parking has been cancelled as you have delayed your arrival time
	If no vacancy	Parking full sorry for the inconvenience caused
	If password correct	Gate opens and allows the vehicle to enter to the bay
	If password is incorrect	Gate do not open
	Lot status	Clearly Identified
Under Light	Lot status	Cannot be seen clearly

If vacancy is available reservation is done and it allots four minutes of time. If timer expires reservation will be cancelled. When the system reserves the parking lot it generates the password and sends back to the user. When the user reaches the parking area password must be entered in the keypad. The access control unit matches this password, if it is correct it allows the user to enter into the bay. Similarly while taking out the vehicle from the bay again same password must be entered, if not the gate do not opens, hence the security is achieved. To monitor the parking lot status IR LED sensors are used. These sensors are sensitive to light. Therefore for better result the project must be carried out under dark.

## V. CONCLUSION

Finding the parking space in more metropolitan areas especially during rush hours is difficult for drivers. The difficulty arises from where the available space may be at that time. It commonly results more traffic congestion and air pollution by constantly cruising in certain area only for the available parking space. If the parking is available there is always frustration for drivers from auto theft. This project overcomes these problems. The Secured Vehicle Parking Management and Reservation System were implemented successfully with the integration of Zigbee, GSM and Microcontroller. Since the reservation is done through a simple SMS technology it is not difficult for common people to reserve their parking spot. And it will not consume much time to reserve the parking lot. To know the confirmation for their booking the user get acknowledgement message in return. All these are done through GSM technology. Since GSM uses the mobile network for the communication the message delivery will be failed if no network coverage. Since the parking lot status is monitored by IR LED sensor it is sensitive to light. For better result it must be operated under dark area. This system is well suitable for underground parking system. The result indicates the accuracy in determining the presence of a vehicle in a parking lot. The system also reduces the traffic congestion in finding the available parking lots. Since password is required to exit from the parking bay, high level of security is achieved. The system proves to be cost effective and highly secure.

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