LOW COST AUTOMATED PARKING SYSTEM FOR MULTI STORIED VEHICLE PARK

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ABSTRACT

This paper describes the design of low cost automated parking system for multi storied vehicle park. A multistoried car park (also called a parking garage, parking structure, parking ramp, parking building or indoor parking) is a building designed for parking and where there are a number of floors or levels on which parking takes place. Most of multi storied parking systems are non-automated due to high capital investment required for the automation. The designed system consists of a microcontroller to control the mechanical parts and web based system for control software of the system. The ultrasonic sensors continuously detect the existing situation of the parking block and update the database according to those results. Web base system facilitates for viewing details of parking block details and reserve the parking block for the system users. User can do their payments through Pay Pal payment system more securely. The system automatically generate unique authentication password for each reservation separately. This authentication password can be used to access the reserved parking block. The prototype developed to test the design worked well for a multi storied parking place.

Keywords: Multi storied parking system, Microcontroller, Ultrasonic sensors

1. INTRODUCTION

Automated parking system is a very popular topic in today's industrial world. The available parking systems which are considered as non-automated multilevel or multi-storied parking methods such as, robot car parking systems, automated multilevel circulation parking systems etc, have been implemented all over the world[1]. But, these systems have a major disadvantage of user inconvenience which is successfully eliminated with the use of automated multi storied

vehicle parking systems. This project was mainly focused on the problems of the already developed multi storied parking systems, because most of them are non-automated and it is not possible to apply most of automated parking technologies to these multi storied parking places. However, it is necessary to automate the systems which are in residential areas to maximize the user satisfaction. In this project, the main concern was to automate multi store parking systems with the aim of providing solution to areas such as, existing building architecture, cost required to deploy the automated system, user convenience, integration of existing systems with developed automated system and security of the vehicles. Those challenges were successfully eliminated with the developed automated system for non-automated multi storied parking systems.

2. METHODOLOGY

2.1 system overview

A prototype of automated system for multi storied parking system have been designed and implemented according to the block diagram shown in figure 1. The LCD display was used to display the messages and information of each block. Dial pad was used to enter the verification code and, buzzer was used to detect unauthorized access. The web based system with serial communication was used for access the parking web site and retrieving database data for control the mechanical part of the system. Microcontroller and the SQL Server management system are the main controlling parts of the system. The mechanical part of the system was set to act according to information retrieved from the SQL Server database management system.
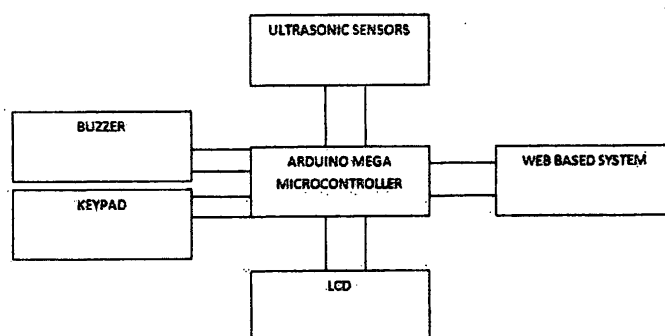

Figure 1 Block diagram of the overall system

2.2 Mechanical part of the system

Ultrasonic sensors which were used to detect the existence of a vehicle, always examine the existing condition of the parking block and the database status. Online users can also view and update the details of SQL server database management system. Customers of the parking station can enter their verification code using keypad module at the parking slots and LCD display and buzzer are reacting according to the information coming from serial communication. Figure 2 shows the circuit diagram for the mechanical part of the system[2, 3,4].
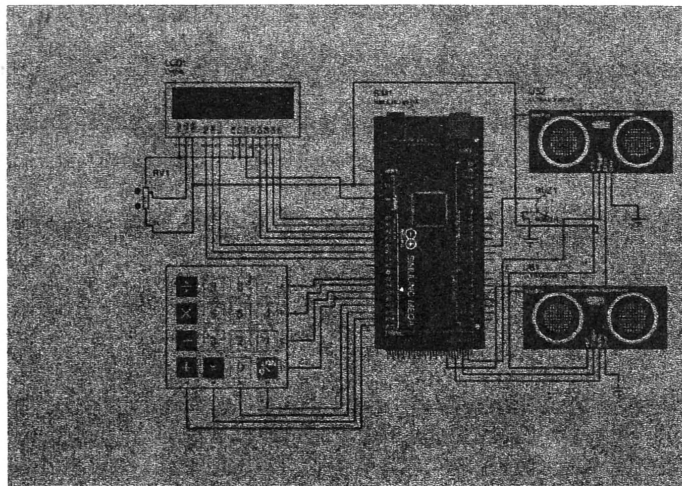

Figure 2 Circuit design of the mechanical part

The figure 3 shows the prototype design of the overall hardware system. It consists of ultrasonic sensors, LCD display, a keypad, a buzzer and a microcontroller to control mechanical part and a web base system for software system control.
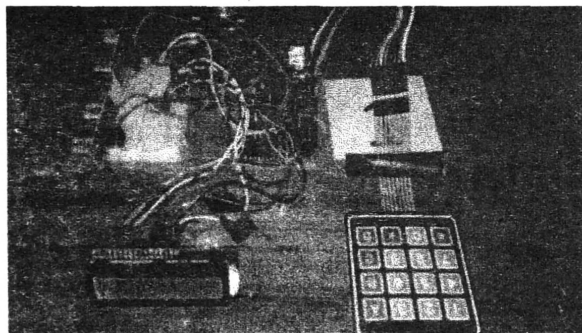

Figure 3 Prototype view of the overall system

Figure 4 shows the main interface of the web base system. System user can use this web based system to reserve a parking block of the system and view details regarding to the parking system

Figure 4 Main interface of the web base system

2.3 Microcontroller programming

Microcontroller is programmed to determine the current condition of the parking block using ultrasonic sensors and to provide commands to other hardware sections according to the retrieving information through serial communication[5,6,7].

2.4 ASP.NET programming

The ASP.NET web development technology was used to develop the web based system with SQL Server database management system. Pay Pal payment system was integrated with web based system to develop online payment system[8,9].

3 RESULTS AND DISCUSSION

The results tested with the prototype developed showed (Table 1) that the microcontroller system controls the mechanical parts of the system according to the information retrieved from the database and update stored information of web based system according to the information retrieved from mechanical part of the system.

Table 1 Testing results of the system

Test Number	Steps to test	Expected result	Result
1	Parking block is empty	Dispaly "Free to park"	OK
2	Park a vehicle in non-booking time slot	Display "No space"	OK
3	Booking time period without a vehicle	Display "Enter password"	OK
4	Booking time period with a vehicle and	Display "Free to park"	OK

	password was entered		
5	Booking time period with a vehicle and password was not entered	Display "Unauthorized"	OK
6	Booking time period with a vehicle and password was not entered	Alarm sound	OK
7	Enter password correctly	Display "Allow to park"	OK
8	Correct user name and password	Login to the system	OK
9	Incorrect username correct password	Message "Your login attempt was not successful. Please try again"	OK
10	Correct username incorrect password	Message "Your login attempt was not successful. Please try again"	OK
11	Incorrect username incorrect password	Message "Your login attempt was not successful. Please try again"	OK
12	All fill without user name	Message "The username field is required"	OK
13	All fill without E-mail address	Message "The email field is required"	OK
14	All fill without Password	Message "The password field is required"	OK
15	All fill without confirm password	Message "The confirm password field is required"	OK
16	Select red colour parking slot	You can't reserve this block, please choose another block	OK
17	Select blue colour parking slot	Free space for you, reserve your block	OK
18	Save without filing date	Please fill the date	OK
19	Save without filing category name	Vehical number required	OK
20	Select already booked time slot	Block already booked for the requested time slot.	OK
21	Save without filing level number	Please add level number	OK
22	Save without filing level name	Please add level name	OK
23	Save without select a level	Please select a level	OK
24	Save without filing block name	Please add block name	OK

The cost required to implement the entire system was about 4000 Sri Lankan Rupees. This value is very low compared to the systems developed to automate parking systems. Another advantage of the system is that it do not need any physical changes for existing parking stations for implement the system. The prototype worked well with serial communication using wired media. Sometimes it will be hard to implement the wired media peripherals in a parking station. This weakness could be removed with the use of ethernet microcontroller shield for this system.

4 CONCLUSION

This study was carried out to design a system to automate multi storied parking places. The system consists with Arduino microcontroller based mechanical section and ASP.NET based web system. The results tested with the prototype developed showed that system was able to fully automate the parking system. The total cost for the prototype system is about 4000 Sri Lankan Rupees which is very low compared to automated systems available in the market.

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