

Indoor Parking Guidance System

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Abstract - This paper makes an attempt to provide solution for parking problems in multi level parking by developing Parking Guidance System. Multi level parking buildings have come up in order to accommodate more number of vehicles. But this does not solve the problem, the major issue with this system is that the driver has to spend his time and fuel in order to locate the free space in the building. The Parking Guidance System is designed so that it communicates and dynamically updates the status of parking slot in each floor in management software. The system uses software interface and visual aid to maintain the parking allotment. The availability of the parking lot is checked by ultrasonic sensor, this system provides an efficient solution for parking

Key Words: Arduino, PGS, RS485, Ultrasonic sensor, visual basic

1. INTRODUCTION

Parking has become a major problem due to increase in the use of vehicle. In order to deal with the issue of parking multilevel parking buildings have come up because it occupies less land space and can accommodate more number of vehicles[1]. But this does not solve the problem because in multi level parking it becomes very time consuming task for the driver to find a free space. It is completely depended on human to human interaction which is not efficient. The solution to the mentioned problem is to have a guidance system which will automatically guide the driver to the available space in the building.

The parking guidance system (PGS) presented in this paper uses ultrasonic sensor in order to locate the free space. Master and slave communication is used to communicate the status to the PC software which will have all the data of the parking lot. The software is built in visual basic. The additional features of the software are that it can store the details of vehicle in a database. Slot booking is also possible by using this software. This helps the parking management team to manage parking lot effectively. The paper describes different methods used in parking management in literature survey and then describes the proposed guidance system. This system is tested and results are shown in the figure.

2. LITERATURE SURVEY

2.1 Use of Loop Detector as counters

Loop detectors are placed at the entrance and exit of the parking lot. There are connected to 7 segment display, so the detectors count the number of vehicles entering and leaving but it does not guide the drive to the available space it only gives the information about number of vacant space in the lot.

2.2 Wired and wireless sensor network for vehicle detection

Wired and wireless sensor both can be used to detect the vacant space in the lot. Both have advantages and disadvantages. Use of wired sensor is more reliable than wireless sensor network [2].

2.3 RFID System

Automated vehicle identification technique is used in RFID system, again it can show the status of the number free space but location cannot be detected [4]

2.4 Image processing technique

Camera is used as sensor in this system, it can be used but it is expensive method and the data generated is huge [3].

3. PROPOSED GUIDANCE SYSTEM

In the proposed guidance system ultrasonic sensor is used for vehicle detection. The problem with wired sensor network is that large numbers of wire and input output points are required, the solution to this problem is to use master and slave communication i.e. every floor will have ultrasonic sensor placed on every parking slot. This sensor will also be connected to led light indicating the status of parking space.

Every sensor will be connected to microcontroller which will act as slave controller. Every floor will have a floor controller which will collect the information all the slave controller present on that floor. There will be a main controller i.e. master controller which will get data from the entire floor controller. This main controller will be connected to computer which will have management software. RS485 is used as physical interface between master and slave because it allows multidrop connection, which is the need of the project. The management software will show the status of all the parking slot in the building so at the entrance itself the

person in charge will issue a ticket to the driver which will have the information of the parking slot the driver is supposed to go and park without wasting his time and fuel in hunting for a space in the building.

3.1 Components used for PGS prototype

1. Arduino UNO microcontroller
2. HC SR04 Ultrasonic sensor
3. Max RS 485 module
4. Visual basic to build parking management software

3.2 Functional block diagram of PGS

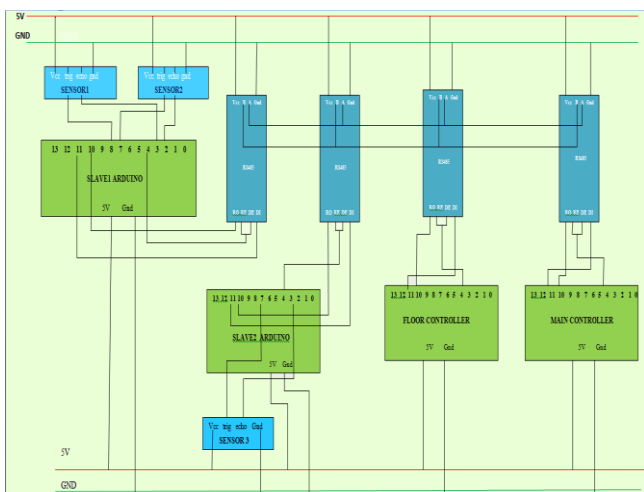


Figure 1. Functional block diagram

Two ultrasonic sensors are interfaced to one of the slave arduino microcontroller. Slave 2 arduino microcontroller has one ultrasonic sensor. The entire controllers are connected to each other through RS485 module.

3.3 Working of sensor network

The output of the ultrasonic sensor is in distance at which the obstacle is detected. By setting a distance range it can be determined wheater the vehicle is present or not. This prototype works on the same principle, the ultrasonic sensor is programmed to calculate the distance of the obstacle present. Every time it calculates the distance it will compare it with the range set. If the distance calculated falls in that range then it will turn the led on indicating the presence of the vehicle. Whenever the led is ON the slave will communicate it to floor controller and then master controller which will communicate it to software. The communication between slave and master is RS485 communication.

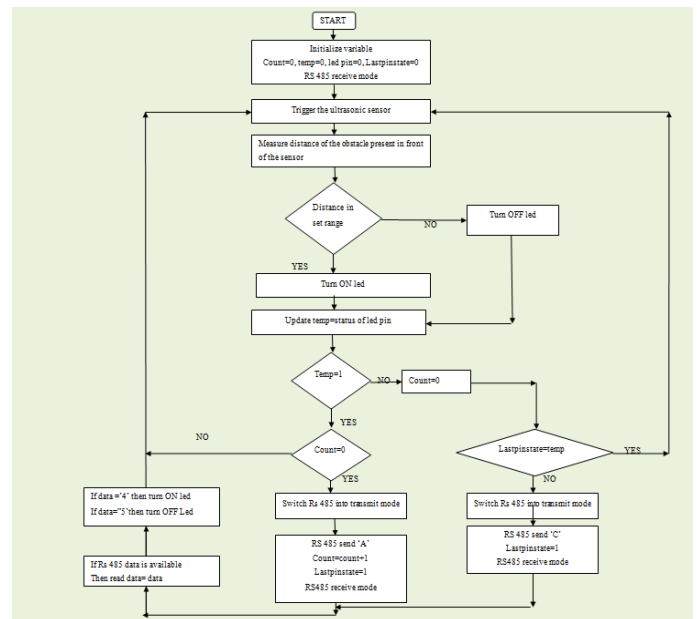


Figure 2 flow diagram of slave controller

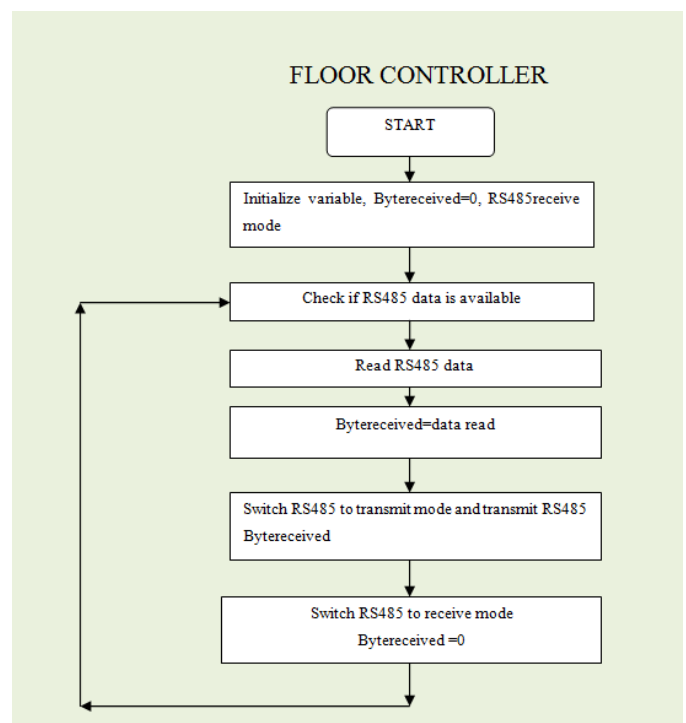


Figure 3 Flow chart of floor microcontroller

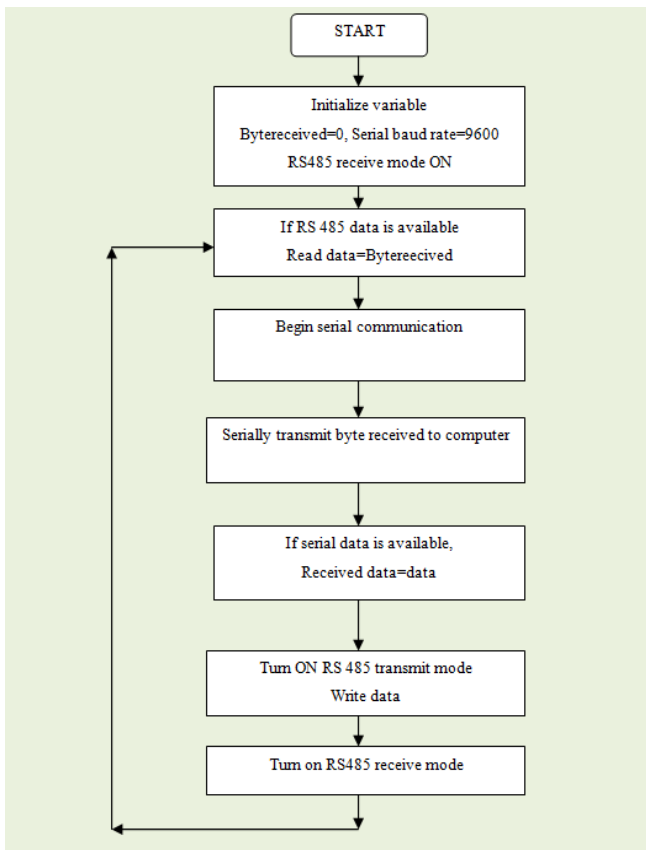


Figure 4 Flow chart of main controller

4. EXPERIMENT AND RESULTS

The PGS prototype is built and tested for one floor. The management software is built in Visual Basic. This will be placed at the entrance of the multi level parking building. Main controller serially transmits the data to the software. When the car arrives, management software is used when we log in to the software, status of each floor is seen as shown in the figure below.



Figure5 PGS software showing status of each floor

The green colored box indicates the floor where parking space is available. As the system is built only for first floor that floors button is clicked. First floor's parking space details are seen as shown in the figure 6. A1, A2 etc are the slots present on that floor. Buttons on the right are used to issue ticket. Button in the center are used for slot booking and on the left hand corner every floor status is visible so if on one floor if all the space is occupied than user can select

any other floor where the space is available which is indicated by green color box in front of every floor.



Figure 6 First floor parking slot status

As it is seen all the spaces on that floor are vacant A1 slot ticket is issued to the driver by clicking on the button on the right section of the window. While issuing the ticket the vehicles details are recorded which is added in a database i.e. Excel file. The ticket will contain information of vehicle number, date, in time, parking charges, slot and floor on which the vehicle will be parked. So the driver after collecting the ticket will directly go to the allotted floor i.e. first floor and A1 slot and park so time in searching for the space is reduced. The A1 slot of which the ticket is issued will turn red in color indicating occupied. It will turn green only when the car leaves and this data are communicated from the sensors attached on each slot. Also when the ticket is issued that slots button will not be visible in available slot section and booking buttons on the top the slot will be disabled. As shown in figure 9

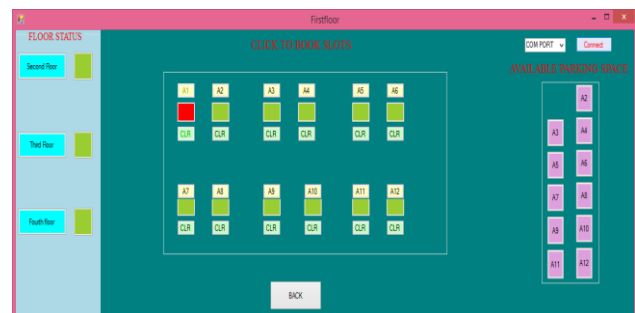


Figure 7 occupied slot

The figure 8 shows the ticket that will be printed and issued to driver



PARKING LOT MANAGEMENT SYSTEM

Number Plate	MH03A8456
Parking Block Number	A1
Date	05 April 2016
In Time	19:44:55

Figure 8 Ticket issued

When the vehicle leaves that out time is also updated in the database. The database can be used to view the history which will help the management in fixing the parking charges.

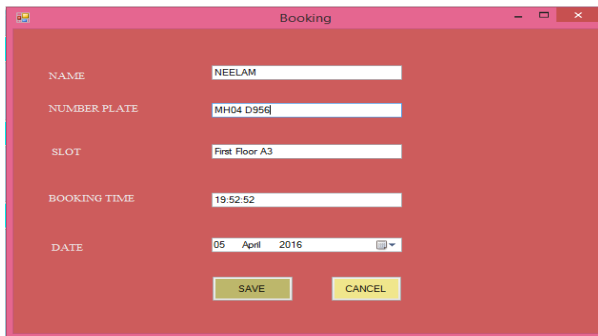


Figure 9 slot booking window

The above window will be opened when the button above the slot is pressed. This will also serially send signal to the led attached on that slot which will turn red. The red and green led light helps the driver in locating free space.

If the driver parks in the space which is not allotted to him the sensor would sense the presence of the vehicle and send signal to software which will make the slot on which car is parked invisible so that the particular slot's ticket will not be issued.

The database will have all the information i.e. the in time of the vehicle, out time, and car details as well as date. The figure below shows the same.

A	B	C	D	E	F
plate number	parking_b date	time	Status	outtime	
MH07AH0125	A1	23 March	09:03:26	Y	09:03:40
MH05HJ0123	A2	23 March	09:51:36	Y	09:51:50
MH06HL0236	A3	23 March	09:52:17	Y	09:52:48
MH08DH2567	A1	23 March	10:02:47	Y	10:03:04
MH07KL1256	A2	23 March	10:03:26	Y	10:03:39
MH08JK0147	A3	28 March	09:00:43	Y	09:09:27

Figure 10 Parking details

5. CONCLUSION

As the prototype is developed and tested for only one floor and the results are seen in the figure 5 to figure 10. This can be extended to all the floors. The execution time is very less i.e. it is the time period when the car enters and ticket is issued which is about only 1 to 2 minutes and as the driver is already aware of the vacant space the time to reach the space will be less as compared to a system where vacant space is not known.

The main purpose of this guidance system was to reduce the time of the driver in hunting for a space in a multi-level building, by use of this sensor and management software this is achieved as the driver at the entrance itself is aware of the slot he has to go and park.

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