

AUTOMATIC CAR PARKING SYSTEM USING RFID

Vipul More¹, Kiran Ravariya², Sohil Shah³, Azharuddin Solkar⁴

^{1, 2, 3, 4}Student, Electronics and Telecommunication, Rajiv Gandhi Institute Of Technology, Maharashtra, India

ABSTRACT

In recent times the number of vehicles are consistently rising and parking space is becoming a major issue in urban and semi urban cities so there is needs to design a parking system which will reduce manual work as well reduce the problem of cars parking on streets. Since in modern world, where space has become a very big problem and in the era of miniaturization it has become a very important to avoid the wastage of space in modern, big companies and apartments etc. Automatic Car Parking enables the parking of vehicles-floor after floor and thus reducing the space used. In this paper we implemented the concept of Microcontroller Based car parking system. As we see in the modern world everything is going automation, here we have deployed an automatic microcontroller based system which is used to sense the presence & movement of cars and depending on availability of space it allows parking and same is displayed on LCD panel. There is also RFID module that will provide security as users who have authority can swap the RFID cards and get entry otherwise not. It will also be used to settle the parking fee that has to be paid by the user. The project is designed for automatically parking a car into the desired parking spot in a multi-floor parking lot.

Keyword –Application of RFID, Automatic Car Parking, Automatic Parking System, Car Parking, RFID.

1. INTRODUCTION

This paper is devoted to make use of control systems in parking systems. The control system is going to play a major role in organizing the entry and the exit for the parking lot. It also presents the design of multi-level parking lots which occupies less need on the ground and contains the large number of cars. Therefore, the need of using technologies became inevitable. Today the parking-space has become a very big problem, it has become very important to avoid the wastage of space in modern big Automatic multilevel car parking system helps to minimize the car parking area companies and apartments etc.

There are two types of car parking systems: the traditional and new automated parking systems. The automated car parking systems are likely to be more cost effective when compared to old traditional parking garages. The multi-storey automated car park systems are less expensive per parking slot, since they require less building space and less ground area than a traditional facility with the same capacity. Both automated car parking systems and automated parking garage systems reduce pollution. A multilevel car parking is essentially a building with number of floors or levels for the cars to be parked.

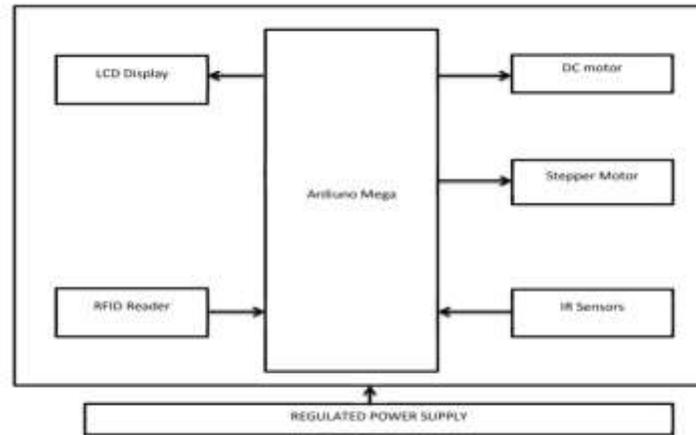


Fig -1: Block Diagram.

The different levels are accessed through interior forklift system. An automated car parking has mechanized lifts which transport the car to the different levels at a certain position. Therefore, these car parks require less building volume and less ground space and thus being cost effective. This system saves a lot of space where more than 100 cars need to be parked as compared to other systems. This system enables the parking of vehicles, floor after floor and thus will reduce the space used. Here any number of cars can be parked according to the requirement. This makes the systems modern and even a space-saving one. Multi-level car parking system is essential especially in regions facing space shortages, also in areas which cater huge crowds. Failing to accommodate the growing number of cars, it has become important to come up with more efficient and effective parking solutions. In this regard, multi-level automated car parking is going to be considered an effective tool in tackling the issue of parking. Multi-level car parks also offer great possibility and flexibility for the realization.

The main objectives of the car parking system are- to design and fabricate a multilevel car parking system and to design and fabricate a cost-effective model, to develop a fully automated control system and to prevent illegally parked vehicles.

2. LITERATURE REVIEW

Automated parking was infrequently built locally, although it did catch on in Asia; there are 1.6 million automated spaces recently in Japan. In the 1980s, one system built in Honolulu was a part of a small office construction on a crowded mixed-use street. Then, in the early 80's, automated parking solution were embraced by Japan and USA and spread to Australia, Southeast Asia, China, Philippines and Singapore. Between early 70's and late 80's, around more than hundred automated systems were built worldwide.

In 20th century the automated parking can be used for multi purposes even though in short term it will come to life again to be implemented and managed by a swipe of card and by many other methods. It will be spread to solve many problems of parking issue and preserve the environments.

While doing a survey we have found that this automatic car parking system has been proposed by various researchers using different technology.

In some paper some researchers have proposed this system using Around View Monitor (AVM). In their paper they have discusses fusion of AVM and ultrasonic sensor, used to detect the vacant parking slot in the automatic car parking system. The AVM provides a virtually 360 degree scene of the car in bird's eye view. The AVM helps the driver to maneuver into parking spots. Through the bird's eye view, a driver can check for obstacle around the vehicle. First, the parking slot marking detected in the AVM image sequence. A tree structure-based method detect the parking slot marking using individual AVM image sequence and image registration technique. Second, empty slot is detected using ultrasonic sensors. The probability of parking slot occupancy is calculated utilizing ultrasonic

sensor data acquired while the vehicle is passing by parking slots, and finally the selected empty slot is tracked and the vehicle is properly parked in selected parking slots. [3]

Some other researchers have discuss this system using another technology i.e. GSM Technology. The functionality of the technology is that user sends a message to the GSM modem which is placed at the parking end. The GSM modem will send a conformation message to the user whether the slot is vacant or not. If it is vacant then the user has to message the exact time and duration he/she wants to park the vehicle in the parking slot. Then the GSM modem will send a password and the parking lot number to access the reserved parking lot. Once the conformation message has been send, the counter for the reservation time will automatically start for sending message. [4]

Another paper attempts to discuss this system using FPGA Technology. In their paper they have discuss how to implement an automatic car parking system using FPGA technology ,where the access in the parking which is made by barrier, if there are vacancies with the lifting of the barrier a ticket is issued with a client code and there starts a timer for measuring the time left in the parking. The analog signals transferred through a digital analog converter as input signals in the FPGA. To work with FPGA Xilinx software has to be used. [5]

Another paper discusses a system using some digital key along with some robotic technique. When a car enters the entry of the automated car parking system, an IR detection subsystem detects the presence. Then the driver is promoted to enter a valid key and to choose the option of either parking or retrieving the car. Each key is checked for accuracy and assigned a designated parking slot .Upon entering the correct key, car is picked up along with the pallet from the stack system and placed in the designated spot .When drivers return to pick up the car he enters the valid key for which the system will check in its database and the car is return back to the drive way. The stack system will pull down the pallets to make room for incoming pallet. The system includes robotic lift with motors for picking the car and placing it in the designating spots. [6]

Another paper discusses a system where microcontroller 89S51 has been used, in their paper they have discussed a system which is automated with the user being given a unique ID corresponding to the trolley being allocated to him/her. The idea is to park and move cars with no disturbance to the already parked cars in their system.[7]

Some other researchers have discussed this system using RFID. According to their system, The vehicle owner has to first register the vehicle with the parking owner and get the RFID tag. When the car has to be parked, the RFID tag is placed near the RFID reader, which is installed near the entry gate of the parking lot. As soon as the RFID tag is read by the reader, the system automatically deducts the specified amount from the RFID tag and the entry gate boomer opens to allow the car inside the parking area. At the same time, the parking counters increments by one. Similarly, the door is opened at the exit gate and the parking counter decremented. [8]

After doing study on various system using various technology, we have tried to discuss a system using Radio frequency technology (RFID), IR (infrared) sensors, Microcontroller. RFID technology is very useful in automation of vehicle parking system in mall/building.

3. METHODOLOGY

This section consists of the overall description of the hardware of the Automated Car Parking system and details of the circuits used in the project. It also discusses the mathematical formulas or any other calculations involved in the project.

3.1 Design of the Prototype

The prototype for the car parking is just a structure with metal scaffoldings to support the cars that are parked by the forklift. The forklift places the car in the vacant space with the help of the pallets.



Fig 2: Rough View of the Prototype

3.1.1 Left and Right movement & Up and down Movement of the pallets:

The left and right movement of the pallets will be achieved by using DC motors. Similarly, the up and down movement of the pallets will be achieved by using another DC motor.

3.1.2 Vertical motion of the platform:

The up and down motion of the platform will be achieved by using gears with string attached, extending in vertical direction. Moving the forklift up and down could be achieved by, either using motor and gears or linear actuators. In our project, we chose the gears as it gives smoother continuous movement.

If the car was to be parked in the second floor, an instruction will be sent to the gears to move the forks of the forklift to the upper level of the spot.

3.1.3 Rotation of the platform:

Each motor has a built-in Rotational Sensor that controls the movement precisely. The Rotation Sensor measures motor rotations in degrees or full rotations.

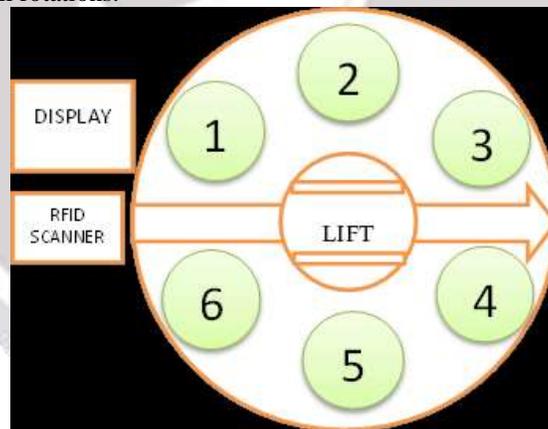


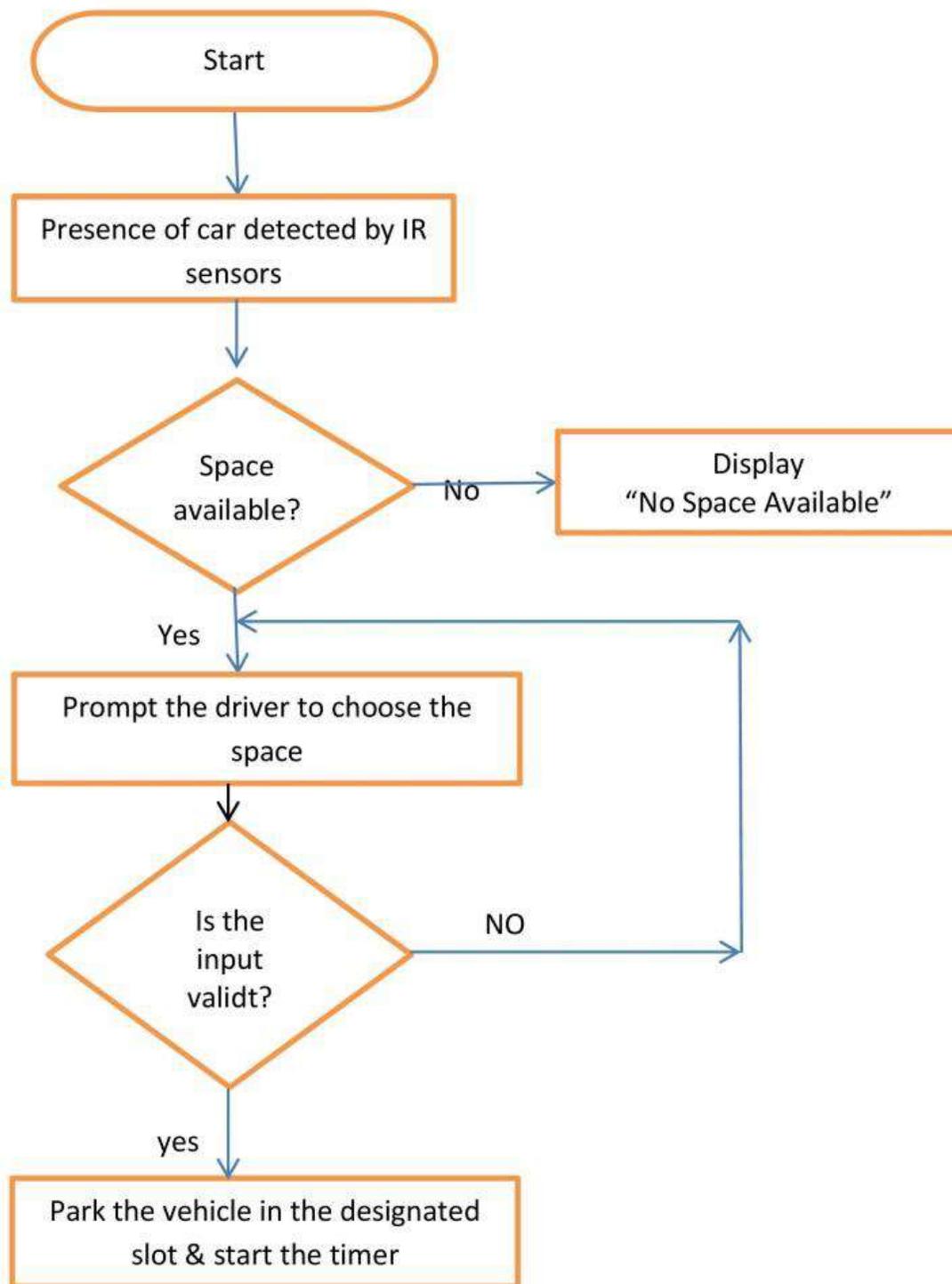
Fig 3: Top view of the prototype

3.2 Car Parking Algorithm:

After the admin starts the system, the driver is prompted to choose either to park or retrieve a car. On selecting the option for parking, the driver is then prompted to choose a vacant spot that is available, input given will be checked for accuracy and the spot will be made available to the user.

The car is placed on the rotating platform, after that, the program sends the signals to the microcontroller to move the forklift to the designated space this will be accomplished by sending continuous movement instructions to make smooth movement.

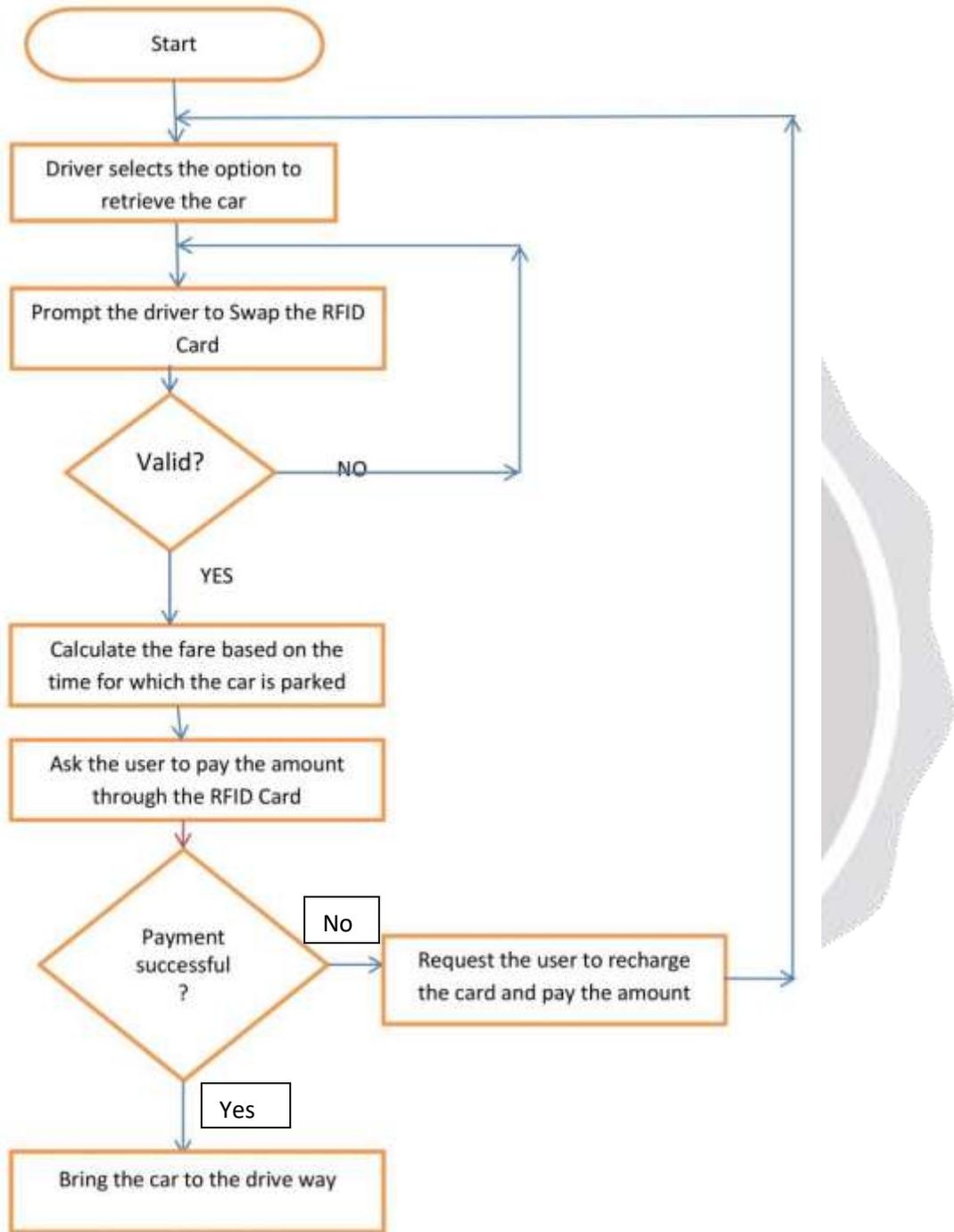
The commands for the working of the forklift will be written according to the following algorithm.



3.3 Car Retrieving Algorithm:

When a driver returns to pick up his car, he is required to choose an option of “retrieving” and then system will prompt the user to swap his RFID card. In the test, the system checks in the database that lists all the parked cars. The listed car is identified; the order is sent to the microcontroller to retrieve the car, the forklift moves to the designated parking spot and delivered the car to the driveway. If the car was not parked, an error message was displayed. The forklift is programmed for retrieving the car according to the algorithm written below.

Meanwhile the driver will be requested to pay the relevant parking fee using the RFID card; the car won't reach the drive way if the payment is not settled.



4. RESULTS

Case 1: A lift mechanism is used to park the car on the first floor which is implemented using motor. Motor is rotated clockwise it stops when it reaches on the first floor. The car is parked on the first floor successfully.

Case 2: The car which was parked on the first floor, was successfully retrieved & also the parking fee was collected successfully.

Case 3: A user tried retrieving a car which was never parked in actual or a wrong RFID card was swapped up, in both the cases, an error message was displayed on the LCD screen

Case 4: A user tried retrieving a car which but the parking fee was not paid by the user and in this case, an error message was displayed on the LCD screen and the car was not brought to the drive way.

5. CONCLUSION

Automatic multi-stored car parking system is very good substitute for car parking area. The design is obviously an efficient one because compared to other existing design it can handle more cars in a limited space. The lifting mechanism is also simpler and cost effective. LCD panel is provided to display the parking space availability information about the total number of cars that can be parked and the place vacant for parking. Two IR sensors TX RX pairs are used in this project to identify the vacant spaces. It is a versatile project with application in almost every field, be it residential or industrial. We would like to conclude this project as a very great and upgradable experience.

6. REFERENCES

- [1]. B.Waraich, RFID-Based Automated Vehicle parking system.
- [2]. P Joshi, M.R Khan and L Motiwalla, Global Review of Parking Management System and Strategies. Volume 2, Issue 6, June-2011 1 ISSN 2279-5141.
- [3]. Car Parking System (2011-12).
From Wikipedia: <http://en.wikipedia.org/wiki/CarParkingSystem>.
- [4]. A.A Kamble and A Dehankar Review on Automatic Car Parking Indicator System, International Journal on recent and innovation trends in computing and communication, Vol 3 no.4 pp 2158-2161.
- [5]. K Sushma, P Raveendra Babu and J.Nageshwara Reddy, Reservation Based Vehicle Parking System using GSM and RFID Technology, International Journal of Engineering Research and Applications Vol 3 no.5 2013.
- [6]. R.Khan, Z.Khan, Y.A Shah, K.Ahmed, A.Manzoor and A.Ali, Intelligent Car Parking Management System on FPGA, International Journal of Computer Science issues Vol 10 no.3 2013.
- [7]. A.Wafa, N.Zeba, Automated Car Parking, 2012.
Volume 2, Issue 3, April 2015
- [8]. C.Patel, M.Swami, P.Saikia, S.Shah, Rotary Automated Car Parking system, International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 4, Issue 2, March 2015.
- [9]. J. Ronald, Automatic Parking System, 2013.