Automated Multilevel Car Parking System Using PLC

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Abstract: Now a day's free land space in urban area is very difficult to find. The traditional parking system management requires large land area. This has to be changed so that we decrease the building area for parking and get better land utilization for that. In India there are some cities where the puzzle parking is available, but it has some drawbacks. For this purpose, we propose a PLC based automated multilevel car parking system design. We made a prototype model of a well-organized unmanned automated multilevel car parking system using PLC. The control technique will carry out a most important part in organizing the arrival to and leaving from the parking track. In our design model the multi-level parking slots contains the great number of cars in less space.

Keywords: Automation, Programmable Logic Controller, Multilevel Car Parking, DC motors.

I. INTRODUCTION

As population of world is gradually increasing and so is the use of vehicles. This results in parking issues in most crowded cities or places mainly in our country such as malls, market areas, offices etc. This gives us motivation to build an efficient space saving and automated car parking system which will reduce human efforts. For this we have designed a model in such a manner that it will automatically park as many as number of cars in a small and congested area. The main area of concentration of this project is to solve the space requirement problem for parking and also make it automated. Automated car parking is a technique where the system automatically park and retrieve cars that typically uses a lift mechanism. The ground area and the capacity of the garage can be used more efficiently by parking cars in this way. The intention is to compact more cars in the same space, reduce the space needed to park the same number of cars or allow car parking where previously there would have been no room. Automated car parking will make a huge difference in urban planning and in designing development of the future.

In this project our main goal is to develop a prototype of automated parking system which is capable of parking and retrieving the vehicle by itself even the driver is not present. All the activities required to convey a vehicle in automated parking system are controlled by Programmable Logic Controller (PLC). PLC is the controller in this system. Programming for PLC is done software named RSLogix by using ladder logic method. Except the programming part, simulation can also be done in RSLogix by which errors can be detected in the program created. This will help in modifications and correcting the program before joining the prototype to a PLC. Allen Bradley Micrologix 1000 series is used as the PLC trainer in this automated parking system project because it has task dedicated inner boards, specialized inputs, output and also high speed communication module. Therefore, it is a powerful and user friendly model of PLC.

Automatic parking systems are a contemporary answer to the increasing number of cars and the limited number of free space available for purposes, especially in city areas. Savings in construction

volume of up to 50% is characteristic for automatic parking system based on their compact warehouse design, joined with effective transport system. In this project, we will design the automation process of an automatic parking system. PLC will control the system.

II. PROBLEM STATEMENT

As it is known the land is becoming less but the population of human is growing day by day. This outline is very obvious in modern developed cities. Therefore, land is very limited and hence this land spaces need to be saved in every aspect of life. By building an automated parking system we can utilize high space is required in that. Because the parking system space can be more close-packed by parking the vehicles floor after floor and as in the parking space as vehicles are transported to parking slots using elevators in automated parking system, so less time is required. Thus, usage of land space can be achieved very effectively. Other than that, when the vehicles in the car park are fully packed, they will slow down to search for an empty parking space. This slow moving traffic will cause the queue of cars to be longer. Generally, traffic jam will occur when the car park is packed. In the automated parking system, the problem of traffic jam can be avoided because the parking spaces are located using green lights. So, the drivers do not have to search for the free parking slot as they are notified by the system where the empty parking slots are located and then the vehicle is transferred to the desired parking slots. In this way, the automated parking system parked the vehicles efficiently in very less time. The automated parking system is simple and suitable for storing vehicles in less time. While the development of country and nation is growing in a quick pace, crime rates are also increasing daily. Therefore, security has become one of the main concerns in everyday life of the society. Car park is also one of the places where individuals are attacked frequently. By having an automated car park safety for both the driver and vehicle is less at risk because the public is not allowed into the car park. In that way, security for individuals and vehicles are more guaranteed. In our country, in some of the cities the puzzle parking system is set up. In puzzle parking, the plate used for parking are generally uses two motor for horizontal and vertical movement. Suppose as shown in fig. 1, we want to retrieve the car from the slot number 3 the all the cars present in slots number 18, 13, 16 and 20 should move first. In puzzle parking there should be one empty pallet in every level except the top level for the independent operation of the system. So, this is a little bit complex because every time we want a car to retrieve, all the cars below that level have to move. Every time in upper level cars retrieval, the below level cars have to shift left or right no matter what. So, here the safety of cars should be concerned.

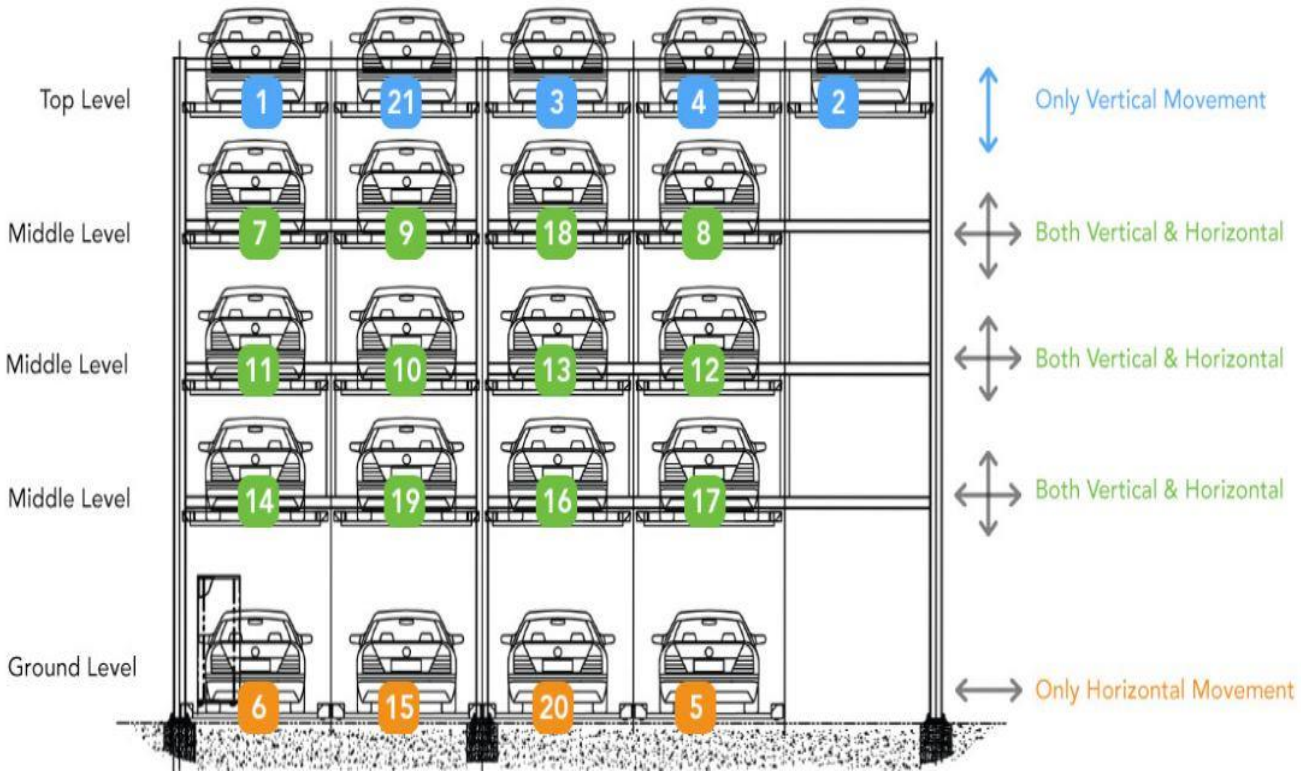


Fig. 1. Puzzle Parking

III. Design Of The Proposed Model

The design of automatic multilevel car parking system allows the vehicles to park floor after floor which reduces the space required. The entire process control should be automatic which helps to reduce the time wasted by a person to park a car. In this prototype of automated parking system, a lifting mechanism and four cars slots are used. The lift is used for parking and retrieving the cars.

This prototype model is implemented with the following hardware and software. The hardware required for the prototype is —

- Allen Bradley Micrologix 1000
- DC motors
- Lifting mechanism
- Mechanical structure and
- Miscellaneous components.

Our design system is very simple, reliable and cost effective. We only use three dc motors in the mechanical structure, which are shown in fig. 2.

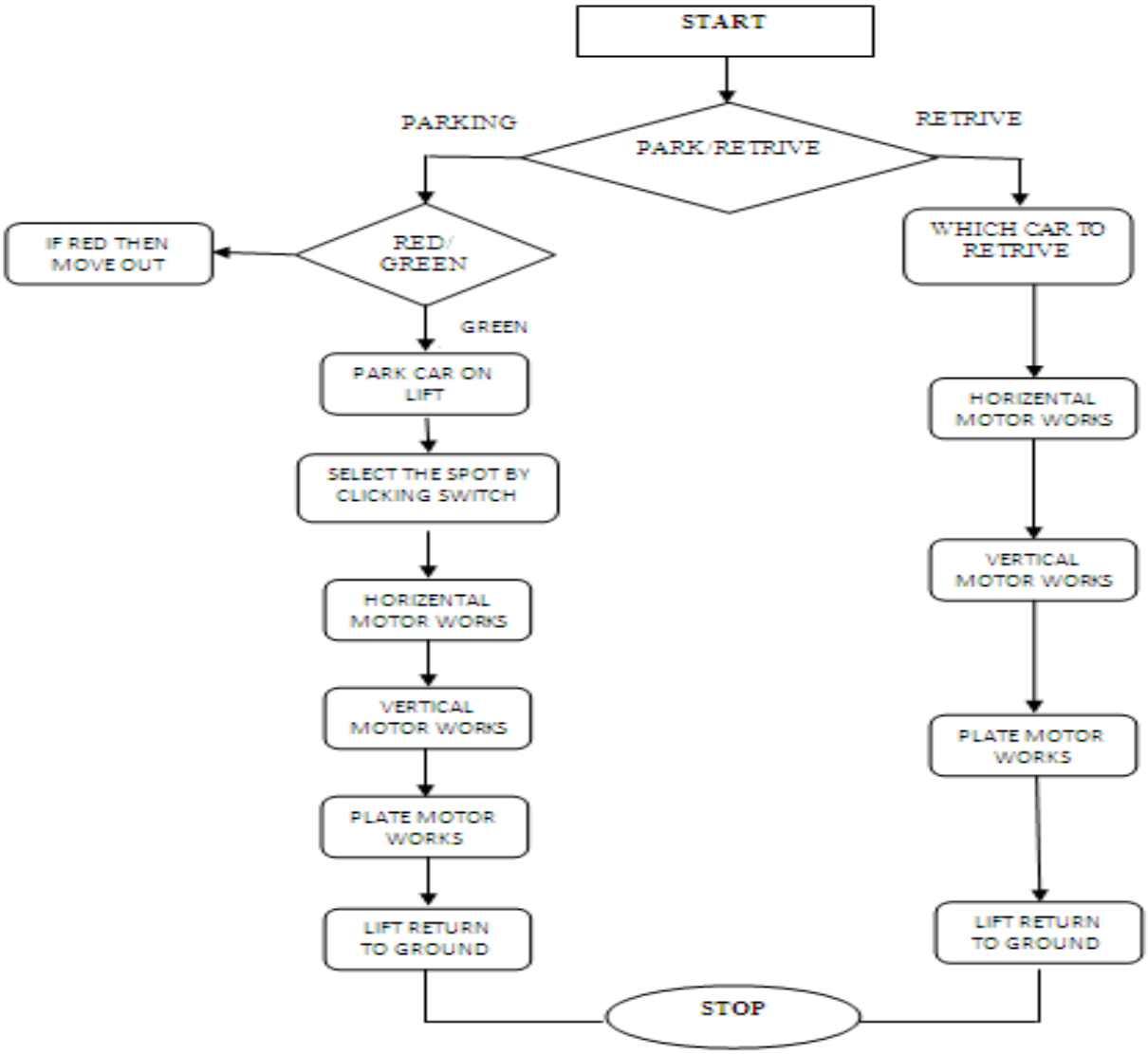
Fig. 2. Hardware architecture 1

Fig. 3. Hardware architecture 2

IV. WORKING

The process of parking is very simple for the driver. In the very beginning in order to park a car the user need to check if there is any space available for parking or not. There will be one green light and one red light. The green light represents that space is available for parking and the red light represents that parking is full. If the green light is on then the user put the car on lift. For the horizontal movement there will be a rail system and for vertical movement there will be pulley system. The motors in the various output points of PLC which directs the timing of the motors till it parks the car to be inputted and then the PLC takes over. Retrieval time for a vehicle is rapid and average of 5 minute depending upon the type automatic car park and its size. Working of the parking system is shown below using a chart.

Flow chart for the system:



V. CONCLUSION

Thus the designed system is specific and very easy in handling. For commercial purpose this system is very advantageous as well as for residential purpose also. The components used in this system are very much available and it makes construction very easy. The structure is compact which allows the system to be installed on any platform. This system is very much effective as it reduces the time wasted by the user to find a car parking slot and the time to park the car. Maximum number of cars can park in small area. Parking and retrieval of cars is fast. It also saves the fuel usage for car parking.

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