

PLC Based Tower Type Elevator Model for Automatic Car Parking System

Gorijala Anitha, N.Prema Kumar

Abstract: Manufacturers from several industries are gaining the advantage in auto machine technology in terms of productivity, flexibility, safety, accuracy and in reducing of manual efforts etc. Operating processes are designed in different modes of operation like manual, semi-automation and automation. Semi-automation and automation processes are controlled by different control devices like micro controller, PLC etc. Currently PLC is being used for many applications like industrial automation, traffic light automation, car parking automation, home application and many areas. This study presents the application of PLC (Programmable Logic Controller) in car parking automation. The aim of this paper is to make more advantageous method of car parking by using PLC application since the car parking is main problem in shopping malls, public traffic and scarcity of land in urban areas. Different types of car parking are currently available. A step beyond the existing scenarios is tower type parking. Car parking is proposed with three floors each floor can accommodate three cars the main components are PLC, sensors and elevator, BLDC motor and programming language is ladder diagram, software is TIA portal. Car is placed on the parking area sense by sensors and select the parking in button it parks automatically in the vacant position and light the respected slot in the panel board followed by receiving a token number. For park out select the parking out button and slot number the car automatically reaches to ground position.

Keywords : PLC, Sensors, Elevator, BLDC Motor, Relays.

I. INTRODUCTION

The important Target of automation is to minimise the manpower, less time, more product and continuous processes, presently automation is used for industrial, civil works and home application, automation can be done by different ways by using, Vision-Based[1], microprocessor, sensors, android[2], internet things, and PLC[3], In this project PLC based automation ,PLC is an industrial digital computer it has analog and digital inputs, analog inputs for the continuous monitoring and digital for sensor monitoring ,counters, timers and programmable logic relay, the programming language are ladder diagram, function block diagram, instruction list, structure text language and sequential function chart in all the above languages ladder diagram is easy under-stand and user friendly basic language in this project used ladder diagram in siemens plc s7-1200.

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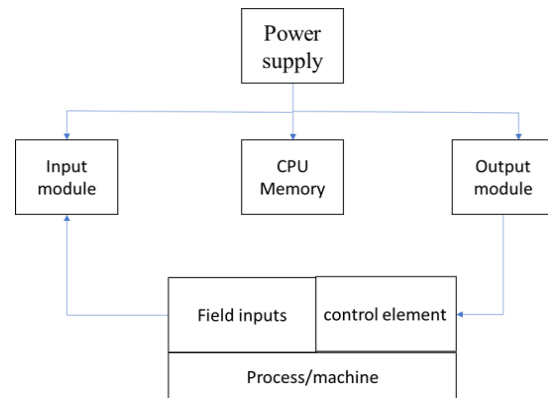


Figure 1: PLC basic block diagram

The problem of vehicle parking is very critical especially in largely populated cities and dense areas as they suffer from lack of parking spaces. This century probable reason for search for vehicle parking problem solution as car parking is an everyday problem faced due to imbalance between parking space availability and traffic congestion due to visitors in search for a parking place.

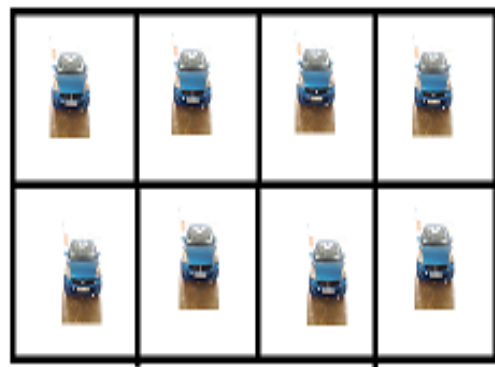


Figure 2: Manual car parking

In this project plc-based car parking automation, the plc continuously monitors the data from the input sensors, some calculation in the control unit and gives the signal to output modules its give response here proposed for three floor building and each floor three cars.



Figure 3: automatic car parking

II. OBJECTIVE

To implement an automatic car parking system based on PLC using sensors, elevator, control panel, BLDC motor and solar panels the input modules are sensors and output module are gate, elevator, PLC perform the logic controlled based on the inputs and outputs.

III. DIFFERENT APPROACHES

1. Street parking:

Street parking two types on street parking and off-street parking, in on-street parking means it parks on the street but sometimes there are restriction due to traffic problem Off street parking means it park the vehicle parking facilities like garages and lots, it can be both indoor and out.



Figure 4: street parking

In this proposed fifteen level configuration, eight carrier signals (C1 – C8) are considered and it divides the whole voltage in to seven regions. Suitable value of carrier frequency will be decreases the lower order harmonics. The carrier frequency is equal to 10Khz and reference frequency is same as the fundamental frequency of the system, the fig.3 shows the all eight PWM signals generation and selecting suitable combination of above signals generate a required pulse for our switches S5,S6 and S7.

2. Ramp based parking system:

In ramp type parking is used for underground and multi-level it reduces the space for the parking but it follows manual parking for car entering, parking and leaving it requires human.

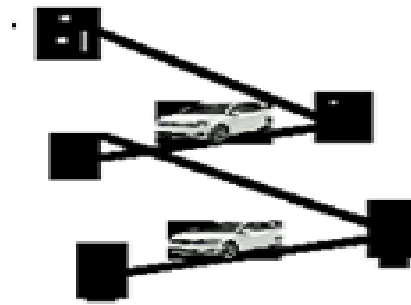


Figure 5: ramp type parking

3. Puzzle type parking system:

Car parking system based on puzzle types features combination pallets carrying cars. Individually load and unload of the cars is possible. Thus, system is independent system. This system is electromechanically operated. Fast IN & OUT of the cars is possible. Easy manoeuvres of the cars. Combination of multiple levels vertically & horizontally is possible. We have specially designed PIT type Puzzle parking system also. Suitable for Indoor & Outdoor installations. Mostly preferred in residential complexes, IT Parks commercial complexes, malls, hotels etc.

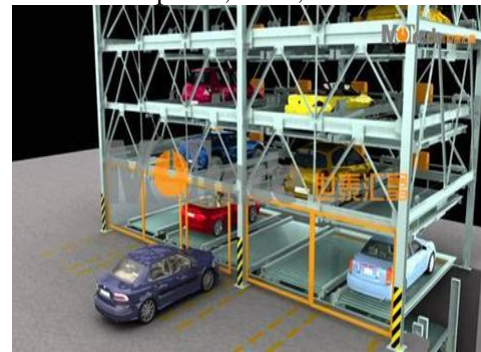


Figure 6: puzzle type parking

4. Multi floor type parking system:

Multilevel vehicle parking modules, a concrete structure is utilised for buildings and vehicles are manually parked. concrete structure is used for making building and cars are parked manually by the owner on the allocated floor. This type of parking system is usually employed in malls, hospital, residential building and many like areas.

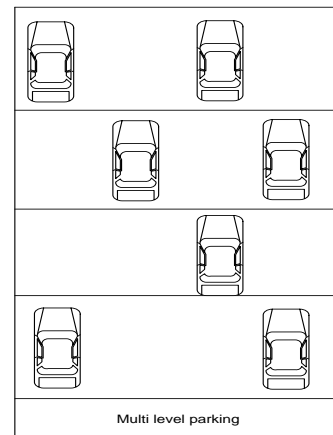


Figure 7: Multi-level parking

Algorithm:

- Step 1: start
- Step 2: check the main gate sensor, elevator sensor and any one sensor in slots are low then only open the main gate and car enter the elevator otherwise move to step 9
- Step 3: then elevator sensor is high and check the first floor vacant or not, if vacant move to next step otherwise move to step 8
- Step 4: if check the first slot sensor is low or not if it is low park the car in the first slot and get the token with respected slot number, (it wants check other slots high or low), otherwise move to next step
- Step 5: it checks the second slot high or low if it is Low Park the car and get the token with respected slot number (it wants check the other slots), otherwise move to next step
- Step 6: it checks the third slot high or low if it is Low Park the car and get the token with respected slot number, otherwise moves to next step
- Step 7: the elevator moves to second floor check the vacant or not if vacant move to step 4 to step 6, otherwise move to next step
- Step 8: the elevator moves to third floor check the vacant or not if vacant move to step 4 to step 6 otherwise move to next step
- Step 9: if all the floors are full it shows parking area full
- Step 10: if parking out enters the token then it senses slot number and floor number the elevator moves to that floor and taken out

Flow Chart:

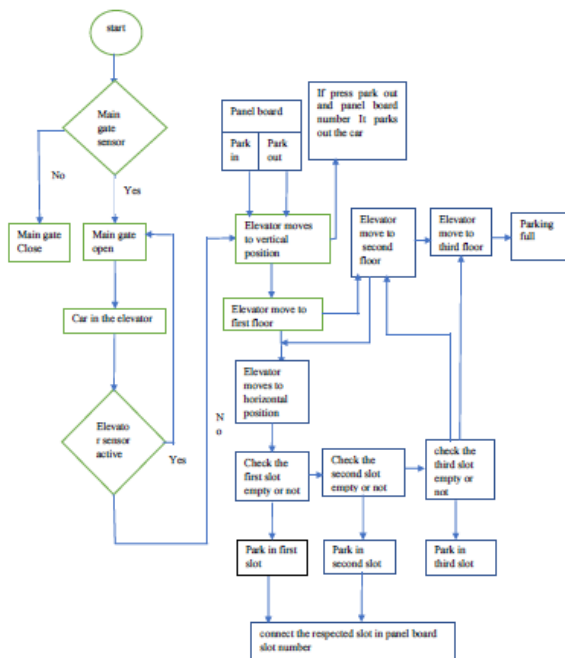
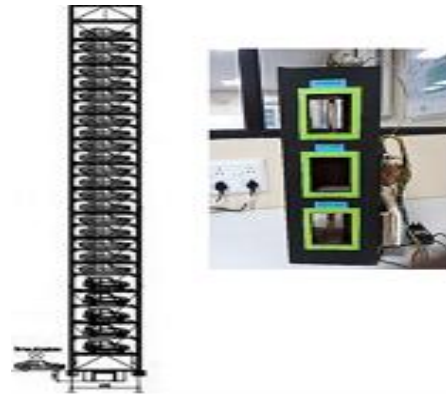


Figure 8: Flowchart

Proposed methodology:

Elevator based Tower type automatic parking system by using PLC The elevator moves to vertical and horizontal direction based on the condition; the moment of the elevator due to BLDC motor.



Specifications:

- Power Supply: 24v
- BLDC Motor: 12 volts 1kw 100rpm

PLC:

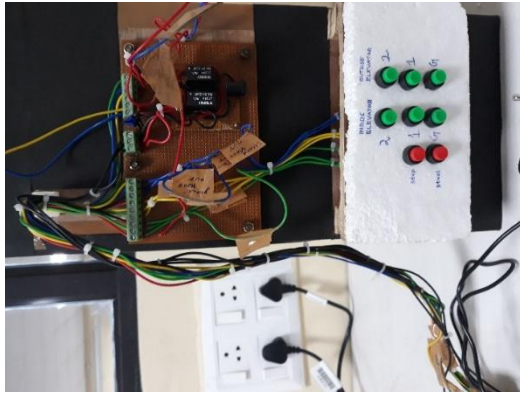
- i. Siemens PLC S71200
- ii. Software: TIA V13
- iii. Programming: ladder diagram
- iv. PLC operation sequence
 1. Testing of its own software and hardware for faults it is called self-test
 2. After self-test check there is any problem if no problem then copies the inputs into memory location,
 3. Using the input variables and ladder programming it run the problem based on the logic.
 4. after logic run. Store the output variables in temporary memory



Figure 10: PLC S7 1200

- Limit switch
- IR sensors
- DC relays: Two pole 12 volts
- Control panel board

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Hard ware implementation:



IV. CONCLUSION

Automation is to reduce the time and manpower, automation using different application in that one parking is also major application. Parking is the main problem in public places to reduce traffic going to automatic car parking system here different methods are available but in this paper proposing tower type automatic car parking algorithm, that algorithm tested with the prototype model, the novelty of the work is proposing new algorithm.

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