

AUTOMATION OF MULTILEVEL CAR PARKING USING PLC

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Abstract- Multilevel car parking automation using PLC obtain information about present space for parking. A prototype of paper. Our lifting and sliding mechanism with pinion-rack mechanism for placed and takes car from parking using ABB1131 software with component list and its use. This system is environment friendly and takes less area for more parking.

Keywords- PLC based, pinion-rack mechanism, prototype model, highest security, greatest flexibility, reduce human error.

I. INTRODUCTION

We know progressive country is mainly depend on the growth of nation which is compare by GDP. This growth is directly relation with use of technology in all the condition of life and it is also depend on use of latest invented technologies.

This paper is dedicated to the use of control system in parking area. it is multilevel automatic car parking using PLC. This control system was played important role in parking and departure of car at parking this all process is work as close loop system

Multilevel car parking is essential in this modern and smart word. Due to increase in demand of parking in private and government places because of increase in number of cars day by day all person need personal car for preferring luxurious life this all problem solved by multilevel car parking system.

1. Review of present parking scenario many problem faces by people such as.
 - A. Finding empty space of parking.
It is very difficult to find empty at holidays and weekends. Also responsible insufficient area of parking at mall, offices, multiplex etc.
 - B. Improper parking
Due to car not parking at allotted area of parking our parking area are not uses completely.
 - C. Safety and security
In general parking we have less safety due to the open place of parking and shortage of time people can't notice the safety of other people. And security of car is done when any security guard is present^[3].

II. BLOCK DIAGRAM

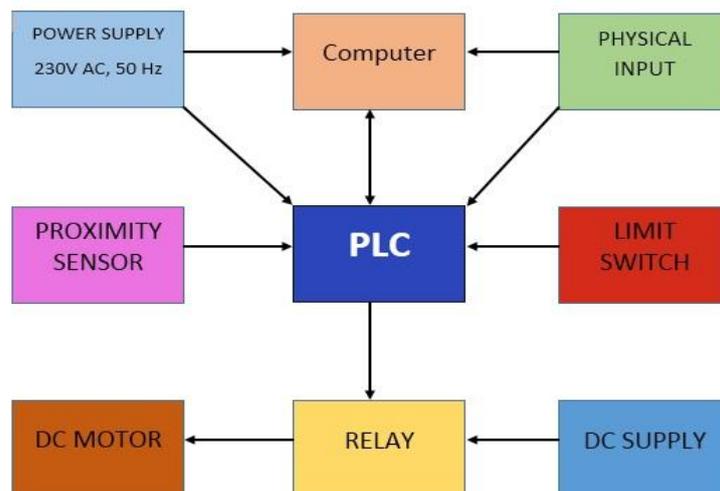


Figure 1: Block diagram

Same as show in block diagram we give ac supply to PLC and dc supply to relay for operating the dc motor. The program is loaded by computer using cable to PLC and PLC have this logic as command and give different output with different condition as like if limit switch or proximity sensor is on then it give directly command to PLC and this command give to relay by PLC. Same as other command also given by PLC to relay of on-off condition. This all possibility of command is work as control loop system^[8].

III. LIFT MECHANISUM

3.1 Purpose of lift mechanism

This multi-level car parking has 4 floors of parking for taking car to other then ground floor we use here lift mechanism. This mechanism is synchronized with vertical as well as circular rotation and sliding mechanism.

3.2 Components used in lift

For operating this we will use 6 relay, 8 proximity sensor ,3 limit switches and 5 dc motors and some other component are required for this all mechanism working

3.3 Relay

Relay is use to drive output of PLC and give required input to geared motor.it was work like a contactor. When PLC give signal to relay driver coil at that time coil is energies and as per requirement we connect our circuit as normally open and normally close contact its physical view is shown in figure^[10].



Figure 2: Physical Appearance of Relay

3.4 DC Motor

Dc motor are use in this prototype is high torque low speed (30rpm) is used due to weight of this mechanism is high due to this high torque mechanism is required torque is high then speed of motor is low. This dc motor is operated at 24V which is given by dc supply^{[1][6]}.



Figure 3: DC geared motor

3.5 Proximity sensor

A sensor that can be detecting presence of objects surrounding it without having any physical contact is termed as a proximity sensor. This can be done using the electromagnetic field or electromagnetic radiation beam in which the field or return signal changes in the event of the presence of any object in its surrounding. This object sensed by the proximity sensor is tired as a target^[10].



Figure 4: Inductive Proximity sensors

3.6 Limit switch

The vertical moment of lift is known by this limit switch which is mainly used for now the position of lift due to this we know where our lift is present this limit switch is work as p push button.



Figure 5: Limit switch

IV. Sliding mechanism

This type of mechanism is easy in all other work but here two work is done by same mechanism it is placed and pick up car.so here we use pinion-rack mechanism, due to this mechanism we slide car to their parking allotment and easily take return by using mirror “c” type logic.

4.1 Pinion-rack mechanism

This mechanism is use to convert rotational torque to linear displacement. Byusing this mechanism we slide our car wheel basement. This mechanism shown in figure^[1].

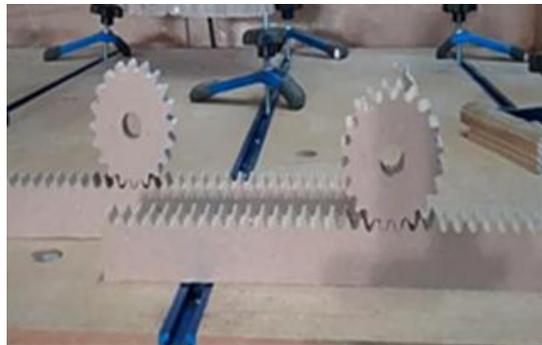


Figure 6: Rack and pinion Mechanism

4.2 Zigzag pattern basement

This type of basement is specially easiness of put the car to parking slot and take back easily without damage this type of mechanism is used this was shown in figure.



Figure 7: Zigzag pattern Basement (Ahmedabad Multilevel car parking at kakariya)

V. PLC

We use ABB07KR51 PLC in this prototype. The main advantage of this PLC uses simple programing language. With the help of other extender bus we extend number of output and input also set time of plc. for any condition this all connections are connected with the help of ABB1131 software which is easy to operate and visualization part also available in this software this PLC is shown in figure



Figure 8: PLC ABB 07KR51(8 input of 24V,6 output for relay)

VI. Construction

In this paper dedicated to the design of building which is in round or circular shape. Generally all the buildings are in shape of rectangular or square shape. We choose this circular design of building due to this maximum area of parking is used by us. We calculate some example of real construction of car parking building which is given below. We take as example of basement of parking slot's dimension is 5000mm*2000mm*2000mm (length*width*height). This dimension for 12 car slot is calculated in rectangular as well as circular platform^[4].

6.1 Measurement of total area of rectangular building:

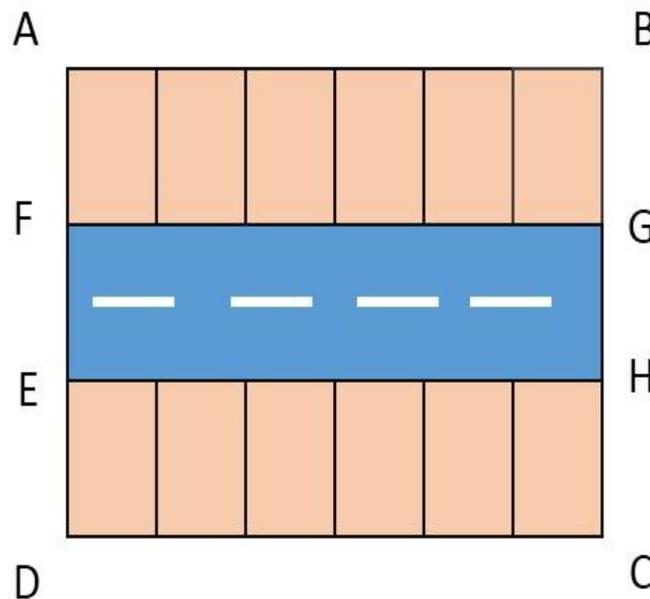


Figure 9: Rectangular Building Plan.

AB=total width of 6 car in one raw which is parallel parked=12000mm=12 m
 AF= total length of one car which is parked=5000mm=5m
 AD=total length of 2 car which is parked in opposite side with parking lift length=15000mm=15m

Area of one slot = $(AB \cdot AF) / 6 = (12000 \text{ mm} \cdot 5000 \text{ mm}) / 6 = 10 \cdot 10^6 \text{ mm}^2 = 10 \text{ m}^2$
 Area of 12 slot = $10 \text{ m}^2 \cdot 12 = 120 \text{ m}^2$
 Total area of building = area of 12 car slot + area of lifting lobby = $120 \text{ m}^2 + 60 \text{ m}^2 = 180 \text{ m}^2$

6.2 Measurement of total area of circular building:

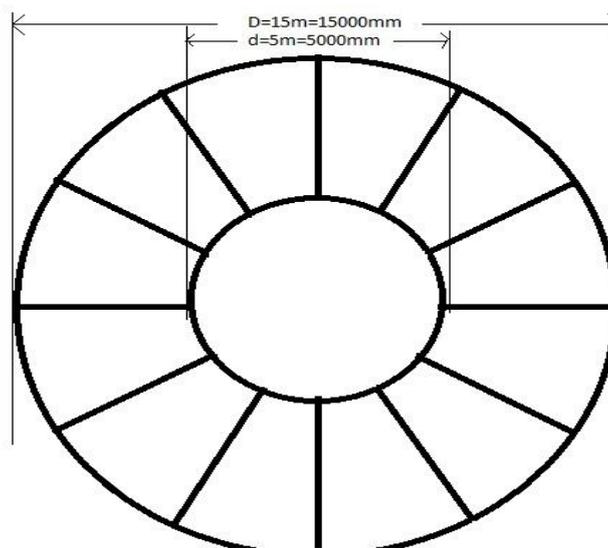


Figure 10: Circular building plan

Diameter 'D'=15000mm=15m (outer surface)

Diameter 'd'=5000mm=5m (inner lift surface)

Total area = πr^2

For 'D' diameter circle's area = πr^2
 $= 3.14 * (7.5)^2$
 $= 176.62 \text{ m}^2$

For 'd' diameter circle's area = πr^2
 $= 3.14 * (2.5)^2$
 $= 19.62 \text{ m}^2$

Area for parking is =D-d
 $= 176.62 - 19.62$
 $= 156.99$
 $\approx 157 \text{ m}^2$

Area of rectangular parking =180 m²

Area of circular parking =157 m²

Here we see that 157 m² is less than 180 m² which gives a proper reason that circular portion is more profitable for parking building construction. Due to this reason here select circular basement as well as circular building.

A. Working:

When a car comes to the parking basement at ground level our lift sensor is cut due to sense the car and give command to PLC. It has already some program for this mechanism and controller given command after some time to motors relay and lift motor works at that time PLC operator given command to empty space location and due to this signal our lift slide to this area and slowly down motor operate and due to zigzag pattern our car is placed at those area of parking. When driver come to the PLC operator give command to PLC and lift take car from parking and put at exit gate^[5].

Dimension of one slot car parking basement is length*width*height is respectively 5000mm*2000mm*2000mm^[9].

Wheelbase distance for zigzag pattern is 2500mm-3500mm.

B. Applications:

- Public parking
- Airport
- Railway station
- Hotels, malls
- Office building
- Collage
- Apartment
- Big industries
- Car industries to stored ready cars

C. Advantages

- Provide enough parking spaces.
- Provide lower building cost per parking slot.
- Required less building volume and ground.
- Provides highest comfort and securities.
- Human error is less.
- Fast and time saving parking with greatest flexibility^[7].

D. Limitation

- Slots are pollutant due to the motor oil.
- Challenge for authority to realize it need and quickly.
- Estimate cost is high.
- Periodic maintenance is required.
- Provide backup systems during electricity failure^[2].

VII. Conclusion

So we can conclude that using multilevel car parking we park more cars with less area required and save time and money from solving problem of traffic and parking also save fuel. The system design is very precise and very easy in handling. This system is advantageous for commercial as well as residential purpose. All component of this system is easily available in market.

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