

AUTOMATIC CAR PARKING USING PLC

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ABSTRACT

Currently, automatic parking system is one of the major issues in a parking lot due to increase of personal vehicles, shortage of space and to avoid any roadblock. In this project PLC is used to sense the movement of cars as well as to control system. The automation process of an automatic car parking system is designed using a fully functional ladder logic, which is a small programmable logic controller (PLC). Infrared sensor (IR) are placed at every parking to detect the pallet and presence of car. It is also use to check whether parking is empty or full. In this parking system concept of lift and pulley is used. PLC operates stepper motors which is use for horizontal and vertical motion of the lift. HMI displays the parking full or empty as well as it also displays whether the sensor is active or in active. This parking system is cost efficient and requires less space.

KEYWORDS: Programmable Logic Controller (PLC), Human Machine Interface (HMI), system model, mechanical design, mechanical model, IR sensor

INTRODUCTION

Currently, automatic parking system is one of the major issues in a parking lot due to increase of personal vehicles, shortage of space and to avoid any roadblock. Parking lot is one of the key installations found of led out too? In the modern world, technology has linked each town, city and country with the other through means of transportation. This has ultimately led to a massive increase in number of vehicles. To manage these vehicles there is need of a proper parking system. The most common often encountered while dealing with vehicles is over crowding of parking places, which finally leads to the wastage of fuel and precious time of people. The ultimate aim of the technology is to reduce the load on people and ease.

It also have the provision to inform person trying to enter the parking area, whether a space to park vehicle is available inside the parking area. In this project we have deployed a PLC which used to sense the movement of cars and depending upon whether there is a capacity of cars to enter, it either opens or close the gate. In automatic car parking, the driver leaves the car inside an entrance area and technology parks the vehicle at a designated area. Mechanical car lifters, with the help of PLC raise the vehicle to another level for proper storing. The vehicle can be transported vertically (up and down) and horizontally (left and right) to a vacant parking space until the car is need again. When the vehicle is needed, the process is reversed and the car lifts transport the vehicle back to the same area where the driver left it.

A programmable logic controller (PLC) is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many industries and machines. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. A PLC is an example of a hard real time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result. The main

difference from other computers is that PLCs are armored for severe conditions (such as dust, moisture, heat, cold) and have the facility for extensive input/output (I/O) arrangements.

I. PREVIOUS WORK

- A) PLC is used for automation and SCADA for monitoring the system. Project ensures less maintenance and reduces risk factor and also increases the efficiency. It was just for supervising cars in a parking lot. The basic idea of working and connection of VFD for lift control and also pallets. Automatic control of lift in Level Type Car Parking System is designed which used to take cars up & down the level, which reduces the space.
- B) In multi-storey parking system, elevator is used to lift car up and down. Pneumatic Mechanism is used for pushing pallet front or back. PLC is used to control the elevator to which floor is empty and where to park the car and motion of pallets as well depending upon the programming.
- C) An intelligent car park management system by using wireless sensors, internet and data acquisition systems. It basically uses the concept of Internet of Things. The information regarding parking lot is stored in a database for parking lot management, manage the payment of parking fee.
- D) The concepts of optical character recognition, geometrical analysis and character segmentation. MATLAB is used for image processing. Simple camera is used to capture an image of the no. plate. This image is matched with the records for parking management and also for billing.
- E) Image processing is used in this project. MATLAB is used as software platform. We learnt the concept of field extraction of an image. This project has two module 1) vehicle counting module 2) automatic payment module where RFID t/r and microcontroller is used
- F) PLC Based Instinctive Car Parking System he concept to detect the arrival of the vehicle using optical proximity sensor. A motor control the position of elevator which is used to lift the vehicle. All drives are control by PLC.

II. SYSTEM MODEL

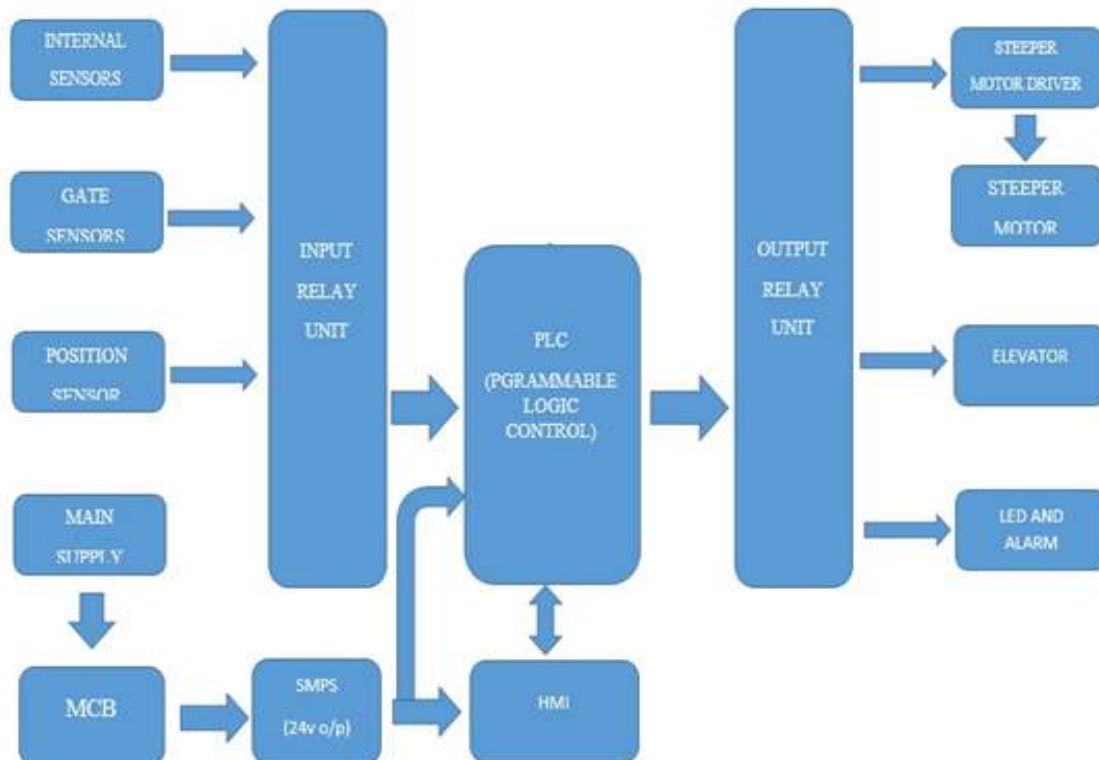


Figure 1. Block Diagram of Parking System.

Figure 1 is block diagram of parking system which shows the interfacing between various parts such as PLC, HMI, sensors, drives, stepper Motor etc.

III. METHODOLOGY

A) Working Principle:-

The car comes at entry point, the sensor sends signal to the control system, then system check the empty pallets and move that pallets at entry point. After car moved on pallets IR sensor send signal to PLC. Then PLC store the information related to that car and pallets using inputs from HMI and IR sensor. At the time of exit, user will enter the car number on HMI. Then HMI send signal to PLC. PLC compare the information with stored data. After matching information, the related pallets move to exit point. The number of cars available in the park will be calculated by the differencing the number of vehicles entering and the number of vehicles leaving the park. PLC will decide whether any space is available or not. If no space is available, the PLC will send acknowledge signal to the gate to keep the gate closed and turn on the indication "Car Park Full"..

B) System Description:-

Panel Layout:-

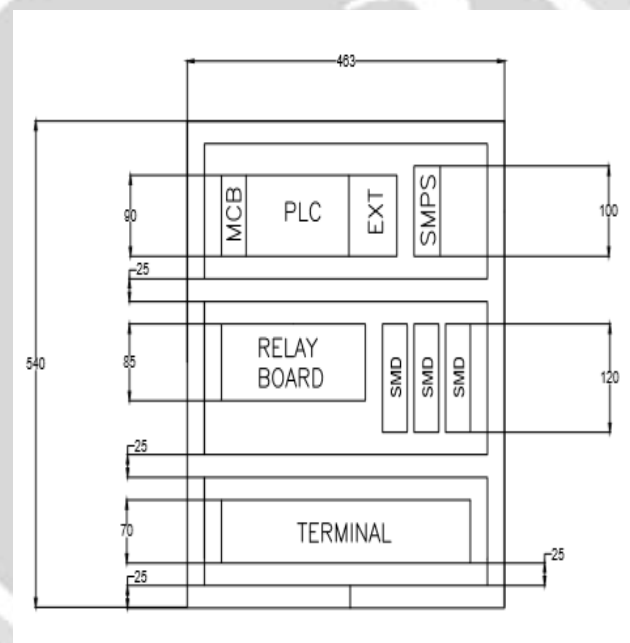


Figure 2. Panel Layout.

Panel layout of system is shown in figure 2 which have dimensions 540mm*463mm in which the space require for each component such as PLC, SMPS, Relay Board, Terminals, MCB etc. is shown.

PLC (Programmable Logic control): - Mitsubishi Fx3U-48M PLC is used to control the working of parking system. This PLC has 24 inputs and 24 outputs in which first 6 outputs are high speed outputs. These outputs are connected to the stepper motor driver. The output of various sensors are used as inputs to the PLC.

HMI (Human Machine Interface): -

OMRON HMI is used to communicate with PLC and system. Display of HMI is 5". In this case we have used NB5Q-TW00B. HMI is nothing but human machine interface. It is used to display various readings, connections etc.

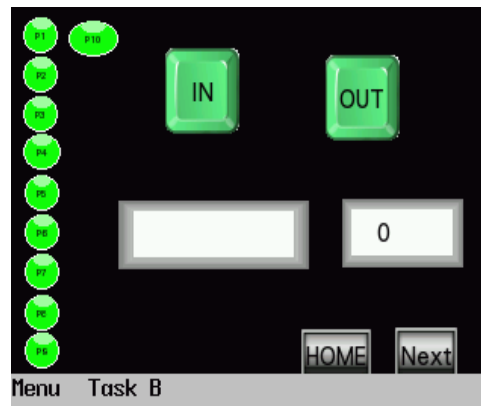


Figure 3. I/O Display screen

Figure 3. Is the I/O display screen which consist of various lamps and buttons. P1 to P10 lamps are output from IR sensor which is used to detect presence and absence of car. When lamp is green, car is absence and when it's red, car is present. Both numeric keypad and alpha keypad buttons are used enter the car number manual. Home button returns the I/O display screen to homepage and Next button is used to switch to next screen manual.

IR Sensor: -

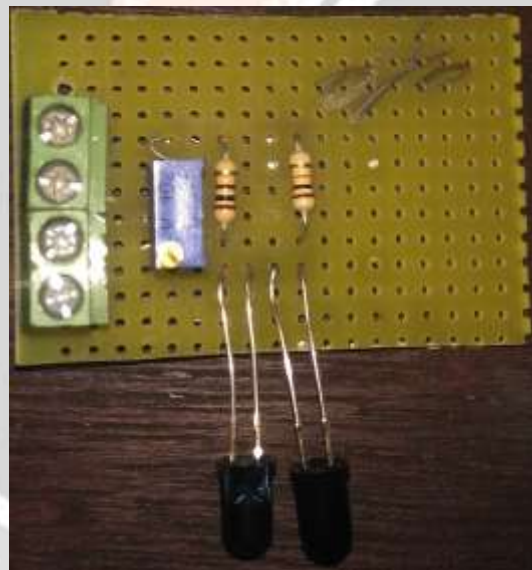


Figure 4. IR Sensor

Figure 4 shows IR Sensor used in parking system. The IR sensor can detect obstacles from 1mm to 10cm. The range can be varied by using potentiometer. The IR sensors are used for detecting vehicle present in parking system. IR sensor is also used as gate sensor to check if the vehicle is present on the parking gate. In this sensor IR couple is used to detect the obstacle, but in this case it is used to detect the car as well as the pallet. The sensitivity of the transmitter can be controlled by using a potentiometer.

C) Mechanical Design:-

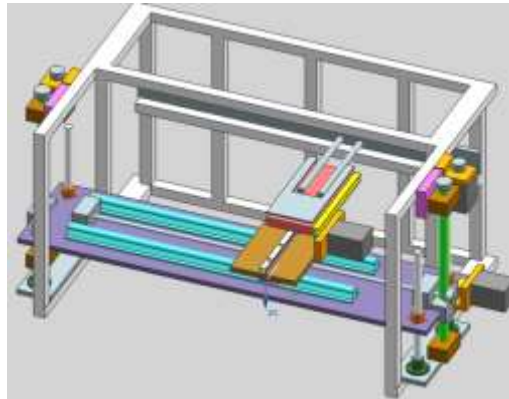


Figure 5. Mechanical Design

Figure 5 shows the mechanical model of parking system which include stepper motor, various drive arrangement including lead screw pulley etc. The dimension of design is 810mm*540mm*500mm. This design can park up to 10 cars and it is created in NX Cad software.

D) Mechanical Model:-



Figure 6. Mechanical Model

Figure 6 shows the mechanical model of car parking system which include hardware such as stepper motor, various drive arrangement including lead screw pulley etc. In this model parking of 10 cars is seen. The lift mechanism is used to lift the car on the first floor. While the rack and pinion is used to place the car as well as remove the car. Lead screw is used to move the rack and pinion horizontally to and fro. While the motor in the middle of the system is used to lift the overall lift vertically up and down.

IV. CONCLUSIONS

Automated car park system save time, space and simplify the tedious task of parking. This system uses simple pulley mechanism which is easy to build. IR sensor is used for its precise detection. This system can be used for multiple floors by using same PLC ladder logic. Automatic car park system are less expensive since they tend to require less volume and less ground area than a conventional facility with the large capacity. Thus this system proves to be very advantageous as well as efficient, the one which might make important role in automation.

V. REFERENCES

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