



PLC AND SCADA BASED MULTILEVEL AUTOMATIC CAR PARKING SYSTEM

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ABSTRACT: This project work presents the study and design of PLC based Multilevel Automatic car parking system. Car parking is a major problem in urban areas in both developed and developing countries. Due to increase number of cars on roads there is a problem car parking. Multilevel Car parking is the most efficient way of parking as by using this arrangement we can park more number of vehicles in least possible area.

This system also gives the number of cars parking in parking slot and also gives parking slots full or empty. In this project basically, we have made 2 floors and 6 parking slots and every parking slot consist of individual sensors and entry and exit gate also consist sensor. When the car is coming at entry gate the main gate is not open if all the parking slots is full, if there is a parking slot free, the main gate is open and this opening and closing of gate is controlled by using PLC and no require of manual labours. If the car is parking in that place the sensors give signal to the PLC. If there is a vehicle in the entry gate the space is available in second floor, the person will not have to search the parking in individual floors. The system will indicate number of free slots in every floor then he can directly go to the floor where the space is available and park the vehicle. This system automates the entire process of parking which reduces human error and make best use of the available space, which in turn results in highest security. Due to these advantages, this system can be used in societies, airports, railway stations or any other place where crowding of vehicles is observed.

Keywords: Automation, PLC, SCADA, and Sensors

1. INTRODUCTION

Nowadays every person owns a vehicle, as the number of vehicle increases parking problem increases. The growth rate of Personal cars is higher in the populated cities like Delhi, Mumbai, and Bangalore etc. The main parking problems are faced by malls, public parking places, cinemas, commercial buildings, hospitals etc.

The problem faced by driver in public parking places are mentioned as below.

- Wait for turn at entry point.
- Wasting of time in finding empty parking spot.
- Not easy to count how many cars are currently in the parking.
- Also not easy to count how many empty spots are available.

In this project we are going to make an automatic multilevel car parking system which will guide the driver to the direct empty parking spot. This system reduces the time in parking and can count the total number cars available in the parking and total spots available in the parking for car. Also it is easy to install, less maintenance and affordable. This setup works on the most advanced industrial automation system PLC (programmable Logic Controller) and is monitored through SCADA (Supervisory Control and Data Acquisition) system. The SCADA system monitors the whole process and gives information to the operator in case any contingency occurs and takes appropriate action itself in case some major fault occurs on the basis of programming done. This automated car parking also saves fuel and has minimal chances of accident & damage that arises in parking area due to manual parking.

2. LITERATURE SURVEY

Saideep Bandarkar (2016): The author uses Artificial Intelligence (AI) techniques to Process images, which recognizes the parking occupied only by vehicles. The system provides guidance images towards the assigned slots, thus making it intelligent. Inter integrated circuit (I2C) protocol is used along with car parking framework(CPF) to assign radio frequency identification (RFID) to each car which will be used to identify car parked over a slot. The system assigns and reserves an optimal parking space based on drivers cost function that combines proximity to destination and parking cost. The ZigBee technique is used along with the GSM module for parking management and reservation. The author uses Global Positioning System (GPS) and Android platform to show available parking spaces.

Priyanka Gharat (2017): Opening of gate to parking slot is done with the help of smart card, if the space is available in ground floor, the driver is guided to the parking space. If full, the driver is instructed to leave the car in a specified place and the car is shifted to parking place in the first floor using elevator. When the car is to be taken out, smart card is used to open the exit gate. Microcontroller is used to control the movement of gate and its mechanism. A user can record his preference through a website/ mobile app otherwise default preference is considered. A message is sent to the car owner about the parking location of the car. But the drawback of this system is that it is not affordable to all companies and buildings as it would add to their cost of applying smart cards to their products which makes the implementation of such system difficult and non economic.

G. Narone (2018): Have identified predicted or researched the lift mechanism concept that will be implemented. There will explain about two options for lift one is a hydraulic lift and the other is traction lift. For moderate height, a hydraulic lift is suitable but when height increases, it becomes very costly. Traction lift is a cost consuming. The main component of lift is the pallet as per the weight of the vehicle the pallet will be designed using a chain mechanism technique Apply pulling force on the pallet.

Vipul More (2019): This study will explain on Geneva wheel mechanism where the multilevel car parking system for the vendor is working on a simple sprocket chain mechanism. Using a multilevel car parking system can park more vehicles in less space and using this technique can detect the available parking space easily, any issue faced by the user during parking.

Multilevel floor parking (2021): In this type of car, vehicles are parked on different layers, floors of a building. These floors are accessed with the help of external or internal mediums such as ramps or other similar structures. There is a vertical lift (mechanized) for the movement of vehicles in the y-direction. This arrangement helps in less ground space which directly associates with cost reduction of the building. This arrangement helps to accommodate more cars and produce a faster parking process. Also, sensor arrangement in this system helps to control and optimize the parking

procedure. The system is designed so that the ground level gets filled first and then moves to the next level above it, and once this level is filled, it moves to the next level and so on.

Outcome of Literature Survey

After referring various literature survey we conclude that:

We can solve the problem of car parking and we can implement PLC AND SCADA based multilevel automatic car parking system. The purpose of making this project is to make it easier, effective in car parking process on less area. Be able to design and make car parking system project using PLC and SCADA appropriately, effectively and efficiently. This system automates the entire process of parking which reduces the human error and make best use of the available space, which in turn result in highest security. The main purpose of PLC is to make a process fast and accurate and it is used to keep record of number of car available in the parking, also the parking slots which are full and empty. Be able to figure out how the process of multilevel automated car parking system on small area using PLC.

3. PROBLEM STATEMENT

Current Situation

In the modern society, there is an ever increasing number of vehicles. This is leading to problems such as large urban parking lots becoming inefficient, increasing difficulty to find open spaces in busy parking lots, as well as the increasing need to devote larger areas of land for additional parking spaces. The three main problems that the increasing number of vehicles and the decreasing efficiency of modern busy parking lots are:

1. Valuable time wasted from inconvenient and inefficient parking lots.
2. More fuel consumed while driving around parking lots, leading to CO2 emission being produced.
3. Potential accidents caused by abundance of moving vehicles in disorganized parking lots.

In order to overcome this problem we have come with an idea to develop a prototype simulation model of “Multilevel automatic car parking system using PLC and SCADA” Multilevel car parking is the most efficient way of parking and we can park more number of vehicles in less possible space.

4. METHODOLOGY

The block diagram of the simulation of a PLC & SCADA based car parking system is shown in the below figure. The diagram displays the input and output components connected to PLC. However the input sections comprise of sensors while the output components comprise lamps for indication and entry gate and exit gate mechanism.

PLC BLOCK DIAGRAM

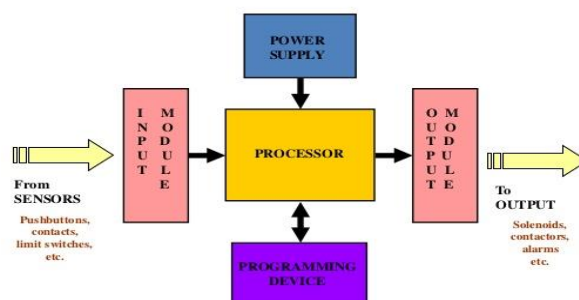


Fig: Block Diagram

A Programmable Logic Controller (PLC) or programmable controller is an industrial digital computer which has been used for the control operation of machines and other equipment. This is an advanced microcontroller which is more reliable and easy to operate. Its advanced features include:

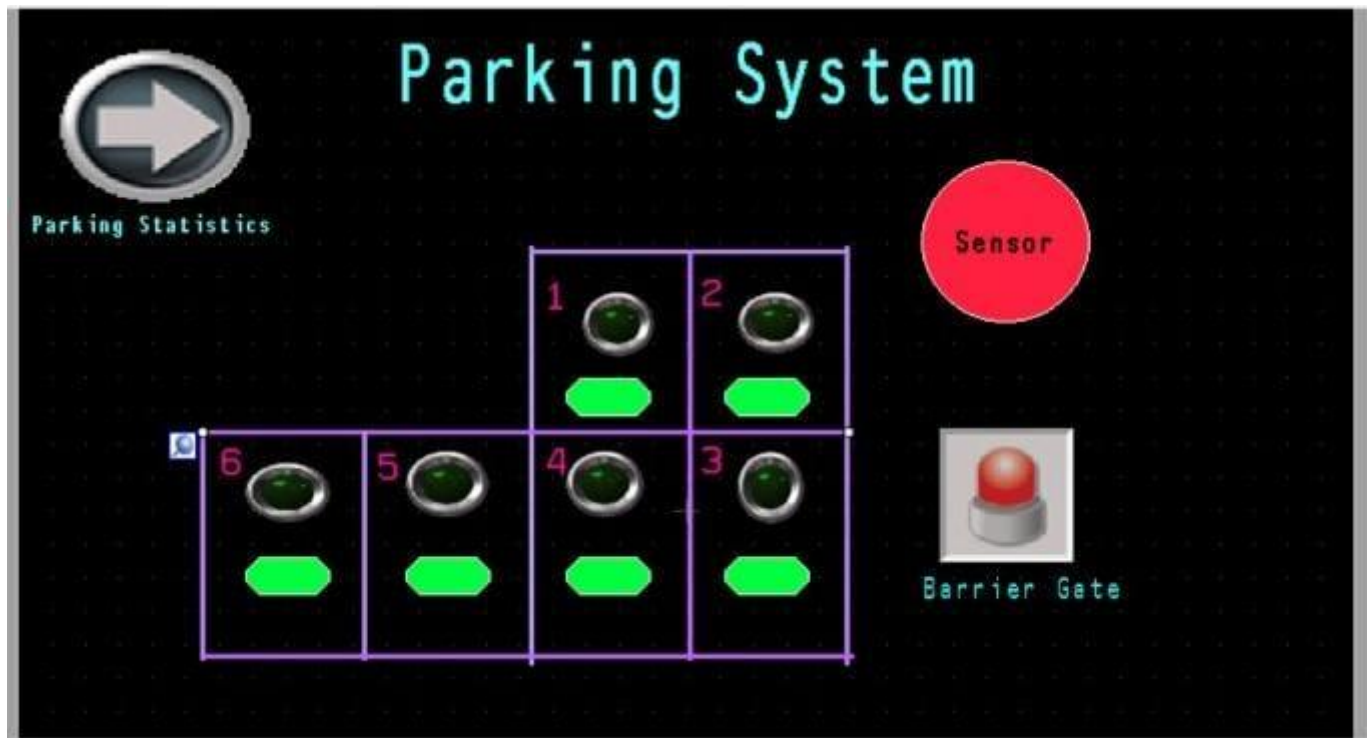
1. Run time debugging: user can fix or change the program in the run time i.e.Operation is easily controllable and accessible.
2. Remote access: with the integration of SCADA system we can see and control the things remotely. This thing will provide security assurance and quality Operation.
3. Speed of operation: response time of PLC program is very less hence its speed of operation is very high. In our model we have used a MITSUBISHI PLC which has 16 inputs and 16 outputs.

In this project basically, we have made 2 floors and 6 parking slots and every parking slot consist of individual sensors and entry and exit gate also consist sensor .When the car is coming at entry gate the main gate is not open if all the parking slots is full, if there is a parking slot free, the main gate is open and this opening and closing of gate is controlled by using PLC and no require of manual labours. If the car is parking in that place the sensors connected at each parking slot which will detect the car and give signal to PLC. If there is a vehicle in the entry gate the space is available in second floor, the person will not have to search the parking in individual floors. The system will indicate number of free slots in every floor then he can directly go to the floor where the space is available and park the vehicle. Output will be seen by SCADA screen. Here we do simulation for single floor consist of 6 slots and every slots consist of individual sensors and also lamps for indication (output). Software used is GP-PROX V4.



Fig: Ladder Diagram

Interfacing SCADA Screen with PLC



Advantages

- Least chances of accidents.
- To occupy the land area effectively.
- Save the wasted time in parking slot.
- Cars are accessible only by the owner that is highly secured.
- Solves the problem of parking in shopping complex, public places or apartments.

Disadvantages

- Any fault in the multilevel car parking system causes great haphazard and inconvenience.
- Expensive because the whole parking and retrieval operation is multilevel.

Applications

- Minor parking lot damages such as scrapes and dents are eliminated.
- The parked cars and their contents are more secure since there is no public access to parked cars.
- This project can be used in shopping malls, railway station, airports or any other places where crowd is observed.
- The set cars and their contents area unit safer since there's no public access to set cars.

5. CONCLUSION

This PLC and SCADA based multilevel automatic car parking system project represents new parking innovation technique. The implementation of system on a large scale will definitely results in better utilization of land, less or no thefts and solves many traffic problems and offers the greatest possible flexibility for the realization of optimum parking solution. The use of 'programmable logic controller' makes the system reliable, easy to maintain, future proof and can be proved cost effective in long run. By increasing the number of inputs outputs and relays coupled together with sensors we can create parking for as many vehicles as required.

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