

Automated Car Parking System Using PLC and HMI System

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Abstract— PLC or Programmable logic controller is used to control system using specific functions. Basic PLC functions such as timing, sequencing, controlling and relaying are implemented. The scope of this project is to control the car parking using PLC and HMI application. The system is able to sense the presence of the vehicles standing at the main car parking gate using through beam sensor and it is counted using limit switch. These through beam sensors give their output to the PLC (programmable logic controller). Due to lack of parking spaces and skilled labour, there is a global shift towards the automatic car parking system to calculate accurate space available for car. In practical situations sensors (Through beam sensor) are used to detect presence of vehicles in a parking slot which send an interrupt signal to the control unit. In PLC the status of the sensors will be checked and certain logical operations are performed to decide which slot is to be serviced. Using PLC ladder programming we interface CPU with PLC through communication and protocols and serial to USB converter. Required components for the project includes PLC, PLC software, sensor (through beam), HMI.

Key words: PLC, HMI, SMPS, Indicator, Limit Switch, Through Beam Sensor

I. INTRODUCTION

The massive increase in the number of vehicles cause parking problems. To manage these vehicles there is a need of a proper parking system. The most common problem often encountered while dealing with vehicles is over crowding of parking places, lack of parking space, which finally leads to wastage of fuel and time of people. The ultimate aim of the technology is to reduce the load on people. So, here we are going to develop an automatic car parking system, which can manage the number of cars inside a parking area. It also has provision to inform the person about the empty or occupied parking slot at the entrance of the parking area. The advantages of the following system are Optimized parking, Reduced pollution, Decreased Management, Increased Safety. In this project we have developed a prototype with the help of PLC and HMI. The parking is smart in the sense that there's no need of any human efforts to provide any security or guide lines to the users. We got motivation from the people who face problems in finding vacant places in a large car parking area. Some people enter in the wrong row and then they reverse their car and face problems to do so. They waste their time for such kind of unnecessary efforts. Also, they sometimes get irritated when they don't get a suitable place for their car. We have also installed a HMI display, through which we can control and monitor the car parking. From HMI, we can also remotely control the car parking and reset it. The opening and closing of gate can also be controlled with the help of HMI. Besides these features, energy is also used efficiently in this project. All the electric components are in use only when there is a need by any user.

II. BASIC APPROACH FOR SMART CAR PARKING

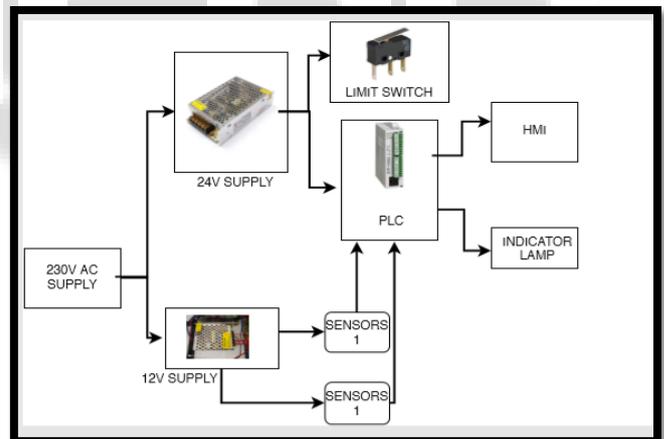
The main objectives of our model can be summarized as follows:

- To design and develop car parking which is very user friendly.
- To understand the problems associated with the user and to solve them.
- To make a program, which should be easy to understand by an electrical engineer.
- To use the most appropriate hardware components that would make the parking more efficient.
- To develop a user-friendly interface on HMI. This car parking is fully automated. There is no need of any kind of human efforts. This is associated with a very user-friendly environment for the users. It is energy efficient and economical. PLC is used of 14I/O.

Modules Used:

- 1) BLOCK DIAGRAM
- 2) DELTA PLC
- 3) HMI SCREEN
- 4) PLC LADDER
- 5) VISUALIZATION

1) *Block diagram -*



2) *PLC:-*

1. *Input /Output Section-*

The input section or input module consists of devices like sensors, switches and many other real-world input sources. The input from the sources is connected to the PLC through the input connector rails. The output section or output module can be a motor or solenoid or a lamp or a heater, whose functioning is controlled by varying the input signals.

2. *CPU or central processing unit-*

It is the brain of PLC. It can be hexagonal or an octal microprocessor. It carries out all the processing related to the input signals in order to control the output signals based on the control program

3. *Programming Device-*

It is the platform where the program or the control logic is written. It can be handheld device or laptop or a computer itself.

4. Power Supply-

It generally works on power supply of about 24V used to power input and output devices.

5. Memory-

The memory is divided into two parts-The data memory and program memory. The program information or control logic stored in the user memory or the program memory from where the CPU fetches the program instructions. The input and output signals and the timer and counter signals are stored on the input and output external image memory respectively.

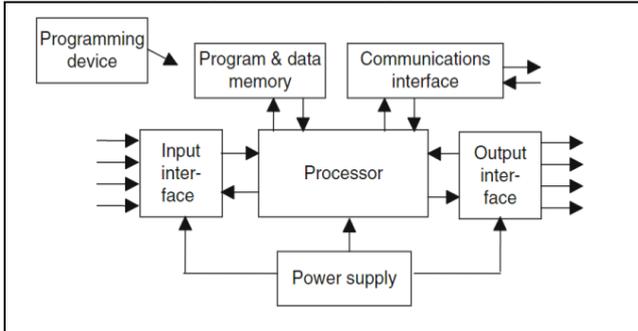


Fig. 1: PLC Architecture



3) HMI Screen-

HMI screen is designed accordingly to the working and programming of the plc. We used DIA view software for delta programming and created the parking windows accordingly to the parking slots allotted to the parking.

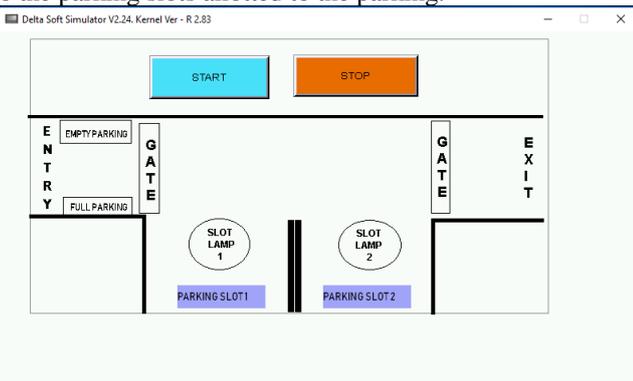
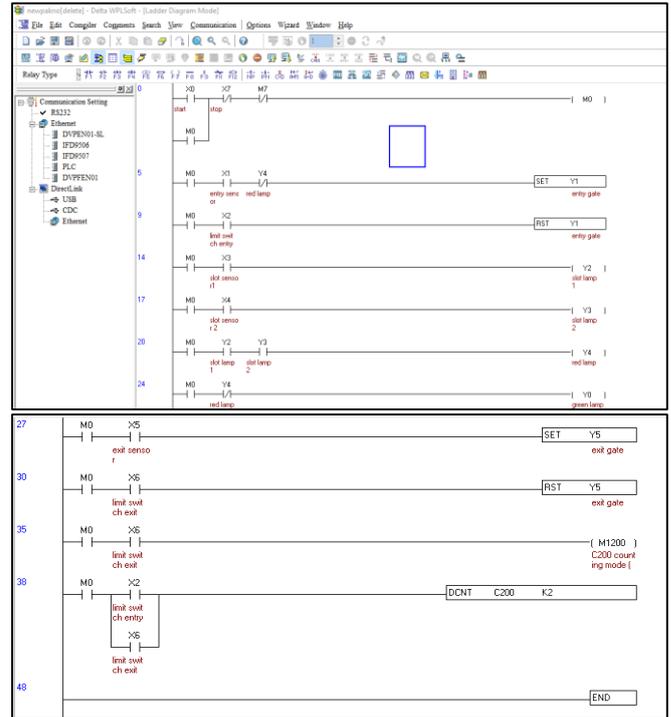


Fig. 2: HMI SCREEN

4) PLC LADDEER-

Ladder logic programming is the most common programming language used to program a PLC. Ladder logic was one of the first

Smart Car Parking logic built up using PLC and HMI programming approaches used in PLCs. The software used for programming is WPLsoft 2.45. Fig. 3 shows the program for entry in car Parking and slots allotting.



III. RESULTS AND DISCUSSION

Smart Car Parking completes the demands of Smart India very efficiently. It provides smart work, energy consumption control, security and ease at the same time. HMI can be implemented for accessing and monitoring from remote location. Thus, it is a completely smart and fully automated car parking and is the future of the car parking.

IV. FUTURE SCOPE

There are basically some points that we are considering in the future scope of our project. Firstly, we replace it by conventional 2 floor or 4-floor parking systems in the residential and corporate building with our advanced car parking system. And secondly, we see our project can be built in collaboration with the construction of 5 and 7-star hotels, malls to accommodate our parking system in the building itself so as the luxury cars can be fitted with the suite of the executive lounges.

V. CONCLUSION

- The main objective of this project is to develop an Intelligent Car Parking system based on public reviews and specifications. This system is successfully implemented using PLC and HMI protocols.
- This parking system is designed in order to minimize human labour and to save the precious time of car owners waiting to find a parking spot.
- This project ensures Car safety and better parking management.

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