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PLC Based Automatic Car Parking System

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Abstract
In the present era of the automobile world, vehicles are increasing at an alarming. This has posed a serious problem of parking. The major problem is with four four-wheeler vehicles. Since the available area for parking is very much limited in urban regions it is a severe problem. Given that the number of automobiles is growing daily, it is imperative that we avoid wasting any more space. Where parking issues are frequent, an automated parking plan ought to be created. Given the aforementioned issue, an automated system for parking cars has been put in place, which helps to reduce the amount of space needed for parking when compared to traditional car parks. In the current project, a programmable logic controller (PLC)-based automated parking system will be designed to identify available parking spaces in the facility and manage the parking process. In the current study, a compact programmable logic controller (PLC) called the ABB AC131GRF, which is based on ladder logic, is used to create the automation process of an automatic automobile parking system. At the departure and entry gates, infrared (IR) electronic sensors were placed to detect cars that are either waiting to enter or exit.

Keywords: *PLC (Programmable Logic Controller), Automobile, Program.*

1. Introduction
In the modern world, where the number of cars on the road is growing daily and there aren't enough parking spots in both public and private areas. The world's population is growing at an astonishing rate, which is contributing to a sharp rise in the number of vehicles in use. due to the quantity of cars and the ensuing scarcity of parking spots. They present a significant problem to city planners, architects, and developers in heavily populated places. Providing enough parking places is a job best left to the experts. Due to this circumstance, an automated parking system is required, one that minimizes the need for manual control while also controlling parking in a designated area [4]. A programmable system used for automation is called a PLC (programmable logic controller). "Is a microprocessor-based specialized computer that carries out control functions of many types and levels of complexity" is one definition for the programmable logic controller. They are capable of storing instructions, such as sequencing, timing counting, arithmetic, data manipulation, and communication, to control industrial machines and processes. Figure 1 and are intended for use by engineers who may have little experience with computers and programming languages. The PLC's creators preprogrammed it so that a basic language could be used to enter the control programme [1].

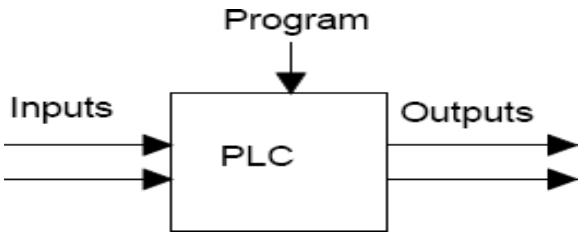

Figure 1 Block Diagram

Programming is mostly concerned with implementing logic and switching operations, such as if A or B occurs, switch on C, or if A and B occur, switch on. For this reason, the term "logic" is employed. The PLC is connected to input devices, such as switches and sensors, and output devices, such as motors and valves, in the system it controls.

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[8] An automated parking system that has the ability to control how many vehicles are parked in the lot. Additionally, it features a feature that notifies everyone attempting to enter the parking lot if there is a spot available for parking their car. In this project, a PLC is used to detect vehicle movement and, based on the number of vehicles that can fit through the gate, it opens or closes the gate. When a car parks automatically, the driver leaves the vehicle inside a designated area, and technology parks the car at a predetermined spot. PLC-assisted mechanical car lifters move the car to a higher height for safe storage. The procedure is reversed when the automobile is needed, and the car lifters return the vehicle to the spot the driver left behind. The programme utilized in this project is the PLC training kit and ABB AC131GRAF. [10].

2. Methodology

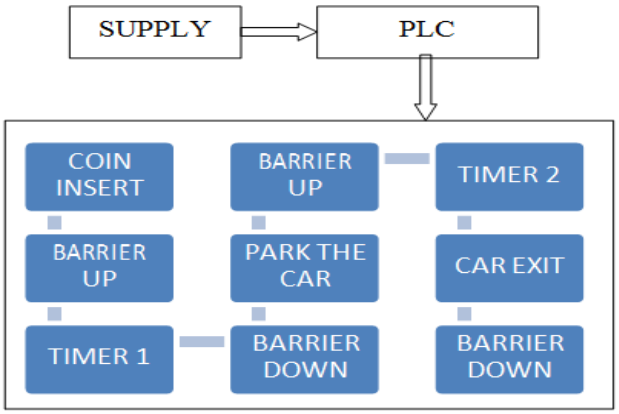

Figure 2 Block Diagram of the System

2.1 Components Used

A. Sensors

A photoelectric sensor or photo eye is equipment used to discover the distance, absence or presence of an object by using a light transmitter.

B. Valves

The valves are used to operate the barrier up and down. Figure 2 shows block diagram.

C. Solenoid

A solenoid is a coil wound into a tightly packed helix.

D. Internal Relay

An electrically powered switch is called a relay. Relays operate a switch mechanically by means of an electromagnet. [14].

3. Ladder Diagram

Ladder logic is the primary programming language of programmable logic controllers. They are called "ladder" diagrams because they resemble a ladder, with two vertical rails, and Figure 3 as many "rungs" as there are control circuits to represent.

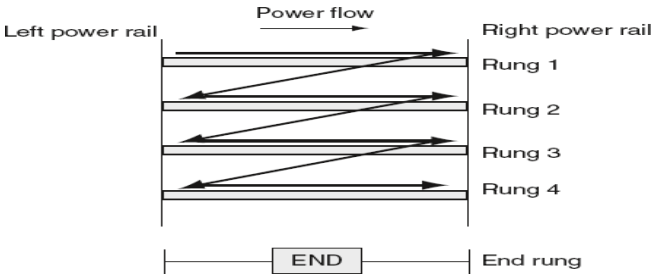

Figure 3 Representation of Ladder Diagram

Every rung on the ladder diagram defines a single control process operation. One might read the ladder diagram from left to right and from top to bottom. There must be an input at the start of each rung and at least one output at the end. The term describes control actions such as cutting the contact on a switch. The term describes an apparatus that is connected to the PLC output in Figure 4, such as a motor.

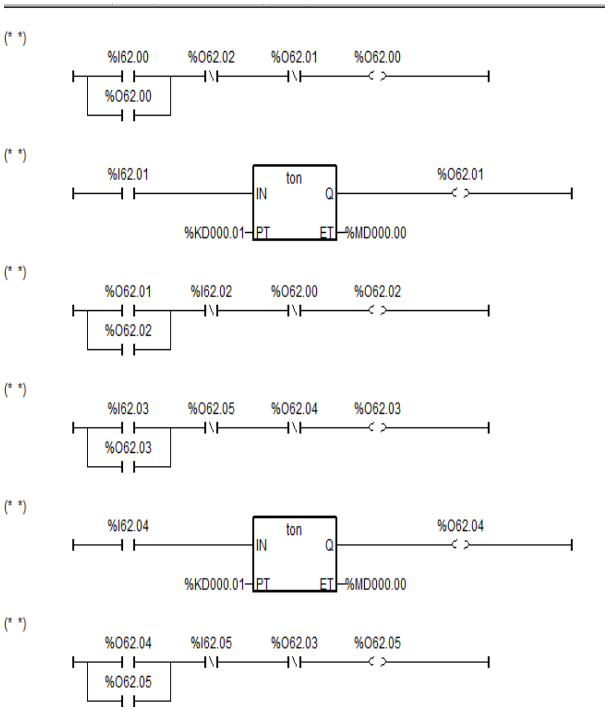

Figure 4 Ladder Diagram

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Table 1 Input and Output

Inputs	Outputs
%I62.00: coin inserting box(sensor).	%O62.00: output ofsolenoid1.
%I62.01: input indicating entry barrier up.	%O62.01: internal relay1.
%I62.02: input indicating entry barrier down.	%O62.02: output of solenoid2.
%I62.03: input when carapproaches exit barrier.(sensor).	%O62.03: output ofsolenoid3.
%I62.04: input indicating exitbarrier up.	%O62.04: internal relay2.
%I62.05: input indicating exitbarrier down.	%O62.05: output ofsolenoid4.

We can see the input and output in Table 1. The in-barrier is opened once the correct amount of money is placed in the collection box. Figure 4.2 depicts the ladder diagram of the car parking system. The out barrier is supposed to open when a car is recognized at the barrier. The barriers are operated by valves that contain a solenoid for one position and a return spring for the other. As a result, the position indicated by the spring when the solenoid is not energized. The piston is moved by the valves, and as it moves upward, the barrier rotates around its pivot and rises as a result. A switch is triggered when a barrier is breached. When it is raised, a switch is tripped. These switches provide inputs that show whether the barrier is up or down. Sensors are utilized to detect when a car has approached the exit barrier and to show when the appropriate amount of money has been placed in the collection box for a vehicle to enter.

In Rung 1: When the coin box sensor's output provides %I62.00 input, solenoid 1 receives the output %O62.00, which raises the entrance barrier. Latched, %O62.00 stays active until internal relay 1 (%O62.01) opens.

In Rung 2: When a sensor indicates that the barrier is up, the timer T1 is triggered by input %I62.01 and is used to hold the barrier up for 10 seconds.

In Rung 3: When the timer (T1) goes off, output %O62.02 turns on, turning on solenoid 2 and lowering the barrier. If the barrier is being lowered and there is an output of %O62.02 to solenoid 2, then the output %O62.00 will likewise not occur.

In Rung 4: When a sensor detects an automobile and sends input %I60.03 to solenoid 3, the exit barrier is raised.

In Rung 5: Timer T2, which is started by input %I62.04 from a sensor indicating the barrier is up, is used to hold the barrier up for 10 seconds when it is up.

In Rung 6: When the timer (T2) reaches its finish, output %O62.04 is activated, which lowers the barrier and activates solenoid 4.

4. Results

Figure 5 shows the Entry barrier operation, Figure 6 shows the Exit Barrier Operation, and Figure 7 shows the ladder diagram.

A. Entry Barrier

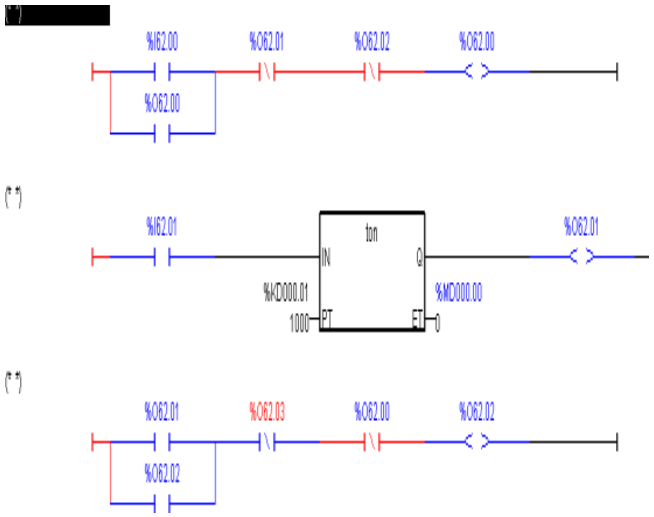

Figure 5 Entry Barrier Operation

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B. Exit Barrier

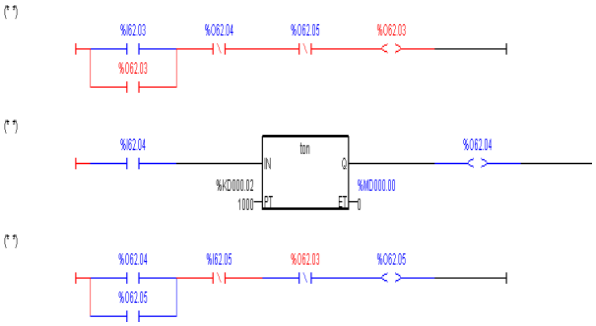

Figure 6 Exit Barrier Operation

C. Ladder Diagram

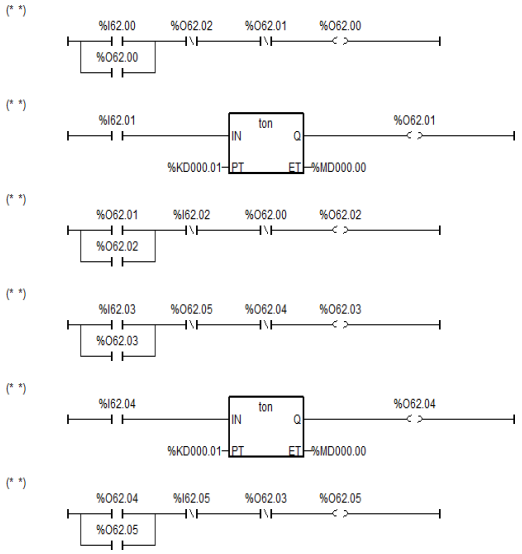

Figure 7 Ladder Diagram

Conclusion

By using PLC the car parking system can be monitored efficiently. The time required to park the car can be reduced. Automatic control is designed which is used to take cars in & out of system to park.

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