PLC & SCADA based Automated Car Parking Management System

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Abstract— Nowadays, haphazard parking problems are common in the city areas, especially in the metropolitan cities. This is a common scenario in the malls, shopping markets and even roadside parking allotments. It is extremely tough to manually supervise the parking of each and every car, keep a record of number of cars and money collected over a vast area. In this project when the car enters inside the parking area, there is a paying booth that is totally automated and there is also a barricade which opens if and only if the driver swipes his card and automatically closes again as the car enters inside. There are Green LED poles in front of each slot that glows when the slot is empty and automatically goes off when the car occupies the slot. Once all the slots are occupied, a Red LED pole at the entrance glows indicating parking full. This easily guides the driver with the availability and non-availability of parking. Delta PLC and SCADA techniques are incorporated in this system. Automatically parking bill is generated according to the time of parking for each vehicle. This system minimizes the human intervention and possibility of fake bill. In case of improper parking the voice message will alert the driver to re-park his vehicle properly into the slot.

Key words: PLC, SCADA

I. INTRODUCTION

Nowadays, haphazard parking problems are common in the city areas, especially the metropolitan cities. This is a common scenario in the shopping malls, supermarkets and even in the roadside parking allotments as shown in Fig 1.1. It is extremely tough to manually supervise the parking of each and every car into the right slot, keep a record of number of cars and money collected and direct the drivers to empty slots over a vast area.

Fig. 1: Improper Car Parking

Automation plays an increasingly important role in the global economy and in daily experience. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities. Automation is the use of control systems such as computers to control industrial machinery and processes, replacing human operators.

Specialized hardened computers, referred to as programmable logic controllers (PLCs) are frequently used to synchronize the flow of inputs from sensors and events with the flow of outputs to actuators and events. This leads to precisely controlled actions that permit a tight control of almost any industrial process.

II. EQUESTIONS AND VARIABLES

The main aim of this project is to design and build a prototype car park control with PLC integration since it gives more structured approach rather than conventional approach. And also aims for monitoring the entire area and the regarding parking activities using SCADA.

The other objectives include:

- To avoid the confusion while parking the car/any vehicle in parking allotments and keep a record of number of cars and money collected and direct the drivers to empty slots over a vast area.
- To develop an intelligent, user friendly automated car parking system which reduces the manpower, traffic congestion and fuel consumption of the vehicle.
- To offer safe and secure parking slots within the limited area, continuous monitoring has been done.

A. Advantages of PLC over Relay Based Controller

- Enhanced Reliability
- Ease in logic modification
- Interactive operator interface
- Online repair facility
- I/O forcing through Software
- Online monitoring of user logics
- Finalization of control logic and fabrication of PLC can be done simultaneously
- Capability of self-diagnostics to find failure in the equipment
- Flexibility while setting and changing the logic during commissioning and operation
- Reliable components make these likely to operate for years before failure
- Trouble shooting aids make programming easier and reduce downtime
- Computational abilities allow more sophisticated control.

This section gives the description of peripherals and modules used in the project. The hardware devices used are as follows:

- PLC

- Sensors
- Relays
- Stepper motor
- LEDs

Power Input	24V DC
Current	Max. 7.5A @ 24V DC
Power consumption	1.8W
Weight (g)	97g
MPU Points	14 (8DI + 6DO)
Max I/O Points	494 (14 + 480)
Program capacity	8k Steps
COM Port	Built-in RS-232 & RS-485 ports
Compatibility	ASCII/RTU protocol

Table 1: Electrical specifications of DVP-14SS2 PLC

III. FIGURES

Fig. 2: DC stepper motor

The barrier gate is operated by a stepper motor that needs 12 volts to run in its full speed in one direction. The full speed here is 60rpm. But using the two 24 volt relays we provide only 5 volt to the motor, thus reducing its speed. Also, the two relays operate it in two different directions. The time for the motor to run or stop has already been specified by the PLC itself. The specifications of DC stepper motor are depicted.

Fig. 3: Red and Yellow LEDs

Here red color LED is used to show that the parking is full. Inside the PLC the inputs from the relays are connected in series. When all of them get connected the series completes and the current is taken to the LED which glows immediately. And also yellow color LEDs are used to show the empty slot which is placed at each slot as shown in Fig. 4.5. And also the specifications of these LEDs.

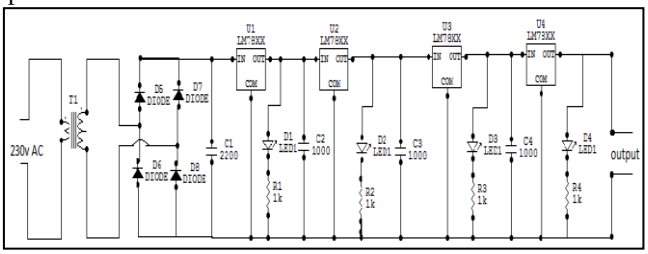

Fig. 4: Power Supply Circuit

The above power supply circuit board describes how to obtain a 24V DC voltage from the AC power line as shown in Fig 4.6. In this circuit, the AC voltage drops down on the transformer's secondary winding. A rectifier bridge with 4 diodes is used to convert the alternating AC voltage to a continuous DC voltage supply. A filter capacitor is added after the rectifier bridge in order to decrease the DC voltage ripple. The LM7824terminal voltage regulator provides a very stable output and high current.

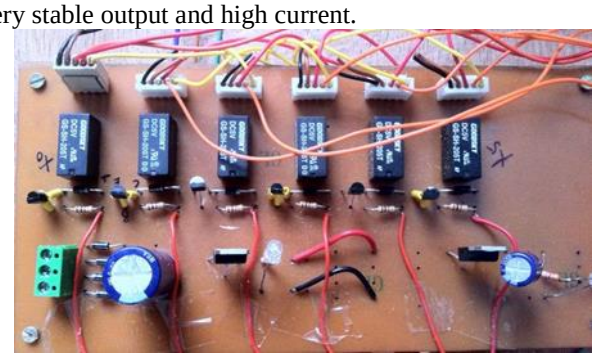

Fig. 5: Sensors circuit board

If the sensor has detected some phenomenon then it will trigger the active line. The active line is directly connected to an NPN transistor. If the voltage to the transistor on the active line is 0V, then the transistor will not allow current to flow into the sensor. If the voltage on the active line becomes larger than the transistor will switch on and allow current to flow into the sensor to the common.

Sourcing sensors are the complement to sinking sensors. The sourcing sensors use a PNP transistor. When the sensor is inactive the active line stays at the V+ value, and the transistor stays switched off. When the sensor becomes active the active line will be made 0V, and the transistor will allow current to flow out of the sensor.

IV. CONCLUSION

From the above project the following conclusions were drawn. PLC and SCADA based automated car parking system is fabricated by using PLC and other hardware components. SCADA as a software interfaced with PLC. Red and Green LEDs are used for non-empty and an empty parking indication respectively. Automatically parking bill is generated according to the time of parking for each vehicle and it avoids the fake bill. Vehicle owner/driver can save the time by observing the LEDs.

The future scope of this project can be implemented by using advanced features of SCADA such as, unique ID generation for counting the time for which the car has been parked in the allotment, this can be achieved by a successful communication between SCADA system and the car while the driver swipes his card for token the SCADA system starts counting the time as soon as the driver swipes his card. So that security of the vehicles can be enhance.

By the implementation of database management system which provides detail information about vehicle i.e. arrival, departure, time, date, day and vehicle number etc. Due to this concept anyone can access past information about vehicles in case of any emergencies from the database.

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