Article

Automatic Car Wash using PLC

Abhishek Meena[1], Anshul Agrawal[2], Aqib Ansari[3]

Abstract

Automatic car washing system is very common in developed countries. Automatic car wash systems can normally be seen at fuel filling stations. Such systems generally have heavy machinery like motor pumps, brush drives etc. which are governed by programmable logical controllers. The automatic car wash consists of five stages namely clean water spray, soapy water spray, brushing, clean water spray and drying. This system uses large quantity of water; thus water recycling plant should also be there to manage water wastage properly but at this level we are only presenting the car washing.

This system is very complex and expensive so it has used very less no of cities in India as compared to foreign countries. But to help our project we have tried to minimize the device list to minimize the cost.

Keywords: PLC=programmable logic controller (Device used for controlling system)

Introduction

Firstly, automatic car washing systems were introduced in late 1930s. Automatic car washes consist of tunnel-like structure into which car has to be driven by the customer. payment at car washing systems can be done through a computerized POS (point of sale unit), also known as an "automatic cashier" or manually through cash. When the sale is automated, after paying for the car, car is put into a line-up often called the stack or queue which moves sequentially, so that the washing system knows what each car purchased and according wash each car entering the system. At some washes, sensors are used to sense the position of tyres and the system will deploy several rollers. The tyre sensor lets the wash know where the wheels are and how far apart they are. On other systems which are not that much automated the employee may guide the customer on and hit a 'Send Car' button on the tunnel controller, to manually send the rollers which push the car through. When the customer is on the conveyor, the attendant will instruct the customer to turn off the vehicle, release all brakes, and not to steer. Failure to do so can cause an accident on the conveyor. The rollers come up behind the tires to push the car through a detector, which measures vehicle length, allowing the controller to teller the wash to each individual vehicle. The number of equipment, frames, or arches, may vary in number and type. A good car wash makes use of many different pieces of equipment and stages of chemical application to thoroughly clean the vehicle.

Methodology

Literature Survey: The approach to develop the automatic car wash is as follows:

[1,2,3]Department of Electrical Engineering,

Correspondence: Mr Anshul Agrawal, Suresh Gyan Vihar University, Jaipur, Rajasthan, India.

E-mail Id: anshagrawal2510@gmail.com

Orcid Id: http://orcid.org/0000-0003-0212-1802

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PLC (Programmable Logic Controller)

Introduction

Programmable logic controller, **PLC**, or **programmable controller** is a solid state device having a digital computer and is used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used to control many heavy machines, in many industries. PLCs are modelled for multiple arrangements of digital and analog inputs and outputs, extended temperature ranges, immune to electrical noise, and resistance to vibration and impact. Programs to control machine operation are stored in battery-backed-up and non-volatile memory. A PLC is a robust, real-time system since output results must be produced in response to input conditions within a limited time, otherwise faulty operation will occur.

Features

- PLCs are armored for severe conditions (such as dust, moisture, heat, cold), and have the facility for extensive input/output (I/O) arrangements.
- PLCs read limit switches, analog process variables (such as temperature and pressure), and the positions of complex positioning systems.
- PLCs operate electric motors, pneumatic or hydraulic cylinders, magnetic relays, solenoids, or analog outputs. The input/output arrangements may be built into a simple PLC, or the PLC may have external I/O modules attached to a computer network that plugs into the PLC.
- A **programmable logic controller**, **PLC**, or **programmable controller** is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory.

PLC like programming combined with remote I/O hardware, allow a general-purpose desktop computer to overlap some PLCs in certain applications.

Prior Approach

➢ Objectives
- The main objective of automatic car wash is to save time, run the system whenever it is needed and minimize human error.

➢ Work Plan:
- **1st Month-** Study of PLC.
- **2nd Month-** Writing codes in PLC and installation of it.
- **3rd Month-** Buying different components and equipments for the project.
- **4th Month-** Designing of the Car wash system.
- **5th Month-** Implementing the codes and testing of it.

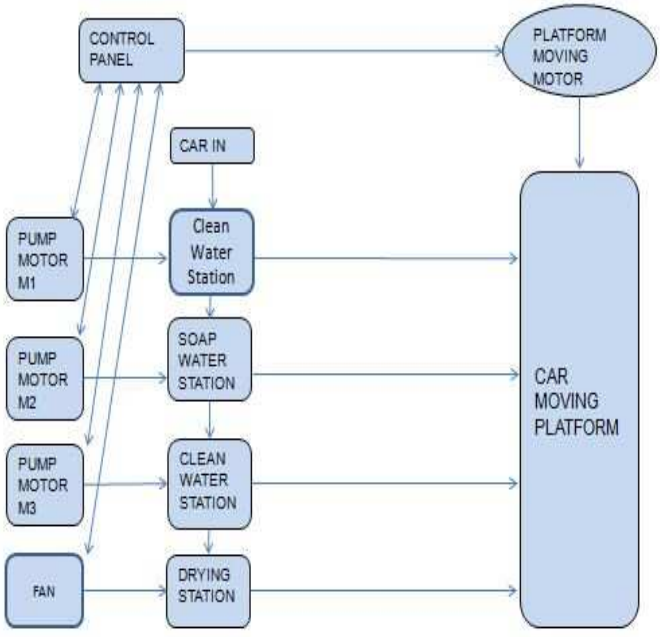

Figure 1.Block Diagram of the Automatic Car Wash

Overview

A **programmable logic controller** (**PLC**) or **programmable controller** is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.

They were first developed in the automobile industry to provide flexible, ruggedized and easily programmable controllers to replace hard wired relays and timers. Since then they have been widely adopted as high reliability automation controllers suitable for harsh environments. 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 deficiencies described above show that the current caching mechanisms will not be sufficient for all applications. Instead application-specific consistency protocols are required. Clients of applications require flexibility in how they interact with an underlying caching system in order that they can optimize performance guard to individual resources. Support for a wider variety of protocols could be provided by extending HTTP horizontally, e.g., by adding resource-driven invalidation of caches to the protocol but, as we have argued previously, improved functionality can better be introduced though the use of object-oriented technology. In the next three sections we shall describe first an overview of the WWW Object technology and then our implementation of open caching within the WWW Object project.

History

PLC History

The development of Allen Bradley PLC (Micro Logix 1000) PLC began in 1968 in response to a request from an US car manufacturer (GE). The first PLCs were installed in industry in 1969.

Communications abilities began to appear in approximately 1973. They could also be used in the 70's to send and receive varying voltages to allow them to enter the analog world. The 80's saw an attempt to standardize communications with manufacturing automation protocol (MAP), reduce the size of the PLC, and making them software programmable through symbolic programming on personal computers instead of dedicated programming terminals or handheld programmers.

The 90's have seen a gradual reduction in the introduction of new protocols, and the modernization of the physical layers of some of the more popular protocols that survived the 1980's. The latest standard-IEC 1131-3‖ has tried to merge plc programming languages under one international standard. We now have PLCs that are programmable in function block diagrams, instruction lists, C and structured text all at the same time.PLC has Processor unit (CPU), Memory, Input/output, Power supply unit, Programming device, and other devices.

PLC Communication

Extension modules

In modular PLCs in order to vary number of inputs and outputs we can use external extension lines. Each module can contain extensions both of input and output lines. Extension modules can have inputs and outputs of a different nature from those on the PLC controller.

Cables

Twisted-pair cabling, often routed through steel conduit. Coaxial cable enables higher data rates to be transmitted and does not require the shielding of steel conduit. Fiber optic cabling has the advantage of resistance to noise, small size and flexibility.

Parallel communication

Parallel communication is when all the constituent bits of a word are simultaneously transmitted along parallel cables. This allows data to be transmitted over distances at high speeds. It might be used when connecting laboratory instruments to the system.

Serial communication

Serial communication is when data is transmitted one bit at a time. A data word has to be separated into its constituent bits for transmission and then reassembled into the word when received. Serial communication is used for transmitting data over long distances. It might be used for the connection between a computer and a PLC.

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PLC I/O

Example of input lines can be connection of external input device. Sensor outputs can be different depending on a sensor itself and also on a particular application.

In practice we use a system of connecting several inputs (or outputs) to one return line. These common lines are usually marked-COMM|| on the PLC controller housing.

SMPS

We have to use an electronic power supply that can be used as a switching regulator to convert electric power efficiently, for that purpose we have to use a switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher).

A SMPS is used to convert voltage and current characteristics of main source to feed a load such as personal computers. Here we are using a SMPS to feed the PLC. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy.

Practically, a switched-mode power supply wastes a very little power in form of heat or radiation which makes it very efficient. By varying duty cycle of the thyristors used in SMPS we can achieve desired voltage regulation. As SMPS is capable of power conversion with much higher efficiency it is thus suited to be used in such applications.

Relays

A relay is an electrically operated switch. Many relays us an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early.

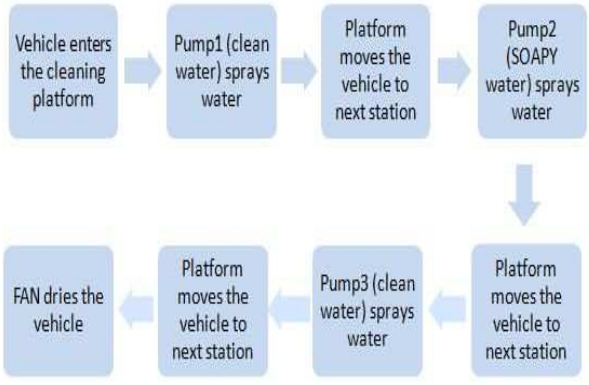
Our Approach

Introduction

The project-Automatic car wash using PLC is just an advanced model of future car wash stations. This project is basically consisting of software and hardware components. Now we tell the description of all hardware components that we used in this project.

List of Hardware Components

- PLC (Allen Bradley Micro logix 1000 AC/DC).
- DC MOTOR HIGH TORQUE (10rpm).
- Conveyor belt.
- DC Motor (100 rpm).
- AC water pumps.
- Drying fans.
- Rollers.
- Water showers.
- Wooden base.
- Acrylic sheets.
- Shafts.
- Water pipes.
- Buckets.
- Connecting wires.
- Clamps.
- Brushes.
- Push buttons.
- Relay.



Conclusion

Merits

- No man power required.
- If we use special car washing pressure pumps no compressor will be required.
- Can be use in domestic service stations.
- Very less maintenance.
- Comparatively cost of system is less.
- Less space is required.
- No environmental pollution
- Fast and accurate operations.

Demerits

The primary environmental considerations for car washing are:

- Use of water and energy sources.
- Contamination of surface waters.
- Contamination of soil and ground water.

Result

In Automatic Car Washing System, we performed all the operations needed to clean the car successfully by using PLC and made a small working model of automatic car wash station. It can be implied on more than one car wash at a time, by simply changing the coding and making small changes in the model.

This prototype will help to perform car washing automatically and results in high quality end product. Thus it will be User-friendly and capable to wash multiple cars at a time. It also requires lesser man power, time and do not pollute the environment.

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