Simulation of Automatic Car Washing Using PLC
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Abstract—The main objective of this project is to perform exterior car washing by using programmable logic controller. A PLC (Programmable Logic Controllers) is a digitally operating electronic apparatus which uses a programmable memory for the internal storage of instructions by implementing specific functions such as logic sequencing, timing, counting, and arithmetic to control, through digital or analog input/output modules, various types of machines or processes. PLC sends the information like entry and exit of the car and emergency conditions to the customer (or) operator through alarm. After receiving the information from the PLC, the operator can be able to act upon it. Car washing includes spraying of soap solution, cleaning with water, wiped by brushes and finished with the forced air drying.

Key words: PLC, AUTOMATIC CAR WASHING, Ladder Logic, HORNER PLC

I. INTRODUCTION
In modern industries, industrial automation was inevitable, which means if it doesn’t move quickly enough in competition with others it will lose. Many factories use programmable logic controls (PLCs) in automation processes to diminish production cost and to increase quality and reliability. There are many types of car washes. Some of them are Hand car wash where the vehicle is washed by employees, Self-services car wash where the customer performs the washing, Chemical car washes which use chemicals to wash and polishing the car surface etc., Nowadays automation has extended its hands in various fields. In automobile services manual car washing requires more labour effects, time consumption and also the results may not be satisfactory to the customers. In order to overcome this, car washing can be done automatically using Programmable Logic Controllers (PLC). A PLC is a microprocessor based specialized computer that carries out control functions of many types and levels of complexity. Its purpose is to monitor crucial process parameters and adjust process operations accordingly. It can be programmed (to a degree), controlled, and operated by a person unskilled in operating (programming) computers.

II. WORKING OF PLC
PLC is a digitally operating electronic apparatus used to monitor output with the input given. It has a programmable memory for instruction storage by using the functions logic sequencing, timing and counting through digital or analog I/O module.

The basic function of PLC is continuous scanning of program. The scanning is done in 3 steps. First is by sensing the sensors, second one is execution of the program and the final scan process will be updating the output. The plc will check the inputs by their status (i.e.) ON or OFF state. If the input is activated the information will be saved and in accordance with that the program will get executed, some of the operations in the plc for the automated car washing system takes place through the following blocks

A. Input Relay:
It is a transistor which acts as a relay that connects to the outside world and gets the signal from the sensor.

B. Counters:
They are used to count pulses, they do not physically exist these are mainly used either as up count, down count or both up and down count

C. Timers:
They do not physically exist. There are many varieties of timers used, most common type of timer is on delay timer

D. Output Relay:
It is also a transistor which acts as a relay that sends the signal to the solenoids, lights which gets connected to the outside of the world

E. Data Storage:
They are used to store the data and retrieve it whenever needed, and it can be used even the power supply is not available.

F. PLC Programming Method:
PLC can be programmed using Programming console PC Hand programmer

III. INTRODUCTION TO LADDER LOGIC
Ladder logic is a graphical representation of Boolean operations, equations, combining contacts with coils. The LD language enables the description of test and modification of Boolean data by placing graphical symbols into the program chart. LD symbols are organized within the chart exactly as an electric contact diagram. Fig.1.

![Fig. 1: General ladder logic diagrams](image-url)
IV. AUTOMATIC CAR WASHING SYSTEM

A 230 v AC supply is given to the system (SMPS) for obtaining 24V, DC supply. HORNER PLC is connected to PC through RS-232 communication cable for running the program. The Conveyor is used for moving the car. We use 10 rpm DC motors for driving the conveyor belt and 100 rpm motor for driving brushes and fans. The car is properly placed on the conveyor belt and the motor for making the conveyor to roll on is turned on and automatically the car place on the belt will set to move. Here High pressure nozzles are placed at various position for spraying soap solution and water to clean the vehicle and the brushes are used over instead of cloth for making a gentle clean of the vehicle it does not harm any painted finish and provides a gentle polishing effect to leave the paint much shinier. And a hot air is made to be touched over the car for making the car to become dry. Construction of this system is depends upon the requirement of the user and a visual programming language known as the Ladder Logic was used to program the PLC. There are four symbols that are used in Ladder Logic; an Open contact, a closed contact, an open output or relay coil and a closed output. PLC can also include items such as Counters and Timers for programming.

V. BLOCK DIAGRAM

An Infrared sensor is used to sense the presence of car at the entry level. Once the Infrared radiation is cut by the car an input signal is given to PLC. PLC sends the message to customer and operator to intimate that car is ready for washing using alarm. Operator can able to control the PLC through start process. Switches are present in the HMI screen. As an input signal is received, PLC starts executing the Ladder Program. First the conveyor moves by fixing a timer for 30sec. After that, it stops at the stage of washing. In general process, Car is cleaned by spraying soap solutions, rinsing, brushing, drying, waxing, etc. depends on the requirement of customer. We have chosen Spraying water, Brushing and finally Drying for cleaning the car.

VI. CONCLUSION

PLC is an easily understood programming language. It can hold data for a long time. The data handling, storage, processing power and communication capabilities of some modern PLCs are approximately equivalent to desktop computers. PLC-like programming combined with remote I/O hardware, allow a general-purpose desktop computer to overlap some PLCs in certain applications.

REFERENCE