Automatic car washing system using PLC

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***Abstract*—Automation is a need of time. Today in this modern era automation helps us to save time, cost as well as manpower. Vehicles are used extensively for transportation. It is also important to have easy and effective system for maintaining the vehicles cleanliness. Our paper focuses on car washing system using PLC and SCADA.**

In developed countries automatic continuous automatic car washing system is already developed and is being used extensively. In developing countries like India it is still uncommon and has lots of potential for development of such system and design.

Car washing can be done at spaces where cars can be parked for a long time and washing car can be done easily like fuel filling stations, super markets, hospitals, government buildings, railway stations etc..

Our car washing system has three main processes namely washing, cleaning and drying, Hence the exterior of the car will be washed by detecting the car on conveyor belt and further controlled by PLC & SCADA.

***Index Terms*—Conveyor Belt, DC Motor, Inductive Type Proximity sensor, PLC, Relay, Solenoid Valve.**

I. INTRODUCTION

Car washing is simple activity done in order to keep the exterior of the car clean. Mostly it is done manually in automobile garage or service centres of automobile companies. This manual way of cleaning car results in more consumption of water, manpower and time.

The automatic car washing system explained in this paper minimises the use of water and also manpower requirement. Our car washing system utilises control using PLC. SCADA system will be installed on the operator panel and hence the operator can monitor and control the whole process.

There are three process involved in our car washing system namely washing, cleaning and drying. Cycles of washing includes washing with water, and then with detergent [1]. Using this automatic car washing system, many cars can be washed and it will save time, energy and manpower. Such systems can be installed anywhere such as malls, airports, railway stations, residential buildings etc.[2]

II. COMPONENTS

A. Proximity Sensor

A proximity sensor is a detects the presence of nearby objects without any physical contacts by emitting electromagnetic field or a beam of electromagnetic radiation.

In our project, we have used inductive type proximity sensor for detection of metal cars.

B. PLC

PLC is a specialized computer used for the control and operation of manufacturing process and machinery. It uses a programmable memory to store instructions and execute functions including on/off control, timing, counting, sequencing, arithmetic, and data handling.[3]

C. Conveyor Belt

A conveyor system is an common piece of mechanical handling equipment. That moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials.

D. Solenoid Valve

It is an electronically operated device. For our requirements, the two port solenoid valve is the most suitable one. It is generally used to replace a manual valve.

E. Motor

In a dc motor, armature rotates inside a magnetic field. The basic principle of DC motor is that whenever a current carrying conductor is placed inside a magnetic field, there will be mechanical forces experienced by the conductor. Generally all dc motors work on same principle.

In our project, we are going to use 24 V DC relay. We are going to use two dc motors for moving the conveyer belt[4].

III. BLOCK DIAGRAM OF AUTOMATIC CAR WASHING SYSTEM

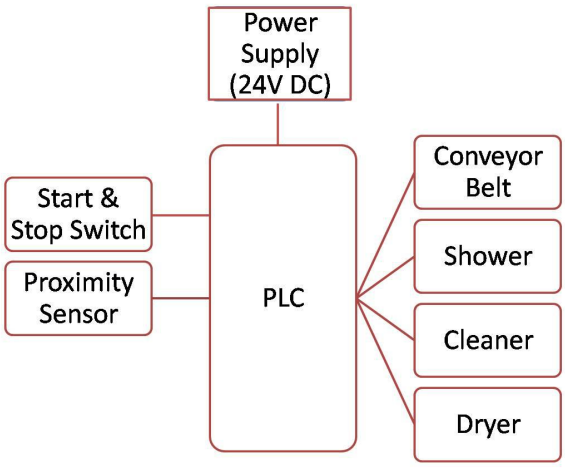

Fig.1.Block diagram of Automatic car washing system

As seen in the above figure, all the components like Conveyor Belt, Shower, Cleaner, Dryer are connected to the PLC. These components are getting signals from the PLC. Also a start and stop switch is given as an input to the PLC.
A Proximity sensor which senses if the vehicle is in place or not is also connected to the PLC.

Details about Components:

- PLC software:-WPLsoft
- Protocol:-Modbus
- Controller:- PLC (Programmable Logic Controller)- DELTA
- I/P devices:-
  Start push button
  Stop push button
  Proximity Sensor
- O/P devices:-
  Solenoid Valve
  Motor
  Dryer (Fan)
  Pump
  Conveyor Belt

IV. PROCESS

Fig.2. Car Washing Process Diagram

A.Washing
In a car washing system , washing is a primary stage. In the first stage car is to be washed by water necessarily to remove dust or mud from the outer body and from wheels of car.
This process is done manually in service stations. In our automatic system when the car is sensed on the conveyor belt by the proximity sensor, the conveyor belt stops the solenoid valve is opened and hence water is sprayed on the car.
There are two solenoid valves used for:

- washing with Water
- Washing with Foam

After washing with foam, the car has to be washed with water to remove the excess soap and water. When this stage is completed the conveyor belt starts again and the car is moved ahead.

Fig.3a. Car washing model

Fig.3b. Car washing model

B. Cleaning
After washing the next process is called Cleaning. In cleaning, car is sensed by the sensor and the mechanism of motor with curtain is use for cleaning.
A set of horizontal brushes wash the top, front and rear of the vehicles. Two sets of side brush wash the area around the vehicles, and another set of wheel brush cleans the wheel. The water rinses away.

Fig.4. Car Cleaning model

C. Drying

After cleaning the further process is called drying. In drying, car is sensed by the proximity sensor and so the conveyor belt stop and dryer/fans starts.

A compressed air dryer is used for removing water vapor from compressed air which are commonly found in a wide range of industrial and commercial facilities.

Hence the car will be dried using the dryers. After this stage the car is cleaned and hence the conveyor belt starts and the car is removed from the conveyor belt.

Fig.5. Car Drying Model

V. FLOW CHART

In car washing system, the car is moved to the conveyor belt and the presence of the car is detected by a proximity sensor. As seen in the flow chart when the car is detected the sensor gives signal to the PLC and hence the conveyor belt stops. After this stage the car has to be washed with water and hence the solenoid valve is opened and water is sprayed on the car.

After washing the car with water the car is to be washed with foam to remove all the dirt and dust so for this another solenoid valve is to be opened. Once the car is washed with foam the car is again washed with water to remove the foam and so water solenoid valve is opened.

After the washing stage the car is moved ahead for cleaning using curtains. The proximity sensor detects that the car is in place and hence the car is cleaned using the brushes.

The last stage of car washing system is drying the car for which the car is again moved ahead and when the proximity sensor detects the car in place the dryer turns on and the car is dried. The conveyor is moved on again and the car is removed from the conveyor belt as shown in the flow chart. Thus all the three stages are completed after which the car is cleaned automatically.

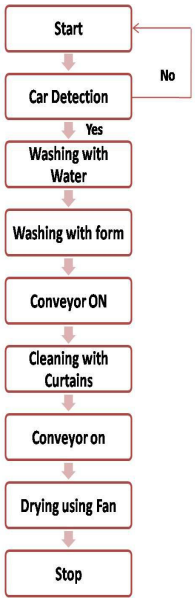

Fig.6. Process Flow Chart

VI. SYSTEM DESIGN

A. Project Mode And SCADA

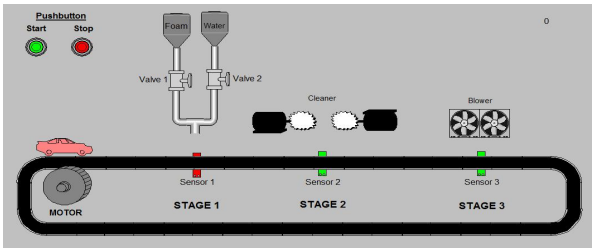

Fig.7. SCADA Model

As seen in the above figure the SCADA for the car washing system was designed. A start and a stop switch is seen in the SCADA which will work The car is seen on the conveyor belt. Three sensors are placed on the conveyor belt for position detection of car. Also two solenoid valves are placed one for water and one for foam. Brushes for cleaning as well as fan for drying can be seen in the SCADA.

VII. RESULTS

In Automatic Car Washing System, we performed all the operations needed to clean the car successfully by using PLC and hybrid compact logic L43 DCS, also developed mimic of the whole system on SCADA RS VIEW 32 Works and checked the overall process step by step by visualization.
After completion of the above processes by installation of this system car washing will be cost effective, time saving and pollution free.

VIII. CONCLUSION

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. Also require less man power, time and no pollution.

REFERENCES

[1] Amir Hossein Daei Sorkhabi, Bita Khazini;"Manufacturing of Full Automatic Carwash Using with Intelligent Control Algorithms;World Academy of Science, Engineering and TechnologyInternational Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering Vol:7, No:3, 2013

[2] Janik, A. Kupiec," Trends in Modern Car Washing" Polish J. of Environ. Stud. Vol. 16, No. 6 (2007).

[3] Johnson, C. D., Process Control Instrumentation Technology, Prentice Hall, 2006. Prof. Mhaske D.A., Bhavthankar R.G, Saindane A. R., Darade D.J.; "PLC Based Car Washing System";International Journal Of Innovative Research In Electrical, Electronics, Instrumentation And Control Engineering Vol. 4, Issue 4, April 2016.

[4] K. Vidyasagar , R. Ram Prasad, P. Nagasekhar ;"RFID-GSM Autonomous Car Washing System"; International Journal of Computer Applications Volume 121 – No.2, July 2015.