

Automatic Car Washing System Using Plc & SCADA

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Abstract: The automatic car washing system explained in this project minimizes 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. 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.

Keywords: Automation, SCADA, PLC.

I. Introduction

The first automatic car washes appeared in the late 1930s. Automatic car washes consist of tunnel-like buildings into which customers (or attendants) drive. Some car washes have their customers pay through a computerized POS (point of sale unit), also known as an "automatic cashier". The mechanism inputs the wash PLU into a master computer or a tunnel controller automatically. When the sale is automated, after paying the car is put into a line-up often called the stack or queue. The stack moves sequentially, so the wash knows what each car purchased. After pulling up to the tunnel entrance, an attendant usually guides the customer onto the track or conveyor. At some washes, both tires will pass over a tire sensor, and the system will send several rollers. The tire sensor lets the wash know where the wheels are and how far apart they are. On other systems 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 put the vehicle into neutral, release all brakes, and refrain from steering. Failure to do so can cause an accident on the conveyor. The rollers come up behind the tires, pushing the car through a detector, which measures vehicle length, allowing the controller to tailor the wash to each individual vehicle. The equipment frame, or arches, 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.



A vehicle in the high pressure

Also visible is the conveyor. The carwash will generally start cleaning with pre-soaks applied through special arches. They may apply a lower pH (mild acid) followed by a higher pH (mild alkali), or the order may be reversed depending on chemical suppliers and formula used. Chemical formulas and concentrations will also vary based upon seasonal dirt and film on vehicles, as well as exterior temperature, and other factors. Chemical dilution and application works in combination with removal systems based on either high pressure water, friction, or a combination of both. Chemical substances, while they are industrial strength, are not used in harmful concentrations since car washes are designed not to harm a vehicle's components or finish. The customer next encounters tire and wheel nozzles, which the industry calls CTAs (Chemical Tire Applicators). These will apply specialized formulations, which remove brake dust and build up from the surface of the wheels and tires. The next arch will often be wraparounds, usually made of a soft cloth, or closed cell foam material. These wraparounds should rub the front bumper and, after washing the sides, will follow across the rear of the

vehicle cleaning the rear including the license plate area. Past the first wraps or entrance wraps may be a tire brush that will scrub the tires and wheels. This low piece is often located beneath a matter (the hanging ribbon-like curtains of cloth that move front to back or side to side) or top wheels. There may also be rocker panel washers which are shorter in size (ranging in size from 18 inches [45 cm] up to 63 inches [160 cm] tall) that clean the lower parts of the vehicle. Most rocker brushes house the motor below the brush hub so they don't inhibit cloth movement and allow the brush to be mounted under a support frame or below a matter. Some car washes have multiple mitters, or a combination of mitters and top brushes.



Fig. A vehicle in the high pressure rinse stage of the wash.



Fig. Brush

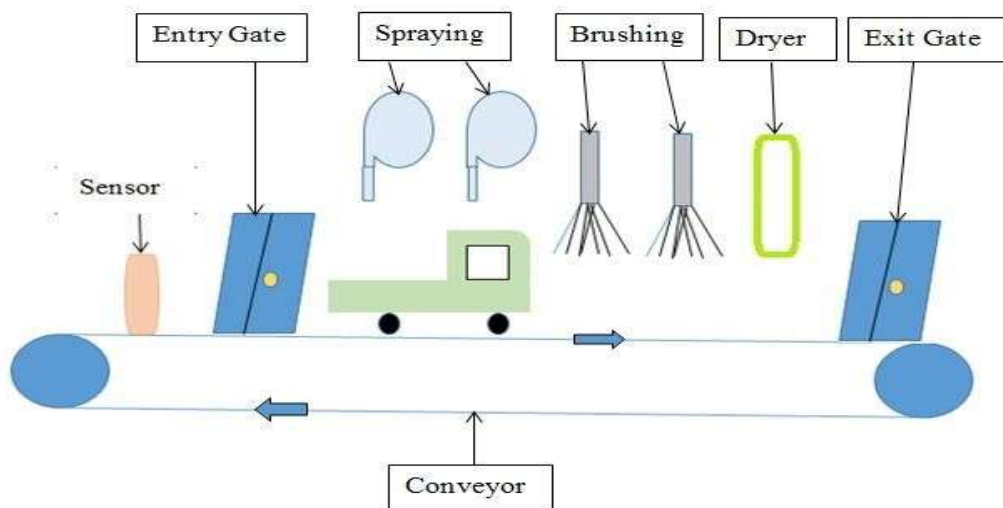
After the mitter or top brushes the car may pass through a second set of wraparounds. This may also be where high pressure water streams are used to clean difficult to reach parts of the vehicle. The car generally passes over an under carriage wash and/or has high pressure nozzles pointed at it from various positions. Next may be a tire spinner, high pressure nozzles angled specifically to clean wheels and tires. After the several wash stations the vehicle may go through triple foamers, usually red, Blue, and yellow, although colors can be customized with higher end chemical suppliers. The triple foam process includes special cleaners as well as some protective paint sealant. Protectants vary by manufacturer. Near the rinse is where a tire shining machine is often installed, which is designed to apply silicone tire dressing to the tires. This application makes the tires look good (new and glossy) and preserves the rubber. Next the vehicle is treated with a drying agent and a final rinse. Many carwashes utilize a "spot free" rinse of soft water that has been filtered of chlorine and sent through semi permeable membranes to produce highly purified water that will not leave spots. After using spot free water, the vehicle is finished with forced air drying, in some cases utilizing heat to produce a very dry car.



Fig. Clean Water Washing

Older automatic washes—a majority of which were built prior to 1980—used to use brushes with soft nylon bristles, which tended to leave a nylon deposit in the shape of a bristle, called brush marks, on the vehicle's paint. Many brushes in the US are now either cloth (which is not harmful to a car's finish, as long as it is flushed with plenty of water to remove the grit from previous washes), or a closed cell foam brush, which does not hold dirt or water, thus is far less likely to harm any painted finish, and can, in fact, provide a gentle polishing effect to leave the paint much shinier. In order to avoid paint marking issues, "touch less" or "no-touch" car washes were developed. This means the car is washed with high water pressure instead of brushes. There is no contact with friction so the chance of any damage is less. However the actual cleaning, or removal of film from the paint, is nearly impossible with no touch systems. At "full-service" car washes, the exterior of the car is washed mechanically with conveyor equipment, or in some cases by hand, with attendants available to dry the car manually, and to clean the interior (normally consisting of cleaning the windows, wiping the front and side dashes, and vacuuming the carpet and upholstery). Many full service car washes also provide "detailing" services, which may include polishing and waxing the car's exterior by hand or machine, shampooing and steaming interiors, and other services to provide thorough cleaning and protection to the car.

BLOCK DIAGRAM OF ACTUAL SYSTEM:-



DESCRIPTION:-

The figure shows the block diagram of Automatic Car Washing System. A 230V AC Supply is given as input to the SMPS for obtaining 24V DC, since PLC can operate at 24V DC. Terminal Block is used for multi inputs and outputs. PLC is connected to PC through RS-232 communication cable for downloading or uploading the program. Conveyor is used for shifting the car through various stages of washing. We use 100 rpm DC motors for driving the conveyor belt via pulley and for driving brushes. When conveyor's components are in good condition and well aligned, it will operate properly. Proper clamping of car wheels on the

conveyor is needed in order to avoid displacement. Generally brushes are now either cloth (which is not harmful to a cars finish, as long as it is flushed with plenty of water to remove the grit from previous washes), or a brush, which does not hold dirt or water. Thus it does not harm any painted finish. It provides a gentle polishing effect to leave the paint much shinier. High pressure nozzles are pointed at various position for spraying soap solution and water to clean difficult to reach parts of the vehicle. At the end, hot steam air is generally used for drying the car. Construction of this system is depends upon the requirement. A visual programming language known as the Ladder Logic was used to program the PLC. An Infrared sensor is used which emits radiation in order to sense presence of car at the entry level. Once the Infrared radiation is cut by the car an input signal is given to PLC. 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 few sec. 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. Each activity is carried out for a certain time period. Water is sprayed for few sec and nozzle is closed. Then four brushes rotate for few sec and stops. Now the conveyor starts moving to next stage. After few sec, it stops for drying. Two fans are used for drying the car up to few sec. Then the conveyor carrying car moves to the exit level. Again an IR sensor senses the car and sends an input signal to Programmable logic controller. Timings are set by using timers in ladder programming. These timings can be varied depending upon the requirement.

Working of system

Input-IR sensor:-

When car comes on IR-sensor, sensor sense and conveyor starts moving with the help of motor (M2) until it will reach to the next IR sensor section As car reached to next ir section then entry gate start to open for 2sec

Pre-Wash Section:-

As the car reaches in pre-wash chamber, shampoo water falls on the car by opening valve (V1).Valve will remain on for 5 sec. After 5sec. valve will close automatically. Again conveyor starts moving until it will reach to the next IR sensor section(Brushing section)

Brushing Section:-

As the conveyor stops vertical brushes starts brushing the car for 10sec. and stop. Again conveyor starts moving until it will reach to the next IR sensor section(Clean wash section)

Final Wash Section:-

Valve (V2) gets open for 5 sec. and get closed. Again conveyor starts moving until it will reach to the next IR sensor section(Drying)

Drying:-

Start dryer for 10 sec. and stop.

Exit:-

After drying stage completion open exit gate with the help of motor(M6) for 2 sec. and stop. Again conveyor starts starts moving until it will reach to the next IR sensor section. Close the gate (M6).

SCADA:-

A Supervisory Control and Data Acquisition (SCADA) is a [computer-based software](#) service that offers the ease of monitoring of sensors placed at distances [and controlling](#) various industrial processes, [from one central location](#).

The SCADA for our project is shown below. It contains the conveyor belt, control valve, IR sensor, Tanks, Dryer and electric motors with the different washing sections namely prewashing, brushing, wheel brushing, washing and drying.

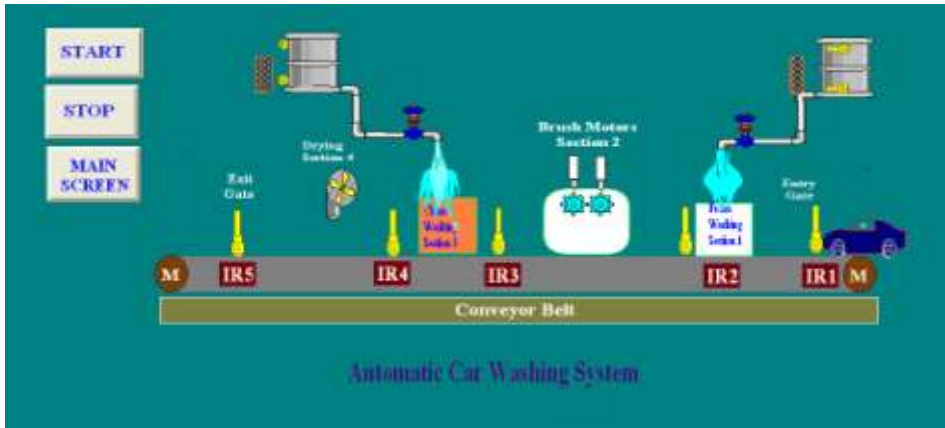


Fig. SCADA MIMIC

Output interfacing circuit diagram of DC Motor, Solenoid & Dryer with PLC :-

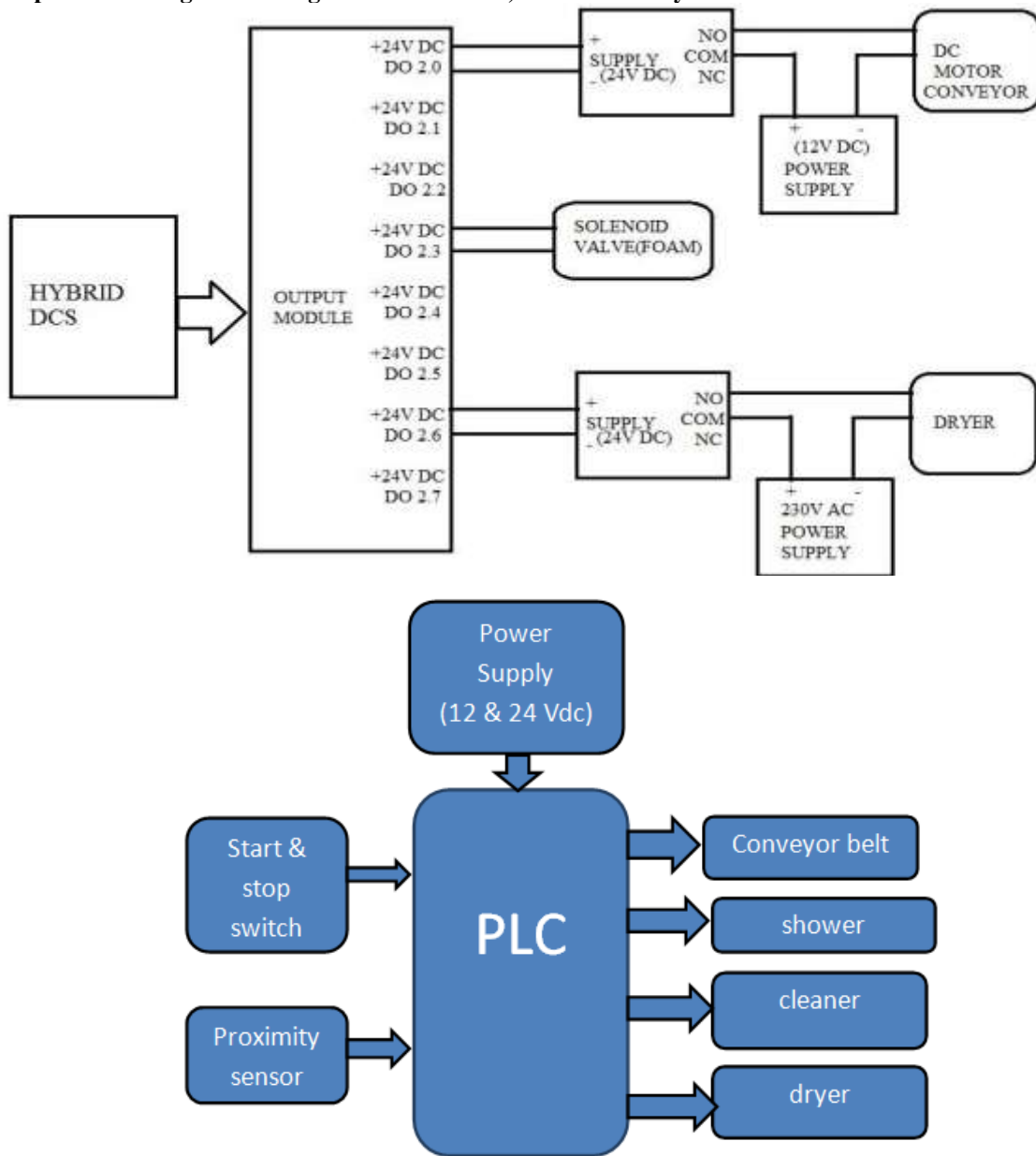


Fig. Block Diagram of car washing system using PLC

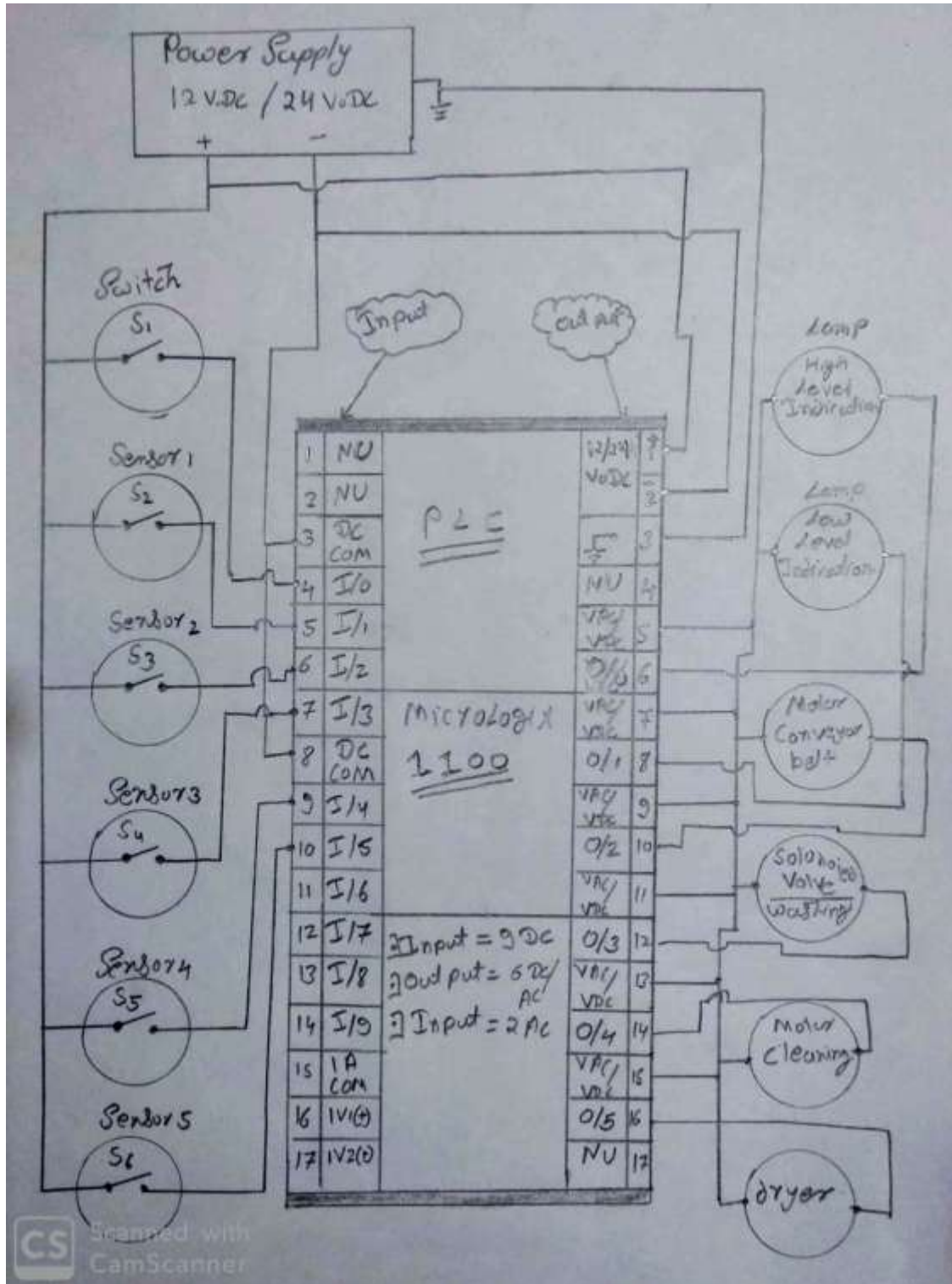


Fig. Circuit diagram

II. Conclusion

Car washing automatically 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.

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