Automatic Car Washing System

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***Abstract*—This paper presents an automated car washing system utilizing PLC and SCADA for efficient control and monitoring. The system incorporates DC motors and pumps, push buttons, indicator lamps, a conveyor belt system, and a brushing assembly to streamline the washing process. The PLC ensures precise timing and coordination, while SCADA provides system monitoring and control. A key feature is the collection and filtration of water from surrounding residencies to reuse it in the washing cycle, promoting sustainability. The automated mechanism enhances reliability, reduces human intervention, and optimizes resource consumption. This approach significantly improves conventional car washing, making it more efficient and environmentally responsible.**

***Index Terms*—Car washing, Washing Stations, PLC, Proximity Sensors, Automation**

I INTRODUCTION

Vehicle cleaning including automobiles, trains, and buses, leads to inefficiency and excessive water waste. An Automatic Car Washing System can address this issue by collecting wastewater from surrounding residences with authorized permissions. The collected dry balcony waste water is filtered for reuse in the washing process. Additionally, post-wash water is recycled to minimize overall wastage. This system improves efficiency, promotes sustainability, and optimizes water usage in vehicle cleaning.

II OBJECTIVE

Manual car washing does consume a lot of time and water as well, although hiring labours increases the investment also. The effective solution on this problem is to automate the washing process this will require only one or two persons in order to maintain the washing system and process properly. Besides that, loss of water is also a concern now a days, so for washing purpose this system will recycle the water from surrounding residencies and apartments by taking an authorized permission.

III OPERATION

The electrical components used in this project operate solely on DC supply. Before initiating car washing cycles, water must be collected from surrounding residences with authorized permissions. The collected water undergoes reverse osmosis filtration to remove waste components. Once the storage tank is filled with filtered water, the system is ready for use. An operator ensures the vehicle is correctly positioned on the conveyor belt before pressing the start push button, triggering the first stage—the rinsing cycle, which removes dust and debris. In the second stage, the vehicle undergoes brushing and shampooing in the brush assembly. Finally, the third stage involves water application for a thorough final rinse. To ensure accurate and time-efficient washing, the system uses a combination of on-delay timers from the PLC and inductive proximity sensors to detect the vehicle and initiate timed operations. During every wash, residual water will be collected and recycled for reuse, reinforcing the project's commitment to sustainability.

IV BLOCK DIAGRAM

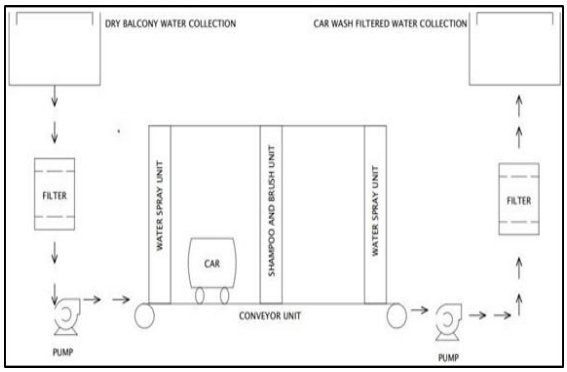

Figure 1: Block Diagram

V SOFTWARE DETAILS & SCADA WINDOW

- RS Linx for communication with PLC Using RS-232.
- RS Logix 500 for Ladder Logic Programming.
- Intouch Wonderware for SCADA window designing.

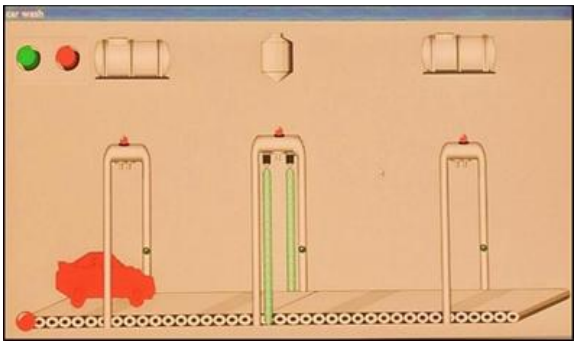

Figure 2: Scada Window components Used And I/O List

1. DC GEAR MOTOR

Voltage – 10 VDC & 12 VDC, Speed – 30 rpm & 50 rpm

A total of three DC motors have been deployed in the system. The primary motor, rated at 10V DC and operating at 30 RPM, is responsible for driving the conveyor belt mechanism. Concurrently, two additional DC motors—each rated at 12V DC and delivering 50 RPM—are integrated at the second workstation to facilitate the scrubbing of the vehicle's exterior surfaces, where in nylon brushes are affixed to their rotating shafts.

2. DC PUMP

Voltage – 12 VDC

Three direct current (DC) pumps have been integrated into the system to ensure the seamless execution of all three washing cycles with operational consistency. Among these, one pump is interfaced with a soap dispensing unit, specifically tasked with applying a detergent solution to effectively dislodge dirt and grime from the vehicle's exterior surfaces. The coordinated functioning of these pumps contributes to a thorough, multi-phase cleaning process comprising pre-wash, detergent application, and rinse cycles.

3. CONVEYOR BELT

The system has been constructed as a self-fabricated wooden prototype, meticulously engineered to simulate an automated car washing process. It is designed to convey miniature vehicle models through successive washing stages in a controlled and systematic manner. This prototype serves as a functional representation of an integrated washing unit, demonstrating the sequential operation of mechanical and fluidic subsystems within a scaled-down framework.

4. PUSH BUTTONS

Voltage 24 VDC, Material Plastic

The system includes Start and Stop push buttons as the primary control interface. Pressing the Start button activates the washing sequence by energizing the control circuit. The Stop button immediately interrupts power to halt all operations, ensuring safe and controlled shutdown.

5. INDUCTIVE PROXIMITY SENSORS

Voltage 24 VDC, S.D. 8 mm, Logic PNP, Contact NO, Current 300 ma

Three proximity sensors have been integrated into the system to facilitate precise object detection and positional feedback during the washing process. These sensors are strategically positioned to detect the presence and alignment of the vehicle as it progresses through each operational stage. Their reliable and responsive performance ensures accurate triggering of subsequent control actions, thereby enhancing the system’s automation and efficiency

make - Allen Bradley, 1746-P1 SLC 500, 16DI, 16DO with Analog I/O, Communication Protocols are RS-232 & Ethernet.

The control system is based on a robust Programmable Logic Controller (PLC), chosen for its modular design and operational reliability. It is equipped with both digital and analog input/output capabilities, allowing for versatile control over discrete and continuous processes. Communication with peripheral devices and supervisory systems is facilitated through standard communication protocols, ensuring seamless integration and data exchange within the system.

6. RELAY CARDS

make- Sha vision

These are integrated into the system to receive output signals from the PLC, facilitating

7. SWITCH MODE POWER SUPPLY
make- Sha vision
To convert single phase AC mains supply into DC stable voltage to deliver power to connected PLC circuit.
8. I/O LIST

INPUT DEVICE	ADDRESS
Start_PB_NO	I1:0/0
Stop_PB_NC	I1:0/1
Proximity_Sensor_1	I1:0/2
Proximity_Sensor_2	I1:0/3
Proximity_Sensor_3	I1:0/4

Table 1: Input address

OUTPUT DEVICES	ADDRESS
Start Lamp	O0:0/0
Stop Lamp	O0:0/1
Conveyor	O0:0/2
Pump_1	O0:0/3
Station_1_Lamp	O0:0/4
Pump_2	O0:0/5
Station_2_Lamp	O0:0/6
Pump_3	O0:0/7
Station_3_Lamp	O0:0/8
Brush_Motor_1	O0:0/9
Brush_Motor_2	O0:0/10

Table 2: Output address

VI RESULTS

The entire PLC based Car washing system setup which is designed as planned is tried and tested for its working and is effectively working. The proximity sensor provides good response when a metal car is detected. The results
are as expected, through ladder logic which is implemented in RS Logix 500 software car is getting wash by passing through three stations.

VII FUTURE SCOPE

Future improvements include integrating an HMI to adjust PLC timer settings, allowing flexible washing cycles based on vehicle size. This system can also be developed into a low- investment startup business for automated car washing. Additionally, incorporating a robotic arm can replace all washing structures, performing the same processes fully automated while the vehicle remains stationary. These upgrades will enhance efficiency, reduce human intervention, and improve scalability of the system.

VIII CONCLUSION

The idea of implementing PLC and SCADA to automate conventional car washing process not only reduces manual intervention but also results in water utilization in lesser amount. Although concept of acquiring water from surrounding residencies for this purpose, will be functioning as a water management activity. Since India is a developing country this concept of automating the time and resource utilizing processes will be helping industry in several ways to accelerate its growth.

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