

# Water Regulation System for Automatic Car Wash – A Review

**Prof. Sagar Khatavkar**

*Assistant Professor  
Department of Mechanical Engineering  
Saraswati College of Engineering, Kharghar,  
Navi-mumbai, India.*

**Mr. Dhiral Prajapat**

*UG Student  
Department of Automobile Engineering  
Saraswati College of Engineering, Kharghar,  
Navi-mumbai, India.*

**Mr. Anandkar Nishad**

*UG Student  
Department of Automobile Engineering  
Saraswati College of Engineering, Kharghar,  
Navi-mumbai, India.*

**Mr. Manish Rane**

*UG Student  
Department of Automobile Engineering  
Saraswati College of Engineering, Kharghar,  
Navi-mumbai, India.*

**Mr. Akash Gaikwad**

*UG Student  
Department of Automobile Engineering  
Saraswati College of Engineering, Kharghar, Navi-mumbai, India.*

## Abstract

The automatic car washer system is very commonly used in metro cities and towns in India. This system is used for all types of cars i.e. sedan, hatchback, SUV etc. The production of cars in India is increasing day by day due to high demand by people in India. The number of cars on Indian roads have increased significantly so high end technology must be developed which must be efficient, must use less water and should be eco-friendly. The appearance of car is important for the people now a days. So this project would solve this problem very efficiently. Various steps involved in automatic car washing are rinsing, shampooing, washing, drying and then waxing. Design of pipe nozzle and water regulation system used in automatic car washer is discussed in this report. This system uses huge amount of water, so water recycling is also important part of automatic car washer. We hope this report will be useful to understand basic of automatic car washer system.

**Keywords: Car wash, PLC, Pipe, Nozzle**

## I. INTRODUCTION

Monika Wadekar, Sayali Naik & Pranoti Utekar in automatic car washing and drying system explains about the use of programmable logic controller (PLC), various IR sensors and modern GSM. The system consists of two robotic arms, one mounted at base of longitudinal wall and Robotic arm (1) is used for cleaning the side of the car. Robotic arm (2) is used for cleaning the front and back of the car. Both the arms will work according to input from GUI. Some challenges like time factor, space factor and water requirement were faced in this paper.

Swapnil Namekar, Nishant Kumar & Suryansh Tyagi in automatic car washing is a PLC (programmable logic controller) based project. This system has winch system which was used in pulling system. PLC plays a very important role in the system which is used for automation this process is very common in developed countries. This project is based on cyclic process which provide more than 95% cleaning. There are various component in the project, the most important is the aluminium casing on which the whole project is mounted. Also a conveyor belt are used which is rolled over three pulley connected to aluminium case. The main component of the project is a PLC and SMPS which are also connected. SMPS transfer power from a source like main power. Cooling fans are also used in this system for drying purpose. The DC motor used in this project gives a supply voltage of 24V and 30 RPM.

Tao Zhang, Xiahong Chen & Rui Jiang in automatic car washing explains about the spray characteristics from a pressure-swirl nozzle, which is widely used device in agriculture, combustion, aerospace have been investigated in this study experimentally with focus on the effects of nozzle hole size and injection pressure on spray morphology, velocity distribution and spray angle. In this device liquid fuel is forced to follow a helical path emerging from the nozzle and breaks up into a cluster of thin sheets. The process consist of first and second atomization although the first atomization plays no direct role in fuel combustion, it can affect fuel vaporization and the mixing of fuel/air antioxidants the spray angle should be neither small nor large. Spray velocity and morphology are important factors affecting combustion stability.

Hamid Rafei, Moh.Hussein, Reza Janumuri & Amir Hatampour in experimental and CFD investigation of nozzle angle in Jet Mixer. Mixing by Jet and impeller are two simplest method for fluid homogenization in the liquid phase. A jet consists of a pump

of fluid circulating, a cheap nozzle and some pipe for transferring fluid. Broken studied jet performance due to CFD and concluding that CFD model can predict mixing time by error of 15%. This research focused on effect of nozzle and suction and also the effect of various turbulence models on mixing time as well as the effect of no. of control volume on certain result based on RNG-K model for huge crude oil tank geometry. The following result are obtained are CFD liquid dynamic calculation is substantially able to predict mixing, nozzle angle reduces mixing time effectively.

N. Hooda & O. Damani studied on optimal design of pressure constrained branched piped water networks, they explain that the main design decision to be made for such network is the choice of pipe diameter from a discrete set of commercially available pipe diameter. Larger the pipe diameter better the service (pressure), but higher the capital cost. The model is based on LP formulation. It not only manages to optimally solve the general case, it also has a run time performance. It also has GIS functionality integrated for ease of providing network details. Piped water network cost optimization has been studied for more than 30 years now. Several constrained optimization techniques are linear programming to genetic algorithm have been employed to solve various variation of cost optimization problem. Reservoir costs are an important component of capital cost of a piped water network. Overall the concept of the study is to optimize the capital cost of pipe water network.

Nourhan Samir, Rawya Kanosh, Walid Elbarki & Amr Fleifle in water regulation of a system have explained about, ways to reduce the leakage and loss of water. They studied the lack of active leakage control (ALC), excess pressure, poor operation and maintenance. Pressure reducing valve (PRV) are the most common and effective method used in pressure management. The characteristics of pipes within water CAD model are studied, so as to maintain optimum pressure. Current annual real losses (CARL) and unavoidable annual real losses (UARL) are used to calculate infrastructure leakage index (ILI), which was specifically designed to compare technical real low management between utilities. Infrastructure leakage index (ILI) showed its performance in evaluating the network and is needed for leakage reduction.

Kuldip Singh, Vikrant Bhakar in the 24<sup>th</sup> CIRP conference on life cycle engineering have explained about the analysis the environmental impact of HDPE pipes manufacturing process at an Indian industry. Specific data was collected by performing time study analysis of each manufacturing process at the industry. The primary and secondary data were compared together for study. It is found that the two of HDPE pipe life cycle (manufacturing and end of life) are more important in all categories of environmental impact assessment.

L. Sushma, A. Udaya Deepak, Sathish Kumar Sunnam, M. Madhavi have explained about the CFD investigation of different nozzle jets. Nozzle design is to be developed with respect to the application based on various factors under consideration during evolving of a nozzle system design. The numerical simulations are performed using commercially available software FLUENT to investigate and understand the performance of conical and scarfed nozzle.

C. Qin and E. Loth from the University of Virginia, California have explained about the numerical description of a pressure-swirl nozzle spray. Pressure-swirl nozzles are widely used in industries and in experimental processes. In this study, Eulerian Numerical approach is chosen for the gas phase and the Lagrangian approach for the liquid phase. To simulate structure of liquid spray after the break-up region, an axisymmetric zone is defined based on the experimental flow field. Thus, this investigation helps in predicting droplets and gas flow distributions for a pressure-swirl nozzle.

Rafael Zaneti, Ramiro Etchepare, Jorge Rubio from PPG3 M, have explained about the waste water reclamation used in carwash and its full scale application. The water usage and savings audit showed that almost 70% reclamation was possible and less than 40L of fresh water per wash was attained. A single three stage oil/water separator, neutral and alkali detergents, sand filtration are used in this process. Reclaimed water was employed in the pre-soak, wash and first rinse and the fresh water was used in the final rinse, before the car being dried. The sludge removed from the column floatation is accumulated in a sand bed and disposed of safely in landfill.

Mr. Chris Brown proposed a paper of water use in the professional car wash industry. Effort was made to clarify water consumption and water conservation measures in professional car washes. The international Carwash Association commissioned a study of techniques used to conserve and reclaim water in the car wash industry and to define those techniques in a standardization manner. Various sites were studied, designated by location, type and number for obtaining precise information. It calculated the amount of water used for different types of washes considering all the aspects of a particular type of vehicle, thus giving the exact idea of amount of water which is consumed.

Cristina Onieva, Almudena Blaquez from Molecor, a Spanish Company have studied about molecular orientation technology used in PVC pipes. It consists of completely dry and clean air system that distributes the air in a specific way to achieve the maximum degree of orientation replacing boiling water used in other manufacturing processes. It has overcome various obstacles in PVC materials. PVC-O pipe bear big deformation of their internal diameter due to its excellent elasticity. It can also be recycled and be used for new piping production, furniture, road safety elements etc. It is more durable, prevents leakage of channeled water and ensures a life of over 50 Years.

Mr. Chris Brown proposed a paper on water conservation in the professional car wash industry. In order to better clarify water consumption and potential conservation measures in response to the water use restrictions imposed by states in the eastern United States in the summer 1999. In this, various specific measures were studied for reducing the water consumption. The nozzle size, pressure and alignment etc are taken into consideration for reducing the use of water consumption. For the reclamation of water in the professional car wash industry treatments like separation, oxidation, filtration, membrane filtration or de-ionization are used. The reclaimed water is thus used in specific car washing processes.

## II. CONCLUSION

Sr. No	Year	Author	Name of the paper	Conclusion
1.	2015	Prof. Monica Wadekar	Implementation of auto car washing system using two robotic arms	Two robotic arms are used for washing, IR sensors integrated with GSM
2.	2016	Mr. Nishant Kumar	Automatic Car Washing using PLC	Based on PLC, cyclic process (water can reuse) and more efficient
3.	2017	Mr. Tao Zhang	Spray characteristics of pressure-swirl nozzle diameters	The experimental investigation of the jet-fuel spray angle, morphology & velocity at different injection varied pressures
4.	2012	Prof. Hamid Rafei	Optimizing and mixing of dilution system	Jet mixer are cheaper and also easier to install. Easy to keep clean & safe
5.	2017	Mr. N. Hooda	A system for optimal design of pressure constrained branched piped water networks	Optimize the capital cost of pipe water network
6.	2017	Mr. Nourhan Samir	Pressure control for minimizing leakage in water distribution system	Infrastructure leakage Index (ILI) showed its performance in evaluating the network and its needed for leakage reduction
7.	2017	Mr. Kuldip Singh Sangwan	Life cycle analysis of HDPE pipe manufacturing	It is found that the two HDPE pipe life cycle are more impacting in all categories of environmental impact assessment
8.	2017	Mr. Sathish Kumar	CFD Investigation of different nozzle jets	Due to the effect of external flow on the scarfed nozzle exit, mach number is less compared to conical nozzle
9.	2016	Mr. C. Qin	Numerical description of a pressure-swirl nozzle spray	The present investigation demonstrates a numerical approach to predict droplets and gas flow distribution
10.	2010	Mr. Rafael Zaneti	Car wash wastewater reclamation	Noticeable car wash wastewater and treated water showed high fecal counting, concluding no direct reclamation is possible without disinfection
11.	2014	Mr. Chris Brown	Water conservation in professional car wash industry	Car wash water can be reclaimed for reusing it

## REFERENCES

- [1] L. Sushma, A. Udaya Deepik, Sathish Kumar Sunnam, Dr. M. Madhavi, CFD investigation for different nozzle jet, MRCET, Hyderabad.
- [2] Nourhan Samir, Rawya Kanosh, Walid Elbarki, Amr Fleifle, Pressure control for minimizing leakage in water distribution systems, Irrigation Engineering and Hydraulics Department, Alexandria university.
- [3] Kuldip Singh Sangwan, Vikrant Bhakar, Life cycle analysis of HDPE pipe manufacturing, The 24<sup>th</sup> CIRP conference on life cycle engineering, Procedia CIRP 61 (2017).
- [4] Cristina Onieva, Almudena Blazquez, PVC-O pipe innovations, Reinforced plastics, volume 00, number 00, August 2017.
- [5] N. Hooda, O. Damani, A system for optimal design of pressure constrained branched pipe water networks, Procedia Engineering 186 (2017), Indian Institute of Technology, Bombay.
- [6] Rafael Zaneti, Ramiro Etchepare, Jorge Rubio, Car wash wastewater reclamation. Full-scale application and upcoming features, Avenida Bento Goncalves, Porto Alegre, Brazil.
- [7] Chris Brown, Water conservation consultant, Water effluent and solid waste characteristics in the professional car wash industry, International Carwash Association.
- [8] Chris Brown, Water conservation consultant, Water use in the professional car wash industry, International Carwash Association.
- [9] C. Qin, E. Loth, Numerical description of a pressure-swirl nozzle spray, University of Virginia, Charlottesville, VA, 2015
- [10] Pranoti Utekar, Sayali Naik, Monica Wadekar, S.G. Watve, Implementation of Auto Car washing system using two robotic arms, International Journal of Innovative Research in Science, engineering and Technology.
- [11] Vivek Kumar Yadav, Suryansh Tyagi, Gulshan Kumar, Nishant Kumar, Swapnil Namekar, Automatic Car Washing using PLC, 2016 IJESC.