

DESIGN AND FABRICATION OF AUTOMATIC CONTROL OF VEHICAL WASHER

Parmesh Kumar¹, Raghavendra B K², Jangli Kondappa³

¹Lecturer in Mechanical Engg, ²Lecturer in E&E Engg, ³Lecturer in E&C Engg

¹Mechanical Engineering, ²Electrical & Electronics Engineering, ³Electronics & Communication Engg

¹Government Polytechnic, Koppal, India

Abstract: We humans are known for maintaining cleanliness may it be our home or the vehicle we travel in. As we know the number of vehicles worldwide increasing day by day hence keeping the vehicles clean have become a big issue. People often tend to give their vehicles outside for cleaning; therefore spending a lot of money and some in order to save money, people exhaust their time and energy cleaning the vehicle themselves. We live in a period where all the works are made to be done by a machine either automatic or remote controlled. The already existing automatic car washer is very costly and takes huge place for a family to install for their personal use. Hence we have come up with a solution of a car washer which is remote controlled and are affordable for family use, which can be parked in the corner of a parking when not in use. This project is about reducing size and cost of the machine that is used for washing vehicle. The machine is remote controlled hence contains transmitter and receiver. For the movement of the machines motors and wheels are used. For the better cleaning the water is directly connected to the tap by the help of pipe and using pump and pressure gun the water is then sprayed. The glass washer and car washing liquid is stored in a container and is sprayed as and when required using a motor and drip technique. The arm is rotated using motors. The wheels of the vehicle are also taken into consideration and there is a separate brush which is used for the cleaning of the wheel. Safety of the car and the operator and the machine is also taken into consideration and hence sensors are used which when detects the machine too close to the vehicle which may cause any harm to the vehicle then it gives out an alarm to warn the operator. Aurdino is used for some of the operations to be performed under some cases and waterproofing of the devices is very important in order to avoid electrical shortage and loose connection, tight packing is given priority.

KEYWORDS: Car Washer, Aurdino, Sensors

I. INTRODUCTION

We humans are known for maintaining cleanliness may it be our home or the vehicle we travel in. As we know the number of vehicles worldwide increasing day by day hence keeping the vehicles clean have become a big issue. People often tend to give their vehicles outside for cleaning; therefore, spending a lot of money and some in order to save money, people exhaust their time and energy cleaning the vehicle themselves. In both the situation wasting lot of power and water. We live in a period where all the works are made to be done by a machine either automatic or remote controlled.

The already existing car washing systems are Two Bucket System of car washing which requires lot of human work and consumes lot of time. It is basically washing the car once with a solution to remove dirt from one bucket and wiping off the dirt with a clean water solution from another bucket.

The different kinds of vehicle washing machines that are present now are brushed car wash machine, brushless car wash machine, two bucket method of and pressure gun etc. some of these techniques are used only for one kind of vehicle and the main problem with these machines are that they are huge in size thus require more space for installation and are fixed at one place and cannot be taken along where ever needed. The power consumed for these machines are more. The cost of these machines is more and the maintenance cost is more and are difficult requiring a periodic service. These machines are built to cover one kind of vehicles and hence no specific lengths or heights are fixed for any vehicle and these results in wastage of water and also power during the washing process.

II. LITERATURE REVIEW

The following are the papers that have been referred for this project and their brief review,

STEPHEN R. REEBS - "ULTRASONIC SENSOR" An improved ultrasonic system for detecting the level of a material with a surface, such as a liquid level inside a tank, which improves detection ability, especially when the tank is nearly full. A transmitted ultrasonic signal from a transducer is reflected against the material in the tank, and when it returns to the transducer, it produces an output pulse. The time between the transmission and the reflected signal is used to calculate the distance or level. A comparator compares the signal from the transducer to a reference and outputs when a pulse with a magnitude greater than the reference is received. To avoid problems with high output signals caused by transducer vibration after a control signal is removed until the transducer reaches rest (referred to as "ring down" time), the reference signal is adjusted on a time basis so that it initially will be above the expected level of any unwanted "ring down" signal, but it will recognize a valid reflected signal when the tank level is close to full because the reflected signal will also have a high magnitude and the Lower magnitude reflected signals associated with lower tank levels will be properly identified as the reference signal decreases over time.

NASSER HASHERNIA AND BEHZAD ASAEI - "COMPARATIVE STUDY OF USING DIFFERENT ELECTRIC MOTORS IN THE ELECTRIC VEHICLES" Brushless direct current (BLDC) motors are conceptually the result of reversing the stator and rotor of permanent magnet direct current (PMDC) motors. In contrast to BLAC motors, which are fed by sinusoidal waves, they are fed by rectangular waves. Their main advantages include the elimination of brushes, compactness, high efficiency, and high energy density. Induction motors have been identified as the best candidate for EV applications because they are robust, less expensive, technologically mature, and require less maintenance. However, it is demonstrated in this paper that in terms of pollution and fuel consumption, permanent magnet and brushless DC motors have higher priorities such as less pollution, lower fuel consumption, and higher power to volume ratio, making them appealing in EV applications.[2] YOSHIKI TAKIDA, AICHI - "ROBOT ARM TYPE AUTOMATIC CAR WASHING DEVICE" A rotating brush for cleaning tyres and a state of installation. Because the vehicle cleaning rotating brush described in the vehicle cleaning process is insufficient for cleaning the tyre, the tyre cleaning rotating brush is used. The vehicle's actual stop position in the vehicle stop position for cleaning is detected. The actual stop position is calculated using the vehicle's actual size data as measured by the vehicle actual size measuring device. Each rotating brush for tyre cleaning moves to each tyre position. A rotating shaft of the rotating brush for vehicle cleaning extends. The rotating brush on the vehicle cleaning machine gently presses the tyre and wheel. The tyre cleaning rotating brush rotates in both directions as the cleaning solution is ejected.

YUSUF ABDULLAHI BADAMASI - "THE WORKING PRINCIPLE OF AN ARDUINO" Arduino is an open-source platform for building and programming electronics. It can receive and send data to most devices, as well as command the specific electronic device via the internet. To programme the board, it makes use of an Arduino Uno circuit board and a software programme (Simplified C++). Sensor alarm uses an infrared, motion, or other type of sensor to detect movement and then sends the message to the Arduino microcontroller, which turns on or off the LED and speaker.

J. A. WINKLER - "VEHICLE WASH DETERGENT/FOAM AND METHOD" A method of producing a vehicle wash detergent/foam for cleaning cars, trucks, and other vehicles using commercial vehicle washing equipment, comprising the step of producing a vehicle wash detergent/foam concentrate solution comprising water as the suspending solvent; dodecyl benzene sulfonic acid as a detergent/foam agent; and water as the suspending solvent.; As a modifying substance, use monoethanolamine, diethanolamine, or triethanolamine to adjust the pH of the solution to the base side of 7.0 while simultaneously forming the amine salt of the dodecyl benzene sulfonic acid; as a detergent/foam agent, use either a 1:1 cocoamide DEA or a 2:1 cocoamide DEA.; As a detergent/foam agent, either sodium lauryl sulphate or an alpha olefin sulfonate is used; as a foam agent, coco-dimethylamidopropylbetaine is used; propylene glycol is used as a solvent; as a surfactant, either a 9-molar ethoxylated secondary alcohol or a 9-molar ethoxylatednonyl phenol or As an oil solubilizing agent, diethanolamine or triethanolamine can be used. The concentrate solution is converted into a vehicle wash detergent/foam solution by introducing the detergent/foam concentrate solution into a stream of water via spray nozzles associated with the vehicle washing equipment.

ROUIS, ROBERT J. - "ELECTRICALLY OPERATED, REMOTE CONTROLLED WHEELTURNER" The invention's main advantage is that it reduces the time required to turn the vehicle wheels, lowering the cost of wheel alignment and other similar operations. Another advantage of the invention is that it significantly reduces the physical effort required to turn the vehicle wheels. When power steering is used, or when the ratio of the degree of turning of the vehicle wheel to the degree of turning of the steering wheel is high, the force required to turn the wheels by applying a turning moment to the vehicle wheels themselves is extremely high.

III. EXPERIMENTAL SETUP

The proposed system is a remote-controlled vehicle washer that cleans the exterior of the vehicle. The machine is made mobile by adding sets of wheels. The sides of the vehicle are washed by the stationary arm and the top and bonnet of the vehicle is washed by the top cleaning brush. The height of the top cleaning brush is adjusted by the help of a chain driven jack system. The machine is controlled by a remote control with the help of a Bluetooth module.

The receiver is placed inside the machine and the transmitter in the form of a controller is given to the operator. The controlling of the machine is made in such way that it is user friendly. There is specific controlling sequence for the specific task; Arduino is used monitor the input and output. The Arduino also extend its usage in sensor and actuators. The mobility of the machine is obtained by set of wheels that are attached to the machine and are driven with a help of remote-controlled motors. There are different kinds of motors used for different purposes which are all controlled by the operator with the help of a remote.

The cleaning of the vehicle is achieved by the help of two different brushes that are attached to the machine for cleaning the side and also the top portions of the car. A tyre cleaning brush is also incorporated for cleaning of the mags and front visible sides of the tyre. Water is given as the inlet from the tap to the tank and with the help of the pump it is pressurized and sent to the pressure gun which shoots the water with high pressure to the car by adjusting the direction with the help of a motor which is useful for even spreading of the water on the surface. Once the water level is low the water can be sent as inlet by opening the gate valve that is connected to the tank. For adjustment of the top cleaning brush we have come up with a chain driven jack system which is controlled by the motor and to fix a top height and the lowest height of the top cleaning brush a limit switch is fixed at both the points.

The main objectives of the proposed project are as follows.

- 1 To design and fabricate a vehicle washing machine which will wash the vehicle exterior with water and foam solution.
- 2 To reduce human efforts by letting the machine do the work.
- 3 To reduce the power consumption.
- 4 To make the machine cost effective.
- 5 To make the machine mobile and to make the machine user friendly

IV. HARDWARE DESIGN

This is a structural system that supports other components and provides strength to the machine. It is made up of angular rod and rectangular rod which is used to support the wheel. It consists of two compartments; the drive systems are placed in the below compartments and power supply and other electrical components and tyre cleaning system are placed in the above compartment. Both compartments are separated by sheet metal. It has projection to hold the cleaning brush. The Jack system is welded on top of the base frame besides which the water storage tank and other components are placed.

Material	Yield strength (MPa)	Ultimate tensile strength (MPa)
Steel mild steels	250	400-500

Specification of base frame material mild steel

Gauge	Nominal [in (mm)]	Min [in (mm)]
16	0.0598(1.52)	0.0548(1.49)

Tolerance of base frame material sheet metal

Length	18 Inches
Width	14 Inches
Height	12 Inches

Dimension of the base frame



Base Frame

The drive system is used to move the machine in required direction; it consists of drive motor and wheels. The detailed information is given below. The motors used are power window motors, which were originally designed for car power windows. However, in recent years, many robot builders have used it to build their robots, particularly combat robots, because of its performance and competitive price. It provides enough torque and power to move the machine in the desired direction. Four of these motors are used. Two of the motors of the same side are connected in parallel so that the machine can perform a 460 turn at the point, this is done to get a sharp 90° turn which will be required while washing the car sides

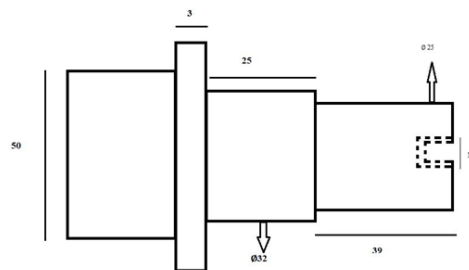
Voltage Rating	12V DC
Rated Speed	60RPM
Rated Torque	2.9 N.m (40 kgf.cm)
Rated Current	< 15 A at 12V
Stall Torque	9.8 N.m (100kg.cm)
Stall Current	<28A at 12V

Specification of power window motor



Drive System Motor

Since the shaft of the motor was made up of plastic and was small to connect the tire, we had to make some modification. The modification was preparing a new shaft from aluminum and customized casing of sheet metal is made to ensure the gears of the motor are all in contact and runs smoothly.



Shaft Measurement



Drive Motor after Modification

The wheels used for the drive system are 17 cm diameter wheels which is made up of rubber and the rim is made up of hard plastic which provides great strength to hold on to the weights of the machine and easy movement of the machine.



Drive Wheels

To lift the top cleaning system to required height we are using chain drive jack system. The jack is attached with a sprocket which is driven with a help of a chain which is connected to another sprocket which is connected to the motor. When the motor turns the jack goes up or down depending upon the direction of the motor. The top cleaning system is attached at the top of the jack thus helping in adjustment of the height as required

Drive Motor	12V DC motor
Driver Sprocket teeth	12 teeth
Driven Sprocket teeth	22 teeth
Gear Ratio	1.84
Jack body height	9 inches
Jack minimum height	9 inches
Jack maximum height	22 inches

Specifications of Jack



Jack System

The stationary cleaning arm is used to clean the front bumper, grill, fender, side doors, side windows, rear bumper and side of the car. Stationary Cleaning Arm consists of a motor mounting, motor and cleaning brush, the detailed information about which are given below.

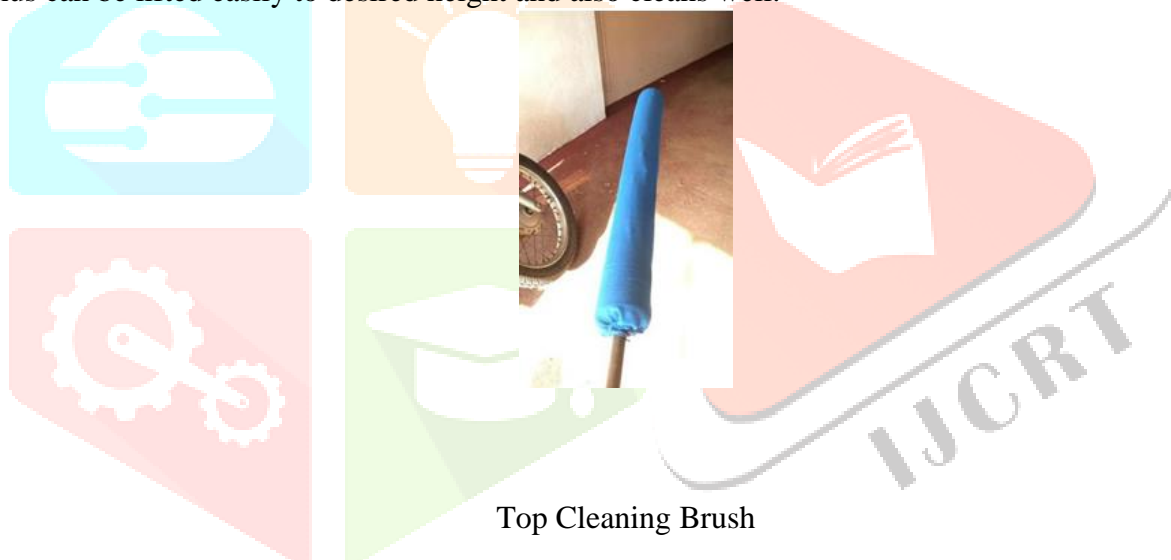
Stationary arm mounting is used to mount the stationary arm in its place connected to the machine. It is done by using MS angle bar in the shape of an upside down "L" and MS square bar at an angle to provide extra support. This is connected to the machine by bolting it to an extension plate that is welded with the machine base frame using 4 nuts and bolts.



The motor and brush are attached using a “U” shaped clamp the base of which is welded at the end of the stationary arm mount. The clamp is fastened using 2 nuts and bolts which holds the brush and motor in place. The motor used for side cleaning brush is of 12V DC motor from exhaust fan the reason for selecting this motor for this project are

Brushless DC motor fans from Delta are designed to outlast popular AC motor models by up to 70%, reducing the need for replacement. Its brushless DC motor fans are among the most efficient available, exceeding ENERGY STAR efficiency requirements by up to 467 percent. Delta Breeze ventilation fans are precision engineered to last at least 70,000 hours.

Top cleaning brush is made up of a sponge that helps ion cleaning of the top part of the vehicle. To provide the extra cleaning effect a layer of cotton cloth is attached on top of the sponge. This makes the arm lightweight and thus can be lifted easily to desired height and also cleans well.



Top Cleaning Brush

Length of Brush	40 cm
Length of attachment rod	10 cm
Diameter	8cm
Inner material	Sponge
Outer material	Cotton
Rod	1 mm circular tube of MS

Specification of top cleaning brush



Centre Shaft DC Geared Motor 400 rpm

DC Motor – 400RPM – 12Volts Geared motors are typically made up of a simple DC motor and a gearbox. This can be used in all-terrain robots as well as a wide range of robotic applications. These motors have a 4 mm threaded drill hole in the shaft, making it simple to connect them to wheels or other mechanical assemblies. 400 RPM 12V DC geared motors are commonly used in robotics. Very simple to use and comes in standard sizes. The shaft has a nut and threads for easy connection, as well as an internally threaded shaft for easy connection to the wheel. DC Geared motors with a strong metal gearbox for heavy-duty applications, available in a wide RPM range, and ideal for robotics and industrial applications. Very simple to use and comes in standard sizes. The shaft has a nut and threads for easy connection, as well as an internally threaded shaft for easy connection to the wheel. The motor is mounted to the body of the machine using a motor mount that is available in the market. The mount is welded to the machine body for extra strength.

V. RESULT AND CONCLUSION

The proposed machine is controlled using a transmitter and receiver principle. The receiver is placed inside the machine and the transmitter in the form of a controller is given to the operator. The controlling of the machine is made in such way that it is user friendly. There is specific controlling sequence for the specific task, Arduino is used monitor the input and output. The Arduino also extend its usage insensor and actuators. The mobility of the machine is obtained by set of wheels that are attached to the machine and are driven with a help of remote-controlled motors. There are different kinds of motors used for different purposes which are all controlled by the operator with the help of a remote.

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Water is given as the inlet from the tap to the tank and with the help of the pump it is pressurized and sent to the pressure gun which shoots the water with high pressure to the car by adjusting the direction with the help of a motor which is useful for even spreading of the water on the surface. Once the water level is low the water can be sent as inlet by opening the gate valve that is connected to the tank.

For adjustment of the top cleaning brush we have come up with a chain driven jack system which is controlled by the motor and to fix a top height and the lowest height of the top cleaning brush a limit switch is fixed at both the points.

The Remote-Controlled vehicle washer is able to wash the exterior body of the car with less power as it runs on 12V 40A SMPS and the pressure and washing time can also vary the water usage

The machine is tested in different modes and tested for current consumption, voltage drops, water consumption, and pressure output of water. Accuracy of the cleaning surface by the cleaning unit is also checked for. The wheels are checked for smooth movement and rotation so as to give easy moment that will help in vehicle washing. The stationary arm which is used to clean the vertical surface of the vehicle is checked for efficiency cleaning and avoiding damages to the paint of the vehicle. The jack system is checked for rotation on both side which moves upward and downward and precautions are taken to avoid resistance loss. The top cleaning arm which is used to wash the horizontal surface of the vehicle is made such that the brush covers the half of the top surface and will also not damage the glass of the vehicle. Hence we would like to conclude by saying that this machine cleans the exterior part of the vehicle with low power and less water consumption and also reduces the time to clean the vehicle since it is remotely controlled and also mobile which can move around the vehicle making it easy for the wash.

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