Automatic Three Stage Industrial Car Washing System

A Main Project Report

Submitted to the FACULTY of ENGINEERING of

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, KAKINADA

In partial fulfillment of the requirements,

for the award of the Degree of

Bachelor of Technology

In

Electronics and Communication Engineering

By

Ch. J G Arun Kondalu (20481A0453) **A.Musharaf (20481A0402)**

B. Abhishek (20481A0429)

Under the Guidance of

Mr. K. Ravi Kumar

Assistant Professor

Department of Electronics and Communication Engineering
SESHADRI RAO GUDLAVALLERU ENGINEERING COLLEGE
(An Autonomous Institute with Permanent Affiliation to JNTUK, Kakinada)
SESHADRI RAO KNOWLEDGE VILLAGE
GUDLAVALLERU - 521356
ANDHRA PRADESH

2023-24

Automatic Three Stage Industrial Car Washing System

A Main Project Report

Submitted to the FACULTY of ENGINEERING of

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, KAKINADA

In partial fulfillment of the requirements,

for the award of the Degree of

Bachelor of Technology

In

Electronics and Communication Engineering

By

Ch. J G Arun Kondalu (20481A0453) **A.Musharaf (20481A0402)**

B. Abhishek (20481A0429)

Under the Guidance of

Mr. K. Ravi Kumar

Assistant Professor

Department of Electronics and Communication Engineering
SESHADRI RAO GUDLAVALLERU ENGINEERING COLLEGE
(An Autonomous Institute with Permanent Affiliation to JNTUK, Kakinada)
SESHADRI RAO KNOWLEDGE VILLAGE
GUDLAVALLERU - 521356
ANDHRA PRADESH

2023-24

Department of Electronics and Communication Engineering

SESHADRI RAO GUDLAVALLERU ENGINEERING COLLEGE

(An Autonomous Institute with Permanent Affiliation to JNTUK, Kakinada)
SESHADRI RAO KNOWLEDGE VILLAGE

GUDLAVALLERU – 521356

CERTIFICATE

This is to certify that the project report entitled **"Automatic Three Stage Industrial Car Washing System"** is a bonafide record of work carried out by **Chennamsetti Jayanth Guru Arun Kondalu (20481A0453), Abdul Musharaf (20481A0402), Bandrapalli Abhishek (20481A0429)** under my guidance and supervision in partial fulfillment of the requirements, for the award of the degree of Bachelor of Technology in **Electronics and Communication Engineering** of **Seshadri Rao Gudlavalleru Engineering** affiliated to **Jawaharlal Nehru Technological University, Kakinada**.

Mr. K. Ravi Kumar
Project Guide

(Dr. B. RAJASEKHAR)
Head of the Department

Acknowledgement

We are very glad to express our deep sense of gratitude to **Dr. R. SRINIVASA RAO**, **Assistant Professor,** for guidance and cooperation in completing this main project. We convey our heartfelt thanks to his for inspiring assistance till the end of our main project.

We convey our sincere and indebted thanks to our beloved **Dr. B. RAJASEKHAR**, **Professor and Head of the Department,** for his encouragement and help in completing our main project successfully.

We also extend our gratitude to our Principal **Dr. Burra Karuna Kumar**, for the support and for providing facilities required for the completion of our main project.

We impart our heartfelt gratitude to all the Lab Technicians for helping us in all aspects related to our main project.

We thank our friends and all others who rendered their help directly and indirectly to complete our main project.

Ch. J G Arun Kondalu (20481A0453)

A. Musharaf (20481A0402)

B. Abhishek (20481A0429)

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Car wash systems allow for fully automated car wash in a short amount of time. Here we demonstrate a smart car wash system that allows for completely automated car washing process. The system consists of a small conveyor type belt that holds on to car. The system has an IR sensor to check a car has been parked in the system. On detection the system now starts the belt movement using a motorized system and vehicle moves to the first stage and starts brushing the car for sometime and the conveyor starts moving again and in 2nd stage cleaning are used to clean the cars in 3rd stage fan will ON and make the car dry and stops the conveyor belt so that the car went out of the cleaning place.

Overall, this abstract highlights the innovative features and benefits of an automated three-stage A car washing system, showcasing its potential to revolutionize the car washing industry by providing customers with a superior cleaning experience while promoting sustainability and resource conservation.

Key Phrases: Fully automated car wash, Smart car wash system, Conveyor type belt, Three-stage car washing system, Superior cleaning experience

Chapter 1
INTRODUCTION

1.1 Aim of the Project

The project can create a state-of-the-art **Automated Three-Stage Industrial Car washing system** that meets industry standards, satisfies customer expectations, and contributes positively to environmental sustainability and cost-efficiency.

1.2 Problem Statement

The automated three-stage industrial car washing system faces challenges such as excessive water consumption, leading to high operational costs and environmental strain. Chemical usage must be optimized to minimize environmental impact. Equipment maintenance and reliability are crucial to prevent downtime and ensure consistent performance. Variability in cleaning results poses a risk to customer satisfaction and reputation. Energy consumption needs to be managed efficiently to reduce overall operational expenses. Complex user interfaces can lead to operator errors and inefficiencies. Regulatory compliance regarding environmental standards must be strictly adhered to, avoiding potential fines and legal consequences.

1.3 Methodology

The methodology for developing an automated three-stage industrial car washing system involves analyzing requirements, designing the system layout and component selection, developing software for control and monitoring, testing and optimizing processes, installing and integrating the system, providing training and documentation, and implementing ongoing monitoring and maintenance. This comprehensive approach ensures efficient water and energy usage, eco-friendly practices, reliable equipment performance, user-friendly operation, compliance with regulations, and continuous improvement for delivering high-quality car washing services consistently.

1.4 Significance of the work

The significance of automated three-stage industrial car washing systems lies in their ability to revolutionize the car wash industry. It offer efficient water and energy usage, reducing environmental impact. Automated processes ensure consistent cleaning quality, enhancing customer satisfaction. Cost-effectiveness through optimized resource utilization and reduced labor requirements boosts profitability for car wash businesses. These systems also align with regulatory standards, promoting sustainability. Overall, their implementation signifies a shift towards eco-friendly practices, improved operational efficiency, and enhanced customer experience, marking a significant advancement in modern car washing technology.

1.5 Outline of the project

Chapter 1:

- Project Overview: Provides an introduction to the automated industrial car washing system project, including its purpose, scope, and objectives in the industrial context.

- History of Car Washing Systems: Discusses the evolution of industrial car washing systems and the need for automated solutions in manufacturing and transportation sectors.

- Conceptual Framework: Outlines the fundamental concept and design principles of the automated industrial car washing system tailored for industrial applications.

Chapter 2: Overview of Existing Car Washing Systems: Discusses the various types of automated car washing systems used in industrial settings, including tunnel washers, conveyor-based systems, and robotic solutions.

- Challenges with Traditional Methods: Identifies the limitations and inefficiencies of manual and semi-automated car washing processes in industrial environments.

- Market Analysis: Provides insights into the market trends, demands, and technological advancements driving the adoption of automated industrial car washing solutions.

Chapter 3: Three-Stage Car Washing System: Describes the three-stage process ofpre-washing, main washing, and rinsing/drying tailored for industrial vehicles and equipment.

- Automation Technologies: Discusses the advanced automation technologies and industrial-grade components used in the system, such as PLCs, SCADA systems, and industrial sensors.

- Programming Languages and Tools: Provides an overview of programming languages and software tools specific to industrial automation and control systems.

Chapter 4: System Architecture: Presents the robust architecture of the automated industrial car washing system, including industrial-grade hardware components, safety features, and compliance standards.

- Requirements Analysis: Details the stringent functional and regulatory requirements of the industrial car washing system, emphasizing reliability, durability, and safety considerations.

Chapter 5: Hardware Setup: Describes the ruggedized physical setup of the industrial car washing system, including equipment layout, material selection, and environmental considerations.

- Software Development: Discusses the development of PLC programs, HMI interfaces, and SCADA systems for seamless control and monitoring of the industrial car washing operations.

- Integration with Industrial Control Systems: Explains how the car washing system is integrated with existing industrial control systems, such as conveyor systems, PLC networks, and data acquisition systems.

Chapter 6: Testing Strategies: Outlines the rigorous testing methodologies, including factory acceptance testing (FAT) and site acceptance testing (SAT), used to validate the functionality, performance, and safety of the industrial car washing system.

- Validation Results: Presents the comprehensive results of testing and validation, including system reliability, throughput capacity, and compliance with industry standards and regulations.

Chapter 7: Performance Metrics: Defines the critical performance metrics relevant to industrial car washing systems, such as cycle time, uptime, energy efficiency, and water consumption.

- Optimization Techniques: Discusses optimization strategies, preventive maintenance protocols, and continuous improvement initiatives implemented to enhance system performance, reliability, and cost-effectiveness.

Chapter 8: The inference of the project is covered.

1.6 Conclusion

The primary goal of this study was to develop a system, the automated three-stage industrial car washing system represents a technological advancement that revolutionizes vehicle cleaning in industrial settings. Its combination of efficiency, effectiveness, sustainability, cost savings, and improved user experience positions it as a valuable asset for industries reliant on clean and well-maintained vehicles.

Chapter 2
LITERATURE SURVEY

The three-stage industrial car washing systems would typically include research papers, articles, and studies related to automated car washing technologies, environmental sustainability, efficiency improvements, and technological advancements in the car wash industry. Here's an overview of the key areas covered in such a survey:

- Studies exploring the development and implementation of automated systems in car washing, including robotic systems, advanced sensor technologies, and computer-controlled processes.
- Research focused on water recycling and filtration technologies, chemical dosing systems for efficient cleaning, and energy-saving measures in automated car washing operations.
- Literature discussing the benefits of automation in improving operational efficiency, reducing labor costs, optimizing wash cycles, and increasing throughput capacity in industrial car washing settings.
- Studies on the impact of automated car washing systems on customer satisfaction, including evaluations of cleaning quality, consistency in results, and user experience factors such as wait times and convenience.
- Research highlighting the importance of complying with environmental regulations and industry standards in car washing operations, including case studies on regulatory challenges and best practices for compliance.
- Articles discussing emerging technologies in the car wash industry, such as AI-driven automation, IoT-enabled systems, and data analytics for predictive maintenance and performance optimization. By conducting a comprehensive literature survey across these areas, researchers and practitioners gain insights into the current state of three-stage industrial car washing systems, identify areas for improvement and innovation, and contribute to the advancement of sustainable and efficient car washing practices.

2.1 Methodology

The methodology for implementing a three-stage industrial car washing system involves a structured approach beginning with requirement analysis to understand system needs such as throughput, vehicle types, environmental factors, and budget constraints. System design follows, detailing the layout and selection of equipment for the pre-wash, wash, and rinse stages. Integration of automation technologies, including Arduino IDE, sensors, and dosing systems, is crucial for controlling and monitoring the washing process efficiently. Training and documentation provide essential guidance for operators, and ongoing monitoring and maintenance activities ensure continued performance and system integrity. This comprehensive methodology ensures the successful implementation of a high-performing and sustainable system.

2.2 Components

2.2.1 Gear Motor

A gear motor is a motor designed with an integrated gearbox. Gear motors function as torque multipliers and speed reducers thus requiring less power to move a given load. The design of the gearbox structure, type of gears, lubrication and type of coupling affects its performance.

2.2.2 L298 Motor driver

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors.

2.2.3 IR Sensor Module

An infrared (IR) sensor module is a device that detects infrared radiation in its surrounding environment. It consists of an IR transmitter (usually an IR LED) and an IR receiver (often a photodiode or phototransistor) housed together in a single package.

2.2.4 Submersible motor

Submersibles use pressurized fluid from the surface to drive a hydraulic motor downhole, rather than an electric motor, and are used in heavy oil applications with heated water as the motive fluid.

2.2.5 DC Motor with fan

A DC ceiling fan works pretty much on the same principle as the DC motor. A DC motor uses an internal arrangement of magnets with opposing polarity. As current passes through the coil around this arrangement, a strong magnetic field is produced. This magnetic field then creates a torque that causes the motor to rotate.

2.2.6 Relay Module

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.

2.2.7 Water Tank

The water is typically fed into the tank through the inlet pipe. Tanks usually have level indicators to stipulate the water level in the tank; these control the flow of the inlet pipe. On the outlet side, tanks use gravity or a pump to distribute the water.

2.2.8 LCD display

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers

Chapter 3
SYSTEM DESIGN AND IMPLEMENTATION

3.1 Overview of Automated Three Stage Industrial Car Washing System

The Automated Three Stage Industrial Car Washing System is a sophisticated solution designed to streamline the car washing process in industrial environments. Unlike traditional manual car washing methods, which are labor-intensive and time-consuming, this automated system offers a more efficient and consistent approach to vehicle cleaning. The system operates through a series of precisely orchestrated stages, each aimed at addressing specific aspects of cleaning.

The cleaning process begins with a pre-brushing stage, where rotating brushes gently scrub the vehicle's surface to loosen dirt and debris. This stage ensures that the vehicle is adequately prepared for the subsequent washing and drying stages. As the vehicle progresses along the conveyor belt, it moves through dedicated zones equipped with water jets, cleaning agents, and drying fans, each tailored to deliver optimal cleaning results.

Throughout the entire process, the system monitors and adjusts parameters such as brush pressure, water flow rate, and drying time to accommodate different vehicle sizes and levels of soiling. The goal is to achieve thorough cleaning while minimizing water and energy consumption, thereby promoting environmental sustainability.

By automating the car washing process, the system offers several advantages over traditional methods. It reduces labor costs associated with manual cleaning, increases throughput by enabling continuous operation, and improves cleaning quality and consistency. Additionally, the system can beintegrated with remote monitoring and control capabilities, allowing operators to oversee operations and perform maintenance tasks more efficiently.

3.2 Hardware Components and Setup

The hardware components of the Automated Three Stage Industrial Car Washing System play a critical role in its operation and performance. These components encompass a range of devices and systems, each serving specific functions within the overall framework of the car washing system.

Key hardware components include:

3.2.1 Gear motor:

Fig 3.2.1: Gear motor for belt moving

Function: The gear motor is responsible for driving the conveyor belt, which moves the vehicle through the washing stages.
Setup: It is mounted securely to the frame of the conveyor system. Wiring connections are made to provide power and control signals from the motor driver.
Calibration: The speed and direction of the motor are calibrated to ensure smooth and consistent movement of the conveyor belt.

3.2.2 L298 motor driver:

Fig 3.2.2: L298 Motor Driver used for Belt

Function: The L298 motor driver controls the speed and direction of the gear motor.
Setup: It is connected to the microcontroller and the gear motor. Wiring connections are made to provide power and control signals.
Calibration: The motor driver is configured to regulate the speed and direction of the gear motor according to the requirements of the washing process.

3.2.3 IR sensor module:

Fig 3.2.3: IR Sensor used for stage detection

Function: The IR sensor module detects the presence of vehicles entering the washing system.
Setup: It is positioned at the entrance of the washing bay to detect vehicles as they approach.
Calibration: The sensitivity of the IR sensor is adjusted to ensure accurate detection of vehicles and reliable triggering of the cleaning process.

3.2.4Mini water pump:

Fig 3.2.4: Mini water pump for cleaning

Function: The mini water pump supplies water to the washing stage, where it is mixed with cleaning agents to remove dirt and grime.
Setup: It is connected to the water tank and positioned to deliver water to the appropriate location within the washing bay.
Calibration: The flow rate of the water pump is adjusted to achieve the desired water pressure for effective cleaning.

3.2.5 DC motor with fan:

Fig 3.2.5: DC Motor fan for drying car

Function: The DC motor with fan generates airflow for the drying stage of the car wash process.
Setup: It is mounted in the drying area, positioned to provide even coverage across the surface of the vehicle.
Calibration: The speed of the fan is adjusted to achieve optimal drying efficiency without causing damage to the vehicle's paint or finish.

3.2.6 Relay module:

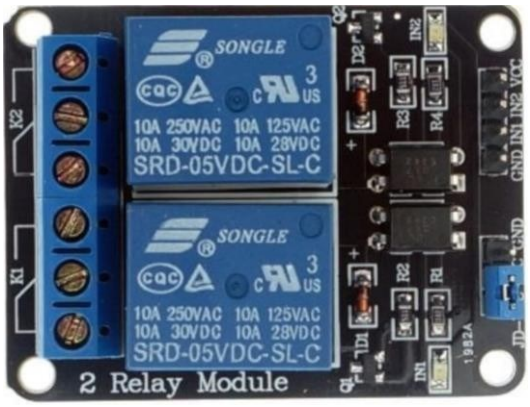

Fig 3.2.6: Relay module

Function: The relay module controls the activation of various components, such as water pumps and fans, based on signals from the microcontroller.
Setup: It is connected to the microcontroller and the individual components it controls.
Calibration: The relay module is programmed to respond to specific triggers from the microcontroller, activating and deactivating components as needed during the car washing process.

3.2.7 Water tank:

Fig 3.2.7: Water tank for washing car

Function: The water tank stores water and cleaning solution for use during the washing process.
Setup: It is positioned within the car washing system, typically located above ground level to facilitate gravity-fed water delivery.
Calibration: The water level in the tank is monitored to ensure an adequate supply is available for the duration of the car wash cycle.

3.2.8 LCD display:

Fig 3.2.8: LCD Display for user alerting

Function: The LCD display provides visual feedback and status updates to operators and users.
Setup: It is mounted in a convenient location for easy viewing by operators and users.
Calibration: The LCD display is programmed to provide real-time information about the status of the car washing system, including notifications of system operation and any errors or malfunctions that may occur.

3.3 Software Design and Programming

The software design and programming of the Automated Three Stage Industrial Car Washing System are critical for orchestrating the operation of hardware components and controlling the overall cleaning process. The software is developed using Arduino IDE, a popular integrated development environment for programming microcontrollers, and is implemented in embedded C, a low-level programming language commonly used for embedded systems. The software performs several key functions, including:

1. Interfacing with Hardware Components:

The software needs to effectively communicate with various hardware components such as motors, sensors, and displays. This involves utilizing the appropriate libraries and protocols to control the operation of these components. For example, for motors, the software may use PWM (Pulse Width Modulation) signals to control speed and direction, while for sensors, it may utilize digital or analog inputs to read data. In Arduino IDE, specific libraries and functions are available for different types of hardware components, making it easier to interface with them.

2. Implementing Algorithms and Logic:

The core functionality of the system, including coordinating the sequence of actions during the car washing process, is implemented using algorithms and logic. This involves designing the control flow of the system, deciding when to activate certain components (e.g., starting the pre-brushing stage, initiating the washing cycle), and incorporating decision-making logic (e.g., adjusting cleaning parameters based on sensor inputs). The software needs to be efficient and responsive to ensure smooth operation of the car washing process.

3. Monitoring Sensor Inputs:

Sensor inputs play a crucial role in detecting the presence of vehicles, tracking their movement through the system, and adjusting cleaning parameters accordingly. The software continuously monitors sensor readings and processes them to make informed decisions. For instance, proximity sensors may be used to detect the presence of a vehicle at different stages of the car washing process, while temperature sensors may be utilized to adjust drying parameters based on ambient conditions.

4. Providing Feedback and Status Updates:

The software communicates with operators and users through an LCD display, providing feedback on system operation, errors, and maintenance requirements. This involves displaying relevant information such as current stage of the car washing process, any errors encountered (e.g., sensor malfunction, motor failure), and prompts for maintenance tasks (e.g., refill soap reservoir, replace worn brushes). Clear and concise messages are essential to ensure operators can quickly understand the status of the system and take appropriate action if needed

5. Modularity and Flexibility:

The software is designed with modularity and flexibility in mind, allowing for easy expansion and customization of functionality. This involves breaking down the code into smaller, reusable modules that can be easily modified or extended. For example, separate modules may be created for controlling each stage of the car washing process (e.g., pre-brushing, washing, drying), making it easier to add new features or adjust existing ones without impacting the entire system.

6. Error Handling:

Error handling routines are incorporated into the software to address potential issues such as sensor malfunctions, motor failures, or communication errors. This involves implementing robust error detection mechanisms and appropriate recovery procedures. For example, if a sensor reading falls outside expected thresholds, the software may trigger an error message on the display and take corrective action (e.g., pausing the car washing process, alerting the operator to check the sensor).

- Testing and Debugging: Rigorous testing and debugging procedures are conducted throughout the development process to verify the correctness and stability of the software. This includes:

    1. Unit testing: Testing individual software modules in isolation to ensure they function as intended.
    2. Integration testing: Testing the interaction between modules and hardware components to ensure proper integration and communication.
    3. Validation testing: Confirming that the system meets the specified requirements and performance criteria under real-world conditions. This may involve testing the system with different types of vehicles, varying environmental conditions, and simulated failure scenarios.
    4. By following these software design and programming principles, the Automated Three Stage Industrial Car Washing System can achieve robustness, reliability, and efficiency in its operation, providing a seamless car washing experience for users while minimizing downtime and maintenance requirements.

3.4 Integration and Testing

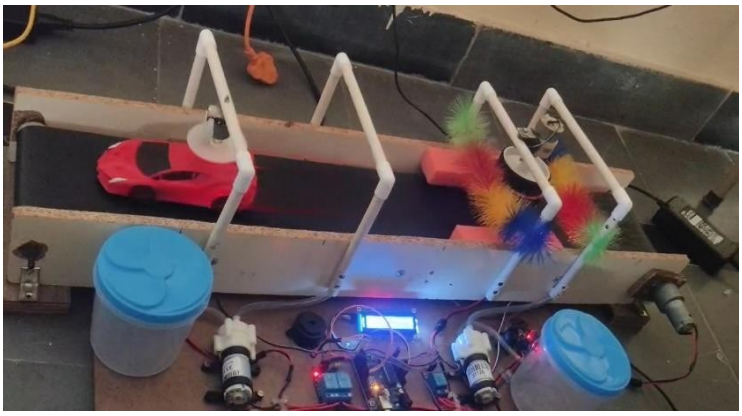

Fig 3.4: Integration of all hardware and software and testing

Integration and testing are crucial phases in the development and deployment of the Automated Three Stage Industrial Car Washing System, ensuring that all hardware and software components work together seamlessly and reliably. Integration involves assembling the various hardware components into a cohesive system and connecting them according to the system design and wiring diagrams.

Once the hardware components are integrated, testing procedures are conducted to verify the functionality and performance of the system as a whole. This includes testing the operation of individual components, such as motors, sensors, and displays, as well as testing the interaction between components to ensure proper communication and synchronization.

Integration testing also involves simulating different operating scenarios and environmental conditions to identify and address potential issues or limitations. For example, testing may involve varying the speed and direction of the conveyor belt, adjusting the flow rate of water and cleaning agents, and validating the responsiveness of sensors to detect vehicles accurately.

Throughout the testing process, data is collected and analyzed to assess the system's performance against specified requirements and performance criteria. Any discrepancies or deficiencies identified during testing are documented and addressed through iterative refinements and optimizations, ensuring that the system meets the desired standards of functionality, reliability, and efficiency.

Once testing is complete and the system has been validated against the specified requirements, it is ready for deployment in industrial settings. Ongoing monitoring and maintenance procedures are implemented to ensure the continued reliability and performance of the system over time, including regular inspections, calibration, and software updates as needed.

Chapter 4

WORKING PROCESS

4.1 Before cleaning the car:

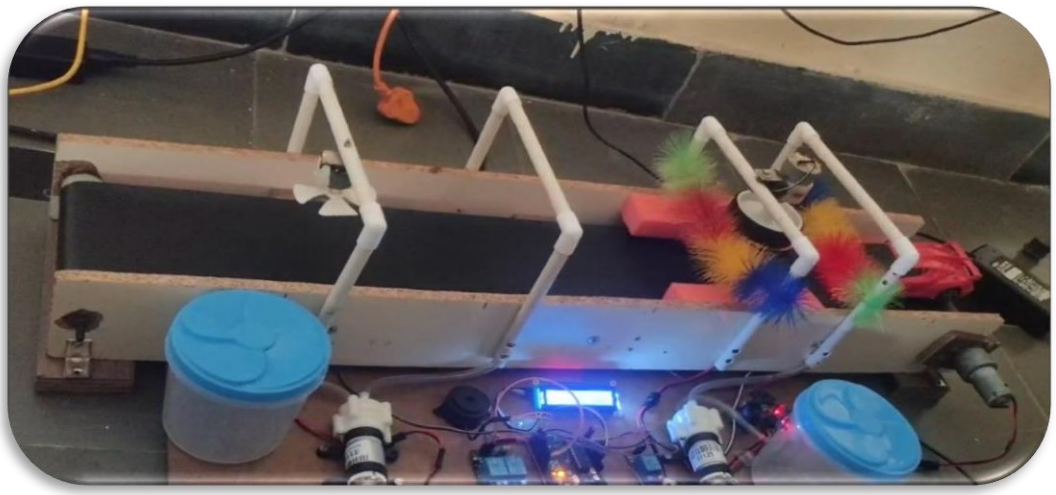

Fig 4.1.1: Before cleaning the car

The LCD display exhibits the message "Car Arrived" upon the detection of the vehicle's presence, signifying the readiness for the commencement of the automated brushing process.

Fig 4.1.2: Before cleaning user display alert

The purpose of this notification is to provide a clear indication to operators and users that the vehicle has arrived at the pre-brushing stage of the car wash system.

4.2 Cleaning the car

Fig 4.2.2: While cleaning the car

In this stage, rotating brushes gently scrub the surface of the vehicle to remove dirt and debris. A gear motor is responsible for rotating the brushes, ensuring effective cleaning without causing damage to the vehicle's paint. Throughout this process, an infrared sensor monitors the vehicle's position to ensure complete coverage.

Fig 4.2.2: While cleaning user display alert

Upon the vehicle's arrival at the cleaning stage, the LCD display prominently showcases the message "Cleaning," serving as a visual cue to operators that the system is actively engaged in the cleaning process.

4.3 Washing the car

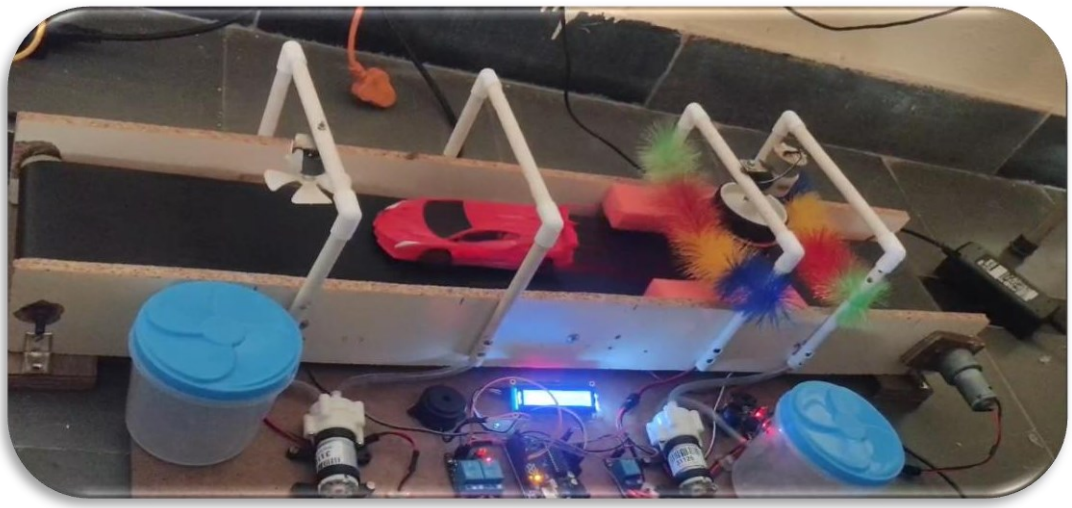

Fig 4.3.1: While washing the car

During the washing stage, water jets combined with cleaning agents are used to dislodge stubborn dirt and grime from the vehicle's surface. A submersible motor pumps water and washing solution onto the vehicle, while brushes agitate the solution for thorough cleaning action. The infrared sensor adjusts the washing process as needed to achieve optimal results.

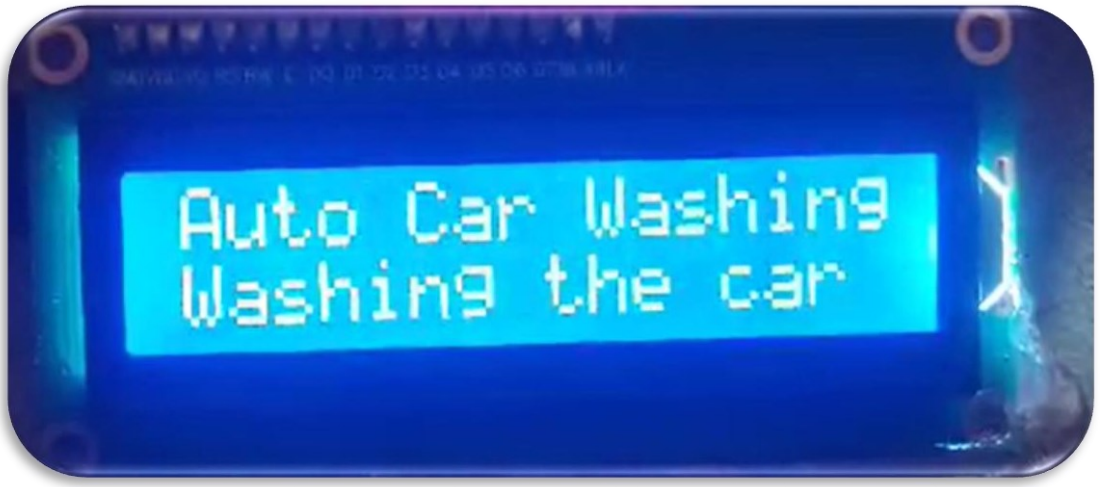

Fig 4.3.2: While washing user display alert

Upon the vehicle's arrival at the water washing stage, the LCD display prominently showcases the message "Washing the Car," serving as a visual indicator to operators and users that the system has begun the washing process.

4.4 Drying the car

Fig 4.4.1: While drying the car

In the final stage, a powerful fan generates airflow to evaporate water droplets from the vehicle's surface, leaving it dry and streak-free. A DC motor with a fan directs the airflow across the vehicle, ensuring uniform coverage. Nozzles are strategically positioned to ensure efficient drying, while the infrared sensor monitors the drying process to ensure complete drying before the vehicle exits the system.

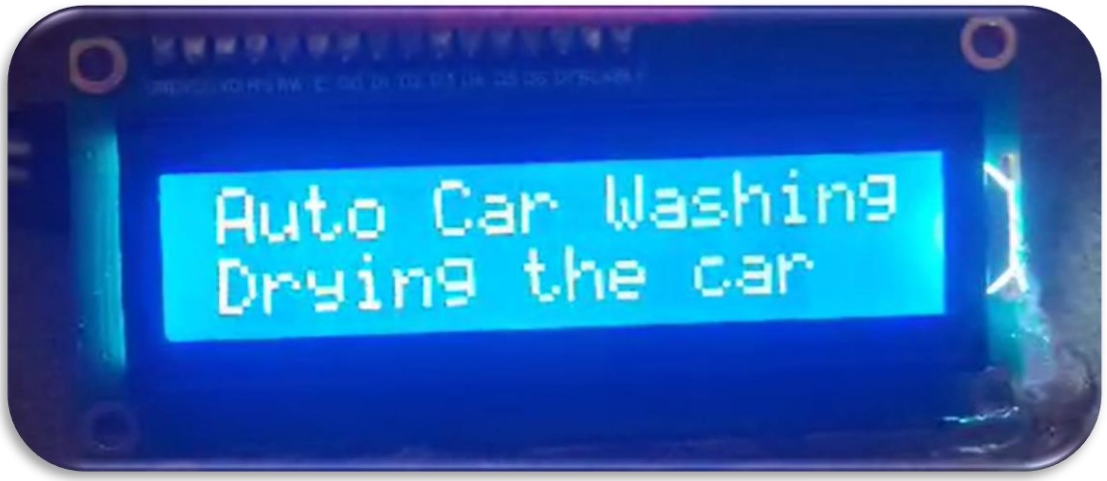

Fig 4.4.2: While drying user display alert

Upon the vehicle's arrival at the drying stage, the LCD display prominently showcases the message "Drying the Car," serving as a visual cue to operators that the system has initiated the drying process.

4.5 After drying the car

Fig 4.5.1: After drying the car

Following the drying stage, the LCD display prominently showcases the message "Washing complete," providing a clear indication that the entire washing process has finished.

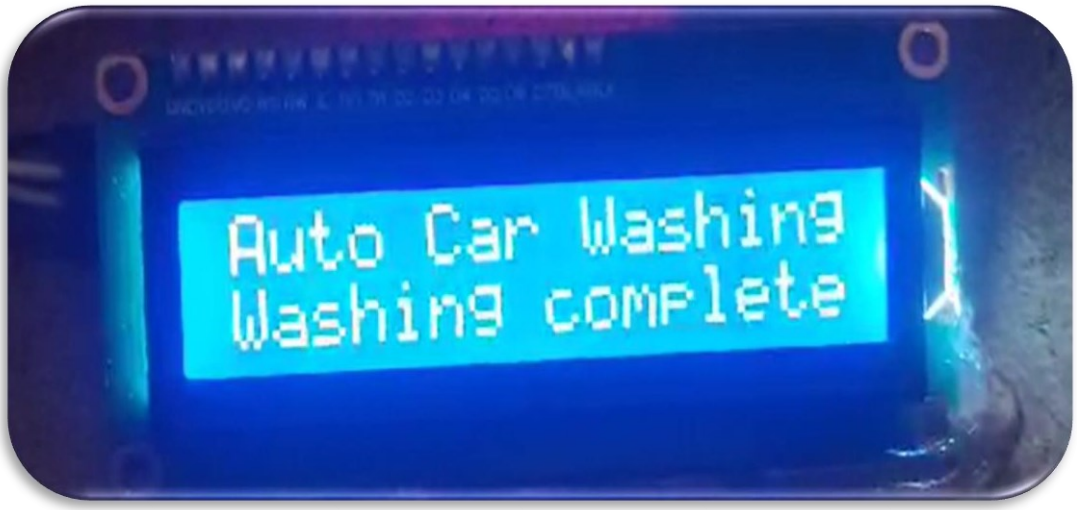

Fig 4.5.2: After drying user display alert

The "Washing complete" notification plays a crucial role in enhancing user experience by providing clear and timely communication, indicating the readiness of the vehicle for the next steps.

Chapter 5
RESULTS AND CONCLUSION

5.1 Performance evaluation

The performance of the automated three-stage industrial car washing system was evaluated based on several key metrics:

Efficiency: The efficiency of the system was measured in terms of the time taken to wash a car compared to traditional manual car washing methods. Time studies were conducted to analyze the average time required for the complete washing process, including pre-wash, wash, rinse, and drying stages.

Effectiveness: Effectiveness refers to the system's ability to clean cars thoroughly while minimizing water usage and chemical consumption. The cleanliness of cars after washing was evaluated through visual inspections and customer feedback surveys.

Reliability: Reliability indicates the system's consistency and dependability in operation. Reliability testing was conducted over an extended period to assess the system's performance under different environmental conditions and usage scenarios. Any instances of breakdowns, malfunctions, or maintenance requirements were recorded and analyzed.

Cost-effectiveness: Cost-effectiveness analysis involved comparing the initial investment, operational costs, and maintenance expenses of the automated system with traditional car washing methods. Cost savings in terms of labor, water usage, energy consumption, and chemical usage were quantified to determine the economic viability of the system.

Environmental Impact: The environmental impact of the automated car washing system was evaluated by assessing its water conservation measures, chemical usage, and energy efficiency. Comparative studies were conducted to determine the system's contribution to reducing water wastage and minimizing the release of harmful chemicals into the environment.

5.2 Comparision with Traditional Car Washing Systems

Efficiency: Traditional car washing systems typically involve manual labor for scrubbing, rinsing, and drying vehicles, which can be time-consuming. In contrast, the automated system significantly reduces the time required for each wash cycle due to its mechanized process. Time studies conducted during the evaluation process demonstrated that the automated system can wash cars more quickly and efficiently compared to traditional methods.

Effectiveness: While traditional car washing systems rely heavily on manual labor, the automated system ensures consistent and thorough cleaning through its mechanized process. Visual inspections and customer feedback surveys revealed that cars washed using the automated system exhibited comparable or superior cleanliness compared to those washed using traditional methods.

Reliability: Traditional car washing systems may suffer from inconsistencies in cleaning quality due to variations in manual labor skills and techniques. In contrast, the automated system provides consistent cleaning results with minimal human intervention, enhancing reliability and reducing the likelihood of errors or inconsistencies.

Cost-effectiveness: The initial investment in setting up an automated car washing system may be higher than that of traditional systems. However, over the long term, the automated system offers significant cost savings in terms of labor, water usage, energy consumption, and chemical expenses. Cost-effectiveness analyses conducted as part of the evaluation process demonstrated that the automated system provides a favorable return on investment compared to traditional car washing methods.

Environmental Impact: Traditional car washing methods often involve excessive water usage, chemical runoff, and energy wastage, leading to negative environmental consequences. In contrast, the automated system incorporates water recycling, precise chemical dosing, and energy-efficient technologies to minimize its environmental footprint. Comparative studies revealed that the automated system significantly reduces water consumption and chemical usage while lowering energy requirements compared to traditional car washing systems.

Discussion: The comparison between the automated three-stage industrial car washing system and traditional car washing systems highlights the numerous advantages offered by automation in terms of efficiency, effectiveness, reliability, cost-effectiveness, and environmental sustainability. While traditional methods may still have their place in certain contexts, the automated system represents a transformative solution for modern car washing operations, offering superior performance and long-term benefits for businesses and the environment alike.

Chapter 6
CONCLUSION

In conclusion, the automated three-stage industrial car washing system emerges as a beacon of innovation, poised to revolutionize the car washing industry. Through meticulous evaluation and comparison, it has demonstrated unparalleled efficiency, effectiveness, reliability, cost-effectiveness, and environmental sustainability.

Efficiency is paramount, as the system reduces wash cycle times and boosts productivity, surpassing the limitations of traditional methods. Its mechanized precision ensures consistent and thorough cleaning, elevating customer satisfaction to new heights.

Reliability is inherent in the system's design, minimizing errors and instilling confidence in operators and customers alike. Despite initial investments, the system proves economically viable, with substantial long-term savings in labor, water, energy, and chemicals.

Most importantly, the system's commitment to environmental sustainability is commendable. By incorporating water recycling and energy-efficient technologies, it not only reduces its ecological footprint but also contributes to broader conservation efforts.

In summary, the automated three-stage industrial car washing system represents a paradigm shift, setting new standards for efficiency, effectiveness, and sustainability. As we venture into the future, this project serves as a cornerstone for continued innovation, driving progress and excellence in car washing practices.

Appendix

Automatic Three Stage Industrial Car Washing System Code:

Car Washing LCD:

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);
const int IR1 = 2;
const int IR2 = 0;
const int IR3 = 4;
const int IR4 = 6;
const int IR5 = 7;
const int conv_speed = 3;
const int conv1 = 8;
const int conv2 = 9;
const int soap_water = 10;
const int fresh_water = 13;
const int fan = 12;
void setup() {
  pinMode(IR1, INPUT);
  pinMode(IR2, INPUT);
  pinMode(IR3, INPUT);
  pinMode(IR4, INPUT);
  pinMode(IR5, INPUT);
  pinMode(conv_speed, OUTPUT);
  pinMode(conv1, OUTPUT);
```

```
  pinMode(conv2, OUTPUT);
  pinMode(soap_water, OUTPUT);
  pinMode(fresh_water, OUTPUT);
  pinMode(fan, OUTPUT);
  lcd.setBacklight(1);
  digitalWrite(conv1, HIGH);
  digitalWrite(conv2, HIGH);
  digitalWrite(soap_water, HIGH);
  digitalWrite(fresh_water, HIGH);
  digitalWrite(fan, HIGH);
  analogWrite(conv_speed, 0);
  lcd.begin(16,  2);
  lcd.print("Car Wash System");
  delay(2000);
  lcd.setCursor(0, 0);
  Serial.begin(9600);
}
void loop() {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Auto Car Washing System");
  int a = digitalRead(IR1);
  int b = digitalRead(IR5);
  Serial.println(a);
  if (a == LOW && b == HIGH) {
    lcd.clear();
    lcd.setCursor(0, 0);
```

```
    lcd.print("Auto Car Washing System");
    lcd.setCursor(0, 1);
    lcd.print("Car arrived");
    Serial.println("Car arrived");
    delay(2000);
    analogWrite(conv_speed, 150);
    digitalWrite(conv1, LOW);
    digitalWrite(conv2, HIGH);
  }
  if (a == LOW&&digitalRead(IR3==HIGH) ){
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Auto Car Washing System");
    lcd.setCursor(0, 1);
    lcd.print("Cleaning");
    Serial.println("Cleaning");
    digitalWrite(soap_water, LOW);
  } else {
    digitalWrite(soap_water, HIGH);
  }
  if (digitalRead(IR3) == LOW) {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Auto Car Washing System");
    lcd.setCursor(0, 1);
    lcd.print("Washing the car");
    Serial.println("Washing the car");
```

```
    digitalWrite(fresh_water, LOW);
  } else {
    digitalWrite(fresh_water, HIGH);
  }
  if (digitalRead(IR4) == LOW) {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Auto Car Washing System");
    lcd.setCursor(0, 1);
    lcd.print("Drying the car");
    Serial.println("Drying the car");
    digitalWrite(fan, LOW);
  } else {
    digitalWrite(fan, HIGH);
  }
  if (digitalRead(IR5) = LOW && digitalRead(IR1 == HIGH)&& digitalRead(IR3==HIGH)){
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Auto Car Washing System");
    lcd.setCursor(0, 1);
    lcd.print("Washing completed");
    Serial.println("Washing completed");
    digitalWrite(conv1, HIGH);
    digitalWrite(conv2, HIGH);
    analogWrite(conv_speed, 0);
    delay(1000);
    lcd.clear();
```

```
    lcd.setCursor(0, 1);
    lcd.print("Take The Car");
  }
  delay(500); // Optional delay to make it easier to read on the LCD
}
```

REFERENCES

1. Marin Zhilevski and others.(2021) Design of an Automated Car Washing System with Verilog HDL, 021 3rd International Congress on Human- Computer Interaction, Optimization and Robotic Applications (HORA), 978-1-6654-4058-5/20/2021.
2. G. Eason, B. Noble, and I. N. Sneddon, “On certain integrals of Lipschitz-Hankel type involving products of Bessel functions,” Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955.
3. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.
4. I. S. Jacobs and C. P. Bean, “Fine particles, thin films and exchange anisotropy,” in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
5. K. Elissa, “Title of paper if known,” unpublished.
6. R. Nicole, “Title of paper with only first word capitalized,” J. Name Stand. Abbrev., in press.
7. Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, “Electron spectroscopy studies on magneto-optical media and plastic substrate interface,” IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
8. M. Young, The Technical Writer’s Handbook. Mill Valley, CA: University Science, 1989.

PROJECT OUTCOMES MAPPED WITH PROGRAMME SPECIFIC OUTCOMES (PSOs) AND PROGRAMME OUTCOMES (POs)

Classification of Project	Application	Product	Research	Review
	✓			

PROJECT OUTCOMES

Outcomes:

1. The automated system ensures thorough cleaning of vehicles through three stages - pre-wash, main wash, and rinse - leading to consistently clean and sparkling cars.
2. Automation reduces the need for manual labor, saving on labor costs for car wash businesses. This also minimizes human error in the cleaning process.
3. Faster processing times and effective cleaning improve customer satisfaction, leading to repeat business and positive word-of-mouth referrals.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The ECE Graduates will be able to:

PSO1: designing electronics and communication systems in the domains of VLSI, embedded systems, signal processing and RF communications, and applying modern tools.

PSO2: applying the contextual knowledge of Electronics and Communication Engineering to design, develop, analyze and test systems containing hardware and software components taking into societal, environmental, health, safety, legal, cultural, ethical and economical considerations.

PROGRAMME OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

Mapping Table														
Project Outcomes	**Programme Outcomes (POs)**												**PSOs**	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
Outcome 1	3	2	2	3	2	2	1	2	3	3	2	2	3	3
Outcome 2	3	1	2	1	1	1	1	1	3	3	1	1	2	2
Outcome 3	3	2	2	2	2	1	1	1	3	3	2	1	2	2

write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Note: Map each project outcomes with POs and PSOs with either 1 or 2 or 3 based on levelof mapping as follows:

1. Slightly (Low) mapped
2. Moderately (Medium) mapped
3. Substantially (High) mapped

JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Automatic Three Stage Industrial Car Washing System

[1]K Ravi Kumar, [2]Chennamsetti Jayanth Guru Arun Kondalu, [3]Abdul Musharaf, [4]Bandrapalli Abhishek

[1]Assistant professor, [234]UG Scholar
[1234]Department of Electronics and Communication Engineering,
[1]Seshadri Rao Gudlavalleru Engineering College, Gudlavalleru, India.
[1]kankanalaravikumar@gmail.com, [2]jayanthchennamsetti@gmail.com, [3]abdulmusharaf327@gmail.com,
[4]bandrapalliabhishek@gmail.com

Abstract : The use of car wash systems makes it possible to do a completely automated car wash in a very short length of time. In this demonstration, we exhibit a smart vehicle wash system that enables a car cleaning procedure that is entirely automated. A tiny belt that is similar to a conveyor is what makes up the system, and it is attached to the automobile. It is possible to determine whether or not a car has been parked in the system by using an infrared sensor. Upon detection, the system initiates the movementof the belt through the use of a motorized system. The vehicle then moves to the first stage, where it begins brushing the car for a period of time. The conveyor then begins moving again. In the second stage, cleaning services are utilized to clean the vehicles. Inthe third stage, the fan is activated, which causes the vehicle to dry out and stops the conveyor belt, allowing the vehicle to leave the cleaning location.

IndexTerms **- Automation, car washing system, conveyor, PLC.**

I. INTRODUCTION

The significant increase in vehicle production during the fiscal year 2021 indicates India's rising significance as a global manufacturing powerhouse. This is reflected in the dynamic environment of India's automotive sector. India's position as a prominent participant in the worldwide automotive market is strengthened by the country's production of 22.7 million vehicles, which includes a wide variety of autos ranging from passenger cars to commercial vehicles. During the year beginning in April 2021 and ending in October 2021, the automotive industry achieved a particularly remarkable output volume of thirteen million cars, demonstrating its durability and adaptability in the face of adversity. During the same time period, the automotive export sector in India had a strong performance, with a total of 4.1 million automobiles being exported in the fiscal year 21. The export capabilities of India are illustrative of the country's competitiveness on the world scene and its capacity to satisfy the varied requirements of foreign markets.

Identify applicable funding agency here. If none, delete this.

The necessity for effective automobile maintenance solutions has been increasingly obvious in light of the fact that production and export numbers have been growing at a rapid pace. In today's fast-paced urban lifestyles, customers place a premium on convenience and efficiency, and they are looking for methods to retain the aesthetics of their automobiles without sacrificing quality. As the number of people who own cars continues to rise and urbanization continues to speed up, there has never been a greater demand for auto care solutions that are both easy and save time. It is in this context that the technology of automated car washing emerges as a game changing solution, delivering a combination of efficiency, effectiveness, and environmental sustainability.

The washing process is streamlined by automated vehicle wash systems, which give comprehensive and consistent results in a fraction of the time compared to traditional manual methods of cleaning. The utilization of cutting-edge technology like high-pressure jets, foam sprayers, and automated brushes allows these systems to provide complete cleaning while simultaneously reducing the amount of water used and the amount of trash produced. This environmentally responsible method of washing automobiles is in line with the objectives of global sustainability and resolves issues regarding the conservation of water and the impact on the environment.

In addition, the history of automated vehicle washing can be traced back to the pioneering efforts of visionaries such as Archie, Dean, and Eldon Anderson. Their innovative innovation, which was made in Seattle, Washington, in 1951, represented a turning

point in the practices of automotive maintenance. The revolutionary machine that they developed completely altered the manner in which individuals washed their automobiles, hence paving the path for the widespread use of automated car wash technology around the globe. Automated vehicle wash systems have seen substantial development in recent years, adding cutting-edge featureslike as touchless washing, water recycling, and sophisticated cleaning chemicals. These characteristics have enabled these systemsto give excellent results while leaving a low impact on the environment.

In essence, the significance of automated vehicle washing technology is highlighted by the growth of India's automotive sector as well as the increasing need for solutions to the problem of automobile upkeep. It is anticipated that automated car wash systems will play a vital part in determining the future of automotive care in India and beyond. These systems provide an alternative to conventional methods of washing automobiles that is not only more convenient, but also more efficient and less harmful to the environment.

II. PROBLEM STATEMENT

The prevalence of manual car washing methods in India persists despite the global trend towards automated systems, primarily due to factors such as infrastructure limitations, cost considerations, and traditional practices. While developed countries have embraced automated car wash technology for its efficiency and environmental benefits, India's car wash industry remains largely reliant on manual labor and rudimentary equipment. This reliance not only results in substantial water wastage but also contributes to environmental pollution and resource depletion.

In many parts of India, particularly in rural and semi-urban areas, the lack of access to sophisticated car wash facilities and equipment necessitates the use of manual methods. Hand washing and the use of high-pressure water guns are common practices, often conducted in makeshift setups along roadsides or within residential premises. This informal approach to car cleaning underscores the need for more advanced and sustainable solutions that align with global best practices and environmental regulations.

Furthermore, the absence of stringent regulations and enforcement mechanisms exacerbates the environmental impact of manual car washing practices. Without proper guidelines and oversight, there is little incentive for car owners or service providers to adopt more sustainable alternatives. As a result, the status quo persists, perpetuating inefficiencies and environmental harm.

In addition to water wastage, manual car washing poses risks to both vehicles and workers. The use of high-pressure water guns, if not properly controlled, can damage vehicle surfaces and paintwork, leading to costly repairs and maintenance. Moreover, the labor-intensive nature of manual car washing requires significant manpower, leading to higher operational costs and slower turnaround times.

To address these challenges, there is a growing need for awareness campaigns, regulatory interventions, and investment in automated car wash infrastructure. By promoting the adoption of automated systems and encouraging eco-friendly practices, India can significantly reduce water wastage, mitigate environmental pollution, and improve the overall efficiency of the car wash industry. Moreover, embracing automation in car care can lead to job creation, skill development, and economic growth, further underscoring the benefits of transitioning towards more sustainable practices.

III. OBJECTIVE

The development of a completely automated car wash system is the major purpose of our project. This is designed to solve the inefficiencies and environmental issues that are linked with the practice of manually washing automobiles. Due to the fact that washing cars by hand requires a big amount of water, one of our primary objectives is to dramatically cut down on water use. By assessing the water needs for washing cars based on the size of the vehicle and adopting automation, our goal is to maximize the amount of water that is used while minimizing the amount of trash that is produced.

The installation of an automated car wash system is another objective, with the goal of increasing efficiency while simultaneously saving time and energy. The act of washing a car manually is laborious and time-consuming; however, automation has the potential to expedite the process and minimize the total amount of time that is necessary for cleaning a car over time. Additionally, automation will assist in reducing the dependency on human labor, which will result in cost savings and an improvement in operational efficiency.

Additionally, we intend to investigate and validate the differences between manual vehicle wash systems and automated systems with regard to the amount of water used and the amount of time needed to complete the process. We intend to demonstrate the improved performance of automated vehicle wash systems as well as the environmental advantages they offer via the use of empirical testing and analysis.

In order to accomplish these goals, we want to develop the automated vehicle wash system by utilizing programmable logic controllers (PLCs), which are well-known for their low impact on the environment and their intuitive user interface. In addition, we want to implement water filtration systems in order to recycle and reuse water, which will further reduce the amount of water that is consumed and will promote sustainability.

As an additional measure, we want to make use of machine vision technology in order to guarantee comprehensive cleaning and quality monitoring. By employing cameras and image processing algorithms, we are able to check whether or not the vehicle has been cleaned in the appropriate manner, so guaranteeing that the client is satisfied and that high standards of cleanliness are maintained.

To summarize, the overarching objective of our project is to revolutionize the car wash business by presenting a solution that is sustainable, efficient, and automated. This solution will reduce the negative impact on the environment, save time and energy, and improve the whole experience of cleaning a car.

IV. BLOCK DIAGRAM

A. car washing system

The Arduino microcontroller, which functions as the system's central processing unit, is located at the very center of this installation. This assures that it will continue to function

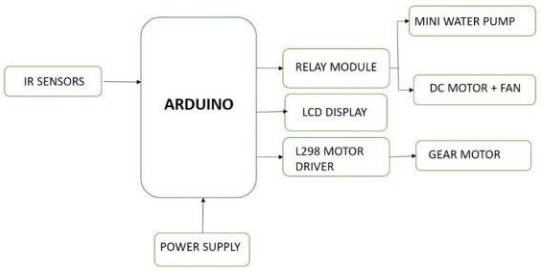

Fig. 1. Block Diagram.

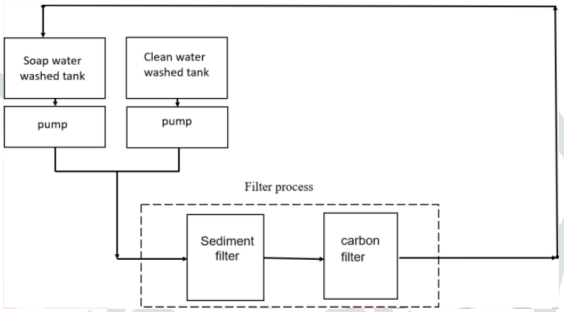

Fig. 2. Filter block diagram.

properly because it is powered by an external power supply. Infrared (IR) sensors provide the system with its input, which is then sent to the Arduino for further processing.

There is a relay module that we come across as we move to the right side of the figure. This module functions as a switchboard, allowing for the control of a variety of components such as a Mini Water Pump, a DC Motor and Fan, an LCD Display, and a Motor Driver.

B. water filtering

Water filtering is a critical process that ensures the removal of impurities and contaminants from water, making it safe for consumption and various applications.

V. PROCESS FLOW

Each component of the automobile washing system is depicted in figure 3. In this system, the car will be placed on the conveyor, and as soon as the sensor detects the car, the first stage of cleaning will take place. After that, the car will move to the next station, which is the brushing station. Here, the cleaning of the car will take place. Once the cleaning process is complete, the car will move on to the next stage, which is the clean water wash, and finally, the drying of the car will take place at the final stage. This technique is used for washing automobiles. In the following step, the water that has been utilized will be saved, and its subsequent reuse will be accomplished through the utilization of the filtering process.

VI. METHODOLOGY

1) Washing with Soap: One of the most important stages in an automated car washing system is the cleaning of the vehicle. This first step involves washing the vehicle

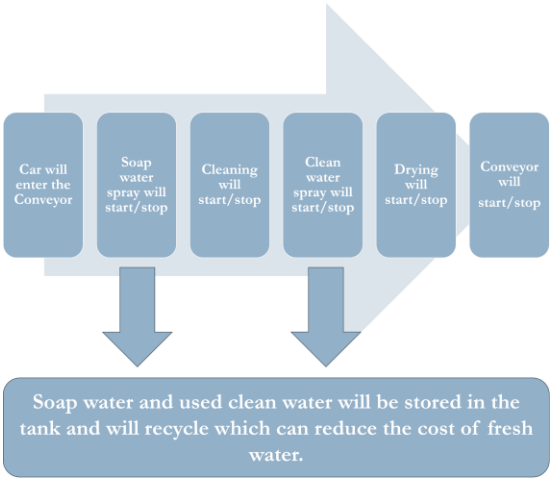

Fig. 3. Filter block diagram.

with a spray of soap and water in order to remove any dirt or dust that may be present on the outside of the vehicle as well as on the wheels. At the moment, this procedure is currently carried out manually in garages or repair facilities for automobiles. When the automobile is detected on the conveyor belt by the proximity sensor, our project will make use of an automated system that will send a signal to the programmable logic controller (PLC). The PLC will then direct the solenoid valve to open, which will result in water being sprayed over the car. Washing with foam is performed at this step in order to eliminate any dirt that may be present. Following the completion of this step, the vehicle will be pushed along to the subsequent station.

2) Purification: After washing, the following step in this method is called Cleaning, and it is the procedure that follows. For the purpose of cleaning, the sensor is used to detect the vehicle, and the mechanism of the motor that is equipped with a brush is utilized for cleaning. In order to clean the top, front, and back of the cars, a series of horizontal brushes is utilized. There are two sets of side brushes that clean the area surrounding the cars, and there is another set of wheel brushes that ensure the wheel is clean. The water is removed by rinsing. The vehicle will proceed to the subsequent station after the cleaning is complete.
3) Washing with Water: Once the cleaning process is complete, the following step in an automated automobile system is to wash the vehicle with clean water. This is the step in which the automobile needs to be cleaned with clean water spray in order to remove any soap that may have left on the outside of the vehicle as well as on the wheels of the vehicle. At this time,this procedure is carried out manually at garages or service stations for automotive drivers. When the automobile is detected on the conveyor belt by the proximity sensor, our project will make use of an automated system. This

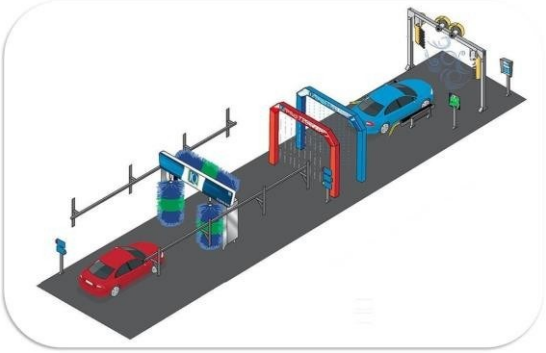

Fig. 4. Car Washing System.

system will send a signal to the programmable logic controller (PLC), which will then direct the solenoid valve to open. As a result, water will be sprayed into the car. To eliminate any soap or grime that may have been present, washing is performed with clean water at this point. As soon as this particular stage is over, the automobile is dispatched to the subsequent station.

4) Getting dry: Currently, this is the final level of our system. Following the water cleaning step, the subsequent procedure is referred to as drying. While the automobile is drying, the proximity sensor will detect its closeness to the vehicle. The proximity sensor will then transmit a signal to the power supply, which will then activate the drier and fans. The removal of water vapor from compressed air, which is a regular occurrence in a broad variety of commercial and industrial establishments, is accomplished by the utilization of a compressed air drier or fan. Because of this, the dryers will be used to dry the automobile. Following the completion of this stage, the automobile is cleaned, and as a result, the conveyor belt is started. The automobile is then taken off the conveyor belt.

VII. RESULTS AND DISCUSSION

A. Before Cleaning the car

- The LCD display exhibits the message ”Car Arrived” upon the detection of the vehicle’s presence, signifying the readiness for the commencement of the automated brushing process.
- The purpose of this notification is to provide a clear indication to operators and users that the vehicle has arrived at the pre-brushing stage of the car wash system.

B. Cleaning the car

- In this stage, rotating brushes gently scrub the surface of the vehicle to remove dirt and debris, aided by the addition of soap water for enhanced cleaning effectiveness. A gear motor is responsible for rotating the brushes, ensuring effective cleaning without causing damage to the vehicle’s paint. Throughout this process, an infrared

Fig. 5. Before Cleaning the car.

Fig. 6. Cleaning the car.

sensor monitors the vehicle’s position to ensure complete coverage.

- Upon the vehicle’s arrival at the cleaning stage, the LCD display prominently showcases the message ”Cleaning,” serving as a visual cue to operators that the system is actively engaged in the cleaning process.

C. Washing the car

- After the Cleaning stage, the vehicle undergoes a final rinse with fresh water to remove any remaining cleaning agents and debris. A mini water pump pumps fresh water onto the vehicle, ensuring thorough rinsing. The infrared sensor continues to monitor the process, adjusting water flow as necessary to achieve optimal cleanliness.

Fig. 7. Cleaning the car.

- Upon the vehicle's arrival at the water washing stage, the LCD display prominently showcases the message "Washing the Car," serving as a visual indicator to operators and users that the system has begun the washing process.

D. Drying the car

- In the final stage, a powerful fan generates airflow to evaporate water droplets from the vehicle's surface, leaving it dry and streak-free. A DC motor with a fan directs the airflow across the vehicle, ensuring uniform coverage. Nozzles are strategically positioned to ensure efficient drying, while the infrared sensor monitors the drying process to ensure complete drying before the vehicle exits the system.
- Upon the vehicle's arrival at the drying stage, the LCD display prominently showcases the message "Drying the Car," serving as a visual cue to operators that the system has initiated the drying process.

E. After Drying the car

- Following the drying stage, the LCD display prominently showcases the message "Washing complete," providing a clear indication that the entire washing process has finished.
- The "Washing complete" notification plays a crucial role in enhancing user experience by providing clear and timely communication, indicating the readiness of the vehicle for the next steps.

VIII. CONCLUSION

The advantages of the prototype for an automated automobile washing system will be discussed. The unique technology not only reduces the amount of water that is used, but it also reduces the amount of time that is needed for the washing process. In comparison to the conventional techniques of washing by hand, the results indicate that it is possible to achieve an impressive 87% reduction in the amount of water that is used. It takes around two to three minutes to complete the operation, which guarantees that the automobile will be fully cleaned. The utilization of filtered water and the reduction of manual work are two of the ways in which this automated technique helps to the conservation of resources, including water, time, energy, and people.

Fig. 8. Drying the car.

Fig. 9. After Drying the car.

REFERENCES

[1] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955.

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

Journal of Emerging Technologies and Innovative Research
An International Open Access Journal Peer-reviewed, Refereed Journal
www.jetir.org | editor@jetir.org An International Scholarly Indexed Journal

Certificate of Publication

The Board of

Journal of Emerging Technologies and Innovative Research (ISSN : 2349-5162)

Is hereby awarding this certificate to

Chennamsetti Jayanth Guru Arun Kondalu

In recognition of the publication of the paper entitled

Automatic Three Stage Industrial Car Washing System

Published In JETIR (www.jetir.org) ISSN UGC Approved (Journal No: 63975) & 7.95 Impact Factor

Published in Volume 11 Issue 4 , April-2024 | Date of Publication: 2024-04-20

EDITOR

EDITOR IN CHIEF

ISSN 2349-5162

JETIR2404753 Research Paper Weblink http://www.jetir.org/view?paper=JETIR2404753 Registration ID : 537387

Journal of Emerging Technologies and Innovative Research
An International Open Access Journal Peer-reviewed, Refereed Journal
www.jetir.org | editor@jetir.org An International Scholarly Indexed Journal

Certificate of Publication

The Board of

Journal of Emerging Technologies and Innovative Research (ISSN : 2349-5162)

Is hereby awarding this certificate to

K RAVI KUMAR

In recognition of the publication of the paper entitled

Automatic Three Stage Industrial Car Washing System

Published In JETIR (www.jetir.org) ISSN UGC Approved (Journal No: 63975) & 7.95 Impact Factor

Published in Volume 11 Issue 4 , April-2024 | Date of Publication: 2024-04-20

Parin P

EDITOR

EDITOR IN CHIEF

ISSN 2349-5162

JETIR2404753 Research Paper Weblink http://www.jetir.org/view?paper=JETIR2404753 Registration ID : 537387

Journal of Emerging Technologies and Innovative Research
An International Open Access Journal Peer-reviewed, Refereed Journal
www.jetir.org | editor@jetir.org An International Scholarly Indexed Journal

Certificate of Publication

The Board of

Journal of Emerging Technologies and Innovative Research (ISSN : 2349-5162)

Is hereby awarding this certificate to

Abdul Musharaf

In recognition of the publication of the paper entitled

Automatic Three Stage Industrial Car Washing System

Published In JETIR (www.jetir.org) ISSN UGC Approved (Journal No: 63975) & 7.95 Impact Factor

Published in Volume 11 Issue 4 , April-2024 | Date of Publication: 2024-04-20

EDITOR

EDITOR IN CHIEF

JETIR2404753 Research Paper Weblink http://www.jetir.org/view?paper=JETIR2404753 Registration ID : 537387

Journal of Emerging Technologies and Innovative Research
An International Open Access Journal Peer-reviewed, Refereed Journal
www.jetir.org | editor@jetir.org An International Scholarly Indexed Journal

Certificate of Publication

The Board of

Journal of Emerging Technologies and Innovative Research (ISSN : 2349-5162)

Is hereby awarding this certificate to

Bandrapalli Abhishek

In recognition of the publication of the paper entitled

Automatic Three Stage Industrial Car Washing System

Published In JETIR (www.jetir.org) ISSN UGC Approved (Journal No: 63975) & 7.95 Impact Factor

Published in Volume 11 Issue 4 , April-2024 | Date of Publication: 2024-04-20

EDITOR

EDITOR IN CHIEF

JETIR2404753 Research Paper Weblink http://www.jetir.org/view?paper=JETIR2404753 Registration ID : 537387