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Rain Sensing Automatic Car Wiper with Voice Command

Priyanka Kadam, Renuka Thakare, Nayan Ukarde, Sanyukta Tekawade, Jyoti Sulakshane
Department of Electronic and Telecommunication
Guru Gobind Singh Polytechnic, Nashik, India

Abstract: *The automatic wiper system for vehicles is an innovative solution that enhance driver convenience and safety by automating the windshield cleaning process. Utilizing an Arduino Nano microcontroller, this system integrates a rain sensor and SG90 servo motor to detect rain or water on the windshield and activate the wiper accordingly. The servo operate in a 0-180 degree range, ensuring effective cleaning. Additionally, an AI Thinker – based offline voice command module allow user to control the wiper via voice command, adding a hand-free operational mode. A red LED indicator lights up when the wiper are active, ensuring a clear status indication. The entire system is powered by a 5V 2A power adapter, providing a reliable and efficient operation. This project aims to reduce driver distraction and enhance safety, especially in sudden rain sensor rain scenario, making it a practical addition to modern vehicles.*

Keywords: Automatic, Sensing, Wiper, Arduino, Rain sensor module, Voice command module

I. INTRODUCTION

Rainy weather condition often reduce visibility, making driving risky. Manual wiper system require constant driver intervention, which can divert attention from the road. An automatic wiper system addresses this challenge by providing an autonomous solution to keep the windshield clear. This project leverages Arduino Nano as the central controller, interfacing with a rain sensor and SG90 servo motor to automate the wiping mechanism. The system detects rainfall or water presence and activates the wiper instantly. Additionally, the integration of a voice command recognition module makes the system more user-friendly by allowing hand-free operation. This feature is especially beneficial during urban driving or high-speed scenarios, where manual adjustment to wiper can compromise safety. A red LED provides a visual cue to indicate the system's operational status. The system is compact and energy-efficient, making it suitable for integration into various vehicle types. With the increasing focus on automation in the automotive industry, this project aligns with the trend towards smarter and safer vehicles. By addressing a common challenge faced by drivers, this project demonstrates the potential of integrating sensor, actuators, and AI-driven modules into everyday automotive system.

II. LITERATURE SURVEY

1.P.Devaraj, Prawin Sundar S, developed system to mitigate driving distractions and allow drivers to focus on their primary. The distraction eliminated with the development of this product is the manual adjustment of windshield wipers when driving in precipitation. The few seconds that a driver takes their attention off the road to adjust a knob while driving in poor weather condition could potentially lead to car accidents. This device converts a cumbersome manual operation to smooth automatic one.

2.Akila Wijesinghe, Chamod Wijedasa, im is to develop an automated wiper system which varies the speed of the wiper blades with the rate of the rainfall for non-expensive automobiles which ordinary customers can buy. The project consist of simple components; a simple raindrop sensor based on the moisture only it shows the resistance, L293D motor driver IC with 12V motor, pic16F877A micro-controller and regulators. Furthermore, project's future development is to set it up using a standard wiper motor with a control system and low budget. By adopting this technique we can achieve the high safety of driver as well as passengers.

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3.P.Abhilash, G. Sai Prudhvi says "In this project, we use Arduino along with a rain sensor, an LCD 16x2 module, and a servo motor. The moisture is measured via analog output pins which are present in the rain sensor, the wiper starts rotating when a threshold of moisture is exceeded. The module used here is completely based om LM393 op-amp. The information sensed by the rain sensor is sent to Arduino. The information about the intensity of the rainfall and speed of the wiper is informed to the driver by means of a 4-bit LCD module which is kept near the driver's seat.

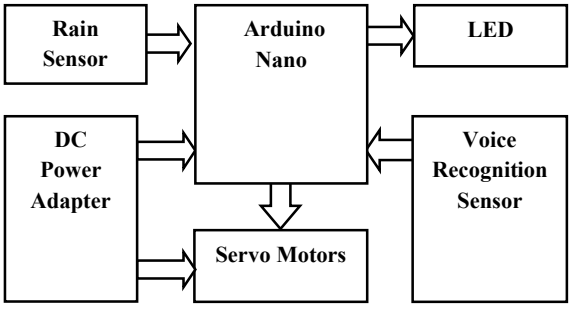
III. PROBLEM STATMENT

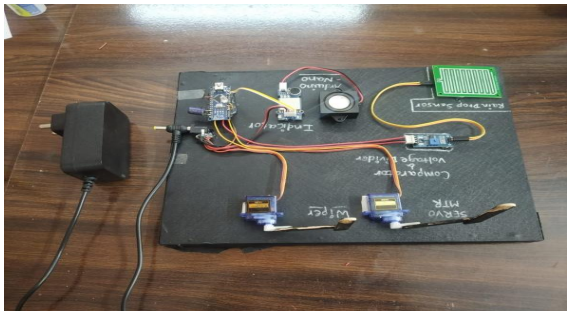
Manual windshield wipers require constant attention and adjustment, distracting the driver and increasing the risk of accidents, particularly during sudden or heavy rainfall. Current automated solution are costly and not universally available.

IV. METHODOLOGY

1. Identify components: Arduino Nano, rain sensor, servo motors, voice command module, LED, and power adapter.
2. Design and implement a circuit connecting components to Arduino Nano.
3. Program the Arduino Nano for rain detection, servo motor control, and voice command processing.
4. Integrate a red LED for operational feedback and Test the system for real- world scenarios and optical performance.

V. SYSTEM ARCHITECTURE





The block diagram represents the integration of the system's hardware and software components. The rain sensor detect water presence on the windshield and sends a signal to the Arduino Nano. Upon receiving this signal, the Arduino activates two SG90 servo motors that rotate the wiper within a 0-180 degree range. A voice command module interfaces with Arduino via a serial port, allowing users to control the system manually. The Arduino also powers a red LED indicator that illuminates during wiper operation. All components draw power from a 5V 2A adapter, ensuring stable performance.

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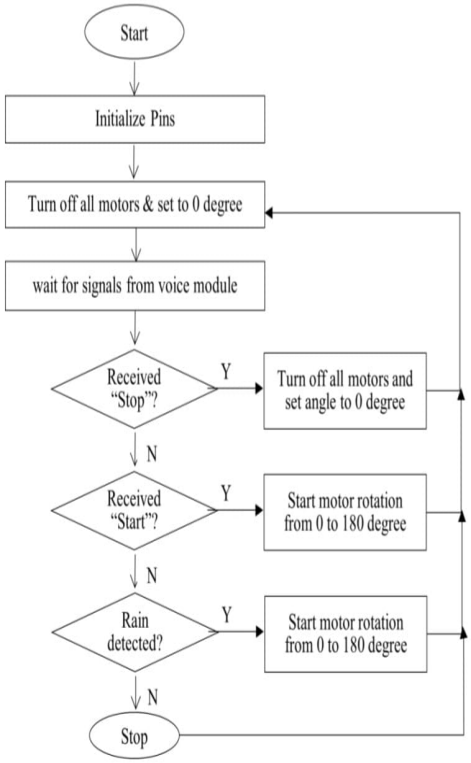
VI. FLOWCHART



VII. OBJECTIVE

1. Develop a rain-detection mechanism using a rain sensor.
2. Automate the wiper movement eith SG90 servo motors.
3. Incorporate offline voice command recognition for manual override.
4. Ensure the system is energy-efficient and compatible with standard vehicles. Provide real-time operational feedback via LED indicators.

VIII. RESULT

The developed system successfully automates windshield cleaning during rain while providing the option for manual control through voice commands. The SG90 servo motors perform reliable wiping action, and the red LED ensures clear feedback for the user. Testing indicates the system's efficiency in detecting rain and responding promptly, making it a practical solution for vehicles.

1. Automatic rain detection and wiper activation.
2. Effective voice command recognition for manual operation.
3. Clear indication of system status via LED.

IX. CONCLUSION

The automatic wiper system is a cost-effective and practical solution to enhance drive safety and convenience. By integrating rain sensors, servo motors, and voice control, the project demonstrates a significant step toward smarter automotive systems. The system's efficient design ensures its adaptability across various vehicle types, marking its potential for widespread application.

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