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# Automatic rain sensing car wiper design

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**Abstract**

In these modern times, the world is shifting towards automation whether it is automobile industry or some other. In this paper we propose automation for car wiper control. Apart from some high-end luxury vehicles all other uses manual schemes for wiper control during rainfall, which can be deadly for drivers and passengers as well as it requires proper attention to increase or decrease the wiping frequency according to rain intensity. This increases the risk of accidents; therefore, automatic rain sensing wiper system becomes a more appealing feature. Although such systems are available in market, but they are not popular due to their high cost and other limitations. The objective of this paper is to provide a cost-effective system for automatic rain sensing wiper control. This system employs a rain sensing module which senses the rain and sends an analog signal to Arduino nano which analyzes the signal and energizes the servomotor which performs the wiping operation. By implementing this automation in automobiles, we can increase the driver and passengers' safety by a great margin.

***Subject Classification:*** *Primary 93-XX, Secondary 49-XX.*

***Keywords:*** *Rain sensor, Car wiper, EV, Driver assistance system.*

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## 1. Introduction

According to the World Health Organization, road accidents account for over 1.3 million deaths annually worldwide. It is estimated that a significant portion of these accidents are related to rain and wet road conditions. In India, according to the Ministry of Road Transport and Highways, over 4000 people die annually due to road accidents caused by heavy rainfall. Rain-sensing automatic car wipers are a useful and innovative technology that has become a standard feature on many modern vehicles specially in electric vehicles (EVs) [1]. These wipers use sensors to detect rain or other precipitation on the windshield and automatically adjust the speed of the wipers pretty similar to wind energy conversion systems[2].

In the 1950s, the first electric motor-based windshield wipers were introduced. However, these wipers were still manually operated and required the driver to adjust the speed of the wipers based on the intensity of the rain.

It wasn't until the 1970s the rain-sensing automatic car wipers were first introduced. These wipers used an infrared sensor to detect the presence of the rain on the windshield and automatically adjust the speed of the wipers accordingly. The first car to feature this technology was the Cadillac Fleetwood. In 1996, the Cadillac STS, Eldorado, and DeVille featured Rain sense, the first system that could see rain and activate without driver input.

In present day world Rain-sensing automatic car wipers are a feature on modern and luxury vehicles along with accident prone system. These systems typically use optical or infrared sensors to detect rain or other precipitation on the wind shield and adjust speed of the wipers accordingly with the help of driver assistance system [1],[3].

Overall Rain-sensing wipers are considered a useful and convenient technology that improves the safety and driving comfort in wet weather conditions.

## 2. History of Technological Development

- In this Paper, the development of an early prototype of an automatic rain-sensing car wiper system based on optical sensors to detect raindrops on the windshield and triggers the wipers [4].
- This Paper introduces a capacitive rain sensor designed specifically for automobile applications. [5].

- The authors proposed a rile-based algorithm for automatic car wiper control based on the rain intensity measured by the rain sensor. [6].
- Zhiqiiang Fu et al presents a real-time raindrop detection method using image processing techniques. [7].
- Authors explore machine learning algorithms to improve rain detection in car wiper systems. [8].
- The authors employ convolutional neural networks (CNNs) to detect raindrops on car windshields from video footage. Additionally, the paper explores techniques to remove raindrop artifacts from videos captured by in-car cameras [9].
- This paper proposed a system that integrates raindrop detection with obstacle detection to optimize automatic wiper control [10].
- Authors present an adaptive rain sensing system that takes into account the vehicle's speed. By considering the vehicle's velocity [11].
- This paper explores the feasibility of using ultrasonic sensors for raindrop detection in car wiper systems. [12].
- This paper investigates the application of deep learning modules for rain detection and automatic car wiper control. [13].

## 3. The Schematic Module

In Figure 1 the first block is the power supply having a 12V centre tapped transformer which stepdown the voltage from 220V to 12V where the 12V passes through a bridge rectifier from diode 1N4007 which rectifies the 12V ac to 12V pulsating dc which then passes through a 1000uf

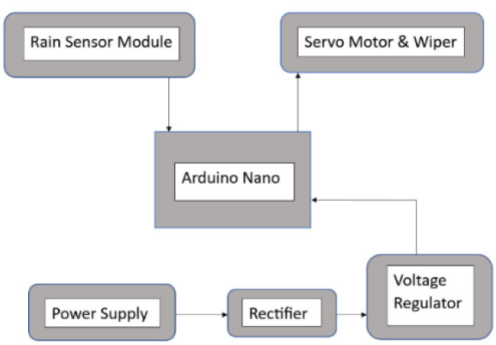



**Figure 1**

**Block Diagram for Automatic Rain Sensing Wiper Control System**

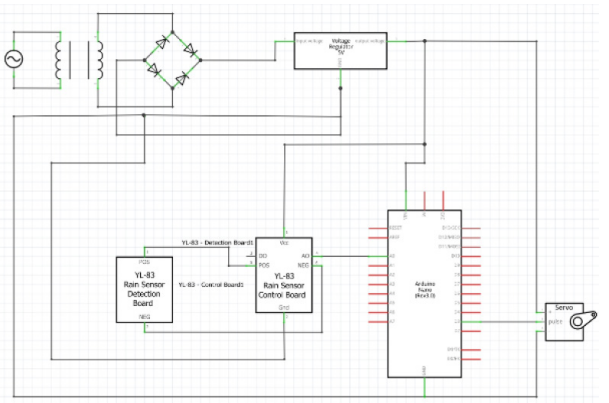



**Figure 2**

**Schematics for Automatic Rain Sensing Wiper Control System**

Capacitor which filter out pulsating ac to nearly a smooth 12V dc which we further stepdown to 5V on which our Arduino will operate. The Rain sensor is connected to one of the analog pin 0 of Arduino and Servo motor is connected to digital pin 3, shown in Figure 2.

Here, a Rain sensor module, Arduino-nano, servomotor are used for controlling the wiper system. As soon as rain starts to pour down the sensing module detects it and generates a PPM signal and send it to the Arduino nano. The Arduino process this signal and send it to servomotor which in response starts the wipers. The rain sensor is positioned on the car's windshield. It detects the presence of rain or moisture on the windshield surface. When rain starts the rain sensor detects the rain on windshield of the car and generates an analog signal ranging from 0 to 1023 i.e., 1023 means no rain and 0 corresponds to heavy rainfall. Then the rain sensor module sends this analog signal to one of the analog input pins of the Arduino nano, which acts as the central processing unit of the system. Based on the rain intensity the Arduino activates and control the wiper motor speed accordingly. The system continuously monitors the rain sensor's output and adjusts the wiper motor control in the real-time.

## 4. Simulation and Inferences

The Figure 3 is designed and simulated on Proteus Software alongwith a prototype was also designed using hardware component.

The Figure 4 shows the control signals generated by Arduino to control the wiping frequency of the wiper. The duty cycle of this signal is

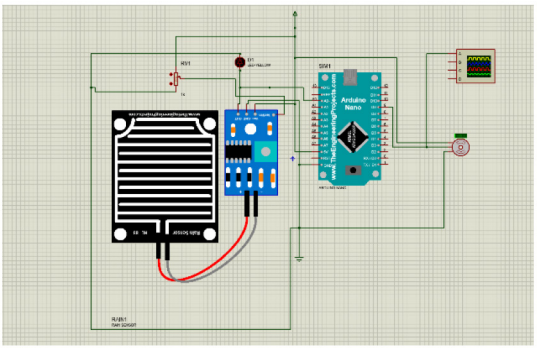


**Figure 3**

**Circuit implementation on Proteus software**

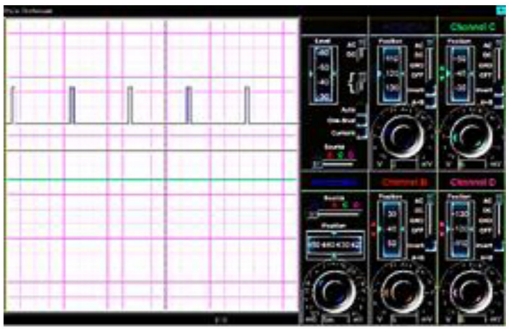


**Figure 4**

**Control Signal generated by Arduino**

5% (1ms) and the whole signal is 20ms. The Arduino generates 5%, 7.5% and 10% duty cycle which corresponds to position of servo motor 0°, 90° and 180° respectively. The movement of servo take place from 0° to 90° and 90° to 0°.

## 5. Conclusion

The Automatic Rain Sensing Car Wiper system was developed and its primary motive which was to make the wiper system automatic and to provide a greater level of comfort and security to driver was achieved. The proposed system is economical, and its cost can be further reduced by mass production of these system. We encountered some challenges with Rain sensor that we are currently using with as it is not thin in size so that it is directly placed on the windshield and the range of analog value sensor

sends is very small which makes it difficult to work with system. In future, improvement of rain sensor and integration of other sensors like Infrared and optical sensors for detection of rain improved. Implementation of Artificial Intelligence powered by machine learning for rainfall prediction provides a big hand in Rain sensing technology.

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