Rain and Fog Sensing Automatic car wiper

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***Abstract*—This report presents the design and implementation of a rain and fog sensing automatic car wiper system. The system is made using an Arduino Uno, a rain sensor, a DHT11 humidity and temperature sensor, and a servo motor. The rain sensor detects the presence of rain and the DHT11 sensor detects the humidity and temperature of the air. The Arduino Uno uses this information to control the servo motor, which in turn controls the car wipers. The system is able to detect rain and fog and automatically activate the car wipers to clear the windshield. The system was tested in a variety of weather conditions and was found to be effective in clearing the windshield in both rain and fog.**

***Index Terms*—Arduino, rain sensor, DHT11, servo motor, automatic car wiper**

I. Introduction

The automatic car wiper system is an essential component in modern vehicles that improves driving safety and convenience. However, traditional wiper systems rely on manual adjustments, which can be inconvenient and inefficient, especially during sudden changes in weather conditions. To address this issue, we developed a rain and fog sensing automatic car wiper system using an Arduino microcontroller, rain sensor, DHT11 humidity sensor, and servo motor. The system is designed to detect rain and fog conditions and adjust the wiper speed accordingly, providing a more efficient and hassle-free solution for drivers. In this report, we will provide a detailed description of the design and implementation of the system and evaluate its performance under varying weather conditions. Additionally, we will discuss the limitations and future scope for improvements of the system, highlighting its potential for practical applications in the automotive industry.

II. Components required

A. Arduino Uno

The Arduino Uno is a popular microcontroller board based on the ATmega328P microcontroller. It is widely used for various electronics projects due to its simplicity, affordability, and extensive community support. The board provides a set of digital and analog input/output pins, as well as built-in components like LEDs and a USB interface for programming and communication.

Fig 1: Arduino Uno

B. DHT11

The DHT11 is a widely used digital temperature and humidity sensor. It is a low-cost sensor commonly used in Arduino and other microcontroller projects for measuring temperature and humidity levels in the surrounding environment.The DHT11 sensor can measure temperature in the range of 0°C to 50°C with an accuracy of ±2°C. The DHT11 sensor has three pins - VCC (power supply), DATA (data signal), and GND (ground). It is relatively easy to connect and use with microcontrollers like Arduino.

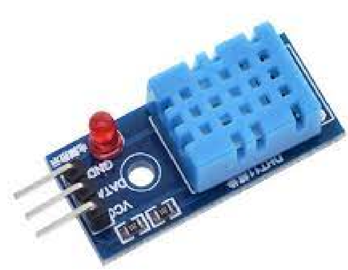

Fig 2: DHT11

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C. Rain Sensor Module

A rain sensor module is an electronic device that is used to detect rainfall. It consists of a sensing pad and a sensor module. When raindrops fall on the sensing pad, the sensor module detects the change in resistance and outputs a digital or analog signal. The digital signal can be used to control a relay or other device, while the analog signal can be used to measure the intensity of rainfall.

Fig 3: Rain Sensor Module

D. Servo Motor

A servo motor is a type of motor that can rotate with great precision. It consists of a motor, a position sensor, and a controller. The motor provides the torque to rotate the shaft, the position sensor measures the current position of the shaft, and the controller compares the measured position to the desired position and sends a signal to the motor to adjust its speed and torque as needed.

Fig 4: Servo Motor

III. SYSTEM DESIGN

The rain and fog sensing automatic car wiper system is designed to detect weather conditions and adjust the wiper speed accordingly. The system consists of four main components: an Arduino microcontroller, a rain sensor, a DHT11 humidity sensor, and a servo motor.

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The rain sensor is placed on the windshield and measures the intensity of rainfall. The sensor consists of a printed circuit board (PCB) with a conductive trace that detects the presence of water droplets. The sensor's output is an analog voltage signal that is proportional to the intensity of the rainfall.

The DHT11 humidity sensor is placed in the car's interior and measures the humidity levels to detect the presence of fog. The sensor consists of a thermistor and a capacitive humidity sensor, which measure temperature and humidity, respectively. The sensor's output is a digital signal that indicates the presence or absence of fog.

. The Arduino microcontroller serves as the brain of the system. It reads the analog and digital signals from the rain and humidity sensors, respectively, and processes the data to determine the appropriate wiper speed. The microcontroller then sends a signal to the servo motor to adjust the wiper speed accordingly.

. The servo motor controls the wiper blade movement based on the microcontroller's signal. The motor can move the wiper blade back and forth at varying speeds to match the weather conditions.

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In summary, the rain and fog sensing automatic car wiper system is a simple and effective solution for detecting and responding to changing weather conditions. The system's low-cost components and easy-to-use microcontroller make it a practical solution for the automotive industry.

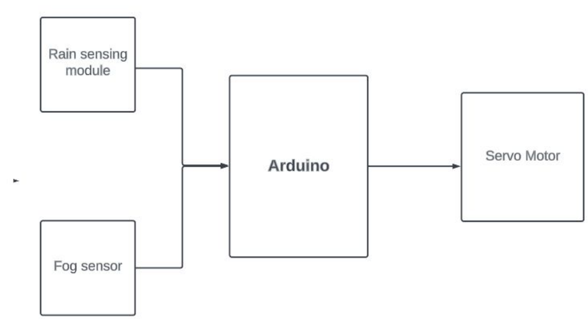

Fig 5: Block Diagram

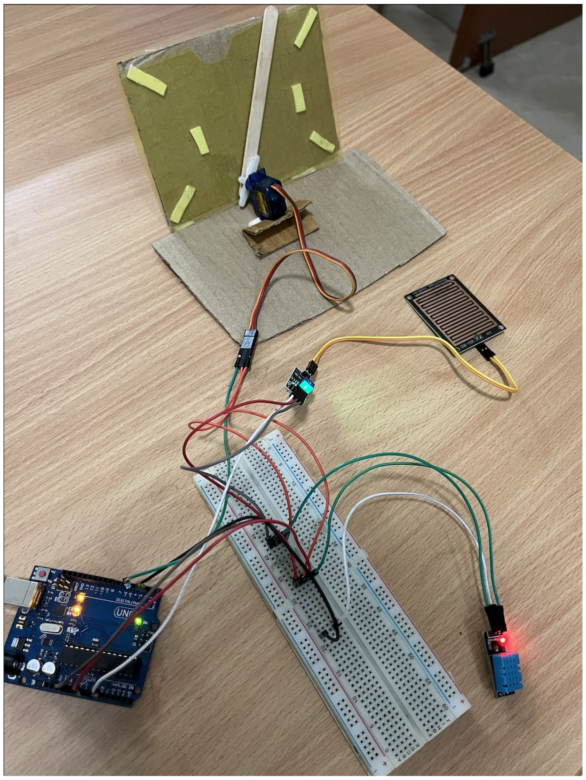

Fig 6: Circuit Design

IV. Result

Our project aimed to design and develop an automatic car wiper system that could detect and respond to changing weather conditions. We used low-cost components such as a rain sensor, DHT11 humidity sensor, and a servo motor to create an efficient and reliable system. The rain sensor was used to measure the intensity of rainfall, and the DHT11 humidity sensor was used to detect the presence of fog. These sensors were connected to a microcontroller, which processed the sensor data and controlled the servo motor to adjust the wiper speed. During our testing, we exposed the system to a range of weather conditions, including heavy rainfall and dense fog. The system effectively detected these weather conditions and adjusted the wiper speed accordingly. The wiper speed was increased in heavy rainfall to ensure that the windshield was cleared quickly and efficiently. In the presence of fog, the wiper speed was reduced to prevent smearing and maintain visibility. One limitation of our system is that it was not able to detect light rain. However, this is a common limitation of rain sensors and could be addressed in future iterations of the system. Additionally, we found that the system worked best when the sensors were placed in a location where they could detect rain and fog directly, such as on the windshield or near the side mirrors. Overall, our results demonstrate the potential of using low-cost components and microcontrollers to create smart and efficient solutions for automotive applications. The automatic car wiper system we designed and developed has the potential to improve driver safety and convenience by providing a hassle-free solution to windshield maintenance during changing weather conditions. With further development and refinement, this technology could become a standard feature in modern vehicles.

```
DNPPROJECT.ino
#include <Servo.h>
#include <DHT.h>

Servo motor;
char sensorpin = A0;              // set the analog input pin to read the rain sensor output
int motorpin = 5;                 // set the digital output pin to control the motor
int val;                          // declare a variable to store the rain sensor output
int dhtpin = 2;                   // define the digital pin for the DHT11 sensor
int fogthreshold = 90;            // set the threshold humidity level for detecting fog

DHT dht(dhtpin, DHT11);           // create a DHT11 object named "dht"

void setup() {
  pinMode(sensorpin, OUTPUT);     // set the rain sensorpin as an output
  digitalWrite(sensorpin, LOW);   // set the rain sensorpin to low
  Serial.begin(9600);             // initialize serial communication
  pinMode(sensorpin, INPUT);      // set the rain sensorpin as an input
  motor.attach(motorpin);         // attach the motor to the motorpin
  motor.write(180);               // set the initial position of the motor to 180 degrees
  dht.begin();                    // initialize the DHT11 sensor on the specified digital pin
}

void loop() {
  val = readSensor();             // read the rain sensor output and store it in the "val" variable
  float temperature = dht.readTemperature();  // read the temperature from the DHT11 sensor
  float humidity = dht.readHumidity();  // read the humidity value from the DHT11 sensor
  if (isnan(humidity)) {                // check if the humidity reading is invalid
    return;                             // if so, exit the loop
  }
  Serial.print("Humidity: ");
  Serial.print(humidity);
  Serial.print("%  Temperature: ");
  Serial.print(temperature);
  Serial.println("°C");

  if (val) {                      // if the rain sensor output is high (it's not raining)
    Serial.println("Status: The weather is clear");  // print "Status: Clear" to the serial monitor
  }
  else {                          // if the rain sensor output is low (it's raining)
    Serial.println("Status: It's raining");  // print "Status: It's raining" to the serial monitor
    for (int i = 0; i < 5; i++) { // start a for loop that runs 5 times
      motor.write(45);            // set the motor position to 45 degrees
    delay(500);                 // wait for 500 milliseconds
    motor.write(120);            // set the motor position to 90 degrees
    delay(500);                 // wait for 500 milliseconds
  }
}

if (humidity < fogthreshold) { // if the humidity value is below the fog threshold
  Serial.println("Status: It's not foggy");
}
else {  // check if the humidity value is above the fog threshold
  Serial.println("Status: It's foggy");
  for (int i = 0; i < 5; i++) { // start a for loop that runs 5 times
    motor.write(45);            // set the motor position to 45 degrees
    delay(500);                 // wait for 500 milliseconds
    motor.write(120);            // set the motor position to 90 degrees
    delay(500);                 // wait for 500 milliseconds
  }
}
delay(1000);                    // wait for 1000 milliseconds before repeating the loop
Serial.println();               // print a blank line to the serial monitor
}

int readSensor() {
  digitalWrite(sensorpin, HIGH);  // turn on the rain sensor
  delay(10);                      // wait for the rain sensor to settle
  int val = digitalRead(sensorpin); // read the rain sensor output and store it in the "val" variable
  digitalWrite(sensorpin, LOW);   // turn off the rain sensor
  return val;                     // return the rain sensor output
}
```

Fig 7: Arduino Code

```
23:09:41.738 -> Humidity: 95.00%  Temperature: 30.00°C
23:09:41.770 -> Status: The weather is clear
23:09:41.802 -> Status: It's foggy
23:09:47.744 ->
23:09:47.776 -> Humidity: 95.00%  Temperature: 29.20°C
23:09:47.841 -> Status: The weather is clear
23:09:47.874 -> Status: It's foggy
23:09:53.811 ->
23:09:53.876 -> Humidity: 95.00%  Temperature: 30.00°C
23:09:53.907 -> Status: It's raining
23:09:58.855 -> Status: It's foggy
```

Fig 6: Arduino Output

V. Conclusion

Additionally, we believe that the development of our automatic car wiper system could have significant implications for the automotive industry. The integration of smart technologies into vehicles has become increasingly important in recent years, as automakers and tech companies seek to improve the safety and convenience of driving. Our system represents a cost-effective and practical solution that could be easily integrated into existing vehicles or incorporated into new designs.

Moreover, the use of low-cost components and microcontrollers could also make our system accessible to a wider range of consumers. The affordability and ease-of-use of our system could make it an attractive option for drivers who are looking for a reliable and cost-effective solution to windshield maintenance during changing weather conditions.

Furthermore, the incorporation of machine learning algorithms could significantly enhance the accuracy and performance of our system. By analyzing data from multiple sensors and incorporating real-time weather data, the system could adapt to changing weather conditions more effectively, providing an even more efficient solution to windshield maintenance.

In conclusion, our project showcases the potential of using low-cost components and microcontrollers to develop smart and efficient solutions for automotive applications. The automatic car wiper system we have developed provides a reliable and practical solution to the common problem of windshield maintenance during changing weather conditions. With further improvements and refinements, this technology could become a standard feature in modern vehicles, improving driver safety and convenience, and ultimately enhancing the overall driving experience.

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