Rain and Dust Sensor Operated Wiper Using Arduino

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Abstract—Day-by-day automobile industry was revolutionised creating new features in the automobile. From past to now, new techniques are implementing on all parts of automobile. Coming to a windshield wiping system, so much of creativeness and implementing new operations to reduce human power. Automatic wiping system are already exists but the method of implementing is changed. During rainy seasons, according to amount of rainfall the automatic wiper wipes the windshield. Even in dusty regions, dust was covered on windshield; visibility is less to avoid this dust sensor is used. By implementing this, can improve driver’s safety and reduce human effort.

In this project automatic rain and dust operated wiper is fabricated by using Rain drop sensor and light dependent resistor (ldr). This comes under full automatic wiper mechanism. While driving on the dusty regions, the windshield covered by dust and less in visibility, it requires a system which detects dust and cleaning of windshield. To achieve the object it is required to develop automatic dust detector and windshield cleaner. In this project an attempt has been made to develop automatic rain and dust sensor to operate wiper using arduino, which measures precipitation and level of dust on windsceen also wipes the windshield.

Keywords—Arduino Uno, LDR Sensor, Rain Sensor

I. INTRODUCTION

Rapidly the automobile sector gradually growing throughout the world. In present generation, due to traffic and roads the drivers cannot focus on controlling several independent controlling systems. In rainy seasons, in order to control the wipers drivers need to pay more attention to turning on the wipers and to maintain the speed of the wipers. Due to this, drivers getting distracted by focusing on roads. In dusty regions, driving visibility is less and driver pays more attention, due to this driver cannot control the remaining control systems. In such case, the automatic wiper cleans the windshield from dust and rain and provides better driving experience.

II. HARDWARE DESCRIPTION

The system hardware consists of following equipment’s are Arduino Uno Board, Raindrop sensor, Dust sensor.

A. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 has shown in Fig 3.8. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter shown in Fig 1.

B. Rain Sensor

FIG 2. Raindrop Sensor
The rain sensor module is an easy tool for rain detection shown in Fig 2. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity through a potentiometer.

The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DC output is high. When dropping a little amount water, DC output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

C. Dust Sensor

A photo resistor (or) light-dependent resistor) LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits is shown in Fig 3.

A photo resistor is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high as several megohms (MΩ), while in the light; a photo resistor can have a resistance as low as a few hundred ohms. If incident light on a photo resistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their whole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photo resistor can substantially differ among dissimilar devices. Moreover, unique photo resistors may react substantially differently to photons within certain wavelength bands.

D. Led

A Light-emitting diode (LED) is a two-lead semiconductor light source has in Fig 4.

It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light

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The ldr sensor works on the principle of when dust detected, the resistance will increase and sends signal to microcontroller then relay activate the nozzle jet spray, the wiper motor will drive to clean the windscreen. The working of a block diagram shown in Fig 5.

IV. SPEED VARIATION OF WIPER

When the rain and dust begins to fall, the rain sensor and dust sensor is being activated according to the block diagram.

The speed of the wiper operation given in wiper motor datasheet in table 1.

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>Voltage</th>
<th>12VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motor Torque</td>
<td>3 Nm Max.</td>
</tr>
<tr>
<td>2</td>
<td>With No Load RPM</td>
<td>50 RPM Max</td>
</tr>
<tr>
<td>3</td>
<td>Speed</td>
<td>Single</td>
</tr>
<tr>
<td>4</td>
<td>Sweep Angle</td>
<td>70 Degree Max</td>
</tr>
<tr>
<td>5</td>
<td>Magnet type</td>
<td>Permanent</td>
</tr>
</tbody>
</table>

When more rainfalls on the raindrop sensor, battery supply 12V power to wiper motor. Then the speed of the motor with load is 48 RPM.

When less rainfalls on the raindrop sensor, battery supply 8V power to wiper motor. Then the speed of the motor with load is 26 RPM.

When dust falls inside the dust sensor, battery supply 12V power to wiper motor. Then the speed of the motor with load is 48 RPM.

V. WORKING PROCEDURE

A. Setup

Initially all the electronic devices used such as arduino, rain sensor, dust sensor, wiper motor, mini vacuum pump, mini submersible pump is biased for proper functioning of the model. The rain sensor is connected to Analog (A2) pin. From rain sensor, power (Vcc) is connected to input of 5V microcontroller. The negative connection (-ve) is connected to ground (GND) of microcontroller. From microcontroller, output digital pin 5 connected to input 2 to relay.

From microcontroller, output digital pin 8 connected to input 4 to relay. The relay output 2 is connected to wiper motor by 12V battery. The relay output 4 is connected to wiper motor by 8V battery.

FIG 6. Connections Setup

The dust sensor is connected to Analog (A1) pin. From dust sensor, power (Vcc) is connected to input of 5V microcontroller. The negative connection (-ve) is connected to ground (GND) of microcontroller. From microcontroller, output digital pin 6 connected to input 1 to relay. From microcontroller, output digital pin 7 connected to input 3 to relay. From microcontroller, output digital pin 8 connected to input 4 to relay. The relay output 1 is connected to submersible motor by 12V battery. The relay output 3 is connected to vacuum pump by 12V battery. The setup is shown in FIG 6.

B. Working

When rain sensor senses the water, analog sensor sends signal to microcontroller, the microcontroller converts analog to digital readings and send signal to relay to activate the wiper motor. The relay will supply power from battery to wiper motor. When dust is detected, the microcontroller converts analog to digital readings and sends signal to relay to activate the submersible jet motor. The vacuum pump will be activating after the submersible jet motor. The relay will supply power from battery to wiper motor and vacuum pump. This process will activate when dust is detected. The circuit diagram shown in FIG 7.
VI. TESTING AND RESULTS

The rain sensor is a conductivity material of two strips very close to each other, without touching. When the surface of the conductive layer exposed to the water, closes the circuit between strips and different voltage can be measured. When the plates are dry, the resistance between two plates is very high. When water is between plates, current can flow between plates and decrease the resistance.

When no rainfall detected, the Analog to Digital converted values will high up to 1023 shown in Fig 8.

When rainfall is moderate, the Analog to Digital converted values will drop from 1023 to below 500 has shown in Fig 9.

When rainfall is high, the Analog to Digital converted values will drop below 250 has shown in Fig 10.
When no dust is detected, the light intensity will be high and its resistance will decrease; the Analog to Digital converted values less than 100 is shown in Fig 11.

![Light intensity diagram](image1)

**FIG 11. No Dust Detected**

When dust is detected, the light intensity will be low and its resistance will increase; the Analog to Digital converted values greater than 100 is shown in Fig 12.

![Light intensity diagram](image2)

**FIG 12. Dust Detected**

VII. CONCLUSIONS

Fabricated Automatic rain and dust operated wiper works well with both rain and dust sensors. This system reduces manual cleaning of windscreen and improved the driver’s level of comfort to an extent. The project presented is quite efficient system, not giving any type of false data and it is cost effective. Comparing with optical sensors, the fabricated automatic rain and dust operated wiper covers all the design specifications together with the requirements of common man. Reason for not using optical sensor is due to higher cost. The wipers can clean the windshield automatically by detecting dust with the help of light dependent resistor. The basic maneuvering is done only to make it cost effective and reliable.

VIII. FUTURE SCOPE

Using more appropriate rain sensor can make more precise automatic wiper system. The system can also be used as a component of home automation system as too it can detect a sudden rain and dust on glass and can shut off windows automatically. By combining two sensors, there may be chance to create dual sensors with more precise quality and cost effective to operates dust and rain.

REFERENCES


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