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Automatic mist wiper

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ABSTRACT

This paper is based on windscreen wiper, which is a device used to wipe rain and humidity dirt from a windscreen. Almost all motor vehicles, including trains, aircraft and watercraft, are equipped with windscreen wipers, which are also generally a legal requirement. The first windshield wipers are operated manually by moving a lever inside the car front glass. Today, most of us take our electric windshield wipers for granted. The wipers faithfully keep the window clear, moving back and forth across the windshield countless times as they sweep the water away and inside car humidity clear. On their highest speed, they move impressively fast. In this paper, it dealt with current scenario's wiper problems caused due to dust and heat during summer which is to be rectified at the most of the possibility. The test should be carried out for mist conditions for the defogging purpose. In order to reduce concentration on wiper for driver, we implemented automatic technique and also internal wiper system.

Index Terms: Automatic, Mist, Wiper, Wiper system, Defogger.

INTRODUCTION

A wiper generally consists of an arm, pivoting at one end and with a long rubber blade attached to the other. The blade is swung back and forth over the glass, pushing water from its surface. The speed is normally adjustable, with several continuous speeds and often one or more "intermittent" settings. Most automobiles use two synchronized radial type arms, while many commercial vehicles use one or more pantograph arms. Mercedes-Benz pioneered a system called the monoblade in which a single wiper extends outward to get closer to the top corners, and pulls in at the ends and middle of the stroke, sweeping out a somewhat 'W'-shaped path.

Some larger cars are equipped with "hidden" (or "depressed-park") wipers. When wipers are switched off, a "parking" mechanism or circuit moves the wipers to the lower extreme of the wiped area, near the bottom of the windscreen, but still in sight. To hide the wipers, the windscreen extends below the rear edge of the hood, and the wipers park themselves below the wiping range at the bottom of the windscreen, but out of sight.

Wipers may be powered by a variety of means, although most in existence today are powered by an electric motor through a series of mechanical components, typically two 4-bar linkages in series or parallel. Vehicles with air operated brakes sometimes use air operated wipers, run by bleeding a small amount of air pressure from the brake system to a small air operated motor mounted just above the windscreen. These wipers are activated by opening a valve which allows pressurized air to enter the motor.

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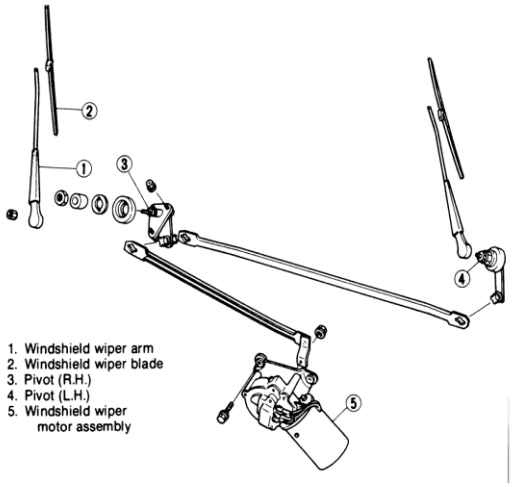

Fig.1 Wiper system

So in conventional wiper system (Fig.1), when the rain falls the driver has to sense it and switch on the button that actuates the wiper. In this paper, sensors are installed to detect the rainfall and actuate the wiper automatically. For the working of the automatic wipers, the sensing of rain intensity must be provided. There are different kinds of rain sensing methods. Some of them are as discussed below [1-10].

Conductive Method

This method uses a sensor, which consists of two sets of contacts separated by an insulator. When water falls on the sensor, the water conducts the signal and closes the circuit. Then it sends the signals to the next unit to operate the wiper motor. This system has some fundamental problems, the sensors used here are prone to oxidization and become unusable. Also the dirt can foul the sensors. So it is very difficult to design such sensors [18].

Capacitive Method

Capacitive method utilizes capacitive proximity detection techniques. They are reasonably successful, but can be susceptible to stray electrical fields. The electronic component used in this case is highly expensive due to the incorporation of tuning components.

Piezo Electric Method

This method uses a piezo crystal element. While Rain falls on the windscreen generates the sound waves at a certain frequency. These waves are transmitted through and across the windscreen. This crystal responds only to the sound wavesdue to rain. Again this system is susceptible to false triggering [11-17].

Optical Method

Optical sensors utilize light and the principle of total internal refraction within the windshield. The optical sensor consists of a light source, a light detector and an optical assembly. The optical assembly consists of two lenses and a light guide.

A beam of light is directed through the optical assembly to the windshields, the light is trapped within the glass due to total internal refraction. The light reflects from the outside surface of the glass back to the inside surface of the windshield glass until it is picked up by the second optical assembly.

If rain falls on the windshield within the sensing area, light is directed by the water droplet in the other direction opposite to the optical assembly. So the optical sensors are reliable and effective detectors of rain. By using the suitable rain sensing method, it is possible to develop the automatic wipers [19].

LITERATURE REVIEW

S Senthil Kumar, K Ganesh, N Ganesh Kumar, J Gautam The aim is to design and develop a control system based an electronically led automotive rain operated motor is called automatic

rain operated wiper. The windshield washer system (Fig.2) helps to remove dirt or dust from the windshield when it is used in concert with the wiper blades. When antifreeze windshield washer fluid is used, it can help the wipers to remove snow or ice. For winter conditions, some vehicles have additional heaters aimed at the windows or embedded heating wire in the glass. These defroster systems help to keep snow and ice from building up on the windshield. In rare cases, miniature wipers are installed on headlights.

The working of automatic wipers and internal wiper to wipe the mist formed inside the vehicles is based on the concept, which makes use of a combination of the wiper motor. The inside wiper used to control the formation of the mist in the rainy seasons the inner wiper motor to actuate the parallel action and control the mist and fog [20].

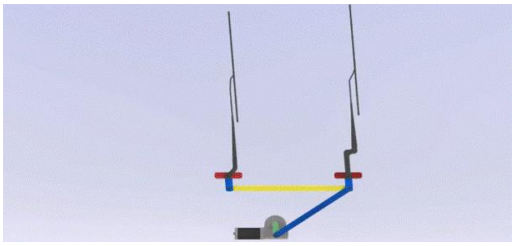

Fig.2 Setup of car wiper

Sonali B. Madankar, Dr. Milind M. Khanapurkar The paper explains the basic skeleton for adjust speed of wiper automatically cording to the amount of water on the windshield and in addition with also in advance removal of moisture inside the car while raining. The system activates the wiper to operate in full automatic mode and detect moister using CAN technology.

The problem definition is to design a prototype for a PIC microcontroller (PIC18F2580) based vision system aid in windshield assembly which controls the windshield wiper speed based on the amount of water.The hardware required for actual implementation and the software used for designing and simulating the test results. The speed of the wiper is controlled electronically with the help of the microcontroller.

This wiper system reduces cumbersome wiper operation and improve driver's level comfort. It will give a new dimension of comfort and aid to the drivers who work at night and traffic prone areas where they already have to concentrate on brakes and clutch.

CONCLSUION FROM LITERATURE REVIEW

As per the literature review, we came to know that both were presented on automatic wiper system with slight modification in design. In paper[1], the internal wiper is used to clean the mist and external wiper for wipe the rain. In paper[2], the automatic wiper system with three mode of speed based on the requirement of the driver.

In this paper, it is about implementation of both the concept as a single by programming the speed and sensor range with Arduino coding. In addition to that, the wipers have a projection for air flowing in internal wiper and water flow for external wiper [21].

MATERIALS AND METHODS

Battery

Battery is use for storing the energy produced from the solar power. The battery used is a lead-acid type and has a capacity of 12V; 2.5A. The most inexpensive secondary cell is the lead acid cell and is widely used for commercial purposes. A lead acid cell when ready for use contains two plates immersed in a dilute sulphuric acid (H_2SO_4)

of specific gravity about 1.28. The positive plate (anode) is of Lead –peroxide (PbO_2) which has chocolate brown color and the negative plate (cathode) is lead (Pb) which is of grey color.

Wiper Structure

The arms of the wiper drag a thin rubber strip across the windshield to clear away the water. The wiper structure is drawn in Creo parametric is shown in Fig.3. The design dimensions are shown in Table.1.When the blade is new, the rubber is clean and has no nicks or cracks. It wipes the water away without leaving streaks. When the wiper blades age, nicks or cracks form, road grime builds up on the edge and it doesn't make as tight a seal against the window, so it leaves streaks.

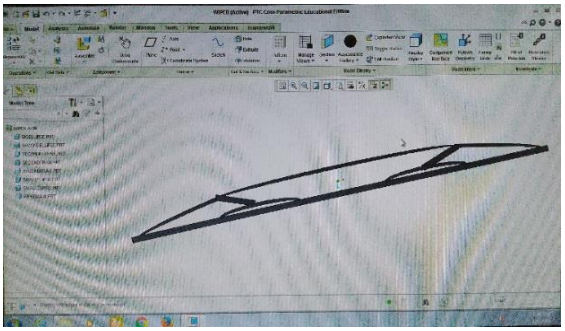

Fig.3 Wiper structure in Creo parametric

Another key to streak-free operation is even pressure over the length of the rubber blades. According to the standard wiper dimensions (Table 3.2), wiper blades are designed to attach in a single point in the middle, but a series of arms branch out from the middle like a tree, so the blade is actually connected in six to eight places.

Table.1 Design dimension of wiper

Parameters	Design dimension
Length	15"
Breadth	1.5"
Width	5"

If ice or snow forms on these arms, it can make the distribution of pressure uneven, causing streaks under part of the blade. Some wiper manufacturers make a special winter blade with a rubber boot covering the arm assembly to keep snow and ice out.

Table.2 Standard dimensions of few car wipers

Model	Wiper Blade Size		
	Driver	Passenger	Rear
Chevrolet camero	24"	21"	-
Chrysler voyager	26"	26"	16"
Ford mustang	22"	20"	-
Honda accord	26"	19"	-
Honda civic	26"	20"	-
Hyundai santa fe	22"	20"	13"
Hyundai sonata	19"	18"	-
Volkswagen passat	20"	20"	-

Sensor

The sensor incorporated in our project detects the rainfall and triggers the wiper motor to activate the wiper. The sensor consists of a pair of copper plates of 1 mm thick, separated by a distance of 1 mm. One of the copper plates is connected to a 5 V battery, while the other copper plate is connected to a micro controller which in turn is connected to the wiper motor.

Rain Detection Sensor

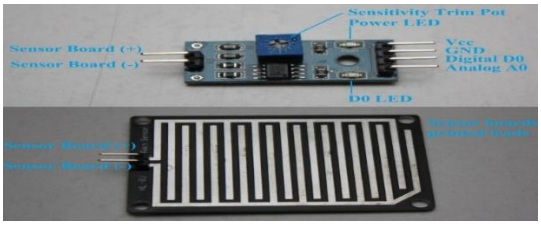

Fig.4 Rain detection sensor

Rain is a form of precipitation which forms when separate drops of water fall to the Earth's surface from clouds. Not all rain reaches the surface, however; some evaporates while falling through dry air. When none of it reaches the ground, it is called virga, a phenomenon often seen in hot, dry desert regions. The scientific explanation of how rain forms and falls is called the Bergeron process.

Rain plays a role in the hydrologic cycle in which moisture from the oceans evaporates, condenses into clouds, precipitates back to earth, and eventually returns to the ocean via streams and rivers to repeat the cycle again. There is also a small amount of water vapor that respires from plants and evaporates to join other water molecules in condensing into clouds.

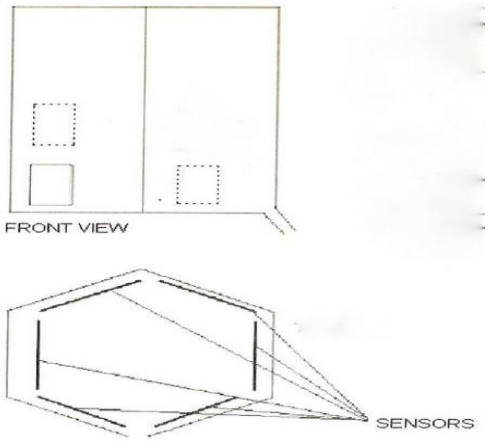

Fig.5 Position of external sensors in the beaker

The amount of rainfall is measured using a rain gauge. It is expressed as the depth of water that collects on a flat surface, and is routinely measured with accuracy up to 0.1 mm or 0.01 in. It is sometimes expressed in liters per square meter (1 liter/m^2 = 1 mm). These are all sensed by rain detection sensor (Fig.4).

This circuit is designed with two lines are tracked with very short distance. Its position is shown in Fig.5. When rain drops falls on this circuit, the track may become short circuit. It gives the corresponding signal to related circuit in order to find the rain fall.

Humidity Sensor

Humidity is the amount of water vapor in an air sample. There are three different ways to measure humidity: absolute humidity, relative humidity, and specific humidity. Relative humidity is the most frequently encountered measurement of humidity because it is regularly used in weather forecasts.These are all sensed by humidity sensor which is shown in Fig.6.

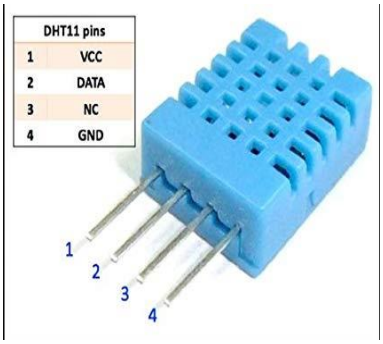

Fig.6 Humidity sensor

It's an important part of weather reports because it indicates the likelihood of precipitation, dew, or fog. Higher relative humidity also makes it feel hotter outside in the summer because it reduces the effectiveness of sweating to cool the body by preventing the evaporation of perspiration from the skin.

This effect is calculated in a heat index table. The sensor position is shown in Fig.7. Warmer air has more thermal energy than cooler air; thus more water molecules can evaporate and stay in the air in a vapor state rather than a liquid state.

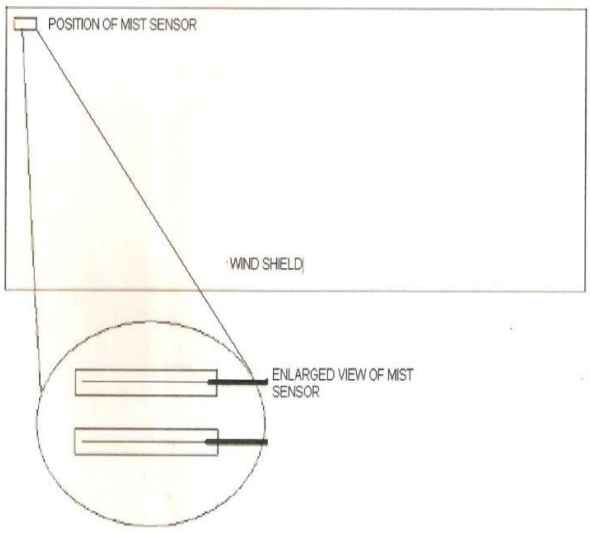

Fig.7 Internal sensor and its position on the windshield

COST ANALYSIS

As in any other problem, in selection of material the cost of material plays an important part and should not be ignored.

Sometimes factors like scrap utilization, appearance and non-maintenance of the designed part are involved in the selection of proper materials. Cost estimation is shown in Table.3.

Table.3 Cost estimation

S. No	Components Name	Cost (in Rs.)
1.	Humidity sensor	250
2.	Rain sensor	170
3.	Arduino controller	650
4.	Relay unit	250
5.	Wiper motor	1200
6.	Display	250
7.	Glass or fiber sheet	500
	TOTAL	**3270**

EXPERIMENTAL PROCEDURE

The wipers combine three technologies to perform their task, sensor on the windscreen to sense the rain, a combination of electric motor and worm gear reduction provides power to the wipers, a neat linkage converts the rotational output of the motor into the back-and-front motion of the wipers, rain sensor and humidity sensor is fixed in the wind screen. This sensor is used to pass the rain fall signal to the electrical circuits. Fig.8 Block diagram of sensor circuit for automatic mist wiper.

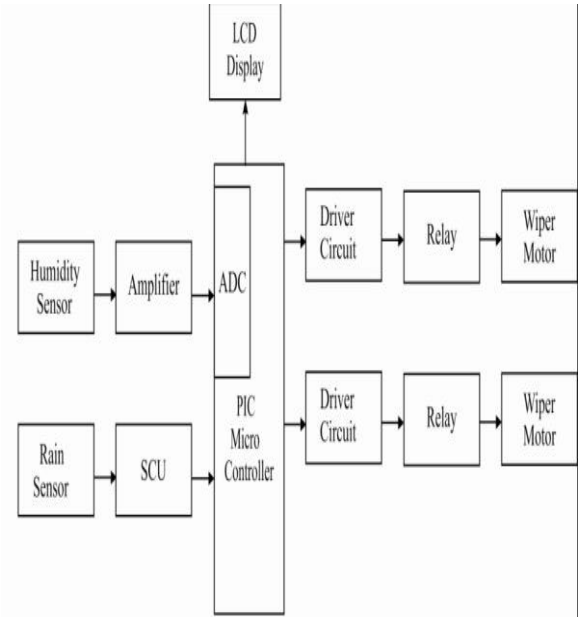

Fig.8 Block diagram of sensor circuit for automatic mist wiper

It takes a lot of force to accelerate the two wiper blades back and front across the windshield so quickly. In order to generate this type of force, a worm gear is used on the output of a small electric motor. The entire design setup is shown in Fig.9.

The worm gear reduction can multiply the torque of the motor by about 50 times, while

slowing the output speed of the electric motor by 50 times as well. The output of the gear reduction operates a linkage that moves the glass wipers back and front. Inside the motor/gear assembly is an electronic circuit that senses when the wipers are in their down position.

The circuit maintains power to the wipers until they are parked at the bottom of the windshield, and then cuts the power to the motor. A short cam is attached to the output shaft of the gear reduction. This cam spins around as the wiper motor runs. The cam is connected to a long rod; as the cam spins, it moves the rod back and front. The long rod is connected to a short rod that actuates the wiper blade on the driver's side. Another long rod transmits the force from the car inside to the passenger-side wiper blade

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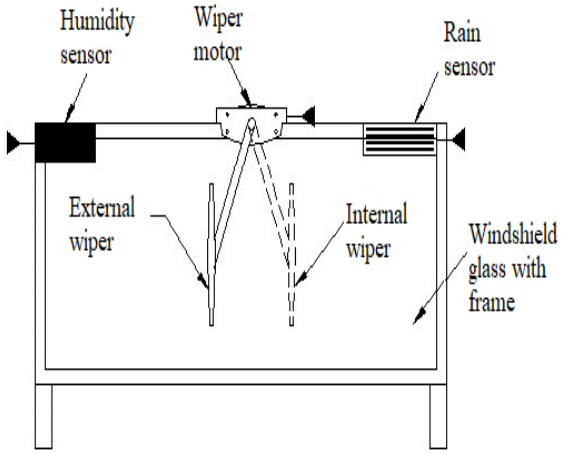

Fig.9 Design of Automatic Mist Wiper

SURVEY FOR WIPER LIFESPAN

Table.4 Survey for wiper lifespan

S.No	Model	Frequency (in years)
1	Mahindra Bolero	3
2	Mahindra XUV 500	4
3	Honda City	4
4	Renault Duster	4
5	Ford Fiesta	5
6	Toyota Fortuner	5
7	Mahindra Xylo	5
8	Toyota Innova	5
9	Honda Accord	6
10	Hyundai Accent	6
11	Skoda Yeti	6
12	Mahindra Scorpio	7
13	Maruthi Ciaz	7
14	Maruthi Alto	8
15	Maruthi Swift	8
16	Maruthi 800	8
17	Maruthi WagonR	10
18	Maruthi Swift dezire	11

19	Maruthi Alto	12
20	Hyundai Santro	13

According to the survey data in Table.4, we can conclude that the problem is came through lagging of proper maintenance for the windshield and wiper. As the wiper system company, they guarantee the wiper for 4 – 5 years. Above the guarantee, it is purely based on the driver's maintenance.

The climate also plays a vital role in damage of wiper blade. In India, there are three climate nature – summer, winter and rainy. The summer exceeds upto six months. Remaining six months are winter and rainy.

In winter and rainy conditions, the wiper operates smoothly and there will be no issue on the performance. Whereas in summer, the heat and dust makes the wiper affected. The wiper blade wore off due to heat and dust accumulation. Hence, proper maintenance should be followed for the better performance.

CONCLUSION

The concept of Automatic Wipers with Mist Control has been implemented successfully. After the experimental setup the wiper motor was tested for all the following conditions drizzling, heavy rain, medium rain. The test has been conducted under mist on the wind shield. The mist has been removed successfully from the wind shield. By the uses of automatic wipers one can drive the commercial vehicles without any distractions to operate the wiper. Use of internal wipers ensures good visibility to the driver, which in turn prevents the accidents. This wiper system efficiently works in summer dust conditions.

- Simple in construction.
- Low cost.
- Easy to maintain.
- Free from wear adjustment.
- It is applicable for all type of four and heavy vehicle.

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