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## **RESEARCH ARTICLE**

#### Design and development of automatic rain operated system using synthesis of mechanism

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#### Manuscript Info

## Abstract

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In this paper, we are going to see the development of any existing technology. In different ages human always tried to develop new methods, new technology for the upgradation of living style. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Degrees of automation are of two types, viz. Full automation. Semi automation. In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

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## Introduction:-

Rain sensitive windscreen wiper is implemented by using a rain sensor. Rain sensor has a device called infrared (IR) light detectors attached to it. A device based on an optical sensor will emit the IR light to the windshield. The IR emitted will be reflected back by the windscreen and the IR detector will detect the amount of the reflected IR. When it's raining, the amount of reflected IR light will decrease because there is a disturbance on the windscreen. The sensor will send this message to the PIC16F84A. The PIC will send the message to the wiper motor and move it. But in our case, we decided to use a motion sensor instead of the expensive rain sensor. The motion sensor also uses IR to detect any movement within its range. In the past, automakers have tried to either eliminate the wipers or to control their speed automatically. Some of the schemes involved detecting the vibrations caused by individual raindrops hitting the windshield, applying special coatings that did not allow drops to form, or even ultrasonically vibrating the windshield to break up the droplets so they don't need to be wiped at all. But these systems were plagued by problems and either never made it to production or was quickly axed because they annoyed more drivers than they pleased. However, a new type of wiper system is starting to appear. The system works by using optical sensors to detect the amount of water on the windshield and controlling the wipers. The sensor is mounted in contact with the inside of the windshield, near the rear mirror. The sensor projects infrared (IR) light into the windshield at a 45-degree angle. If the glass is dry, most of the light is reflected back into the sensor by the front of the windshield. If rain drops on the windshield, they reflect the IR light in different direction.

This is because the wetter the glass, the less light makes it back into the sensor. The electronic and software inside the sensor will turn on the wipers when the amount of light reflected onto the sensor decreases to a present level. The software sets the speed of the wipers based on how much the IR is reflected back into the sensor.

# Material and Methods:-

Experimental set-up: In the set up automatic rain operated wiper system, the main unit is of circuit which contains the sensor unit and relay, IC chip. The system will be controlled by a microcontroller. In our case, we have chosen

Printed Control Board (PCB). It is a microchip that has been developed by Microchip Technology Inc. Microcontroller is an ideal chip to program any electronic application. Microcontroller can use many languages to as its program such as Assembly Language, C, Basic and many more. The major components of the "Automatic rain operated wiper and dim/bright controller" are Conductive Sensor, Glass frame, Battery, Wiper Motor and its arrangement Relay. This is fixed to the class frame. In this circuit are having two leads which are fixed to the class frame. The distance between these two leads is 3 mm. The wiper motor fixed to the class frame so that it clean the class whenever rain occurs. In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

Working principle: In our circuit conductive is used as a sensor unit. Water resistance is very high so the conducting path to the sensor probes of the resistance is very high. So we use CD4049. This chip is CMOS based so the gain of this chip is very high. Whenever input gets low, output of the chip is high and relay driving circuit i.e. Darlington pair (BC547) is used to drive the relay. This chip runs on 5v supply therefore we use 7805 for 5v regulator. The CD4049 supply goes through single diode i.e. forward bias. It is to protect the reverse polarity.

Whenever rain starts, sensor will sense the water, the motor will start through the relay. When rain stops, the output of the CD4049 is default high so we use the 1MOHm resistance for lower status of the motor.

## Printed circuit board (pcb) design:-

Nowadays the printed circuit board hereafter mentioned as PCB's makes the electronic circuit manufacturing as easy one. In olden days vast area was required to implement a small circuit. To connect two leads of the components, separate connectors are needed. But PCB's connect the two leads by copper coated lines on the PCB board. PCB's are available in various types' namely single sided and double sided boards. In single sided PCB's the copper layer is one side.

MANUFACTURING:-First, the wanted circuit is drawn on a paper and it is modified or designed to reduce the space this designed PCB layout is to be drawn on the plain copper coated board. There boards are available in 2 types. Phenolic, Glass epoxy. Most computer PCB's are glass epoxy. To draw the circuit diagrams we can use the black color paint. Before that the required size of the plane PCB board is determined from the roughly drawn PCB layout. Using black paint the desired circuit is drawn on the board.

CAD IN PCB: First the PCB layout is designed by CAD. The print out is taken from the computer (of large size) for out clearance. This layer is given to the photography section to get the layout in its actual size. From this we can have the positive and negative images of the layout. This photographic image is exposed in the following three methods. Polybluem, Chrombin, Five star. The exposed mesh is placed on plain copper coated board in correct alignment by using wooden clamps. Special paints are used to spread over the mesh. Paint flow through the board and the layout lines are made on the copper board. Finally, there are fine layouts on the copper board.

ETCHING: This can be done both by manual and mechanical ways by immersing the board in to a solution of formic chloride and hydrochloric acid and finally cleaning the board with soap.

Term	Definition	Range of Options
Dielectric constant	Relative capacitance to that of air vacuum or dielectric	3-6
Dissipation factor	Electrical efficiency of loss	0.33 to 0.03 (60 – 1000) Hz
Dielectric strength	Voltage that material can withstand prior to failure	300 – 450 V/min for 0.125 inch thickness
Arc Resistance	Resistance to electrical breakdown initiated by formation of conductive path or tracking	80 –100 sec.
Surface resistivity	Resistance to electric current along surface of 1 cm2 measurement	-

Table: characteristics of epoxy resin



Figure: Circuit diagram & proposed work figure

## Mechatronics components:-

**IC-4049**: The CD4049UBC and CD4050BC hex buffers are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. These devices feature logic level conversion using only one supply voltage (VDD). The input signal high level (VIH) can exceed the VDD supply voltage when these devices are used for logic level conversions. These devices are intended for use as hex buffers, CMOS to DTL/TTL converters, or as CMOS current drivers, and at VDD =5.0V, they can drive directly two DTL/TTL loads over the full operating temperature range.

# Pin diagram:-



Figure: - pin diagram of ic-4049

**Features:** Wide supply voltage range: 3.0V to 15V.Direct drive to 2 TTL loads at 5.0V over full temperature range High source and sink current capability. Special input protection permits input voltages greater than VDD. Design of wiper mechanism: - There are various mechanism which are used in now days life. This mechanism is functionally viable and can be made from easily available material parts. This is four bar mechanism which runs on grashoffs criterion having class-I type of mechanism

# **Result and Discussion:-**

Thus we have developed an "*AUTOMATIC RAIN OPERATED WIPER*" which helps to know how to achieve low cost automation. The application of sensor produces smooth operation. By using more techniques, they can be modified and developed according to the applications





Fig: - Overall set-up of automatic rain operated wiper system with circuit

Sl. No.		Qty.	Material	Amount (Rs)
	PARTS			
i.	Acrylic Frame	1	Fiber	300.00
ii.	Wiper Motor	1	Aluminium	1000.00
iii.	Battery	1	Lead-acid	800.00
iv.	Circuit	1	Electronic	600.00
V	Frame	1	M.S	500.00
vi.	Connecting wire	5 meter	Copper	50.00
vii.	Bolt and Nut	-	M.S	50.00

#### Table: - material cost

# TOTAL = 3300.00

**Overhead Charges:** 

The overhead charges are arrived by "Manufacturing cost"

 $\begin{array}{rcl} \text{Manufacturing Cost} &= & \text{Material Cost} \\ &= & 3300.00 + 200.00 \end{array}$ 

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3500.00

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+ Labor cost

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