iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4513

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

An Automated Wiper System for Vehicles

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Abstract: ***In cars and other four wheeler vehicles, wiper is an essential component to clean the wind shield so that driver can drive safely. Previously the wipers of vehicle are turned on and off manually and the driver needs to switch on and off the control stalk.***
This is very risky process as driver has to concentrate on driving [1]. The system proposed here is similar with the other conventional wiper systems. At the place of switch the whole system is made automatic. Two types of sensors are used in this system to detect the water drop.
The wiper operation is controlled by Microcontroller control unit. The system works by both way viz manually and automatically.
Keywords: Microcontroller, IR sensor, Raindrop sensor plate, Stepper Motor, Wiper, Automobile

I. INTRODUCTION

Many automobile industries are researching on the automation of the vehicles exploiting the safety, entertainment technologies, reliability, etc of the vehicle.
The automatic wiper systems are relatively uncommon in modern vehicles for a number of reasons. These wiper systems are too expensive and not suitable for new vehicles.
Wipers are designed to clean the water from a windshield. Up till now many attempts have been made to construct the cost effective and reliable automatic wiper control system for vehicles, so that the driver can concentrate on driving without any disturbance. The major drawback of most of the systems is a small area of windshield under observation. Also, the speed of wiper motor is constant when they are invented.
This forced automotive industries to the invention of different speed wiper motors increasing the visibility of driver [2]. But again the major problem arises with this system is, driver has to change the speed of motor manually which will affect the speed of vehicle and also distracts the concentration of driver.
This newly proposed automatic wiper system will provides the solutions for all the above said problems. The system presented here uses two types of sensors (Water drop sensing plate and IR sensor) to detect rain drops or any liquid fallen on windshield. These sensors will activate the control unit which contents microcontroller and other circuitry. The AT89S51 Microcontroller is used in this system to make it cost effective and compact. According to the signals wiper motor is activated and the wiper speed is controlled as per the sensor activations

II. LITERATURE SURVEY

In the literature study, it is seen that various sensors are used for detection of rain drops. Ashik K.P and A. N. Basavaraju have been worked on automatic wipers with Mist control. They used beaker to collect the rain water and according to the level of collected water the speed of motor is controlled [3].
Mukul Joshi et al worked on modified and cost effective automatic wiper control system. PIC Micro-controller is used to process the signal received from rain drop sensor [4]. Hyundai:kia America Technical Centres' design team worked on new rain sensing system for wiper control based on capacitive sensor technology. Capacitive-sensing relies on interactions with an emitted electric field to determine the presence of water drops/ object [5].
H Kajioka et al have developed an optical automatic wiper system using rain sensor. An optical sensor is used to detect the rain water. LED and LDR are used for detection of raindrops.
The degree of rain fall is determined by the frequency of change in intensity of received light [6]. N Prabhakaran proposed an efficient low cost wiper system for autonomous vehicles. Here, Atmega8 /microcontroller to control the movement of wiper. Plate based water sensor is used to detect the rain drops [7].

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III. METHODOLOGY

In every four wheeled vehicle, the wiper movements are done by the windshield wiper motor. By adjusting the speed of this motor, wiper speed can also be controlled. The system proposed here is able to detect and process the data received from sensors, then controls the speed of wiper.

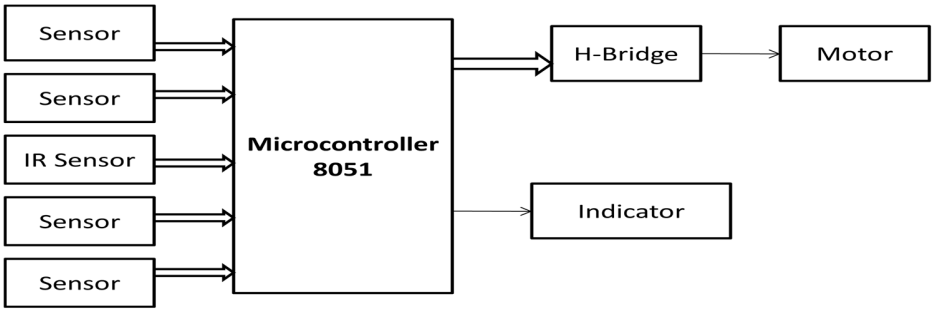


Fig. 1 Block Diagram of an automated wiper system

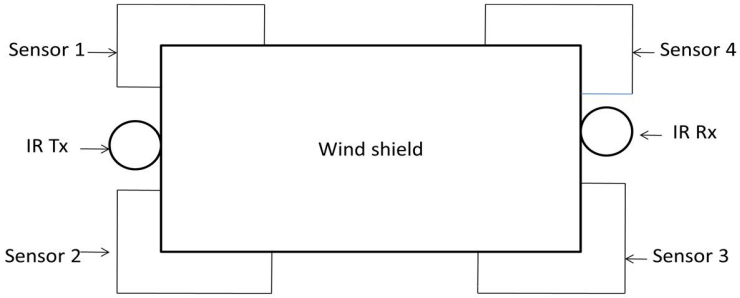


Fig. 2 Positions of rain sensors on the windshield

A. Description and Working

The system works on two types of sensors, raindrop sensor or water sensor plate and an optical sensor. IR sensor is used as an optical sensor. The water sensor plate is simply made up of copper clad PCB. These types of sensors are also available in market. Aluminium plate sensor can also be used as a rain drop sensor. One water sensor plate is placed on each corner of the windshield. Optical sensor is placed from inside the windshield horizontally at the centre of windshield. The signals received from these sensors are processed by micro-controller circuit. Different speeds of wiper motor are set for activation of number of sensors through controller program. When there is a heavy rain fall, all sensors are activated and give signal to microcontroller, setting the speed and time duration of wiper movement to maximum.

B. Micro-Controller AT89S51

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of in-system programmable Flash memory. It is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash memory allows the programmer to reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

Timer 0 and Timer 1 in the AT89S51 operate the same way as Timer 0 and Timer 1 in the AT89C51. XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier that can be configured for use as an on-chip oscillator. Quartz crystal or ceramic resonator may be used for on chip oscillator.

C. Optical Raindrop Sensor

Most of the optical raindrop sensors are based on the principle of total internal reflection. An IR light is emitted at an angle of 45 degree into the windshield from inside. When any drop of rain falls on windshield glass, attenuated light is reflected back to the IR sensor, this change in light intensity gives signal to microcontroller to turn on the wiper motor. This technique depends on the statistical probability. The distance between IR emitter and receiver may affect the performance as while travelling, light's power loss increases.

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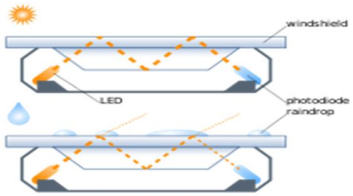


Fig. 3 Optical Raindrop Sensor

D. Raindrop Sensor Plate and Module

The raindrop sensor available in market comes with module circuit. It is usually rectangular in shape and small in size. These raindrop sensors are made from Bakelite base material and Aluminium tracks on it. The sensors used here are made from copper clad printed circuit board.



Fig. 4 Raindrop Sensor Plate and Module

As corners of windshield have to cover with sensing material, the shape of sensor plate used is kept according to corner shape of windshield and same sensor module is used to process the signal. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer. It uses op-amp as a comparator. Module can work with voltage supply 3V to 5V.

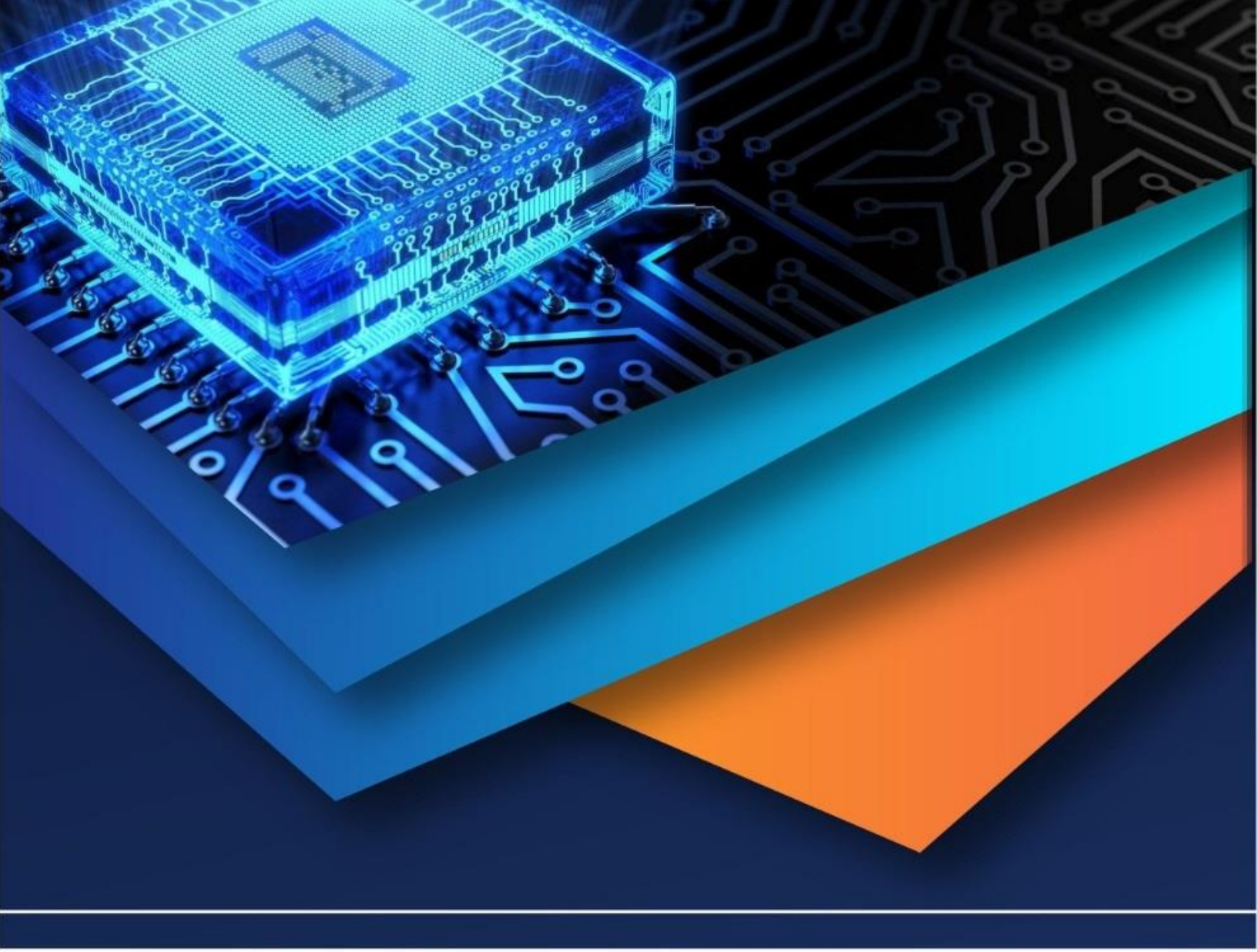
IV. CONCLUSION

The implementation of this system helps to reduce human efforts, providing more stable driving with concentration without any distraction. It is cost effective and simple to implement on windshield. The speed and movement duration of wiper depends on heaviness of rain according to software program. Large area of windshield is covered with sensors therefore wipers can activate to clean on very light raindrops also.

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