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Design of Arduino Based Smart Automobile Wiper

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Abstract
Lack of proper vision has responsible for many automobile accidents on the roads during heavy rainfall. Wiper is one of the many devices, which are used to wipe the water on the windshield during rainy seasons so as to obtain clear vision. The operation of these wipers in many of the existing vehicle models is yet manual which can cause distraction to the driver. Automation of the wiper greatly decreases the need for human sensory and mental requirements as well. The proposed design will make use of rain sensor that detects the rainfall, arduino microcontroller will estimate the intensity of rain fall signal given by the rain sensor, process the signal according to the rainfall intensity to trigger the blower for few drops or trigger the servo motor carrying the wiper if the intensity of the rainfall is high.

Keywords: *Wiper, Rainfall, blower, microcontroller, servo motor.*

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I. INTRODUCTION

The issue of driver's safety is of great importance in today's automotive industry. In many cases, a lack of proper vision is responsible for accidents during heavy rainfall. In many cases, manual errors like not increasing the speed of the wiper by the driver lead to accidents (Reddy et al, 2018). All vehicle manufacturers and automobile device companies have developed and incorporated several devices for the safety as well as taking convenience and easy operability of those devices into consideration. One of the many devices is the wiper, which are used to wipe the water on the windshield during rainy seasons so as to obtain clear vision.

A windscreen wiper is an essential device that come pre-installed in almost all motor vehicles including trains, cars, buses, some aircrafts, watercrafts etc. Operation of these wipers in the existing models is yet manual. The physical model of the operation includes two arms twirling at one end back and forth over the glass. The wipers invented previously used to oscillate at a slow speed, sometimes this cause the distraction to the driver's visibility (Kalra et al, 2020). Hence there is need for automation. Automation greatly decreases the need for human sensory and mental requirements as well. An automation system consisting of a connection between hardware and software has freed the individuals from their day to day chores (Abhijit et al, 2017).

Over the last ten years, the advancement in the automobile industry has been increased to find modern techniques to increase safety (Reddy et al, 2018). Nowadays, each and every vehicle is provisioned with the wiper to avoid the accidents and many efforts are geared toward decrease in the human intervention in controlling the wiper to ensure luxury. Although the provision of the automatic wiper is costly, this makes its provision limited to luxury and expensive cars.

Many works had been done by researchers to design and implement cheap and efficient automatic car wipers. This will make the device to be affordable to all and sundry and also reduce auto accidents related to the use of wipers. Automatic wiper using rain sensor, servo motor and arduino uno microcontroller was design by Kalra et all (2020). The wiper which triggers automatically as it rain sensor detects rainfall on the windscreen, the design also incorporated the lcd that displays the intensity of the rainfall to the driver.

Lohith et al (2017), designed a smart arduino based vehicle automatic wiper using a cuboid rain sensor incorporated with a blower to blow away water droplets on the rain sensor. This will eliminate the problem of false rain sensing by the sensor when water droplets fall on it.

Das et all (2021) implemented a model wiper with rain sensor and controlled by AT89C51 Microcontroller that senses rains and automatically switches on the wiper and adjusts its speed according to the intensity of the rain. As the intensity of the rain increases, the speed of the wiper increases to a certain level.

A system that successfully monitors the water content of the glass using the water sensor and also regulates the speed of wiper motor using servo motor was designed by Anshumali and Bhattacharya (2019). The Sensor values were successfully tested using reading through LCD module and if the motor suddenly stops, the stop message sent to the Arduino.

Reddy et al (2018) also developed arduino based automatic wiper with rain sensor on the windscreen. The response of the wiper is 400 milliseconds upon sensing the rain while the incorporated LCD screen in the vehicle displays the intensity of the rain and wiper speed.

Description of the Proposed System

The proposed rain sensing wiper system is designed using Rain Sensor, Servo motor, Blower and Arduino microcontroller.

Rain sensor

A rain sensor module is an easy tool for rain detection (Gupta et al.).They are electrically isolated and are available as printed circuit boards. Because of its compactness in design and its light weight, it can be easily attached into any system. 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. The board is coated with nickel in the form of lines. The working principle of a rain sensor can be compared to the working of a switch. When rain falls, the switch turns to off mode. Whenever rain falls, the circuit gets completed and thus the resistance varies (Kalra et al, 2020). The analogue output is used in detection of drops in the amount of rainfall Lohith et al (2017).

The rain sensor is equipped with digital analogue pins through which the humidity can be sensed. When the sensed humidity is more than the threshold limit, then the desired action is performed (Reddy et al., 2018). When there is no raindrop on board. Resistance is high so we get high voltage according to Ohm's law V = IR. When raindrop present, it reduces the resistance because water is a conductor of electricity and the presence of water connects nickel lines in parallel so reduced resistance and the reduced voltage drop across it.

Fig 1: Rain sensor

Servo Motor

Servo motors are self-contained mechanical devices that are used to control the machines with great precision (Sachin & Gaonkar, 2013). It is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal. As long as the coded signal exists on the input

line, the servo will maintain the angular position of the shaft. As the signal change, the angular position of the shaft changes (Anshumali and Bhattacharya, 2019). The servo motor can be moved to a desired angular position by sending Pulse Width Modulated (Holtz, 1992) signals on the control wire. The servo understands the language of pulse position modulation. A pulse of width varying from 1 millisecond to 2 milliseconds in a repeated time frame is sent to the servo around 50 times in a second. The width of the pulse determines the angular position. For example, a pulse of 1 millisecond moves the servo towards 0°, while a 2 milliseconds wide pulse would take it to 180°. The pulse width for in between angular positions can be interpolated accordingly. Thus a pulse of width 1.5 milliseconds will shift the servo to 90°. It must be noted that these values are only the approximations. The actual behavior of the servos differs based on their manufacturer. A sequence of such pulses (50 in one second) is required to be passed to the servo to sustain a particular angular position. When the servo receives a pulse, it can retain the corresponding angular position for next 20 milliseconds. So a pulse in every 20 millisecond time frame must be fed to the servo (Anshumali and Bhattacharya, 2019).

Fig 2: servo motor

Blower

The Micro Blower can also be used for Arduino, LED lighting, Beagle Bone Black, robotics, and other applications. The Micro Blower requires low start up voltage and offers up to 40 percent power savings over traditional fans, but its compact 250 mm long design and low-profile allow the work to stand out.

Fig 3: Blower

Microcontroller

Microcontroller is a small computer on single integrated circuits containing processor core, memory and programmable input/output reference. Arduino UNO3 microcontroller is chosen for this system, because it can easily interface with the system and it can easily programmed for operation of desired performance. It is microcontroller board and based on the Atmel's ATmega328 microcontroller, it has a 16 MHz ceramic resonator, a USB connection, a power jack with a AC-to-DC adapter or battery to get started, an ICSP header, a reset button, 6 analog inputs and 14 digital input/output pins (of which 6 can be used as PWM outputs). The board has 32 KB flash memory of which 0.5 KB is used by boot-loader, 2 KB of SRAM and 1 KB of EEPROM. The Arduino system offers a set of analog and digital pins that can be integrated to many other boards and circuits which absolutely have different functions in a design. Arduino board provides a USB serial communication interfaces for loading the codes from computer. For the uploading of the codes, Arduino has prepared its own software called integrated development environment (IDE) which completely supports C and C++ programming languages (May and Htay, 2020).

Figure 3: Arduino Uno R3

Operation the Proposed System

The rain sensor will be placed on the vehicle front glass. Whenever the droplets of the rain on the rain sensor, it will sense the rainfall and send Arduino the necessary information for the process to carry on. The Arduino module will estimate the intensity of rain fall by manipulating the signal given by the rain sensor module and then process the signal according to the rain fall. If the water on the sensor are few drops, the blower will be activated by the microcontroller and blow the droplets away from the screen while the servo motor is in the off mode. As the intensity of the rainfall increases, the blower is switched off while the servo motor is switched on by the microcontroller. The servo motor takes the signal in the form of pulse width modulation, which is the representation of the intensity of the rain drops. The servo motor will then rotate the wiper in accordance with the signal given by the Arduino module. The wiper will rotate in accordance with the intensity of the rain fall. For instance, if the rain fall intensity is very high the pulse width modulation will be high and hence the servo motor will drive the wiper speedily and if the rain fall intensity is low then wiper will rotate slowly. The rain sensor, servo motor and other required components will be powered by the battery.

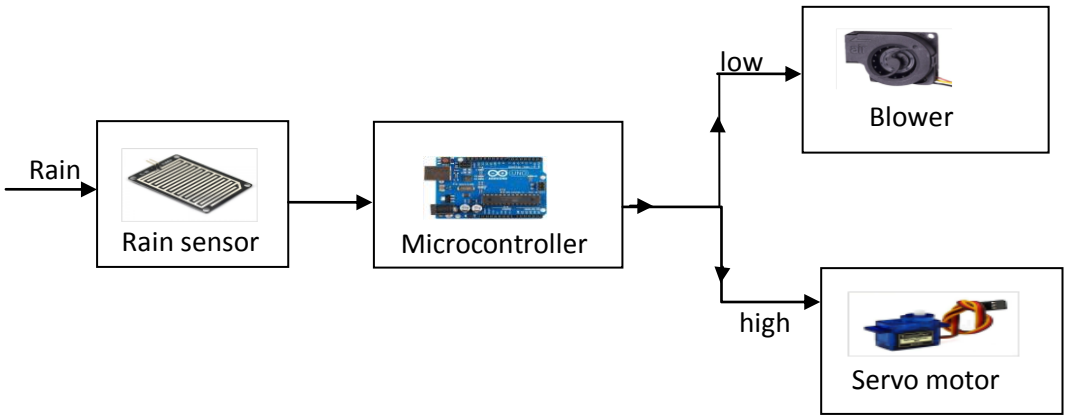

Figure 4: B*lock* diagram of the proposed smart automobile wiper

II. CONCLUSION

Proper vision is very important to the automobile drivers during heavy rainfall. Automatic wipers do not only reduce the stress of operation for the drivers but also prevent distractions which might cause accident and makes driving more comfortable during heavy rainfall.

The proposed system designed will operate without interference of the driver during rainfall.

It is also cheap and affordable system as this will encourage many automobile vehicle owners to acquire the system. This will also reduce accidents related to the use of wipers on the roads.

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