Automatic Rain Sensing Car Wiper

Submitted By

1. Md. Omar Faruk
ID No: BME 1903019497.

2. Bikash Das
ID No: ME2003022016.

3. Mithun Biswas
ID No: BME2001020257.

4. Mainul Islam
ID No: BME2001020459.



Supervised By

M.I. Washif Rahman

Lecturer

Department of Mechanical Engineering

Sonargaon University (SU)

September, 2024

Automatic Rain Sensing Car Wiper



Submitted By

1. Md. Omar Faruk
ID No: BME 1903019497.

2. Bikash Das
ID No: ME2003022016.

3. Mithun Biswas
ID No: BME2001020257.

4. Mainul Islam
ID No: BME2001020459.

Thesis Submitted to the Department of Mechanical Engineering, Sonargaon University in partial fulfillment of the requirements for the degree of Bachelor of Science in Mechanical Engineering.

Supervisor

M. I. Washif Rahman

Lecturer

Department of Mechanical Engineering Sonargaon University (SU)

September, 2024

DECLARATION

We hereby, declare that the work presented in this project is the outcome of the investigation and research work performed by us under the supervision of M. I. Washif Rahman, Department of Mechanical Engineering, & Sonargaon University (SU). We also declare that no part of this project & thereof has been or is being submitted elsewhere for the award of any degree.

Md. Omar Faruk

Bikash Das

Mithun Biswas

Mainul Islam

CERTIFICATION OF APPROVAL

The thesis title "**Automatic Rain Sensing Car Wiper** "submitted by Md. Omar Faruk (BME1903019497), Bikash Das (ME2003022016), Mithun Biswas (BME2001020257), Mainul Islam (BME2001020459) has been accepted as satisfactory partial fulfillment of the requirement for the degree of bachelor of science in mechanical engineering on 22 September 2024.

Countersigned

M. I. Washif Rahman

Lecturer

Department of Mechanical Engineering

Sonargaon University (SU), Dhaka-1215, Bangladesh

ACKNOWLEDGEMENTS

We are thankful to our supervisor, teachers, parents, and all the friends who supported us in completing this project & Thesis .Without their support; it would not have been possible for us to complete this. We would like to extend our thanks and appreciation to Md. Mostofa Hossain sir, head of the Mechanical Engineering Department at SU, for his continued encouragement. Lastly, we thanks to our project supervisor M. I. Washif Rahman sir for the unceasing encouragement, support, and attention

Md. Omar Faruk

Bikash Das

Mithun Biswas

Mainul Islam

ABSTRACT

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. Today's car wipers work on the principle of manual switching. In this paper, has been proposed an automatic rain sensing wiper system that detects rain and starts automatically and stops when the rain stops. The automatic rain sensing car wiper system is not only automatic but also intelligent. The wiper system detects the rainfall automatically and starts itself. The Wiper system is also intelligent. When the droplets of rainfall on the sensor, the sensor detects the intensity and the speed of the wiper are automated accordingly. The higher speed of rotation indicates the higher rainfall. There will be no need for manual intervention for controlling wiper.

Contents Page no.

Declaration ---------- -----iii

Certification of approval----------iv

Acknowledgement----------v

Abstract----------vi

CHAPTER -01

1.1 Introduction----------1

1.2 Objectives----------2

1.3 Methodology----------2

CHAPTER- 02

2.1 Literature Review----------3

CHAPTER- 03

3.1 System Description----------7

3.2 Block Diagram ---------- 7

3.3 Schematic Diagram----------8

3.4 Working Principle----------8

3.5 Complete Project Prototype Image----------8

3.6 Component List----------9

3.7 Cost Analysis----------9

3.8 Ardino Nano----------9

3.9 Rain sensor ---------- ----------13

3.10 Servo Motor---------- ----------16

3.11 SMPS---------- ----------17

3.12 SPDT Switch----------19

3.13 Arduino Software----------20

3.14 Easy EDA----------22

CHAPTER- 4

4.1 Discussion----------23

4.2 Advantage----------23

4.3 Limitation----------23

4.4 Designe Calculation----------24

4.4 Application----------24

4.5 Future Scope----------25

CHAPTER- 5

5.1 Conclusion----------26

REFERENCES----------27

APPENDIX----------29

Chapter 1

INTRODUCTION

1.1 Introduction:

A car wiper is a device which is used to remove droplets of rainwater from a windscreen. Nowadays, each and every vehicle is provisioned with the wiper to avoid the accidents and to decrease the human intervention in controlling the wiper to ensure luxury. A wiper generally consists of a metal arm and a long rubber blade. In some vehicles, pneumatic power is used. Here, the metal arm gets powered by an electric motor. The blade moves in clock-wise and counter clock-wise direction on the glass, pushing the water from the surface of the glass.

Modification of speed is automatically done based on the intensity of the rainfall. Two synchronized radial type arms are used in most of the automobiles, whereas pantograph arms are used in commercial automobiles. Wipers are automated in many ways. These days' automobiles consist of a series of mechanical parts which are automated by an electric motor. In this, we propose an unmanned wiper which senses rain and starts automatically and switches off automatically when the rain stops. By using this, there will be no need for physical intervention of human to control the speed of the wiper.

For this purpose, we use a rain sensor to detect the rain and then the signal is managed by Arduino and takes the required action. Over the last ten years, the advancement in the automobile industry has been increased to find modern techniques to increase safety. There are many reasons behind the vehicles which are not equipped with automatic car wipers. Many reasons in the sense, the car wipers are too expensive to fit in economical automobiles and they are too unreliable for new automobiles. Many automobile companies made an attempt to construct the automatic car wiper at low cost which is not only economical but also efficient. This paper is all about the attempt they tried to construct.

1.2 Objectives:

In the course of design and installation of a **Automatic Rain Sensing Car** Wiper, the following criteria are set to fulfill its objectives:

- To automate the wiper mechanism and working in automobiles.
- To reduce the driver's tasks and allow driver to concentrate on driving.
- To reduce the operations of the wiper, in manual mode.

1.3 Methodology:

Our Project Methodology is:

- Creating an idea for Design and construction of **Automatic Rain Sensing Car**. And designing a block diagram & circuit diagram to know which components need to construct it.
- Collecting the all components and programming for the micro controller to controlled the system.
- Setting all components in a PCB board & soldering. Then assembling the all block in a board and finally run the system & checking.

Chapter 2

LITERATURE REVIEW

1.1 Literature Review:

In this work, they proposed an automated wiper manage machine that's economical, efficient and has an excellent output. This paper uses a resistive rain sensor. They developed a wiper which is practically demonstrated and a sensor is advanced that's an equivalent mathematical version. The rain sensor normally has a predetermined rotational geometry, when the droplets of the rainfall on the sensor, the droplets forms a layer at the floor of the sensor inflicting non linearity to its resistance. To lower the non-linearity and to growth the efficiency of the gadget, the reaction from the sensor is to be linearized.

Hidedki Kajioka, An automatic wiper which sense raindrops with an optical rain sensor and controls the wiper interval. This automatic wiper is implemented by combining an existing wiper system with a rain sensor and controller. A power control circuit is attached so that the sensitivity of the sensor will not deteriorate when the intensity of incident light is lowered due to contamination. The controller is a four-bit microprocessor which processes signals from the sensor and controls the wipers to a driver's linking. The Rain Sensor detects raindrops by sensing the little change in light intensity. They developed an optical automatic wind shield wiper control which is an improved version of intermittent wiper system. The automatic wiper system reduces wiper operations and increases the driver's level of comfort. [1]

The response can be linearized by using the linearized circuit with the equivalent electrical version of the sensor. To reap the changes inside the speed based in the output provided by using the rain sensor, customized PIC micro-controller is used inside the paper named ""A novel and cost-effective resistive rain sensor for automatic wiper manage: circuit modeling and implementation" through Mukul Joshi, M. A Joshi, Vinayak Sagare, D. N. Sonawane. In this paper, fuzzy common sense become used to operate the collected analog information from the rain sensor. [2]

The program turned into programmed to apply fuzzy logic in collecting records. The wiper motor is controlled by the micro controller which uses pulse width modulation (PWM). The reason for the usage of the bushy common sense in this is only because it is able to be without problems rearrange-able. They are used to decorate things. It can be used to construct specific wiper for exclusive cars without changing any hardware configuration. This is primarily based at the paper named “Design and implementation of a re-configurable computerized rain sensitive windshield wiper” via Lubna Alazzawi, Avik Chakravarty. [3]

In this paper, the Bluetooth car wiper system is proposed. The wiper starts to wipe when it captures any wireless Bluetooth signal from any mobile. They introduced an innovative way to wipe the windshield. Although it is a Bluetooth based car wiper, there is a need for human intervention. For the wiper to start, it needs to detect Bluetooth signals and those should be sent by the driver in order to start the wiper. The Bluetooth car wiper is constructed using HC05 Bluetooth, Arduino and servo motor. We can control the movement of the car wiper by sending low range Bluetooth signals. This work is done in the paper named “Arduino based Bluetooth operated car wiping technique using android mobile phone” by Sourish Mitra, Soham Biswas, Mrinmoy Aus. Tapan S Kulkarni, This research paper deals with the simple and ease design of semi-automatic rain wiper system. It is semi because it is implemented 1st time in auto vehicles. This system is developed by using 8051 microprocessor. In this paper it was found that they are using cup sensor which is reasonable in price. Here sensing device is used basically a conical shape cup with a tray on the top of the cup to collect the maximum possible amount of water. This table top model of semi-automatic rain wiper system has worked successfully at three different stages of rain intensity and it is very cheap in cost which can be implemented in economic class vehicles. [4]

Anuradha S. Joshi1, Sheeja S. Suresh In this paper they present automatic rain wiper system used to remove raindrops and activate automobile windshield wipers without driver interactions. This system was developed to reduce the driver efforts so he/she can give focus on main task of driving. The project aims to develop an automatic windshield wiper system that automates the process of the driver’s manual response to rain on the windshield. By reducing the need for drivers to adjust wiper speed while driving, the number of accidents caused by distraction can be slightly reduced.

The demonstration is able to simulate the operation of the system as if installed in an automobile. [5]

Tapan S. Kulkarni, Harsh S. Holalad. Automatic windshield Wipers play a key role in assuring the driver's safety during precipitation. The manually wiper system, requires driver's constant concentration in adjusting the wiper speed. This manual adjustment of the wiper distracts driver's attention. The proposed system has ability to change the wiper speed automatically with change in the rain sensitivity, but it is not able to measure rain intensity. Hence to solve the problem Mat lab 7.0FUZZY logic toolbox is used. Fuzzy clustering is used to analyze the system behavior after taking the sensor output voltage readings at different rainy position. [6]

N. M. Z. Hashim, Wiper is an essential component that used to remove raindrops or any water from the vehicle's windscreen. The previous system used to activate the wiper manually. Thus, this system is proposed to solve these problems. The objectives of this project are to upgrade the older cars system by providing automatic wiping system, to improve the system by using sensor with actuator and to design a basic program that will fully operate with the system. Most of cars have two wipers on the windscreen, one on the rear window and the other on each headlight. The wiper system was well functionally according the water condition from the outside of a car. This project showed a contribution on the design of the automatic wiper system for the future research in this field. [7]

K. V. Viswanadh , This paper shows Automatic wipers with mist control. Now a day, the accidents are most common in commercial vehicles. One of the reasons for these accidents is formation of the mist inside the vehicle due to heavy rain. In rainy seasons for commercial vehicles, the wiper on the windshield has to be controlled by the driver himself, which distracts his concentration on driving. Also when the rain lasts for more time (say for about 15 minutes) the formation of mist on the wind shield is also hinders the visibility of the driver and makes driving difficult. The main aim of the project is to prevent the distractions to the driver of a truck or bus. The rain intensity is measured by the set of sensors placed in the beaker at the predetermined levels. All the four wheeled vehicles are equipped with the wipers. These wipers are used to wipe the water on the windshield during rainy season. 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, and medium rain. The tests have been conducted under mist on the wind shield. [8]

Sugimoto, M., Kakiuchi, N., Ozaki, N., and Sugawara, R, from the last two decades, the automobile industry has aggressively researched ways to increase modern computing and electronic advances in the development of safety, reliability, and entertainment technologies for vehicles. With drivers exposed to an ever increasing number of distractions, automatic rain-sensing wiper systems become an even more appealing feature, as they work to minimize the time the driver must take his/her hands off the wheel. Most manual systems offer intermittent as well as variable speed operation. The manual wiper system however requires driver constant concentration in adjusting the wiper speed .Manual windshield wiper speed constantly varies according to time and vehicle's speed. Because the manual adjustment of the wiper distracts driver's attention, which may be a direct cause accidents. In this to developed an automatic wiper control system which is improved version of intermittent wiper system. This wiper system reduces cumbersome wiper operation and improves driver's level comfort. [9]

Rahul Sindhw Gormer, S., Kummert an, The 21st century is the time of automation and it is defined as the replacement of manual efforts by mechanical power in all degree of automation. While driving the car, the driver cannot give his full attention on the road. So it will increase the chance of accidents in rainy season. This paper shows the factors affecting of efficiency of rain sensor which includes Convenience, comfort, installation, failsafe function. From above it conclude that technology is very cheap and design is also simple. It is also conclude the removal of controlling the wiper during rain which will provide them much ease and help them to concentrate on driving. [10]

Kore, S. S, This present invention is relates generally to an automobile vehicle rain sensor system which controls the wiper speed in rainy season to remove the raindrops from the windshield. This invention is directed to a rain sensor system for automatically controlling windshield wiper action in associated with rain condition. The manual wiper system does not give the safety so the automation is required. [11]

Chapter 3

THEORY & WORKING PRINCIPLE

3.1 System Description:

Today's car wipers are manual systems that work on the principle of manual switching. So here we propose an automatic wiper system that automatically switches ON on detecting rain and stops when rain stops. Our project brings forward this system to automate the wiper system having no need for manual intervention. For this purpose we use rain sensor along with micro-controller and driver IC to drive the wiper motor.

Our system uses rain sensor to detect rain, this signal is then processed by micro-controller to take the desired action. The rain sensor works on the principle of using water for completing its circuit, so when rain falls on it it's circuit gets completed and sends out a signal to the micro-controller. The micro-controller now processes this data and drives the motor IC to perform required action. The motor driver IC now drives a servomotor to simulate as a car wiper.

3.2 Block Diagram:

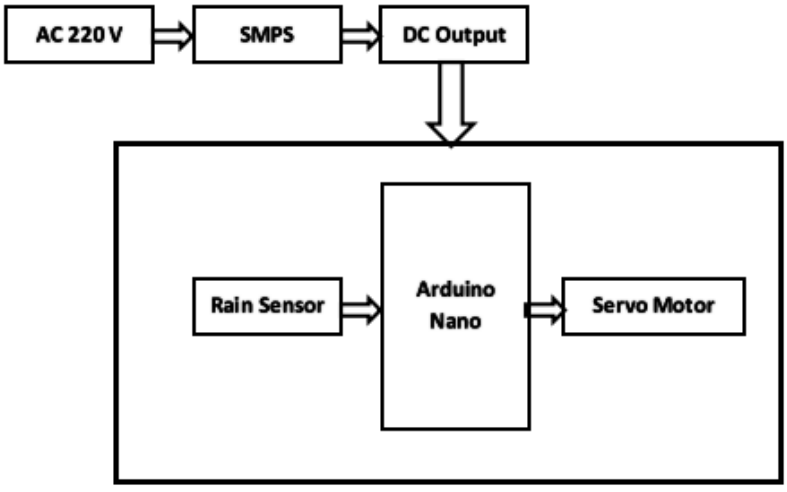


Figure 3.1: Block Diagram

3.3 Schematic Diagram:

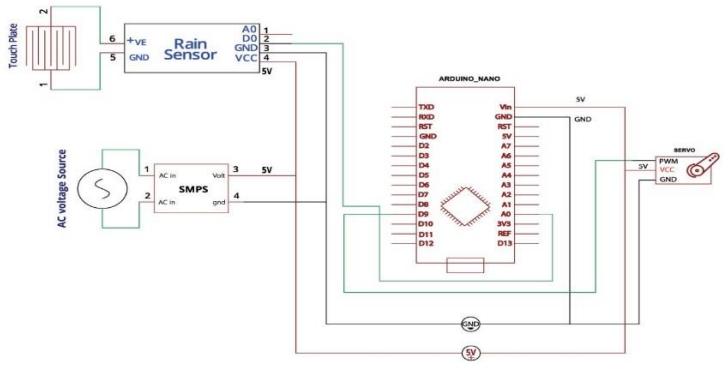


Figure 3.2: Schematic Diagram of Automatic rain sensing car wiper

3.4 Working Principle:

It uses a conductive sensor to detect rain on the windshield and sends a control signal to activate the wiper motor. The major components are the Rain Sensor, Arduino Nano servo Motor, SMPS, SPDT Switch .When rain is sensed, the control unit automatically turns on the wiper motor to clear water from the windshield.

3.5 Complete Project Prototype Image:

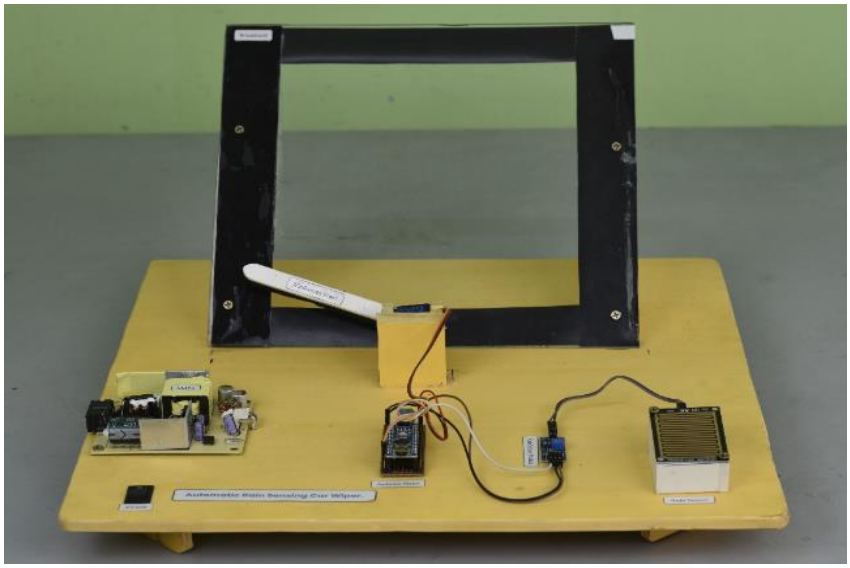


Figure 3.3: Project Prototype Image.

3.6 Components List:

1. Arduino Nano
2. Rain Sensor
3. Servo Motor (SG-90)
4. SMPS (5v 7A)
5. SPDT switch

3.7 Cost Analysis:

Table 01: Instrument list with Cost

Sl.no	Particulars	Specification	Qty.	Unit Price (Taka)	Total Price (Taka)
1	Arduino Nano	At mega 328p	1	480.00	480.00
2	Rain Sensor		1	165.00	165.00
3	Servo Motor	SG-90	1	140.00	140.00
4	SMPS	5V 7A	1	300.00	300.00
5	SPDT Switch		1	9.00	9.00
12	Others			1200.00	1200.00
				Total Cost	2294.00

3.8 Arduino Nano:

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling Lights, motors, and other actuators.

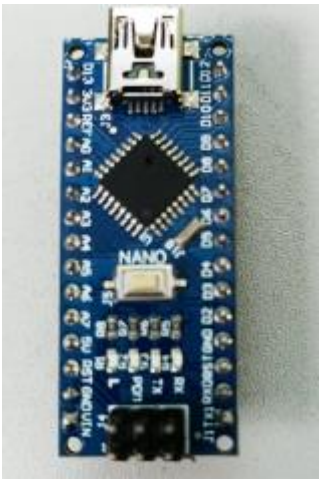


Figure 3.4: Arduino Nano

The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, max MSP).

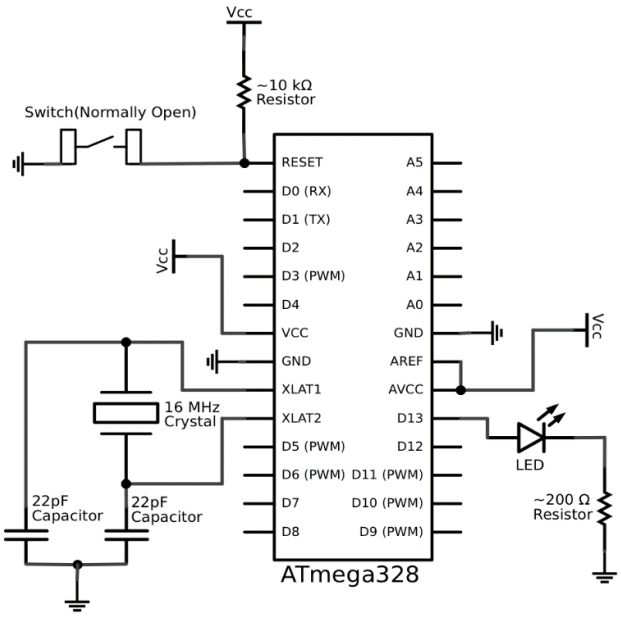


Figure 3.5: Schematic Diagram of Micro controller IC AT mega 328p [12]

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a smallest, complete, and breadboard friendly. It has everything that Decimal has (electrically) with more analog

input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano is automatically sense and switch to the higher potential source of power Nano's got the breadboard-ability of the Boarduino and the Mini + USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, and GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable.

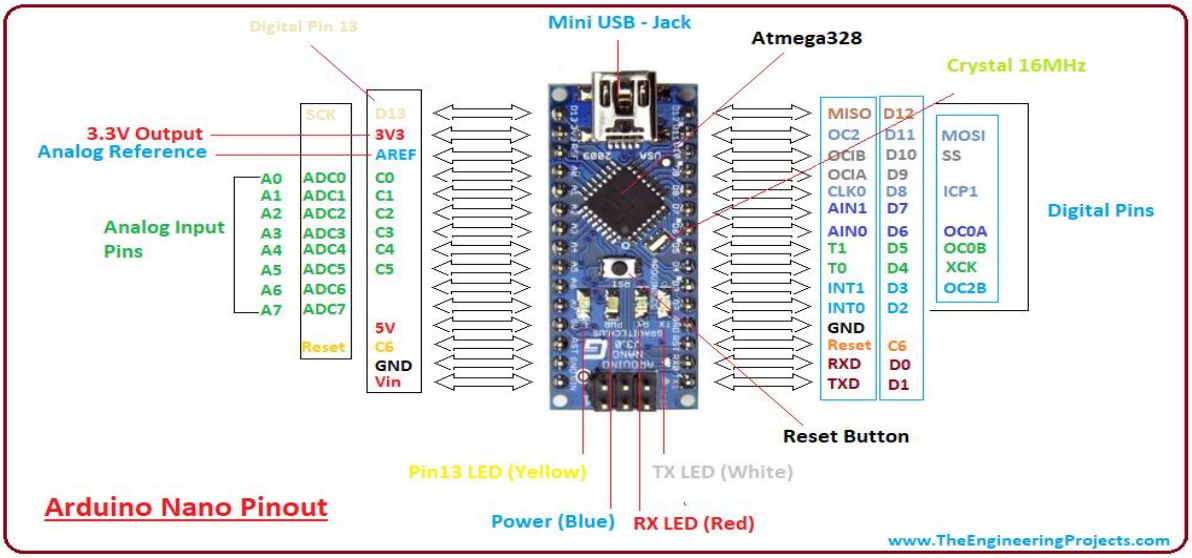


Figure3.6: Arduino Pin Output [12]

Specifications:

- Microcontroller: Atmel ATmega328
- Operating Voltage (logic level):5 V
- Input Voltage (recommended):7-12 V
- Input Voltage (limits):6-20 V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 8
- DC Current per I/O Pin: 40 mA
- Flash Memory: 32 KB (of which 2KB used by boot loader)
- SRAM : 2 KB
- EEPROM: 1 KB

- Clock Speed: 16 MHz
- Dimensions: 0.70” x 1.70”

Features:

• Automatic reset during program download

• Power OK blue LED

• Green (TX), red (RX) and orange (L) LED

• Auto sensing/switching power input

• Small mini-B USB for programming and serial monitor

• ICSP header for direct program download

• Standard 0.1 spacing DIP (breadboard friendly)

• Manual reset switch

Micro Controller IC ATmega328p:

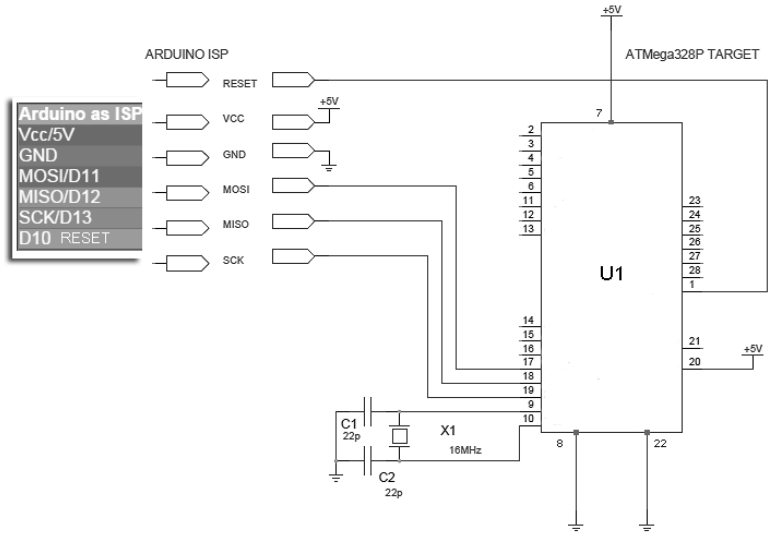


Figure 3.7: Schematic Diagram of Micro controller IC AT mega 328p [12]

The high-performance Microchip Pico Power 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-

wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

3.9 Rain Sensor:

Rain sensor is one kind of switching device which is used to detect the rainfall. It works like a switch and the working principle of this sensor is, whenever there is rain, the switch will be normally closed.

This module is similar to the LM393 IC because it includes the electronic module as well as a PCB. Here PCB is used to collect the raindrops. When the rain falls on the board, then it creates a parallel resistance path to calculate through the operational amplifier. This sensor is a resistive dipole, and based on the moisture only it shows the resistance. For example, it shows more resistance when it is dry and shows less resistance when it is wet.



Figure3.8: Rain Sensor

Rain Sensor Technical Specifications

The specifications of the rain sensor include the following.

- This sensor module uses good quality of double-sided material.
- Anti-conductivity & oxidation with long time use.
- The area of this sensor includes 5cm x 4cm and can be built with a nickel plate on the side.
- The sensitivity can be adjusted by a potentiometer.
- The required voltage is 5V.
- The size of the small PCB is 3.2cm x 1.4cm.
- For easy installation, it uses bolt holes.
- It uses an LM393 comparator with wide voltage.
- The output of the comparator is a clean waveform and driving capacity is above 15mA.



Figure 3.9 Rain Sensor Module

Applications:

This sensor is used as a water preservation device and this is connected to the irrigation system to shut down the system in the event of rainfall. This sensor is used to guard the internal parts of an automobile against the rainfall as well as to support the regular windscreen wiper's mode blower over the opening of the aerial feed, to get rid of water droplets from the Mylar wrap to keep pressurized as well as dry air within the waveguides.

Thus, this is all about the rain sensor. From the above information finally, we can conclude that this sensor is used to detect the rain and generate buzzer sound to take necessary action in further.

How to Use the Rain Sensor Module:

Like Soil Moisture Sensor, the Rain detection sensor module also has four pins VCC, GND, A out, and D out that can be used to get the needful information out of the sensor, The pin out of the rain detection sensor is given below:

VCC is the power supply pin of the Rain Detection Sensor that can be connected to 3.3V or 5V of the supply. But do note that the analog output will vary depending upon the provided supply voltage. GND is the ground pin of the board and it should be connected to the ground pin of the Arduino. DOUT is the Digital output pin of the board, output low indicates rain is detected, and high indicates no rain condition. A OUT is the Analog output pin of the board that will give us an analog signal in between VCC and ground.

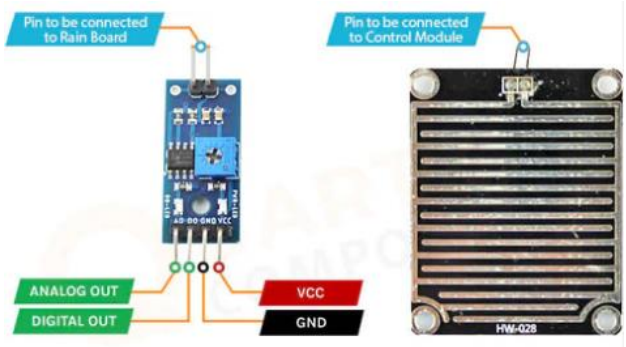


Figure3.10: Rain sensor pin out [13]

Pin Configuration of Rain Sensor

The pin configuration of this sensor is shown below. This sensor includes four pins which include the following.

- Pin1 (VCC): It is a 5V DC pin.
- Pin2 (GND): it is a GND (ground) pin.
- Pin3 (DO): It is a low/ high output pin.
- Pin4 (AO): It is an analog output pin..

3.10 Servo Motor:

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about the DC servo motor working. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.



Figure 3.11: Servo Motor

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

Servo Motor Features:

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation : 0°-180°
- Weight of motor : 9gm
- Package includes gear horns and screws

Servo Motor Wire Configuration:

Table 02: Wire Configuration

Wire Number	Wire Color	Description
1	Brown	Ground Wire connected to the group of system.
2	Red	Powers the motor typically +5V is used.
3	Orange	PWM signal is given in through this wire to drive the motor.

3.11 SMPS:

SMPS is an electronic power supply system that makes use of a switching regulator to transfer electrical power effectively. It is a PSU (power supply unit) and is usually used in computers to change the voltage to the appropriate range for the computer.



Figure 3.12: SMPS

Features:

- Universal AC input / Full range
- Forced air cooling by built-in DC Fan
- Protections: Short circuit / Overload / Over voltage / Over temperature
- Built-in fan ON / OFF control
- LED indicator for power on

Benefits of SMPS:

- The switch-mode power source is small in scale.
- The SMPS is very lightweight.
- SMPS power consumption is typically 60 to 70 per cent, which is ideal for use.
- SMPS is strongly anti-interference.
- The SMPS production range is large

Specification of SMPS:

- Input voltage: 85 - 264V AC or 120 - 373V DC.
- Output voltage: 5V DC.
- Maximum output current: 7A.
- Protection against short-circuit, overload and over-voltage (at the output).

Diagram of SMPS:

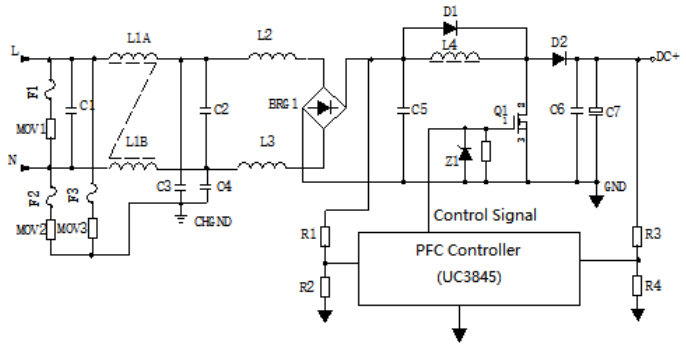


Figure 3.13: Diagram of SMPS [14]

3.12 SPDT Switch:

A switch that has a single input and two dissimilar outputs is known as SPDT. The term SPDT stands for Single Pole Double Throw Switch which is used to control two dissimilar circuits through a similar single input. The operating of this switch can be done manually or included through the electromagnetic coil.



Figure 3.14: SPDT Switch

SPDT Switch Applications:

- This switch is used in a three-way circuit for controlling a load from two locations like from the top and bottom of a staircase.
- This switch is used to control two different circuits through a similar single input.
- Control Circuit.
- ABB/Siemens VFDs.
- PLC system output switches.
- Selector switches through a single common arrangement.

Advantage of SPDT:

- It is less cost
- It is reliable for most the applications
- It can work with high voltages & currents.
- High switching currents let the device control relays, pumps & drive motors.

SPDT Switch Diagram:

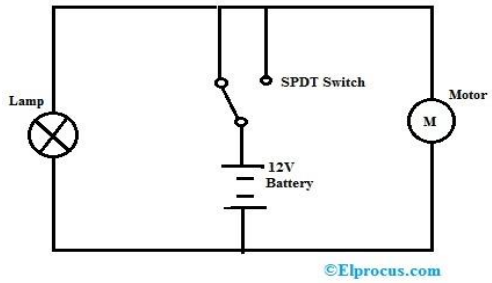


Figure 3.15: Diagram of SPDT Switch [15]

Specification of SPDT Switch:

- Powered by +12VDC.
- The device has a typical switching speed of 20 milliseconds.
- Insertion loss of 0.25 dB and high isolation of 80 db.

3.13 Arduino software

The smart microcontroller unit named as Arduino Nano can be programmed with the Arduino software. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Nano from the Tools, Board menu (according to the microcontroller on your board). The IC used named as ATmega328 on the Arduino Nano comes pre burned with a boot loader that allows you to upload new code to it without the use of an external hardware programme.

Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the microcontroller through the ICSP (In Circuit Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by: On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

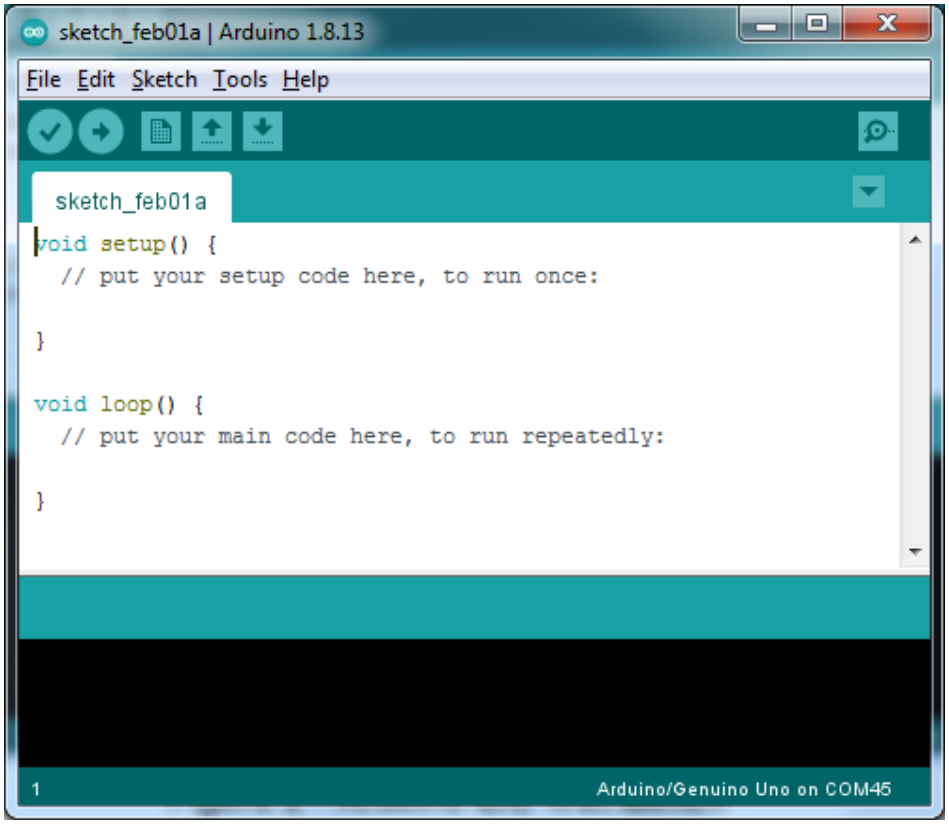


Figure 3.16: Arduino Software Interface IDE [16]

The Arduino Nano is one of the latest smart microcontroller units and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows an inf. file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.

The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial Communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and

AVR Libc to compile programs, and for uploading the programs it uses avrdude. As the Arduino platform uses Atmel microcontrollers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino.

3.14 Easy EDA:

Easy EDA is a web-based EDA tool suite that enables hardware engineers to design, simulate, share - publicly and privately - and discuss schematics, simulations and printed circuit boards. Other features include the creation of a bill of materials, Gerber files and pick and place files and documentary outputs in PDF, PNG and SVG formats. Easy EDA allows the creation and editing of schematic diagrams, SPICE simulation of mixed analogue and digital circuits and the creation and editing of printed circuit board layouts and, optionally, the manufacture of printed circuit boards.

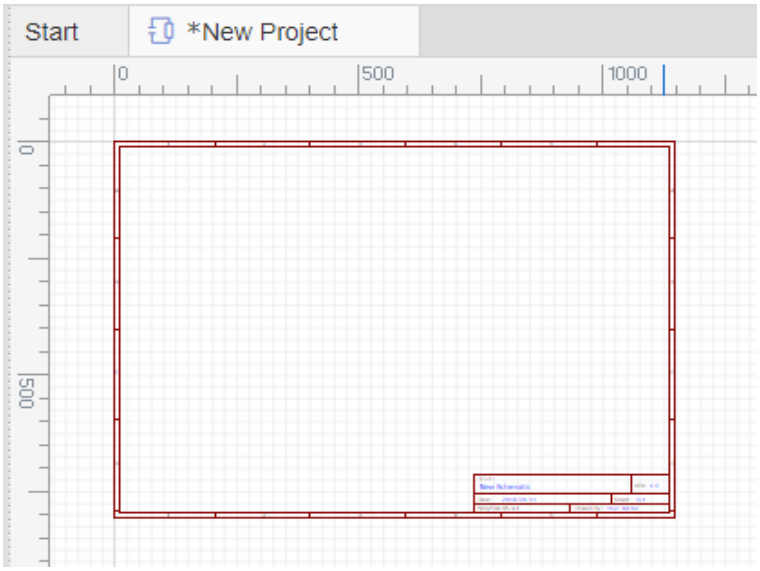


Figure 3.17: Easy EDA Software interface [17]

Subscription-free membership is offered for public plus a limited number of private projects. The number of private projects can be increased by contributing high quality public projects, schematic symbols, and PCB footprints and/or by paying a monthly subscription. Registered users can download Gerber files from the tool free of charge; but for a fee, Easy EDA offers a PCB fabrication service. This service is also able to accept Gerber file inputs from third party tools.

Chapter 4

RESULTS AND DISCUSSION

4.1 Discussion:

The system is focusing on the controller design. At first, we collected all of the elements which are used in this project and connected it perfectly as our circuit design. The main controller is Arduino Nano. All of this instrument is controlled by Arduino Nano. While working on our project, we did face some difficulties as it is a very complex system but the end results we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features to serve the whole system online.

4.2 Advantage:

- **Convenience**: Automatically activates, saving the driver from manual adjustments.
- **Safety**: Immediate response to rain improves visibility and reduces accident risk.
- **Efficiency**: Adjusts wiper speed to match rain intensity, preventing unnecessary wear.
- **Focus**: Allows the driver to concentrate on the road, reducing distractions.

4.3 Limitation:

- **Sensor Dependence**: May struggle in low-visibility conditions like mist or fog.
- **Inconsistent Detection**: Light rain or snow may not trigger the system effectively.
- **Environmental Interference:** Dirt or debris on the sensor can reduce its accuracy.
- **Manual Override**: Some situations still require manual control.
- **Limited Customization**: Automatic adjustments might not fit every driver's preference.

4.4 DESIGN CALCULATION:

For Wiper top motor speed=120 RPM

The worm gear in wiper mechanism reduce the speed 25 times increase torque time 25

So the wiper top speed will be = $\frac{120}{25}$ = 4.8 rpm

Using this we can vary speed of motor using various voltage level of sensor at 1800 rpm at 1200 rpm which will give the wiper speed 36 rpm & 24 rpm.

This variation of wiper speed is satisfactory for our requirement,

Given,

Servo motor rotational time = $\frac{0.12\ Sec}{60\ Degree}$ for requirement at an angle of 110- 125 degree

Time required= $\frac{110\times\ 0.12}{60}$ to $\frac{125\times 0.12}{60}$ = .22 sec to .25 sec

We want to required angle servo motor have to rotated .22 sec to .25 sec

1. Running Time = 20 Sec
2. Windshield cleaning movement= 10 times

3. Running Time = 60 Sec
4. Windshield cleaning movement= 25 times

4.5 Application:

- **Improved Safety**: Automatically adjusts wiper speed for better visibility, helping drivers stay focused.
- **Convenience**: Eliminates the need for manual adjustments in changing weather conditions.
- **Sensor Technology**: Utilizes optical sensors to detect rain, enhancing responsiveness.
- **Energy Efficiency**: Reduces wear on wiper blades and conserves energy by optimizing operation.

4.6 Future Scope:

- **Smart Integration**: Future systems may connect with IoT devices for real-time weather updates, allowing proactive adjustments.
- **Advanced Sensors**: Improved sensors could detect various precipitation types, enabling precise responses for different conditions.
- **AI Optimization**: AI and machine learning could personalize wiper performance based on driver preferences and environmental data.
- **Sustainable Design**: Future models may use eco-friendly materials and energy-efficient**.**

Chapter 5

CONCLUSIONS

5.1 Conclusion:

An automatic wiper control system will be the modified version of the intermittent wiper system. This system will improve the driver's level of comfort. Its need is more especially for the drivers who have to work night shifts and drive in the areas prone to traffic where drivers have to give maximum concentration on the brakes and clutches. The wiper controlling task during the rainfall is eliminated with this implementation. This system contains high precision, high accuracy. This system will also be useful in home applications like cleaning the window glasses and it intimates the rainfall and also notifies people in the house. So that people can take care of things like clothes, food grains and products. The following points explain the requirement of additional implementations; these points will act as future scope. • Use of micro controller enables the wiper rotate through 180 degree rather than 360 degree. The usage of better speed control mechanisms will guide wiper more effectively and reduce the consumption of battery power

REFERENCES

[1] Hideki Kajioka, et al.; FUJITSU TEN Tech J. No. 2; 1989; Page No. 69.

[2] Mukul Joshi, Kaustubh Jogalekar, Dr. D.N.Sonawane, Vinayak Sagare, M.A.Joshi; IEEE; 2013, Page No. 40.

[3] P. Abhilash Reddy, G. Sai Prudhvi, P J Surya Sankar Reddy, Dr. S. S. Subashka Ramesh; International Journal of Advance Research, Ideas and Innovation in Technology, Lubna Alazzawi, Avik Chakravarty Volume.4, issue 5, 2018.

[4] H. Kurihara, T. Takahashi, I. Ide, Y. Mekada, H. Murase, Y. Tamatsu, and T. Miyahara, "Rainy Weather Sourish Mitra, Soham Biswas, Mrinmoy AusTapan S Kulkarni," In IEEE Intelligent Vehicles Symposium, 2005, pp. 205-210.

[5] Anuradha S. Joshi1, Sheeja S. Suresh, "review report on soc on various platforms for vehicles", International Research Journal of Engineering and Technology (IRJET).

[6] Tapan S. Kulkarni, Harsh S. Holalad, July 2012, "Semi-Automatic Rain Wiper System," International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 2, Issue 7.

[7] N. M. Z. Hashim, July 2013. "Smart Wiper Control System," International Journal of Application or Innovation in Engineering & Management (IJAIEM), ISSN 2319 – 4847, Volume 2, Issue 7.

[8] K. V. Viswanadh, January-2015, "Design & Fabrication of Rain Operated Wiper Mechanism using Conductive Sensor Circuit," International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 4, Issue 01.

[9] Sugimoto, M., Kakiuchi, N., Ozaki, N., and Sugawara, R.: 'A novel technique for raindrop detection on a car windshield using geometric-photometric model' in Intelligent

Transportation Systems (ITSC), 2012 15th International IEEE Conference on. IEEE, 2012, pp. 740–745.

[10] Gormer, S., Kummert, A., Park, S.-B., and Egbert, P: 'Visionbased rain sensing with an in-vehicle camera' in Intelligent Vehicles Symposium, 2009 IEEE. IEEE, 2009, pp. 279–284.

[11] Kore, S. S. : 'A rain sensor' CBR No. 5955, Patent Application No. 1367, Mumbai 2012.

[12] https://en.wikipedia.org/wiki/Arduino_Nano

[13] https://en.wikipedia.org/wiki/Rain_sensor

[14] https://en.wikipedia.org/wiki/Switched-mode_power_supply

[15] https://en.wikipedia.org/wiki/Switch

[16] https://www.arduino.cc/en/software

[17] https://easyeda.com/

APPENDIX

```
//automatick Rain sensor
const int rainSensorPin = A0;
const int motorPin1 = 2;
const int motorPin2 = 3;
const int motorPin3 = 4;
const int motorPin4 = 5;

// Threshold for rain detection
const int rainThreshold = 500; // Adjust according to your rain sensor's sensitivity

  void setup() {
  // Initialize motor control pins
  pinMode(motorPin1, OUTPUT);
  pinMode(motorPin2, OUTPUT);
  pinMode(motorPin3, OUTPUT);
  pinMode(motorPin4, OUTPUT);

  // Start with wipers off
  stopWipers();

  // Initialize serial communication for debugging
  Serial.begin(9600);
  }

  void loop() {
  // Read the rain sensor value
  int rainValue = analogRead(rainSensorPin);

  // Debugging output
```

```
  Serial.print("Rain Value: ");
  Serial.println(rainValue);

  // Check if it's raining (based on threshold)
  if (rainValue < rainThreshold) {
    // It's raining, turn on the wipers
    startWipers();
  } else {
    // No rain, turn off the wipers
    stopWipers();
  }

  // Delay before next reading
  delay(100); // Adjust as needed
}

// Function to start the wipers
void startWipers() {
  digitalWrite(motorPin1, HIGH);
  digitalWrite(motorPin2, LOW);
// Define pins
const int rainSensorPin = A0;
const int motorPin1 = 2;
const int motorPin2 = 3;
const int motorPin3 = 4;
const int motorPin4 = 5;

// Threshold for rain detection
const int rainThreshold = 500; // Adjust according to your rain sensor's sensitivity

  void setup() {
```

```
// Initialize motor control pins
pinMode(motorPin1, OUTPUT);
pinMode(motorPin2, OUTPUT);
pinMode(motorPin3, OUTPUT);
pinMode(motorPin4, OUTPUT);

// Start with wipers off
stopWipers();

// Initialize serial communication for debugging
Serial.begin(9600);
}

void loop() {
// Read the rain sensor value
int rainValue = analogRead(rainSensorPin);

// Debugging output
Serial.print("Rain Value: ");
Serial.println(rainValue);

// Check if it's raining (based on threshold)
if (rainValue < rainThreshold) {
  // It's raining, turn on the wipers
  startWipers();
} else {
  // No rain, turn off the wipers
  stopWipers();
}

// Delay before next reading
```

```
    delay(100); // Adjust as needed
  }

// Function to start the wipers
   void startWipers() {
  digitalWrite(motorPin1, HIGH);
  digitalWrite(motorPin2, LOW);
  digitalWrite(motorPin3, HIGH);
  digitalWrite(motorPin4, LOW);
  }

// Function to stop the wipers
   void stopWipers() {
  digitalWrite(motorPin1, LOW);
  digitalWrite(motorPin2, LOW);
  digitalWrite(motorPin3, LOW);
  digitalWrite(motorPin4, LOW);
  }
```