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Automatic Car Windshield Operation based On Atmega328 MCU

Research Project
Submitted to the department of (Electrical Engineering) in partial fulfillment of the requirements for the degree of B.A or BSc. In (Electrical Engineering)

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SUPERVISOR'S CERTIFICATION

I certify that this Project, titled "**Automatic Car Windshield Operation based On Atmega328 MCU"** and presented by "Begard Ziyad, Alaa Handren" was prepared under my supervision at the University of Salahaddin – Erbil as a partial requirement for the degree of Bachelors of Science in Electrical Engineering.

Signature:

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Date:05/06/2020

Acknowledgment:

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Abstract:

In this automatic wiper system, a rain sensor, a microcontroller and Servo-motor was used to convert the manual operation into automatic operation. When water falls on the rain board of the rain sensor, the sensor sends the signal to the microcontroller regarding the data and then the microcontroller processes the data and energizes the Servo motor to make the required motion. By taking the signal from the microcontroller the servo motor drives the wiper to clean the car glass.

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Chapter One
An Introduction to Auto windshield wiper system

1.1 Introduction

Automation have taken the comfort of the human life to high level. The implementation of new technologies in the present technology changes the effort of the operator and reduces the risks in the working areas. Also these implementations have high flexibility, reliability and accuracy. Due to these advantages the demand of these technologies are increasing day by day. Generally, the word automation itself describes that no need to involve in the working process i.e., with the implementation of this technology the human need not to involve in the procedure. The main theme in this project is to fabricate automatic rain sensing car wiper which detects the rainfall and snowfall automatically and energizes the wiper to clean the glass. An Arduino UNO board, a rain sensing module, a servo motor is used for constructing the automatic wiper system. In this setup, the microcontroller adjusts the speed of the servo motor according to the signal given by the rain sensing module. The rain sensing module sends the data according to the intensity of the rain or snowfall in the form of signals. The intensity of the rain or snowfall is resembled as pulse width modulation (PWM) to control the servo motor at its signal line. [1]

1.2 Windshield

An optical sensor is used in this proposed model to sense the rain drops and also to control wiper interval. In this model the automation is achieved by implementing rain sensor and controller. The rain sensor is used to detect droplets of water and by this detection the rain sensor sends the signal to microcontroller. The microcontroller energizes the wind shield wiper to remove the rain drops on the glass. This system increases the drivers' level of comfort and decreases the wiper tasks.

The proposed system which has the capacity of removing the raindrops and this system can activate the windshield wiper without the contribution of driver. This system was anticipated to develop an automatic windshield wiper system that automates the process of manual switching ON the windshield wiper. With the implementation of this system, the driver can focus on the driving. So, with this the modal there is a possibility to reduce the accidents by decreasing the drivers' tasks in driving. [1]

1.3 OBJECTIVES

The following are the objectives of the project: -

- 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.

Chapter Two
The components

2.1 Introduction

The design of the Automatic Car Windshield Operation consists of several parts that can be defined each unit with the code to test including
- Rain sensor: is able to detect the presence of rain droplets then initiates a process of data sending.
- Servo Motor: Enables the Windshield to move after it receives the signal Arduino.

2.2 Components

* Rain Sensor
* Servo Motor
* Arduino UNO
* Liquid C

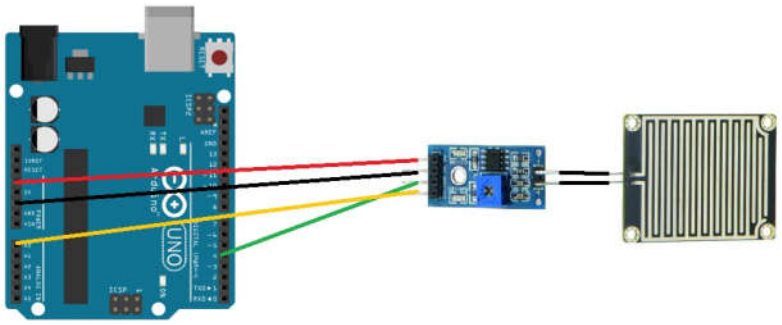
2.3 Rain Sensor

Rain sensors are electrically isolated and are available as printed circuit boards. These have zigzag pattern of conductive path for conducting the rain fall or water fall. This rain sensor module can be used as switch for detecting the rain fall and the usage is very simple. With this module finding of the rain fall intensity is also easy. This rain sensor unit contains rain board and control board. Rain board is set in order to fall rain on it and control board is equipped with two LED lights. In which one is for indicating the power supply and another one is for indicating the rain fall. The second LED light on the control board will blink only when the rain drops collided with the rain board. Rain board is adjusted to make fall the rain drops on it. Whenever the rain drops fall on the rain.

The Figure (2.1) Rain Sensor

The Code below is used to test Rain Sensor

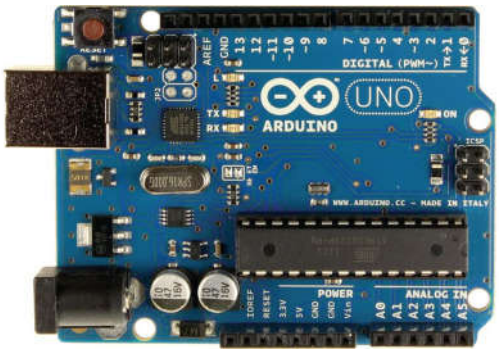
```
const int capteur_D = 4;
const int capteur_A = A0;

int val_analogique;

void setup()
{
  pinMode(capteur_D, INPUT);
  pinMode(capteur_A, INPUT);
  Serial.begin(9600);
}

void loop()
{
if(digitalRead(capteur_D) == LOW)
  {
    Serial.println("Digital value : wet");
    delay(10);
  }
else
  {
    Serial.println("Digital value : dry");
    delay(10);
  }
val_analogique=analogRead(capteur_A);
 Serial.print("Analog value : ");
 Serial.println(val_analogique);
 Serial.println("");
  delay(1000);
}
```



The figure (2.2) Connection between rain sensor and Arduino UNO

2.4 Arduino UNO

The Arduino UNO is nothing but the microcontroller based on the ATmega328. 14 digital input/output pins, 6 analog inputs, 16MHz ceramic resonator, a USB connection, a Power jack, an ICSP header and a reset button is contained by the Arduino Uno. It is fabricated with requirements to support the microcontroller. It can be connected with the computer with a USB or to the power with AC-to –DC adapter. A battery may be used for starting this. This is equipped with Atmega16U2 programmed as a USB to serial converters. This serial converter differs the Arduino from preceding boards which are equipped with FTDI USB-to-driver chip.



The figure (2.3) Arduino UNO

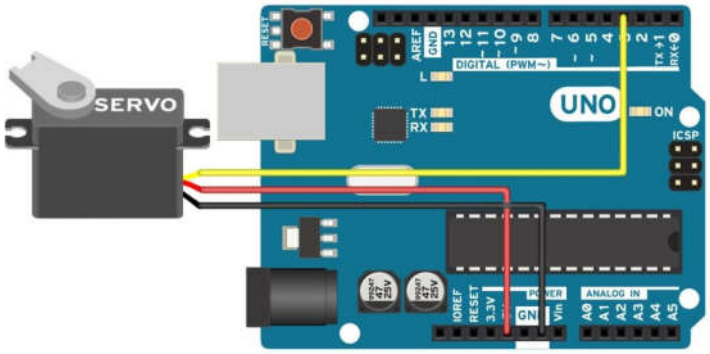
2.5 Servo Motor

It is an electrical component which can be used to move or rotate an object with high precession and high accuracy. Servo motor is the best option to rotate an object at some required angles. It is simply created from a straight forward motor that runs through a servo mechanism. If the motor is employed is dc powered then it's referred to as a dc servo motor, and if it's an ac powered motor then it's referred to as an ac servo motor. We are able to get a really high force servo motor in little and light-weight weight packages. Due to these advantages several applications sort of a toy automobile, RC helicopters, and planes, robotics, machine etc. Servo motors are articulated in kg/cm (kilogram per centimeter) most hobby servo motors are articulated in 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you ways a lot of weight your servo motor will carry at a specific distance. for instance, a 6kg/cm servo motor ought to be ready to carry 6kg if the load is suspended 1cm far from the shaft of the motor, the bigger the gap the lesser the burden carrying capability. The position of a servo motor is determined by an electrical pulse and its electronic equipment is placed beside the motor.

The Figure (2.4) Servo Motor

The code below is used to test Servo Motor prior functioning

```
#include <Servo.h>

const int capteur_D = 4;
const int capteur_A = A0;

int val_analogique;

void setup()
{
  pinMode(capteur_D, INPUT);
  pinMode(capteur_A, INPUT);
  Serial.begin(9600);
}

void loop()
{
if(digitalRead(capteur_D) == LOW)
  {
    Serial.println("Digital value : wet");
    delay(10);
  }
else
  {
    Serial.println("Digital value : dry");
    delay(10);
  }
val_analogique=analogRead(capteur_A);
 Serial.print("Analog value : ");
 Serial.println(val_analogique);
 Serial.println("");
  delay(1000);
}
```



The Figure (2.5) the connection between Servo Motor and Arduino UNO

2.6 Liquid Crystal (LCD)

A liquid crystal display is essentially a liquid crystal sandwiched between 2 pieces of glass, the liquid crystal reacts depending on current applied. Our LCD is a white on black, 16 by 2-character LCD that we will use to display symbols. Graphical LCDs also exist.

Each character is off by default and is a matrix of small dots of liquid crystal. These dots make up the numbers and letters that we display on screens. The actual coding that goes into making these characters appear is quite complicated.

Essentially you will just need to pick a character spot on your screen and tell your Arduino what to write there. We call the place that we are writing characters to 'the cursor', similar to the cursor on PC.

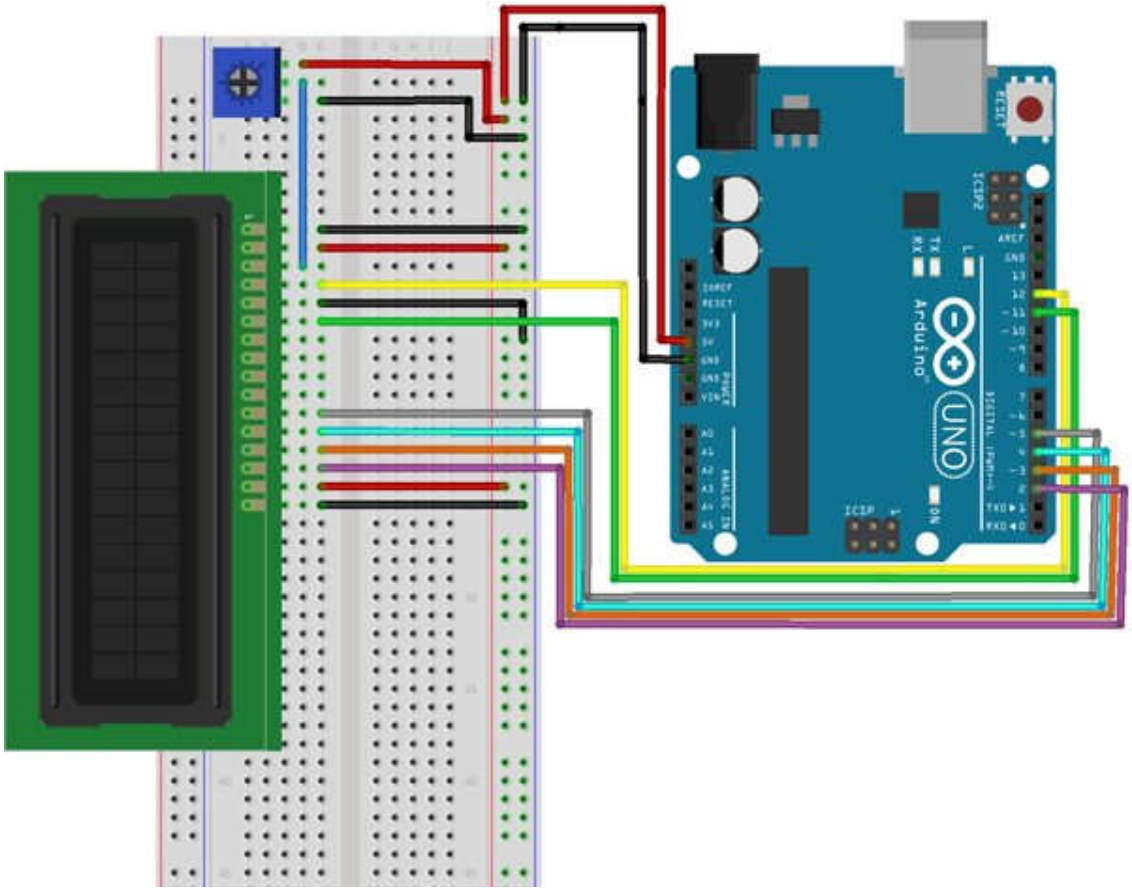
The LCD also has a backlight and contrast control options. The backlight will shine through the pieces of glass the screen is made of to display the characters on the screen. The contrast will control how dark (or light) the characters appear. A variable resistor to control contrast is used, and the backlight to being on will be set.

The Figure (2.6.1) LCD

Pin	Function	Label
1	Ground (0v)	GND
2	Supply Voltage (5v)	Vcc
3	Contrast Adjustment	Vee
4	Register Select (0 for Command Register, 1 for Data Register)	Register Select
5	Read/write select (0 for write, 1 for read)	Read/Write
6	Data Enable (When pulse is given, send data)	Enable
7	Data Pin 1	DB0
8	Data Pin 2	DB1
9	Data Pin 3	DB2
10	Data Pin 4	DB3
11	Data Pin 5	DB4
12	Data Pin 6	DB5
13	Data Pin 7	DB6
14	Data Pin 8	DB7
15	Backlight Supply Voltage	LED+
16	Backlight Ground	LED-

The code below is used to test Liquid Crystal prior functioning

```
// Import the Liquid Crystal library
#include (LiquidCrystal.h);
//Initialise the LCD with the arduino. LiquidCrystal(rs, enable, d4, d5, d6, d7)
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {
  // Switch on the LCD screen
  lcd.begin(16, 2);
  // Print these words to my LCD screen
  lcd.print("HELLO WORLD!");
}

void loop() {
  // put your main code here, to run repeatedly:

}
```



The Figure (2.6.2) the connection between LCD and Arduino UNO

Chapter Three

Implementation of conceptual design

3.1 Codding:

MH-RD rain detector is the sensor module that we are using here. The module has 4 pins: Vcc, A0, D0 and Gnd. Vcc and Gnd are connected to the supply pins of the Arduino. A0 and D0 are the analog and digital output pins of the module respectively. Since we need continuous change in rainfall, we will make use of the A0 pin instead of D0. The analog out from senor is then connected to one analog input pin of Arduino.

As mentioned earlier a servo motor is used here for wiper movements. Servo motor is a special kind of high torque dc motor whose shaft can be adjusted to desirable position by generating an appropriate PWM signal at its signal line. Here we connect the signal line of servo to one of the PWM pin of Arduino (i.e. digital pin 9). Next comes is the LCD module, which is for displaying the rainfall intensity. Interfacing of Arduino to 16×2 LCD is quite simple. JHD162A is the LCD module used here. JHD162A is a 16×2 LCD module based on the HD44780 driver from Hitachi. The JHD162A has 16 pins and can be operated in 4-bit mode (using only 4 data lines) or 8-bit mode (using all 8 data lines). Here we are using the LCD module in 4-bit mode. To facilitate communication between Arduino and LCD module, we make use of a built in library in Arduino <LiquidCrystal.h> – which is written for LCD modules making use of the Hitachi HD44780 chipset (or a compatible chipset). Control pin RS, RW and En are directly connected to arduino pin 13, GND and 10. And data pin D4-D7 is connected to 7,6,5 and 4 of Arduino.

When the device is switched ON, the servo motor will turn the wiper to zero-degree position. After that the controller will continuously checks the signal from rain sensing module. If the signal from the module goes beyond a minimum value, the servo motor begins to operate. The speed of operation of servo will be varied according to the strength of the signal. And the intensity of rainfall will be displayed on the LCD according to the signal strength.

The complete program code is shown below:

```
#include <LiquidCrystal.h>
#include <Servo.h>
LiquidCrystal lcd(11,10,7,6,5,4);
Servo myservo;

int pos = 0;
int sensorValue = 0;

void setup() {
  Serial.begin(9600);
  lcd.begin(16,2);
  myservo.attach(9);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Intelligent Rain");
  lcd.setCursor(0,1);
  lcd.print("Sensing CarViper");
  delay(3000);
  lcd.clear();
  lcd.setCursor(5,0);
  lcd.print("Rainfall");
  lcd.setCursor(0,1);
  lcd.print("Intensity-");
}
void wipe(int Speed)
{

  if(Speed>400){Speed=5000;lcd.print("  LOW ");}
  if(Speed>350&&Speed<=400){Speed=3000;lcd.print("MEDIUM");}
  if(Speed<=350){Speed=500;lcd.print(" HIGH ");}
  for (pos = 180; pos >= 0; pos--) {
    myservo.write(pos);
    delay(3);
  }
  for (pos = 0; pos <= 180; pos++) {
    myservo.write(pos);
    delay(3);
  }
  delay(Speed);
}
void loop()
{
lcd.setCursor(10,1);
sensorValue = analogRead(A0);
Serial.println(sensorValue);
if(sensorValue>600){myservo.write(180);lcd.print(" NIL  ");delay(1000);}
if(sensorValue<=600){lcd.setCursor(10,1);wipe(sensorValue);}
}
```

At the beginning, program will continuously check the reading from the rain sensor. A library called “Servo.h” is used here for servo operations. By calling the inbuilt function “myservo.write(angle)” we can turn the servo shaft to desired angle. One more library called “LiguidCrystal.h” is used, to facilitate communication between Arduino and LCD module. At the interfacing section the LiquidCrystal library is first initialized and then pins are defined using the command “LiquidCrystal lcd(RS, E, D4, D5, D6, D7)”.

The position of the servo will be at 0 degree at the beginning. The Arduino reads the sensor output through the analog input pins using the built in “analogRead(pin_number)” function. For example, “analogRead(sensorPin);” converts the voltage (in the range 0 to 5V) at the A0 pin into an integer in the range 0 to 1023. In this way the voltage at A0 is compared to a fixed number for identifying the current rainfall intensity. If the value obtained from the sensor goes beyond a specific limit, the controller will trigger the servo to operate. And the speed of operation will be varied according to the sensor output. A user defined function called “wipe(speed)” is used for controlling the servo speed. Meanwhile the intensity of rainfall will be displayed on the LCD module using the function “lcd.print(“low/medium/high”).

3.2 Hardware:

3.2.1 Connection diagram of the system:

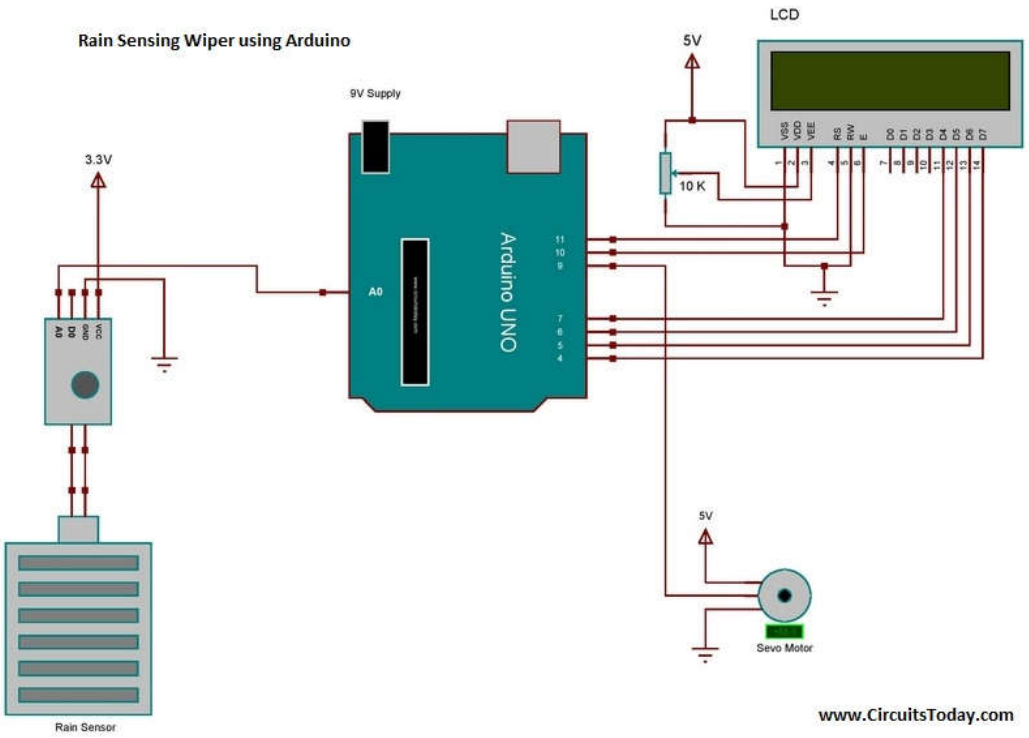


Figure 3.2.1: Connections between working parts with Arduino

3.3 The functional project assembly

As it's shown below, the sensor is mounted at the top of windshield near the rearview mirror. The servo motor connected with the wiper below the windshield.

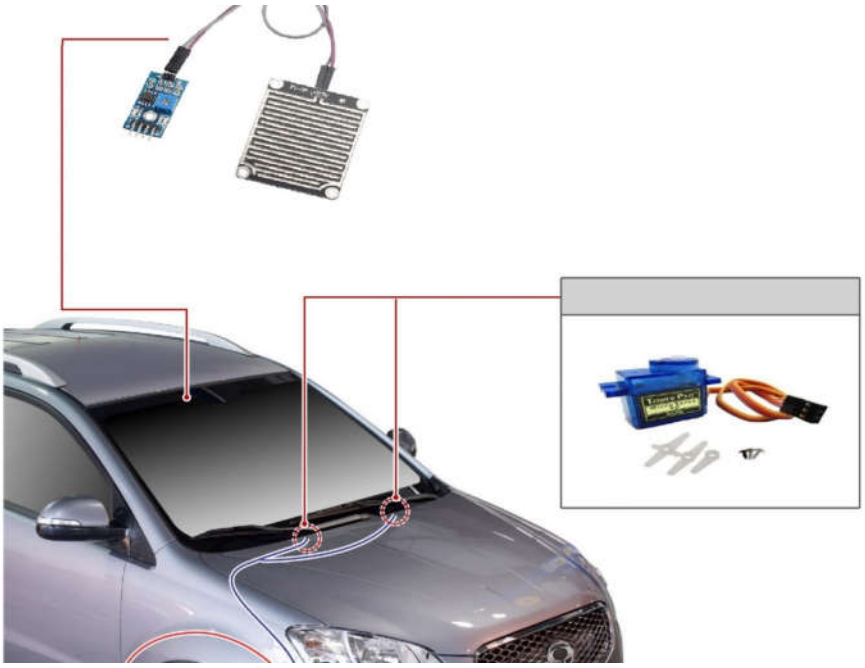


Figure 3.3.1 Exterior view of applied Components (rain sensor and Servo motor)

Figure 3.3.1 interior view of applied Components

Chapter Four

Conclusions:

An automatic wiper control system was built which is the modified version of the intermittent wiper system. This system improves the driver's level of comfort. Its need is more for the drivers who work at night and traffic prone areas where drivers has 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 also useful in home applications like cleaning the window glasses and it intimates the rainfall and also notify 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 1800 rather than 3600.
- The usage of better speed control mechanisms will guide wiper more effectively and reduce the consumption of battery power.

References

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[3] Engineering Circuit Analysis by William H. Hayt, Jr., Jack E.Kemmerly, Steven M.Durbin in 2002 by Tata Mcgraw-Hill Publishing Company Limited.