// include the library code:

#include <LiquidCrystal.h>

// initialize the library by associating any needed LCD interface pin

// with the arduino pin number it is connected to

const int rs = 4, en = 3, d4 = 2, d5 = 5, d6 = 6, d7 = 7;

LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

#define ph\_Pin A0

#define relayPin1 A1

#define relayPin2 A2

#define relayPin3 A3

float calibration = 21.34 + 5.20;  //change this value to calibrate

int sensorValue = 0;

unsigned long int avgValue;

float b;

int buf[10], temp;

float phValue;

int count = 0;

void setup() {

  Serial.begin(115200);

  lcd.begin(16, 2);

  lcd.setCursor(0, 0);

  lcd.print("PH Sensor");

  pinMode(relayPin1, OUTPUT);

  pinMode(relayPin2, OUTPUT);

  pinMode(relayPin3, OUTPUT);

  for(int i = 0; i < 30; i++)

  {

     ph\_Sensor();

     delay(1000);

  }

}

void loop() {

  count++;

  ph\_Sensor();

  delay(1000);

  if(count > 30)

  {

    digitalWrite(relayPin1, LOW);

    digitalWrite(relayPin2, LOW);

    digitalWrite(relayPin3, LOW);

    count = 31;

  }

  else if(count )

  if (phValue < 5.00) {

    digitalWrite(relayPin1, HIGH);

    digitalWrite(relayPin2, LOW);

    digitalWrite(relayPin3, LOW);

  } else if (phValue > 6.0 && phValue < 8.5) {

    digitalWrite(relayPin1, LOW);

    digitalWrite(relayPin2, HIGH);

    digitalWrite(relayPin3, LOW);

  } else if (phValue > 8.50) {

    digitalWrite(relayPin1, LOW);

    digitalWrite(relayPin2, LOW);

    digitalWrite(relayPin3, HIGH);

  }

}

void ph\_Sensor() {

  for (int i = 0; i < 10; i++) {

    buf[i] = analogRead(ph\_Pin);

    delay(10);

  }

  for (int i = 0; i < 9; i++) {

    for (int j = i + 1; j < 10; j++) {

      if (buf[i] > buf[j]) {

        temp = buf[i];

        buf[i] = buf[j];

        buf[j] = temp;

      }

    }

    avgValue = 0;

    for (int i = 2; i < 8; i++)

      avgValue += buf[i];

    float pHVol = (float)avgValue \* 4.8 / 1023.0 / 6;

    phValue = -5.70 \* pHVol + calibration;

   if(phValue < 6.5 )

   {

    phValue = phValue \* 0.6;

   }

   else if(phValue > 6 && phValue < 7.8)

   {

    phValue = phValue \* 1.03;

   }

   else if(phValue > 7.8)

   {

    phValue = phValue \* 1.3;

   }

    Serial.print("phValue   : ");

    lcd.setCursor(0, 0);

    lcd.print("PH\_Value: ");

    lcd.print(phValue);

    lcd.print("  ");

    Serial.println(phValue);

  }

}