Group - 11

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Experiment 3

Aim:

- Building the basic circuit for an Ohmmeter
- Displaying resistance on PC via serial monitor
- Interfacing an LCD
- Display the resistance on LCD
- Sound the buzzer on short-circuit

Building the basic circuit for an Ohmmeter and Displaying the Resistance

Circuit Diagram and Code

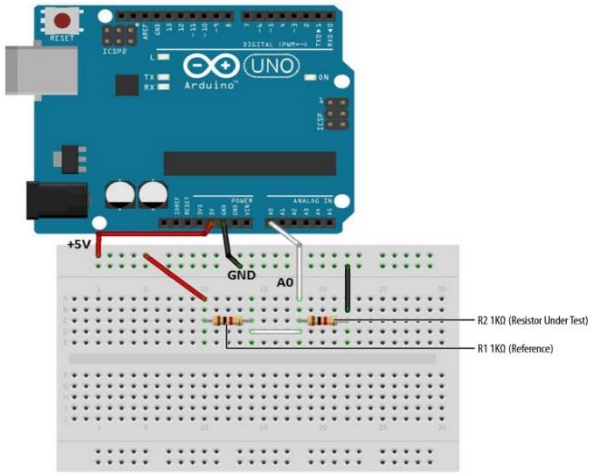
Ohmmeter

```
int analogPin = 0; // reads the resistance of R2
int raw = 0; // variable to store the raw input value
int Vin = 5; // variable to store the input voltage
float Vout = 0; // variable to store the output voltage
float R1 = 1000; // variable to store the R1 value
float R2 = 0; // variable to store the R2 value
float buffer = 0; // buffer variable for calculation
void setup()
{
Serial.begin(9600); // Set up serial
}
void loop(){

  raw = analogRead(analogPin);
  if (raw){

    buffer = raw * Vin;
    Vout = buffer /1023.0; // calculates the voltage on the input pin
    buffer = (Vin / Vout) - 1;
    R2 = R1 / buffer;
    Serial.print("Vout: ");
    Serial.println(Vout); // outputs the information
    Serial.print("R2: "); //
    Serial.println(R2); //
    delay(1000);
  }

}
```



Interfacing an LCD

Circuit Diagram and Code

LCD_interface

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(8, 9, 4, 5, 6, 7);
#define Xdelay 1900
void setup() {
  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.setCursor(0,0);
  lcd.print("Group No. 11");
  delay(Xdelay);
}

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

Displaying the Resistance on LCD

Code

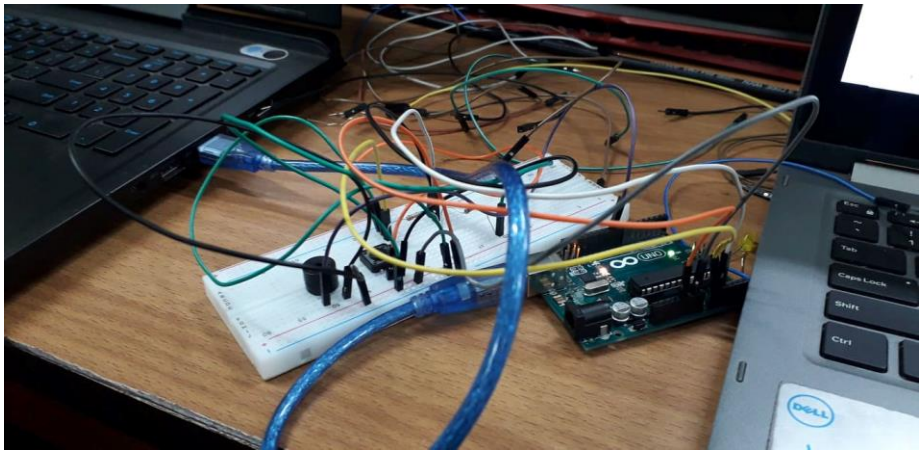
LCD_Res

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(8, 9, 4, 5, 6, 7);
int known = A1;
int known_resistance = 1000;
void setup() {
  pinMode(known, INPUT);
  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.setCursor(0,0);
  lcd.print("Group No. 11");
}

void loop() {
  // put your main code here, to run repeatedly:
  lcd.setCursor(0,1);
  int observed_voltage = analogRead(known);
  Serial.println(observed_voltage);
  float voltage = (float)(5*observed_voltage)/1023;
  float current = (5 - voltage)/known_resistance;
  float unknown_resistance = voltage/current;
  lcd.print("resistance = ");
  lcd.print(unknown_resistance);
}
```

Sound the buzzer on short circuit

Circuit Diagram, Video and Code



Link to the video:

https://drive.google.com/file/d/158D9NIE4USI3d_NCTpjH4ddYrVhvOsGR/view?usp=sharing

Buzzer

```
const int analog1 = A0;
const int analog2 = A1;
const int buzzer = 9;
float val = 0.0;
void setup() {
  // put your setup code here, to run once:
  pinMode(buzzer, OUTPUT);
  Serial.begin(9600);

}

void loop() {
  int v1 = analogRead(analog1);
  int v2 = analogRead(analog2);
  val = (v1-v2)/1023.0;
  Serial.print("v1 = ");
  Serial.print(v1);
  Serial.print(" v2 = ");
  Serial.print(v2);
  Serial.println(val);
  if (val<0.0){
    tone(buzzer, 5000);
  }
  else{
    noTone(buzzer);
  }
  // put your main code here, to run repeatedly:

}
```

Discussions

1) The operation of the Arduino Ohmmeter is based around the concept of the *voltage divider*. Two resistors are connected in series, and the reading is taken from where the two resistors join. The voltage measured at that point is the ratio of R2/(R1+R2) multiplied by the voltage in. For example, if R2 is 10K and R1 is 10K, then the ratio is 1/2; multiplying that by 5 volts returns 2.5 volts. The Arduino Ohmmeter uses that relationship between voltage and resistance slightly differently. It knows that it started with 5 volts from the VCC pin. It also knows that the reference R1 has a value of 1K ohms. It then reads the divided voltage at analogue pin 0. Using those numbers, it is relatively easy to calculate the value of the object at R2.

   R2=R1/(Vin/Vout - 1)

2) The Liquid Crystal library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. A register select (RS) pin controls where in the LCD's memory you're writing data to. You can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next. A Read/Write (R/W) pin selects

reading mode or writing mode. An Enable pin enables writing to the registers. The states of the 8 data pins (D0 -D7) pins (high or low) are the bits that you're writing to a register when you write, or the values you're reading when you read. There's also a display contrast pin (Vo), power supply pins (+5V and Gnd) and LED Backlight (Bklt+ and BKlt-) pins that you can use to power the LCD, control the display contrast, and turn the LED backlight on and off, respectively.

3) For the buzzer experiment, the circuit was similar to that used for the ohmmeter. Here a pushbutton was connected in parallel to one of the resistors and we sense the voltage across its two ends. Whenever the pushbutton is pressed, the resistor gets shorted and we check if the voltage difference across it is <= 0 V. This condition is used to trigger a digital PWM pin connected to the piezo buzzer. The buzzer then emits a sound at a frequency of 5 kHz.