



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with
'A++' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University,
Chennai



DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT213- IoT SYSTEM ARCHITECTURE

II ECE / IV SEMESTER

UNIT 3 – ACTUATORS AND IOT NETWORKING DEVICES

TOPIC 1 –Programming and Interfacing of Actuators: Liquid Crystal Display



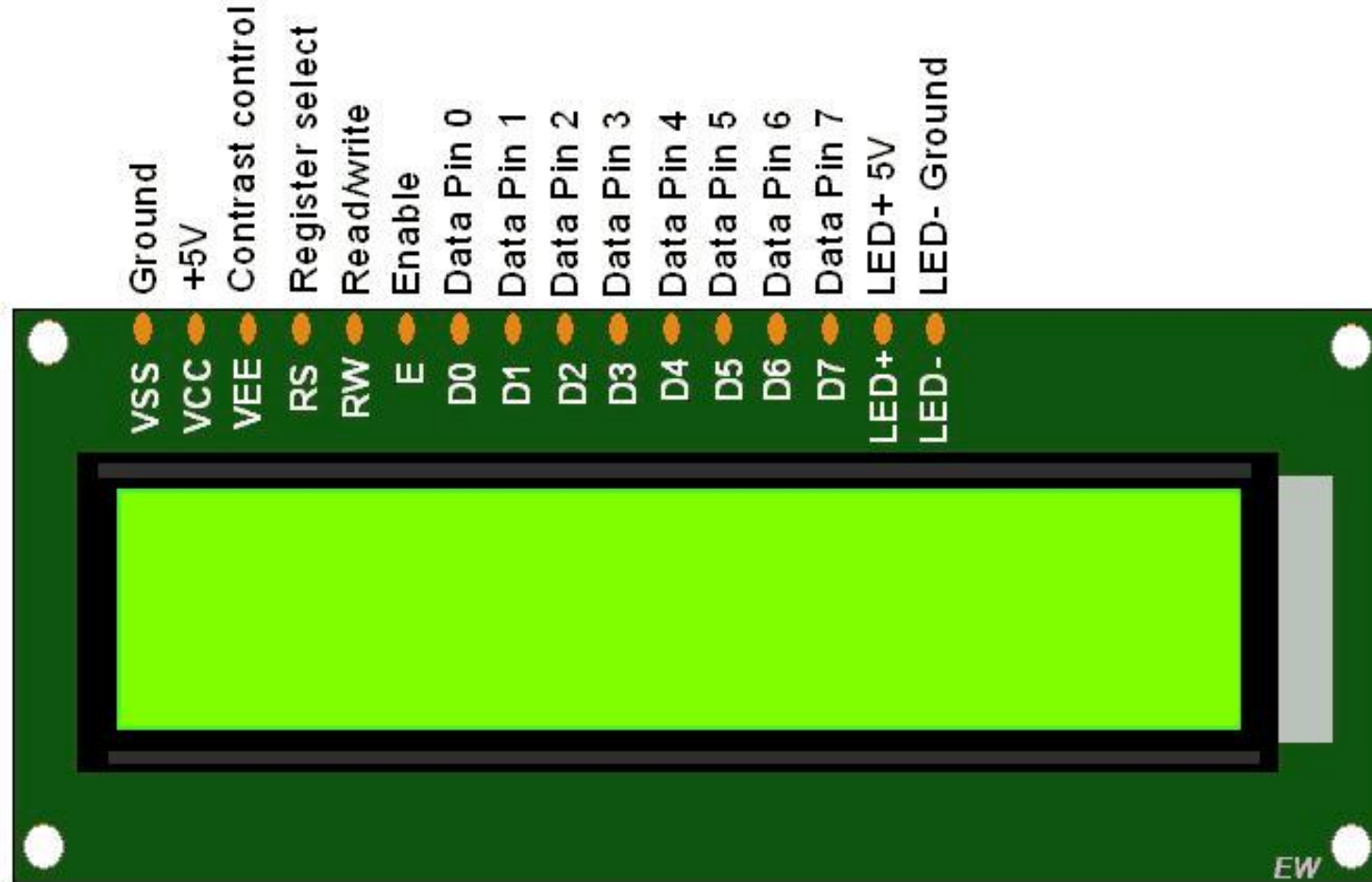
1.1 - LCD -Liquid Crystal Display



- It is a flat panel display technology, mainly used in TVs and computer monitors, nowadays it is used for mobile phones also.
- In LCD, each pixel consists of a layer of molecules aligned between two transparent electrodes and two polarizing filters, the axes of transmission perpendicular to each other.
- The LCD is finding widespread use by replacing the LEDs
- LCDs use much less power than their CRT counterparts. The size of LCDs is all small.
- In LCDs, there is no bulky picture tube. These factors make the LCDs practical where size and weight are essential



LCD 16x2 Interfacing With Arduino Uno



- pin 1 - **GND** - Ground
- pin 2 - **Vcc** - power supply (5v)
- pin 15 - Backlight (+) - 5V
- pin 16 - Backlight (-) - Gnd
- pin 3 - **Contrast** (adjustable with potentiometer)
- pin 4 - **Register Select**
- pin 5 - **Read or Write**
- pin 6 - **Enable**
- pin 7 to pin 14 (D0 - D7) - **Data pins**



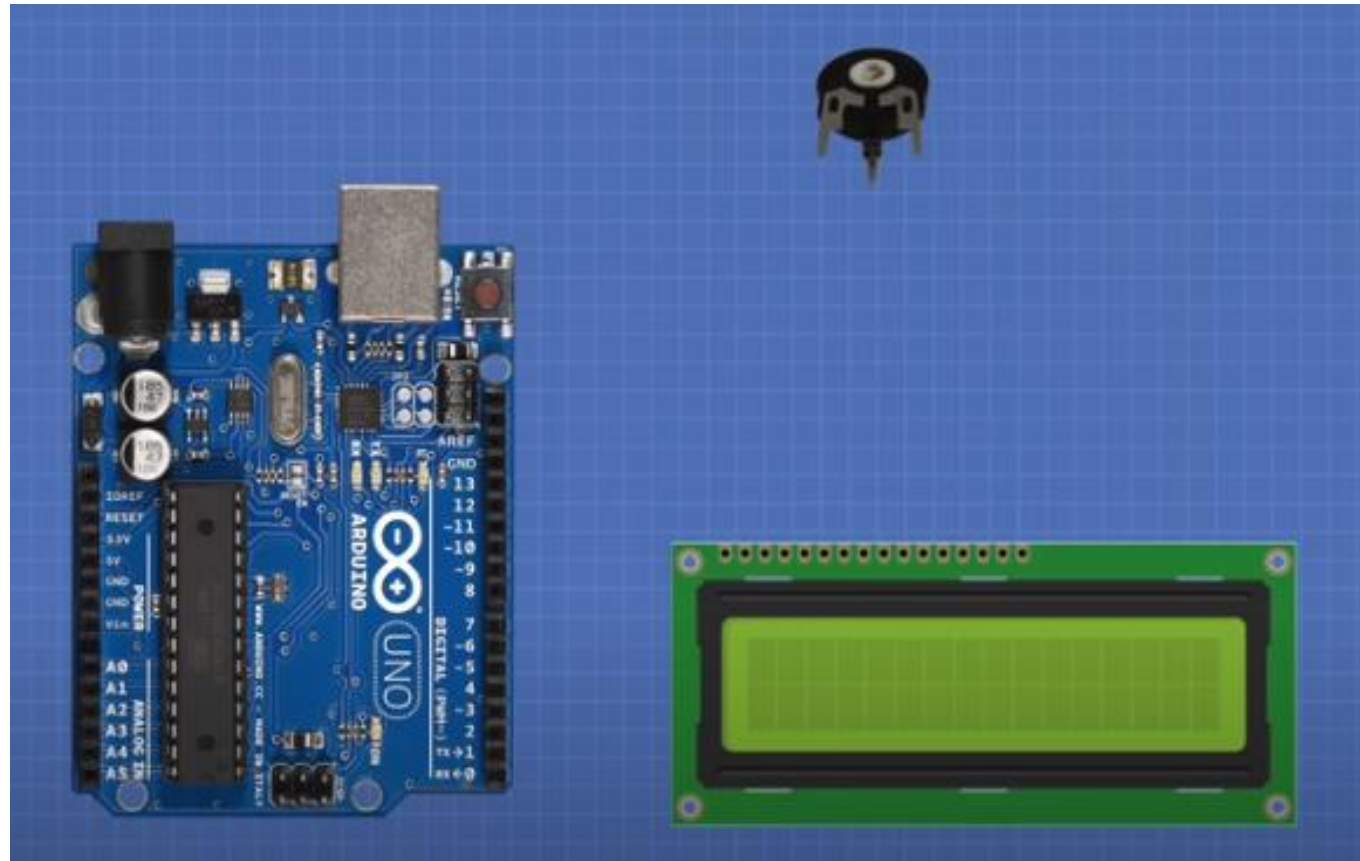
Specifications of 16×2 LCD



- **Contrast (pin 3)** - connected to potentiometer to adjust the text contrast . depending upon potentiometer output contrast is adjusted.
- **Register Select (pin 4)** - switch between two registers (data or instruction registers) . Data register holds the display data of the screen . Instruction register holds the next operation to execute.
- **Read / Write (pin 5)** - High - Reads from register . Low - write to register.
It is permanently grounded to write.
- **Enable (pin 6)** - enables inputing data into the data pins.
- **Data pins (D0 - D7)** - It has two modes 4 bit or 8 bit mode.
 - In **4 bit mode** , last four significant bits (D4 - D7) are used.
 - In **8 bit mode** , all bits are used (D0 - D7).
 - 4 bit mode is commonly used.

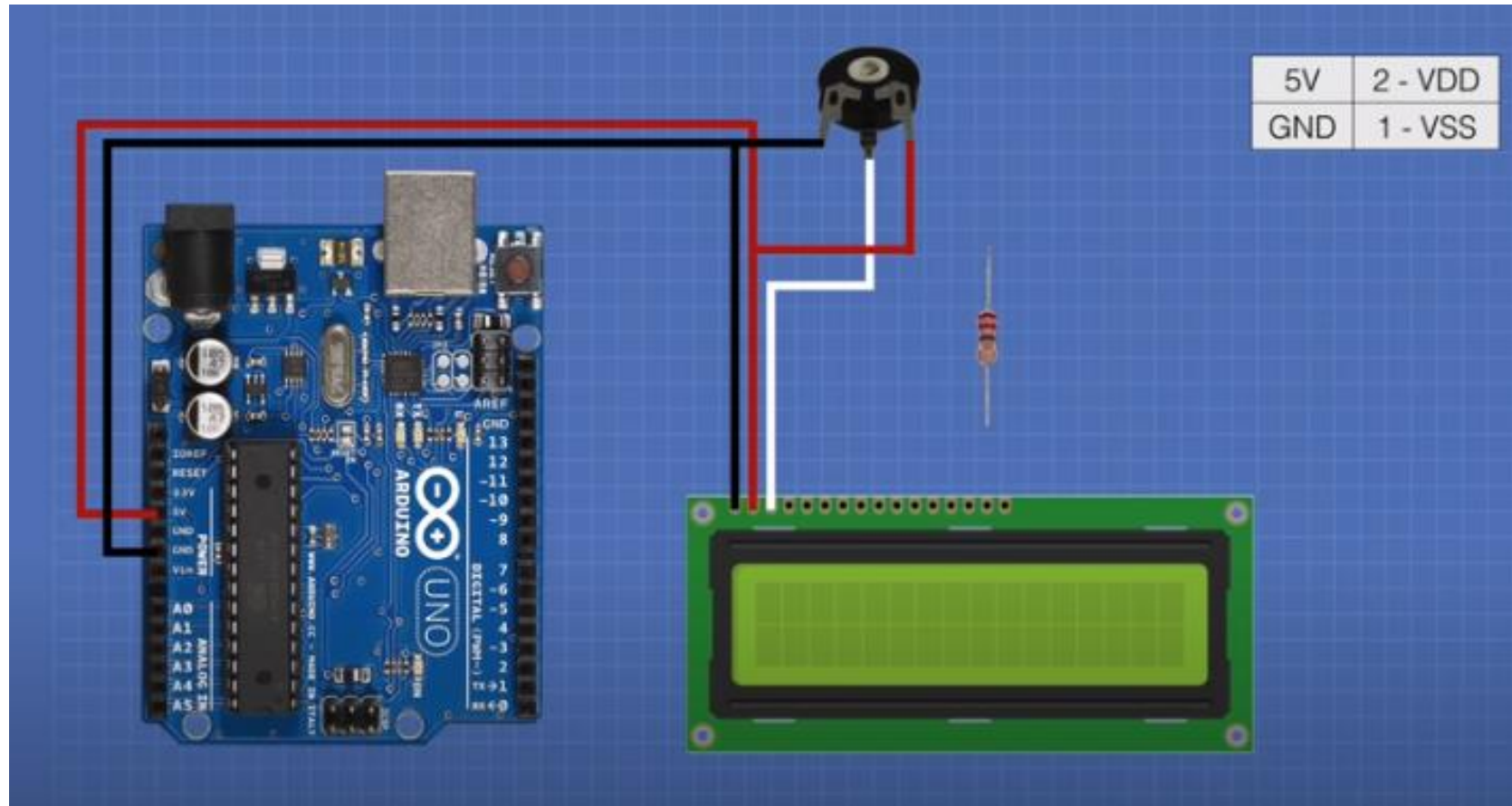


LCD 16x2 Interfacing With Arduino Uno



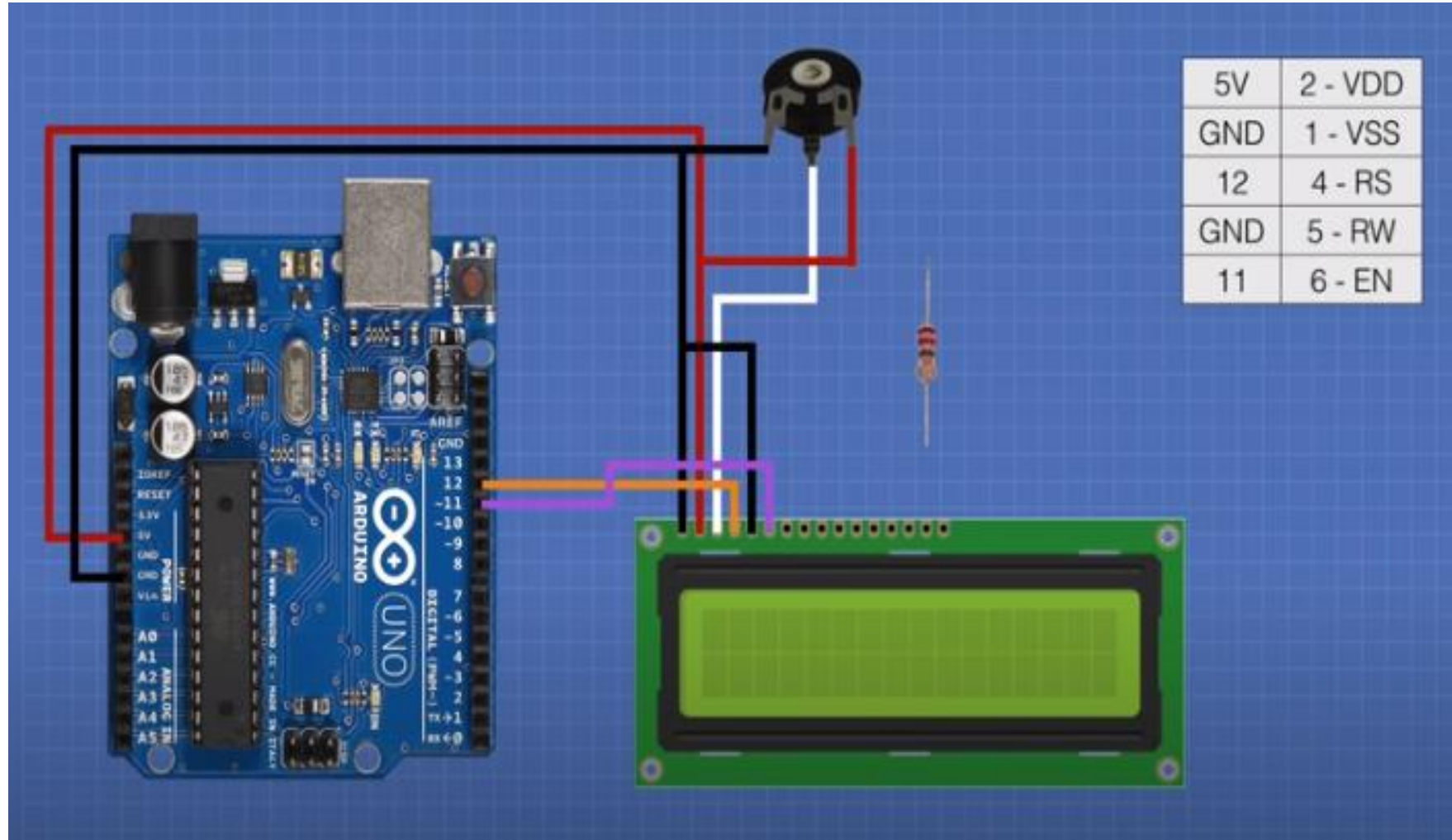


LCD 16x2 Interfacing With Arduino Uno



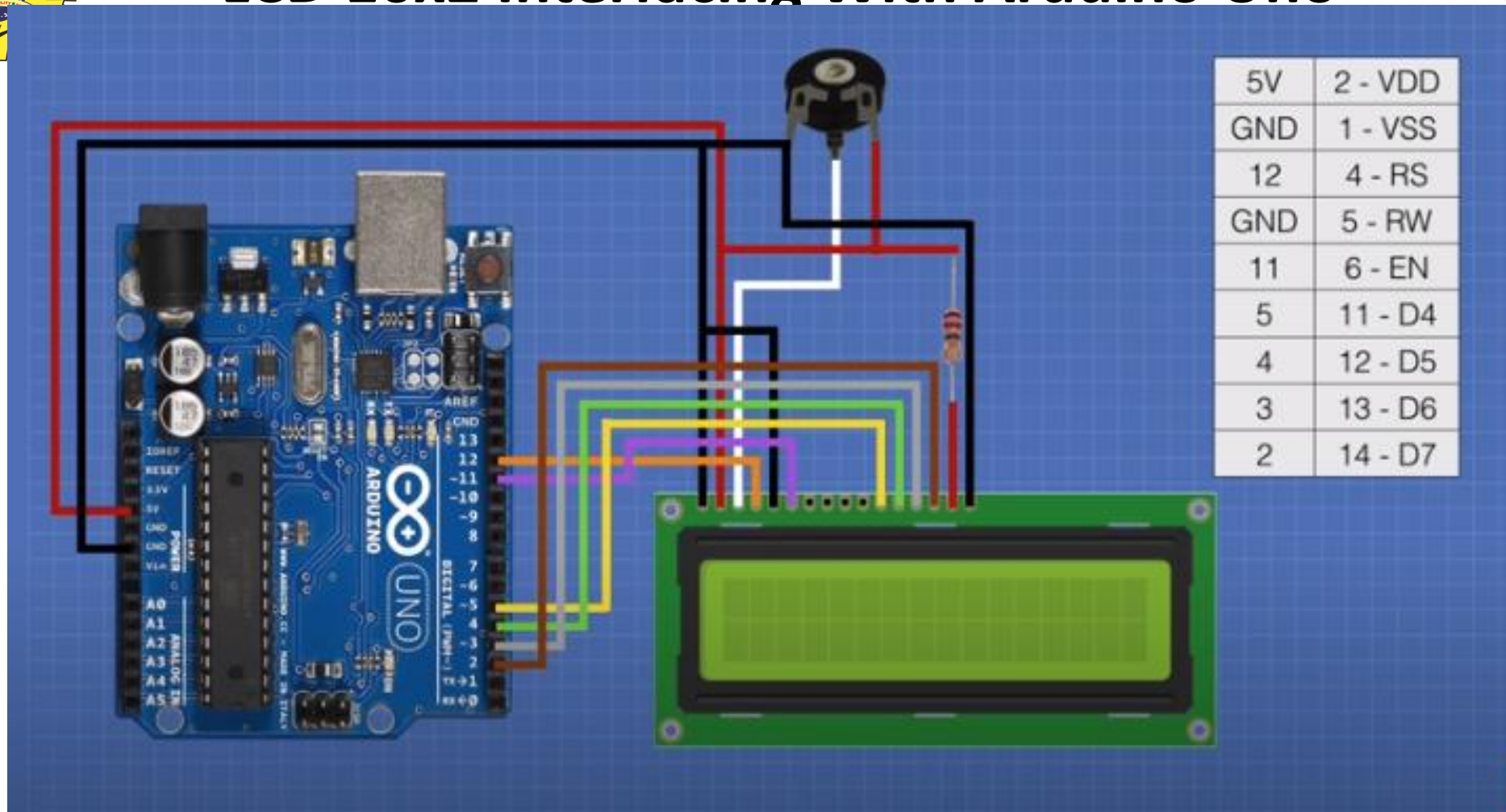


LCD 16x2 Interfacing With Arduino Uno





LCD 16x2 Interfacing With Arduino Uno





LCD 16x2 Interfacing With Arduino Uno



```
// 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 = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
```

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

```
void setup() {
```

```
    // set up the LCD's number of columns and rows:
```

```
    lcd.begin(16, 2);
```

```
    // Print a message to the LCD.
```

```
    lcd.print("hello, world!"); }
```

```
void loop() {
```

```
    // set the cursor to column 0, line 1 // (note: line 1 is the second row, since counting begins with 0):
```

```
    lcd.setCursor(0, 1);
```

```
    // print the number of seconds since reset:
```

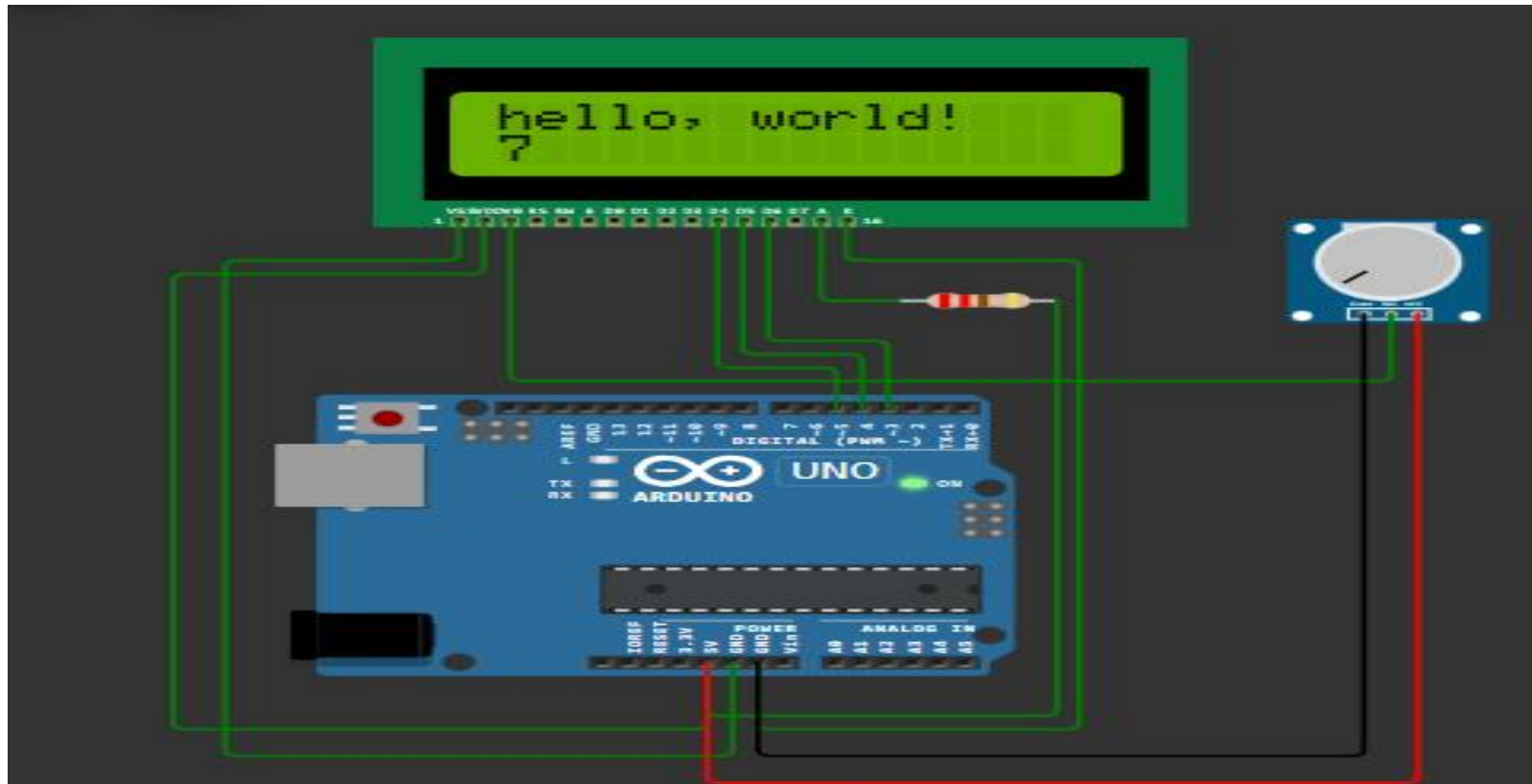
```
    lcd.print(millis() / 1000); }
```



LCD 16x2 Interfacing With Arduino Uno



- Simulation <https://wokwi.com/projects/390504875666724865>

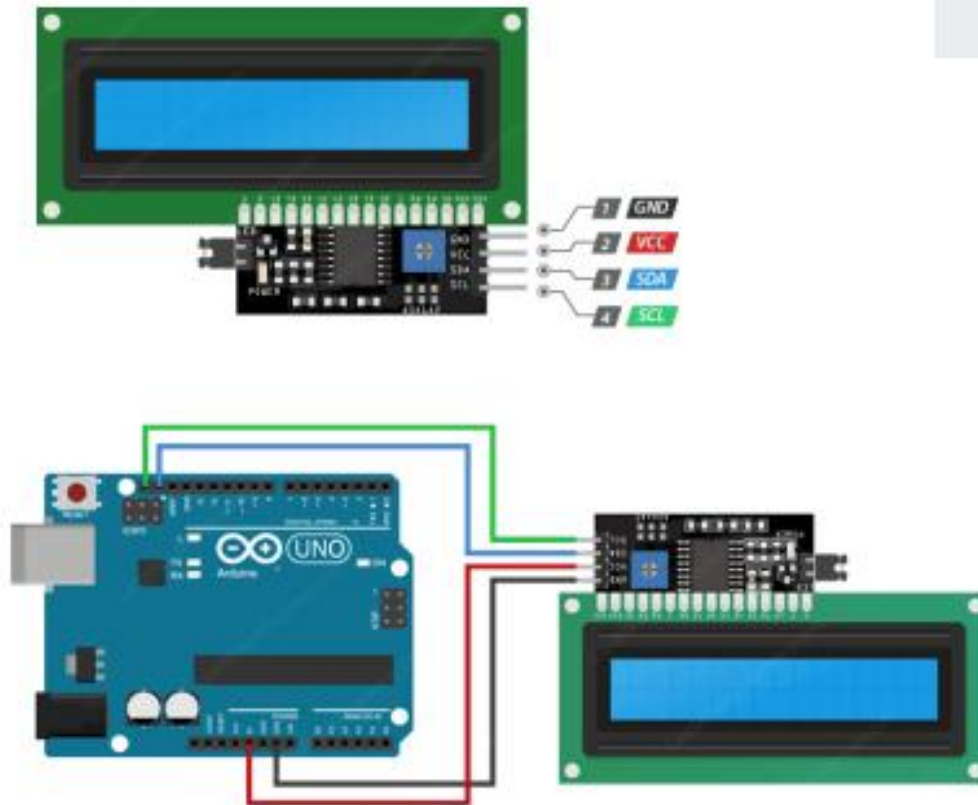




Interfacing I2C LCD With Arduino Uno



interfacing I2C lcd with Arduino



```
#include <LiquidCrystal_I2C.h> // include library for i2c lcd
```

```
LiquidCrystal_I2C lcd(0x3F,16,2); // sets address and dimensio
```

```
void setup() {  
  lcd.init();  
  lcd.clear();  
  lcd.backlight();  
  lcd.setCursor(2,0); //Set cursor to character 2 on line 0  
  lcd.print("Hello world!");  
  lcd.setCursor(2,1); //Move cursor to character 2 on line 1  
}
```

```
void loop() {  
}
```

SCL SDA

Arduino Uno

A5 A4

The module is an 8-Bit I/O Expander chip - PCF8574. This chip converts the I2C data from an Arduino into the parallel data