SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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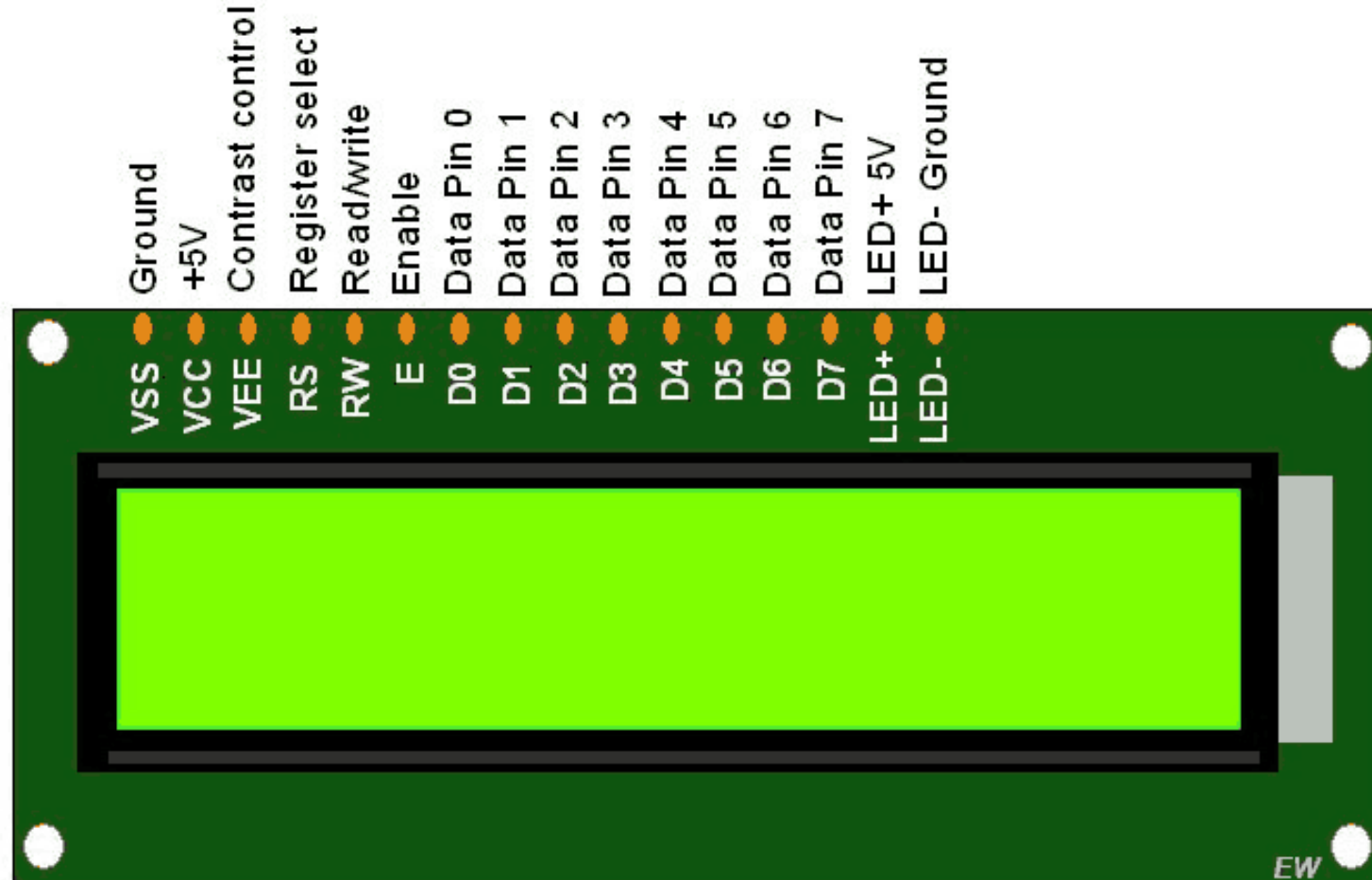
- pin 1 - **GND** - Ground
- pin 2 - **Vcc** - power supply (5v)
- pin 15 - Backlight (+) - 5V
- pin 16 - Backlight (-) - Gnd
- pin 3 - **Contrast** (adjustable with potentiometer)
- pin 4 - **Register Select**
- pin 5 - **Read or Write**
- pin 6 - **Enable**
- pin 7 to pin 14 (D0 - D7) - **Data pins**

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 - D4).
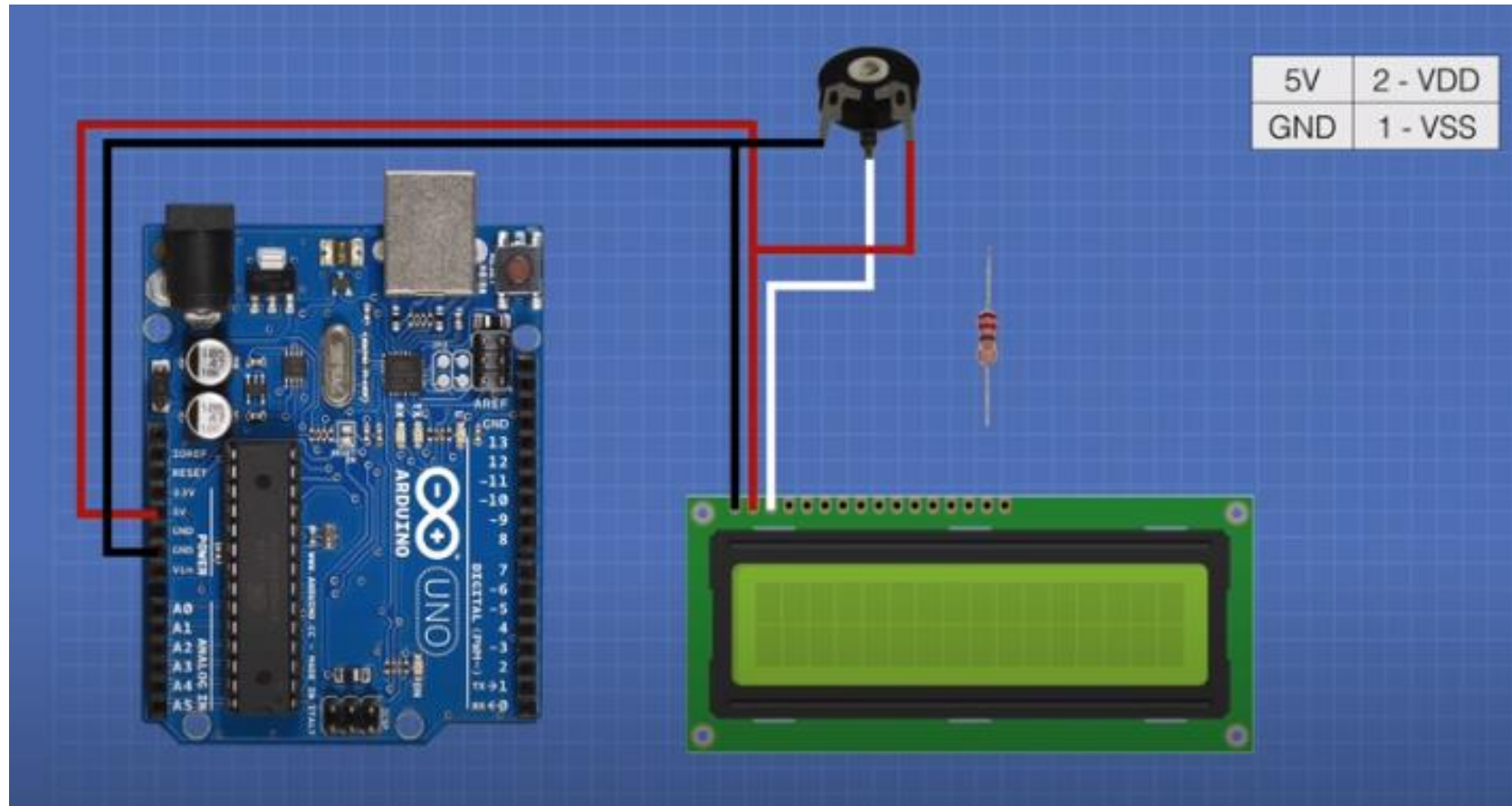 - 4 bit mode is commonly used.
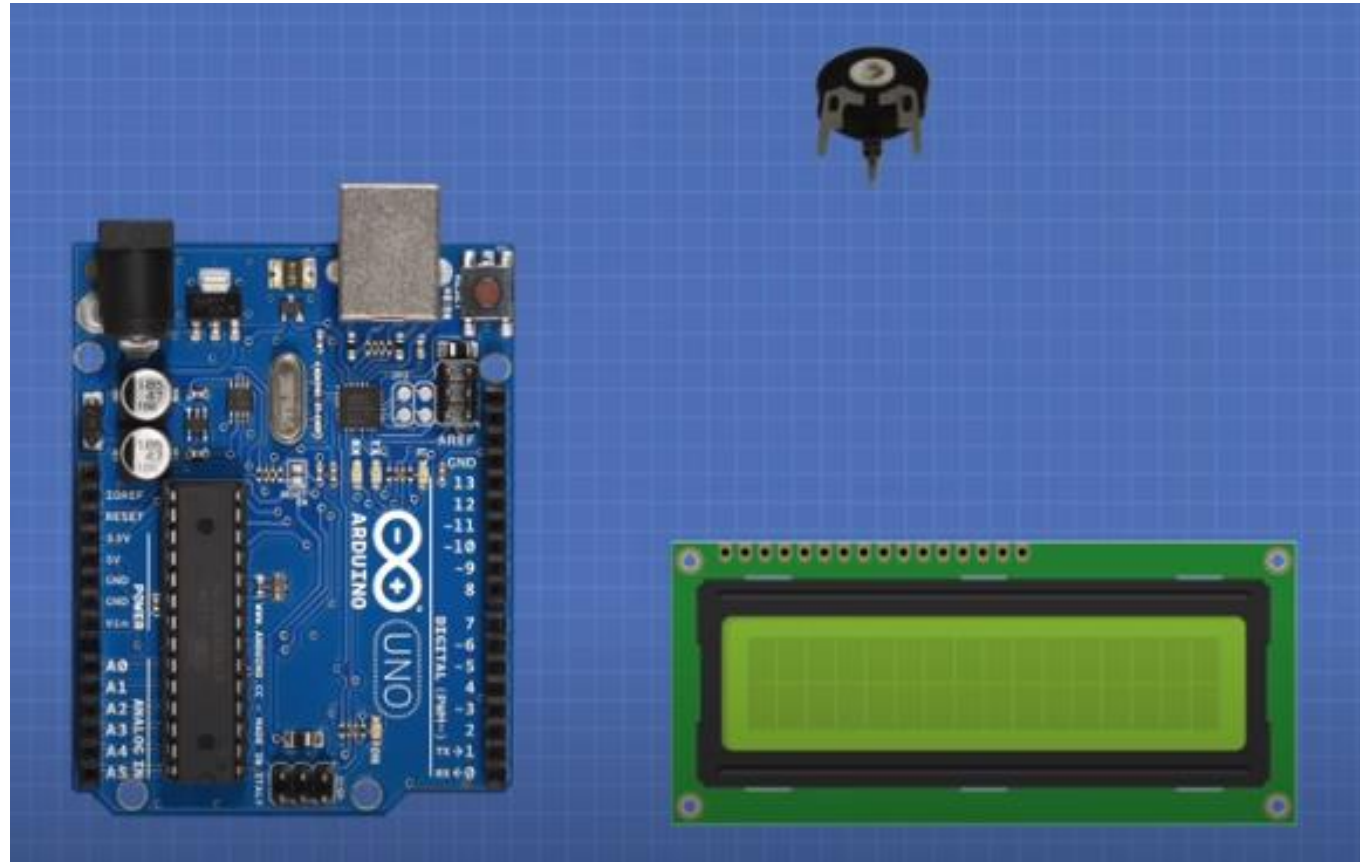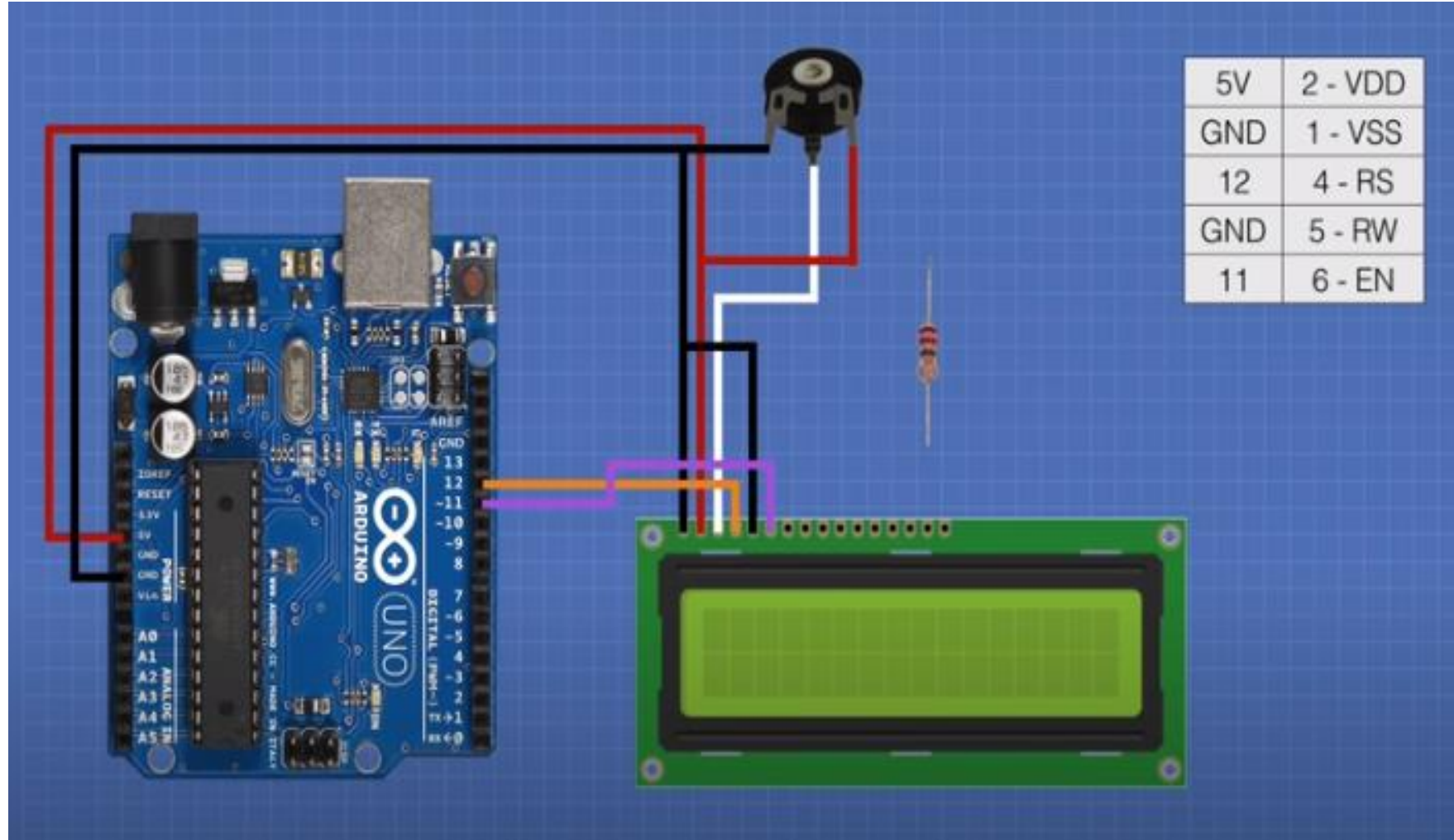
LCD 16x2 Interfacing With Arduino Uno
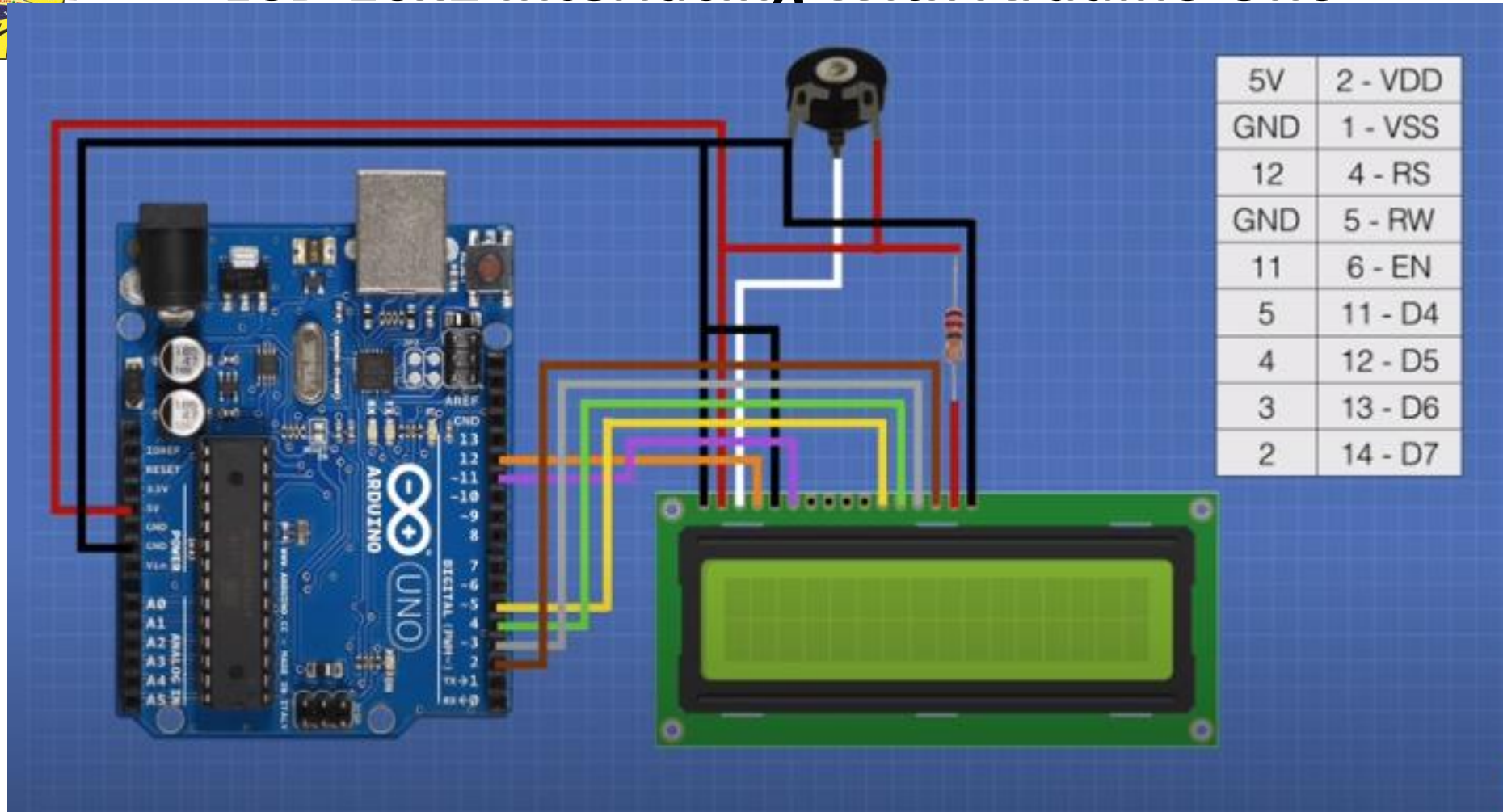
LCD 16x2 Interfacing With Arduino Uno

| 5V | 2 - VDD |
| GND | 1 - VSS |

LCD 16x2 Interfacing With Arduino Uno

5V	2 - VDD
GND	1 - VSS
12	4 - RS
GND	5 - RW
11	6 - EN

LCD 16x2 Interfacing With Arduino Uno

5V	2 - VDD
GND	1 - VSS
12	4 - RS
GND	5 - RW
11	6 - EN
5	11 - D4
4	12 - D5
3	13 - D6
2	14 - D7

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);   }
```
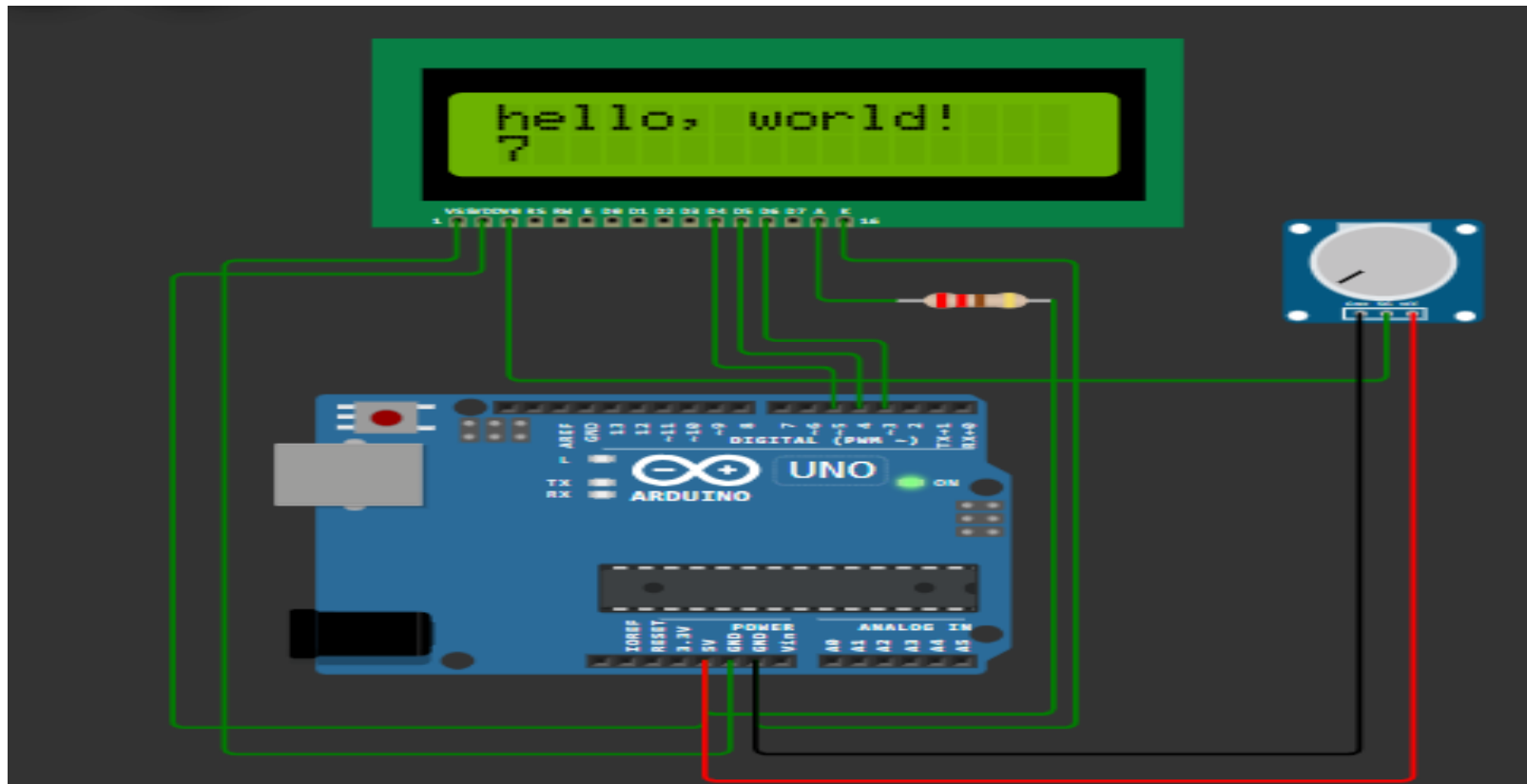
LCD 16x2 Interfacing With Arduino Uno

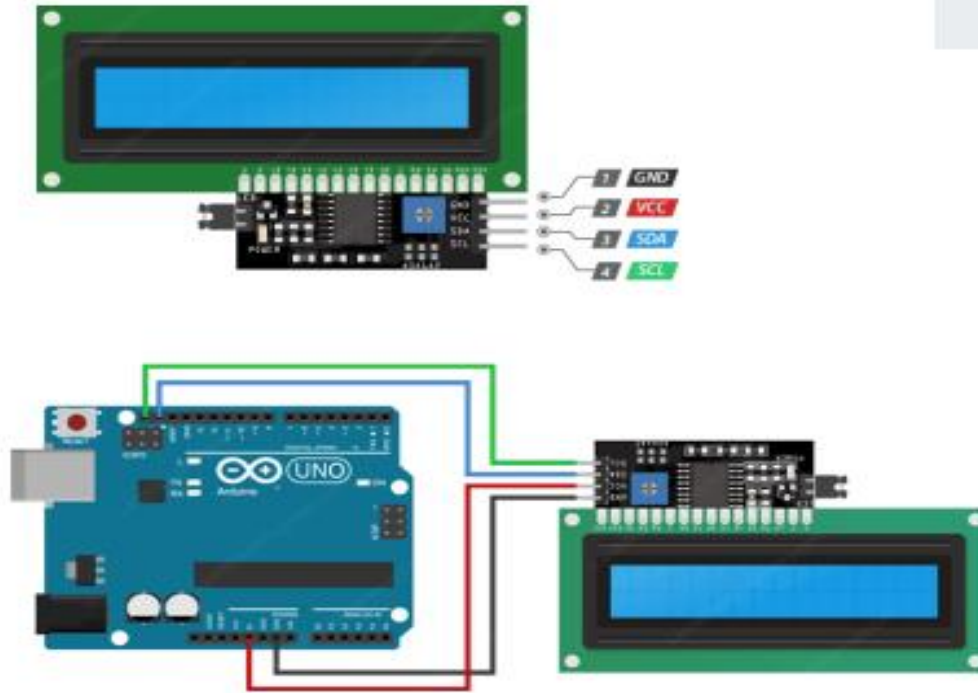- Simulation https://wokwi.com/projects/390504875666724865

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 required by the LCD display.

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