Arduino: LCD Screen and Touchpad

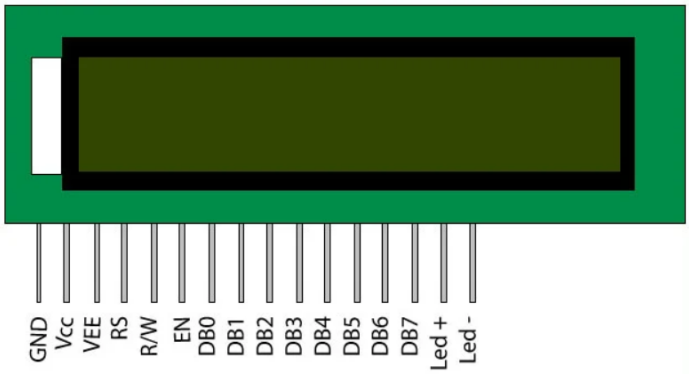
By: Matthew Jourden
Brighton High School
Brighton, MI

LCD Screen: You can easily interface a liquid crystal display (LCD) with an Arduino to provide a user interface.

Liquid crystal displays (LCDs) are a commonly used to display data in devices such as calculators, microwave ovens, and many other electronic devices..

In this tutorial, I will show you how to use a 16x2 LCD with an Arduino. The 16x2 LCD used in this experiment has a total of 16 pins. As shown in the table below, eight of the pins are data lines (pins 7-14), two are for power and ground (pins 1 and 16), three are used to control the operation of LCD (pins 4-6), and one is used to adjust the LCD screen brightness (pin 3). The remaining two pins (15 and 16) power the backlight. The details of the LCD terminals are as follows:

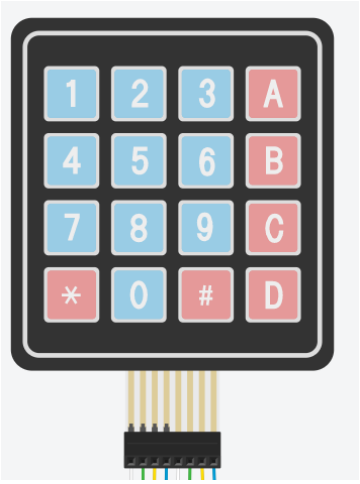
Terminal 1	GND
Terminal 2	+5V
Terminal 3	Mid terminal of potentiometer (for brightness control)
Terminal 4	Register Select (RS)
Terminal 5	Read/Write (RW)
Terminal 6	Enable (EN)
Terminal 7	DB0
Terminal 8	DB1
Terminal 9	DB2
Terminal 10	DB3
Terminal 11	DB4
Terminal 12	DB5
Terminal 13	DB6
Terminal 14	DB7
Terminal 15	+4.2-5V
Terminal 16	GND



LCD pins

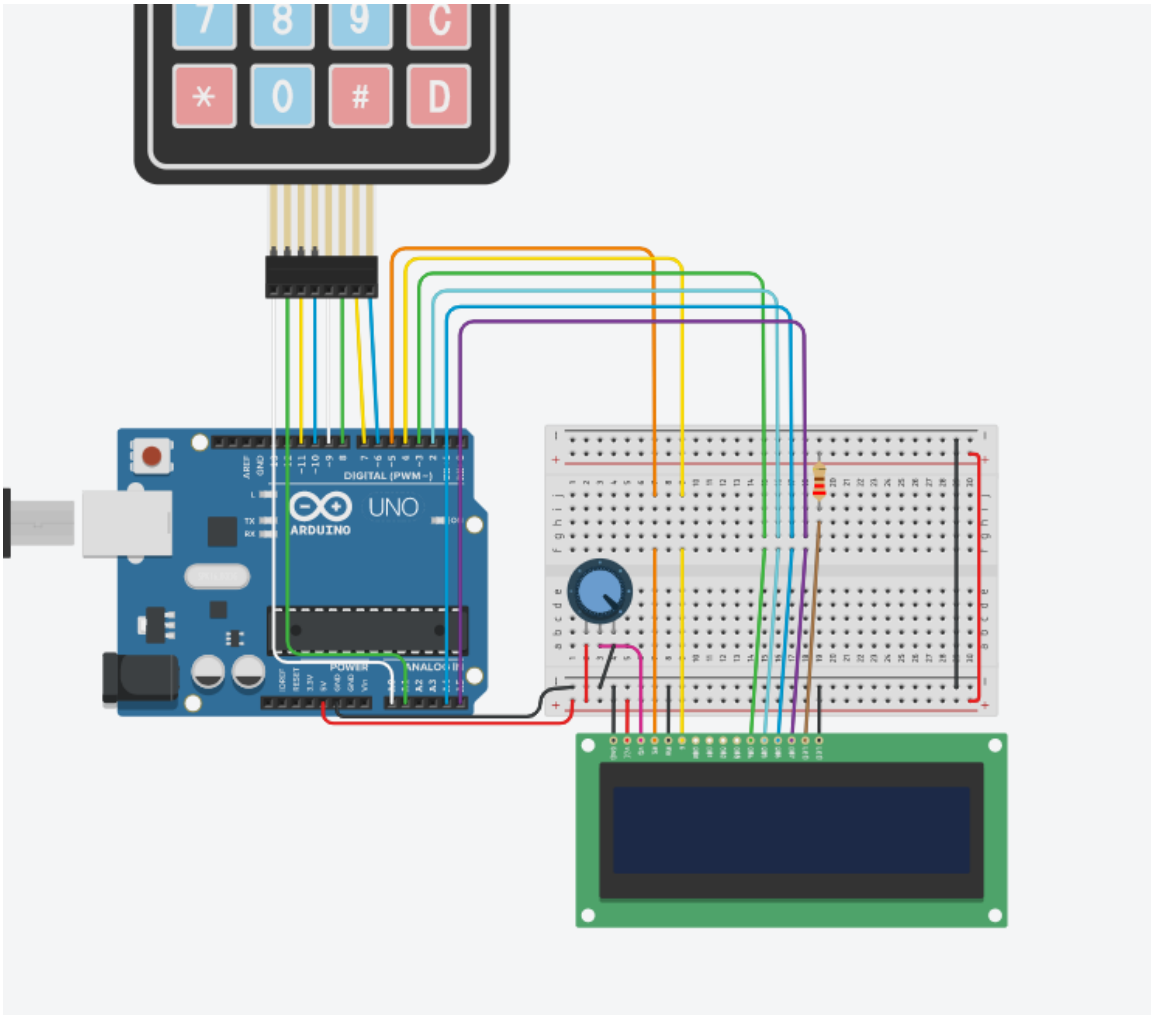
LCD Modules are also produced where the LCD Monitor is mounted to an integrated circuit that has 4 pins (opposed to 16 pins) and potentiometer (adjusts brightness)

Touchpad: Standard number pad found with computers



Objective: Type in information on the touchpad and have it appear on the LCD Screen

1. Navigate to TinkerCAD > Create the following circuit > Circuit > Create a New Circuit > Rename to LCD and Touchpad > Create the following Circuit



2. Write the following program

```
#include <Keypad.h>
#include <LiquidCrystal.h>

LiquidCrystal lcd(5, 4, 3, 2, A4, A5);          // initialize the library with the numbers of the interface pins


//2-Dimension Array Setup.  Arrays allows users to store multiple data values using only one variable
//2D Array looks like a tic-tac-do board
const byte ROWS = 4;                            //four rows
const byte COLS = 4;                            //three columns
char keys[ROWS][COLS] = {                       //Assigns Keypad values in the array
  {'1','2','3','A'},
  {'4','5','6','B'},
  {'7','8','9','C'},
  {'*','0','#','D'}
};

byte rowPins[ROWS] = {A0, A1, 11, 10};          //connect to the row pinouts of the keypad
byte colPins[COLS] = {9, 8, 7, 6};              //connect to the column pinouts of the keypad
int LCDRow = 0;

//Variable type of Keypad with a variable of keypad
//Links 2D array to variable keypad
Keypad keypad = Keypad( makeKeymap(keys), rowPins, colPins, ROWS, COLS );
```

```
void setup(){
   Serial.begin(9600);
   lcd.begin(16, 2);                            //Sets LCD Screen 2 rows with 16 columns
   lcd.setCursor(LCDRow, 0);                    //Places cursor in row 1 which is equal to value of 0
                                                //Row 2 equals to a value of 1
                                                //This is do due how an array is read.  See Mr Jourden for more details
   }

void loop(){
  char key = keypad.getKey();                   //Accepting user input from the keypad

  if (key){                                     //Taken User input and display on screen
    Serial.println(key);
    lcd.print(key);
    lcd.setCursor (++LCDRow, 0);
  }
}
```

Assignment:

Add the following component and modify the code to meet the scenario

Scenario: Number Guessing Game

1. Generate a random number > Use the following Code

```
long randNumber;

void setup() {

  // if analog input pin 0 is unconnected, random analog
  // noise will cause the call to randomSeed() to generate
  // different seed numbers each time the sketch runs.
  // randomSeed() will then shuffle the random function.
  randomSeed(analogRead(0));
  randNumber = random(10);         // print a random number from 0 to 9
}

void loop() {}
```

2. Give User 3 Guesses
   a. If User Guesses the correct number on Print on Row 1 > "Congratulations"
   b. If User does not guess the number after 3 attempts > "Too Bad"
   Set specific User Output Sample Code

```
// include the library code:
#include <LiquidCrystal.h>

// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

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);
}
```

3. Clear LCD Screen
   a. Use the following Code: lcd.clear();
4. Add RGB LED
   a. Green Color: When Answer is guessed correctly
   b. Red Color: When 3 Guesses are up
   c. Blue Color: When Guessing

Submission: To Submit TinkerCAD Tutorials and Assignments: Select Share Icon (Top Right Corner) > Select Invite People > Copy URL > Navigate to Student Email Account > Compose a New Email > To: jourdem@brightonk12.com > Fill Subject Heading TinkerCAD "Tutorial or Assignment" "Tutorial/Assignment Name" > Send