Building a DumbPhone

A) Set-up

1. For this we will be using Tinkercad. Go to:

   ### www.tinkercad.com

   To use Tinkercad you either need a **free account** or **classroom code**.

2. After logging in, click **Circuits** and **Create new Circuit**.

3. In the top right, find **Components** and change it to list **All** rather than Basic. Then find and assemble the following components in the Build Area:

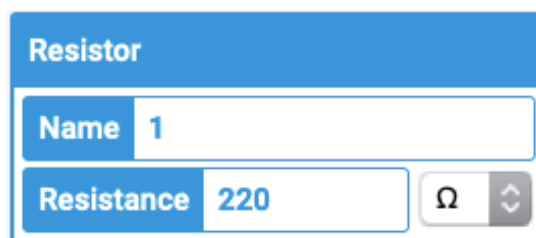 | | | |
   |---|---|---|
   | 1x **Arduino Uno** | 1x **Breadboard Small** | 1x **LCD 16 x 2** |
   | 1x **Piezo Speaker** | 1x **Resistor** | 1x **Keypad 4 x 4** |

4. Click on your **resistor** and change its **resistance** to **220 Ω**.
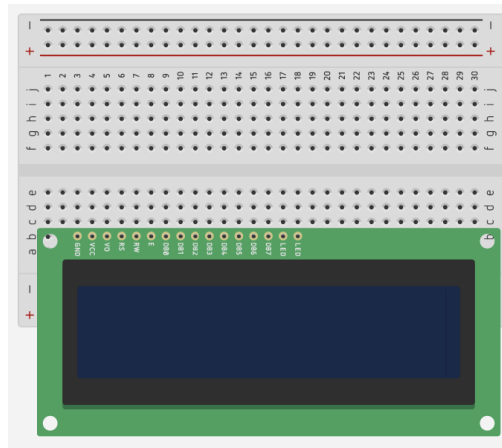
Building a DumbPhone

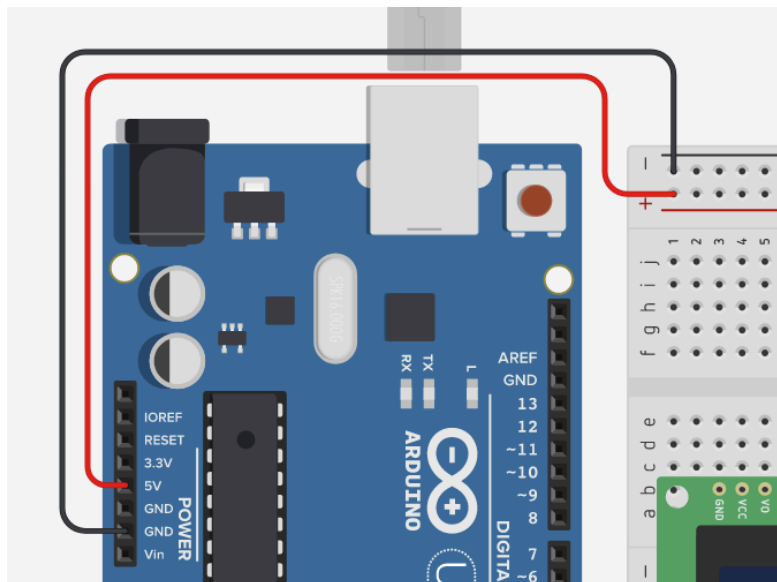## B) Assembling the Components
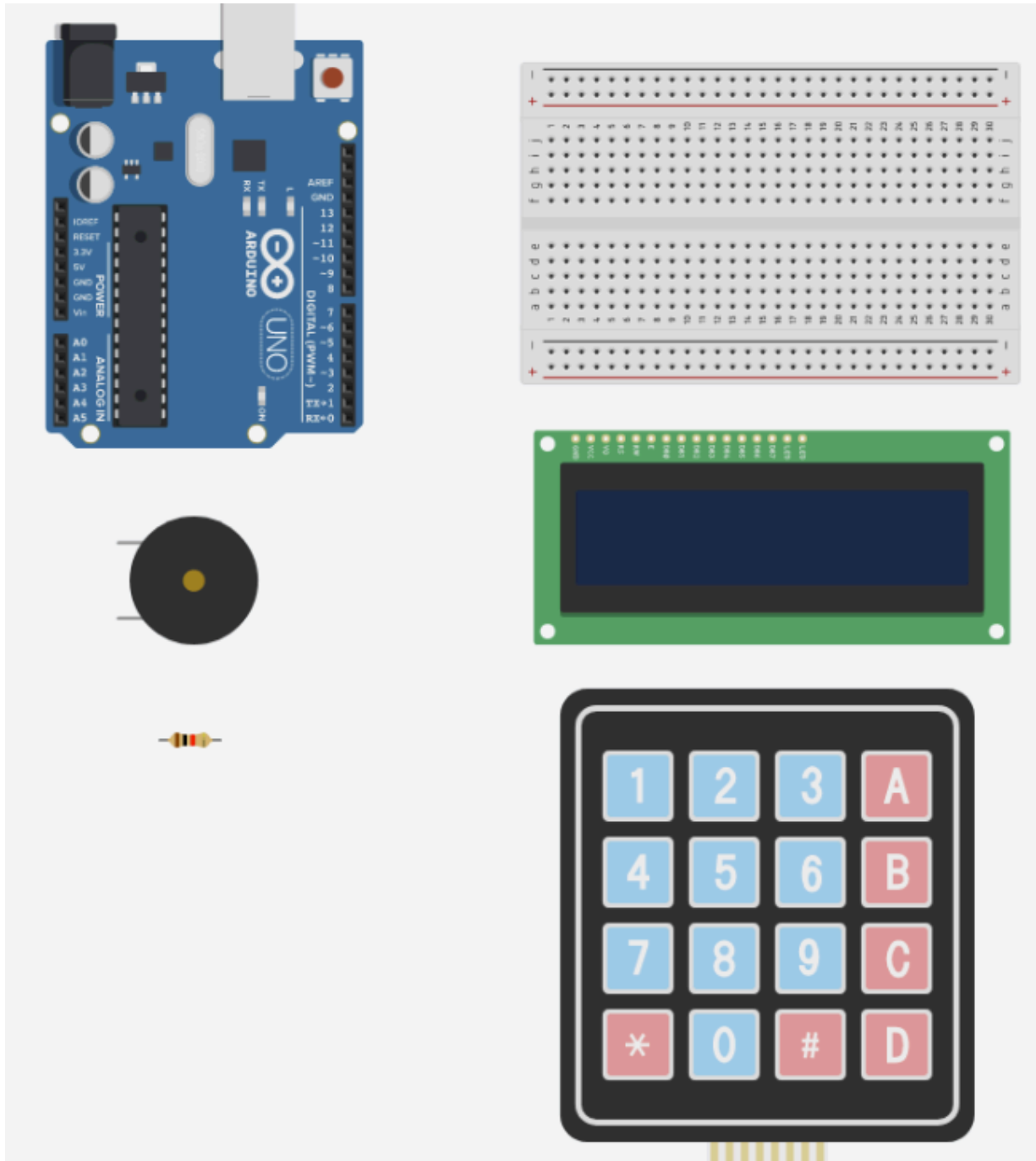
Building a DumbPhone

C) Setting up the Breadboard

5.   First we need to attach the LCD to the Breadboard.

6.   Then, we should power the breadboard by connecting the **+ line** to **5V** and the **- line** to the **GND** on the Arduino.

Building a DumbPhone

D) Connecting the LCD

7. Start by attaching the resistor to the **rightmost** pin of the LCD. Then connect this resistor to the **- line**. Next, connect the next pin along of the LCD to the **+ line**. We have now powered the backlight.
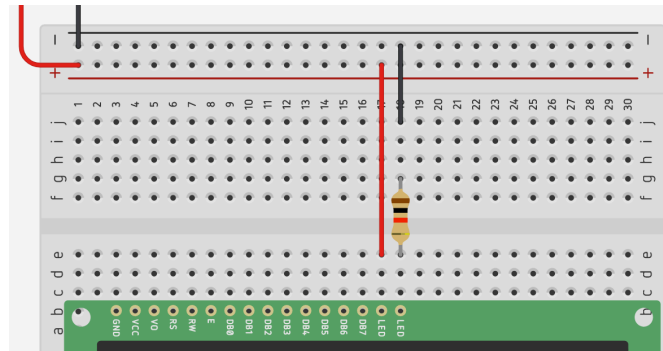
8. Now we can hook up the **Data Buses** of the LCD to the Arduino. Do so in this order:

   DB7 goes to **Pin 8**
   DB6 goes to **Pin 9**
   DB5 goes to **Pin 10**
   DB4 goes to **Pin 11**
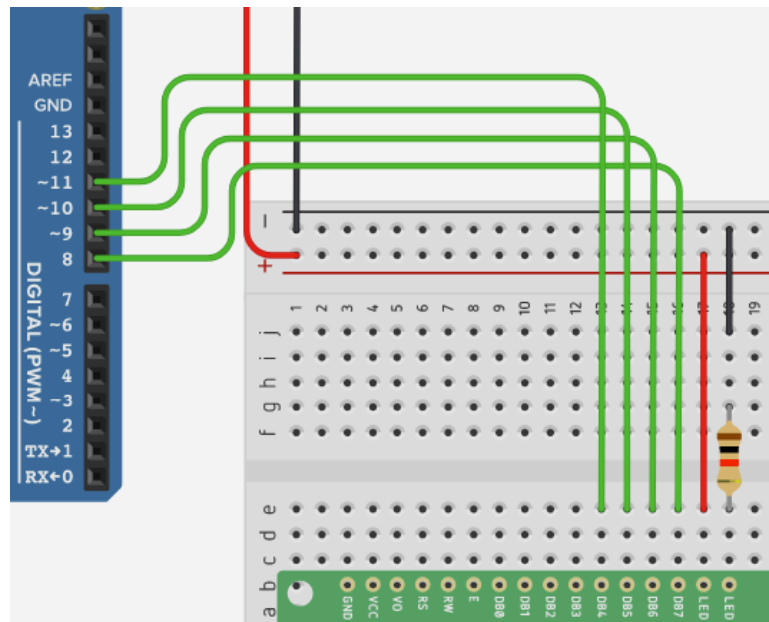
Building a DumbPhone

E) Connecting the LCD (part II)

9. We're going to skip the next four Data Buses (DB3 to DB0) and instead start connecting from the **E Bus** on the LCD. Connect up the following pins to the right places according to the following:
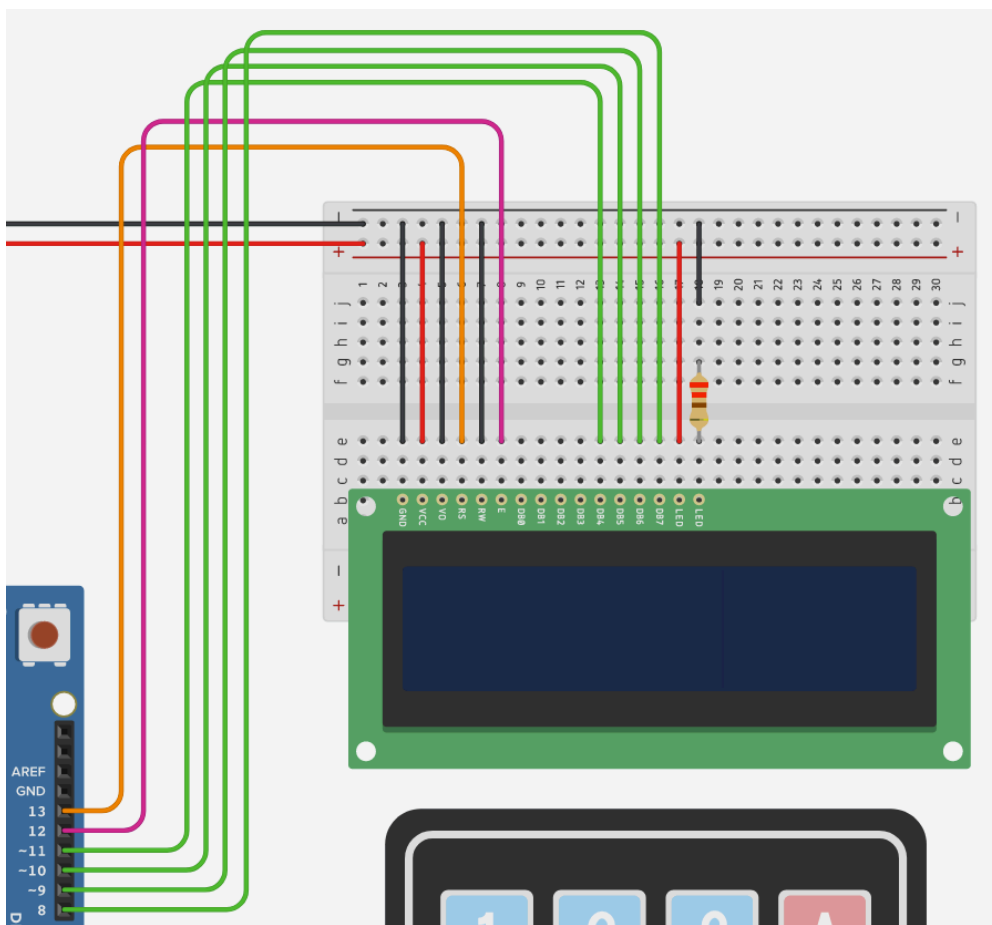
> **E** goes to **Pin 12**
> **RW** goes to **- line**
> **RS** goes to **Pin 13**
> **V0** goes to **- line**
> **VCC** goes to **+ line**
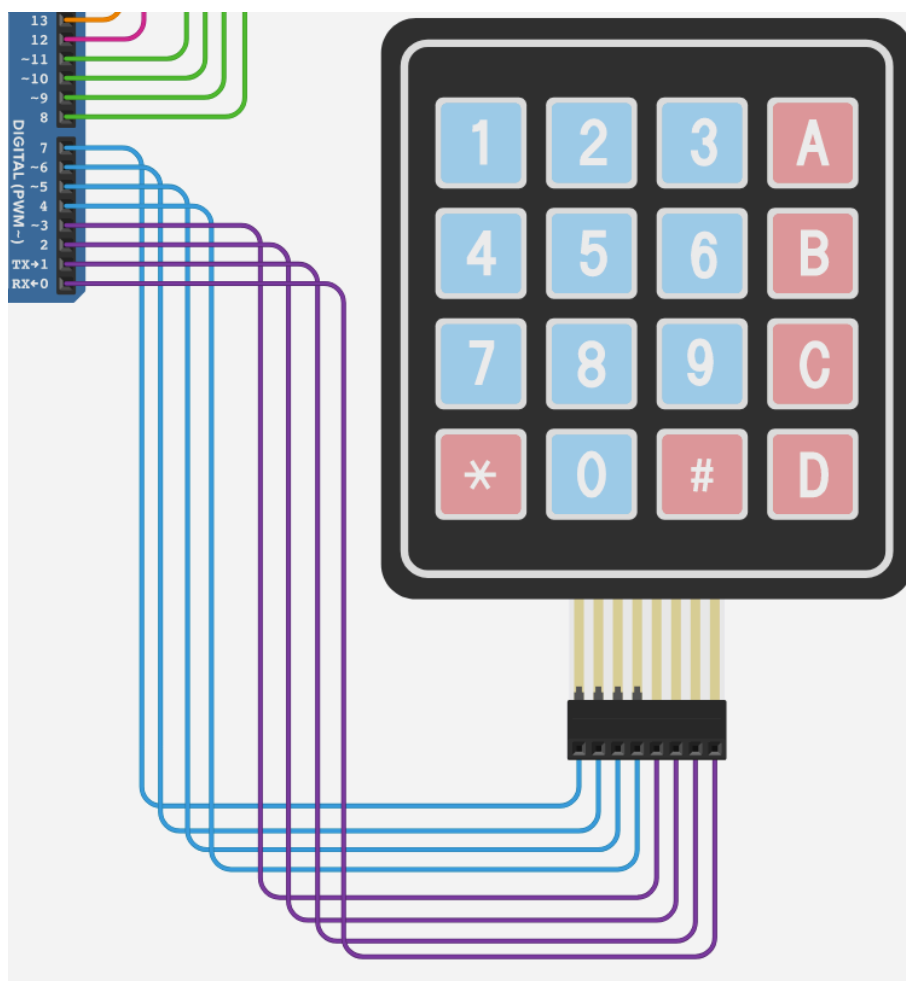> **GND** goes to **- line**

F) Connecting the Keypad

10. Now it's time to connect up the Keypad.

    If you **hover your mouse** over each terminal of the keypad it will tell you its name. Use this technique to connect the keypad to the Arduino:

 | | |
    |---|---|
    | **Row 1** goes to **Pin 7** | **Row 1** goes to **Pin 7** |
    | **Row 2** goes to **Pin 6** | **Row 2** goes to **Pin 6** |
    | **Row 3** goes to **Pin 5** | **Row 3** goes to **Pin 5** |
    | **Row 4** goes to **Pin 4** | **Row 4** goes to **Pin 4** |

Building a DumbPhone

G) Finishing Touches

11. To make our phone sound, we need to attach the **Piezo Speaker** to the Arduino. Hovering over the legs of the Piezo reveal a negative and positive terminal. Connect the negative to **GND** and the positive to **A0**.
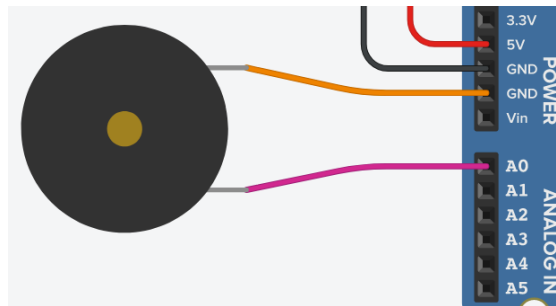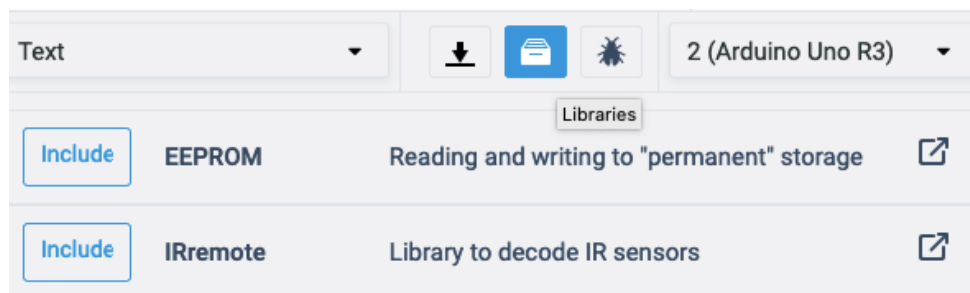

13. With everything connected, we can start writing the code. Click **Code** in the top right.

    We need to convert to **Text Mode**. To do so, click the drop-down menu next to 'Blocks'. Then, select **Text**.
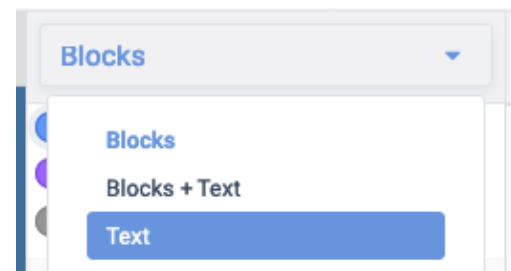
14. The last step before coding; Click the **Libraries** button and Include both **LiquidCrystal** and **Keypad**.

Building a DumbPhone

H) The Code

14. Here is listed the code needed for basic functionality. Make sure to rewatch the livestream for a full explanation of each part of the code.

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

LiquidCrystal lcd(13, 12, 11, 10, 9, 8); //Tells Arduino the LCD Pins

const byte numRows = 4; //How many rows does the Keypad have?
const byte numCols = 4; //How many column does the keypad have?

byte rowPins[numRows] = {7,6,5,4}; //Which pin controls which row (1 to 4)
byte colPins[numCols]= {3,2,1,0}; //Which pin controls which column (1 to 4)

//Here we tell the Arduino what symbol is on which letter.
char keymap[numRows][numCols]=
{
  {'1', '2', '3', 'A'},
  {'4', '5', '6', 'B'},
  {'7', '8', '9', 'C'},
  {'*', '0', '#', 'D'}
};

Keypad myKeypad= Keypad(makeKeymap(keymap), rowPins, colPins, numRows, numCols);

int currentCol = 0;

void setup() {
  lcd.begin(16, 2); //Tells Arduino how many columns and rows our LCD has.
  lcd.print("Enter number:");
}

void loop() {
  lcd.setCursor(currentCol, 1); //Tells LCD to start printing on second row.

  char keypressed = myKeypad.getKey();
  if (keypressed != NO_KEY){
    if (keypressed == '#') {
      lcd.clear();
      currentCol = 0;
      lcd.print("Dialing...");
    } else {
      tone(A0, 400, 50);
      lcd.print(keypressed);
      currentCol = currentCol + 1;
    }
  }
}
```