

Smart Bin

Abstract:

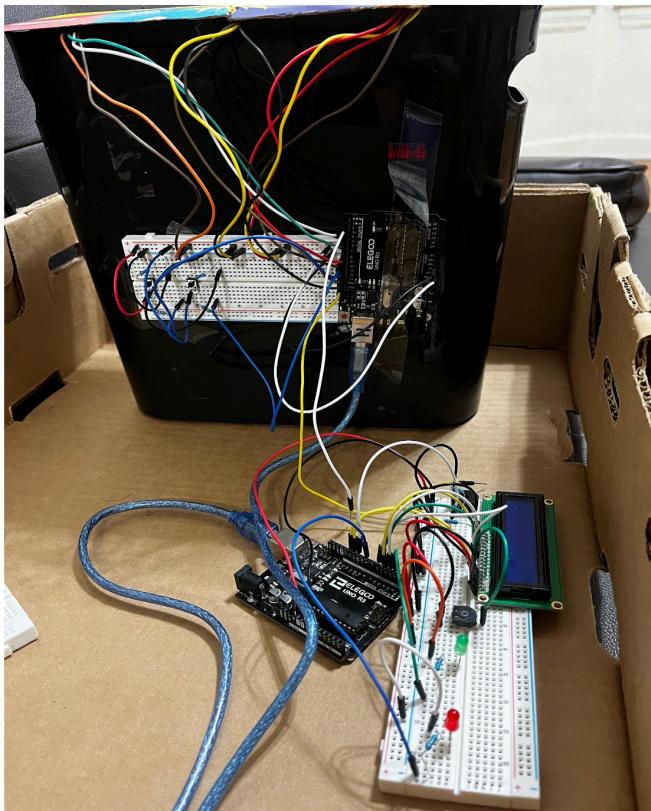
Bored of checking when to take out the trash? Introducing a smart trash management system that eradicates the need to constantly keep on checking how much trash is occupied in the bin. With today's technology, the smart trash will notify the user via different output methods that trash needs to be removed. By having the user notified without having them open the bin themselves to check trash levels, The aim is to reduce daily human effort and at the same time make sure trash is being removed from households rather than being collected.

Detailed Project Idea:

1. Overall Project Idea: It gets hard to track how much trash is filled in each bin every now and then. So to ease human efforts we are creating a smart bin that will detect trash in each bin using 3 ultrasonic sensors. The data collected will be sent to a common output device which will display the results and give output using multiple output devices depending on the data received.

When the first push button is pressed, we assume that the bin is empty so that the max height of the bin is stored. When button 2 is pressed, this is when the sensors will constantly detect the trash level. The output devices we are using are 16x2 LCD, LED's (red and green), and a buzzer. Once the trash data is received, it will be displayed on the LCD constantly. If the trash level is below 65% then a green LED will light up indicating the trash level is fine and the LCD will also show a message saying "the trash is fine!!" When the trash level is between 65% and 89%, the green LED will switch off and the red LED will switch on to indicate that trash is now filling up and will require removal soon. The LCD display will also show a message "prepare to empty". When the trash level is above 90%, the buzzer is activated (which gives an annoying sound) to let the user know they need to empty the trash now. The LCD will give a message "Empty Trash now".

2. There are 2 arduinos being used for this project. One is attached to the bin to detect the trash and send out data. This arduino will have 3 ultrasonic sensors and 2 push buttons connected to it. The second arduino is used to receive data and provide appropriate feedback to the user. This arduino will have a 16x2 LCD, 2 LED's (red and green), and a buzzer.



3. The 2 arduinos mentioned above will communicate via serial communication (RX and TX pins). The TX pin of arduino 1 (trash detect) is connected to the RX pin of arduino 2 (trash output). As mentioned before, 1 arduino is connected to the bin which will collect the trash data using 3 ultrasonic sensors and 2 pushbuttons. The second arduino will receive the data and will display it to the user using a LCD, LED's and a buzzer.

4. **Input devices:** 3 ultrasonic sensors, 2 push buttons
Output devices: 16x2 LCD, 2 LED's (red and green), Buzzer.

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5. The original work for our project is the way we use the buttons to detect the trash being collected in the bin via the 3 ultrasonic sensors. 1 button is used to store max height of the bin and the other will one trash to detect trash change once it has been pressed. Also the way we are using different output devices to provide feedback to the user.

6. In this project, you are designing a smart bin that detects the level of trash filled in the bin using 3 ultrasonic sensors and 2 pushbuttons, and displays the results onto another arduino via LCD, LED's and a buzzer. You will connect two Arduinos using a hardwired serial connection. Based on the value obtained by the sensors and received by the display (2nd arduino), appropriate results are displayed.

Display results as follows:

1. LCD will always display the trash levels.
2. If the trash level is between 0% and 64% then only a Green LED will switch on and stay ON.
3. If the trash level is between 65% and 89%, then only a Red LED will switch on and stay ON (Green LED switches OFF).
4. If the trash level is above 89% i.e. $\geq 90\%$, then a buzzer is activated. The Red LED stays ON.

Wiring (Trash detect Arduino):

First take 2 wires. Take one wire and connect the +5V pin to the power rail of the breadboard. Take the 2nd pin and connect the GND pin of the arduino to the ground of the breadboard.

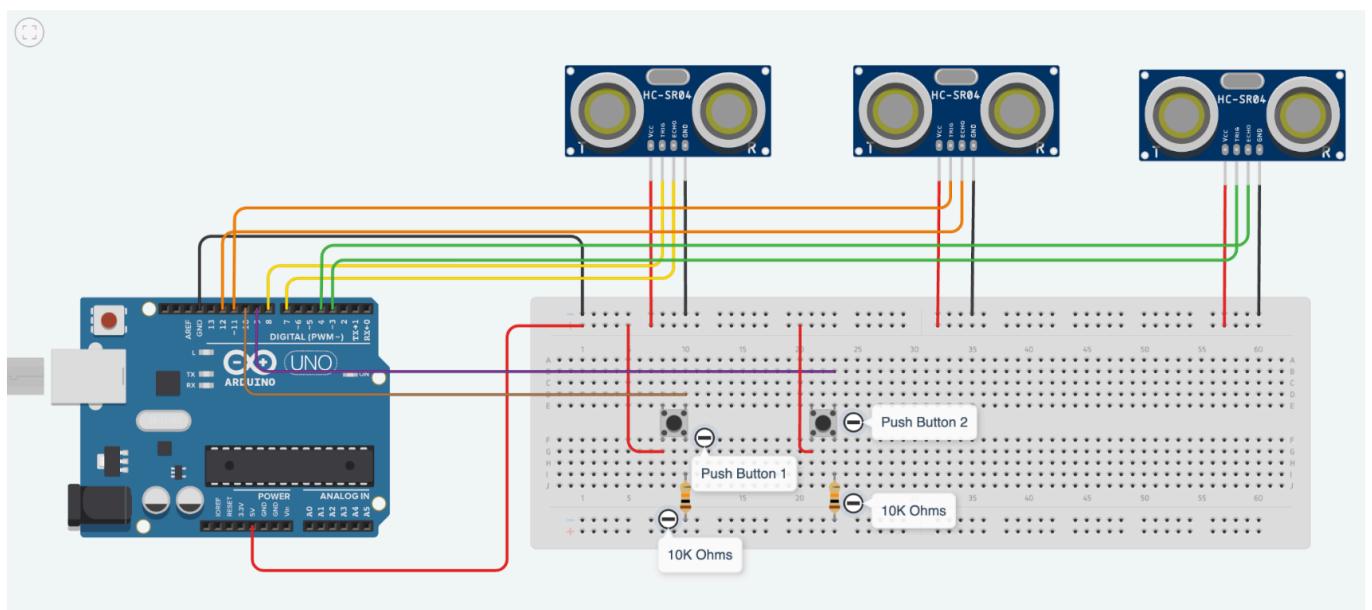
- a. Wiring for the sensor 1 -
 - i. Connect the Sensor's VCC to the power rail.
 - ii. Connect the Sensor's GND to the GND.
 - iii. Connect the Sensor's Trig pin to the Arduino pin **8**.
 - iv. Connect the Sensor's Echo pin to the Arduino pin **7**.
- b. Wiring for the sensor 2 -
 - i. Connect the Sensor VCC to the power rail.
 - ii. Connect the Sensor GND to the GND.
 - iii. Connect the Sensor Trig pin to the Arduino pin **11**.
 - iv. Connect the Sensor Echo pin to the Arduino pin **12**.
- c. Wiring for the sensor 3 -
 - i. Connect the Sensor VCC to the power rail.
 - ii. Connect the Sensor GND to the GND.
 - iii. Connect the Sensor Trig pin to the Arduino pin **3**.
 - iv. Connect the Sensor Echo pin to the Arduino pin **4**.
- d. Wiring for push button 1 -
 - i. Attach the pushbutton to the breadboard.
 - ii. Connect the lower left leg of the push button to the power rail (5 V) on the

breadboard.

- iii. Connect the lower right leg of the pin to the GND using a $10\text{K}\Omega$ resistor.
- iv. Connect the top right leg of the push button to Digital pin **10** of the Arduino.

e. Wiring for push button 2 -

- i. Attach the pushbutton to the breadboard.
- ii. Connect the lower left leg of the push button to the power rail (5 V) on the breadboard.
- iii. Connect the lower right leg of the pin to the GND using a $10\text{K}\Omega$ resistor.
- iv. Connect the top right leg of the push button to Digital pin **9** of the Arduino



Wiring (Trash Display Arduino):

First take 2 wires. Take one wire and connect the +5V pin to the power rail of the breadboard. Take the 2nd pin and connect the GND pin of the arduino to the ground of the breadboard.

a. Wiring for lcd -

- i. LCD RS pin to digital pin 12
- ii. LCD Enable pin to digital pin 11
- iii. LCD D4 pin to digital pin 6
- iv. LCD D5 pin to digital pin 5
- v. LCD D6 pin to digital pin 4
- vi. LCD D7 pin to digital pin 3
- vii. LCD R/W pin to GND
- viii. LCD VSS pin to GND
- ix. LCD VCC pin to 5V
- x. LCD LED+ to 5V through a 220Ω resistor
- xi. LCD LED- to GND

xii. Wire the 10k potentiometer to +5V and GND, with its wiper (output) to LCD screens VO pin (pin3)

b. Wiring for Red LED -

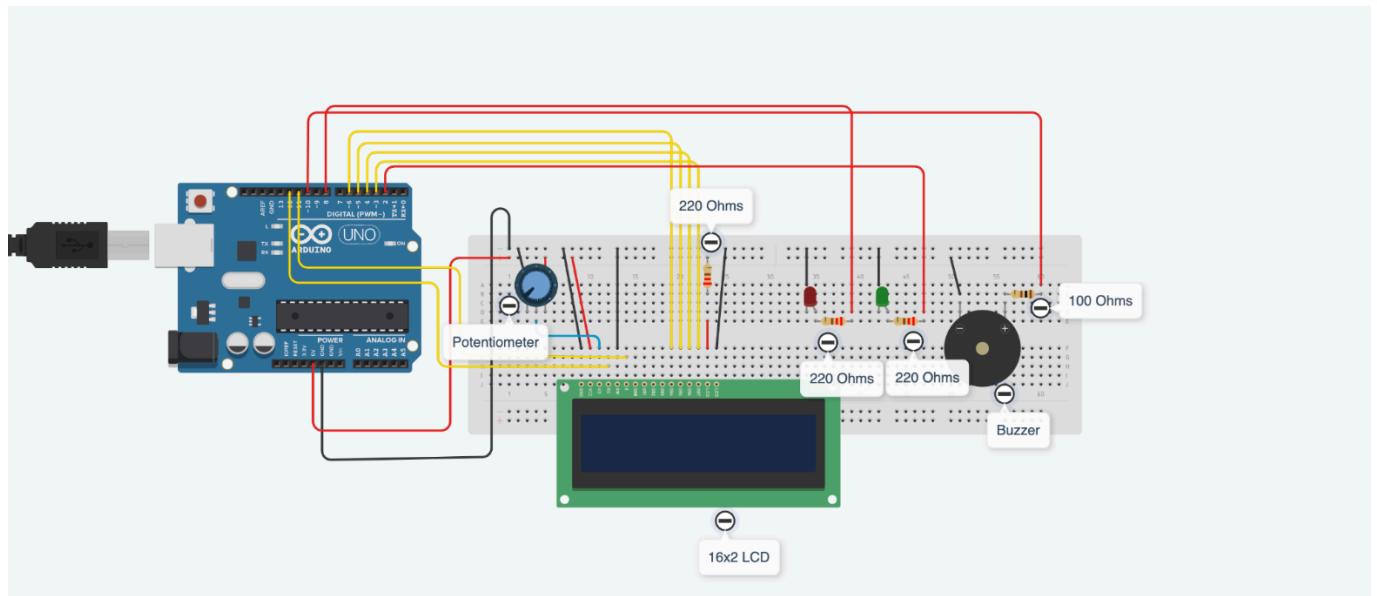
- i. Attach the red LED to the breadboard.
- ii. Connect the negative (shorter) end to GND.
- iii. Connect the longer (positive) end to digital pin 8 via a 100Ω resistor.

c. Wiring for Green LED -

- i. Attach the red LED to the breadboard.
- ii. Connect the negative (shorter) end to GND.
- iii. Connect the longer (positive) end to digital pin 2 via a 100Ω resistor.

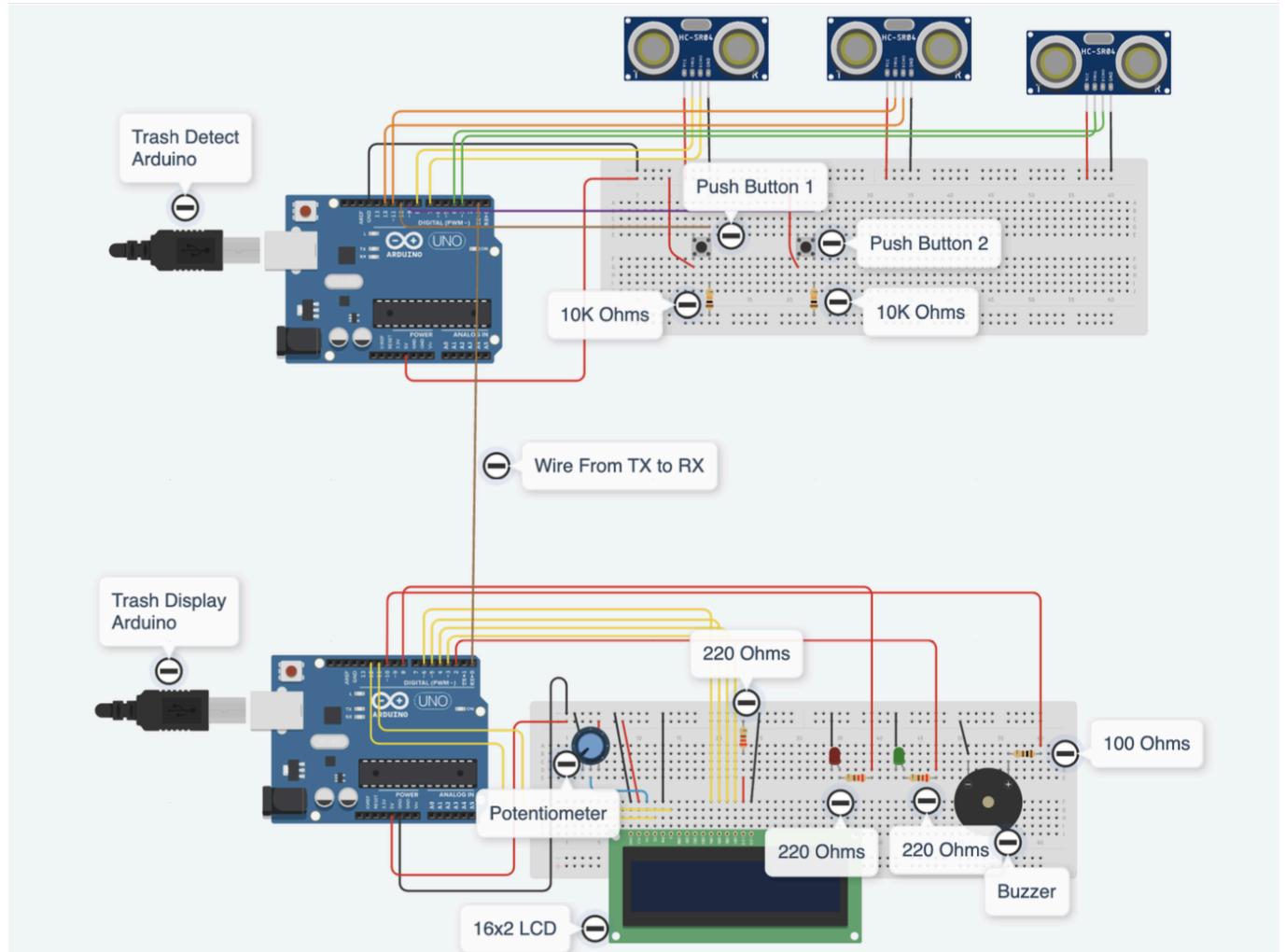
d. Wiring for Buzzer -

- i. Attach the buzzer to the breadboard.
- ii. Connect the negative end of the buzzer to GND.
- iii. Connect the positive end of the buzzer to digital pin 10 via a 100Ω resistor.



Wiring between the 2 Arduinos

- Connect the TX pin from trash detect arduino and connect it to the RX pin of the trash display arduino.



6. User Guide:

- i. Make sure the bin is empty at first and the lid is properly kept on the top of the bin with the sensors pointing towards the bottom of the bin.
- ii. Press the left button for a second (assuming the bin is empty). This stores the max height of your bin.
- iii. Press the second button for a second.
- iv. Now feel free to enter trash and see the output being displayed through the lcd display, LED's, and the buzzer.
- v. Green Light indicates trash level is okay.
- vi. Only the Red light indicates that trash level is rising to the max
- vii. Red Light and the buzzer being activated means trash is almost full and that user needs to remove the trash.

Required Supporting Materials

Timeline:

09/16 - 09/22	<ul style="list-style-type: none"> Finalizing project idea and completing milestone 2. Submitted on 09/22
10/09 - 10/15	<ul style="list-style-type: none"> Working on Milestone 3
10/16 - 10/22	<ul style="list-style-type: none"> Finishing Milestone 3. Submitted on 10/17.

10/30 - 11/05	<ul style="list-style-type: none"> Working and finishing Milestone 4. Submitted on 11/03 Gathering all required materials for the project and testing each sensor to see if they work.
11/06 - 11/12	<ul style="list-style-type: none"> Setting up circuit for Trash Detect arduino and writing code for it. Working on HC-05 Bluetooth module (in the end it was defective hardware and not user friendly so moved to serial communication).
11/13 - 11/19	<ul style="list-style-type: none"> Finished writing code for Trash Detect arduino. Setting up circuit for Trash Display arduino and completing writing code. Having the 2 arduinos to communicate via Serial Communication. Project is ready. Completing Milestone 6 (Design presentation slides)
11/20 - 11/26	<ul style="list-style-type: none"> 11/21 -> Design Presentation 11/22 -> Completed Milestone 8 11/23 -> Completed Milestone 9 (Final Presentation) Finished Final Demo (Aryansingh Chauhan only)
11/27 - 12/03	<ul style="list-style-type: none"> Completed Milestone 10

Materials Required

- 2x Breadboard
- 2x Arduinos
- 3x ultrasonic sensors
- 2x Push Button
- 2x $10k\Omega$ Resistor

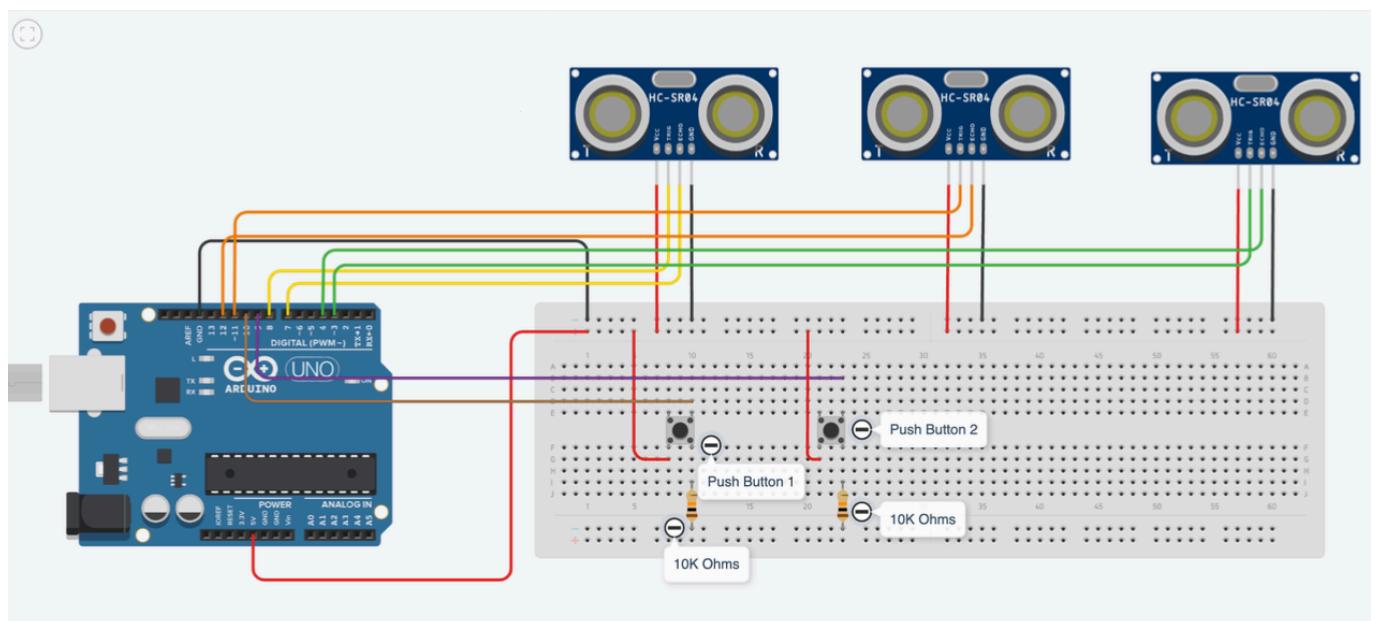
- 1x 16x2 LCD Display
- 1x Potentiometer
- 2x LED's (Red and Green)
- 3x 220Ω Resistor
- Buzzer
- 1x 100Ω Resistor
- Jumping Wires
- 1 x Cardboard box

References

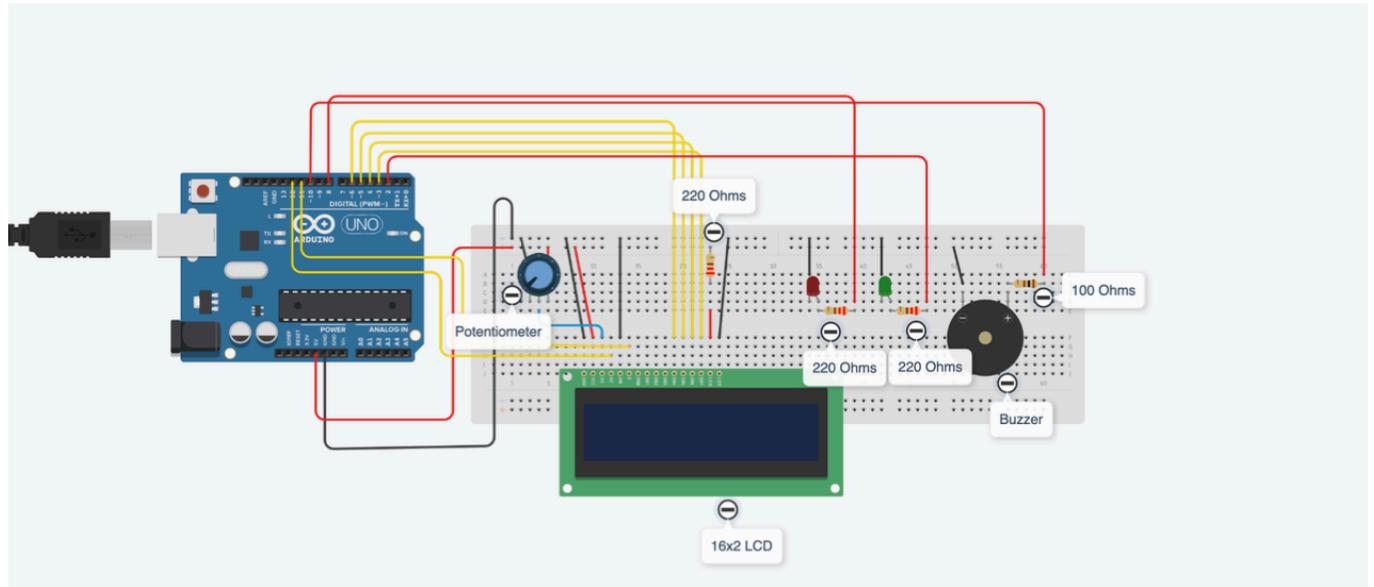
1. <https://howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/>
2. <https://docs.arduino.cc/learn/electronics/lcd-displays>
3. <https://docs.arduino.cc/built-in-examples/digital/Button>
4. <https://roboticsbackend.com/arduino-led-complete-tutorial/>
5. <https://www.ardumotive.com/how-to-use-a-buzzer-en.html>

Diagrams:

Trash Detect Arduino:



Trash Display Arduino:



Combined image of both arduinos:

