Technical Report Report Deliverable 3

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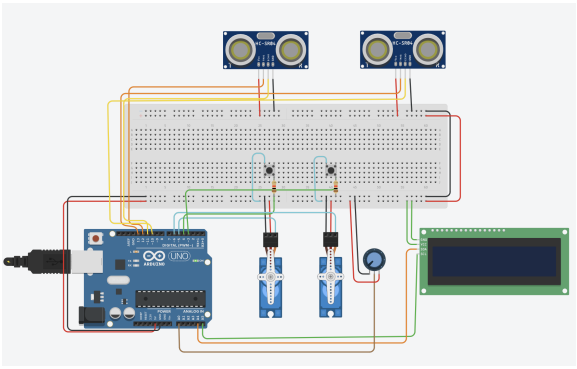
Hardware Report

This circuit is made up of 8 components:

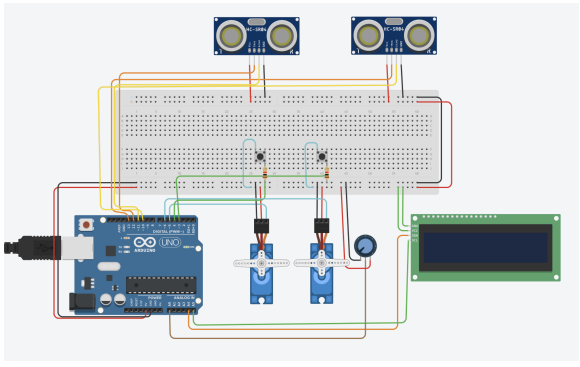
- Servo Motor 1
- Load sensor (pedometer)
- Ultrasonic 1
- Push Button 1
- Servo Motor 2
- OLED screen
- Ultrasonic 2
- Push Button 2

The pedometer acts as the load sensor, and the behavior of both components is relatively the same. Our code is still in progress as we are looking into the mentor feedback.

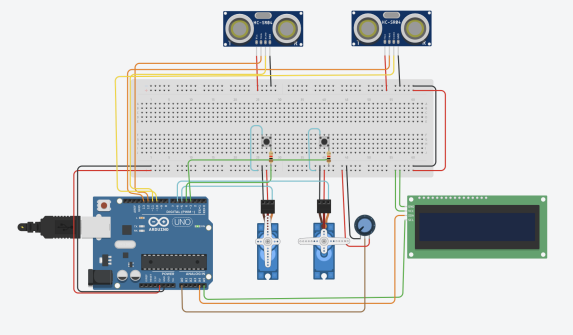
Motor Circuit & Detailed Explained



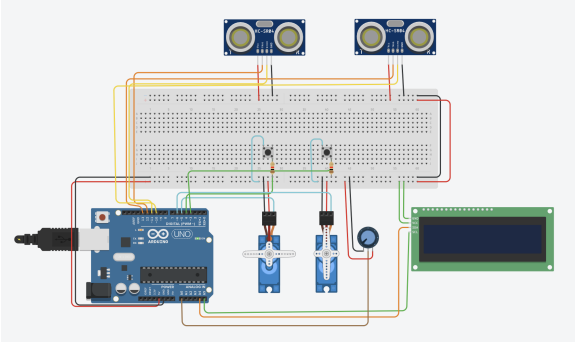
Picture 1: Button one switched off. Button two is switched off.



Picture 2: Button one switched on. Button two is switched on.



Picture 3: Button one switched on. Button two is switched off.



Picture 4: Button one switched off. Button two is switched on.

```
#include <Servo.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
int t=3000;
int button1 = 0;
int button2 = 0;
int us1 = 0;
Servo servo_5;
Servo servo_6;
LiquidCrystal_I2C lcd(32,16,2);
void setup()
{
  pinMode(4, INPUT);
  Serial.begin(9600);
  servo_5.attach(5, 500, 2500);
  pinMode(3, INPUT);
  servo_6.attach(6, 500, 2500);
  lcd.begin(16,2);
  lcd.init();
  lcd.backlight();
}
void loop()
{

  button1 = digitalRead(4);
  Serial.println(button1);
  if (button1 == 0) {
    servo_5.write(0);
  } else {
    servo_5.write(90);
    delay(1000); // Wait for 1000 millisecond(s)
  }

  button2 = digitalRead(3);
  if (button2 == 0) {
    servo_6.write(0);
  } else {
    servo_6.write(90);
    delay(1000); // Wait for 1000 millisecond(s)
  }
}
```

More details

Ultrasonic sensors: these are used to detect when the box is at 90% capacity. Once the ultrasonic detects 90% a message will be sent to the LCD to display that the box is too full to receive any objects.

LCD: apart from its role of showing if the box is near full capacity. At the initial state of the LCD will be a welcome message. A thank you message is displayed at the last state.

Load Sensor: Used to measure the amount of donation and convert it into points for the user's system. This load will also be displayed on the LCD.

Simulation results

State diagram:

The state diagram is necessary to help guide the machine through states to consider a certain output.

As shown in figure 1 the state diagram for the smart donation box is a moore state diagram containing 4 states with two outputs and 3 inputs.

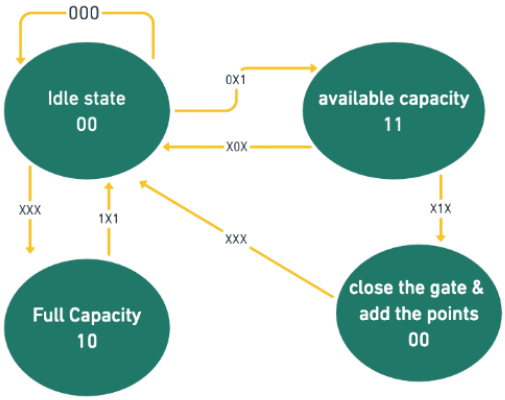


Figure 1 : smart charity box state diagram

The ultrasonic is to be placed at the inner box's ceiling pointing downwards towards the items. When the distance measured by the ultrasonic between the ceiling and the items reaches a certain limit it will alert the machine at it's full capacity.

The load sensor is added to distinguish when an item is added and when it's not.

The press buttons are for the user to choose the category of donation and to activate the machine.

Table 1 : inputs functionality

Each state holds a consistent output in a moore state machine, the two outputs present in the state diagram represent the lcd screen and the servo motor.

The lcd screen displays the capacity's percentage and the servo motor unlocks the donation drawer when appropriate.

	0	1
ultrasonic	No available capacity	Available capacity
Load sensor	No items added	Load detecte an item is ad
Press button	Button is not pressed	Button is pressed

Table 2 : outputs functionality

	0	1
Lcd screen	off	on
Servo motor	Drawer is closed	Drawer will open

The state diagram illustrates 4 cases the machine will operate on:

Case 1 : The donation box has available capacity and the load sensor was activated. The user added an item. In this situation, the machine will go through the following states:

Case 2: There is available room for the user to add donations. However, they don't. The load sensor will not detect any additional items. The machine will transition from:

Case 3: When the donation box capacity limit is met (the ultrasonic for this case is deactivated).

Case 4: If no button is pressed, the machine is not operated and remains in the idle condition.

The circuit this state diagram will generate is shown in figure 2.

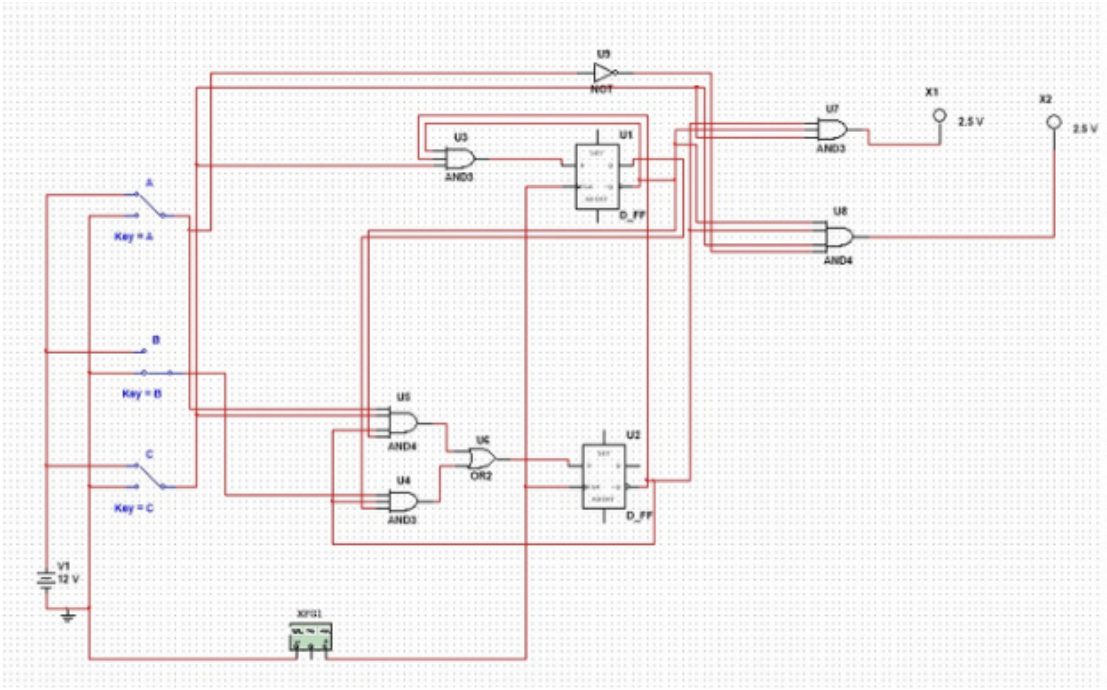
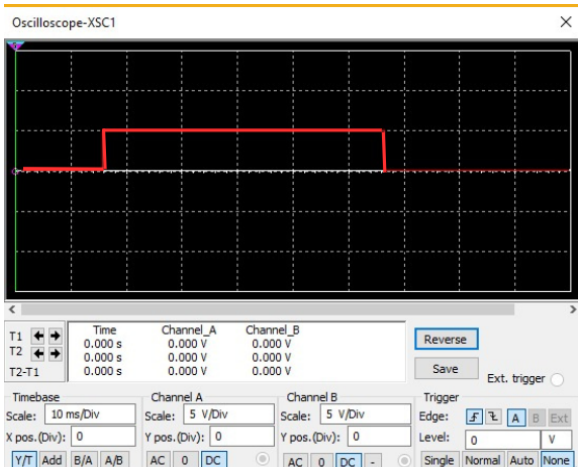


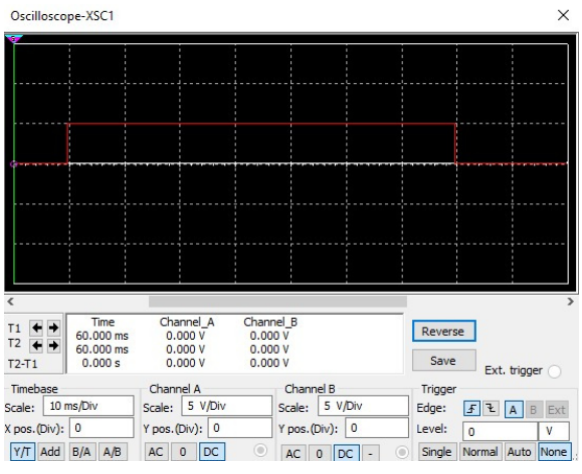
Figure 2 : smart donation box circuit

Figure 3 : timing diagram for cases 1,2

The timing diagram each case will generate are shown in figures 3 and 4. The timing diagrams and the circuit were obtained from the multisim software, each timing diagram shows the behavior of both outputs in each case.

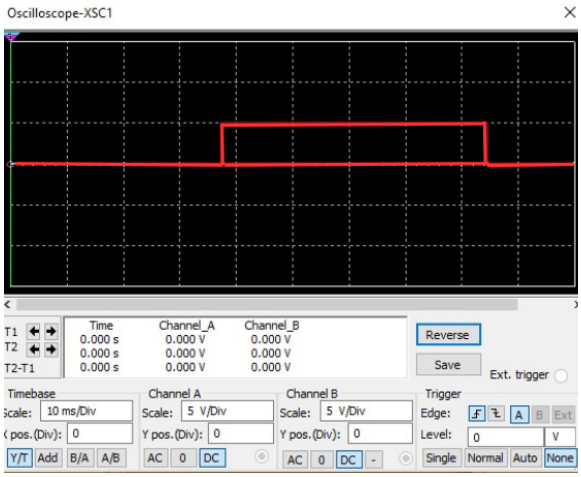


Case 1

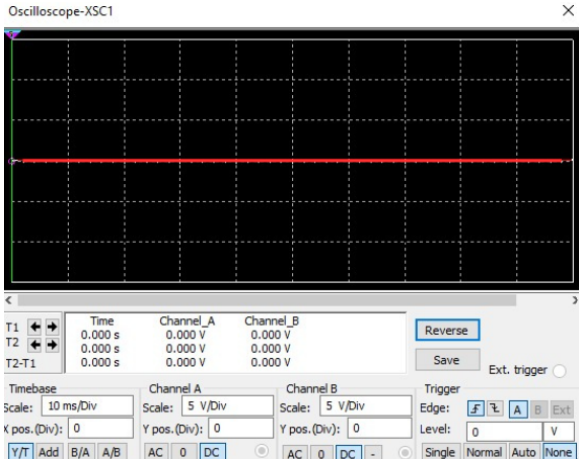


Case 2

Figure 4 : timing diagram for cases 3,4



Case 3



Case 4

Addressing received Feedback

Elaborate explanation of our design

For our previous deliverable, our Mentor remarked a very little explanation of our design. The additional description of the box will be presented in this section.

It is AI Arduino based donation box, programmed to receive only books on one side and miscellaneous items on the other. The product is designed to interact with the user in the following manner:

The product is initially in “off power” mode, waiting for the user to press a button located on the box to start it. The user may donate only if the current available capacity of the box allows it which will be displayed on the screen once the box is on. Moreover, the system allows the user to scan a QR code to log into the charity’s organization website with the required credentials. And based on the weight of the donated items, the user will be rewarded redeemable points viewable via the user’s account.

However if the box is saturated, a message will be sent to the user stating when the box will be available next using a bluetooth module.

The hardware is designed to contain an ultrasonic and load sensor, a motor Servo, LCD screen, a bluetooth module and buttons.

A QR code is to be developed and displayed on the box for the user to scan and access the website with the relevant credentials which is to be developed as well.

Finally, with respect to the physical aspect, the box is comprised of two main compartments; one will take in books only and the other will receive the miscellaneous items.

- For future deliverables, no handwritten figures will be used for illustrations. Only digitally generated ones shall be utilized.

- In text citations shall be incorporated when necessary.

To improve the box’s and organization’s efficiency and effectiveness, a barcode reader is incorporated in the box to identify the kind of book that has been donated. So the organization may plan how and where the books will be distributed without having to count every book.

In conclusion, for future deliverables, the above feedbacks will be taken into account for further improvement.