Group #12 **Fall ECGR 4101/5101 Lab #09 Report** **12/06/2022**
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Lab Objective:

The objective of this lab is to connect two MSP430G2553 together. An ultrasonic sensor is connected to chip 1. It is used to find the distance in cm and display it on Quad-Digit 7 segment LED connected to chip 2 using UART communication. An accelerometer I also is connected, and it displays the x and y axis is a 0–90-degree range on the Quad-Digit 7 segment LED using UART connections. Two buttons are present. One to switch between ultrasonic sensor and accelerometer and the other one is used to select a distance. A buzzer is used to buzz when the distance selected by the user is displayed or if the accelerometer is placed on a flat surface or when the x and y-axis read 0 on the Quad-Digit 7 segment LED. All these components were soldered on a perforated board to build a embedded system which runs on a battery.

Tables, Figures and Schematic:

	Pins
UART Tx	P1.2
Identifier Pin	P1.4

Table 1 – Connection for Chip 1

Ultrasonic Sensor	Pins
VCC	VCC
Trigger	P1.5
Echo	P1.6
GND	GND

Table 2 – Ultrasonic Sensor Connections on Chip 1

Buzzer	Pins
VCC	P2.2
GND	GND

Table 3 – Buzzer Connections on Chip 1

Button 0	Pins
Input	P1.3
VCC	VCC

Table 4 – Button 0 connection on Chip 1

Voltage Regulator	Pins
Vin	VCC from battery
GND	GND from battery
Vout	Vin to the circuit

Table 5 – Button 0 connection on Chip 1

Button 0	Pins
Input	P1.3
VCC	VCC

Table 6 – Button 1 connection on Chip 1

Accelerometer	Pins
Vcc	Vcc
X-axis	P1.7
Y-axis	P1.6
GND	GND

Table 7 – Accelerometer connections

Quad digit 7-segment display	Pins
A	P2.0
B	P2.1
C	P2.2
D	P2.3
E	P2.4
F	P2.5
G	P2.6
DP	P2.7
D1	P1.0

D2	P1.5
D3	P1.6
D4	P1.7

Table 8 - Quad digit 7-segment display connections for Chip 2

	Pins
UART Rx	P1.1
Identifier Pin	P1.4

Table 9 – Other pins connected to chip 2

Ultrasonic sensor Distance	Buzzer Level
6	1 (highest level)
30	2
60	3
120	4
210	5(base level)

Table 10 – Preset distances and ranging

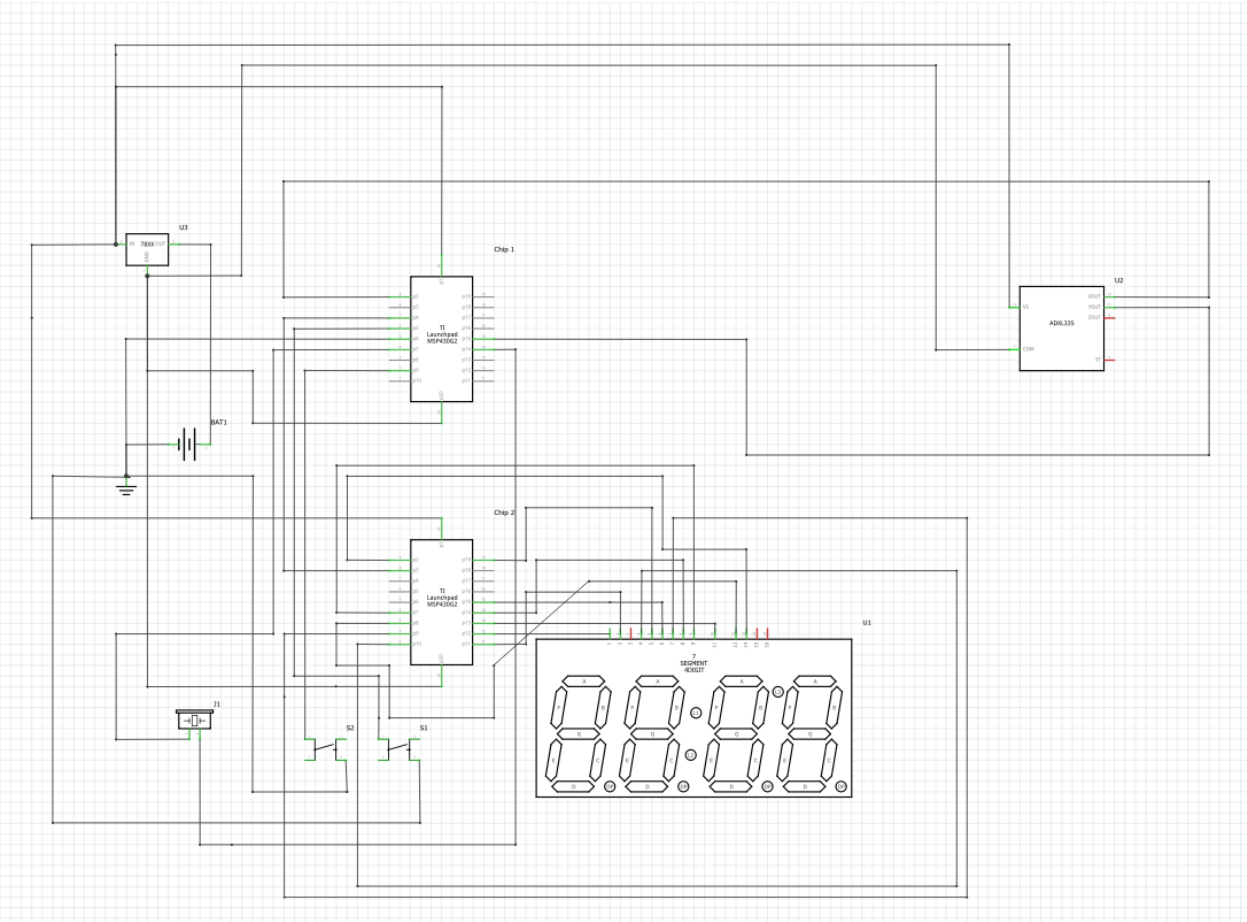

Figure 1 - Schematic diagram of the circuit connection.

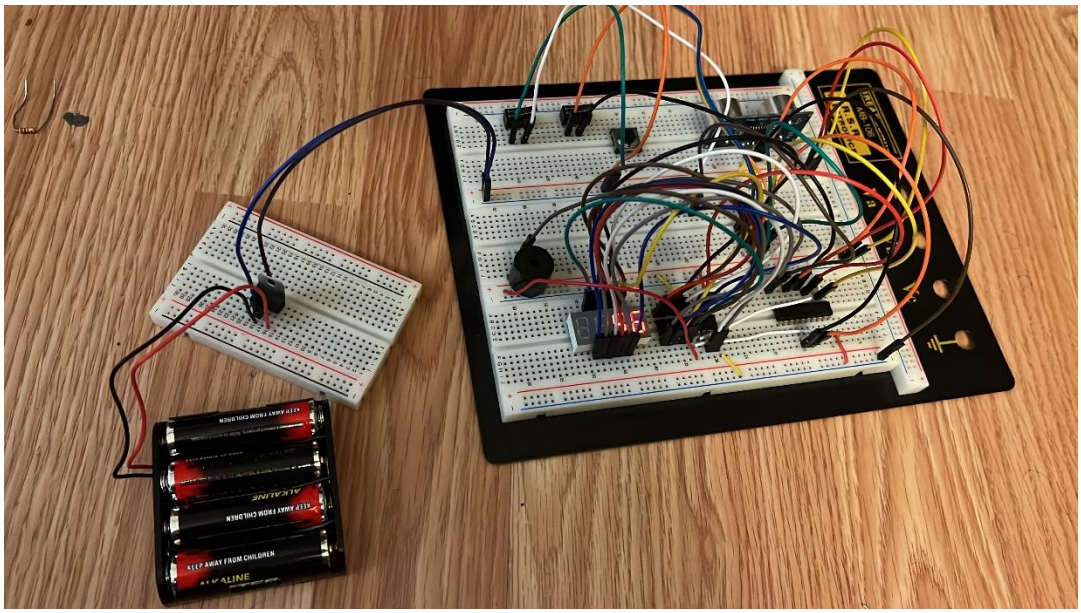

Figure 2 – Circuit Connection on breadboard with voltage regulator and battery

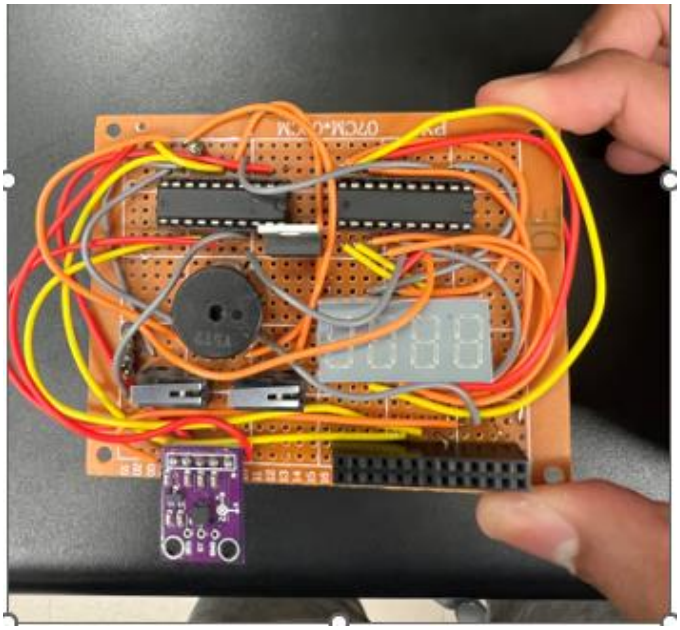
Figure 3 – Front side circuit connection on perforated board without voltage regulator and battery (Used for final testing)

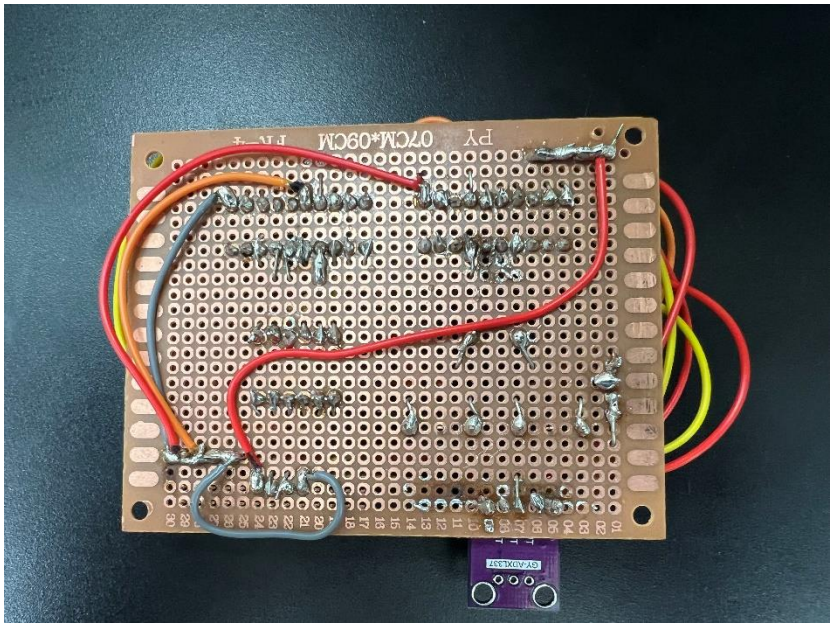

Figure 4 – Back side circuit connection on perforated board without voltage regulator and battery

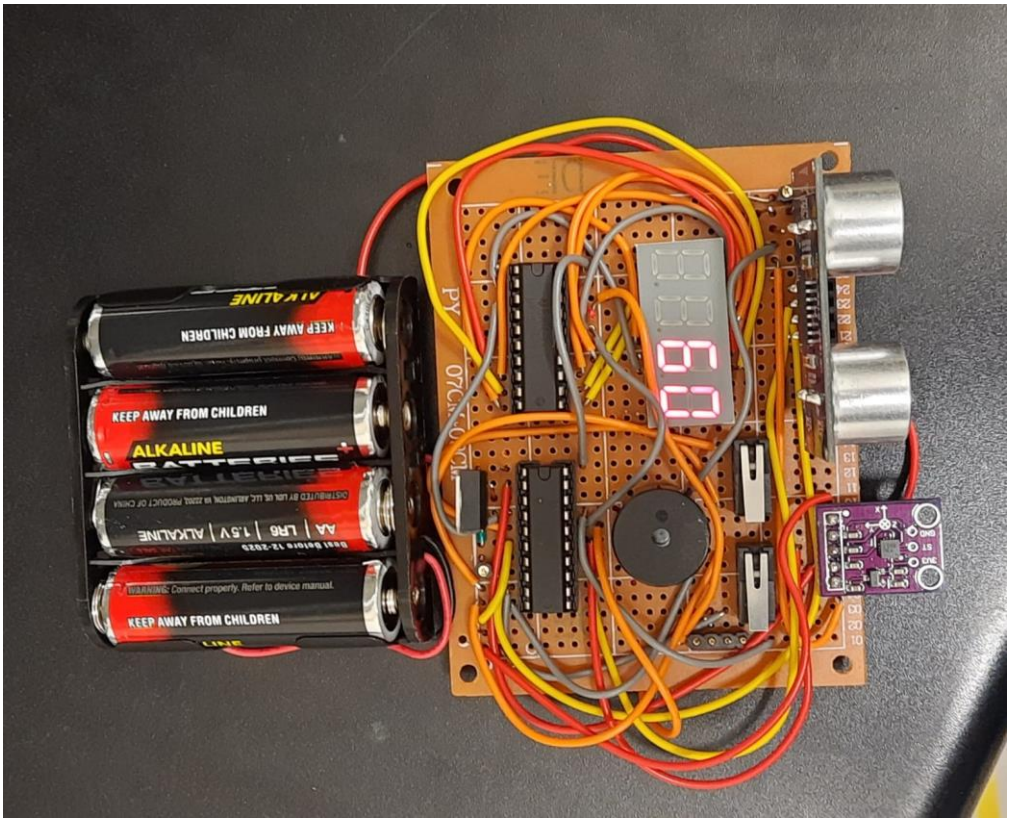

Figure 5 – Final circuit connections on perforated board with Voltage regulator and battery.

Commentary and Conclusion:

There were a lot of challenges during the process of completing this project. Setting up the timers for the interrupts, two button interrupts, ADC for accelerometer and PWM for buzzer were quite challenging on their own but putting them together was a lot more challenging. Many things went wrong during the coding phase. It was hard to setup two different button interrupts and setting up the buzzer was a little challenging as well. Preventing noises and oscillations remained the toughest part but we managed to eliminate them using advanced coding techniques. Moreover, testing the accelerometer and converting that value to a 0 – 90degree scale was quite difficult.
Finally, after a lot of testing and debugging, we were able to write a code that worked smoothly. The hardest part was the soldering. Since there were almost no room for error, the soldering was quite a challenge. Getting so many parts wired on such a small, perforated board required a lot of time and patience. After carefully soldering all the parts together, we were able to successfully make the lab work. Even though the lab was time consuming, it was an amazing project, and it was an we are elated for having built an embedded system.