	ECGR 4101/5101 LAB 2 Report	09/12/2023
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Lab Objective:

The objective of this lab was to use interrupts and timers to display HEX digits (0-F) in a order with a 0.5 seconds delay. The goal was to code as efficiently as possible, within the limits of 30 lines of executable code, thus making the program optimized in terms of memory and ultimately making it easier to read and follow through.

Lab Figures/Tables:

Table 1: PIN Mappings to Segments on the 7-Segment LED

PIN # on PORT 2	Specific Segment
PIN 0	a
PIN 1	b
PIN 2	c
PIN 3	d
PIN 4	e
PIN 5	f
PIN 6	g
PIN 7	dp

To connect the 7-Segment LED with MSP430g2553, pins 0-7 on port 2 were used and the connections as shown in Table 1 were made. Pin 0 was connected to segment a, and so on until the last segment, the point (dp) was connected to Pin 7.

Table 2: Hex Digit's Binary and Hexadecimal Values Used

Hex Digit	Binary Combination	Hexadecimal Combination
0	1100 0000	0xC0
1	1111 1001	0xF9
2	1010 0100	0xA4
3	1011 0000	0xB0
4	1001 1001	0x99
5	1001 0010	0x92
6	1000 1001	0x82
7	1111 1000	0xF8
8	1000 0000	0x80
9	1001 0000	0x90
A	1000 1000	0x88
B	1000 0011	0x83
C	1100 0110	0xC6
D	1010 0001	0xA1
E	1000 0110	0x86

F	1000 1100	0x8E

To make the code efficient and smaller in length, an array with 16 elements was declared and the hexadecimal combinations of the 16 unique digits (0-F) was stored in as separate elements. The connections were made for the Anode. i.e., 0 represented OFF state and 1 represented ON state. For a particular segment to light up, that bit, mapped to the PIN was set to 0 and the segment that was not needed was set to 1. To display different digits, a predefined combination in terms of Hexadecimal values was used and every time, a different element was turned displayed. ON. Table 2 shows a list of the hex digit and its binary as well as hexadecimal representation.

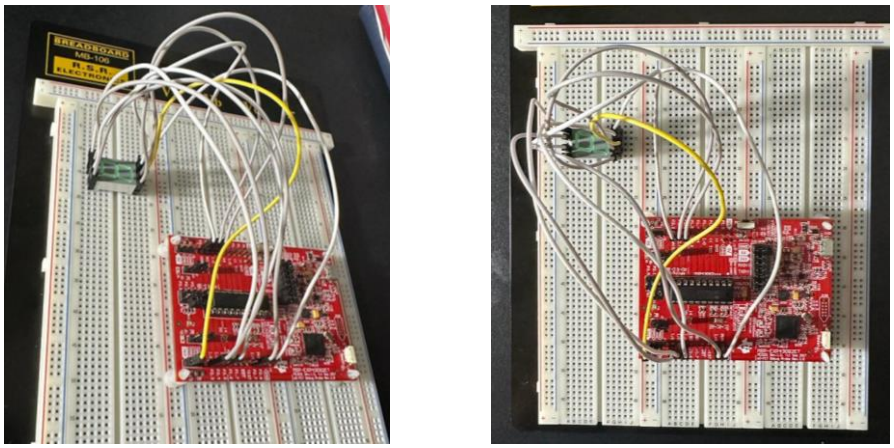

Figure 1: Connections made between the Breadboard and MSP430g2553 for 7-Segment LED Display to display HEX Digits (0-F)

Commentary and Conclusion:

Lab 2 was completed in 2 parts, with part 1 being just a display of HEX digits (0-F) using just a few lines of code. For this, an array of 16 elements was created storing the different combinations of '0' and '1' which was used to light up the 7 segments of the LED display. Then a FOR loop was used to cycle through the different hex combinations. Part 2 of the lab demanded for a code modification from part 1 to use internal board interrupt timer library for an improved delay accuracy.

A problem that came up along the way included using a FOR loop to display the 16 unique digits. To make coding easier, the same code from part 1 of the lab was used by adding the FOR loop and within that loop, an IF statement that checked whether 500 ms had passed for the display to change. With this code, the result was a flicker of random segments. An unsuccessful attempt of debugging was made using the debugging tools, but due to the fact that interrupts and timers continue counting even when using debugging tools, made it unclear as to what the exact problem was. Finally, the FOR loop was taken out and a simple IF statement logic was used, which, in-fact, did solve the problem. To have the display show nothing at start, a single line of code was added that turned everything OFF manually at first.

In conclusion, the lab went as expected. Initially OFF, and when started the program, the 7-Segment LED displayed the digits 0-F and the cycle ran continuously. Every digit was displayed, turned ON for 0.5 seconds and then the next digit was displayed. The internal board interrupt timer library was used and the value of 500 ms was used to achieve the delay of 0.5 seconds.