



Countdown Alarm

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ELC 343

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Requirements

The Idea: This project is meant to serve as a proof of concept for an “alarm clock” that “closes the blinds” when a countdown is set, counts down from the set time, and upon reaching 0, run a servo to “open the blinds” of the room.

Devices

- PSOC CY8C5868AXI-LP035 Board
- 1 input buttons on PSOC board
- 2 seven segment displays
- 16 330 ohm resistors
- 1 Parallax Standard Servo
- One character LCD

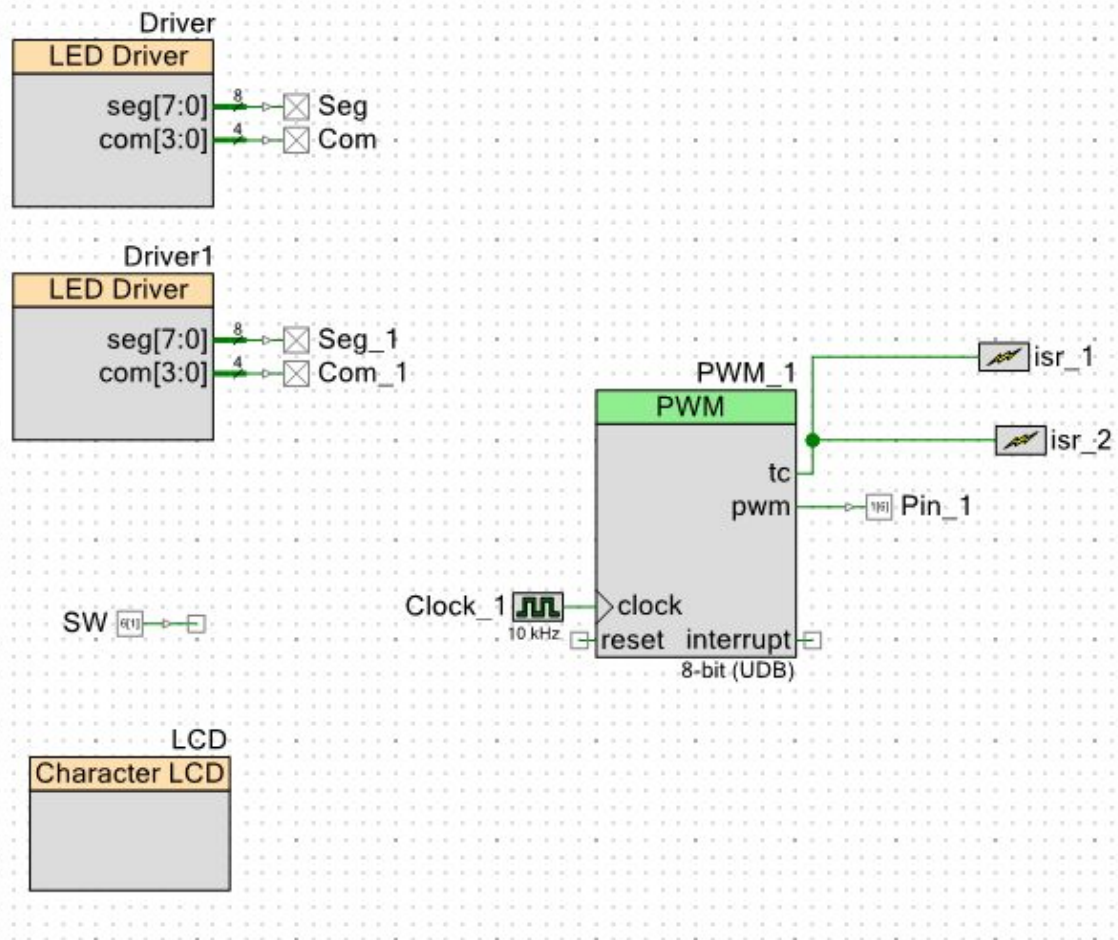
Points Breakdown

- Servo Motor (30 Points)
- 7 Segment Displays (20 Points)
- Pulse Width Modulator (30 Points)
- Interruptor Service Routines (20 Points)

Total 100 Points

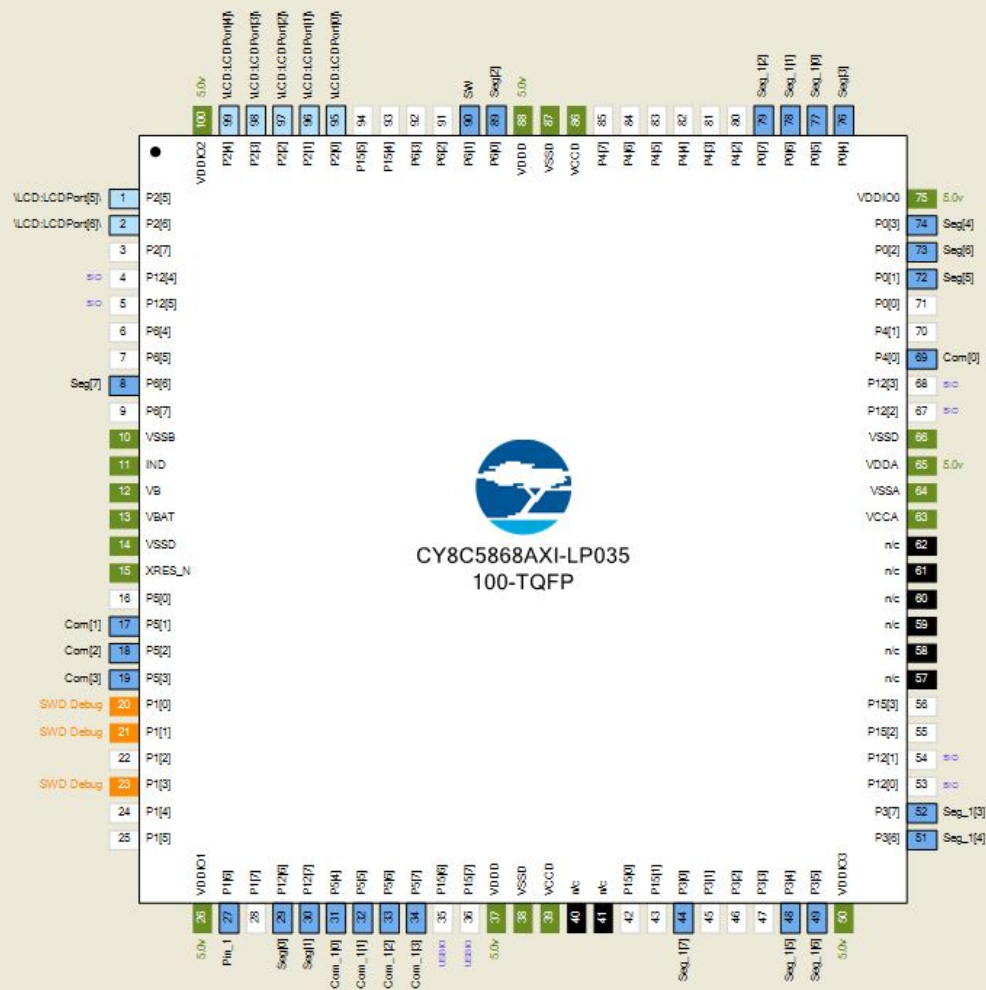
Tasks

- Use the buttons to input time in minutes and seconds
- Wait for end of input
- Turn servo 180 degrees
- Begin counting down
- Display current time on display
- Return servo to beginning state
- Wait for input





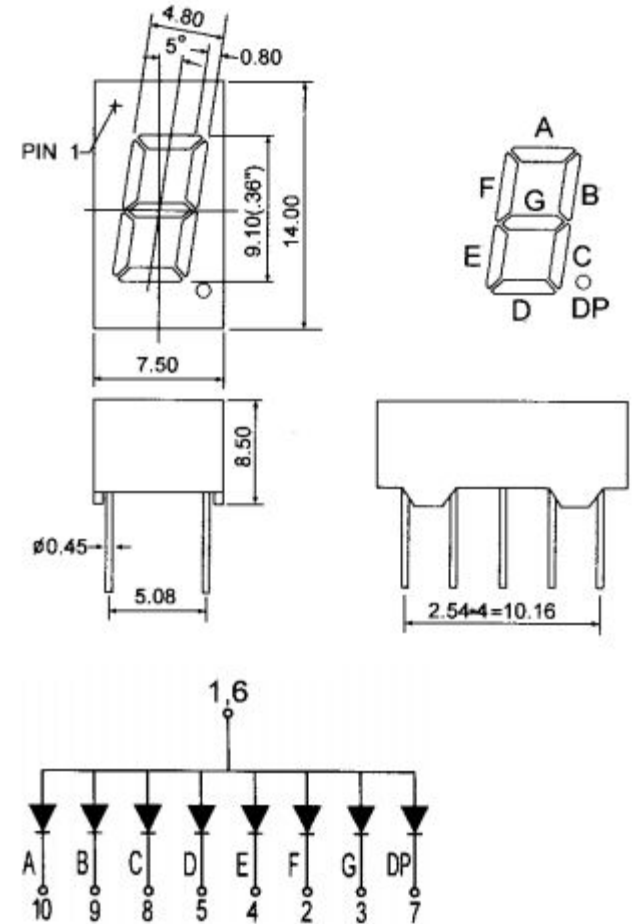
CY8C5868AXI-LP035
100-TQFP

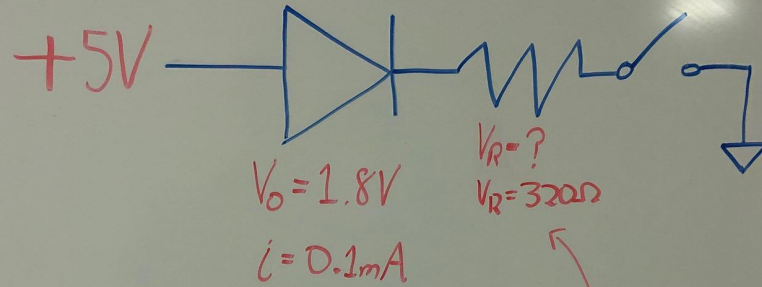


Name	Port
\LCD:LCDPort[6:0]\	P2[6:0]
Com[0]	P4[0]
Com[1]	P5[1]
Com[2]	P5[2]
Com[3]	P5[3]
Com_1[0]	P5[4]
Com_1[1]	P5[5]
Com_1[2]	P5[6]
Com_1[3]	P5[7]
Pin_1	P1[6]
Seg[0]	P12[6]
Seg[1]	P12[7]
Seg[2]	P6[0]
Seg[3]	P0[4]
Seg[4]	P0[3]
Seg[5]	P0[1]
Seg[6]	P0[2]
Seg[7]	P6[6]
Seg_1[0]	P0[5]
Seg_1[1]	P0[6]
Seg_1[2]	P0[7]
Seg_1[3]	P3[7]
Seg_1[4]	P3[6]
Seg_1[5]	P3[4]
Seg_1[6]	P3[5]
Seg_1[7]	P3[0]
SW	P6[1]

3161BS 7 Segment Display

- Only 2 were used due to space limitations on the PSOC board. Thus it can only display 0-60 seconds.





$$\begin{aligned}5V &= V_0 + V_R \\ V_R &= 5 - V_0 \\ V_R &= 5 - 1.8 \\ V_R &= 3.2V\end{aligned}$$

$$\begin{aligned}V_R &= iR \\ R &= \frac{V_R}{i} \\ R &= \frac{3.2}{0.001} \\ R &= 3200\Omega\end{aligned}$$

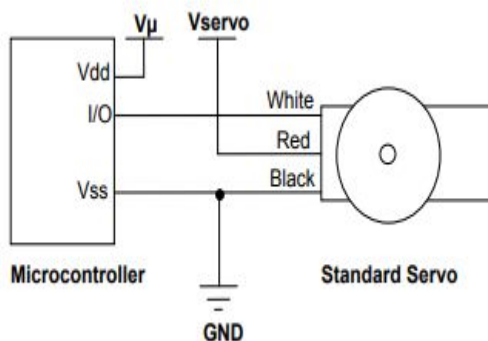
Parallax Standard Servo (#900-00005)

Power requirements: 4 to 6 VDC*;

Maximum current draw is 140 +/- 50 mA at 6 VDC when operating in no load conditions, 15 mA when in static state

The Parallax Standard Servo is controlled through pulse width modulation, where the position of the servo shaft is dependent on the duration of the pulse. In order to hold its position, the servo needs to receive a pulse every 20 ms

Specifications: Pulse-width modulation, 0.75–2.25 ms high pulse, 20 ms intervals

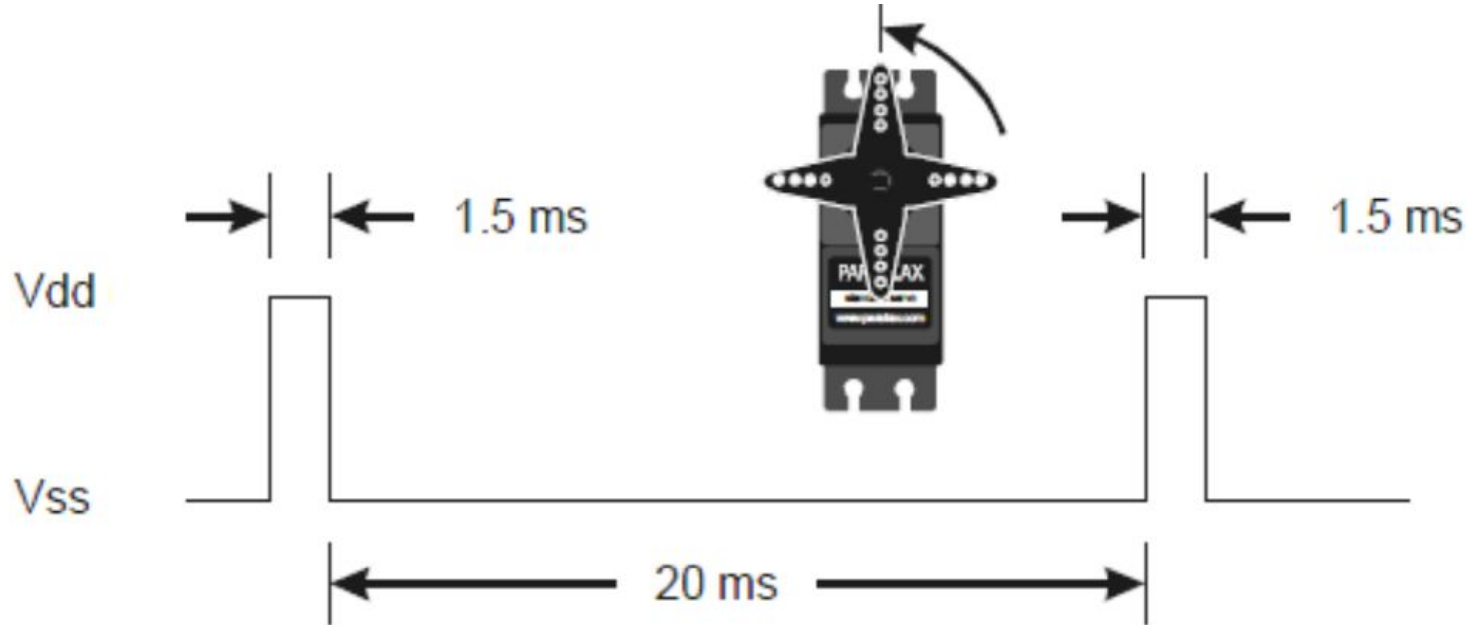


V_{μ} = microcontroller voltage supply

V_{servo} = 4 to 6 VDC, regulated or battery

I/O = PWM TTL or CMOS output signal from microcontroller: 3.3 to 5 V, not to exceed $V_{servo} + 0.2$ V

Timing Diagram



PWM Calculations

BASIC Stamp Module	0.75 ms	1.5 ms (center)	2.25 ms
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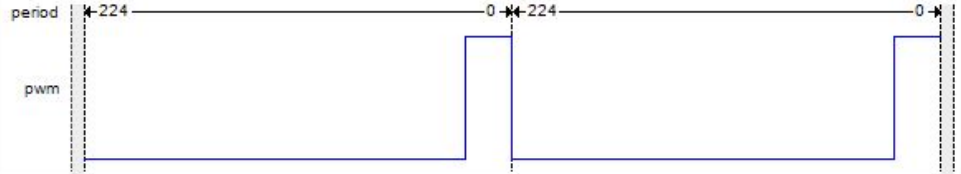
Desired Period = 22.5 ms

Pulse Width = 2.5 ms

Duty cycle = 11%

Name:

Configure Advanced Built-in



Implementation: ☐ Fixed Function ☒ UDB

Resolution: ☒ 8-Bit ☐ 16-Bit

PWM Mode: One Output

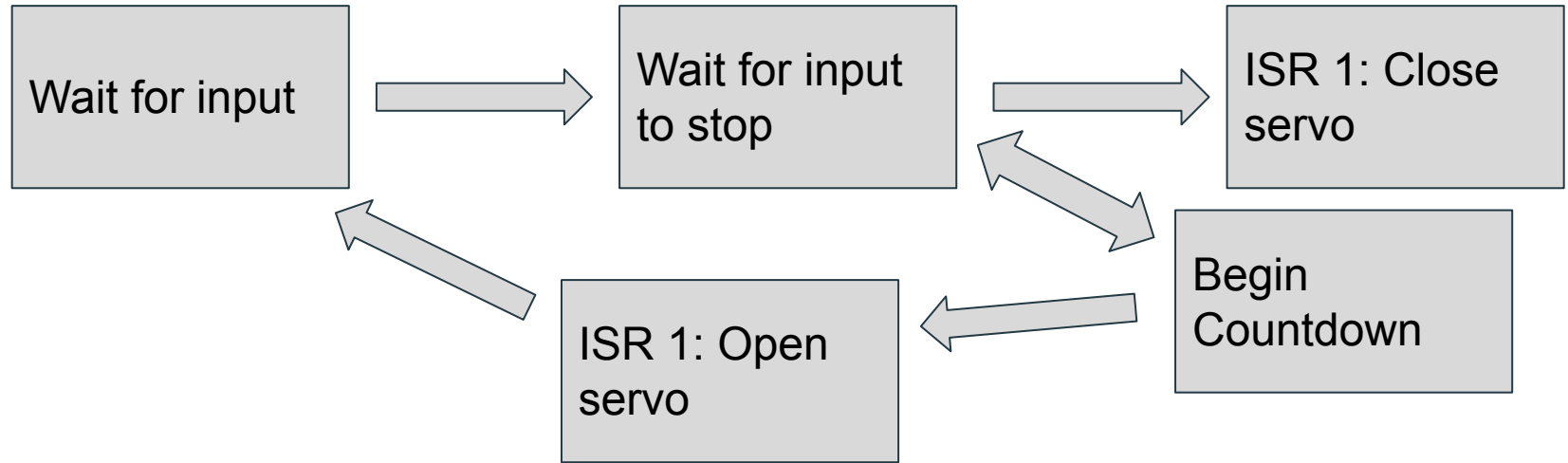
Period: Max **Period = 22.5ms**

CMP Value 1:

CMP Type 1: Less

Dead Band: Disabled

Software Architecture



Instance Name	Interrupt Number	Priority (0 - 7)
isr_1	0	7
isr_2	1	7

```

CY_ISR(isr_1_Interrupt)
{
    #ifdef isr_1_INTERRUPT_INTERRUPT_CALLBACK
        isr_1_Interrupt_InterruptCallback();
    #endif /* isr_1_INTERRUPT_INTERRUPT_CALLBACK */

    /* Place your Interrupt code here. */
    /* `#START isr_1_Interrupt` */
    int x = 0;
    char str1[15];

    while (x<25)
    {
        PWM_1_WriteCompare(x);
        x = x + 1;

        LCD_ClearDisplay();
        LCD_Position(0,0);
        sprintf(str1, "%d",x );
        LCD_PrintString(str1);
        CyDelay(10);
    }
    isr_1_Stop();
    /* `#END` */
}

```

```

CY_ISR(isr_2_Interrupt)
{
    #ifdef isr_2_INTERRUPT_INTERRUPT_CALLBACK
        isr_2_Interrupt_InterruptCallback();
    #endif /* isr_2_INTERRUPT_INTERRUPT_CALLBACK */

    /* Place your Interrupt code here. */
    /* `#START isr_2_Interrupt` */
    int x = 25;
    char str1[15];

    while (x>0)
    {
        PWM_1_WriteCompare(x);
        x = x - 1;
        LCD_ClearDisplay();
        LCD_Position(0,0);
        sprintf(str1, "%d",x );
        LCD_PrintString(str1);
        CyDelay(10);
    }

    isr_2_Stop();
    /* `#END` */
}

```

```

//setting the initial display to show all zeros
Driver_Write7SegDigitDec(0, 0);
Driver1_Write7SegDigitDec(0, 0);

for(;;)
{
    //increment seconds by 1 when button two is pressed
    if (SW_Read() == 0)
    {
        LCD_ClearDisplay();
        LCD_Position(0,0);

        if (seconds < 59)
        {
            seconds = seconds + 1;
            sprintf(str1, "%d", seconds);
            LCD_PrintString(str1);

            if (seconds < 10)
            {
                Driver_Write7SegDigitDec(0, 0);
                Driver1_Write7SegDigitDec(seconds, 0);
            }
            else //when double digits
            {
                Driver_Write7SegDigitDec((seconds / 10), 0); //divid
                Driver1_Write7SegDigitDec((seconds % 10), 0); //modu
            }
        }
    }
    CyDelay(500);
}

```

```

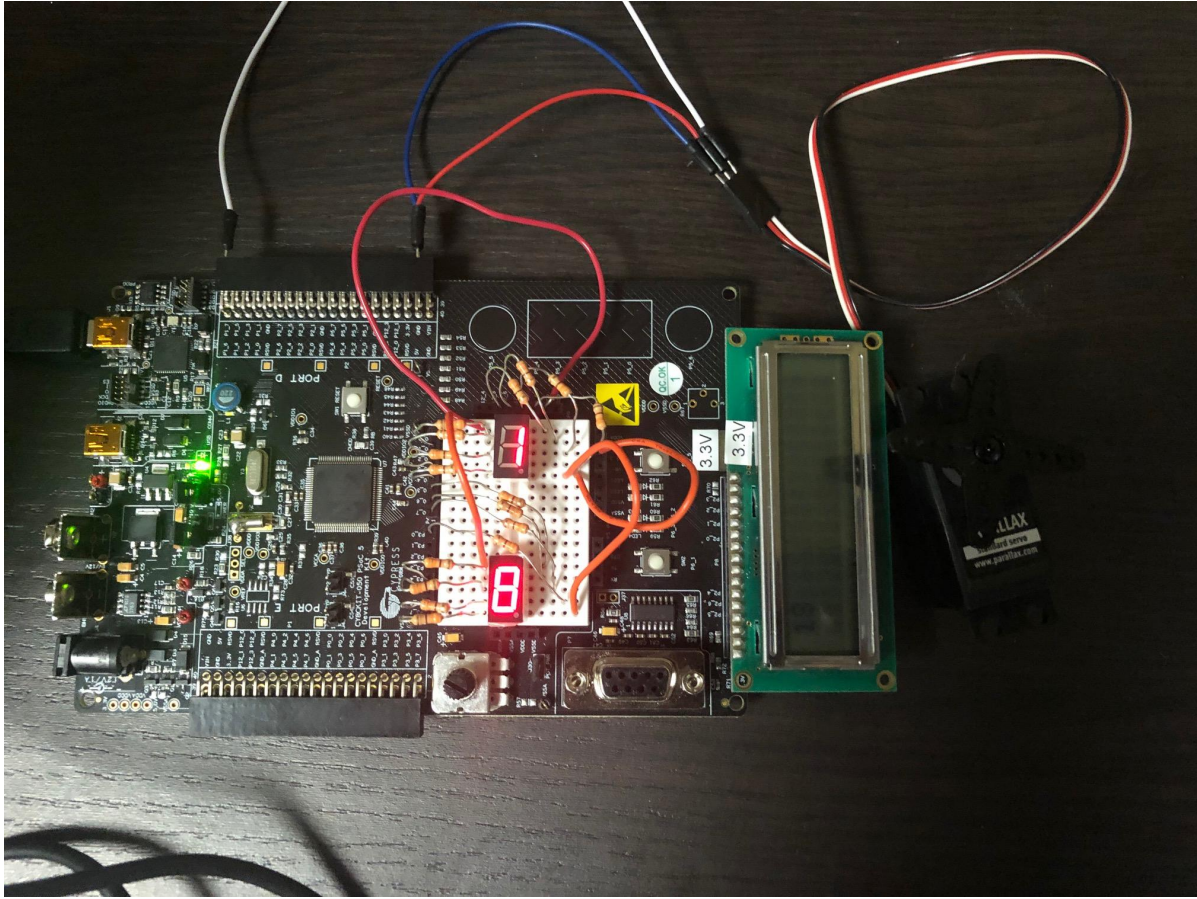
//this is the count down section of the code
if ((SW_Read() != 0) && (seconds > 0))
{
    isr_1_Start();

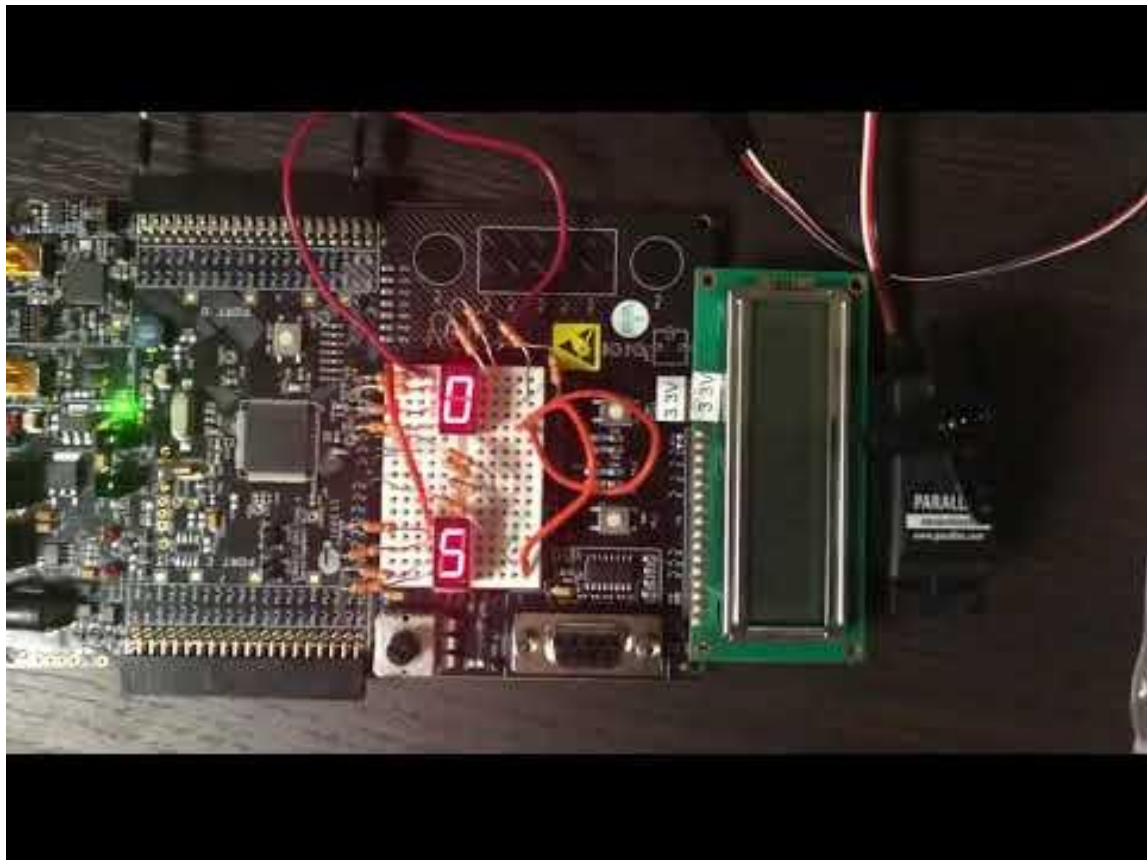
    //this decrements the minutes every 60 seconds
    while (seconds > 0)
    {
        //begin countdown
        CyDelay(1000);

        seconds = seconds - 1;
        LCD_ClearDisplay();
        sprintf(str1, "%d", seconds);
        LCD_PrintString(str1);

        if (seconds < 10)
        {
            Driver_Write7SegDigitDec(0, 0);
            Driver1_Write7SegDigitDec(seconds, 0);
        }
        else //when double digits
        {
            Driver_Write7SegDigitDec((seconds / 10), 0); //sh
            Driver1_Write7SegDigitDec((seconds % 10), 0); //mo
        }
    }
    isr_2_Start();
}

```



Challenges

- Having the count-down timer count down based on an interrupt
- Making sure the servo is in the starting position
- Learning the new components

Conclusion

- We were successful in accomplishing our goals
- We learned a significant amount about PWM, Servos, ISRs, 7-Segment Displays, the C Programming Language, and PSOC Microcontrollers
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Questions?