CPE301 – SPRING 2019

Design Assignment 4A

Student Name: Geovanni Portillo
Student #: 8000603824
Student Email: portig1@unlv.nevada.edu
Primary Github address: https://github.com/portig1/submissions_E
Directory: submissions_E/DA/LAB4A/

Submit the following for all Labs:

1. In the document, for each task submit the modified or included code (only) with highlights and justifications of the modifications. Also, include the comments.

2. Use the previously create a Github repository with a random name (no CPE/301, Lastname, Firstname). Place all labs under the root folder ESD301/DA, sub-folder named LABXX, with one document and one video link file for each lab, place modified asm/c files named as LabXX-TYY.asm/c.

3. If multiple asm/c files or other libraries are used, create a folder LabXX-TYY and place these files inside the folder.

4. The folder should have a) Word document (see template), b) source code file(s) and other include files, c) text file with youtube video links (see template).

1. COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS

Atmel Studio 7
ATmega328PB Xplained mini

Figure 1-1. ATmega328P Xplained Mini Headers and Connectors

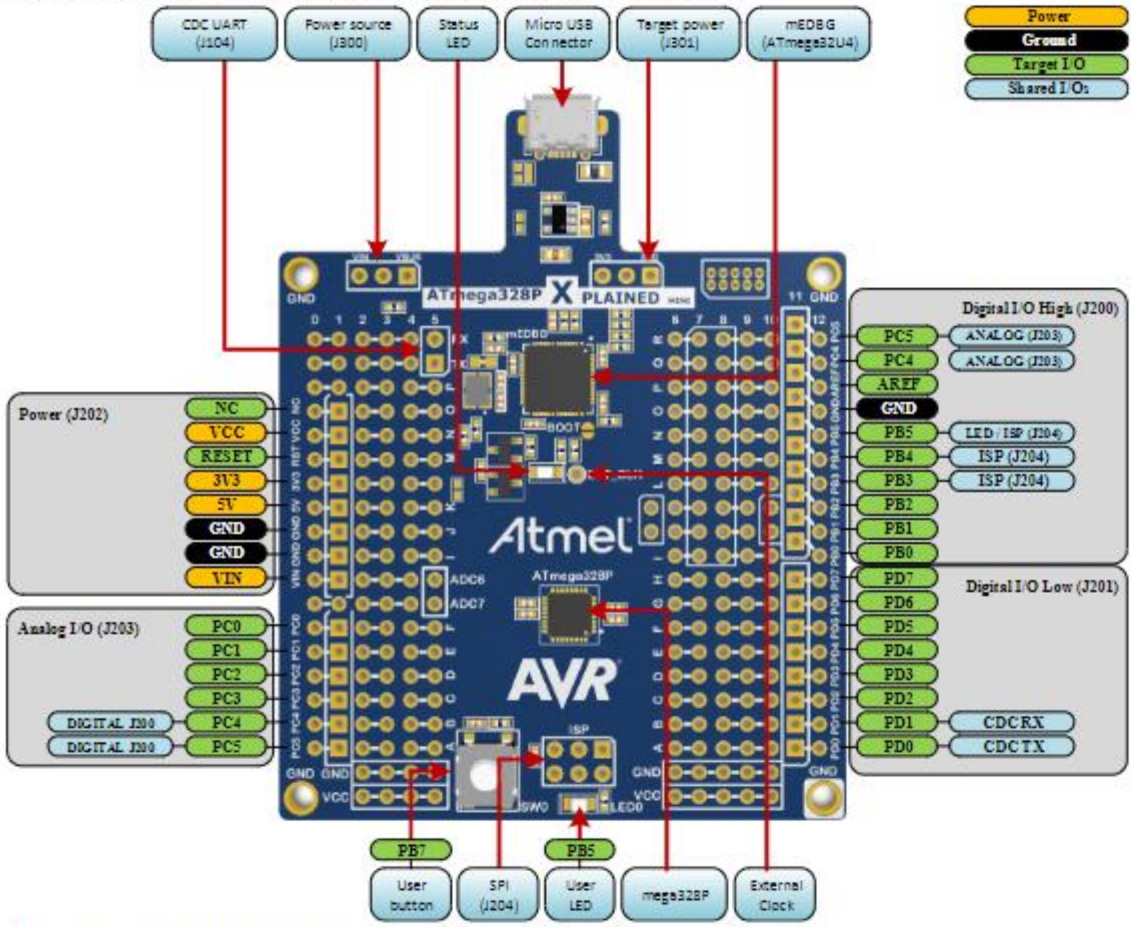
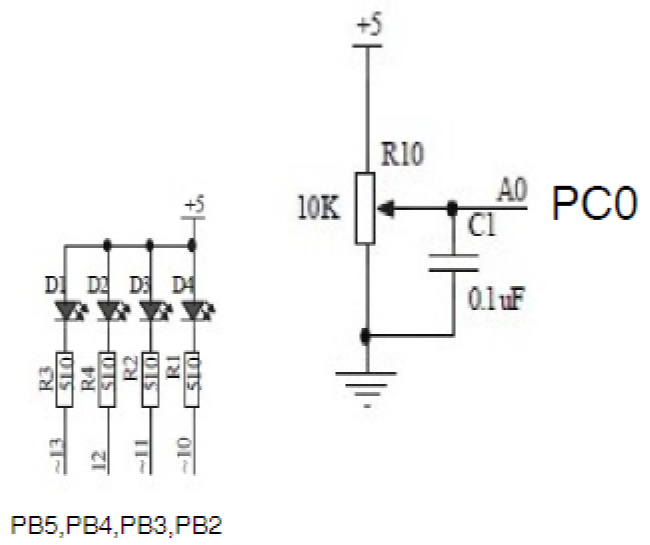
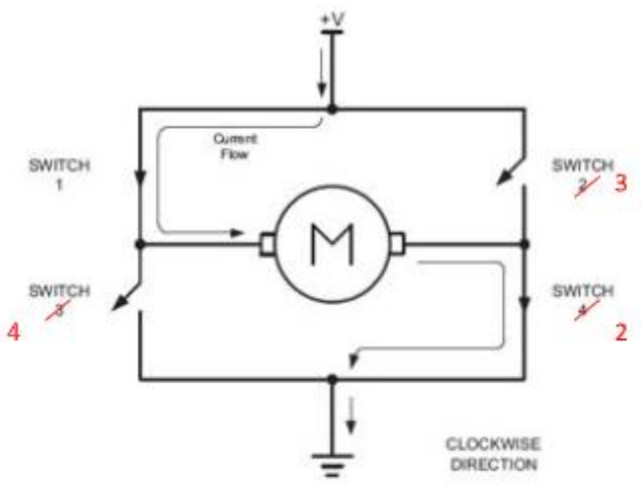
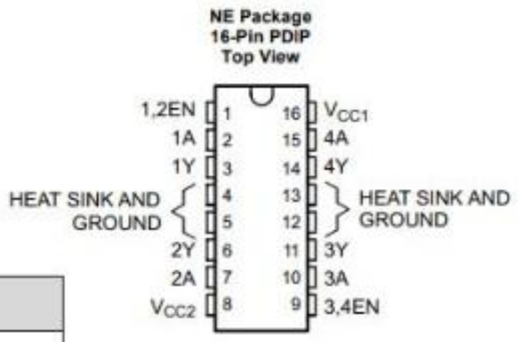


Table 1-1. Default Configurations



Schematic for shield LEDs (PB5:2) and Potentiometer (PC0)





Schematic for the driver L293D

2. INITIAL CODE OF TASK 1 (Replacing Motor With LED)

```
/*
I didn't realize I don’t have the driver chip for the motor in time for this assignment.
There wasn't one included in the lecture kit and the lab kit only has one which my
partner has at the
time of writing this. So to still demonstrate the application of the potentiometer being
used to vary the duty cycle
I’m using the LEDs on the multifunction shield instead.  Though the only difference in
the code would be where
I turn the LEDs off and on, I would change that with turning the 1,2 enable pin on the
driver on and off.
*/

#define F_CPU 16000000UL
#define BAUD_RATE 9600
#define BAUD_PRESCALLER (((F_CPU / (BAUD_RATE * 16UL))) - 1)

#include <avr/io.h>
#include <avr/interrupt.h>
#include <stdio.h>
#include <util/delay.h>

void usart_init ();
void USART_send(unsigned char data);
void USART_putstring(char* StringPtr);

int MTR_Status = 0; //Will be used for the pin change interrupt to toggle whether the
motor can be on or off
int psuedoFallingEdgeDetector = 0; //Will be used so that only on the falling edge of the
pin change process will the MTR _Status be toggled

int main (void)
{
	DDRB = 0xFF;
	PORTB = 0xFF;
	usart_init ();

	PCICR = (1 << PCIE1);
	PCMSK1 = (1 << PCINT9);     //Enable pin change interrupt vector 1 then enable pin
change interrupt 9
	sei();

	/** Setup and enable ADC **/
	ADMUX = (0<<REFS1)|    // Reference Selection Bits
	(1<<REFS0)|    // AVcc - external cap at AREF
	(0<<ADLAR)|    // ADC Left Adjust Result
	(0<<MUX2)|     // Analog Channel Selection Bits
	(0<<MUX1)|     // ADC0 (PC0) Potentionmeter
	(0<<MUX0);

	ADCSRA = (1<<ADEN)|    // ADC Enable
	(0<<ADSC)|     // ADC Start Conversion
	(0<<ADATE)|    // ADC Auto Trigger Enable
	(0<<ADIF)|     // ADC Interrupt Flag
	(0<<ADIE)|     // ADC Interrupt Enable
```

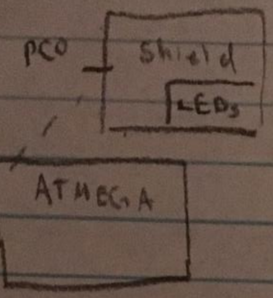
```
        (1<<ADPS2)|     // ADC Prescaler Select Bits
        (0<<ADPS1)|       // CLK/32
        (1<<ADPS0);

        while (1)
        {
               PORTC = (1 << 1); //Enable pull-up for PC1
               ADCSRA|=(1<<ADSC);   //start conversion
               while((ADCSRA&(1<<ADIF))==0);//wait for conversion to finish

               ADCSRA |= (1<<ADIF);

               int tempC = ADCL;
               tempC = tempC | (ADCH<<8);

               char output[20];
               snprintf(output, sizeof(output), "%d\r\n", tempC); //prints out
potentiometer value to serial terminal
               USART_putstring(output);

               //When the ADC value from the potentiometer is below 10, a duty cycle of 0%
will be output. Then above 10 and below 20, a duty cycle of 10%. This goes on until the
value is above
               //90 for which only a 95% duty cycle will be produced
               if((0 <= tempC) & (tempC < 10))
               {
                      if(MTR_Status)
                      {
                             //DC = 0%
                             //Enable motor in clockwise direction;
                             PORTB = 0;
                             _delay_us(0);
                             //Disable motor
                             PORTB = 0xFF;
                             _delay_us(1000);
                      }
                      else
                      {
                             //Disable motor
                             PORTB = 0xFF;
                      }
               }
               else if((10 <= tempC) & (tempC < 20))
               {
                      if(MTR_Status)
                      {
                             //DC = 10%
                             //Enable motor in clockwise direction;
                             PORTB = 0;
                             _delay_us(100);
                             //Disable motor
                             PORTB = 0xFF;
                             _delay_us(900);
                      }
                      else
                      {
                             //Disable motor
                             PORTB = 0xFF;
```

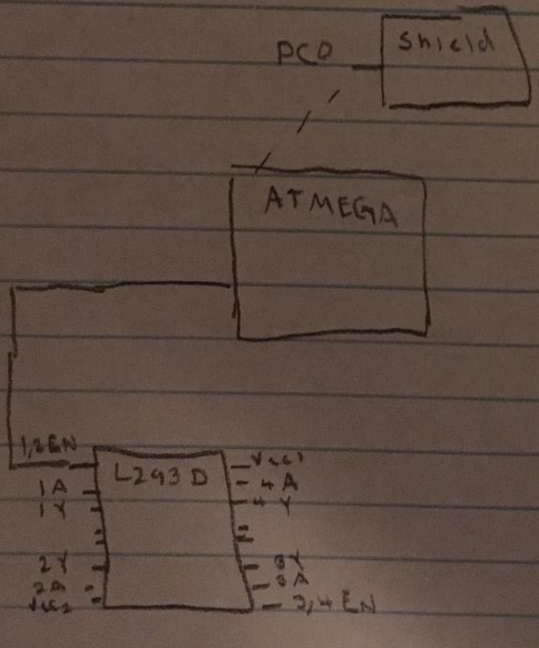
```
		}
	}
	else if((20 <= tempC) & (tempC < 30))
	{
		if(MTR_Status)
		{
			//DC = 20%
			//Enable motor in clockwise direction;
			PORTB = 0;
			_delay_us(200);
			//Disable motor
			PORTB = 0xFF;
			_delay_us(800);
		}
		else
		{
			//Disable motor
			PORTB = 0xFF;
		}
	}
	else if((30 <= tempC) & (tempC < 40))
	{
		if(MTR_Status)
		{
			//DC = 30%
			//Enable motor in clockwise direction;
			PORTB = 0;
			_delay_us(300);
			//Disable motor
			PORTB = 0xFF;
			_delay_us(700);
		}
		else
		{
			//Disable motor
			PORTB = 0xFF;
		}
	}
	else if((40 <= tempC) & (tempC < 50))
	{
		if(MTR_Status)
		{
			//DC = 40%
			//Enable motor in clockwise direction;
			PORTB = 0;
			_delay_us(400);
			//Disable motor
			PORTB = 0xFF;
			_delay_us(600);
		}
		else
		{
			//Disable motor
			PORTB = 0xFF;
		}
	}
	else if((50 <= tempC) & (tempC < 60))
	{
```

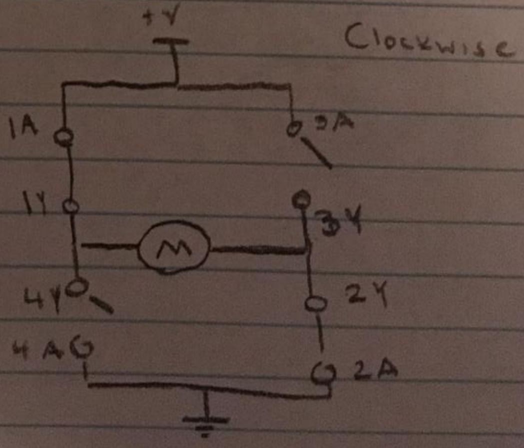
```
                if(MTR_Status)
                {
                        //DC = 50%
                        //Enable motor in clockwise direction;
                        PORTB = 0;
                        _delay_us(500);
                        //Disable motor
                        PORTB = 0xFF;
                        _delay_us(500);
                }
                else
                {
                        //Disable motor
                        PORTB = 0xFF;
                }
        }
        else if((60 <= tempC) & (tempC < 70))
        {
                if(MTR_Status)
                {
                        //DC = 60%
                        //Enable motor in clockwise direction;
                        PORTB = 0;
                        _delay_us(600);
                        //Disable motor
                        PORTB = 0xFF;
                        _delay_us(400);
                }
                else
                {
                        //Disable motor
                        PORTB = 0xFF;
                }
        }
        else if((70 <= tempC) & (tempC < 80))
        {
                if(MTR_Status)
                {
                        //DC = 70%
                        //Enable motor in clockwise direction;
                        PORTB = 0;
                        _delay_us(700);
                        //Disable motor
                        PORTB = 0xFF;
                        _delay_us(300);
                }
                else
                {
                        //Disable motor
                        PORTB = 0xFF;
                }
        }
        else if((80 <= tempC) & (tempC < 90))
        {
                if(MTR_Status)
                {
                        //DC = 80%
                        //Enable motor in clockwise direction;
```

```
				PORTB = 0;
				_delay_us(800);
				//Disable motor
				PORTB = 0xFF;
				_delay_us(200);
			}
			else
			{
				//Disable motor
				PORTB = 0xFF;
			}
		}
		else
		{
			if(MTR_Status)
			{
				//DC = 95%
				//Enable motor in clockwise direction;
				PORTB = 0;
				_delay_us(950);
				//Disable motor
				PORTB = 0xFF;
				_delay_us(50);
			}
			else
			{
				//Disable motor
				PORTB = 0xFF;
			}
		}

	}
	return 0;
}

ISR(PCINT1_vect) //For Pin Change INT 9 on PC1
{
	psuedoFallingEdgeDetector++;
	if(psuedoFallingEdgeDetector > 1) //Only after the pin change interrupt occurs a
second time will it toggle, needed since there isn't a default way of making it so the
interrupt occurs on the falling edge.
	{
		MTR_Status ^= 1; //Toggles MTR_Status
		psuedoFallingEdgeDetector = 0;
	}
	_delay_ms(200); //Delay for switch debouncing
}

void usart_init (void)
{
	UBRR0H = (uint8_t)(BAUD_PRESCALLER >> 8);
	UBRR0L = (uint8_t)(BAUD_PRESCALLER);
	UCSR0B = (1 << RXEN0) | (1 << TXEN0);
	UCSR0C = (3 << UCSZ00);
}


void USART_send( unsigned char data) {
	while (!(UCSR0A & (1 << UDRE0))); //wait until UDR0 is empty
	UDR0 = data;                                //transmit ch

}

void USART_putstring(char* StringPtr) {

	while (*StringPtr != 0x00) {
		USART_send(*StringPtr);
		StringPtr++;
	}

}
```

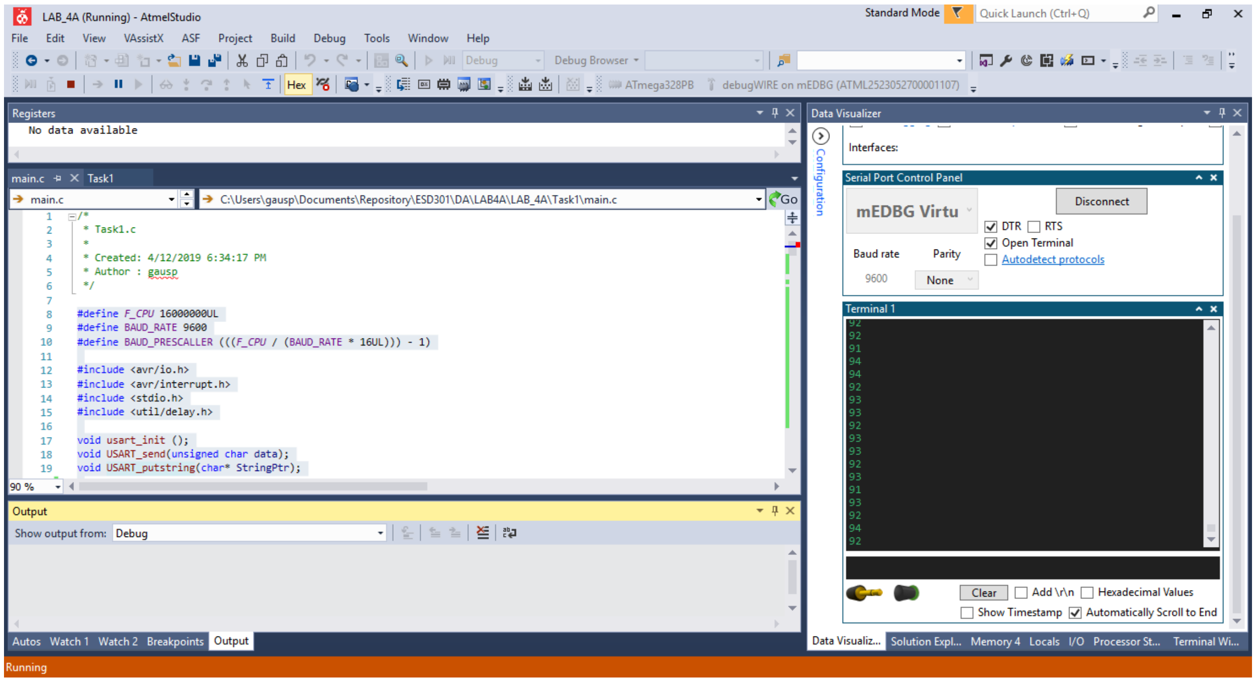
3. SCHEMATICS


PC0
Shield
LEDs
ATMEGA


PC0
Shield
ATMEGA
1,2EN
L293D
1A
1Y
2Y
2A
Vcc2
Vcc1
4A
4Y
3Y
3A
3,4EN


+V
Clockwise
1A
3A
1Y
3Y
M
4Y
2Y
4A
2A

4. SCREENSHOTS OF EACH TASK OUTPUT



LAB_4A (Running) - AtmelStudio

C:\Users\gausp\Documents\Repository\ESD301\DA\LAB4A\LAB_4A\Task1\main.c

```c
/*
 * Task1.c
 *
 * Created: 4/12/2019 6:34:17 PM
 * Author : gausp
 */

#define F_CPU 16000000UL
#define BAUD_RATE 9600
#define BAUD_PRESCALLER (((F_CPU / (BAUD_RATE * 16UL))) - 1)

#include <avr/io.h>
#include <avr/interrupt.h>
#include <stdio.h>
#include <util/delay.h>

void usart_init ();
void USART_send(unsigned char data);
void USART_putstring(char* StringPtr);
```

Registers: No data available

Show output from: Debug

Serial Port Control Panel: mEDBG Virtu; Baud rate 9600; Parity None; [✓] DTR, [ ] RTS, [✓] Open Terminal, [ ] Autodetect protocols

Terminal 1:

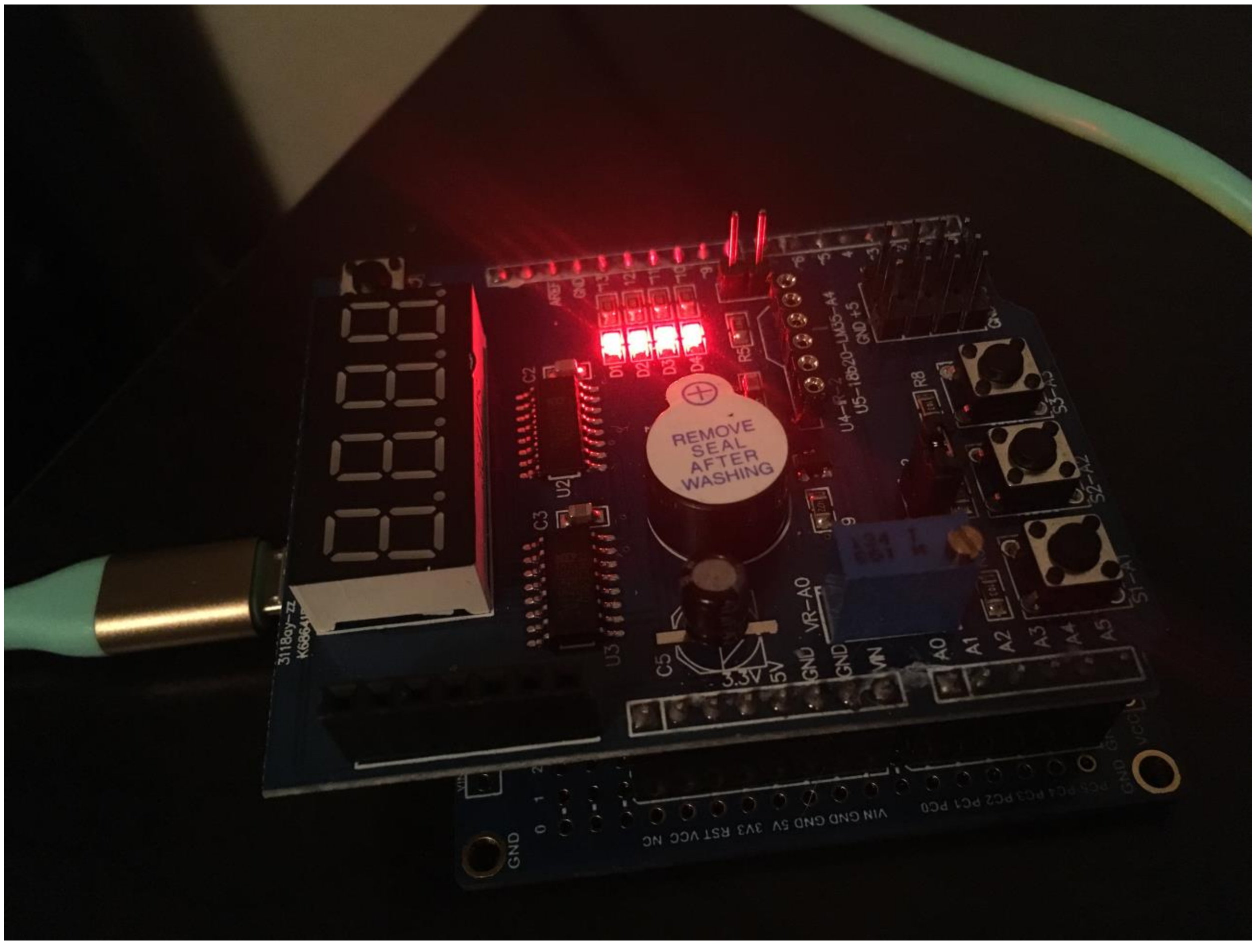
```
92
92
91
94
94
92
93
93
92
93
93
92
93
91
93
92
94
92
```

[ ] Add \r\n [ ] Hexadecimal Values [ ] Show Timestamp [✓] Automatically Scroll to End

Running

Output of potentiometer value on serial terminal

5. SCREENSHOT OF EACH DEMO (BOARD SETUP)


Board setup for PWM with LEDs

6. VIDEO LINKS OF EACH DEMO

https://youtu.be/KiNvxbXI3i0

7. GITHUB LINK OF THIS DA

https://github.com/portig1/submissions_E/tree/master/DA/LAB4A

Student Academic Misconduct Policy

http://studentconduct.unlv.edu/misconduct/policy.html

"This assignment submission is my own, original work".

Geovanni Portillo