

CPE 301 - 1001
DESIGN ASSIGNMENT 4

The goal of the assignment is to write, implement and demonstrate using Microchip Studio 7 a C code for the AVR ATMEGA328pb microcontroller that performs the following functions:

- Read the ADC value from the POT connected to AC0/PC0. Keep displaying the voltage value UART

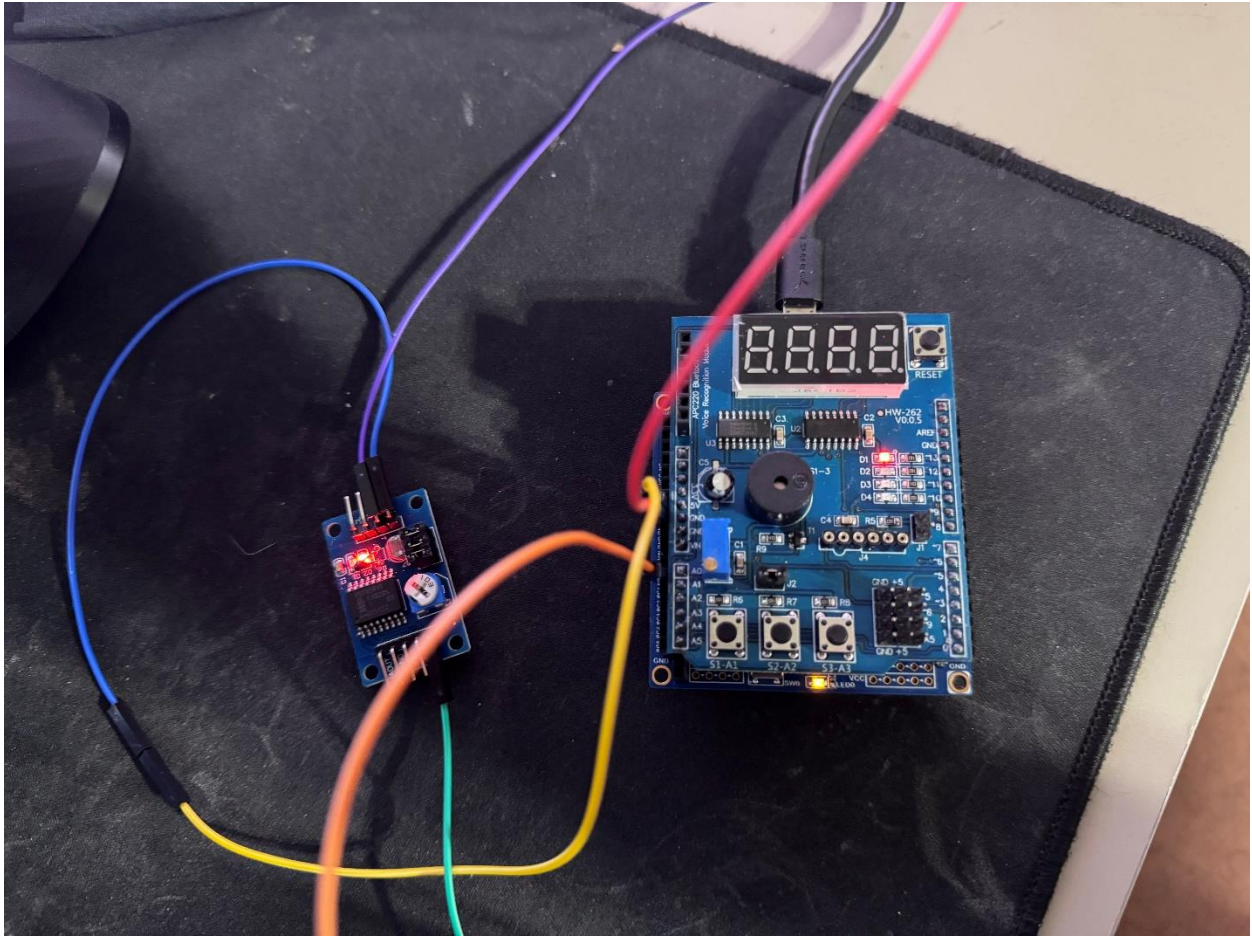
terminal every 0.01 sec. The resolution of the oscilloscope should be 0.1V. Use Timer auto-trigger for

this implementation.

- Using a GUI Python script, display the ADC values as waveform (using tkinter).

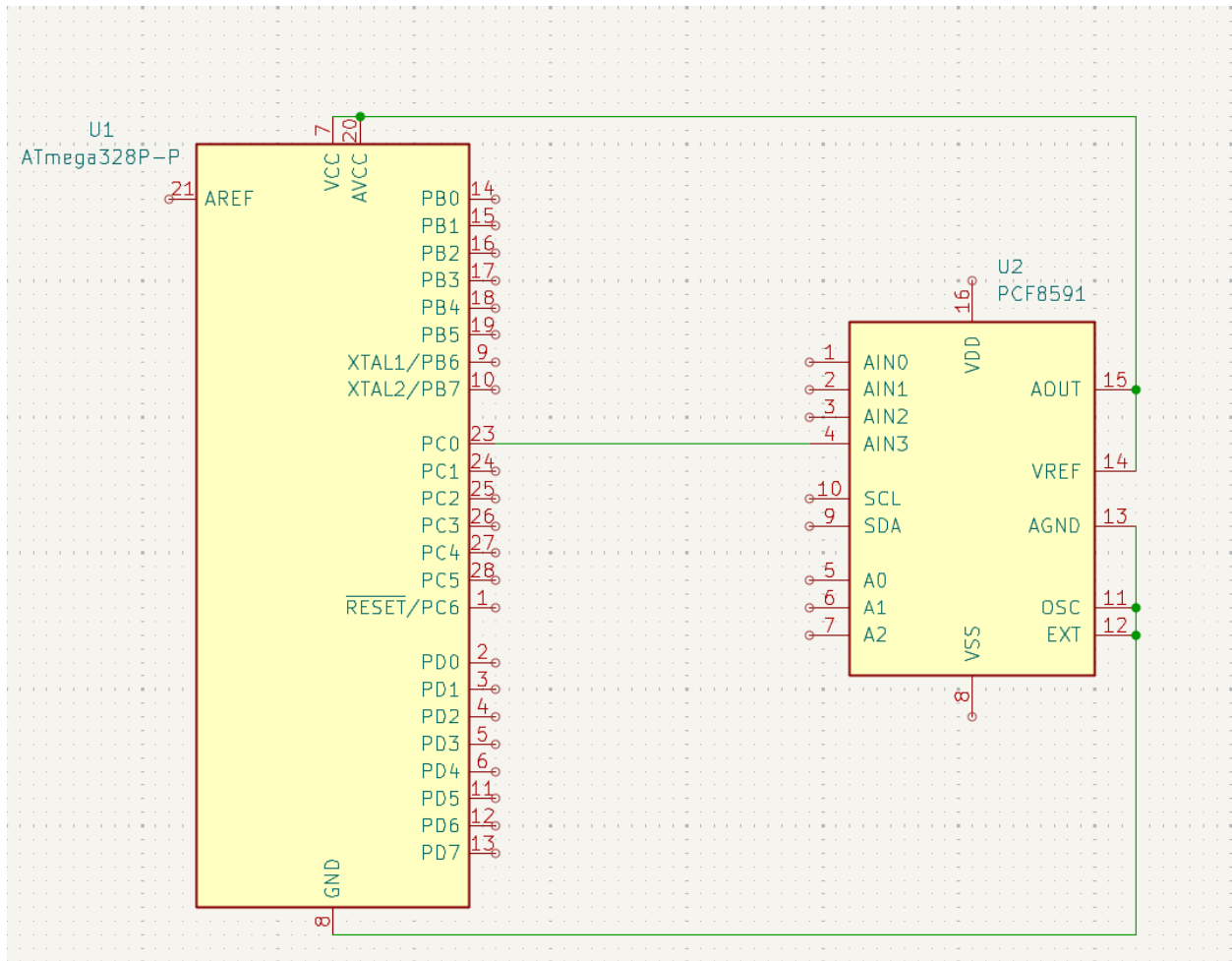
Digital Pins 11, 12 & 13 are used by the ICSP header for MOSI, MISO, SCK connections (Atmega168 pins 17, 18 & 19). Avoid low-impedance loads on these pins when using the ICSP header.

DA4



Atmega328p and potentiometer setup

DA4



Schematic. Instead of an individual potentiometer I used the PCF8591T module which had a potentiometer on it. I just had to hook up AIN3 since that's where the voltage was read.

AVR C Code

```

/*
 * DA4.c
 *
 * Created: 4/5/2025 6:22:31 PM
 * Author : enriq
 */

#ifndef F_CPU
#define F_CPU 16000000UL
#endif

#define BAUD 9600
#define UBRR_VALUE ((F_CPU/16/BAUD) - 1)

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

volatile uint16_t adc_result = 0;

void uart_init() {
    UBRR0H = (UBRR_VALUE >> 8);
    UBRR0L = UBRR_VALUE;
    UCSR0B = (1<<TXEN0);
    UCSR0C = (1<<UCSZ01)|(1<<UCSZ00);
}

void uart_send(char c) {
    while (!(UCSR0A & (1<<UDRE0)));
    UDR0 = c;
}

void adc_init() {
    ADMUX = (1<<REFS0);
    ADCSRA = (1<<ADEN)|(1<<ADSC)|(1<<ADIF)|(1<<ADIFSC)|(1<<ADIFSC)|(1<<ADIFSC); //
    Enable ADC, Auto Trigger, Interrupt
    ADCSRB = 0x00;
    DIDR0 = (1<<ADC0D);
    ADCSRA |= (1<<ADSC); // Start ADC conversion
}

void timer_init() {
    TCCR1B |= (1<<WGM12); // CTC Mode
    OCR1A = 12499; // OCR1A = 2499; // 10ms
    TCCR1B |= (1<<CS11)|(1<<CS10); // prescaler 64
    TIMSK1 |= (1<<OCIE1A);
}

ISR(ADC_vect) {
    adc_result = ADC;
}

```

DA4

```
ISR(TIMER1_COMPA_vect) {
    uint16_t mv = (adc_result * 500) / 1023; // Convert ADC to millivolts

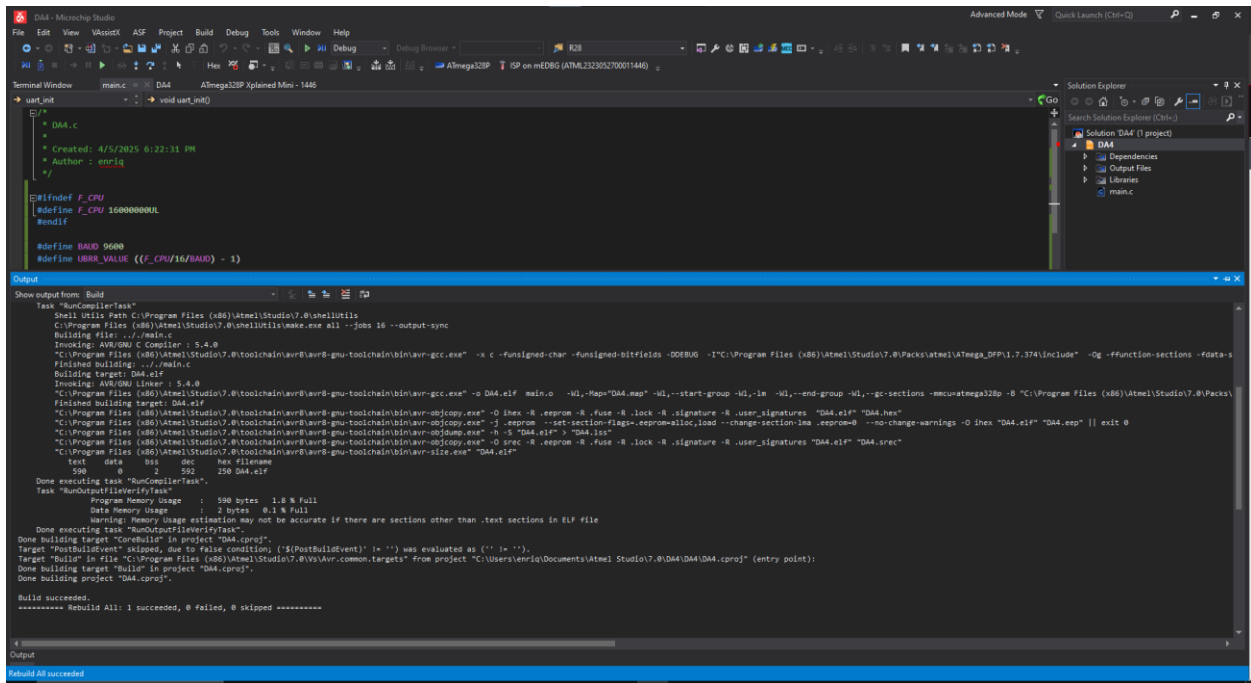
    uart_send((mv / 10) + '0'); // Send whole number part
    uart_send('.');
    uart_send((mv % 10) + '0'); // Send decimal part
    uart_send('\n');
}

int main(void) {
    uart_init();
    adc_init();
    timer_init();

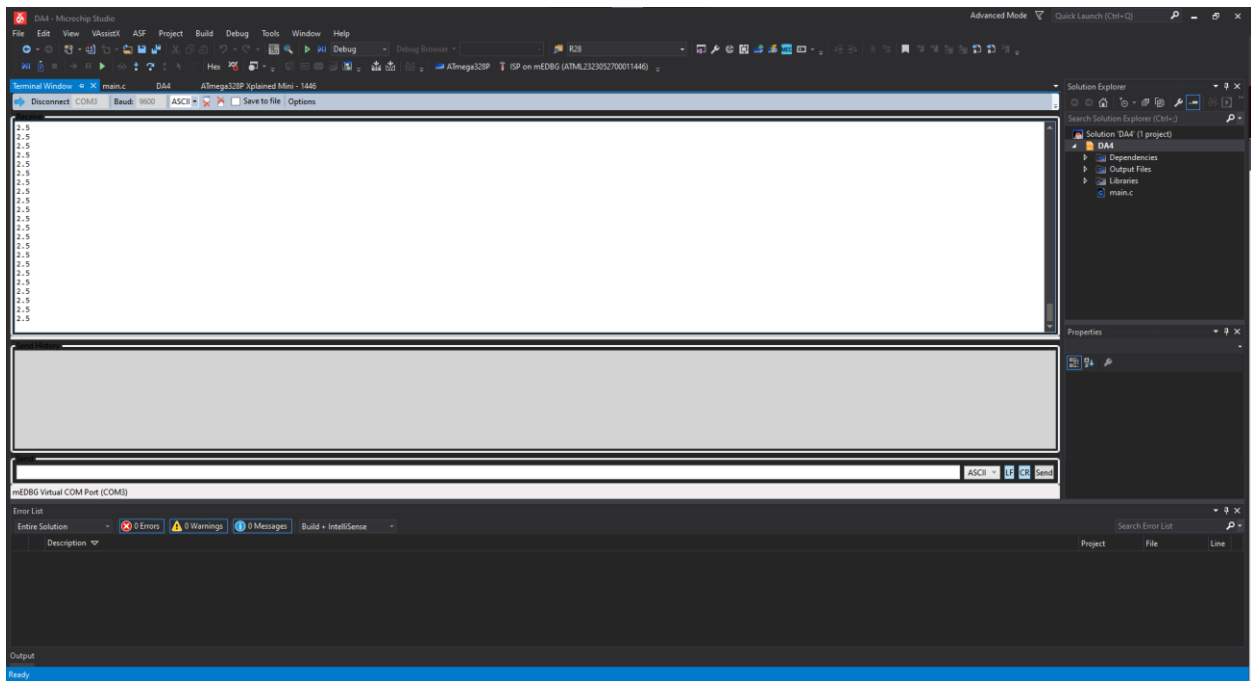
    sei(); // set global interrupt

    while (1) {
    }
}
```

DA4

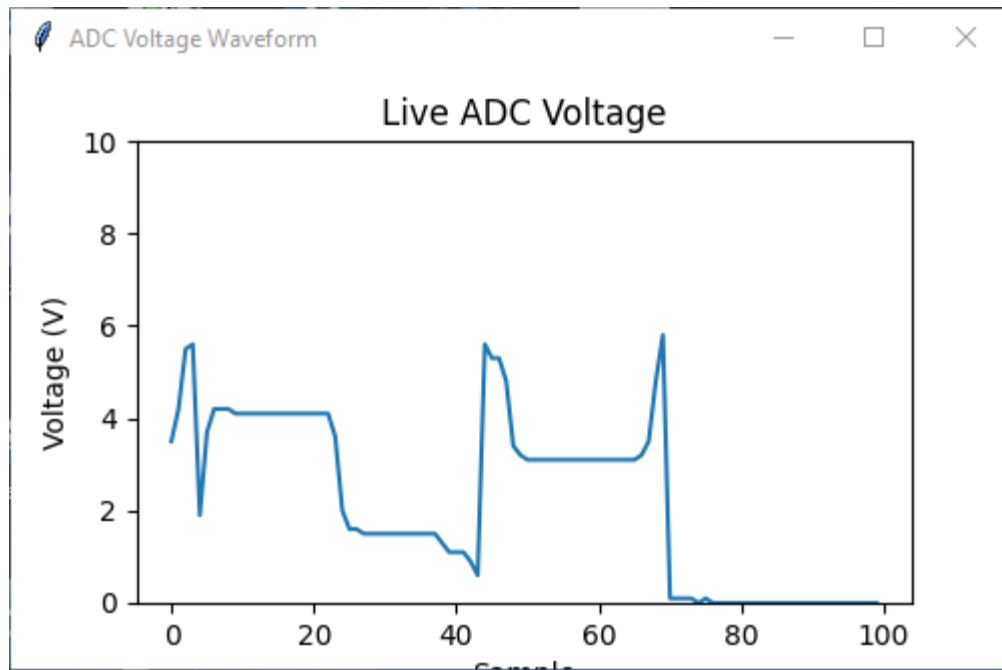


Successful Compilation



Successfully reading values from potentiometer in COM3 at 9600 Baud

DA4



```
Administrator: Windows PowerShell
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\WINDOWS\system32> cd $HOME\Desktop
PS C:\Users\enriq\Desktop> python da4.py
```

Running python script. Used a generic graph template for tkinter to make the script.