CPE301 – SPRING 2019

Design Assignment 5

Student Name: Chris Barr

Student #: 2000682859

Student Email: barrc1@unlv.nevada.edu

Primary Github address: https://github.com/BarrChris

Directory: <https://github.com/BarrChris/submission_da.git>

Partners Name: Cody McDonald

Submit the following for all Labs:

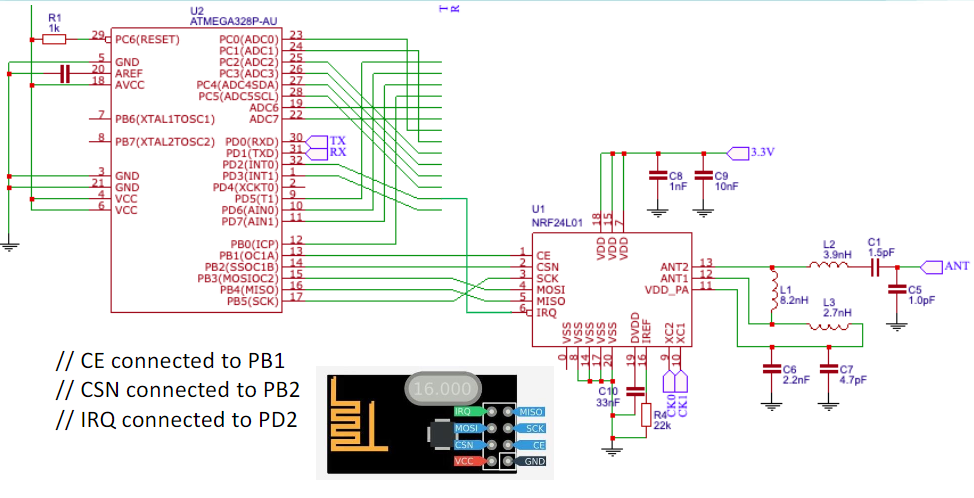
1. In the document, for each task submit the modified or included code (only) with highlights and justifications of the modifications. Also, include the comments.
2. Use the previously create a Github repository with a random name (no CPE/301, Lastname, Firstname). Place all labs under the root folder 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**

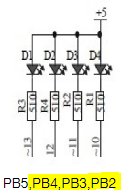
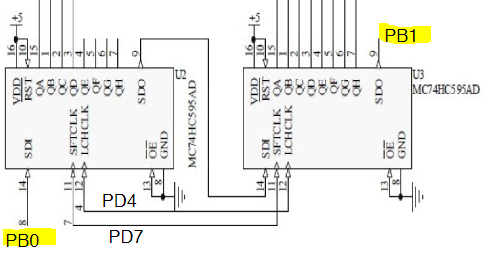
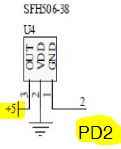
List of Components used

* Atmega328P
* nrf24L01
* FTDI Basic
* 8 M-F wires
* 3 M-M wires
* LM34

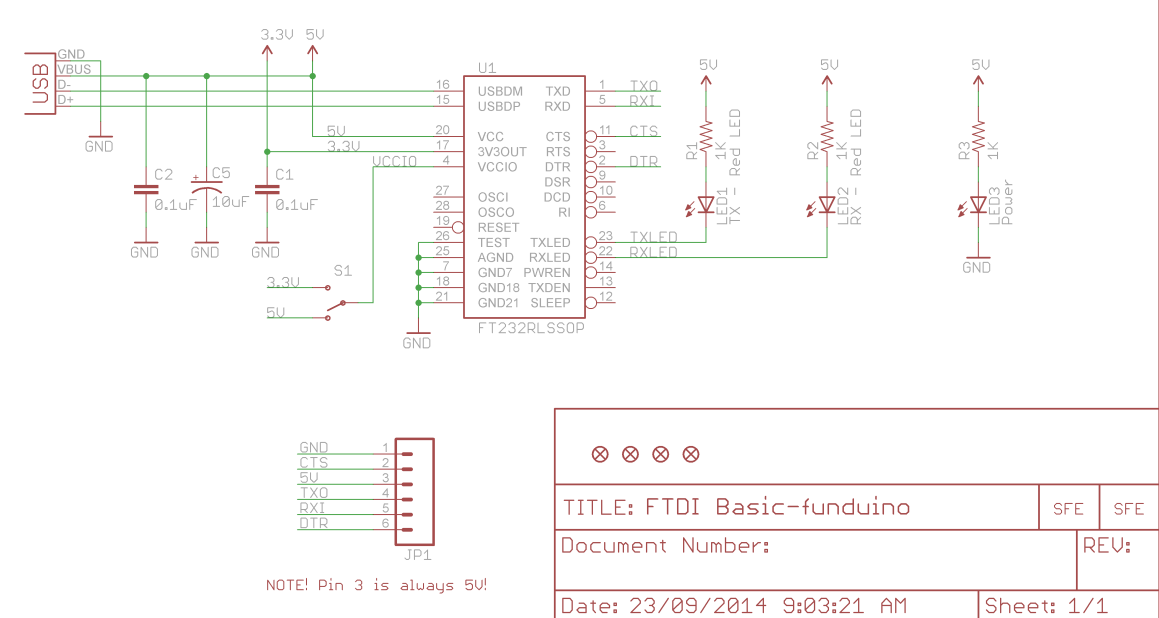
Block diagram with pins used in the Atmega328P



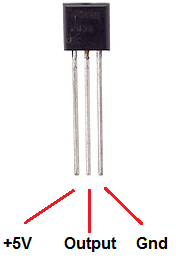
nrf24L01

Pins used on the ATmega328P



This is the diagram for the FTDI



LM34

1. **INITIAL/MODIFIED/DEVELOPED CODE OF TASK 1/A**

// Set clock frequency

#ifndef F\_CPU

#define F\_CPU 16000000UL

#endif

#include <avr/io.h>

#include <util/delay.h>

#include <avr/interrupt.h>

#include <stdbool.h>

#include <stdio.h>

#include <string.h>

// Set up UART for printf();

#ifndef BAUD

#define BAUD 9600

#endif

#include "inc\STDIO\_UART.c"

// Include nRF24L01+ library

#include "inc\nrf24l01.c"

#include "inc\nrf24l01-mnemonics.h"

#include "inc\spi.c"

void print\_config(void);

// Used in IRQ ISR

volatile bool message\_received = false;

volatile bool status = false;

void ADC\_init (void);

volatile unsigned char ADCtemp[5];

volatile *uint8\_t* ADCvalue;

int main(void)

{

// Set cliche message to send (message cannot exceed 32 characters)

char tx\_message[32]; // Define string array

*strcpy*(tx\_message,"It's working!"); // Copy string into array

// Initialize UART

uart\_init();

// Initialize ADC

ADC\_init();

// Initialize nRF24L01+ and print configuration info

nrf24\_init();

print\_config();

// Start listening to incoming messages

nrf24\_start\_listening();

*strcpy*(tx\_message,"Initializing Chat Room..."); // Copy string into array

nrf24\_send\_message(tx\_message);

while (1)

{

if (message\_received)

{

// Message received, print it

message\_received = false;

*printf*("Received Temperature: %s\n\n",nrf24\_read\_message());

// Send message as response

*\_delay\_ms*(500);

status = nrf24\_send\_message(ADCtemp);

if (status == true) *printf*("Temperature Successfully Sent\n\n");

}

}

}

// Interrupt on IRQ pin

ISR(INT0\_vect)

{

message\_received = true;

}

// Interrupt for Temperature Sensor

ISR(ADC\_vect)

{

volatile unsigned int j=0;

char temp[5];

ADCvalue = (ADCH << 1); // Shifts the value left to one place

*itoa*(ADCvalue, temp, 10); // Converts integers to string

// Takes ADCvalue, turns it into an ASCII representation

// the ASCII representation will be stored under 'temp'

// '10' represents the buffer

while (j<5) // Transfers the temp string from itoa() to ADCtemp

{

ADCtemp[j] = temp[j];

j++;

}

}

// Prints configuration

void print\_config(void)

{

*uint8\_t* data;

*printf*("Startup successful\n\n nRF24L01+ configured as:\n");

*printf*("-------------------------------------------\n");

nrf24\_read(CONFIG,&data,1);

*printf*("CONFIG 0x%x\n",data);

nrf24\_read(EN\_AA,&data,1);

*printf*("EN\_AA 0x%x\n",data);

nrf24\_read(EN\_RXADDR,&data,1);

*printf*("EN\_RXADDR 0x%x\n",data);

nrf24\_read(SETUP\_RETR,&data,1);

*printf*("SETUP\_RETR 0x%x\n",data);

nrf24\_read(RF\_CH,&data,1);

*printf*("RF\_CH 0x%x\n",data);

nrf24\_read(RF\_SETUP,&data,1);

*printf*("RF\_SETUP 0x%x\n",data);

nrf24\_read(STATUS,&data,1);

*printf*("STATUS 0x%x\n",data);

nrf24\_read(FEATURE,&data,1);

*printf*("FEATURE 0x%x\n",data);

*printf*("-------------------------------------------\n\n");

}

void ADC\_init (void)

{

//ADC Multiplexer Selection Register

ADMUX = (1 << REFS0) | // Voltage reference during conversion, "AVcc with external capacitor at AREF pin"

(1 << ADLAR); // Left adjust ADC conversion result in ADC Data Register

//ADC Control and Status Register A

ADCSRA = (1 << ADEN) | // ADC enable

(1 << ADSC) | // ADC Start Conversion

(1 << ADATE) | // ADC Auto Trigger enable

(1 << ADIE) | // ADC Interrupt enable

(1 << ADPS2) |

(1 << ADPS1) |

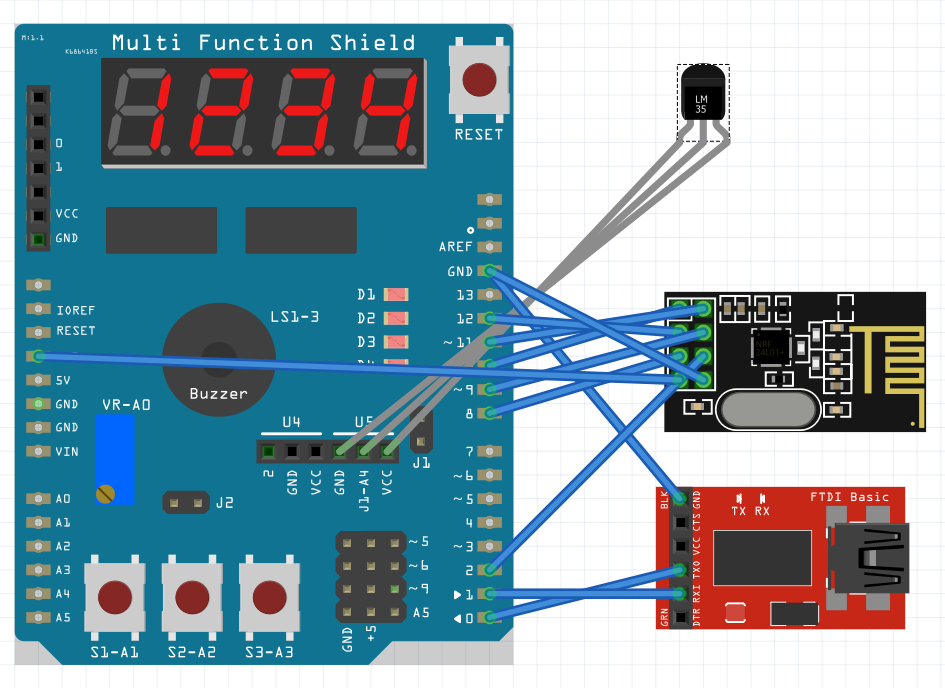
(1 << ADPS0); // ADPS2:0 = 111 = 128 prescaler

}

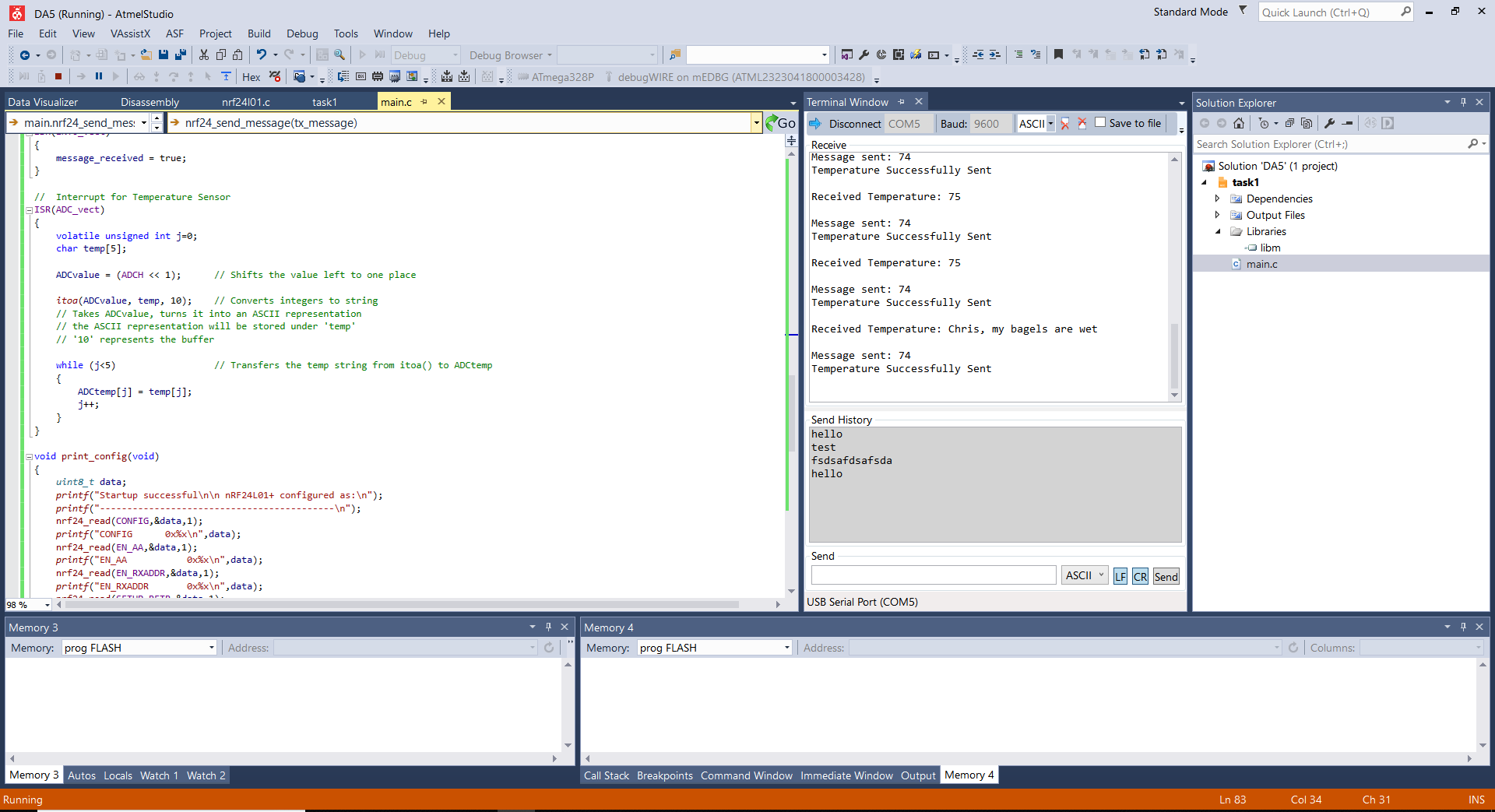
1. **DEVELOPED MODIFIED CODE OF TASK 2/A from TASK 1/A**

N/A

1. **SCHEMATICS**

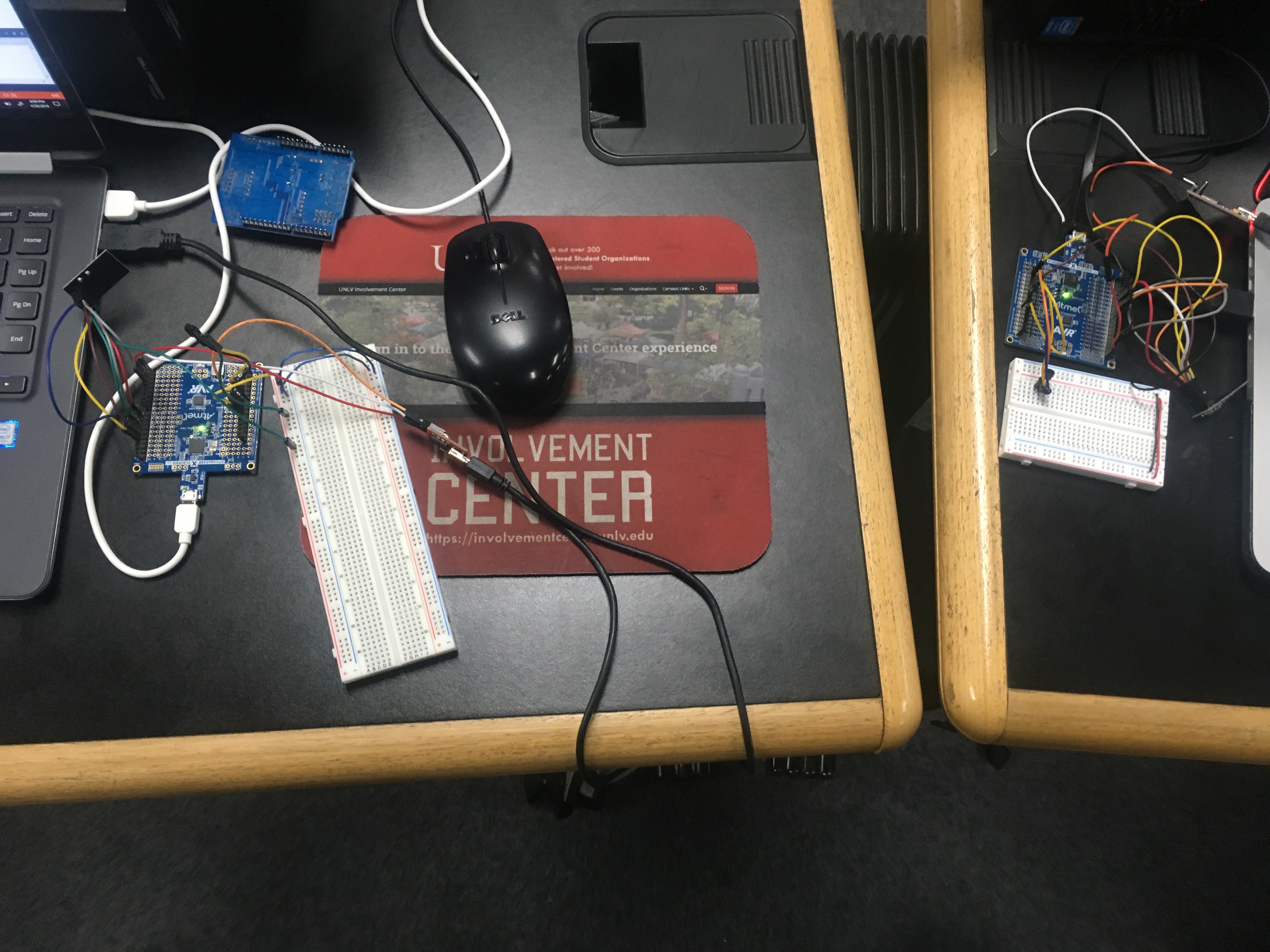


1. **SCREENSHOTS OF EACH TASK OUTPUT (ATMEL STUDIO OUTPUT)**



Terminal Window shows my message sent and their message sent

1. **SCREENSHOT OF EACH DEMO (BOARD SETUP)**



Two boards setup



Whole setup

1. **VIDEO LINKS OF EACH DEMO**

<https://www.youtube.com/watch?v=KRzlfvb9-Io>

1. **GITHUB LINK OF THIS DA**

<https://github.com/BarrChris/submission_da/tree/master/DesignAssignments/DA5>

**Student Academic Misconduct Policy**

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

“This assignment submission is my own, original work”.

Chris Barr