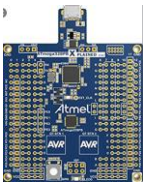
CPE301 – SPRING 2019

Design Assignment 3A

Student Name: Meral Abu-Jaser
Student #: 5003137888
Student Email: abujaser@unlv.nevada.edu
Primary Github address: https://github.com/MeralAbuJaser/Submission_da.git
Directory: https://github.com/MeralAbuJaser/Submission_da/tree/master/DA3A

1. COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS


Atmega 328pb

Atmel Studio 7.0
-debugger
-simulator
-assembler
-programmer
-data visualizer

ATmega328PB
-FTDI chip
-USART

CpE301 Embedded Systems Design — Venki Muthukumar

CpE301 - Design Assignment 3A — DUE: See Website

Design Assignment 3A:
The goal of the assignment is to modify the above codes to do the following:

1. Write a C AVR program that will display a string, random integer and floating-point values on the serial terminal every 1 sec. Use a FTDI chip for serial to USB conversion and display the values in the terminal.
2. Repeat 1 using a timer with interrupt for the 1 sec delay. Use a FTDI chip for serial to USB conversion and display the values in the terminal.

Submission:

The following are required for successful completion of the design assignment:
a. AVR C code that has been compiled and working.
b. The C code should be well documented with explanation of every instruction.
c. A word document that contains the flow chart of the assembly code along with the snapshots of the schematics, components connected on the breadboard and screen shoots.

Points:
Task 1: 100%. (Code=60%, Documentation=20%, Verification/Snapshots=20%)

Evaluation Rubrics:
See class website for the DA evaluation rubrics.

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

```
/*
 * DA3A_PART1.c
 *
 * Created: 4/15/2020 9:41:52 AM
 * Author : Meral
 */

#define F_CPU 16000000UL
#define BAUD 9600

#include <stdio.h>
#include <stdlib.h>
#include <avr/io.h>
#include <util/delay.h>
#include <util/setbaud.h>
#include <time.h>

void USART_init(void){
	UBRR0H = UBRRH_VALUE;
	UBRR0L = UBRRL_VALUE;
	UCSR0C = _BV(UCSZ01) | _BV(UCSZ00); /* 8-bit data */
	UCSR0B = _BV(RXEN0) | _BV(TXEN0);   /* Enable RX and TX */
}

/* Send data to the serial port */
void USART_tx_string( char *data ){
	while ((*data != '\0')){ //while the register is empty enter date
		while (!(UCSR0A & (1 <<UDRE0)));
			UDR0 = *data;
			data++; //increment data location forward
	}
}

int main(void){
	srand(time(NULL)); //random number generator
	USART_init(); //call function to initialize

	float float_num; //to hold random floating values
	char char_num[20]; //buffer for whole numbers
	char char_float[20]; //buffer for float

	while (1){
		_delay_ms(1000); //display 1 second
		itoa(rand(), char_num, 10); //convert integer to string
		float_num = rand()*0.15;
		snprintf(char_float,sizeof(char_float),"%f\r\n",float_num);//prints formatted output

		USART_tx_string("Hello! this is Meral and this is my DA3A task 1 code\n"); //print the string
		USART_tx_string(char_num); //print the int value
		USART_tx_string(" \n");
		USART_tx_string(char_float); // print the floating value
	}
}
```

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

```
/*
Meral Abu-Jaser
Assignment 3A. Task 2
*/

#define F_CPU 16000000UL
#define BAUD 9600

#include <stdio.h>
#include <stdlib.h>
#include <avr/io.h>
#include <util/delay.h>
#include <util/setbaud.h>
#include <time.h>
#include <avr/interrupt.h>
volatile uint8_t counter = 0;

void USART_init(void){
	UBRR0H = UBRRH_VALUE;
	UBRR0L = UBRRL_VALUE;
	UCSR0C = _BV(UCSZ01) | _BV(UCSZ00); //8-bit data
	UCSR0B = _BV(RXEN0) | _BV(TXEN0);   //Enable RX and TX
}

//Send data to the serial port
void USART_tx_string( char *data ){
	while ((*data != '\0')){ //while the register is empty enter date
		while (!(UCSR0A & (1 <<UDRE0)));
			UDR0 = *data;
			data++; //increment data location forward
	}
}

ISR(TIMER0_OVF_vect){
	counter++;     //increment counter
}

int main(void){
	srand(time(NULL));    //random number generator
	USART_init();  //call function to initialize
	TCCR0A = 0x00; //normal mode timer
	TCCR0B = 0x05; //set pre0scaler = 1024
	TCNT0 = 0;     //counter = 0
	TIMSK0 = (1<<TOIE0);  //enable interrupt
	sei(); //enable global

	float float_num; //to hold random floating values
	char char_num[20]; //buffer for whole numbers
	char char_float[20]; //buffer for float

	while (1){
		if(counter > 61){
		itoa(rand(), char_num, 10); //convert integer to string
		float_num = rand()*0.15;
		snprintf(char_float,sizeof(char_float),"%f\r\n",float_num);//prints formatted output

		USART_tx_string("Hello! this is Meral and this is my DA3A task 2 code\n"); //print the string
		USART_tx_string(char_num); //print the int value
		USART_tx_string(" \n");
		USART_tx_string(char_float); // print the floating value

		counter = 0; //reset the counter
		}
	}
}
```

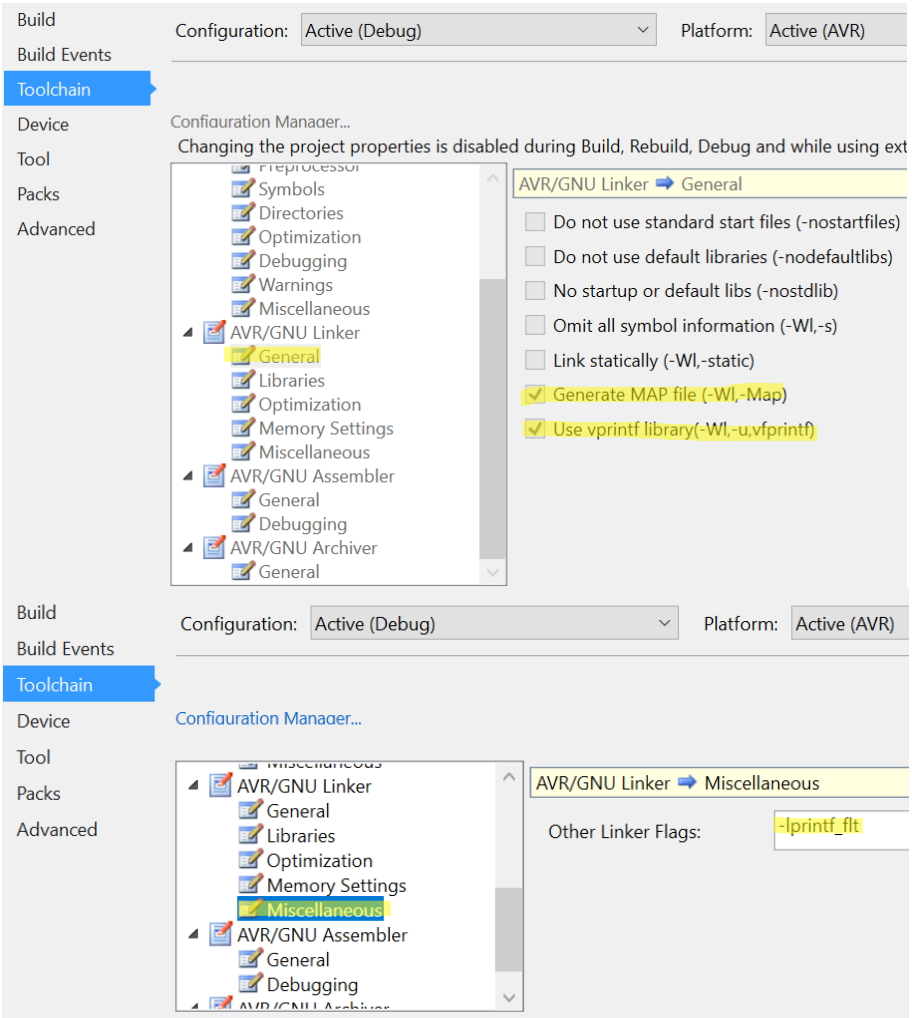
4. SCHEMATICS

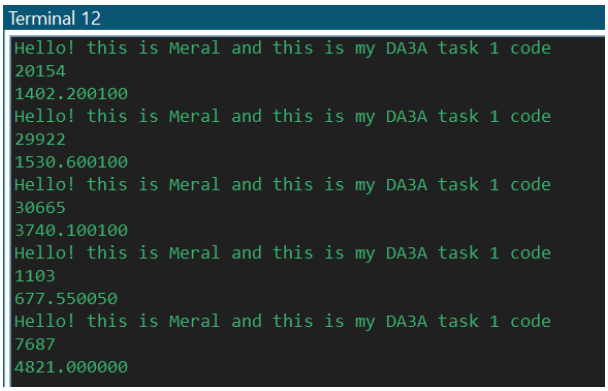
N/A

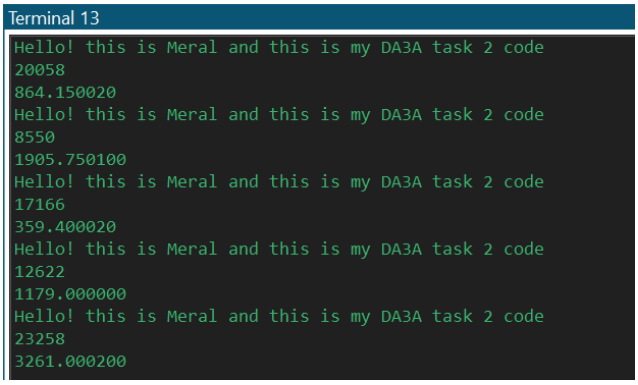
5. SCREENSHOTS OF EACH TASK OUTPUT (ATMEL STUDIO OUTPUT)

To show the floating value I had to so the following:

1. on the top menu, click Project → <project name> Properties
2. Click Toolchain in the page at the left of the project properties page and then General under the AVR/GNU Linker
3. click Miscellaneous under the AVR/GNU Linker item and add the following in the Other Linker Flags
4. write the following flag -lprintf_flt

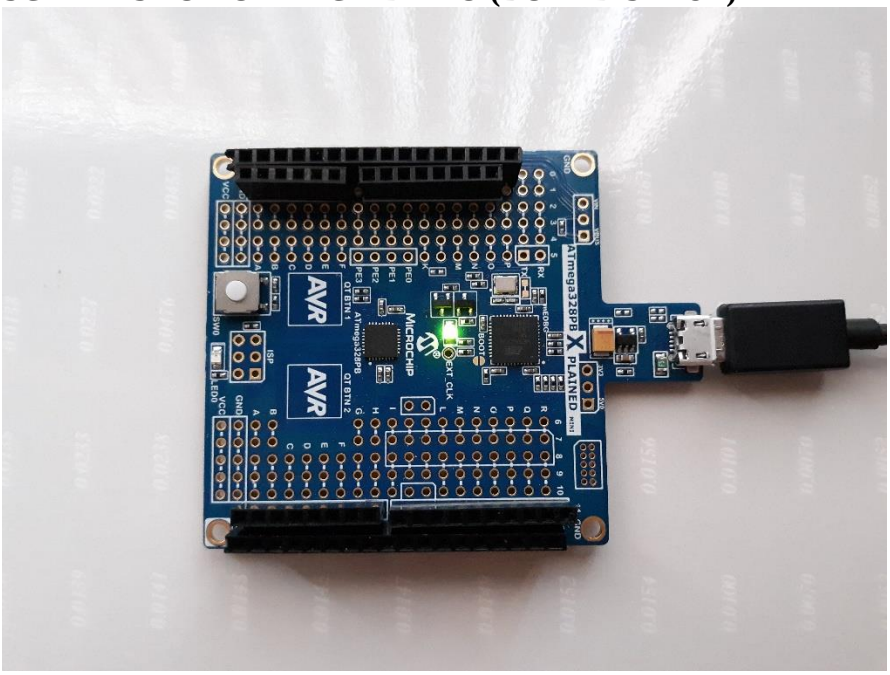






Task 1 output task 2 output

6. SCREENSHOT OF EACH DEMO (BOARD SETUP)



7. VIDEO LINKS OF EACH DEMO

Task 1.
https://www.youtube.com/watch?v=eP6CCqT10Lo
Task 2.
https://www.youtube.com/watch?v=6EmyEIeam9A

8. GITHUB LINK OF THIS DA

https://github.com/MeralAbuJaser/Submission_da/tree/master/DA3A

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