Design Assignment 6

CPE 301 Fall 2016

Luis Ruiz

PART 0

The assignment took me about 1 hours to do.

1. PART A: Description

My design consists of a C program that reads in a value from a potentiometer and outputs on to the screen using UART. The program takes advantage of Analog to Digital converter to read a voltage off a potentiometer that is creating a voltage divider with a resistor. The value being read is consistently fluctuating from 0 – 5 V max, depending on the restive state of the potentiometer. The value of the resistor is 330 ohms as for the potentiometer, it has a max value of 2000 ohms. The output will be via PUTTY using UART using asynchronous communication. Note a delay of 1 second is placed for more readability, since it is a string is consistently being outputted.

PART B: Code

Header File ioe.h

```
#include <avr/io.h>


#ifndef IOE_H
#define IOE_H

#ifndef FREQ
#define FREQ  16000000UL
#endif

/*SETTINGS*/
#define BAUDRATE 9600                                                    //BAUDRATE (9600 is
default)
#define BUFF   256

#define ASYNCH_NORM  (FREQ/16/BAUDRATE - 1)
#define ASYNCH_DUB   (FREQ/8/BAUDRATE - 1)
#define SYNC_MASTER (FREQ/2/BAUDRATE - 1)

/*MACROS USEFUL TO DISABLE AND ENABLE*/
#define TX_START()          UCSR0B |= _BV(TXEN0) // Enable TX
#define TX_STOP()           UCSR0B &= ~_BV(TXEN0)       // Disable TX
#define RX_START()          UCSR0B |= _BV(RXEN0) // Enable RX
#define RX_STOP()           UCSR0B &= ~_BV(RXEN0)       // Disable RX
```

```
#define COMM_START() TX_START(); RX_START()      // Enable communicationsF
#define COMM_STOP()         TX_STOP();RX_STOP()         // Disable Communication

//Frame Size to be Transmitted
#define CHAR6()                     UCSR0C |= _BV(UCSZ00)
#define CHAR7()                     UCSR0C |= _BV(UCSZ01)
#define CHAR8()                     UCSR0C |= _BV(UCSZ01)|_BV(UCSZ00)
#define CHAR9()                     UCSR0B |= _BV(UCSZ02);UCSR0C |= _BV(UCSZ01)|_BV(UCSZ00)

/* Interrupt macros; Remember to set the GIE bit in SREG before using (see datasheet) */
#define RX_INTEN()          UCSR0B |= _BV(RXCIE0)       // Enable interrupt on RX complete
#define RX_INTDIS()         UCSR0B &= ~_BV(RXCIE0)      // Disable RX interrupt
#define TX_INTEN()          UCSR0B |= _BV(TXCIE0)       // Enable interrupt on TX complete
#define TX_INTDIS()         UCSR0B &= ~_BV(TXCIE0)      // Disable TX interrupt

/*Stop Bit*/
#define STOPBIT_1()         UCSR0C &= ~(1<<USBS0)
#define STOPBIT_2()         UCSR0C |= (1<<USBS0)

/*Parity Mode*/
#define DisParity()  UCSR0C &= ~(1<<UPM01);UCSR0C &= ~(1<<UPM00)
#define EvenParity() UCSR0C |= (1<<UPM01)
#define OddParity()         UCSR0C |= (1<<UPM01)|(1<<UPM00)

/*MODE*/
#define ASYNCH_MODE()       UCSR0C &= ~(1<<UMSEL01);UCSR0C &= ~(1<<UMSEL00)
#define SYNCH_MODE() UCSR0C |= (1<<UMSEL00)
#define MASTER_MODE()       UCSR0C |= (1<<UMSEL01)|(1<<UMSEL00)

/*Enable Interrupts*/
#define recInterrupt UCSR0B |= (1 << RXCIE0)

/*FUNCTION DECLERATION*/

/*
 * Procedure to initialize USART0 asynchronous with enabled RX/TX, 8 bit data,
 * no parity, and 1 stop bit.
*/
void usart0_init_ ();


// Return a char from the serial buffer
/*  Use this function if the RX interrupt is not enabled.
*      Returns 0 on empty buffer
*/

unsigned char getChar_(void);


//Transmits a byte
/*
 *     Use this function if the TX interrupt is not enabled.
 *     Blocks the serial port while TX completes
 */
void putChar_(unsigned char data);


/*A string print called printm that uses a
```

```
char array and your putchar clone to transmit
strings*/

void printm(unsigned char *str);


/*uses an uninitialized char array and your getchar clone to
construct a string for your ATmega328P */
//const unsigned char* scanm(void);


#endif /*IOE_H*/
```

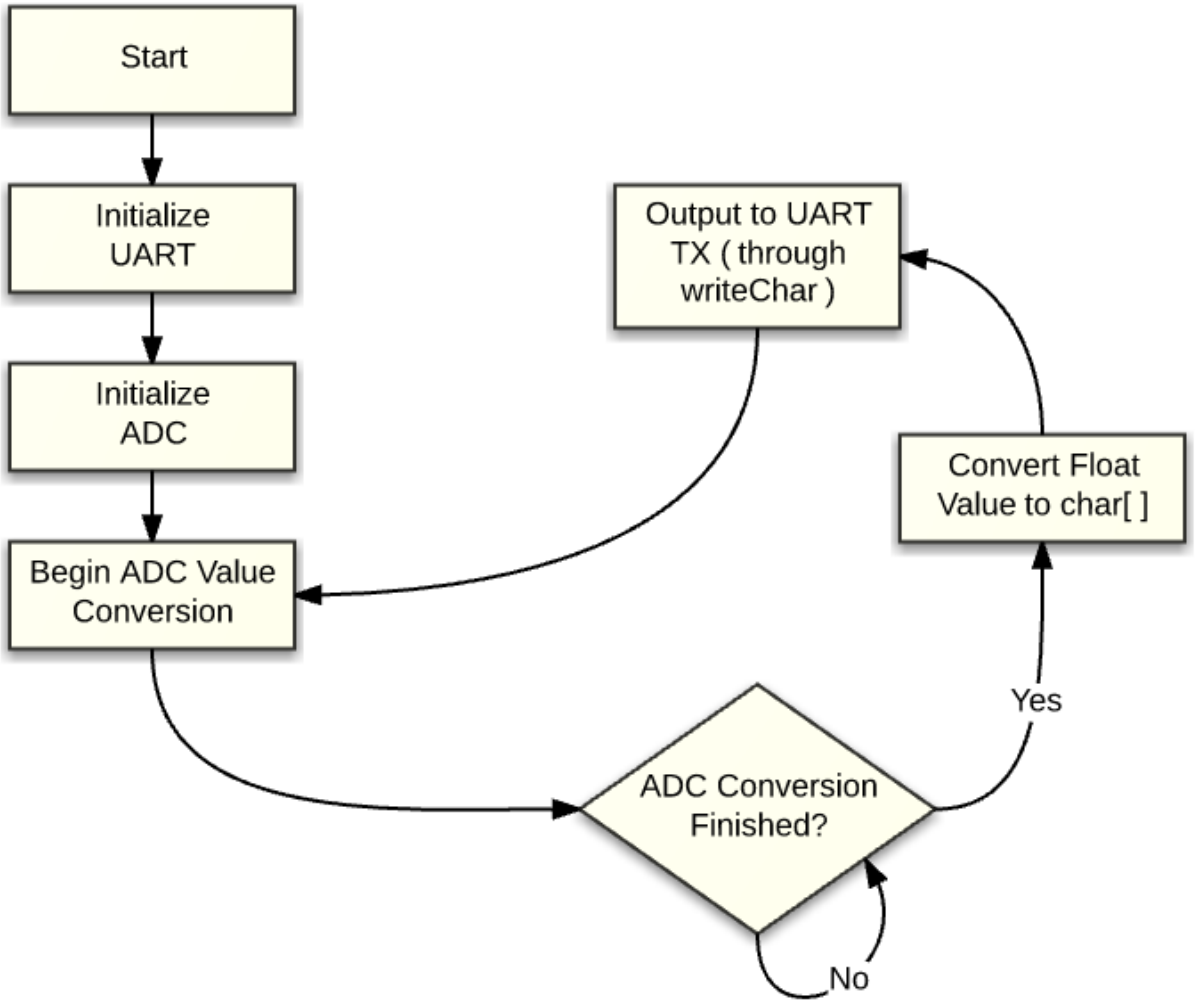
Main.c

```
/*
 * Author : Luis
 */

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

#define F_CPU 16000000UL

/*
 * Procedure to initialize USART0 asynchronous with enabled RX/TX, 8 bit data,
 * no parity, and 1 stop bit.
*/
void usart0_init_ ()
{
	// To set baud rate
	UBRR0H = ((ASYNCH_NORM) >> 8);                          //top nibble
	UBRR0L = (uint8_t) ((ASYNCH_NORM)) ;            //lower byte

	COMM_START();                                                                   // enable
transmit/receive

	// asynchronous, 8N1, disable parity, 1 stop bit
	ASYNCH_MODE();
	DisParity();
	STOPBIT_1();
	CHAR8();
}

// Return a char from the serial buffer
/*  Use this function if the RX interrupt is not enabled.
*	Returns 0 on empty buffer
*/

unsigned char getChar_(void)
{
	//Check if something was received and then
	//return the item
```

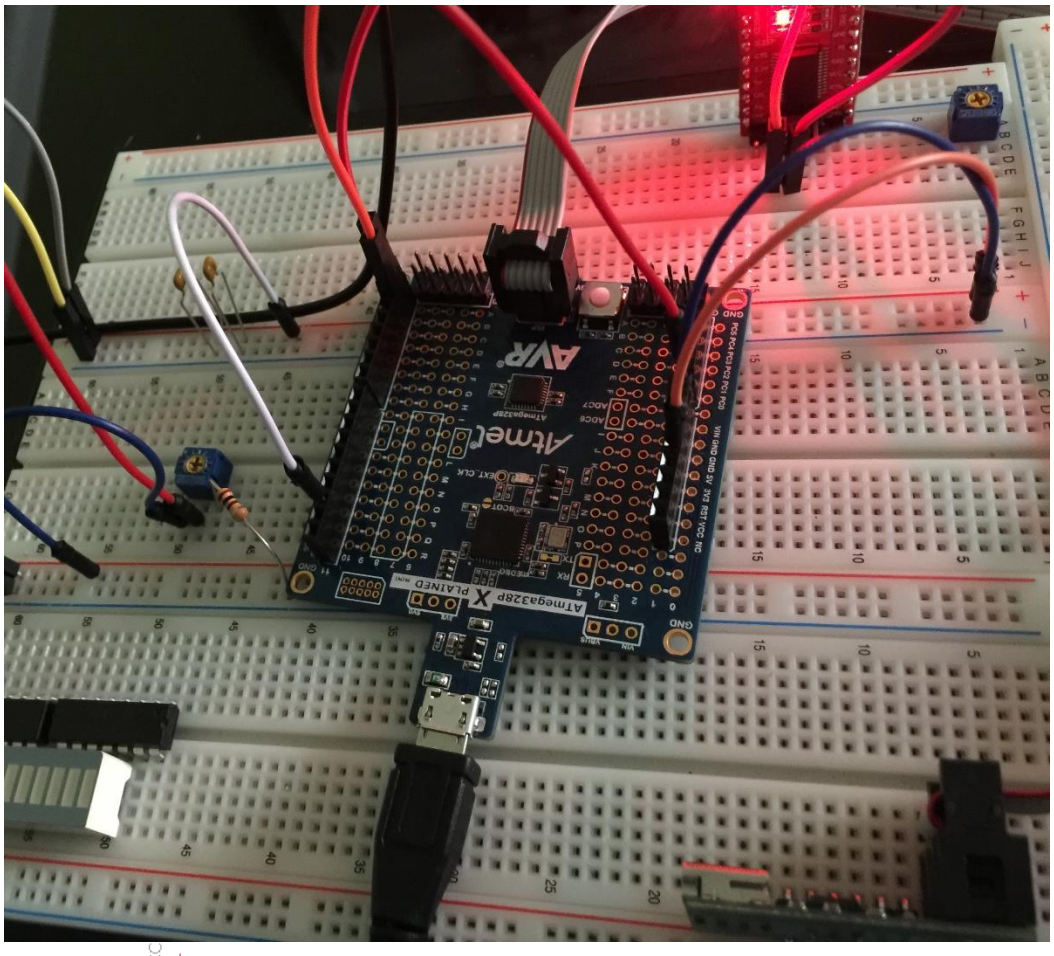
```
	while(!(UCSR0A & _BV(RXC0)));
	return (unsigned char) UDR0;
}

//Transmits a byte
/*
 *	Use this function if the TX interrupt is not enabled.
 *	Blocks the serial port while TX completes
 */
void putChar_(unsigned char data)
{
	//What until the buffer is empty
	while(!(UCSR0A & _BV(UDRE0)));
	UDR0 = (unsigned char)data;
}

/*A string print called printm that uses a
char array and your putchar clone to transmit
strings*/

void printm(unsigned char *str)
{
	//While it's not NULL
	while(*str != '\0')
	{
		putChar_(*str);
		++str;
	}
}

/*uses an uninitialized char array and your getchar clone to
construct a string for your ATmega328P */
const unsigned char* scanm(void)
{
	//Allocate buffer of size 256
	//and a ptr to it
	unsigned char buff[BUFF] = {0};
	unsigned char* ptr;
	ptr = buff;

	while((*ptr = getChar_())){
		if(*ptr == '\n'|| *ptr == '\0' )break;
		putChar_(ptr);
		++ptr;
	}

	return buff;
}
void ADC0init()
{
	DDRC   &= ~(0<<DDC0);       // SET PC.0 as an input
	ADCSRA = 0x87;                      // Enable ADC and CLK/128
	ADMUX  = (1<<REFS0); // VCC reference, ADC0 single ended input
}

double Convert(double val)
{
	return (((val*5.0)/1024.0));
```

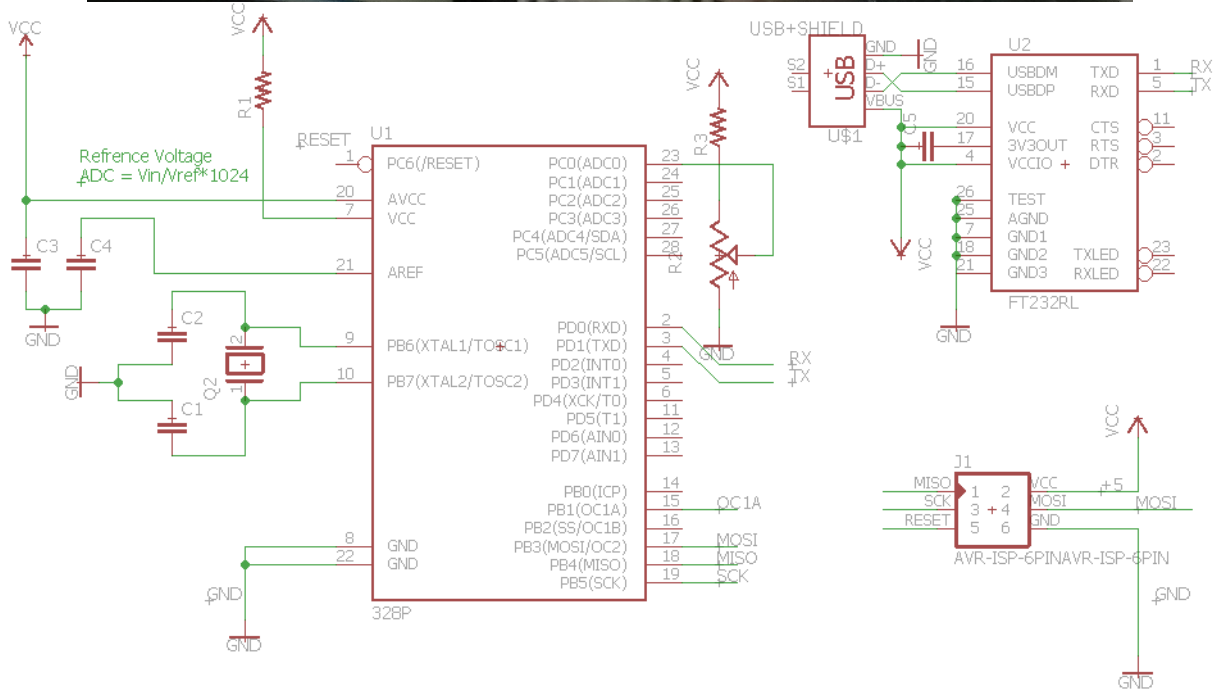
```
}
void main()
{
	char str[30];
	double val;
	unsigned int prev;
	usart0_init_();
	ADC0init();
	while(1)
	{

		//Start conversion
		ADCSRA |= (1 << ADSC);
		//wait conversion to finish
		while((ADCSRA & (1 << ADIF)) == 0);

		//Get value that was converted
		if(!((unsigned int)ADC == prev)){

			prev = ADC;
			val = Convert(prev);
			dtostrf(val,1,3,str);

			printm("Voltage Read: ");
			printm(str);
			putChar_('\n');
			putChar_('\r');
			_delay_ms(1000);
		}
	}

}
```

PART C:Flow Chart



PART D: Schematic




VCC
R1
RESET
U1
Refrence Voltage
ADC = Vin/Vref*1024
C3
C4
C2
C1
Q2
GND
AVCC
VCC
AREF
PC6(/RESET)
PB6(XTAL1/TOSC1)
PB7(XTAL2/TOSC2)
PC0(ADC0)
PC1(ADC1)
PC2(ADC2)
PC3(ADC3)
PC4(ADC4/SDA)
PC5(ADC5/SCL)
PD0(RXD)
PD1(TXD)
PD2(INT0)
PD3(INT1)
PD4(XCK/T0)
PD5(T1)
PD6(AIN0)
PD7(AIN1)
PB0(ICP)
PB1(OC1A)
PB2(SS/OC1B)
PB3(MOSI/OC2)
PB4(MISO)
PB5(SCK)
328P
R3
R4
OC1A
MOSI
MISO
SCK
RX
TX
USB+SHIELD
USB
U$1
S2
S1
D+
D-
VBUS
U2
USBDM
USBDP
VCC
3V3OUT
VCCIO
TEST
AGND
GND1
GND2
GND3
TXD
RXD
CTS
RTS
DTR
TXLED
RXLED
FT232RL
J1
MISO
SCK
RESET
MOSI
+5
AVR-ISP-6PINAVR-ISP-6PIN

PART E: Video

URL Video of Design Assignment 6: https://youtu.be/Q0ZNh5p4kQE