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CPE301 – SPRING 2018

Design Assignment 3

DO NOT REMOVE THIS PAGE DURING SUBMISSION:

The student understands that all required components should be submitted in complete for grading of this assignment.

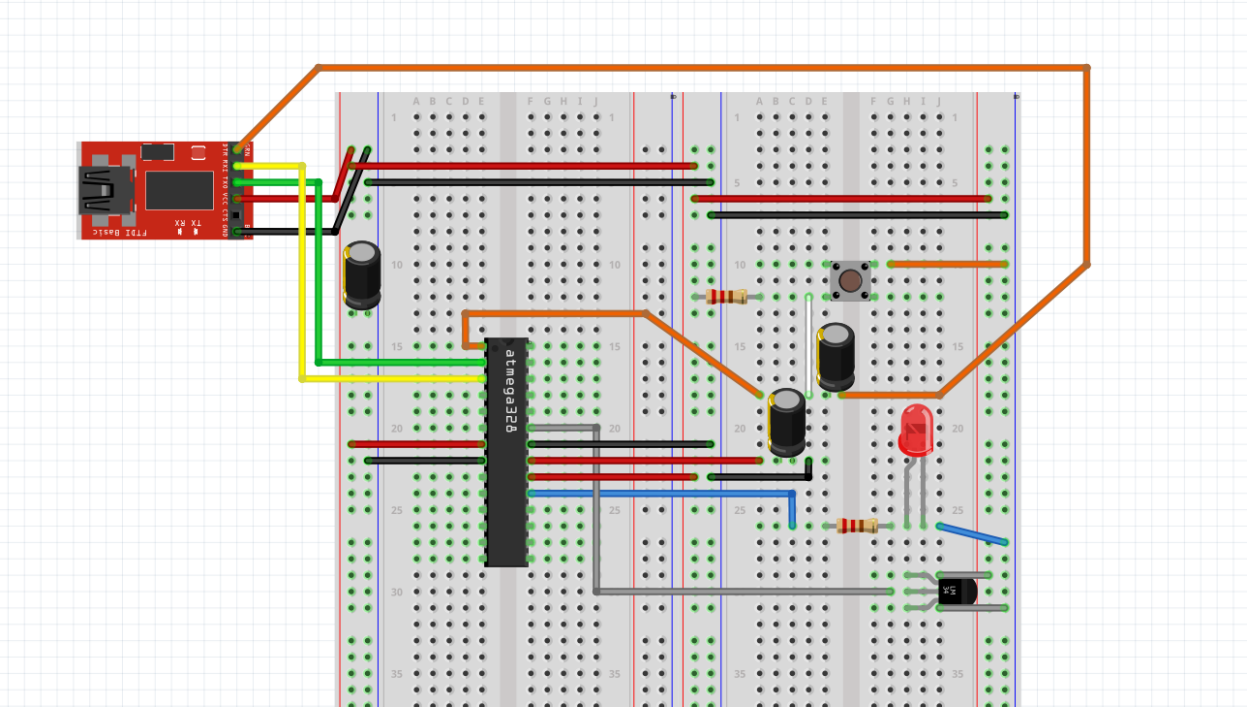
NO	SUBMISSION ITEM	COMPLETED (Y/N)	MARKS (/MAX)
1	COMPONENTS LIST AND BREADBOARD		
2.	SCHEMATIC		
3.	C CODE TO MEASURE TEMPERATURE (F)		
4.	FLOWCHART OF C CODE		
5.	SCREENSHOTS OF DATA VISUALIZER WAVEFORM		

1. COMPONENTS LIST AND BREADBOARD

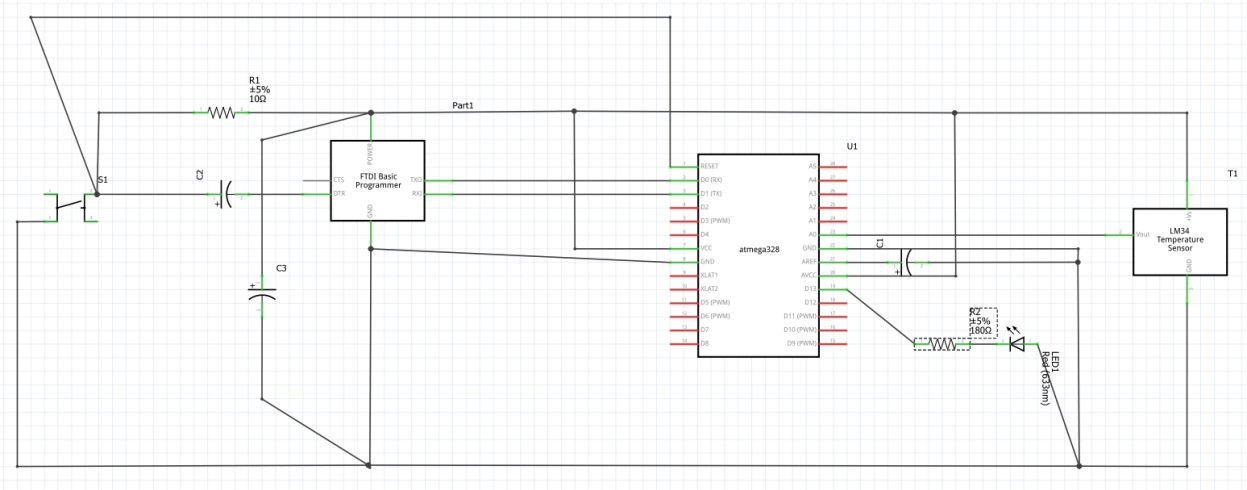
Components used:

a) Atmega328
b) 3 capacitors (0.1 µF – 100 µF) [Sufficient to safely store 5V]
c) 10K Ω and 200 Ω resistors
d) FTDI Basic 5V

Breadboard



2. SCHEMATIC

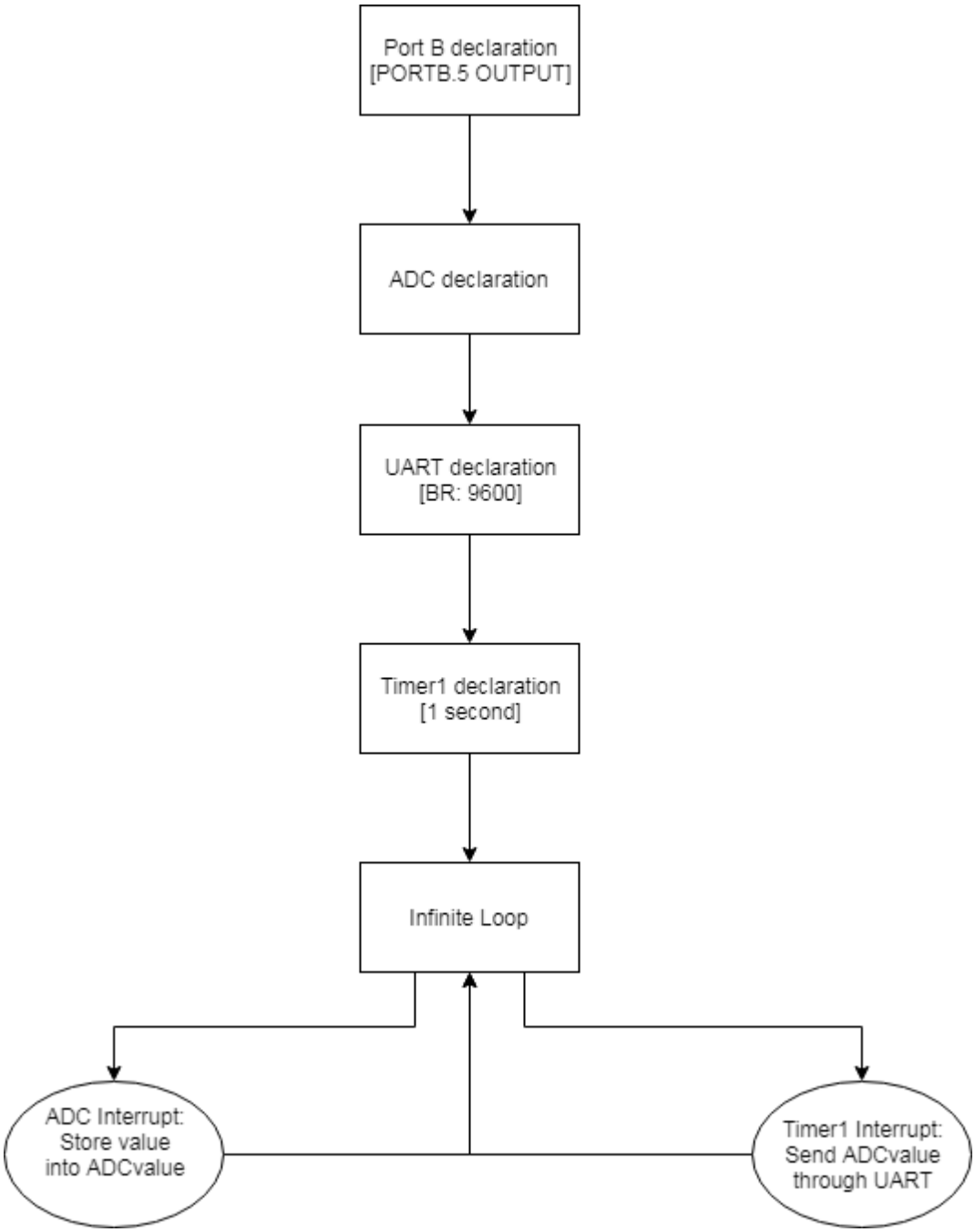


3. C CODE TO MEASURE THE TEMPERATURE (F)

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

#define FOSC 8000000                    // Clock speed
#define BAUD 9600                       // Desire baud rate
#define MYUBRR FOSC/16/BAUD-1           // Formula to set the baud rate

volatile uint8_t ADCvalue;              // Storage for the temperature in F

int main(void)
{
       // Port declarations
       DDRB = (1<<5);                   // Set PORTB.5 as output
       PORTB = 0x00;              // Clear PORTB

       // ADC declaration
       ADMUX = 0;                       // Use ADC0
       ADMUX |= (1<<ADLAR);             // Left justified
       ADMUX |= (1<<REFS0);             // AVcc is reference
       ADCSRA |= (1<<ADPS2) | (1<<ADPS1); // 8 MHz with prescalar of 64
       ADCSRA |= (1<<ADATE);            // Enable auto trigger
       ADCSRB = 0;                      // Free running settings for auto trigger
       ADCSRA |= (1<<ADEN);             // Enable ADC
       ADCSRA |= (1<<ADIE);             // Enable ADC interrupt
       ADCSRA |= (1<<ADSC);             // Start conversion

       // USART declaration
       UBRR0H = ((MYUBRR)>>8);          // Set baud rate for UPPER Register
       UBRR0L = MYUBRR;                 // Set baud rate for LOWER Register
       UCSR0B |= (1<<TXEN0);                                  // Enable transmitter
       UCSR0C |= (1<<UCSZ01) | (1<<UCSZ00);// Frame: 8-bit Data and 1 Stop bit

       // F = 8 MHz
       TCNT1 = 34286;                   // 65536-(8 MHz/256)
       TIMSK1 = (1<<TOIE1);             // Enable TIMER1 OVF interrupt
       TCCR1A = 0x00;
       TCCR1B = 0x04;                   // Start TIMER1 with prescalar 256
       TCCR1C = 0x00;
       sei();                           // Enable global interrupts
    while (1)
    {
    }
       return 0;
}

// Interrupt subroutine for TIMER1 overflow (1 second)
ISR(TIMER1_OVF_vect)
{
       TIFR1 = (1<<TOV1);               // Clear TOV1 flag
       PORTB ^= (1<<5);                 // Toggle LED
       TCNT1 = 34286;                   // Reset TCNT1
       while(!(UCSR0A & (1<<UDRE0)));   // Wait for the transmitter to finish
       UDR0 = ADCvalue;                 // Transmit the the new value
}
```

```
// Interrupt subroutine for ADC value
ISR(ADC_vect)
{
	ADCvalue = (ADCH<<1);// Store the decimal value of the converted signal
}                            // Shift left by one to multiply by 2 and adjust the value
```

4. FLOWCHART OF C CODE



5. SCREENSHOTS OF DATA VISUALIZER WAVEFORM

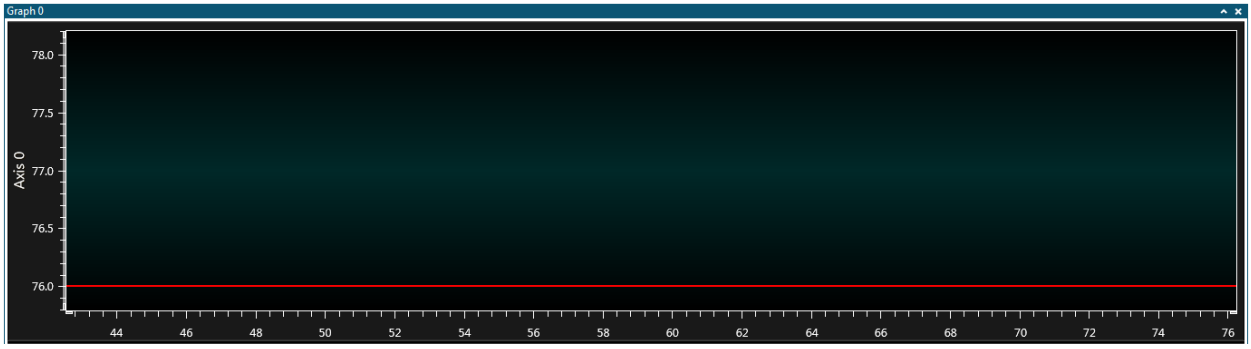


Figure 1: Steady measurement of room temperature

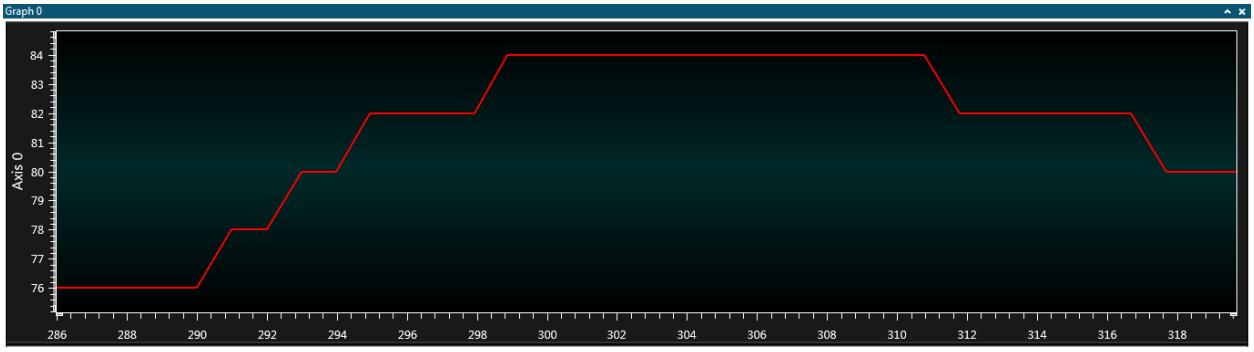


Figure 2: Temperature spikes after touching the LM34

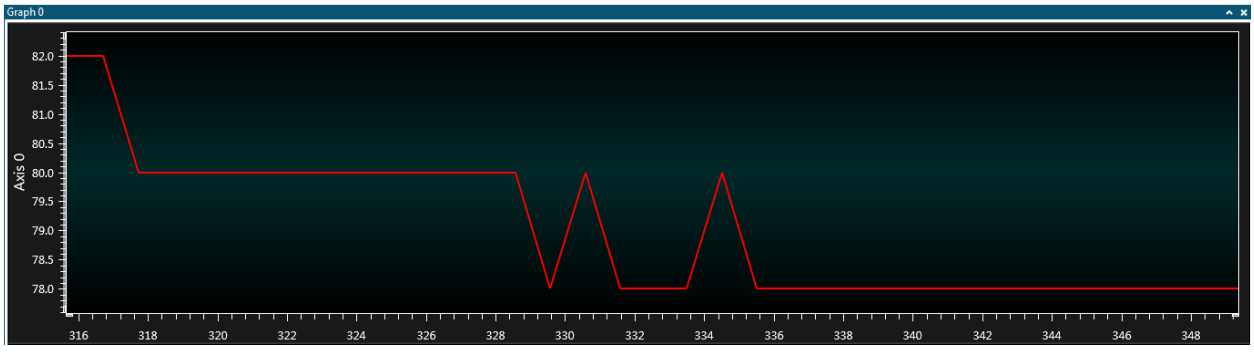


Figure 3: Temperature returns to room temperature

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