CPE301 – SPRING 2019

Design Assignment DA6

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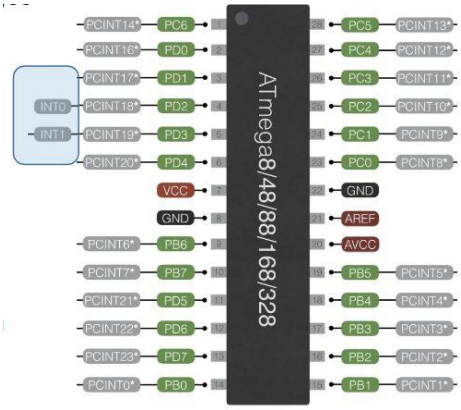
Primary Github address: https://github.com/guerrj1/Submission_DA.git
Directory: DA6 - https://github.com/guerrj1/Submission_DA/tree/master/DA6

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

-ATMega328p
-Male to female wires
-Micro USB cable
-MPU6050 Module



Atmega328P using PB5 and PB4 for SDA and SCL. 5v for VCC and GND for GND.

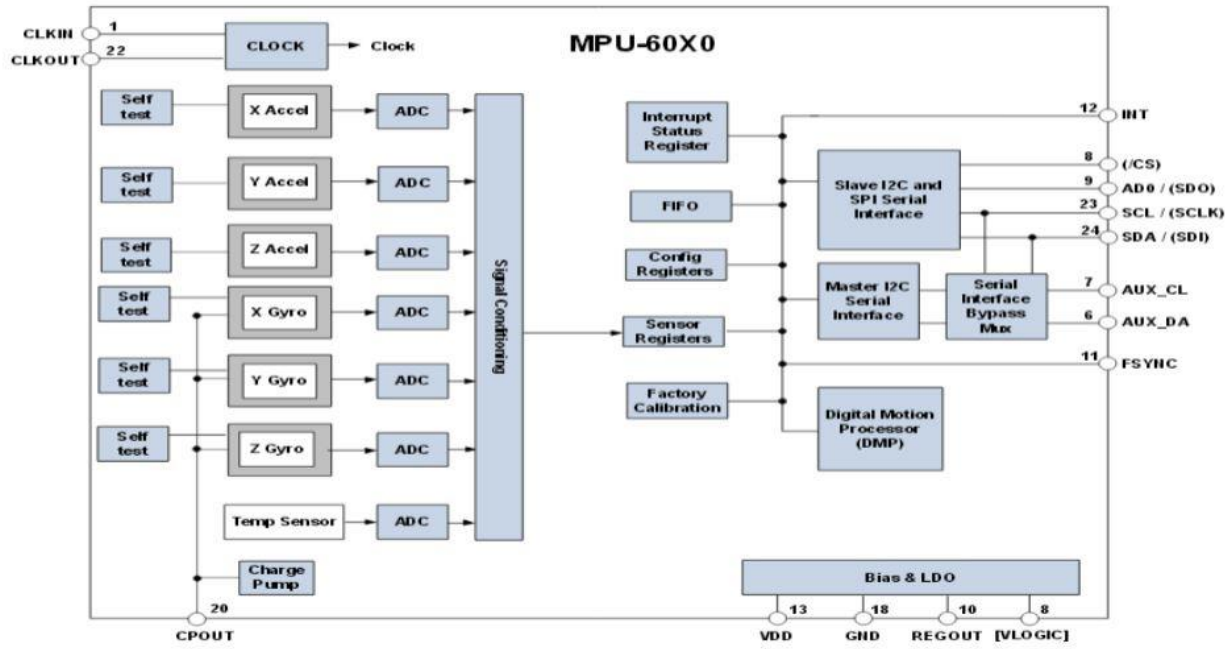
2. DEVELOPED CODE OF TASK 1 C CODE

```
//DA6

#ifndef F_CPU
#define F_CPU 16000000UL
#endif

#include <avr/io.h>
#include <util/delay.h>
#include <math.h>
#include <stdlib.h>                                                    /*
Include standard library file */
#include <stdio.h>                                                     /*
Include standard library file */
#include "libraries\MPU6050_def.h"                                  /* Include MPU6050
register define file */
#include "libraries\i2c_master.h"                                /* Include i2c Master header file */
#include "libraries\i2c_master.c"
#include "libraries\uart.h"                                       /* Include USART header file */
#include "libraries\uart.c"

#define MPU6050_WRITE 0xD0
#define MPU6050_read 0xD1

float Acc_x, Acc_y, Acc_z, Gyro_x, Gyro_y, Gyro_z;

void init_uart(uint16_t baudrate){

        uint16_t UBRR_val = (F_CPU/16)/(baudrate-1);

        UBRR0H = UBRR_val >> 8;
        UBRR0L = UBRR_val;
```

```
	UCSR0B |= (1<<TXEN0) | (1<<RXEN0) | (1<<RXCIE0); // UART TX (Transmit - senden)
einschalten
	UCSR0C |= (1<<USBS0) | (3<<UCSZ00); //Modus Asynchron 8N1 (8 Datenbits, No Parity, 1
Stopbit)
}

void uart_putc(unsigned char c){

	while(!(UCSR0A & (1<<UDRE0))); // wait until sending is possible
	UDR0 = c; // output character saved in c
}

void uart_puts(char *s){
	while(*s){
		uart_putc(*s);
		s++;
	}
}

void init_MPU6050(void){
	_delay_ms(150);
	/* Power up time >100ms */
	i2c_start(MPU6050_WRITE); // Set Gyroscope Sample Rate = 1 KHz, Accelerometer Sample
Rate = 1 KHz (default)
	i2c_write(SMPLRT_DIV); // Sample Rate is generated by dividing the gyroscope output
rate by SMPLRT_DIV
	i2c_write(0x07); // Gyroscope Output Rate = 8kHz, Sample Rate = Gyroscope Output Rate /
(1 + SMPLRT_DIV)
	i2c_stop();

	i2c_start(MPU6050_WRITE);
	i2c_write(PWR_MGMT_1);
	i2c_write(0x01); // PLL with X axis gyroscope reference
	i2c_stop();

	i2c_start(MPU6050_WRITE);
	i2c_write(CONFIG); //Frame Synchronization & Digital Low Pass Filter (DLPF) setting
	i2c_write(0x00);
	i2c_stop();

	i2c_start(MPU6050_WRITE);
	i2c_write(GYRO_CONFIG); //gyroscopes' scale range = FS_SEL selects = 11 = ± 2000 °/s
	i2c_write(0x18);		// accelerometer range = ± 2g (default)
	i2c_stop();

	i2c_start(MPU6050_WRITE);
	i2c_write(INT_ENABLE); // DATA_RDY_EN = 1
	i2c_write(0x01);
	i2c_stop();
}

void getreading(void){

	i2c_start(MPU6050_WRITE);
	i2c_write(ACCEL_XOUT_H); // set pointer
	i2c_stop();

	i2c_start(MPU6050_read);
	Acc_x = (((int)i2c_read_ack()<<8) | (int)i2c_read_ack());
	Acc_y = (((int)i2c_read_ack()<<8) | (int)i2c_read_ack());
	Acc_z = (((int)i2c_read_ack()<<8) | (int)i2c_read_ack());
```

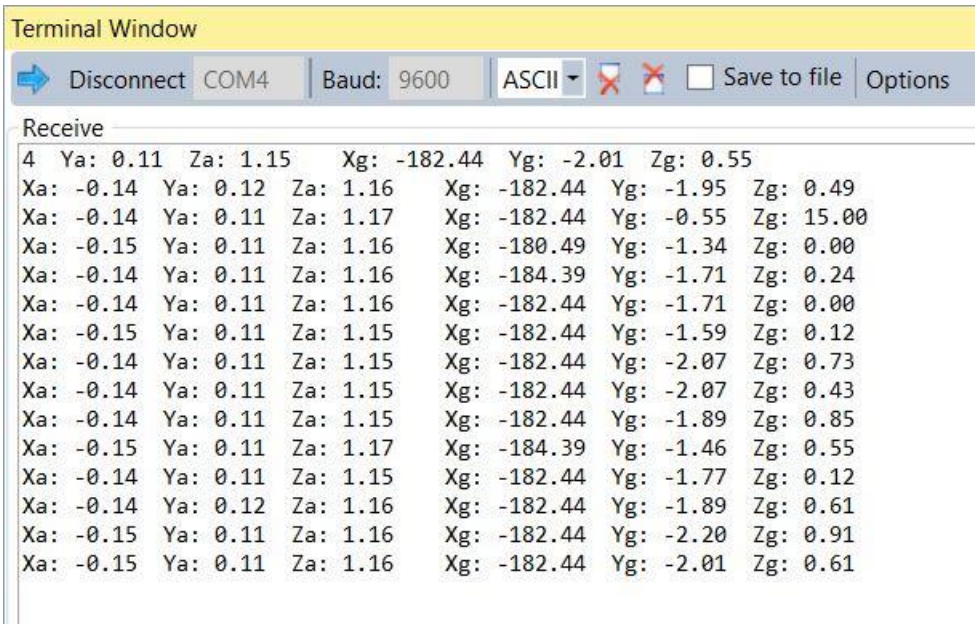
```
        Gyro_x = (((int)i2c_read_ack()<<8) | (int)i2c_read_ack());
        Gyro_y = (((int)i2c_read_ack()<<8) | (int)i2c_read_ack());
        Gyro_z = (((int)i2c_read_ack()<<8) | (int)i2c_read_nack());
        i2c_stop();
}


int main(void){
        char buffer[20], float_[10];
        float Xa, Ya, Za;
        float Xg, Yg, Zg;
        init_uart(9600);
        i2c_init();
        init_MPU6050();

        while(1){
                getreading();
                Xa = Acc_x/16384.0;  /* Divide raw value by sensitivity scale factor to get real
values */
                Ya = Acc_y/16384.0;
         Za = Acc_z/16384.0;

         Xg = Gyro_x/16.4;
         Yg = Gyro_y/16.4;
         Zg = Gyro_z/16.4;

                dtostrf( Xa, 3, 2, float_ );  /* Take values in buffer to send all parameters
over USART */
                sprintf(buffer,"Xa: %s  ",float_);
                USART_SendString(buffer);

                dtostrf( Ya, 3, 2, float_ );
                sprintf(buffer,"Ya: %s  ",float_);
                USART_SendString(buffer);

                dtostrf( Za, 3, 2, float_ );
                sprintf(buffer,"Za: %s    ",float_);
                USART_SendString(buffer);

                 //GYRO
                dtostrf( Xg, 3, 2, float_ );
                sprintf(buffer,"Xg: %s  ",float_);
                USART_SendString(buffer);

                dtostrf( Yg, 3, 2, float_ );
                sprintf(buffer,"Yg: %s  ",float_);
                USART_SendString(buffer);

                dtostrf( Zg, 3, 2, float_ );
                sprintf(buffer,"Zg: %s \r\n ",float_);
                USART_SendString(buffer);

                _delay_ms(1000);
        }

        return 0;
}
```

3. SCHEMATIC



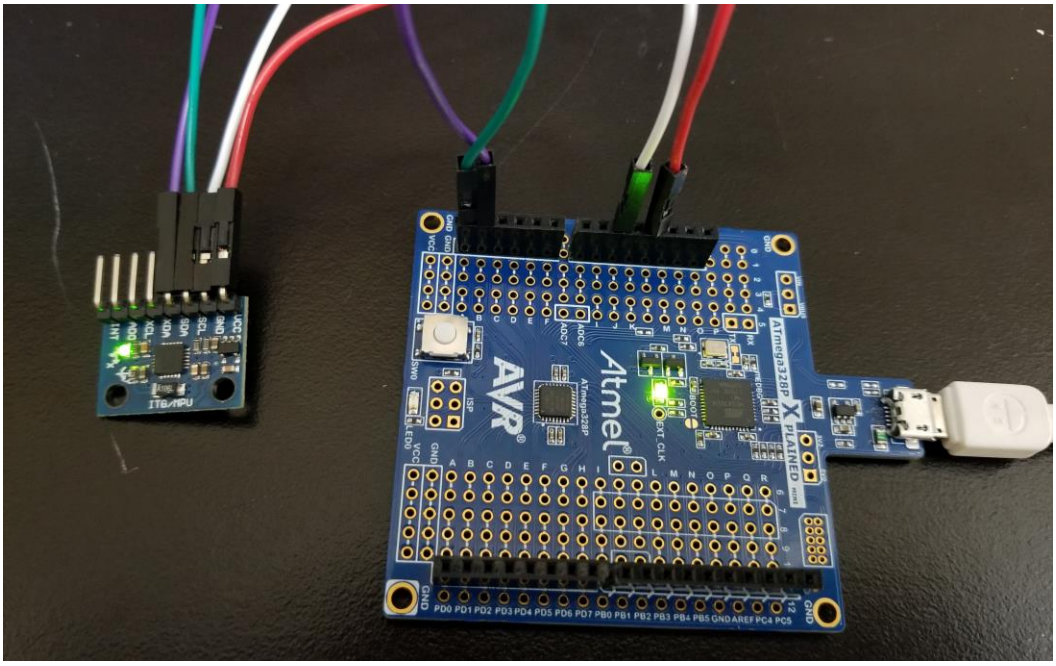
MPU6050 Diagram Schematic

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



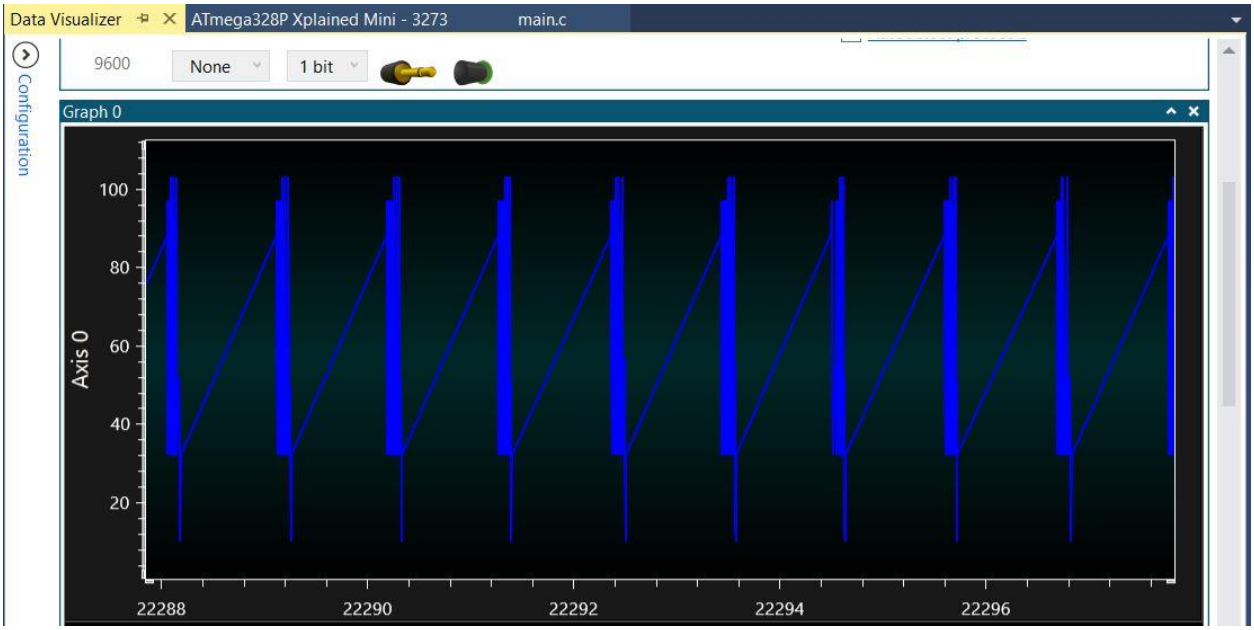
Terminal window of the UART display for the 6-dimension values.

5. SCREENSHOT OF EACH DEMO (BOARD SETUP)



Board set up for the MPU6050 connection to the Atmega328p

6. EXTRA CREDIT (VISUALIZING THE ACCELEROMETER AND GYRO VALUES)



Accelerometer and Gyro values

7. VIDEO LINKS OF EACH DEMO

https://youtu.be/l9Y3AdRotis

8. GITHUB LINK OF THIS DA

https://github.com/guerrj1/Submission_DA/tree/master/DA6

Student Academic Misconduct Policy
http://studentconduct.unlv.edu/misconduct/policy.html

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