CPE403 – Advanced Embedded Systems

Design Assignment 2

DO NOT REMOVE THIS PAGE DURING SUBMISSION:

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Github Repository link (root): https://github.com/AngeloNol/Design_Assignments

Youtube Playlist link (root): https://www.youtube.com/watch?v=An8f5po_wqM

1. Code for Tasks

```
#include <stdint.h>                      // Library of Standard Integer Types
#include <stdbool.h>                     // Library of Standard Boolean Types
#include "inc/tm4c123gh6pm.h"            // Definitions for interrupt and register assignments on Tiva C
#include "inc/hw_memmap.h"               // Macros defining the memory map of the Tiva C Series device
#include "inc/hw_types.h"                // Defines common types and macros
#include "inc/hw_gpio.h"                 // Defines Macros for GPIO hardware
#include "driverlib/sysctl.h"            // Defines and macros for System Control API of DriverLib
#include "driverlib/interrupt.h"         // Defines and macros for NVIC Controller API of DriverLib
#include "driverlib/gpio.h"              // Defines and macros for GPIO API of DriverLib
#include "driverlib/timer.h"             // Defines and macros for Timer API of driverLib
#include "driverlib/adc.h"               // Defines and macros for ADC API of driverLib
#include "driverlib/rom.h"               // Defines and macros for ROM API of driverLib
#include "driverlib/uart.h"
#include "driverlib/pin_map.h"
#include "utils/uartstdio.h"
#include "driverlib/debug.h"
#include "inc/hw_ints.h"
#include "math.h"
#include "driverlib/i2c.h"
#include "IQmath/IQmathLib.h"
#include "driverlib/rom_map.h"
#include "inc/hw_i2c.h"

#include "i2c.h"


#ifdef DEBUG
```

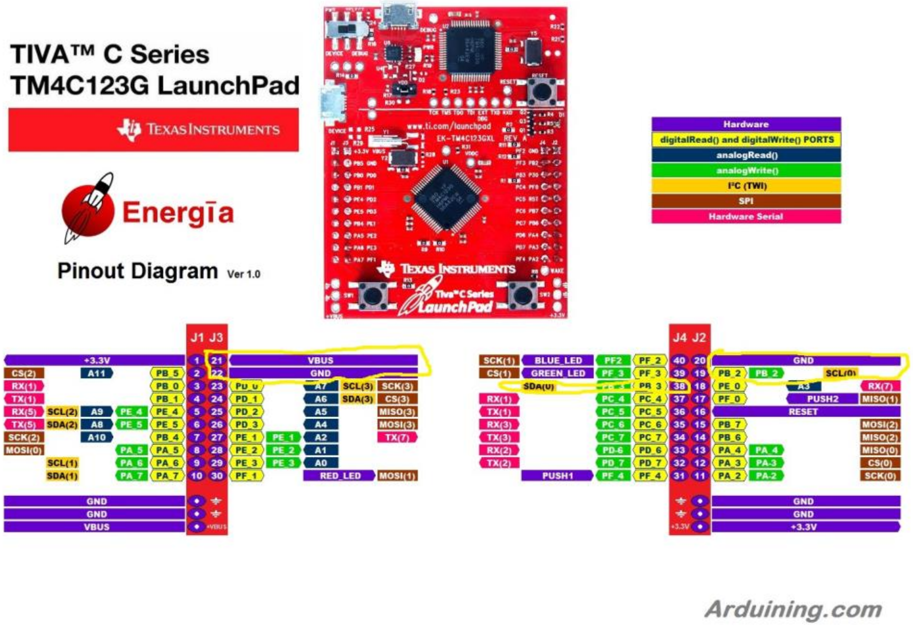
```
void
__error__(char *pcFilename, uint32_t ui32Line)
{
}
#endif


#define MPU_ADDRESS     0x68

#define WHO_AM_I        0x75
#define PWR_MGMT_1      0x6B
#define SMPRT_DIV       0x19
#define CONFIG          0x1A
#define GYRO_CONFIG     0x1B
#define ACC_CONFIG      0x1C
//#define INT_PIN_CFG     0x37
//#define INT_ENABLE      0x38

#define ACCEL_XOUT_H    0x3B
#define ACCEL_XOUT_L    0x3C
#define ACCEL_YOUT_H    0x3D
#define ACCEL_YOUT_L    0x3E
#define ACCEL_ZOUT_H    0x3F
#define ACCEL_ZOUT_L    0x40

#define GYRO_XOUT_H     0x43
#define GYRO_XOUT_L     0x44
#define GYRO_YOUT_H     0x45
#define GYRO_YOUT_L     0x46
#define GYRO_ZOUT_H     0x47
#define GYRO_ZOUT_L     0x48
```

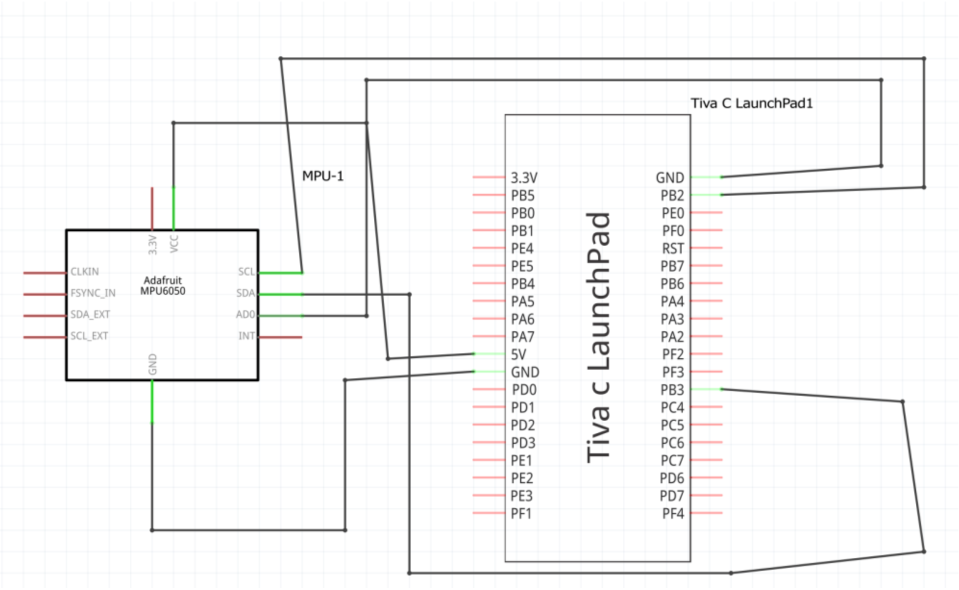
```
#define PI 3.14159265359
#define dt 0.01
#define ACCELEOMETER_SENSITIVITY 16385.0
#define gyroscope_SENSITIVITY 16.4

/************ Global Variable ***************/
int WhoAmI, RegReset;

int accXout_L, accXout_H, accXout;
int accYout_L, accYout_H, accYout;
int accZout_L, accZout_H, accZout;



int gyroXout_L, gyroXout_H, gyroXout;
int gyroYout_L, gyroYout_H, gyroYout;
int gyroZout_L, gyroZout_H, gyroZout;

_iq16 Acc[3],Gyro[3];
_iq16 roll,pitch;
double p,r,y;//pitch,roll,yaw




/************** Function Pro-type****************/
void initMPU6050();
void MPUtestConnection();
void readMPU();
void ComplementaryFilter();
void getAngle(_iq16 Ax, _iq16 Ay, _iq16 Az);
```

```
/******************  Main *********************/
int main(void){
        //set the clock
       SysCtlClockSet(SYSCTL_SYSDIV_2_5 | SYSCTL_USE_PLL | SYSCTL_XTAL_16MHZ |
SYSCTL_OSC_MAIN);

        // Configure peripherals
        SysCtlPeripheralEnable(SYSCTL_PERIPH_UART0);
        SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOA);
        SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOB);
        SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOE);
        SysCtlPeripheralEnable(SYSCTL_PERIPH_GPIOF);

        // Configure pins for UART
        GPIOPinConfigure(GPIO_PA0_U0RX);
        GPIOPinConfigure(GPIO_PA1_U0TX);
        GPIOPinTypeUART(GPIO_PORTA_BASE, GPIO_PIN_0 | GPIO_PIN_1);
        UARTClockSourceSet(UART0_BASE, UART_CLOCK_PIOSC);
        UARTStdioConfig(0, 115200, 16000000);



        GPIOPinTypeGPIOOutput(GPIO_PORTF_BASE, GPIO_PIN_3);

        initI2C();//calls the initI2C function
        initMPU6050();//calls the initMPU function
        MPUtestConnection();//calls the MPU test function
```

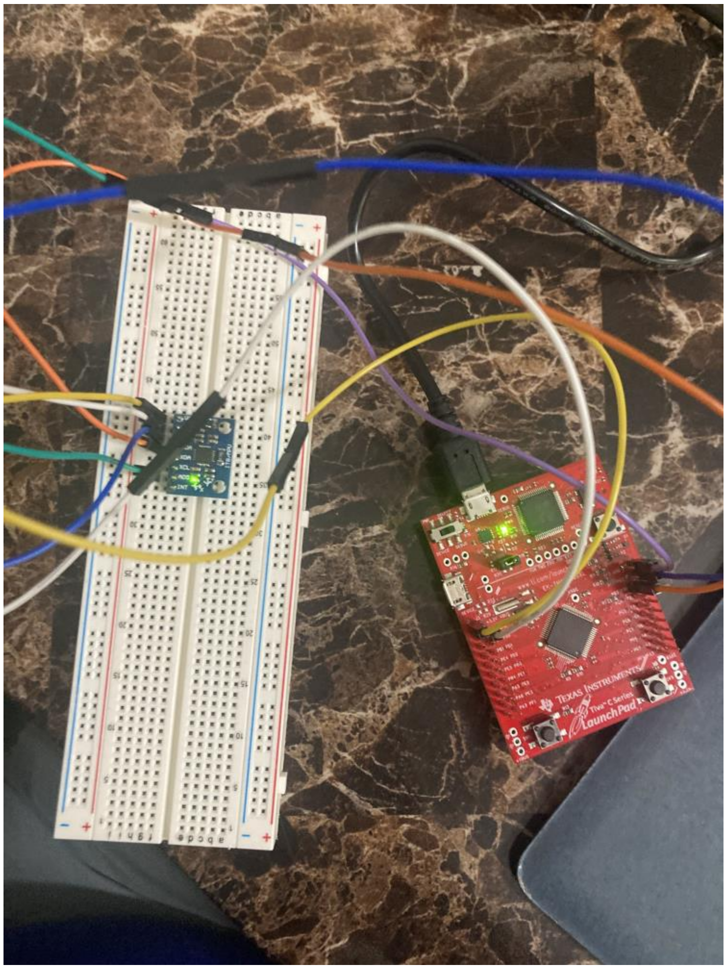
```
    while(1){
      readMPU();//calls the readMPU function
      SysCtlDelay(1000000);
      getAngle(Acc[0],Acc[1],Acc[2]);//calls the getAngle function
      ComplementaryFilter();//calls the filter function
      UARTprintf("Pitch :%d\n",p);//print the pitch
      UARTprintf("Roll :%d\n", r);//print the roll
      UARTprintf("Yaw :%d\n", y);//print the yaw

    }




}
```

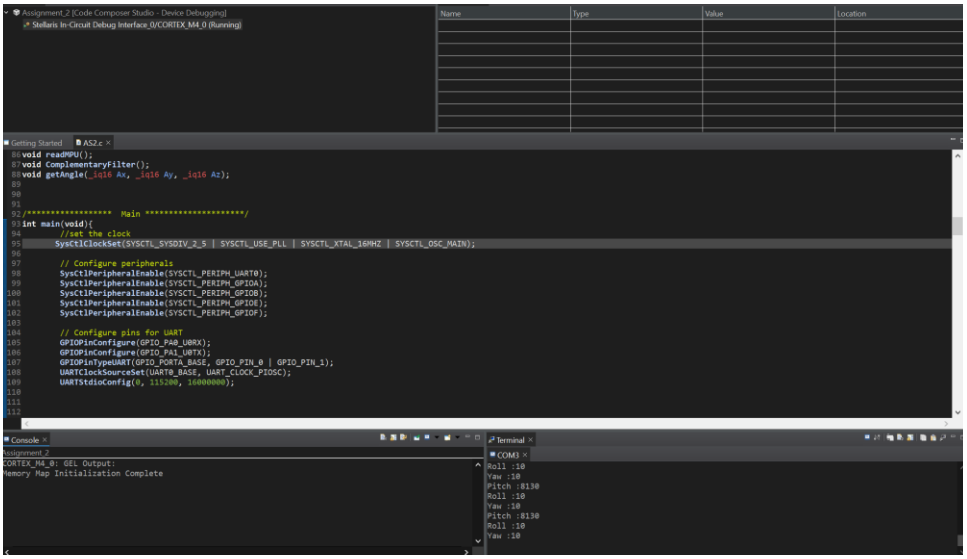
2. Block diagram and/or Schematics showing the components, pins used, and interface.


TIVA™ C Series
TM4C123G LaunchPad
Texas Instruments
Energīa
Pinout Diagram Ver 1.0
Hardware
digitalRead() and digitalWrite() PORTS
analogRead()
analogWrite()
I²C (TWI)
SPI
Hardware Serial
J1 J3
+3.3V 1 21 VBUS
CS(2) A11 PB_5 2 22 GND
RX(1) PB_0 3 23 PD_0 A7 SCL(3) SCK(3)
TX(1) PB_1 4 24 PD_1 A6 SDA(3) CS(3)
RX(5) SCL(2) A9 PE_4 PE_4 5 25 PD_2 A5 MISO(3)
TX(5) SDA(2) A8 PE_5 PE_5 6 26 PD_3 A4 MOSI(3)
SCK(2) A10 PB_4 7 27 PE_1 PE_1 A2 TX(7)
MOSI(0) PA_5 PA_5 8 28 PE_2 PE_2 A1
SCL(1) PA_6 PA_6 9 29 PE_3 PE_3 A0
SDA(1) PA_7 PA_7 10 30 PF_1 RED_LED MOSI(1)
GND
GND
VBUS
J4 J2
SCK(1) BLUE_LED PF2 PF_2 40 20 GND
CS(1) GREEN_LED PF_3 PF_3 39 19 PB_2 PB_2 SCL(0)
SDA(0) PB_3 38 18 PE_0 A3 RX(7)
RX(1) PC_4 PC_4 37 17 PF_0 PUSH2 MISO(1)
TX(1) PC_5 PC_5 36 16 RESET
RX(3) PC_6 PC_6 35 15 PB_7 MOSI(2)
TX(3) PC_7 PC_7 34 14 PB_6 MISO(2)
RX(2) PD-6 PD_6 33 13 PA_4 PA_4 MISO(0)
TX(2) PD_7 PD_7 32 12 PA_3 PA-3 CS(0)
PUSH1 PF_4 PF_4 31 11 PA_2 PA-2 SCK(0)
GND
GND
+3.3V
Arduining.com



3. Screenshots of the IDE, physical setup, debugging process





```
Assignment_2 [Code Composer Studio - Device Debugging]
  Stellaris In-Circuit Debug Interface_0/CORTEX_M4_0 (Running)
```

```
void readMPU();
void ComplementaryFilter();
void getAngle(_iq16 Ax, _iq16 Ay, _iq16 Az);



/******************  Main *********************/
int main(void){
        //set the clock
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        // Configure pins for UART
        GPIOPinConfigure(GPIO_PA0_U0RX);
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        GPIOPinTypeUART(GPIO_PORTA_BASE, GPIO_PIN_0 | GPIO_PIN_1);
        UARTClockSourceSet(UART0_BASE, UART_CLOCK_PIOSC);
        UARTStdioConfig(0, 115200, 16000000);
```

```
Assignment_2
CORTEX_M4_0: GEL Output:
Memory Map Initialization Complete
```

```
Roll :10
Yaw :10
Pitch :8130
Roll :10
Yaw :10
Pitch :8130
Roll :10
Yaw :10
```

4. Declaration
   I understand the Student Academic Misconduct Policy - http://studentconduct.unlv.edu/misconduct/policy.html

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