使用Nano130控制MPU9250傳感器

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	本範例代碼使用 Nano130 控制傳感器 MPU9250
BSP Version	Nano100B_Series_BSP_CMSIS_v3.03.000
Hardware	NuEdu-EVB-Nano130

1 功能描述

本範例介紹如何使用 NANO130 與運動傳感器 MPU9250 通訊以獲取設備的運動軌跡和方向。
首先，Nano130 通過 I2C 接口對 MPU9250 進行初始化，設定模式為 Measurement Mode，取樣頻率為 125Hz,頻寬為 5Hz，加速度測量範圍±2g，角速度測量範圍±2000 dps。
然後，通過 I2C 總線發出指令獲取 MPU9250 測量到的九個數值，我們可以拿這些數值來做一些有趣的應用，比如，用加速度及角速度記錄移動軌跡，用磁力數值判斷移動方向。

2 代碼描述

首先初始化 MPU9250：

```
    void Init_MPU9250(void)
    {
     I2C0_Write(GYRO_ADDRESS,PWR_MGMT_1, 0x00);
     I2C0_Write(GYRO_ADDRESS,SMPLRT_DIV, 0x07);
     I2C0_Write(GYRO_ADDRESS,CONFIG, 0x06);
     I2C0_Write(GYRO_ADDRESS,GYRO_CONFIG, 0x18);
     I2C0_Write(GYRO_ADDRESS,ACCEL_CONFIG, 0x01);
    }
```

MCU 通過 I2C 獲取 MPU9250 傳感器測量到的加速度值，角度值和磁力計值：

```
void READ_MPU9250_ACCEL(void)
{

   BUF[0]=I2C0_Read(ACCEL_ADDRESS,ACCEL_XOUT_L);
   BUF[1]=I2C0_Read(ACCEL_ADDRESS,ACCEL_XOUT_H);
   T_X=  (BUF[1]<<8)|BUF[0];
   T_X/=164;

   BUF[2]=I2C0_Read(ACCEL_ADDRESS,ACCEL_YOUT_L);
   BUF[3]=I2C0_Read(ACCEL_ADDRESS,ACCEL_YOUT_H);
   T_Y=  (BUF[3]<<8)|BUF[2];
   T_Y/=164;
   BUF[4]=I2C0_Read(ACCEL_ADDRESS,ACCEL_ZOUT_L);
   BUF[5]=I2C0_Read(ACCEL_ADDRESS,ACCEL_ZOUT_H);
   T_Z=  (BUF[5]<<8)|BUF[4];
   T_Z/=164;
}
void READ_MPU9250_GYRO(void)
{

   BUF[0]=I2C0_Read(GYRO_ADDRESS,GYRO_XOUT_L);
   BUF[1]=I2C0_Read(GYRO_ADDRESS,GYRO_XOUT_H);
   T_X=  (BUF[1]<<8)|BUF[0];
   T_X/=16.4;

   BUF[2]=I2C0_Read(GYRO_ADDRESS,GYRO_YOUT_L);
   BUF[3]=I2C0_Read(GYRO_ADDRESS,GYRO_YOUT_H);
```

```
    T_Y=  (BUF[3]<<8)|BUF[2];
    T_Y/=16.4;

    BUF[4]=I2C0_Read(GYRO_ADDRESS,GYRO_ZOUT_L);
    BUF[5]=I2C0_Read(GYRO_ADDRESS,GYRO_ZOUT_H);
    T_Z=  (BUF[5]<<8)|BUF[4];
    T_Z/=16.4;

}
void READ_MPU9250_MAG(void)
{
    I2C0_Write(GYRO_ADDRESS,0x37,0x02);//turn on Bypass Mode
    CLK_SysTickDelay(10000);
    I2C0_Write(MAG_ADDRESS,0x0A,0x01);
    CLK_SysTickDelay(10000);
    BUF[0]=I2C0_Read (MAG_ADDRESS,MAG_XOUT_L);
    BUF[1]=I2C0_Read (MAG_ADDRESS,MAG_XOUT_H);
    T_X=(BUF[1]<<8)|BUF[0];

    BUF[2]=I2C0_Read(MAG_ADDRESS,MAG_YOUT_L);
    BUF[3]=I2C0_Read(MAG_ADDRESS,MAG_YOUT_H);
    T_Y=  (BUF[3]<<8)|BUF[2];

    BUF[4]=I2C0_Read(MAG_ADDRESS,MAG_ZOUT_L);
    BUF[5]=I2C0_Read(MAG_ADDRESS,MAG_ZOUT_H);
    T_Z=  (BUF[5]<<8)|BUF[4];
}
```

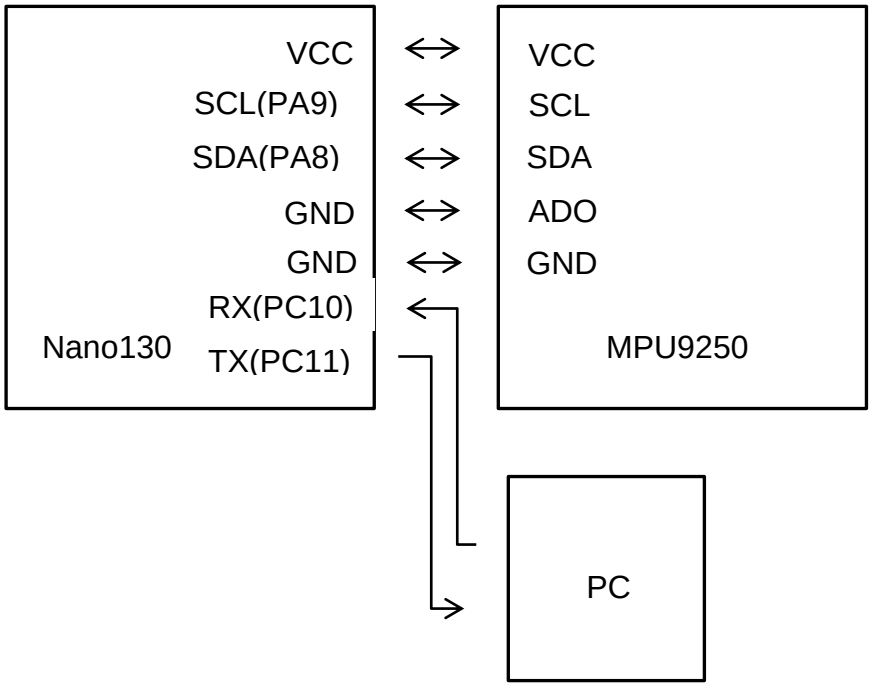
通過串口 1 將獲取的數值打印出來：

```
    READ_MPU9250_ACCEL();
    printf("ACCEL:  X: %4d  Y: %4d  Z: %4d   /0.01 g\n", T_X, T_Y, T_Z);
    READ_MPU9250_GYRO();
    printf("GYRO :  X: %4d  Y: %4d  Z: %4d   /1 dps\n", T_X, T_Y, T_Z);
    READ_MPU9250_MAG();
    printf("MAG  :  X: %4d  Y: %4d  Z: %4d   /0.6 uT\n\n\n", T_X, T_Y, T_Z);
```

3 軟件和硬件環境

- **軟體環境**
  - BSP 版本
    - Nano100B_Series_BSP_CMSIS_v3.03.000
  - IDE 版本
    - Keil uVersion 4.6
- **硬體環境**
  - 電路元件
    - NuEdu-EVB-Nano130
    - MPU9250
  - 示意圖

Nano130 使用 I^{2}C 來傳輸控制命令至 MPU9250 傳感器，使用 UART1 來打印數據。



4 目錄信息

EC_Nano130_Control_MPU9250_Sensor_V1.00	
Library	Sample code header and source files
CMSIS	Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
Device	CMSIS compliant device header file
NuEdu	Library for NuEdu board
StdDriver	All peripheral driver header and source files
SampleCode	
ExampleCode	Source file of example code

5 如何執行示例代碼

1. 根據目錄信息章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 Nano130_Control_MPU9250_Sensor.uvproj.
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

6 修訂記錄

Date	Revision	Description
Sep.25, 2019	1.00	1. 初始發佈

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