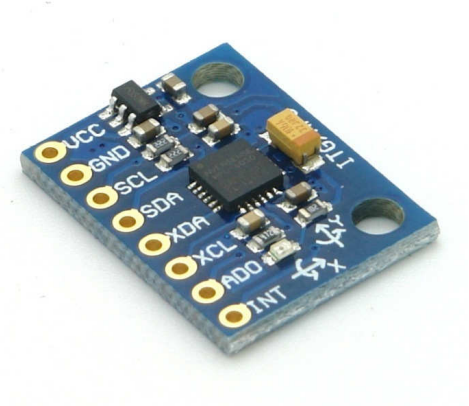
MPU6050 (Gyroscope + Accelerometer + Temperature) interface with AVR ATmega16.

Overview of Gyroscope



MPU6050 Module

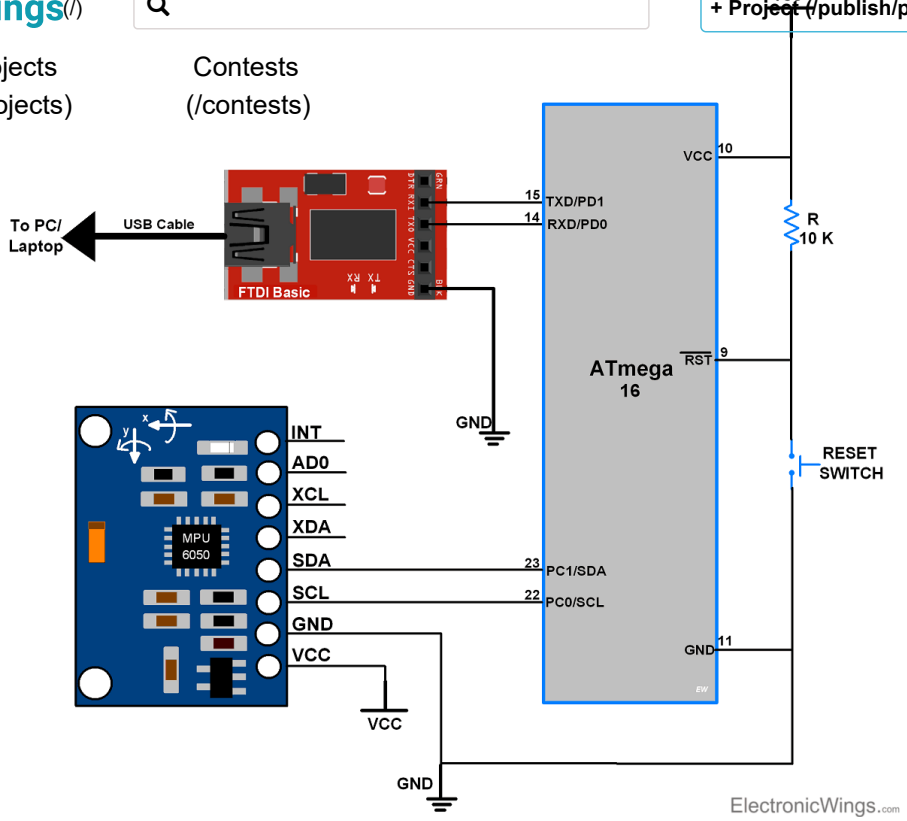
The MPU6050 sensor module is an integrated 6-axis Motion tracking device.

- It has a 3-axis Gyroscope, 3-axis Accelerometer, Digital Motion Processor, and a Temperature sensor, all in a single IC.
- It can accept inputs from other sensors like a 3-axis magnetometer, and pressure sensor using its Auxiliary I2C bus.
- If an external 3-axis magnetometer is connected, it can provide complete 9-axis Motion Fusion output.
- A microcontroller can communicate with this module using the I2C communication protocol.
- Gyroscope and accelerometer reading along X, Y, and Z axes are available in 2's complement form. The temperature reading is available in a signed integer form.
- Gyroscope readings are in degrees per second (DPS) unit; Accelerometer readings are in g unit, and Temperature reading is in degrees Celsius.

For more information about the MPU6050 Sensor Module and how to use it, refer to the topic **MPU6050 Sensor Module** (http://electronicwings.com/sensors-modules/mpu6050-gyroscope-accelerometer-temperature-sensor-module) in the sensors and modules section.

Connection Diagram of MPU6050 with ATmega16/32

The interfacing of the MPU-6050 module with ATmega16 is shown in the below figure.



Interfacing MPU6050 With ATmega16/32

MPU6050 Example Using ATmega16/32

Let's program MPU6050 (Gyro meter + Accelerometer + Temperature) sensor module with AVR-based ATmega16 to read all sensor values and send all values on computer terminals over USART.

- MPU-6050 has an I2C communication interface to connect it with the **I2C of ATmega16** (https://www.electronicwings.com/avr-atmega/atmega1632-i2c).
- The module requires a +5V DC power supply, so connect it to the VCC pin of the module.
- Connect the ground to the GND pin of the module.
- Here we have used FTDI serial to USB converter to send values serially to a computer terminal.

MPU6050 Gyroscope Code for ATmega16/32

```
 * ATmega16 Interface with MPU6050
 * http://www.electronicwings.com
 *
 */


#define F_CPU 8000000UL            /* Define CPU clock Frequency 8MHz */
#include <avr/io.h>                /* Include AVR std. library file */
#include <util/delay.h>            /* Include delay header file */
#include <inttypes.h>          /* Include integer type header file */
#include <stdlib.h>                /* Include standard library file */
#include <stdio.h>                 /* Include standard I/O library file */
#include "MPU6050_res_define.h"    /* Include MPU6050 register define file */
#include "I2C_Master_H_file.h"  /* Include I2C Master header file */
#include "USART_RS232_H_file.h"    /* Include USART header file */

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

void Gyro_Init()               /* Gyro initialization function */
{
        delay_ms(150);                  /* Power up time >100ms */
```

MPU6050 Output Window of Terminal

The output window will show all values mentioned below

Ax = Accelerometer x-axis data in g unit

Ay = Accelerometer y-axis data in g unit

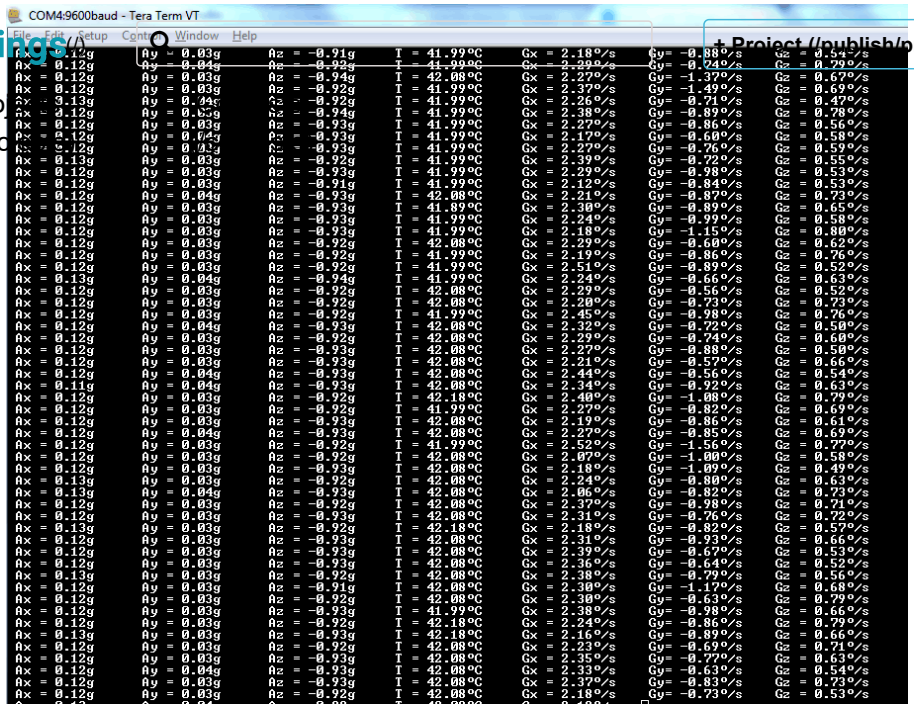
Az = Accelerometer z-axis data in g unit

T = temperature in degree/Celcius

Gx = Gyro x axis data in degree/seconds unit

Gy = Gyro y axis data in degree/seconds unit

Gz = Gyro z axis data in degree/seconds unit



Components Used

ATmega 16 ATmega 16	**X 1**	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA16L-8PU?qs=%2Fha2pyFaduiGCJtTvs2wv8fVZbVAalLu7Iq%2FglTS0tALAx6fMenLvg%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega-16/1/datasheet)

Components Used

Powered By

Atmega32 Atmega32	X 1	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA32-16PU?qs=aqrrBurbvGdpkmgj7RWmsQ%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega32/1/datasheet)
MPU6050 Gyroscope and Accelerometer MPU6050 (Gyroscope + Accelerometer + Temperatur...	X 1	(https://www.mouser.com/ProductDetail/TDK-InvenSense/MPU-6050?qs=u4fy%2FsgLU9O14B5JgyQFvg%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/mpu6050-gyroscope-and-accelerometer/1/datasheet)

Components Used

CP2103 USB TO UART BRIDGE CP2103 is single chip USB to UART Bridge. It su...	X 1	(https://www.mouser.com/ProductDetail/Silicon-Labs/CP2103-GMR?qs=Zq62GxwlckYrXEgTuxpNRg%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/cp2103-usb-to-uart-bridge/1/datasheet)

Downloads

MPU-6050_DataSheet.pdf	Dow nloa d (/api/download/platform-attachment/189)
RM-MPU-60xxA.pdf	Dow nloa d (/api/download/platform-attachment/190)
ATmega MPU6050 Interface	Dow nloa d (/api/download/platform-attachment/355)

Comments

Comment

Rascal
(/users/Rascal/profile)
2017-12-29 12:45:34

Hi and thanks for you code. I ran it on an atmega16 but found that now and again the i2c bus hangs the code when reading the raw values. My xtal is 11059200 and I changed the F_cpu valu accordingly. Any suggestions? Thanks

Reply Like

Rascal
(/users/Rascal/profile)
2017-12-29 12:45:36

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Reply Like

lokeshc
(/users/lokeshc/profile)
2017-12-30 00:51:00

@Rascal: Hello friend,

make sure that your MPU6050 is connected to atmega16 properly. since the i2c functions used in above example using while(1) methods for sending and receiving the data. so the situation may come while your connection gets loose and i2c functions will get stuck to while(1) behaviour due to no response from slave device(MPU6050 here).

Also you need to change the f_cpu in every library used for above example i.e. you need to change the f_cpu in i2c library and uart library as well.

you are using external crystal so i hope you already sets controller to use external crystal.

try above things and let me know if still it getting stucks

Reply Like

Rascal
(/users/Rascal/profile)
2017-12-30 01:42:07

@lokeshc: thanks I believe that part was all done ok. It works perfectly for a couple of minutes at times and prints fine but then hangs. I did use a sparkfun level converter but will try without that when I am back and will let you know. Russell

Reply Like

Rascal
(/users/Rascal/profile)
2018-01-01 17:21:36

@Rascal: Hi. Ok I removed the level converter and just did a direct connection. Now it seems fine and runs reliably. Thanks for the great site and info. Regards and best for the new year. Russell

Reply Like

mina
(/users/mina/profile)
2018-03-03 21:26:58

Hi,can I do the same connections and interfacing with atmega32?
Reply Like

lokeshc (/users/lokeshc/profile)
2018-03-04 00:07:59 • Edited

Yes sure. Just you have to change the selected microcontroller in the project from ATmega16 to ATmega32
Reply Like

raosige (/users/raosige/profile)
2018-10-25 04:16:45

Hi,
Thank you very much for your source code and hardware information.
It is really great work.
i have connected mpu6050 to ATMEGA32A micorcontroller and i succeeded to get raw data from 3 axis accelerometer/Gyroscopes from MPU6050.
i want to find ROll, Pitch and YAW angles. how can i find or calculate from these raw data from mpu6050?
any help will be appreciated
Reply Like

anjanaouseph (/users/anjanaouseph/profile)
2019-03-09 18:58:04

why do we need to use USART communication in this?whats buffer here?
Reply Like

lokeshc (/users/lokeshc/profile)
2019-03-11 12:00:00

to see the output of MPU6050
Reply Like

anjanaouseph (/users/anjanaouseph/profile)
2019-03-11 12:12:19

How do you set up tera term?
Reply Like

lokeshc (/users/lokeshc/profile)
2019-03-12 18:45:03

Just start with new connection and set used baud rate.
Reply Like

anjanaouseph (/users/anjanaouseph/profile)
2019-03-16 09:01:04

When i opened a new connection iam not able to select the serial communication radio button, its greyed out! Do you know what to do here?
Reply Like

lokeshc (/users/lokeshc/profile)
2019-03-16 10:13:08

Have you installed driver for serial to USB module? It should be installed then it will show serial port in serial communication radio button.
Aslo closed all previous connections in tera term.
Reply Like

anjanaouseph (/users/anjanaouseph/profile)
2019-03-16 10:36:41

Tera term works fine now, i selected atmega328p as the board in the project,now its showing errors such as UCSRB undeclared and so on.What has to be done?
Reply Like

dannyfabricio3006
(/users/dannyfabricio3006/profile)
2019-04-29 09:46:47

Hello, I have problems with the code you have provided, I am using an Atmega32A and change the frequencies in all the libraries, but
in TeraTerm it gives me negative zeros in the 6 axes, also in the Proteus simulator.
Excuse my English grief, greetings from Ecuador.
Reply Like

JohnSanchez
(/users/JohnSanchez/profile)
2020-09-06 02:21:10 • Edited

Hello, thanks for the code so much . I just want to ask how can I get the data for my PC exactly as a HID gyroscope , not as a console text ?
Reply Like

Pacimani
(/users/Pacimani/profile)
2020-09-10 20:37:43

Does anyone know where I can find the licence for the codes so that I can them for my school project? My school requires me to provide a licence before I include the device's code into my project.
Reply Like

zeverist0101
(/users/zeverist0101/profile)
2021-06-04 12:48:58

How would you do if you want to use this code with atmega328p chip instead?
Reply Like

NoorAmalinaOthmanA18MB0090
(/users/NoorAmalinaOthmanA18MB0090/profile)
2021-06-29 15:07:55

Hi sir. May i know how i can change the coding for Atmega328 because i faced error with the MPU6050 res.h and recipe for target main.o failed when i try to copy the coding to another file
Reply Like

MohammadBidokh
(/users/MohammadBidokh/profile)
2022-05-04 15:20:43

Hi how can i use this code in codevision?
please guide me
Reply Like

TalalAedo
(/users/TalalAedo/profile)
2022-12-25 03:38:02

Hello, I need the mikroc code to run the mpu5060
Reply Like 1