Lab2 2023/09/22

B09901055 楊倢綺

Code: https://github.com/stanthemaker/EmbeddedSystem

1. What are the units used for the sensor values?

   Hint: refer to the manual and the BSP source code for the Microcontroller and the sensors. if not explicit showing units, please show the information about resolution (8-bit/16-bit etc and the range about the measurement)

sensor	unit	intro
LIS3MDL 3-axis magnetometer	Gauss / microTesla(uT)	measuring magnetic fields
LSM6DSL 3D gyroscope	acceleration range: g angular rate range: dps(degrees per second)	
LPS22HB digital barometer	hPa	pressure sensor
HTS221 humidity and temperature	temperature: °C humidity: rH(Relative Humidity), not a unit	
VL53L0X ToF and gesture detection		3D image sensor measure distance and size and to track motion and movements

1. What is I2C read address and I2C write address allocated for the LSM6DSL 3D accelerometer and 3D gyroscope sensors in the IoT node (B-L475E-IOT01A or B-L4S5I-IOT01A)?

   Hint: refer to the manual and the BSP source code for the Microcontroller and the sensors.

Table 11.SAD+read/write patterns

Command	SAD[6:2]	SAD[1] = SDO/SA1	SAD[0]	R/W	SAD+R/W
Read	00111	0	0	1	00111001 (39h)
Write	00111	0	0	0	00111000 (38h)
Read	00111	1	0	1	00111101 (3Dh)
Write	00111	1	0	0	00111100 (3Ch)

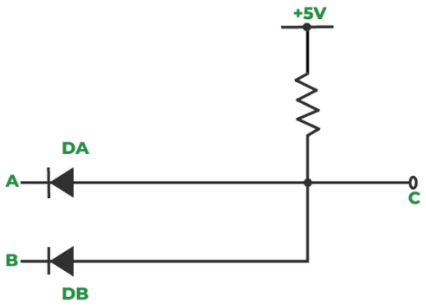
2. What are the main differences I2C between SMbus (System Management Bus)?
   Reference: https://www.analog.com/en/design-notes/guide-to-comparing-ic-bus-to-the-smbus.html
   SMBus is derived from the I2C, allowing devices to generate alerts to the controller when specific conditions occur. This is useful for monitoring and managing hardware conditions, such as overtemperature or undervoltage situations. Also, handling communication timeouts and retries to improve robustness and error recovery in noisy environments.

	I2C	SMbus	Description
Timeout	No	Yes (35ms timeout)	Timeout is where a slave device resets its interface whenever Clock goes low for longer than the timeout
Minimum Clock Speed	DC Potential for bus lockup	10kHz	timeout also dictates a minimum speed for the clock, because it can never go static
Maximum Clock Speed	100kHz (400kHz and 2MHz also available)	100kHz	
Voltage Level	VDD dependent	fixed	
V-high	0.7 × VDD, 3.0V Fixed	2.1V	
V-low	0.3 × VDD, 1.5V Fixed	0.8V	
Max Current	3mA	350uA	SMBus specifies a minimum sink current of 100µA, and a maximum of 350µA, compared to 3mA for the I²C bus
Alert Response	No	provide a line called ALERT#, sent to address 0001 100	

3. What is the I2C address of ADXL 345, if ALT ADDRESS is connected to HIGH? (hint: check the lecture note and the manual of ASXL 345 that can be found at Internet)

   7-bit I2C address for the device is 0x1D — followed by the R/W bit

4. How to connect two open-drain signal lines to achieve the wired-AND logic?
   Connect with a pull-up resistor as image shown below:



5. What is the main difference between the bus master and the bus slave?

   The master is defined as the one who is operating on the external bus, performing instruction fetches and data read/writes from/to the external memory. The slave is defined to normally execute out of internal resources, such as its internal ROM or RAM.

Personal Report:
This time, I started working with a development board that connects to Wi-Fi. It reads data from sensors and uploads it to a localhost. Additionally, using a Python package to visualize the data helps me better understand how the code operates. However, the code in PowerPoint scatters in everywhere, thus it's quite difficult to reconstruct them.