**EE390 Lab 7**

**Subject**: I2C Interfacing & single-tap/double-tap detection using the Accelerometer sensor.

**Description:**

Single-tap and double-tap detection can be done using the accelerometer sensor. Write a program to perform the following steps:

**Step 1**. Initialize the STM32L475 I2C2 module to operate at 400 kHz and also enable I2C2 interrupt.

**Step 2.** Initialize the USART1 module to transmit data at 115200 baud.

**Step 3**. Wait for 100 ms to allow the LSM6DSL to complete the boot procedure.

**Step 4.** Configure the PD11 pin for EXTI11 pin interrupt source. This pin is connected to the INT1 pin of the LSM6DSL sensor chip.

**Step 5.** Write an appropriate value into the **CTRL1\_XL** register to set ODR\_XL to 416 Hz, FS\_XL to ±2g.

**Step 6.** Write an appropriate value into the **TAP\_CFG** register to enable interrupts and tap detection on X, Y, and Z axes.

**Step 7.** Write an appropriate value into the **TAP\_THS\_6D** register to set the threshold for detecting the single-tap to 562.5 mg (= 9 \* FS\_XL / 25).

**Step 8.** Write an appropriate value into the **INT\_DUR2** register to set the DUR, Quiet and Shock windows to 538.5 ms (7 \* 32 / ODR\_XL), 28.8 ms (3 \* 4 /ODR\_XL) and 38.5 ms (2 \* 8 / ODR\_XL).

**Step 9.** Write an appropriate value into the **WAKE\_UP\_THS** register to enable single-tap and double detection.

**Step 10.** Write an appropriate value into the **MD1\_CFG** register to drive both single-tap and double-tap interrupt to the INT1 pin.

**Step 11.** Write the interrupt handling routine for **EXTI11** pin. This service routine checks to see whether interrupt is from the single-tap or double-tap and output the message accordingly. For example, output “Single-tap is detected!” when single-tap is detected. Output “double tap is detected!” when double-tap is detected.

**Step 12.** Write an I2C interrupt service routine for I2C2 module to take care of the I2C data transmission.

**Step 13.** Build the project and download the program onto the demo board. Your program should output a message like “Single-tap experiment starts!” on the terminal window and you start to move the demo board quickly downward and sideway to see if it causes any single tap. When performing single-tap detection, your program should **disable double-tap interrupt to be driven to the INT1 pin**. Performs this experiment for about 20 seconds (by calling a delay function to wait for 20 seconds) then change to double-tap experiment by outputting a message “double tap experiment starts!”. At this moment, you program should **enable double tap interrupt to be driven to the INT1 pin**. You then move the demo kit downward or sideway one after another to see if double tap is detected. Also perform this for about 20 seconds (by calling the delay function to delay for 20 seconds). Repeat this experiment several times.

**Due: 04/07/2023 (Monday)**