

## ENEL 351: LAB 4 interrupts

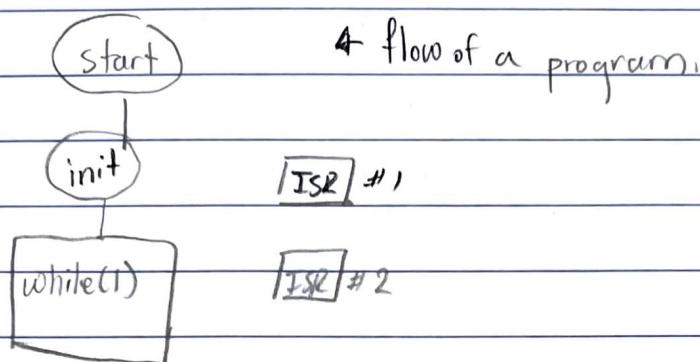
Objective: Familiarize the student with the operation of interrupts using the STM3210X.

RAMS: Risk Assessment and Mitigation strategy.

Risks	Mitigation strategy
<ul style="list-style-type: none"><li>◦ Spills</li><li>◦ Tripping</li><li>◦ Electro static damage to STM board</li></ul>	<ul style="list-style-type: none"><li>◦ keep liquids and anything else that can spill away or in a locker.</li><li>◦ keep workplace around and on the working table clean and organized.</li><li>◦ Make sure to wear the electrostatic band protection provided.</li></ul>

Pre-lab

What is an interrupt?



ISR  $\Rightarrow$  looks for an event to occur

One of the ISR will connect to SysTick.  
it runs independently ~~and~~ is the SysTick  
is a part of ARM chip.

The other ISR will look for the PB5 to  
have a falling edge.

All peripherals have capability to use  
interrupts.

How does it know what to do with events that occurs?

↳ defined in the vector table in the start up files.

vector table handlers points to handlers (ISR)

stack

- defined in start up
- first in - last out

Interrupts has masks

- 1) local  $\Rightarrow$  located in a subsystem
- 2) global  $\Rightarrow$

what's the process?

- SysTick time operate

flow: stack to handler to vector table then pop stack.



## vector table

HANDLERS (ISR)

STACK

MASKS

vector table is in startup - stm32x

ICD  $\Rightarrow$  Creating a 32 bit address in a table

when you put reset

- init system
- go to main

## Systick

- Branches to 'here'

GPIO handlers work through  
EXTIO to EXTI015

Pin 0 will be used for each of the  
ports.

## Procedure Notes:

◦ use pattern generator for pulse generator.

Systick : generating a cyclical register.

```
void Systick - Timer {
```

```
    GPIOA = GPIO_ODR_ODR5  
}
```

in the cortex m3 PDF : section 4.5.6

Part B:

EXTI system, section 10 in the STM32 ref manual.

10.2.2

Block

Diagram.



AFIO register and port B clocks  
need to be on.

- in section 9.4.3

write a 1 into PB(x) pin.

- who's generating interrupt.



10.3.1 Interrupt mask register

Falling/trigger selection register.

NVIC Register

Section 10.1.2

turn a 1 on the bit 6 position in EXTI0.

NVIC → ~~USER[0]~~ USER[0] = NVIC\_ISR - SETEN - 6

Systick helps to schedule tasks in program by way of interrupts.

EXTIO is an example of an interrupt.

- allows to detect and respond to external logic transitions.

To use an interrupt:

- 1) ISR (interrupt service routine) needs to be defined.
- 2) Provide address to ISR from the vector table.
- 3) System that is generating the interrupt must be setup properly.

it is not good to stay in an interrupt for long - should be fast.



## Procedure

- 1)
  - Find SysTick-Timer in section 4.5 of M3 manual.
  - Set  $0xB71B00$  on SysTick Reload
  - Set  $0x5$  (101b) on systick-ctrl register.
    - enables timer and assigns system clock.
- 2) created an ISR that toggles PA5 when it executes.
- 3) The frequency of system clock that I measured was ~~480~~ 480 KHz. The value of Reload value was 12 MHz.
- 4) Created and configured the EXTI ~~to~~ interrupt to use PB0, makes interrupt on falling edge.
- 5) made an ISR for EXTI0. will go H when High to Low takes place.
- 6) tested and done.
- 7) tested and done.

using Interrupt system with the keil setup files.

1) disable SysTick, 0 in CTRL register

2) clear counter, 0 in VAL register

3) Configure clock interval

◦ 24 MHz

◦ Automatically reloaded.

4) write 7 into the CTRL register

~~4~~

```
void SysTick_Handler(void)
{
    //
}
```

~~4~~

1) turn clocks on for EXTI0, port B

2) Select Port B as source for EXTI0 events.

3) unmask PBD as interrupt source.

4) Select falling events as trigger

5) unmask EXTI0 as interrupt source in the NVIC

```
void EXTI0_IRQHandler(void)
{
```

```
    EXTI->PR &= EXTI->PR_PRR;
```

```
}
```



Self Assessment

- I understand the purpose and use cases for interrupts after this lab. They deal with events that need to be taken care of right away and are efficient.
- I had some struggle getting the interrupts configured, need to have a better understanding of registers and their functionality.

Signed: Mubashir  
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