國立中正大學
National Chung Cheng University

微處理機系統與介面技術

LAB 5 – GPIO Interrupt & WDT

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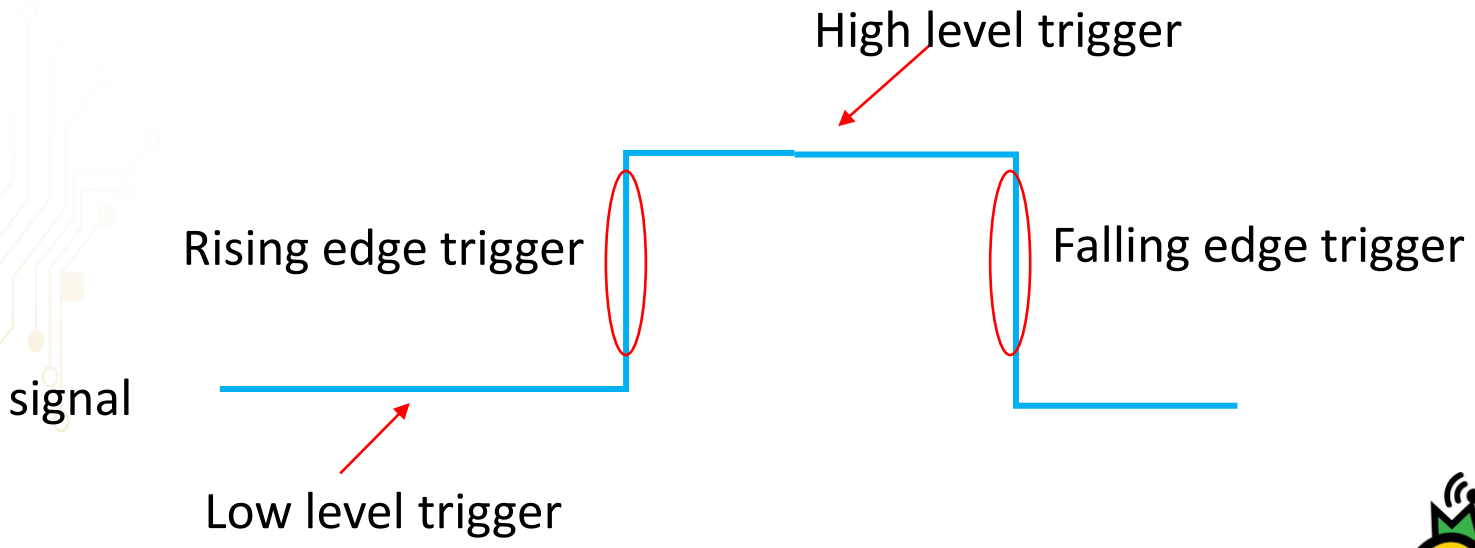
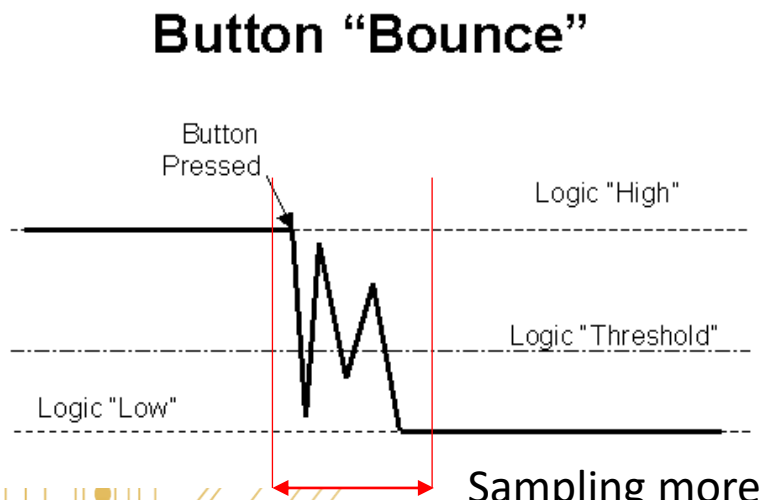
GPIO interrupt

- GPIO interrupt mode
  - Level trigger: low level trigger, high level trigger
  - Edge trigger: falling edge trigger, rising edge trigger

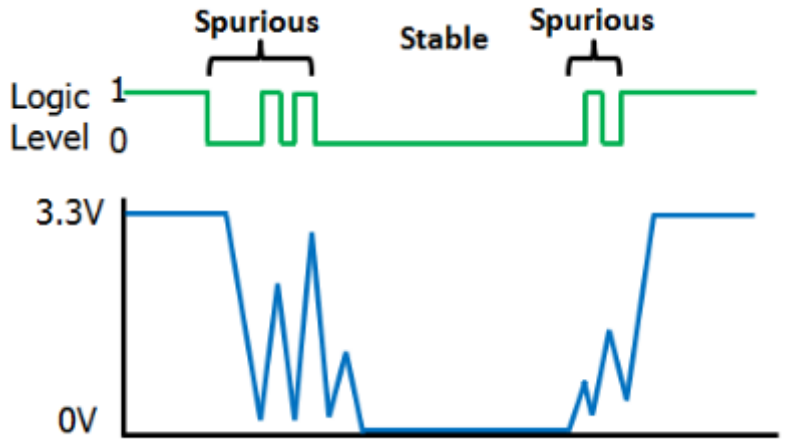


GPIO de-bounce problem

- When using button generate Pulse Wave, it might cause a voltage bouncing problem before it become stable stage.
- If you use GPIO interrupt to read this pin, interrupt will generate more times than you thought

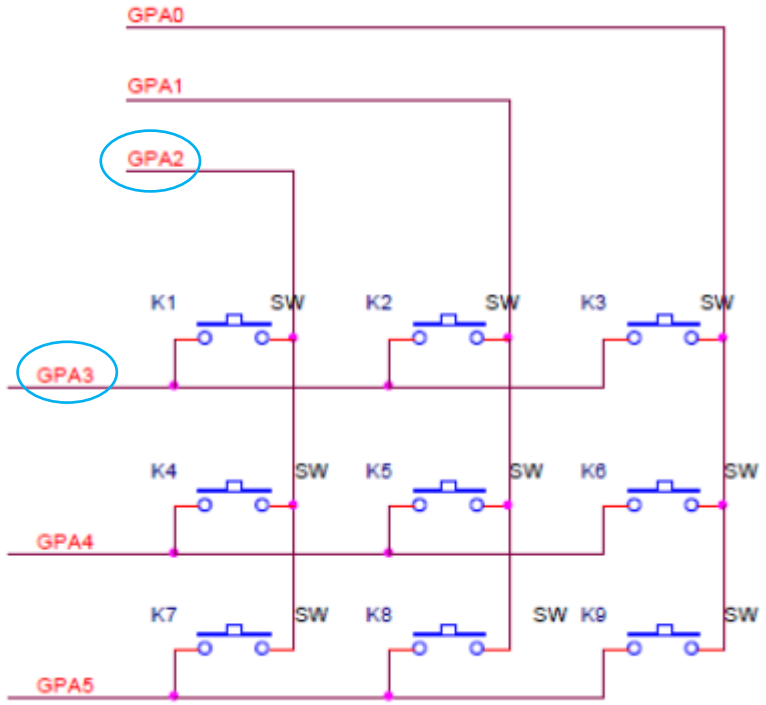


Sampling more clock cycle to solve this problem



Use GPIO interrupt implement Keypad

- Configure one pin as output, another to read GPIO interrupt
- When button press, you can get Rising/Falling edge on GPIO pin



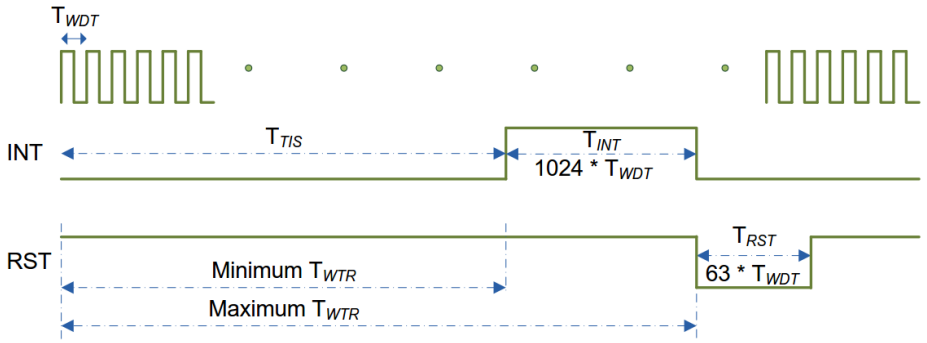
- Tips: Interrupt pin is recommended to use QUASI bi-direction mode, pin will pull high for no use

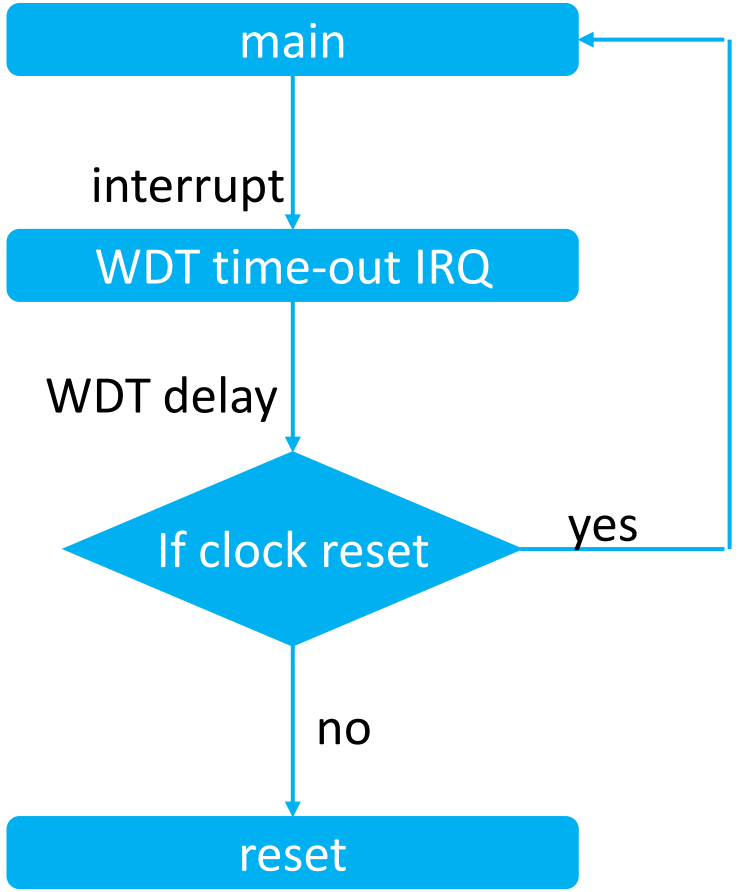
GPIO interrupt register

- GPIOx_IMD: interrupt mode control
- GPIOx_IEN: interrupt enable control
  - IR_EN, IF_EN
- GPIOx_ISRC: interrupt source flag
- GPIOx_DBEN: de-bounce enable
- GPIO_DBNCECON: interrupt de-bounce cycle control

WDT - Watch Dog Timer

- Perform a system reset when system runs into unknown state
- WDT generate an interrupt with a selected time-out interval(2^14~2^18 Twdt)
- WDT IRQ will wait 1024*Twdt, if WDT counter not reset, WDT will generate chip reset signal





Twdt: WDT Clock period Time

WDT configure register

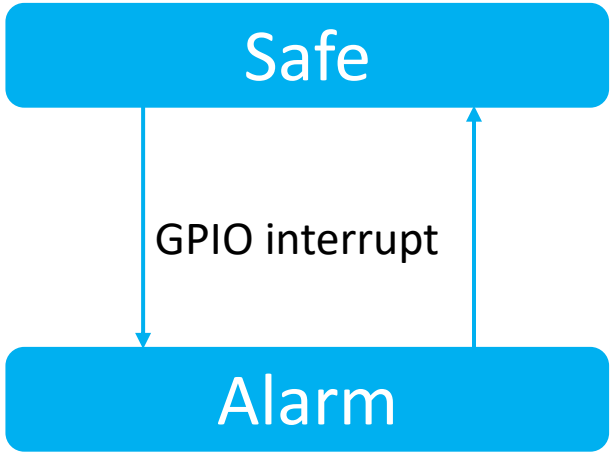
- WDT_WTCR: watch dog timer control register
  - WTIS
  - WTE
  - WTIE, WTIF
  - WTRF, WTRE
  - WTR

31	30	29	28	27	26	25	24
DBGACK_WDT	Reserved						
23	22	21	20	19	18	17	16
Reserved							
15	14	13	12	11	10	9	8
Reserved					WTIS		
7	6	5	4	3	2	1	0
WTE	WTIE	WTWKF	WTWKE	WTIF	WTRF	WTRE	WTR

- Tips: part of WDT register are write-protected!!

Basic

- Make an emergency alarm



- Use GPIO interrupt to change alarm state
  - Use keypad key1 as GPIO interrupt source

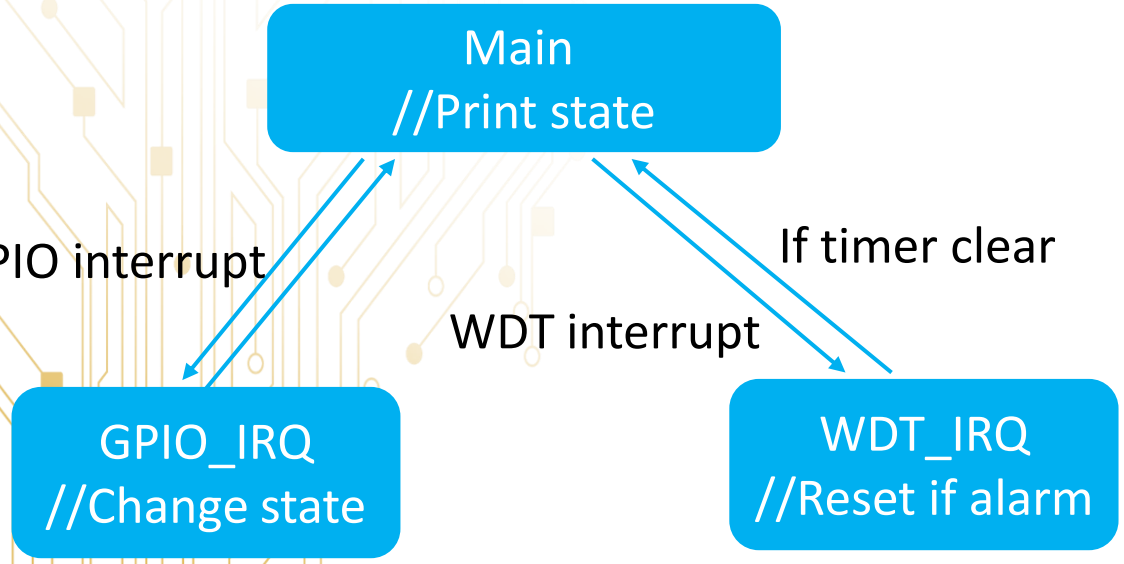
- You can use putty or buzzer make alarm

COM8 - PuTTY

```
Start Lab5
Safe!
Safe!
Safe!
Change!!!
Alarm!!!
Alarm!!!
Alarm!!!
Change!!!
Safe!
Safe!
```

Bonus

- Let emergency alarm can reset
- Use WDT reset the emergency alarm when the state is not safe



COM8 - PuTTY

```
Start Lab5
Safe!
Safe!
Safe!
Safe!
Watch dog timer ocurred!!!
No problem~~~
Safe!
Change!!!
Alarm!!!
Alarm!!!
Alarm!!!
Watch dog timer ocurred!!!
Alarm!!!~~~reset!!!
Start Lab5
Safe!
Safe!
```

Tips

- 範例程式: GPIO_INT, GPIO_EINTAndDebounce, WDT_TimeoutReset

- Keypad configuration
  - PA.3 output low
  - PA.2 quasi bi-directional, remember to set de-bounce

- Most of the WDT register need to write protected
  - Use SYS_UnLockReg(), SYS_LockReg()
  - You have to clean up WDT counter in WDT_IRQ

Demo

- Place: 創新大樓515 找助教 夏子聰
- Demo Time: (二)(四)下午三點~五點
- Report deadline: 12/2(五)
- Report title format: LABx_ID_Name.pdf

- Demo必須在Report deadline前完成
- Demo前須先上傳程式碼(上傳main所在的.c檔即可)

Graded

- Basic : 70%
- Bonus : 15%
- Report & Code : 15%