GPIO 軟體防彈跳

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

代碼簡述	使用定時器週期模式，每 1 毫秒產生一次定時器中斷，來完成軟體按鈕防彈跳
BSP 版本	M031_Series_BSP_CMSIS_V3.02.000
開發平台	NuMaker-M032SE V1.3

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1 功能介紹

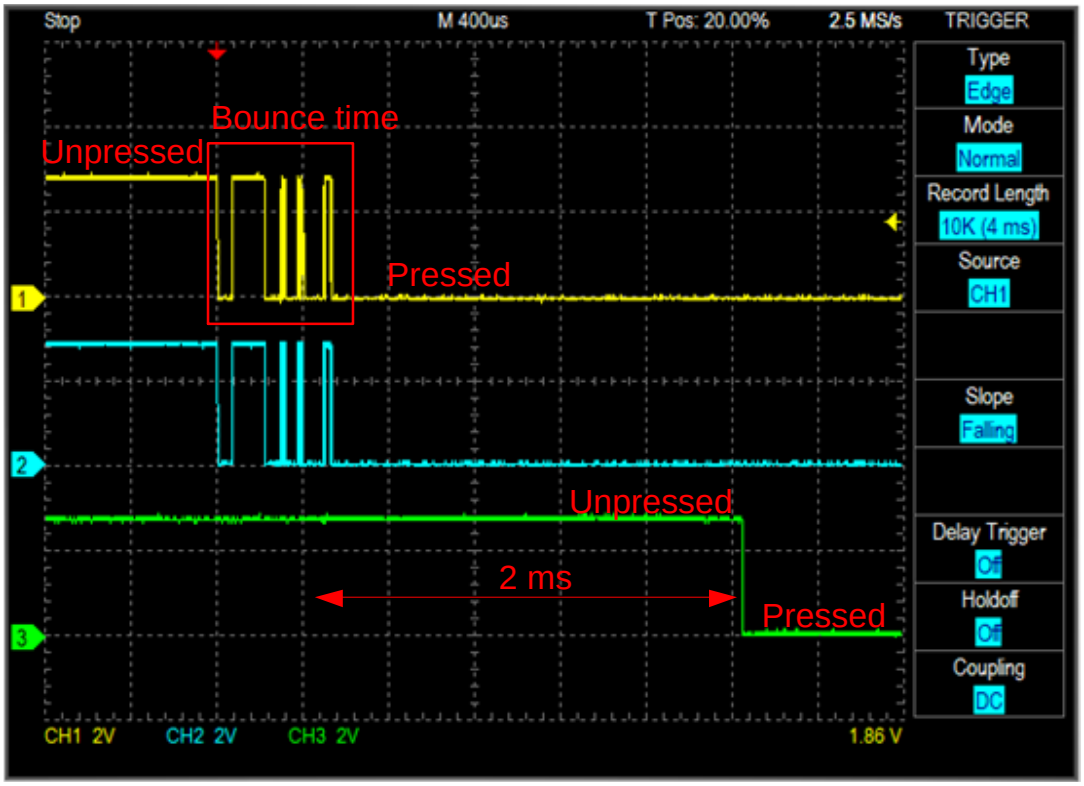
1.1 簡介

彈跳是由電子設備中觸點的閉合或斷開產生的多個脈衝信號。 最常見的是機械按鈕，當按下按鈕一次時，會產生多個脈衝信號， MCU會認為是多次按下並放開按鍵，而導致誤動作，因此需要防彈跳，以確保獲得正確的信號。 本文主要使用計時器和GPIO進行軟體防彈跳實驗。

1.2 原理

此軟體防彈跳是使用Timer每1ms產生一個中斷並將1ms旗標設置為1，然後根據此旗標每1ms確認按鈕的狀態。 在按鈕狀態一段時間未改變之後，即可以確定按鈕已被穩定地按下或放開。然後MCU可以將其判斷為正確的信號，並將該信號輸出到LED。 另外，可以根據不同按鈕的穩定時間設置防彈跳時間。

1.3 執行結果



CH1: 按鍵輸入 (PC.14),

CH2: 沒有防彈跳的訊號輸出 (PB.15),

CH3: LED, 有防彈跳的訊號輸出(PB.14)

註: 這個波型的防彈跳時間設為 2 ms.

2 代碼介紹

```
/*---------------------------------------------------------------------------*/
/* Define                                                                    */
/*---------------------------------------------------------------------------*/
#define DEBOUNCE_TIME 50            //Press and release button settling time ( ms )
#define BUTTON1 PC14                //Button input port
#define LED PB14                    //Indicator light used to indicate that a button is
                                      pressed(debounced)
#define TEST_PIN PB15               //Used to measure button state without debouncing

/*---------------------------------------------------------------------------*/
/* Global variables                                                          */
/*---------------------------------------------------------------------------*/
uint8_t bTimer_1ms;                 //Timer 1ms flag
uint8_t g_ButtonState;              //BUTTON1's current state
uint8_t g_ButtonStateOld;           //BUTTON1's previous state
uint8_t g_ButtonStateDebounced = 1; //BUTTON1's de-bounced state
uint32_t g_ButtonDebounceCnt = 0;

/*---------------------------------------------------------------------------*/
/* Functions                                                                 */
/*---------------------------------------------------------------------------*/
uint8_t GPIO_Debounce(void);

void TMR0_IRQHandler(void)
{
    /* Set 1ms flag */
    bTimer_1ms = 1;
    /* clear timer interrupt flag */
    TIMER_ClearIntFlag(TIMER0);
}

void SYS_Init(void)
{
    /* Unlock protected registers */
    SYS_UnlockReg();

    /* Enable HIRC */
    CLK_EnableXtalRC(CLK_PWRCTL_HIRCEN_Msk);
```

```
    /* Waiting for HIRC clock ready */
    CLK_WaitClockReady(CLK_STATUS_HIRCSTB_Msk);

    /* Switch HCLK clock source to HIRC */
    CLK_SetHCLK(CLK_CLKSEL0_HCLKSEL_HIRC, CLK_CLKDIV0_HCLK(1));

    /* Set both PCLK0 and PCLK1 as HCLK/2 */
    CLK->PCLKDIV = (CLK_PCLKDIV_APB0DIV_DIV2 | CLK_PCLKDIV_APB1DIV_DIV2);

    /* Switch UART0 clock source to HIRC */
    CLK_SetModuleClock(UART0_MODULE, CLK_CLKSEL1_UART0SEL_HIRC, CLK_CLKDIV0_UART0(1));

    /* Enable UART peripheral clock */
    CLK_EnableModuleClock(UART0_MODULE);

    /* Enable IP clock */
    CLK_EnableModuleClock(TMR0_MODULE);

    /* Select IP clock source */
    CLK_SetModuleClock(TMR0_MODULE, CLK_CLKSEL1_TMR0SEL_HIRC, 0);

    /* Update System Core Clock */
    /* User can use SystemCoreClockUpdate() to calculate PllClock, SystemCoreClock and
       CycylesPerUs automatically. */
    SystemCoreClockUpdate();

    /*---------------------------------------------------------------------*/
    /* Init I/O Multi-function                                             */
    /*---------------------------------------------------------------------*/
    /* Set GPB multi-function pins for UART0 RXD and TXD */
    SYS->GPB_MFPH = (SYS->GPB_MFPH & ~(SYS_GPB_MFPH_PB12MFP_Msk |
                     SYS_GPB_MFPH_PB13MFP_Msk)) |
                    (SYS_GPB_MFPH_PB12MFP_UART0_RXD | SYS_GPB_MFPH_PB13MFP_UART0_TXD);

    /* Lock protected registers */
    SYS_LockReg();
}
```

```
/*---------------------------------------------------------------------------*/
/* Init UART0                                                                */
/*---------------------------------------------------------------------------*/
void UART0_Init(void)
{
    /* Reset UART0 */
    SYS_ResetModule(UART0_RST);

    /* Configure UART0 and set UART0 baud rate */
    UART_Open(UART0, 115200);
}

int main(void)
{
    /* Init System, IP clock and multi-function I/O. */
    SYS_Init();

    /* Init UART0 for printf */
    UART0_Init();

    printf("\nThis sample code use timer to generate interrupt every 1 ms for software
              debouncing test \n");

    /* Set timer frequency to 1000 Hz */
    TIMER_Open(TIMER0, TIMER_PERIODIC_MODE, 1000);

    /* Enable timer interrupt */
    TIMER_EnableInt(TIMER0);
    NVIC_EnableIRQ(TMR0_IRQn);

    /* Start Timer 0 */
    TIMER_Start(TIMER0);

    /* Set PC4 to QUASI mode for BUTTON1 debouncing test*/
    GPIO_SetMode(PC, BIT14, GPIO_MODE_QUASI);

    /* Set PB14 and PB15 to output mode for BUTTON1's debouncing test*/
    GPIO_SetMode(PB, BIT14, GPIO_MODE_OUTPUT);//LED
    GPIO_SetMode(PB, BIT15, GPIO_MODE_OUTPUT);//TEST_PIN



    while (1)
```

```
    {
        /* Output BUTTON1 state to TESE_PIN */
        TEST_PIN = BUTTON1;

        /* Check the BUTTON1 state every 1ms */
        if (bTimer_1ms)
        {
            /* Clear 1ms flag */
            bTimer_1ms = 0;
            /* Output debounced BUTTON1 state to LED */
            LED = GPIO_Debounce();
        }
    }
}


uint8_t GPIO_Debounce(void)
{
    /* Read the BUTTON1 state */
    g_ButtonState = BUTTON1;

    /* Increase g_ButtonState if the previous state is the same as the current state */
    if (g_ButtonStateOld == g_ButtonState)
    {
        g_ButtonDebounceCnt++;

        /*The state is held longer than the button settling time,
          so this state can be treated as the correct state of the button. */
        if (g_ButtonDebounceCnt >= DEBOUNCE_TIME)
        {
            g_ButtonStateDebounced = g_ButtonState;
        }

        /* Clear the count to zero if the current state of the button is different from
           the previous state */
    }
    else
    {
        g_ButtonDebounceCnt = 0;
    }

    g_ButtonStateOld = g_ButtonState;
```

```
    /* Return the correct state of the button */
    return  g_ButtonStateDebounced;
}
```

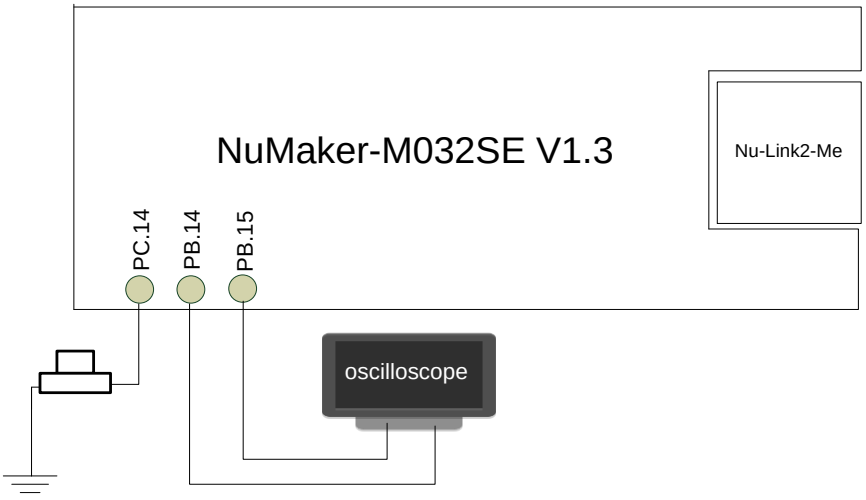
3 軟體與硬體環境

● 軟體環境

- ■ BSP 版本
  - ◆ M031_Series_BSP_CMSIS_V3.02.000
- ■ IDE 版本
  - ◆ Keil uVersion 5.28

● 硬體環境

- ■ 電路元件
  - ◆ NuMaker-M032SE V1.3
- ■ 示意圖



4 目錄資訊

- EC_M031_GPIO_Software_Debounce_V1.00
  - Library — Sample code header and source files
    - CMSIS — Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
    - Device — CMSIS compliant device header file
    - StdDriver — All peripheral driver header and source files
  - SampleCode
    - ExampleCode — Source file of example code

5 如何執行範例程式

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 EC_M031_GPIO_Software_Debounce.uvproj。
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
Nov. 01, 2019	1.00	1. 初始發布.

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