MINI51控制HC-SR04感測器

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

代碼簡述	本範例代碼使用 MINI51 控制 HC-SR04 感測器
BSP 版本	Mini51DE_Series_BSP_CMSIS_v3.02.000
開發平台	NuTiny-EVB-Mini51

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1 功能介紹

1.1 簡介

本程式是HC_SR04 超聲波模組的測距程式。

1.2 原理

處理過程：
a.上電進行系統初始化和 timer 初始化。
b.在 timer 外部捕捉口有上升沿和下降沿變化時，MCU 產生外部捕捉中斷，在中斷中將 timer 值保存起來，當檢測到下降沿後置一個檢測標誌。
c.主程序判斷到該標誌，算出兩次捕捉到的時差。根據 HC_SR04 模組說明，該時差即從超聲波到物體間的來回傳輸時間。
d.距離計算。距離=傳輸時間*340/2。
e.把計算的距離通過串口列印出來。如超出2cm~4m模組檢測範圍，串口將列印超距離資訊。

1.3 執行結果

```
Mini51 + HC_SR04 Sample Code...
Now distance is 97 mm
Now distance is 99 mm
Now distance is 95 mm
Now distance is 99 mm
Now distance is 104 mm
Now distance is 104 mm
Now distance is 109 mm
Now distance is 117 mm
Now distance is 113 mm
Now distance is 113 mm
Now distance is 118 mm
Now distance is 118 mm
Now distance is 118 mm
```

2 代碼介紹

timer 初始化：

```
/* Give a dummy target frequency here. Will over write capture resolution with macro */
TIMER_Open(TIMER0, TIMER_PERIODIC_MODE, 1000000);

/* Update prescale to set proper resolution.
   Timer 0 clock source is 12MHz, to set resolution to 1ms, we need to
   set clock divider to 12. e.g. set prescale to 12 - 1 = 11 */
TIMER_SET_PRESCALE_VALUE(TIMER0, 11);

/* Set compare value as large as possible, so don't need to worry about counter overrun too frequently */
TIMER_SET_CMP_VALUE(TIMER0, 0xFFFFFF);

/* Configure Timer 0 free counting mode, capture TDR value on rising edge */
TIMER_EnableCapture(TIMER0, TIMER_CAPTURE_FREE_COUNTING_MODE, TIMER_CAPTURE_FALLING_THEN_RISING_EDGE);

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

/* Enable timer interrupt */
TIMER_EnableCaptureInt(TIMER0);
NVIC_EnableIRQ(TMR0_IRQn);
```

MCU 產生外部捕捉中斷，在中斷中將 timer 值保存起來：

```
void TMR0_IRQHandler(void)
{
    /* clear timer over flag */
    TIMER_ClearIntFlag(TIMER0);
    TIMER_ClearCaptureIntFlag(TIMER0);
    /* high level */
    if((P3->PIN)&(1<<2))
    {
        t0 = TIMER_GetCaptureData(TIMER0);
    }
    else
    {
        t1 = TIMER_GetCaptureData(TIMER0);
        g_u8DetFlag=1;
```

```
        }
    }
```

主程序算出兩次捕捉到的時差。根據 HC_SR04 模組說明，該時差即從超聲波到物體間的來回傳輸時間，把計算的距離通過串口列印出來：

```
    while (1)
    {
        P1->DOUT |= (1 << 0);
        CLK_SysTickDelay(100000);

        if (g_u8DetFlag)
        {
            g_u8DetFlag = 0;

            if (t1 >= t0)
            {
                Detected_dis = (t1 - t0);

                if (Detected_dis < 120)
                {
                    printf("Your distance is too close, must over than 2cm\n");
                }
                else if (Detected_dis > 23600)
                {
                    printf("Your distance is too farway ,not in my reach. The distance must less
than 4m\n");
                }
                else
                {
                    Detected_dis *= 17;
                    Detected_dis /= 100;
                    printf(" Now distance is %d mm\n", Detected_dis);
                }
            }

            P1->DOUT &= ~(1 << 0);
            CLK_SysTickDelay(100);
        }
    }
```

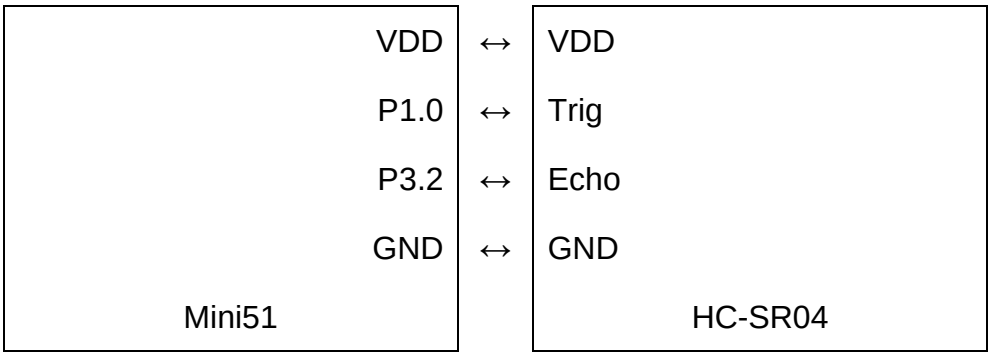
3 軟體與硬體環境

● 軟體環境

- ■ BSP 版本
  - ◆ Mini51DE_Series_BSP_CMSIS_v3.02.000
- ■ IDE 版本
  - ◆ Keil uVersion5.25

● 硬體環境

- ■ 電路元件
  - ◆ NuTiny-EVB-Mini51
  - ◆ HC-SR04
- ■ 示意圖



4 目錄資訊

- EC_MINI51_Control_HC-SR04_Sensor_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 Control_HC-SR04_Sensor.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
Jul.24, 2019	1.00	1. 初始發布.

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