MINI51控制HC-SR04传感器

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

代码简述	本范例代码使用 MINI51 控制 HC-SR04 传感器
BSP 版本	Mini51DE_Series_BSP_CMSIS_v3.02.000
开发平台	NuTiny-EVB-Mini51

1 功能介绍

1.1 简介

本程序是HC_SR04 超声波模块的测距程序。

1.2 原理

处理过程

a.上电进行系统初始化和 timer 初始化。

b.在 timer 外部捕捉口有上升沿和下降沿变化时，MCU 产生外部捕捉中断，在中断中将 timer 值保存起来，当检测到下降沿后置一个检测标志。

c.主程序判断到该标志，算出两次捕捉到的时差。根据 HC_SR04 模块说明，该时差即从超声波到物体间的来回传输时间。

d.距离计算。距离=传输时间*340/2。

e.把计算的距离通过串口打印出来。如超出2cm~4m模块检测范围，串口将打印超距离信息。

1.3 执行结果

```
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 代码介绍

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 产生外部捕捉中断，在中断中将 timer 值保存起来：

```
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;
```

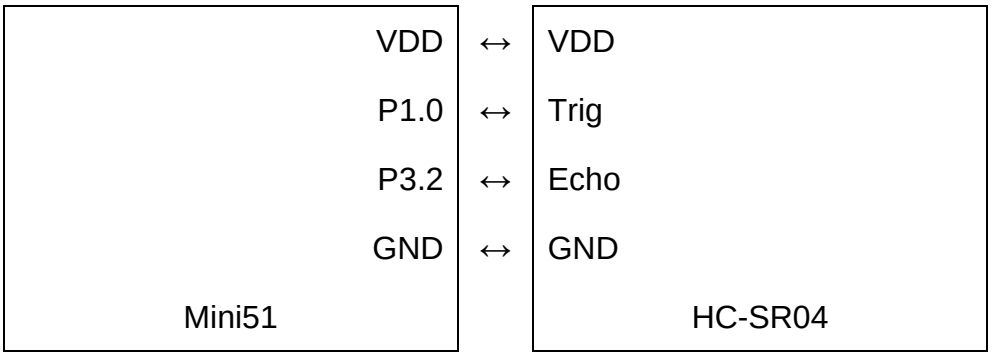
```
        }
    }
```

主程序算出两次捕捉到的时差。根据 HC_SR04 模块说明，该时差即从超声波到物体间的来回传输时间，把计算的距离通过串口打印出来：

```
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 软件与硬件环境

- 软件环境
  - BSP 版本
    - Mini51DE_Series_BSP_CMSIS_v3.02.000
  - IDE 版本
    - Keil uVersion5.25
- 硬件环境
  - 电路组件
    - NuTiny-EVB-Mini51
    - HC-SR04
  - 示意图



4 目录信息

- 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 如何执行范例程序

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 Control_HC-SR04_Sensor.uvproj。
2. 进入编译模式接口
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开除错模式
3. 进入除错模式接口
   a. 执行代码

6 修订纪录

Date	Revision	Description
Jul.24, 2019	1.00	1. 初始发布.

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