# 实验八 定时器计时实验

#include "stm32f10x.h" *// 根据您的 STM32 型号和库版本调整*

#include <stdio.h>     *// 用于 sprintf 函数将数值转换为字符串*

*// USART\_SendString 函数 (来自实验指导书)*

void USART\_SendString(USART\_TypeDef\* USARTx, char \*DataString) {

    unsigned char i = 0;

    while (DataString[i] != '\0') {

        USART\_SendData(USARTx, DataString[i]);

        while (USART\_GetFlagStatus(USARTx, USART\_FLAG\_TXE) == RESET);

        i++;

    }

}

*// 需要测量其执行时间的延时函数*

void Delay\_ms\_Target(volatile unsigned int nms) {

    volatile unsigned int i, j;

    for (i = 0; i < nms; i++) {

        for (j = 0; j < 12000; j++); *// 此值需要根据实际时钟和目标精度调整*

    }

}

*// KEY0 初始化 (PE4, 上拉输入, 低电平有效)*

void KEY0\_Init(void) {

    GPIO\_InitTypeDef GPIO\_InitStructure;

*// 使能 GPIOE 时钟 (KEY0 连接在 PE4)*

    RCC\_APB2PeriphClockCmd(RCC\_APB2Periph\_GPIOE, ENABLE);

*// 配置 PE4 为上拉输入模式*

    GPIO\_InitStructure.GPIO\_Pin = GPIO\_Pin\_4; *// KEY0 在 PE4*

    GPIO\_InitStructure.GPIO\_Mode = GPIO\_Mode\_IPU; *// 上拉输入*

    GPIO\_Init(GPIOE, &GPIO\_InitStructure); *// 初始化 GPIOE*

}

*// USART1 初始化 (PA9 TX, PA10 RX) - 保持不变*

void USART1\_Init\_For\_Experiment(unsigned int bound) {

    GPIO\_InitTypeDef GPIO\_InitStructure;

    USART\_InitTypeDef USART\_InitStructure;

*// 使能 GPIOA 和 USART1 时钟 (GPIOA 用于 PA9/PA10)*

    RCC\_APB2PeriphClockCmd(RCC\_APB2Periph\_GPIOA, ENABLE);

    RCC\_APB2PeriphClockCmd(RCC\_APB2Periph\_USART1, ENABLE);

*// 配置 PA9 (USART1\_TX)*

    GPIO\_InitStructure.GPIO\_Pin = GPIO\_Pin\_9;

    GPIO\_InitStructure.GPIO\_Speed = GPIO\_Speed\_50MHz;

    GPIO\_InitStructure.GPIO\_Mode = GPIO\_Mode\_AF\_PP;

    GPIO\_Init(GPIOA, &GPIO\_InitStructure);

*// 配置 PA10 (USART1\_RX)*

    GPIO\_InitStructure.GPIO\_Pin = GPIO\_Pin\_10;

    GPIO\_InitStructure.GPIO\_Mode = GPIO\_Mode\_IN\_FLOATING;

    GPIO\_Init(GPIOA, &GPIO\_InitStructure);

*// USART1 参数配置*

    USART\_DeInit(USART1);

    USART\_InitStructure.USART\_BaudRate = bound;

    USART\_InitStructure.USART\_WordLength = USART\_WordLength\_8b;

    USART\_InitStructure.USART\_StopBits = USART\_StopBits\_1;

    USART\_InitStructure.USART\_Parity = USART\_Parity\_No;

    USART\_InitStructure.USART\_HardwareFlowControl = USART\_HardwareFlowControl\_None;

    USART\_InitStructure.USART\_Mode = USART\_Mode\_Rx | USART\_Mode\_Tx;

    USART\_Init(USART1, &USART\_InitStructure);

    USART\_Cmd(USART1, ENABLE);

}

*// TIM2 初始化用于计时 (配置为10微秒每计数一次) - 保持不变*

void TIM2\_Base\_Init\_For\_Timing(void) {

    TIM\_TimeBaseInitTypeDef TIM\_TimeBaseStructure;

    unsigned short prescaler\_value;

    unsigned short period\_value;

    RCC\_APB1PeriphClockCmd(RCC\_APB1Periph\_TIM2, ENABLE);

    prescaler\_value = 719; *// (72MHz / (719+1)) = 0.1MHz -> 10µs tick*

    period\_value = 0xFFFF;

    TIM\_TimeBaseStructure.TIM\_Period = period\_value;

    TIM\_TimeBaseStructure.TIM\_Prescaler = prescaler\_value;

    TIM\_TimeBaseStructure.TIM\_ClockDivision = TIM\_CKD\_DIV1;

    TIM\_TimeBaseStructure.TIM\_CounterMode = TIM\_CounterMode\_Up;

    TIM\_TimeBaseInit(TIM2, &TIM\_TimeBaseStructure);

}

int main(void) {

    unsigned short timer\_raw\_count;

    unsigned long measured\_time\_us;

    char message\_output\_buffer[60];

    KEY0\_Init(); *// 初始化 KEY0 (PE4)*

    USART1\_Init\_For\_Experiment(115200); *// 初始化 USART1*

    TIM2\_Base\_Init\_For\_Timing(); *// 初始化 TIM2*

    USART\_SendString(USART1, (char\*)"Experiment 8: Program Run Time Measurement\r\n");

    USART\_SendString(USART1, (char\*)"Press KEY0 (PE4) to measure Delay\_ms\_Target(200) time.\r\n");

    while (1) {

*// 检测 KEY0 是否按下 (PE4 低电平表示按下)*

        if (GPIO\_ReadInputDataBit(GPIOE, GPIO\_Pin\_4) == Bit\_RESET) { *// 检查 PE4*

            Delay\_ms\_Target(25); *// 消抖*

            if (GPIO\_ReadInputDataBit(GPIOE, GPIO\_Pin\_4) == Bit\_RESET) { *// 再次检查 PE4*

                USART\_SendString(USART1, (char\*)"KEY0 pressed. Starting measurement...\r\n");

                TIM\_SetCounter(TIM2, 0);

                TIM\_Cmd(TIM2, ENABLE);

                Delay\_ms\_Target(200);

                TIM\_Cmd(TIM2, DISABLE);

                timer\_raw\_count = TIM\_GetCounter(TIM2);

                measured\_time\_us = (unsigned long)timer\_raw\_count \* 10;

                sprintf(message\_output\_buffer, "Delay\_ms\_Target(200) execution time: %lu us\r\n", measured\_time\_us);

                USART\_SendString(USART1, message\_output\_buffer);

                while (GPIO\_ReadInputDataBit(GPIOE, GPIO\_Pin\_4) == Bit\_RESET); *// 等待 PE4 释放*

                USART\_SendString(USART1, (char\*)"KEY0 released. Ready for next measurement.\r\n\r\n");

            }

        }

    }

}