《嵌入式系统原理与实践》作业

10213903403 岳锦鹏
10225001410 朱宇笑

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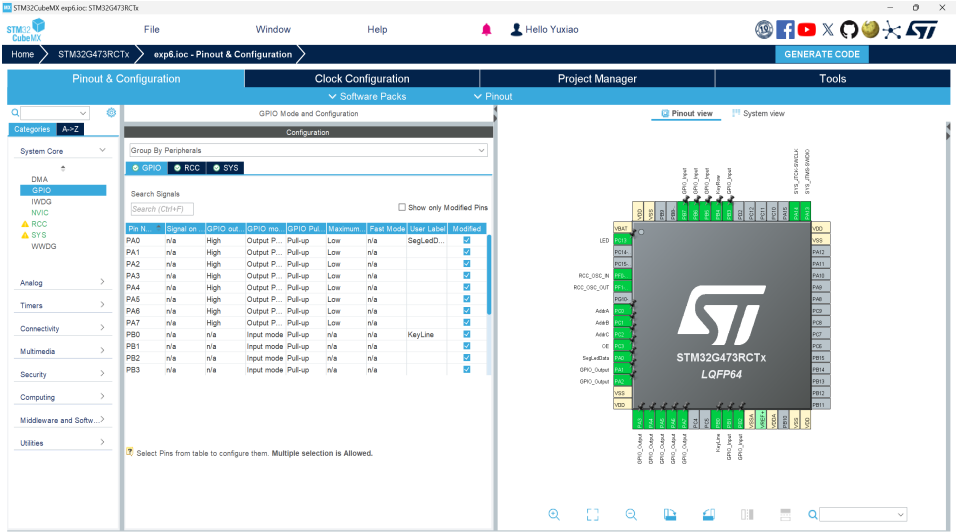
端口设置如图。


STM32CubeMX exp6.ioc: STM32G473RCTx
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exp6.ioc - Pinout & Configuration
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PB0 n/a n/a Input mode Pull-up n/a n/a KeyLine
PB1 n/a n/a Input mode Pull-up n/a n/a
PB2 n/a n/a Input mode Pull-up n/a n/a
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Select Pins from table to configure them. Multiple selection is Allowed.
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LQFP64

添加 tim.h:

```
20  /* Define to prevent recursive inclusion
    ↪  -------------------------------------*/
21  #ifndef __TIM_H__
22  #define __TIM_H__
23
24  #ifdef __cplusplus
25  extern "C" {
26  #endif
27
28  /* Includes
    ↪  ------------------------------------------------------*/
29  #include "main.h"
30
31  /* USER CODE BEGIN Includes */
32
33  /* USER CODE END Includes */
34
```

```
35  extern TIM_HandleTypeDef htim3;
36
37  /* USER CODE BEGIN Private defines */
38
39  /* USER CODE END Private defines */
40
41  void MX_TIM3_Init(void);
42
43  /* USER CODE BEGIN Prototypes */
44
45  /* USER CODE END Prototypes */
46
47  #ifdef __cplusplus
48  }
49  #endif
50
51  #endif /* __TIM_H__ */
```

添加 tim.c:

```
20  /* Includes ------------------------*/
21  #include "tim.h"
22
23  /* USER CODE BEGIN 0 */
24
25  /* USER CODE END 0 */
26
27  TIM_HandleTypeDef htim3;
28
29  /* TIM3 init function */
30  void MX_TIM3_Init(void)
31  {
32
33    /* USER CODE BEGIN TIM3_Init 0 */
34
35    /* USER CODE END TIM3_Init 0 */
36
37    TIM_ClockConfigTypeDef sClockSourceConfig = {0};
38    TIM_MasterConfigTypeDef sMasterConfig = {0};
39
40    /* USER CODE BEGIN TIM3_Init 1 */
41
42    /* USER CODE END TIM3_Init 1 */
43    htim3.Instance = TIM3;
44    htim3.Init.Prescaler = 170-1;
45    htim3.Init.CounterMode =
      ↪  TIM_COUNTERMODE_CENTERALIGNED1;
46    htim3.Init.Period = 999;
47    htim3.Init.ClockDivision = TIM_CLOCKDIVISION_DIV1;
48    htim3.Init.AutoReloadPreload =
      ↪  TIM_AUTORELOAD_PRELOAD_ENABLE;
```

添加 tim.c:

```
49    if (HAL_TIM_Base_Init(&htim3) != HAL_OK)
50    {
51      Error_Handler();
52    }
53    sClockSourceConfig.ClockSource =
      ↪  TIM_CLOCKSOURCE_INTERNAL;
54    if (HAL_TIM_ConfigClockSource(&htim3,
      ↪  &sClockSourceConfig) != HAL_OK)
55    {
56      Error_Handler();
57    }
58    sMasterConfig.MasterOutputTrigger = TIM_TRGO_RESET;
59    sMasterConfig.MasterSlaveMode =
      ↪  TIM_MASTERSLAVEMODE_DISABLE;
60    if (HAL_TIMEx_MasterConfigSynchronization(&htim3,
      ↪  &sMasterConfig) != HAL_OK)
61    {
62      Error_Handler();
63    }
64    /* USER CODE BEGIN TIM3_Init 2 */
65
66    /* USER CODE END TIM3_Init 2 */
67
68  }
```

添加 tim.c:

```
70  void HAL_TIM_Base_MspInit(TIM_HandleTypeDef*
    ↪  tim_baseHandle)
71  {
72
73    if(tim_baseHandle->Instance==TIM3)
74    {
75    /* USER CODE BEGIN TIM3_MspInit 0 */
76
77    /* USER CODE END TIM3_MspInit 0 */
78      /* TIM3 clock enable */
79      __HAL_RCC_TIM3_CLK_ENABLE();
80
81      /* TIM3 interrupt Init */
82      HAL_NVIC_SetPriority(TIM3_IRQn, 0, 0);
83      HAL_NVIC_EnableIRQ(TIM3_IRQn);
84    /* USER CODE BEGIN TIM3_MspInit 1 */
85
86    /* USER CODE END TIM3_MspInit 1 */
87    }
88  }
```

```
89
90  void HAL_TIM_Base_MspDeInit(TIM_HandleTypeDef*
    ↪  tim_baseHandle)
91  {
92
93    if(tim_baseHandle->Instance==TIM3)
94    {
95    /* USER CODE BEGIN TIM3_MspDeInit 0 */
96
97    /* USER CODE END TIM3_MspDeInit 0 */
98      /* Peripheral clock disable */
99      __HAL_RCC_TIM3_CLK_DISABLE();
100
101     /* TIM3 interrupt Deinit */
102     HAL_NVIC_DisableIRQ(TIM3_IRQn);
103   /* USER CODE BEGIN TIM3_MspDeInit 1 */
104
105   /* USER CODE END TIM3_MspDeInit 1 */
106   }
107 }
```

添加 SegLed.h:

```
20  #include <stdint.h>
21  #ifndef __SEGLED_H
22  #define __SEGLED_H
23
24  #ifdef __cplusplus
25  extern "C" {
26  #endif
27
28  #include <stdint.h>
29  #include "variable.h"
30
31  void Display(void);
32  void TimeToBuff(structTime *nstTime);
33  void DispToBuff(uint8_t val);
34
35
36  #ifdef __cplusplus
37  }
38  #endif
39
40  #endif /* __SEGLED_H */
```

添加 SegLed.c:

```c
#include "main.h"
#include "variable.h"

uint16_t display_tab[] = {
  0x3f,
  0x06,
  0x5b,
  0x4f,
  0x66,
  0x6d,
  0x7d,
  0x07,
  0x7f,
  0x6f,
  0x77,
  0x7c,
  0x39,
  0x5e,
  0x79,
  0x71,
  0x40
};
uint8_t DispBuff[8];
uint16_t PosSel = 0;
```

添加 SegLed.c:

```c
static void DisplayOneLed(uint8_t dat, uint8_t pos,
↪  uint8_t dot) {
  uint16_t temp;

  temp = display_tab[dat];
  if (dot)
    temp |= 0x80;

  SegLedData_GPIO_Port->ODR &= 0xFF00;
  SegLedData_GPIO_Port->ODR |= temp; // 段码
  AddrA_GPIO_Port->ODR &= 0xFFF0;
  AddrA_GPIO_Port->ODR |= pos; // 位码
}

void Display(void) {
  static uint8_t mPos = 0;
  DisplayOneLed(DispBuff[mPos], mPos, 0);
  if (++mPos >= 8) mPos = 0;
}
```

```c

void TimeToBuff(structTime *nstTime) {
  DispBuff[0] = nstTime->mHour / 10;
  DispBuff[1] = nstTime->mHour % 10;
  DispBuff[2] = 16;
  DispBuff[3] = nstTime->mMinute / 10;
  DispBuff[4] = nstTime->mMinute % 10;
  DispBuff[5] = 16;
  DispBuff[6] = nstTime->mSecond / 10;
  DispBuff[7] = nstTime->mSecond % 10;
}

void DispToBuff(uint8_t val) {
  uint8_t i;
  for (int i = 0; i < 7; i++) {
    DispBuff[i] = DispBuff[i + 1];
  }
  DispBuff[7] = val;
}
```

main.c:

```
25  /* USER CODE BEGIN Includes */
26  #include "variable.h"
27  #include "directkey.h"
28  #include "MatrixKey.h"
29  #include "SegLed.h"
30  /* USER CODE END Includes */


49  /* USER CODE BEGIN PV */
50  stSysTickTimer sSysTickTimer = {
51    0, 0, 0, 0
52  };
53  uint8_t tempValue;
```

```
54  structTime stTime = {
55    .mSecond = 50,
56    .mMinute = 45,
57    .mHour = 8,
58    .mTimeCount = 0,
59    .bSecondIsOk = 0,
60    .mTenMilCount = 0,
61    .bTenMilIsOk = 0
62  };
63  /* USER CODE END PV */
64
65  /* Private function prototypes -----------------*/
66  void SystemClock_Config(void);
```

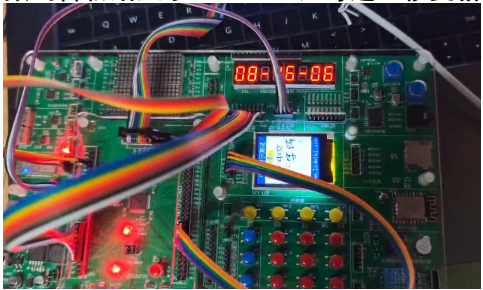
main.c:

```c
/**
  * @brief  The application entry point.
  * @retval int
  */
int main(void)
{

  /* USER CODE BEGIN 1 */
  uint8_t KeyValue = 0;
  /* USER CODE END 1 */

  /* MCU Configuration--------------------------*/

  /* Reset of all peripherals, Initializes the Flash interface and the Systick. */
  HAL_Init();

  /* USER CODE BEGIN Init */

  /* USER CODE END Init */

  /* Configure the system clock */
  SystemClock_Config();

  /* USER CODE BEGIN SysInit */

  /* USER CODE END SysInit */

  /* Initialize all configured peripherals */
  MX_GPIO_Init();
  MX_TIM3_Init();
  /* USER CODE BEGIN 2 */
  // FlashLeds_GPIO_Port->ODR &= 0xff01;
  HAL_TIM_Base_Start_IT(&htim3);
  TimeToBuff(&stTime);
  /* USER CODE END 2 */
```

main.c:

```
112     /* Infinite loop */
113     /* USER CODE BEGIN WHILE */
114     while (1)
115     {
116       /* USER CODE END WHILE */
117
118       /* USER CODE BEGIN 3 */
119       if (stTime.bTenMilIsOk) {
120         stTime.bTenMilIsOk = 0;
121       }
122       if (stTime.bSecondIsOk) {
123         stTime.bSecondIsOk = 0;
124         if (++stTime.mSecond >= 60) {
125           stTime.mSecond = 0;
126           if (++stTime.mMinute >= 60) {
127             stTime.mMinute = 0;
128             if (++stTime.mHour >= 24) {
129               stTime.mHour = 0;
130             }
131           }
132         }
133         TimeToBuff(&stTime);
134       }
135       if (sSysTickTimer.bTenMilSecOk) {
136         sSysTickTimer.bTenMilSecOk = 0;
137         KeyValue = MatrixKeyScan();
138         if (KeyValue != NO_KEY) {
139           for (int i = 0; i < 16; i++) {
140             if (KeyValue == KeyTable[i]) {
141               tempValue = i;
142             }
143           }
144           // DispToBuff(tempValue);
145         }
146       }
147       if (sSysTickTimer.bTimeOk) {
148         sSysTickTimer.bTimeOk = 0;
149         // TimeToBuff();
150         HAL_GPIO_TogglePin(LED_GPIO_Port, LED_Pin);
151       }
152     }
153     /* USER CODE END 3 */
154   }
```

数码管初始显示 08-45-50，每过一秒更新一次，逻辑与正常定时器相同。



完整视频可以查看：
https://gitea.librastalker.top/423A35C7/STM32CubeMX-Keil_uVision5