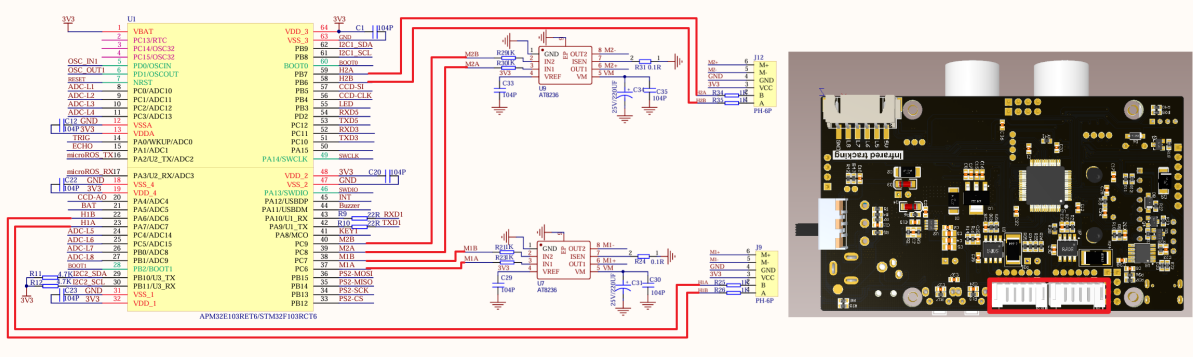
Advanced Timer (TIM)

Tutorial demonstrating advanced timer (TIM8) PWM driving motor.

```
The tutorial only introduces the standard library project code
```

Hardware connection



Since we have configured a special connection line, we only need to install it to the corresponding interface:

Peripherals	Development Board	Description
Motor 1: M+ (M1A)	PC6	The PC6 pin of the development board controls the input pin of the motor driver chip, and the output pin of the driver chip controls motor 1: M+
Motor 1: M- (M1B)	PC7	The PC7 pin of the development board controls the input pin of the motor driver chip, and the output pin of the driver chip controls motor 1: M-
Motor 1: Encoder VCC	3.3V	Connect the development board 3.3V to power the encoder
Motor 1: Encoder GND	GND	Connect the development board GND to the encoder common ground
Motor 1: Encoder A phase (H1A)	PA7	Encoder A of motor 1 is connected to pin PA7 of the development board
Motor 1: Encoder B phase (H1B)	PA6	Encoder B of motor 1 is connected to pin PA6 of the development board

Peripherals	Development Board	Description
Motor 2: M+ (M2A)	PC8	The PC8 pin of the development board controls the input pin of the motor driver chip, and the output pin of the driver chip controls motor 2: M+
Motor 2: M- (M2B)	PC9	The PC9 pin of the development board controls the input pin of the motor driver chip, and the output pin of the driver chip controls motor 2: M-
Motor 2: Encoder VCC	3.3V	Connect the development board 3.3V to power the encoder
Motor 2: Encoder GND	GND	Connect the development board GNDV to the encoder common ground
Motor 2: Encoder A phase (H2A)	PB7	Encoder A of motor 2 is connected to pin PB7 of the development board
Motor 2: Encoder B phase (H2B)	PB6	Encoder B of motor 2 is connected to pin PB6 of the development board

Control principle

Use the PWM output function of TIM8 of the advanced timer on the STM32F103RCT6 development board to change the duty cycle of the PWM signal to control the speed of the motor rotation.

- **PWM (Pulse Width Modulation)**

PWM is the abbreviation of pulse width modulation, which is a technology that controls the level by adjusting the pulse width of the signal.

Period: The duration of a complete PWM waveform;

Duty cycle: The ratio of the duration of the high level to the period time;

Frequency: The reciprocal of the period is called the frequency, that is, the number of PWM periods generated per second;

- **Advanced timer**

Timer type	Advanced timer
Timer name	TIM1, TIM8
Counter digits	16
Counting mode	Incremental/decremental/center alignment
Prescaler coefficient	1-65536
Generate DMA request	Yes
Capture/compare channel	4
Complementary output	Yes

Timer type	Advanced timer
Clock frequency	72MHz (maximum)
Mount bus	APB2

Pin definition

Main control chip	Pin	Main function (after reset)	Default multiplexing function	Redefine function
STM32F103RCT6	PC6	PC6	I2S2_MCK/TIM8_CH1/SDIO_D6	TIM3_CH1
STM32F103RCT6	PC7	PC7	I2S3_MCK/TIM8_CH2/SDIO_D7	TIM3_CH2
STM32F103RCT6	PC8	PC8	TIM8_CH3/SDIO_D0	TIM3_CH3
STM32F103RCT6	PC9	PC9	TIM8_CH4/SDIO/D1	TIM3_CH4

Software code

Since the default function of the pin is the normal IO pin function, we need to use the multiplexing function.

```
Product supporting materials source code path: Attachment → Source code summary → 1.Base_Course → 9.Advanced_Timer
```

Control function

The tutorial only briefly introduces the code, you can open the project source code to read the details.

> **MiniBalance_Motor_Init**

```
void MiniBalance_Motor_Init(void)
{
    GPIO_InitTypeDef GPIO_InitStructure;
    RCC_APB2PeriphClockCmd(RCC_APB2Periph_GPIOC, ENABLE); //Enable PC port clock
    GPIO_InitStructure.GPIO_Pin = GPIO_Pin_6|GPIO_Pin_7|GPIO_Pin_8|GPIO_Pin_9;
//Port configuration
    GPIO_InitStructure.GPIO_Mode = GPIO_Mode_AF_PP; //Push-pull output
    GPIO_InitStructure.GPIO_Speed = GPIO_Speed_50MHz; //50M
    GPIO_Init(GPIOC, &GPIO_InitStructure); //Initialize GPIOC according to the set parameters
}
```

> **MiniBalance_PWM_Init**

```
void MiniBalance_PWM_Init(u16 arr,u16 psc)
{
    TIM_TimeBaseInitTypeDef TIM_TimeBaseStructure;
    TIM_OCInitTypeDef TIM_OCInitStructure;
```

```
    RCC_APB2PeriphClockCmd(RCC_APB2Periph_TIM8, ENABLE);
    TIM_DeInit(TIM8);
    TIM_TimeBaseStructure.TIM_Period = arr - 1; //Set the value of the auto-
reload register period to load the activity at the next update event
    TIM_TimeBaseStructure.TIM_Prescaler = psc; //Set the prescaler value used as
the divisor of the TIMx clock frequency. No division
    TIM_TimeBaseStructure.TIM_ClockDivision = 0; //Set the clock division: TDTS =
Tck_tim
    TIM_TimeBaseStructure.TIM_CounterMode = TIM_CounterMode_Up; //TIM up counting
mode
    TIM_TimeBaseInit(TIM8, &TIM_TimeBaseStructure); //Initialize the time base
unit of TIMx according to the parameters specified in TIM_TimeBaseInitStruct

    TIM_OCInitStructure.TIM_OCMode = TIM_OCMode_PWM1; //Select timer mode: TIM
pulse width modulation mode 1
    TIM_OCInitStructure.TIM_OutputState = TIM_OutputState_Enable; //Comparison
output enable
    TIM_OCInitStructure.TIM_Pulse = 0; //Set the pulse value to be loaded into
the capture comparison register
    TIM_OCInitStructure.TIM_OCPolarity = TIM_OCPolarity_High; //Output polarity:
TIM output comparison polarity high

    TIM_OC1Init(TIM8, &TIM_OCInitStructure); //Initialize peripheral TIMx
according to the parameters specified in TIM_OCInitStruct
    TIM_OC2Init(TIM8, &TIM_OCInitStructure); //Initialize peripheral TIMx
according to the parameters specified in TIM_OCInitStruct
    TIM_OC3Init(TIM8, &TIM_OCInitStructure); //Initialize peripheral TIMx
according to the parameters specified in TIM_OCInitStruct
    TIM_OC4Init(TIM8, &TIM_OCInitStructure); //Initialize peripheral TIMx
according to the parameters specified in TIM_OCInitStruct

    TIM_CtrlPWMOutputs(TIM8,ENABLE); //MOE main output enable

    TIM_OC1PreloadConfig(TIM8, TIM_OCPreload_Enable); //CH1 preload enable
    TIM_OC2PreloadConfig(TIM8, TIM_OCPreload_Enable); //CH2 preload enable
    TIM_OC3PreloadConfig(TIM8, TIM_OCPreload_Enable); //CH3 preload enable
    TIM_OC4PreloadConfig(TIM8, TIM_OCPreload_Enable); //CH4 preload enable

    TIM_ARRPreloadConfig(TIM8, ENABLE); //Enable TIMx preload register on ARR

    /* TIM8 enable counter */
    TIM_Cmd(TIM8, ENABLE); //Enable timer 8
}
```

Set_Pwm

```
void Set_Pwm(int motor_left,int motor_right)
{
    if(motor_left == 0)// stop
    {
        L_PWMA = 0;
        L_PWMB = 0;
    }
    if(motor_right == 0)
    {
```

```
        R_PWMA = 0;
        R_PWMB = 0;
    }
    //left wheel
  if(motor_left>0)   // forward
    {
        L_PWMB = myabs(motor_left);
        L_PWMA = 0;
    }
    else // backward
    {
        L_PWMB = 0;
        L_PWMA = myabs(motor_left);
    }
    //right wheel
    if(motor_right>0) // forward
    {
        R_PWMA = myabs(motor_right);
        R_PWMB = 0;
    }
    else // backward
    {
        R_PWMA = 0;
        R_PWMB = myabs(motor_right);
    }
}
```

> **myabs**

```
int myabs(int a)
{
    int temp;
    if(a<0)  temp=-a;
    else temp=a;
    return temp;
}
```

Experimental phenomenon

The Advanced_Timer.hex file generated by the project compilation is located in the OBJ folder of the Advanced_Timer project. Find the Advanced_Timer.hex file corresponding to the project and use the FlyMcu software to download the program to the development board.

After the program is successfully downloaded: the two motors will continue to run according to the rule of moving forward for 2s, stopping for 1s, moving backward for 2s, and stopping for 1s.

```
When using the serial port debugging assistant, you need to pay attention to the
serial port settings. If the settings are wrong, the phenomenon may be
inconsistent
```