4. FreeRTOS applications

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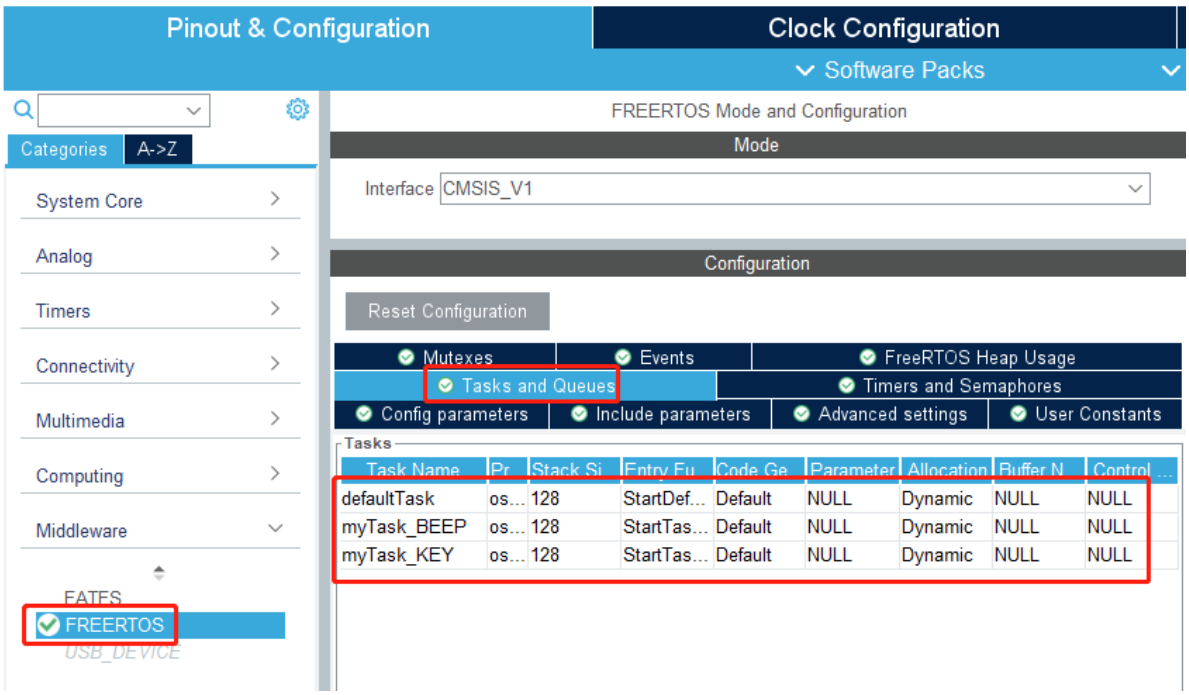
4.1 Purpose of the experiment

On the basis of the program "Key Control Buzzer Beeping", import the function to run on FreeRTOS system to realize detecting the status of KEY1 on the expansion board and controlling the buzzer beeping. Press the key, the buzzer beeps (once every 200 ms), and press the key again, the buzzer turns off.

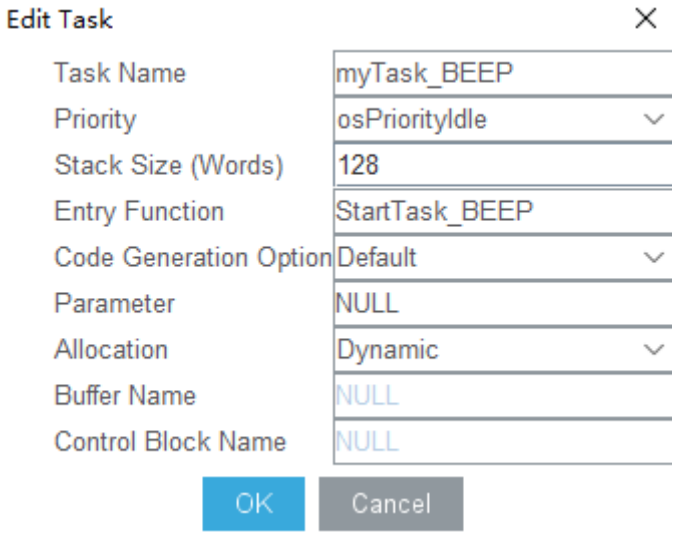
4.2 Configuring FreeRTOS Information

As we need to configure the information every time we create a new project, it is quite troublesome, good thing STM32CubeIDE provides the function of importing .ioc file, which can help us save time.

1. Import the .ioc file from the BEEP project and name it FreeRTOS.
2. Click Middleware->FREERTOS, select CMSIS_V1, click Tasks and Queues, there will be one task here by default, and then create two new tasks, one of them manages the buzzer, and the other one manages the keys.



3. The buzzer task information is shown below:



Task Name: the name of the task.

Priority: set the priority.

Stack Size: stack space, can be modified according to the actual size.

Entry Function: Entity of the task function.

Code Generation Option: code generation configuration, default is weak generation task entity, you can choose external not to generate task entity.

Parameter: task parameters.

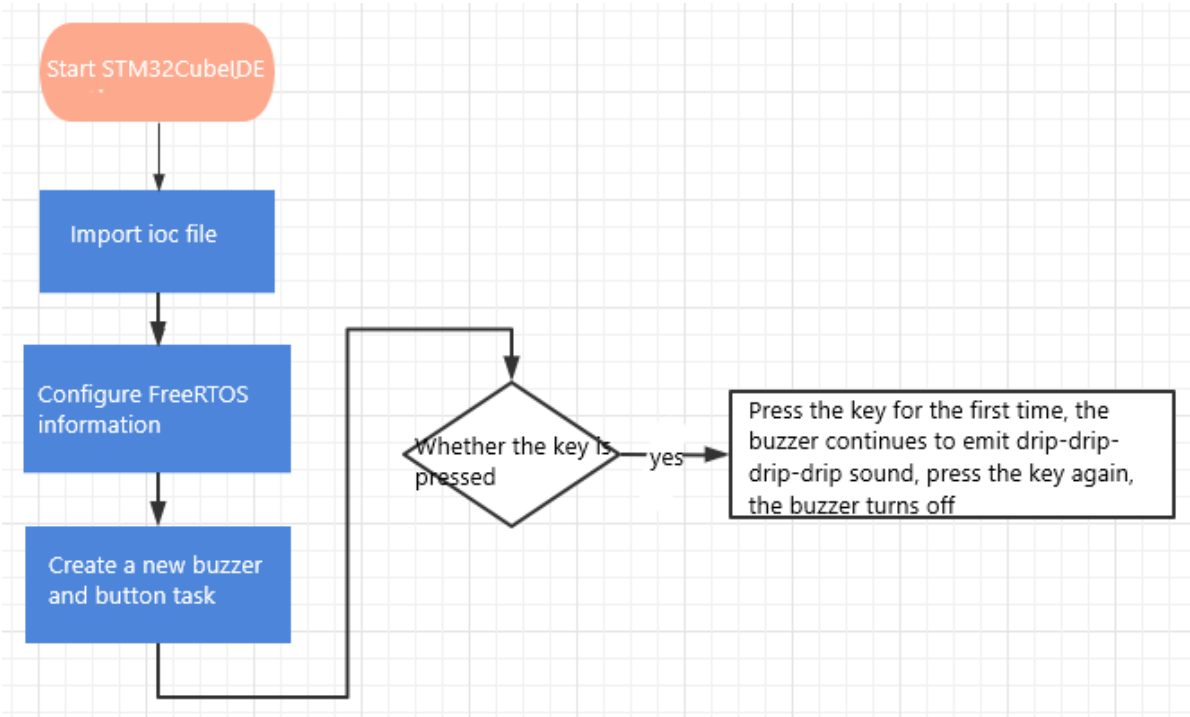
Allocation: you can choose Dynamic or Static allocation.

Buffer Name:Buff name of static allocation.

Control Block Name: the name of the statically assigned block.

Same for the key task, just different name.

4.3. Experimental flow chart analysis



4.4 Core Code Explanation

1. Create a new buzzer driver library bsp_task.h and bsp_task.c file in BSP. Add the following to bsp_task.h:

```
void Task_Entity_LED(void);
void Task_Entity_Beep(void);
void Task_Entity_Key(void);
```

The Task_Entity_LED() function manages the LEDs, Task_Entity_Beep() manages the buzzer, and Task_Entity_Key() manages the keys.

```
// LED light task entity function  LED灯任务实体函数
void Task_Entity_LED(void)
{
    while (1)
    {
        // The indicator lights up every 100 milliseconds  指示灯每隔100毫秒亮一次
        LED_TOGGLE();
        osDelay(100);
    }
}
```

```
// Buzzer task entity function  蜂鸣器任务实体函数
void Task_Entity_Beep(void)
{
    while (1)
    {
        if (enable_beep)
        {
            // The buzzer goes off every 200 milliseconds  蜂鸣器每200毫秒响一次
            BEEP_ON();
            osDelay(100);
            BEEP_OFF();
            osDelay(100);
        }
        else
        {
            BEEP_OFF();
            osDelay(100);
        }
    }
}
```

```
// Key task entity function  按键任务实体函数
void Task_Entity_Key(void)
{
    while (1)
    {
        if (Key1_State(1) == KEY_PRESS)
        {
            // Button controls the buzzer switch  按键控制蜂鸣器开关
            enable_beep = !enable_beep;
        }
        osDelay(10);
    }
}
```

2. In freertos.c file to introduce bsp.h, find the corresponding three tasks of the entity function, and respectively call our manually established task function.

```c
void StartDefaultTask(void const * argument)
{
  /* USER CODE BEGIN StartDefaultTask */
  /* Infinite loop */
  // for(;;)
  // {
  //   osDelay(1);
  // }
  Task_Entity_LED();
  /* USER CODE END StartDefaultTask */
}
```

```c
/* USER CODE END Header_StartTask_BEEP */
void StartTask_BEEP(void const * argument)
{
  /* USER CODE BEGIN StartTask_BEEP */
  /* Infinite loop */
  // for(;;)
  // {
  //   osDelay(1);
  // }
  Task_Entity_Beep();
  /* USER CODE END StartTask_BEEP */
}
```

```c
/* USER CODE END Header_StartTask_KEY */
void StartTask_KEY(void const * argument)
{
  /* USER CODE BEGIN StartTask_KEY */
  /* Infinite loop */
  // for(;;)
  // {
  //   osDelay(1);
  // }
  Task_Entity_Key();
  /* USER CODE END StartTask_KEY */
}
```

4.5. Hardware Connections

The LEDs, key KEY1 and buzzer in the FreeRTOS application are all on-board components and do not need to be connected manually.

4.6 Experimental Effect

After burning the program, the LED flashes every 200 ms, press the key and the buzzer ticks (every 200 ms), press the key again and the buzzer turns off.