SPI flash as a storage for USB MSC

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

代碼簡述	本範例代碼使用SPI flash作為USB隨身碟的儲存空間
BSP 版本	M480 Series BSP CMSIS V3.04.000
開發平台	NuMaker-PFM-M487 Ver 3.0

1 功能介紹

1.1 簡介

範例程式中，M480作為USB2.0隨身碟，其透過SPIM介面外接SPI Flash當作儲存空間，且帶有檔案系統(File system)，此功能可以實現替代SD卡當作儲存空間的替代方案，測試寫入速度約為每秒128位元組。

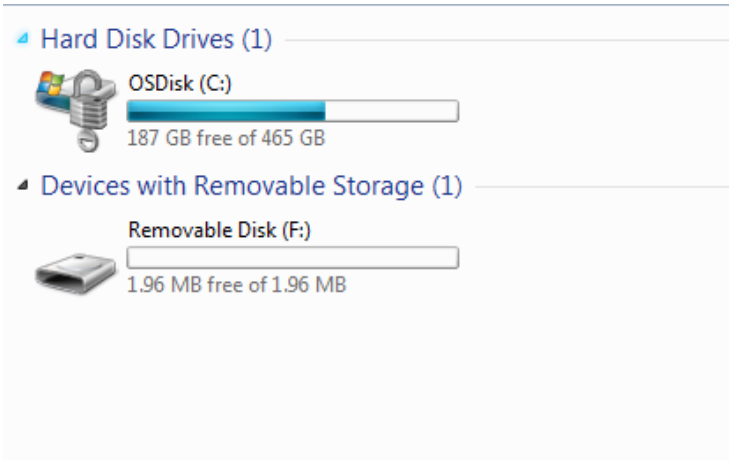
使用者須透過MSC_Init(SectorOffset, TotalSector)設定儲存記憶體起始位置，以及總共記憶體空間大小。一個Sector預設為512 KB。由於SPI Flash限制一次最少需要清除4KB，因此會先讀取4KB內容，並且刪除再重新寫入。USB處理程序在MSC_ProcessCmd()內，M480會根據所收到的指令進行相對應的處理動作。

1.2 執行結果

執行後會打印出以下資訊

```
+----------------------------------------------------------+
|             HSUSB Mass Storage Sample Code               |
|  use SPI flash as back end storage through SPIM interface |
+----------------------------------------------------------+
disk size is : 2048 KB
SPIM get JEDEC ID=0xEF, 0x40, 0x16
```

連接NuMaker-PFM-M487上的USB2.0插槽至電腦後，出現以下隨身碟圖示



2 代碼介紹

在main.c中首先進行初始化並讀取外接SPI flash ID，接著設定隨身碟儲存起始位置與儲存空間大小，最後等待連接電腦後在MSC_ProcessCmd()內執行USB處理程序：

```
int32_t main(void)
{
    /* Init System, IP clock and multi-function I/O
       In the end of SYS_Init() will issue SYS_LockReg()
       to lock protected register. If user want to write
       protected register, please issue SYS_UnlockReg()
       to unlock protected register if necessary */
    SYS_Init();

    /* Init UART to 115200-8n1 for print message */
    UART_Open(UART0, 115200);

    printf("+------------------------------------------------------------+\n");
    printf("|             HSUSB Mass Storage Sample Code                 |\n");
    printf("|  use SPI flash as back end storage through SPIM interface |\n");
    printf("+------------------------------------------------------------+\n");
    printf("disk size is : %d KB\n", (disk_size*512)/1024);

    SYS_UnlockReg();

    /* SPIM init */
    SPIM_Init();

    HSUSBD_Open(&gsHSInfo, MSC_ClassRequest, NULL);

    /* Massstorage init */
    MSC_Init(memory_offset, disk_size);

    /* Enable USBD interrupt */
    NVIC_EnableIRQ(USBD20_IRQn);

    /* Start transaction */
    while (1) {
        if (HSUSBD_IS_ATTACHED()) {
            HSUSBD_Start();
```

```
            break;
        }
    }
    /* Massstorage process */
    while (1) {
        if (g_hsusbd_Configured)
            MSC_ProcessCmd();
    }
}
```

讀寫SPI flash程式碼如下:

```
/* Read data through SPIM */
void MSC_ReadMedia(uint32_t addr, uint32_t size, uint8_t *buffer)
{
    SPIM_Read(addr + g_SectorsOffset, size, buffer);
}
/* Write data through SPIM */
void MSC_WriteMedia(uint32_t addr, uint32_t size, uint8_t *buffer)
{
    SPIM_Write(addr + g_SectorsOffset, size, buffer);
}
```

3 軟體與硬體環境

● 軟體環境

- ■ BSP 版本
  - ◆ M480 Series BSP CMSIS V3.04.000
- ■ IDE 版本
  - ◆ Keil uVersion 5.26

● 硬體環境

- ■ 電路元件
  - ◆ NuMaker-PFM-M487 or other M480 Development Board
- ■ 示意圖

透過 SPIM 介面外接 SPI flash，使用硬體的方式處理傳輸協議，來提升對於 SPI flash 的讀寫速度。使用 USB2.0 OTG 插槽連接電腦，即可在電腦端看到隨身碟。

SPIM_MOSI (PC.0)	↔	IO0
SPIM_MISO (PC.1)	↔	IO1
SPIM_CLK (PC.2)		CLK
SPIM_SS (PC.3)		/CS
SPIM_D2 (PC.5)		IO2
SPIM_D3 (PC.4)		IO3
M480		W25Q32

4 目錄資訊

- EC_M480_HSUSBD_MassStorage_SPIMFlash_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 如何執行範例程式

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 HSUSBD_MassStorage_SPIMFlash.uvproj
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
Oct. 01, 2019	1.00	1. 初始發布.

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