使用GPIO擷取CMOS感測器影像

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 M480 GPIO 擷取 CMOS sensor 影像資料
BSP 版本	M480 Series BSP CMSIS V3.03.000
開發平台	NuMaker-IoT-M487 v1.2

1 功能介紹

1.1 簡介

本範例代碼使用GPIO模擬影像傳輸介面(CCIR601, 8/4 bit)，並且從Himax CMOS感測器取得影像。其相關特性參數如下

產品	解析度	資料長度	幀數	傳輸介面
HM01B0	320x240	8 bit	30	CCIR601

使用者可以按下SW2按鍵(PF.11)即會存BMP圖檔至SD卡上。

1.2 執行結果

執行結果，打印出來資料如下

```
CPU @ 192000000Hz(PLL@ 192000000Hz)
+-----------------------------------------------------+
|         CMOS sensor Driver Sample Code              |
|         Use PG.8~PG.15 to latch Data from D0~D7     |
|         MCLK:PD12 Vsync:PE0, Hsync:PE1, PCLK:PD5    |
+-----------------------------------------------------+

I2C clock 100000 Hz
***** card insert !
HM01B0 Configured done.
```

2 代碼介紹

首先檢查 CMOS 感測器 ID 以及對感測器對初始化設定：

```
/* Read CMOS sensor ID */
CMOS_ID = HM01B0_ReadID();

/* Check CMOS sensor ID (default is Himax HM01B0) */
if (!(CMOS_ID == 0x1b0))
{
    printf("Device ID is not correct (0x%x), please reboot MCU.\n", CMOS_ID);
    while(1);
}
```

GPIO 接收 CCIR601 影像數據處理程序如下：

```
    if (GPIO_GET_INT_FLAG(PE, BIT0))
    {
        /* Wait Vsync high */
        GPIO_CLR_INT_FLAG(PE, BIT0 | BIT1);
        for (i = 0; i < IMAGE_HEIGHT; i++)
        {
            // Wait Hsync high
            while (!GPIO_GET_INT_FLAG(PE, BIT1));

            GPIO_CLR_INT_FLAG(PE, BIT1);
            GPIO_CLR_INT_FLAG(PD, BIT8);

            for (j = 0; j < IMAGE_WIDTH * PIXEL_BYTES; j++)
            {
                // Latch data when PCLK is high
                while (!GPIO_GET_INT_FLAG(PD, BIT8));

                GPIO_CLR_INT_FLAG(PD, BIT8);
                /* Collect data in 8 bit mode */
                image[i * IMAGE_WIDTH + j] = (PG->PIN >> 8);
            }
        }
        …
        GPIO_CLR_INT_FLAG(PE, BIT0);
    }
```

3 軟體與硬體環境

● 軟體環境

- ■ BSP 版本
  - ◆ M480 Series BSP CMSIS V3.03.000
- ■ IDE 版本
  - ◆ Keil uVersion 5.26

● 硬體環境

- ■ 電路元件
  - ◆ NuMaker-IoT-M487
  - ◆ CMOS sensor (HM01B0)
- ■ 示意圖

M480 使用 I^{2}C 來傳輸控制命令至 CMOS 感測器，使用 BPWM 作為 MCLK 供應頻率給 CMOS 感測器，CMOS 感測器會根據設定回傳 PCLK 以及 HSYNC、VSYNC 和 D0~D7 資料數據。

M480		CMOS Sensor
VCC	↔	VCC
I2C2_SDA (PD.0)	↔	SDA
I2C2_SCL (PD.1)	↔	SCL
BPWM0_CH(PD.12)	→	MCLK
PD.8	←	PCLK
PE.1	←	HSYNC
PE.0	←	VSYNC
PG.8~PG.15	←	D0~D7
GND	↔	GND

4 目錄資訊

- EC_M480_CMOS_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
  - ThirdParty
    - FatFs — A generic FAT file system module for small embedded systems. Its official website is: http://elm-chan.org/fsw/ff/00index_e.html.

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 M480_CMOS.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
Jun. 21, 2019	1.00	1. 初始發布.

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