使用GPIO撷取CMOS传感器影像

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

代码简述	本范例代码使用 M480 GPIO 撷取 CMOS sensor 影像数据
BSP 版本	M480 Series BSP CMSIS V3.03.000
开发平台	NuMaker-IoT-M487 v1.2

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1 功能介绍

1.1 简介

本范例代码使用GPIO仿真影像传输接口(CCIR601, 8/4 bit)，并且从Himax CMOS传感器取得影像。其相关特性参数如下

产品	分辨率	数据长度	帧数	传输接口
HM01B0	320x240	8 bit	30	CCIR601

用户可以按下SW2按键(PF.11)即会存BMP图档至SD卡上。

1.2 执行结果

执行结果，以及打印数据如下

```
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 代码介绍

首先检查 CMOS 传感器 ID 以及对传感器对初始化设定：

```
/* 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 影像数据处理程序如下：

```
    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 软件与硬件环境

- 软件环境
  - BSP 版本
    - M480 Series BSP CMSIS V3.03.000
  - IDE 版本
    - Keil uVersion 5.26
- 硬件环境
  - 电路组件
    - NuMaker-IoT-M487
    - CMOS sensor (HM01B0)
  - 示意图

M480 使用 I²C 来传输控制命令至 CMOS 传感器，使用 BPWM 作为 MCLK 供应频率给 CMOS 传感器，CMOS 传感器会根据设定回传 PCLK 以及 HSYNC、VSYNC 和 D0~D7 数据数据。

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 目录信息

- 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 如何执行范例程序

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 M480_CMOS.uvproj
2. 进入编译模式接口
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开除错模式
3. 进入除错模式接口
   a. 执行代码

6 修订纪录

Date	Revision	Description
Jun. 21, 2019	1.00	1. 初始发布.

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