ArduCAM-Mini
Multi-Camera Adapter Board User Guide
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1 Introduction

ArduCAM-Mini multi-camera adapter board is designed for using up to 4 ArduCAM-Mini camera boards on a single microcontroller including the Arduino, BeagleBone Black and Raspberry Pi platform. The adapter board can be well mated with these popular open source hardware platform but not limited to them, you can also connect this adapter board to any platform you are familiar with as long as they have a free I2C and SPI interface.

Figure 1 ArduCAM Mini Adapter Board

2 Application

- IoT cameras
- Robot cameras
- Panorama cameras
- Can be used in MCU, Raspberry Pi, ARM, DSP, FPGA platforms

3 Features

- Accommodate up to 4 ArduCAM mini boards
- Onboard SD/TF card storage (only available for Arduino)
- Additional power supply input
- Well mate with Arduino, Raspberry Pi and BeagleBone Black boards
4 Pin Definition

Table 1 lists the pins used for Arduino, Raspberry Pi and BeagleBone Black boards. Please note that the SD_CS signal is only available for Arduino, because the Raspberry Pi and BeagleBone Black have their own SD card.

<table>
<thead>
<tr>
<th>PIN NAME</th>
<th>TYPE</th>
<th>Arduino</th>
<th>Raspberry Pi</th>
<th>BeagleBone Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger</td>
<td>Input</td>
<td>D2</td>
<td>GPIO8</td>
<td>GPIO3_21 (P9 Pin25)</td>
</tr>
<tr>
<td>CS1</td>
<td>Input</td>
<td>D4</td>
<td>GPIO17</td>
<td>GPIO1_28 (P9 Pin12)</td>
</tr>
<tr>
<td>CS2</td>
<td>Input</td>
<td>D5</td>
<td>GPIO23</td>
<td>GPIO1_16 (P9 Pin15)</td>
</tr>
<tr>
<td>CS3</td>
<td>Input</td>
<td>D6</td>
<td>GPIO22</td>
<td>GPIO3_19 (P9 Pin27)</td>
</tr>
<tr>
<td>CS4</td>
<td>Input</td>
<td>D7</td>
<td>GPIO24</td>
<td>GPIO1_17 (P9 Pin23)</td>
</tr>
<tr>
<td>MOSI</td>
<td>Input</td>
<td>MOSI</td>
<td>GPIO10/MOSI</td>
<td>SPI0_D1 (P9 Pin18)</td>
</tr>
<tr>
<td>MISO</td>
<td>Output</td>
<td>MISO</td>
<td>GPIO9/MISO</td>
<td>SPI0_D (P9 Pin21)</td>
</tr>
<tr>
<td>SCLK</td>
<td>Input</td>
<td>SCLK</td>
<td>GPIO11/SCLK</td>
<td>SPI0_SCLK (P9 Pin22)</td>
</tr>
<tr>
<td>GND</td>
<td>Ground</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>VCC</td>
<td>POWER</td>
<td>+5V</td>
<td>+5V</td>
<td>VDD_5V</td>
</tr>
<tr>
<td>SDA</td>
<td>Bi-directional</td>
<td>SDA</td>
<td>GPIO2/SDA</td>
<td>I2C2_SDA (P9 Pin19)</td>
</tr>
<tr>
<td>SCL</td>
<td>Input</td>
<td>SCL</td>
<td>GPIO3/SCL</td>
<td>I2C2_SCL (P9 Pin20)</td>
</tr>
<tr>
<td>SD_CS</td>
<td>Input</td>
<td>D9</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

5 Work with Adapter Board

The ArduCAM-Mini power supply is selected via a jumper in the center of the adapter board. It can work with both 3.3V and 5V supply, it is default set to 5V. An alternative mini USB connector is just a AUX power supply, it should be used when lack of current condition. The LED on the adapter board is the indicator for the SD card write (only applicable for Arduino). There are ready to use source code which can be found from github.org/arducam.

5.1 Arduino

User ArduCAM-Mini adapter board on Arduino is straight forward, just plugging the adapter board on top of the Arduino board, inserting the SD/TF card into the card slot, and plugging the ArduCAM-Mini board on to the adapter board. Then uploading example sketch ArduCAM_Mini_2MP_4Cams_TimeElapse2SD_LowPower or ArduCAM_Mini_5MP_4Cams_TimeElapse2SD_LowPower depending on which ArduCAM-Mini model you are using, it will detect how many cameras are in position and start capture on a defined intervals.

5.2 BeagleBone Black

It is more complicated to use ArduCAM-Mini on BeableBone Black board, we should do some setup before we can take a photo.

Log in the BBB board with any SSH tools you are familiar with, here I use SmarTTY for example. The user name is debian, password is temppwd. The IP address is assigned by your DHCP, you have to check your own IP address.
Click the SCP->Upload a directory to upload the source code downloaded from github.

Enter the directory you just uploaded to the BBB board, here use BBBCAM for example, then use make command to compile the code.

Make sure there is no compilation error like this.

It will generate related examples like this.

We use SPI0 hardware pins on BBB board, which is not enabled by default, so we have to enable the SPI0 from the device tree by running the command like this.

```
sudo bash -c "echo ADAFRUIT-SPI0 > /sys/devices/bone_capemgr.*/slots"
```
If you don’t want to run the command each time, you can add it to `rc.local` before the line `exit 0`, then save the file.

```
sudo nano /etc/rc.local
```

Now you can run the demos.

```
sudo ./OV2640_DigitalCamera
```

### 5.3 Raspberry Pi

Same tools as BBB board, we use SmarTTY to log in the Raspberry Pi with user name: `pi`, password: `raspberry`. The IP address is assigned by your DHCP, you have to check your own IP address.

Edit the `raspi-blacklist.conf` file to enable the SPI and I2C hardware on the Raspberry Pi with command

```
sudo nano /etc/modprobe.d/raspi-blacklist.conf
```

Add `#` before the blacklist `spi-bcm2708` and blacklist `i2c-bcm2708`, then save.

Open file `/etc/modules` to add three lines, like follows,
sudo nano /etc/modules

then reboot the Pi.

    sudo reboot

After reboot use `lsmod` command to check if the driver is properly loaded.

Before install the `wiringPi` and ArduCAM, please install the `git` first.

    sudo apt-get install git-core

If there is error message, please try to update the Raspbian, using command below:

    sudo apt-get update
    sudo apt-get upgrade

Fetching the `wiringPi` by `git` command

    git clone git://git.drogon.net/wiringPi

If need up to date `wiringPi`, run the following commands:

    cd wiringPi
    git pull origin

Next enter the `wiringPi` directory to compile and install the package as follows:

    cd wiringPi
    ./build
Using the following command to check if the wiringPi is properly installed.

```bash
gpio -v
gpio readall
```

Download the ArduCAM library with github.

```bash
git clone https://github.com/ArduCAM/RaspberryPi.git
```

Compile the ArduCAM library

```bash
cd RaspberryPi/ArduCAM4Pi
make
```

Compile the code using `make`
If report "undefined reference to `i2c_smbus_write_word_data' error message, you have to reinstall the i2c-tools, libi2c-dev, python-smbus packages, then recompile. It will generate all the demo program marked as red square box.

```
sudo apt-get install i2c-tools libi2c-dev python-smbus
```

Run the demo.

```
sudo ./OV2640_DigitalCamera
```