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1. Introduction

In many application scenarios, it is necessary to update the program to upgrade the functions or fix the known problems. A lot of communication protocols can be used for IAP (in application programming). USB can be used as device and host, and both can be used for IAP. The USB host IAP can be realized without the assistance of the upper computer and only with a mobile storage device (such as USB flash disk). The other communication protocols do not have this advantage.
2. Description of USB Host IAP

2.1. File introduction

In addition to the files contained in the library, the USB host IAP routine contains the following files:

<table>
<thead>
<tr>
<th>File Name</th>
<th>Function description</th>
</tr>
</thead>
<tbody>
<tr>
<td>main.c</td>
<td>Including initialization of USB host, execution of host state machine, and judgment of whether to enter IAP mode</td>
</tr>
<tr>
<td>usbh_usr.c</td>
<td>Including user callback interface and LCD display data</td>
</tr>
<tr>
<td>gd32f4xx_it.c</td>
<td>Include interrupt service routine</td>
</tr>
<tr>
<td>command.c</td>
<td>Including commands implemented by IAP (download, upload, jump)</td>
</tr>
<tr>
<td>flash_layer.c</td>
<td>Flash operate</td>
</tr>
</tbody>
</table>

2.2. Instruction for use

Using GD USB host IAP routine, after compilation, you can download it to the corresponding development board through JLINK or GDlink, or generate a bin file and download it through ISP.

After downloading to the development board, you can see the corresponding information on the LCD screen and operate according to the prompts on the LCD. In addition, a USB flash disk is needed to copy the bin file.

After the chip is powered on, the IAP code is executed by default. If the APP code has been successfully downloaded, you can enter the APP by pressing the User key when powered on. After entering the IAP code, you can also jump to the APP through the jump command.

The execution process of IAP program is shown in the following figure:

**Figure 2-1 IAP execution process**
Begin
Press the user key?
Yes
No
Enter IAP Mode
USB Host State machine
Display IAP operation list on LCD
Use the keys to select commands
Upload internal flash content
Yes
No
Jump to app base address to execute app
Upload success
Yes
No
Is it a bin file?
Yes
No
Use the key to select bin file
LCD display error message
Flash programming
Enter IAP mode
Upload internal flash content
DownLoad
UpLoad
Jump
Execute app
END
3. **User define**

User can define the starting address of the APP. The specific configuration options are as follows:

1. In the IAP program, set the page size, flash size, IAP space size and the starting address of APP program.

```c
#define PAGE_SIZE ((uint16_t)0x800) /* 2K Bytes */
#define FLASH_SIZE ((uint32_t)0x300000) /* 3M Bytes */
#define IAP_SIZE ((uint32_t)0x20000) /* 128K Bytes */
#define APPLICATIONADDRESS ((uint32_t)0x08020000) /* User start code space */
```

2. Set flash start address and interrupt vector offset address in APP program:

Add the interrupt vector offset at the beginning of the main function as follows:

```c
nvic_vector_table_set(NVIC_VECTTAB_FLASH, 0x20000);
```

In keil's configuration options, set the flash start address of APP to 0x0802000:

**Figure 3-1 Start address of APP**

3. The allocation of the whole chip is shown in the figure below:

**Figure 3-2 The allocation of the whole chip**
IAP routine based on USB host

Flash Memory

APP Code

APP Vector Table

USB Host IAP Code

IAP Vector Table
4. **USB IAP operation options**

After the chip is powered on, if the user key is not pressed, the IAP program will be run by default. At this time, connect the USB flash disk containing bin file to the USB port to perform IAP related operations. IAP recognizes the USB flash disk see figure 4-1 *IAP recognizes the USB flash disk*, the specific operation options of IAP are shown in the figure 4-2 *IAP options*.

*Figure 4-1 IAP recognizes the USB flash disk*

*Figure 4-2 IAP options*
4.1. Download

Download a BIN file to the specified flash address. The process is as follows:

Figure 4-3 IAP download process
4.2. **Upload**

Upload the contents of the specified flash to the bin file on the USB flash disk. The specific process is as follows:

*Figure 4-4 IAP down*
4.3. **Jump**

When the APP is updated, the user can execute the jump command to jump to the APP code area for execution. The jump process is as follows:

**Figure 4-5 IAP jump process**
5. Revision history

Table 5-1 Revision history

<table>
<thead>
<tr>
<th>Revision No.</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Initial Release</td>
<td>Sep.06, 2021</td>
</tr>
</tbody>
</table>
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