In order to facilitate user to quickly update firmware, RAK410 has a built-in boot program 'bootloader' to upgrade firmware by serial ports. The boot program data can be uploaded via XModem-CRC protocol, which can be supported by common terminal programs.

RAK410 comprises MCU chip and WIFI chip, each of which has a FLASH. The upgrade consists of two parts: the MCU firmware (MCU FW) and WIFI firmware (WIFI FW).

Here are the steps to upgrade firmware by bootloader:

I. Hardware connection instructions:

1. UART0: Pin 31(TX), Pin 32(RX);

2. UART1: Pin 22(TX), Pin 23(RX);

Note: the connection of the two pins is used to select a serial port for upgrade, and it is available only when the two pins are connected and then a serial port is selected. User should check if the serial port is connected when selecting the serial port.

II. Preparation:

2.1 HyperTerminal Setting:

Note: The following examples are for Windows XP system which comes with a serial port terminal. For Windows 7 system user can download serial port terminal and Install.

Start -> All Programs -> Accessories -> Communications -> HyperTerminal, open the HyperTerminal, the whole process is shown in Figure 1:



Figure 1: Open HyperTerminal

1. As the pop-up window shows in Figure 2, enter the name of HyperTerminal,

👒 New Connection - HyperTerminal		
Eile Edit View Call Transfer Help		
□☞⊚꺏∣▫ъ≌∣⊠		
-	Connection Description Image: New Connection: Enter a name and choose an icon for the connection: Name: Image: Imag	
Disconnected Auto detect Aut	o detect SCROLL CAPS NUM Capture Print echo	1.

such as WIFI, then click 'OK' as shown in Figure 3:

Figure 2

New Connection - HyperTerminal Ele Edit View Call Transfer Help Ele Edit View Call Transfer Help		
	Connection Description Image: New Connection: Image: New Connection: WiFi con: Image: New Connection: OK	
Disconnected Auto detect	Auto detect SCROLL CAPS NUM Capture Print echo	1.

Figure 3

🌯 WIFI - HyperTerminal		
File Edit View Call Iransfer Help		
	Connect To Settings	
	WIFI Change [con]	
	Enter details for the phone number that you want to dial:	
	Lountry/region: 中华人民共和国 (86)	
	Arga code: 010	
	Phone number:	
	Connect using: COM23	
	Configure	
Disconnected Auto detect Aut	to detect SCROLL CAPS NUM Capture Print echo] 💌

Figure 4

 Modify the parameters in the pop-up window as shown in Figure 5. By default, RAK410 supports baud rate with 115200, 8 bits, no parity check, 1 stop bit, no data flow control, and click 'Apply' -> 'OK'

🛃 Uart Setting	
PortName	<u>COM23</u> -
BaudRate	115200 👻
DataBits	8 🗸
StopBits	One 🗸
Parity	None 🗸
Open	Cancel

Figure 5

As the pop-up window shows in Figure 6, click 'Properties', select 'Settings' ->
 'ASCII Code Settings', and set the relevant parameters as shown in Figure 7,
 click 'OK', then properties are set.

冬 WIFI - HyperTerminal		
<u>File E</u> dit <u>V</u> iew <u>C</u> all <u>T</u> ransf	er <u>H</u> elp	
New Connection	r de la companya de la compa	
Open		
Save As		
Page Setup		
Print		
Properties		
Exit Alt+E4		
	J. Contraction of the second sec	
		
Displays the properties of the cu	rrent session	

Figure 6

🌯 WIFI - HyperTerminal		
<u>File Edit View Call Iransfer Help</u>		
D 🖆 📨 🌋 🗈 🎦 😭		
	WIFI E性 2 送 Connect To Settings 2 × ASCII Sending 2 × ASCII Sending 2 × End line ends with line feeds 1 ≤ Echo typed characters locally Line delay: 0 milliseconds. Gharacter delay: 0 milliseconds. Fee ASCII Receiving Append line feeds to incoming line ends Eorce incoming data to 7bit ASCII Wap lines that exceed terminal width OK Cancel	
Connected 0:00:06 Auto detect Aut	to detect SCROLL CAPS NUM Capture Print echo	

Figure 7

Starting Module RAK410:

Connect RAK410 with PC via Serial Interface and module power supply via USB Interface. The module directly executes user code after powered on, and enters into normal operation, displaying a string of 'WELCOME TO RAK410'.

2.2 Swith to bootloader

There are two ways to enter bootloader mode.

(1) The hardware enters into 'bootloader' mode, when pin 28 is pulled up. The operation afterwards is same as that of enter via command;

(2) In AT command mode, input "at+boot_mode" in a terminal and enter into 'bootloader' mode, then enable upgrade, the operation is as follows:

CMD:at+boot_mode=0

```
Welcome to RAK410
at+ascii=1
OK
at+boot_mode=0
O
Please chioce update interface(1/2)!
*1.UART0*
*2.UART1*
-
```

After RAK410 has entered into 'bootloader' mode, the terminal prompts you to select UART0 or UART1 serial port for upgrading. Input '1 ' for UART0 and input '2' for UART1, as shown in Figure 1.1.

```
Welcome to RAK410
at+ascii=1
OK
at+boot_mode=0
O
Please chioce update interface(1/2)!
*1.UART0*
*2.UART1*
-
```



After user has entered '1 'or '2', it prompts that if user is positive to do upgrade, as shown in Figure 1.2:

Welcome to RAK410 at+ascii=1 OK at+boot_mode=0 O Please chioce update interface(1/2)! *1.UART0* *2.UART1* 1 Upgrade firmware(y/n)?_ Figure 1.2 Enter into UART0 Mode



Figure 1.3 Enter into UART1 Mode

Note: when selecting UART0 or UART1 serial port, ensure that the pins in the hardware are connected.

2.3 Bootloader Commands Introduction

Enter 'y' to upgrade firmware, then the terminal displays the commands of the bootloader as shown in Figure 2.1:



Figure 2.1

f: upgrade WIFI FW. This command is used to update WIFI firmware

u: upgrade MCU FW. This command is used to upload a user program to flash, start address: 0x1000

 $\ensuremath{\textbf{b}}$: start user program. This command starts a user program in bootloader mode.

d: delete the saved configuration parameters.

r: resets RAK410.

III. Upgrading WIFI Firmware

The steps are as follows:

After the terminal has entered into 'bootloader' mode, upgrade WIFI FW via command 'f', then the bootloader enters into the data-receiving state, as shown in

Figure 3.1:





Click 'Send' -> select 'Send File', then select the WIFI upgrade process in the pop-up dialog box, click 'Browse' as shown in Figure 3.2:

WIFI - HyperTerminal	Select File to Send	
File Edit View Call Transfer Help	C→ → RAK410A_B V2.0.1	✓ 4 Search RAK410A_B V2.0.1
		8
Send File		8== ¥ 🛄 🔮
Folder: C) Lleam Vramv	🛠 Favorites 💦 Name	Date modified Type
Filename:	Desktop MCU_FW.bin	12/28/2012 12:02 BIN File
Browse	Desktop	1/16/2013 2:49 PM BIN File
Protocol:	Downloads WLAN_FW_02.bin	1/16/2013 2:49 PM BIN File
Xmodem	Recent Places	
Send Close Cancel Please chioce update interface(1. *1.UART0* *2.UART1* 1 Upgrade firmware(y/n)?y *Command:* *u : Upgrade MCU FW * f : Upgrade MCU FW * f : Upgrade MIFI FW *	Elbraries Documents Music Pictures Videos File name: WLAN_FW_01.bin	III → All Files (*.*) → Open → Cancel
d : Delete saved data *r : Reset RAK410 * f Ready CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	

Figure 3.2

Select the 'Xmodem' transfer protocol as shown in Figure 3.3, and then click 'Send' to start transmission as shown in Figure 3.4:

Send File			? <u>×</u>
Folder: C:\Documents and Filename: C:\Documents and Setting Protocol: Xmodem	l Settings\Ad gs\Administra	ministrator tor\.appletv	<u>B</u> rowse
<u>s</u>	end	<u>C</u> lose	Cancel

Figure 3.3

NIFI - HyperTerminal	0		T T (1)		
File Edit View Call Transfer	Help				
🛛 🗅 🍘 🌋 🖾 🔐 😭					
Upgrade firmware(y/ *Command:* *u : Upgrade MCU F *f : Upgrade MIFI *b : Boot APP *d : Delete saved *r : Reset RAK41 f Ready CCCCCHCCCCCCCCCCC Please chioce upda *1.UART0* *2.UART1* 1	n)?y Xmodem file se Sending: C? Packet: 92 Retries: 0 Last error: File:	nd for WIFI Users\keny\Desktop\RAK410A_B Error checking: [CRC Total retries:]0	V2.0.1\WLAN_FW_01.bi	in	
Command: *u : Upgrade MCU FI *f : Upgrade WIFI *b : Boot APP *d : Delete saved *r : Reset RAK410	Eapsed: 00 uctor *	:00:02 Remaining:	Throughput:	cps/bps	
CCCCC	t 115200 8-	N-1 SCROLL CAPS	NUM Capture	Print echo	E

Figure 3.4

When the transfer is completed, RAK410 automatically runs WIFI_FW_01, in which state the terminal is constantly outputting 'C', waiting for serial port to transmit WIFI firmware. Then continue to click the 'Send' -> select 'Send File', select a path for WIFI firmware in the pop-up dialog box, click 'Browse' to select RAK410 WIFI firmware WIFI_FW_02.bin as shown in Figure 3.5:

🍓 WIFI - HyperTerminal	Select File to Send	X
File Edit View Call Transfer Help	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○	 ✓ ✓ Search RAK410A_B V2.0.1
	Organize 🔻 New folder	i≡ - □ 0
	★ Favorites	Date modified Type
Folder: C:\Users \keny\Desktop\RAK41UA_B V2.0.1 Filename:	Desktop MCU_FW.bin	12/28/2012 12:02 BIN File
Browse	Desktop WLAN_FW_01.bin Downloads = WLAN FW 02.bin	1/16/2013 2:49 PM BIN File 1/16/2013 2:49 PM BIN File
Protocol: Xmodem	Recent Places	
Send Close Cancel Please chioce update interface(1/2 *1.UART0* *2.UART1* 2 Upgrade firmware(y/n)?y *Command:* *u Upgrade MCU FW	↓ Libraries ☑ Documents ☑ Music ☑ Pictures ☑ Videos ✓ File name: WLAN_FW_02.bin	·· All Files (*.*) ▼
*f : Upgrade WIFI FW * *b : Boot APP * *d : Delete saved data* *r : Reset RAK410 * f		
Ready CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	

Figure 3.5

Select the 'Xmodem' transfer protocol as shown in Figure 3.6, then click 'Send' to start transmission as shown in Figure 3.7:

Send File	? <mark>X</mark>
Folder: C:\Users\keny\Desktop\RAK410A_B V2.0.1 Filename: C:\Users\keny\Desktop\RAK410A_B V2.0.1\WL	Browse
Protocol: Xmodem	
1K Xmodem Kermit	
Ymodem Ymodem-G Zmodem	
Zmodem with Crash Recovery	

Figure 3.6

WIFI - HyperTerminal File Edit View Call Transfer I □ 😂 😂 🗟 □ 😂 □ <th>leip</th>	leip
Upgrade firmware(y/ *Command:* *u : Upgrade MCU Ff	n)?y Xmodem file send for WIFI
*f : Upgrade wifi *b : Boot APP *d : Delete saved	Sending: C:\Users\keny\Desktop\RAK410A_B V2.0.1\WLAN_FW_02.bin
r : Reset RAK410 f	Packet: 331 Error checking: CRC
Ready CCCCCHCCCCCCCCCCCC	Retries: 0 Total retries: 0
Please chioce upda *1 HARTA*	Last error:
2.UART1	File: 39K of 165K
Úpgrade firmware(y. *Command:*	Elapsed: 00:00:10 Remaining: 00:00:32 Throughput: 3980 cps
*u : Upgrade MCU F *f : Upgrade WIFI *b : Boot APP *d : Delete saved	Cancel cps/bps
∗r : Reset RAK410 f	*
Ready CCCCCHCCCCCCCCCCCCC	
Connected 0:38:25 Auto detec	t 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

Figure 3.7

When the upgrade is completed, it prompts 'PIs upgrade MCU APP' as shown in Figure 3.8. If the upgrade is failed, it prompts 'program failed' as shown in Figure 3.9:

Please chioce update interface(1/2)! *1.UART0* *2.UART1* 1 Upgrade firmware(y/n)?y *Command:* *u : Upgrade MCU FW * *f : Upgrade WIFI FW * *f : Upgrade WIFI FW * *b : Boot APP * *d : Delete saved data* *r : Reset RAK410 * f Ready	
Waiting process 1256 Programming Successful Programming Successful Pls upgrade MCU APPPlease chioce update interface(1/2)!	
1.UART0 *2.UART1* -	

Figure 3.8



Figure 3.9

The above shows the steps for upgrading WIFI FW, the MCU FW has been changed when upgrading WIFI FW. Therefore, it is required to re-upgrade MCU firmware after WIFI has been upgraded. Please refer to Section IV for specific operation.

IV. Upgrading MCU Firmware

In 'bootloader' mode, enter the command 'u' to upload MCU firmware on the terminal, then the bootloader enters into the data-receiving state as shown in Figure 4.1:



Figure 4.1

Click 'Send' -> select 'Send File', and in the pop-up dialog box, select a path for the bin file 'MCU_FW.bin' which is ready to be written into flash, then click 'Browse' as shown in Figure 4.2:

🗞 WIFI - HyperTerminal	Select File to Send	
File Edit View Call Transfer Help	○ ○ □ ► RAK410A_B V2.0.1	✓ 4 Search RAK410A_B V2.0.1
	Organize 🔻 New folder	
Send File	Favoriter Name	Date modified Type
Folder: C:\Users\keny\Desktop\RAK410A_B V2.0.1	Desktop	12/28/2012 12:02 BIN File
Filename: Browse	Desktop WLAN_FW_01.bin	1/16/2013 2:49 PM BIN File
Protocol:	Downloads Downloads Downloads Depto Stream	1/16/2013 2:49 PM BIN File
Xmodem	Recent Places	
Send Close Cancel Please chioce update interface(1 *1.UART0* *2.UART1* 1 Upgrade firmware(y/n)?y *Command:* *u : Upgrade MCU FW *f : Upgrade WIFI FW *f : Upgrade WIFI FW *	Libraries Documents Music Pictures Videos File name: MCU_FW.bin	✓ All Files (*,*) Open ▼ Cancel
d : Delete saved data *r : Reset RAK410 * u Ready CCCCCCCCCCCCCCCCC_		III .
Connected 0:30:17 Auto detect 115200 8-N-1	CROLL CAPS NUM Capture Print echo	14

Figure 4.2

Select the 'Xmodem' transfer protocol as shown in Figure 4.3, and then click 'Send' to start transmission shown in Figure 4.4:

Send File	? <mark>X</mark>
Folder: C:\Users\keny\Desktop\RAK410A_B V2.0.1 Filename: C:\Users\keny\Desktop\RAK410A_B V2.0.1\WL	Browse
Protocol: Xmodem	•
1K Xmodem Kermit	
Ymodem Ymodem-G Zmodem	-
Zmodem with Crash Recovery	

Figure 4.3

🗞 WIFI - HyperTerminal 📼 🖾 🔀	
Image: Solution of the second of the seco	*
t Ready CCCCCHCCCCCCCCCCCC Sending: C:\Users\keny\Desktop\RAK410A_B V2.0.1\MCU_FW bin Value Packet: 224 Error checking: CRC 1320 Programming Success Packet: 224 Error checking: CRC Programming Success Pls upgrade MCU AP Please chioce upda Retries: 0 Total retries: 0 1 Upgrade firmware(y Last error:	
Connected 0:40:14 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo	• //.

Figure 4.4

After the upgrade has completed, RAK410 automatically runs user program and displays the boot string of 'Welcome to RAK410' as shown in Figure 4.5:



Figure 4.5

Note: If fail to upgrade, user can reset the module, and re-do the previous steps over again.