AIoT Starter Kit for Arduino HUB 8735 ultra User Manual

【MIT Smart AI Camera Toolkit】
Model：HUB 8735 ultra
(Main Chip：RTL8735)

Adviser：Industrial Development Administration, Ministry of Economic Affairs

Organizer：Institute for Information Industry

Implementer：IoT Service HUB

Solution Provider：Winstec Corporation

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1. Required environment

HUB 8735 ultra development toolkit can be developed by Arduino IDE 1.8.19 version or newer version on Windows 7/8/10 and newer 32bit / 64bit, Linux Ubuntu, and MAC OS.

2. Introduction to HUB 8735 ultra development toolkit

The HUB 8735 ultra development toolkit is a highly integrated Smart AI camera module with built-in AI NPU, dual band Wi-Fi, BT BLE, and 1080P camera together into the small form factor (5.3cmx2.7cm) hardware board. The platform already built-in several pre-trained AI models (object detection, face recognition, voice recognition) for direct use, and you can also easily add in your customized AI models.
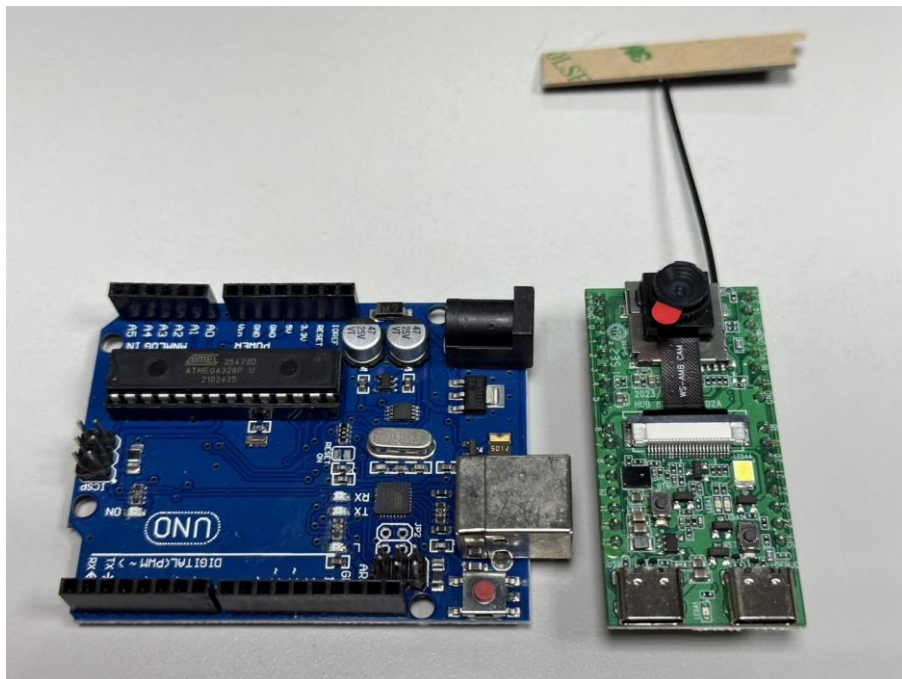

Figure 1、HUB 8735 ultra and Arduino Uno Pictures

The board on the right in the Figure 1 is HUB 8735 ultra, and the left one is the Arduino Uno

(1) HUB 8735 ultra Hardware Specification

Function	Description
Processor	Realtek RTL8735B
Camera Input	1080P camera module
Audio Input	Built-in high sensitivity digital microphone
Storage	Support Micro SD memory card
Connectivity	Wi-Fi 2.4GHz/5GHz Bluetooth BLE 5.1 Wireless video streaming
Video Encoder	H.264/265
AI Models	Provide several pre-trained AI models Add in your customized AI models
USB-C Interface	USB Download、Debug USB video output
LED	Camera Flash LED
I/O Interface	UART SPI, I2C, PWM, ADC, GPIO...
Native Develop	Support Arduino IDE development
Environment	Operation temperature : 0 ~ 60℃ Storage temperature : -20 ~ 85 ℃
Production	Made in Taiwan

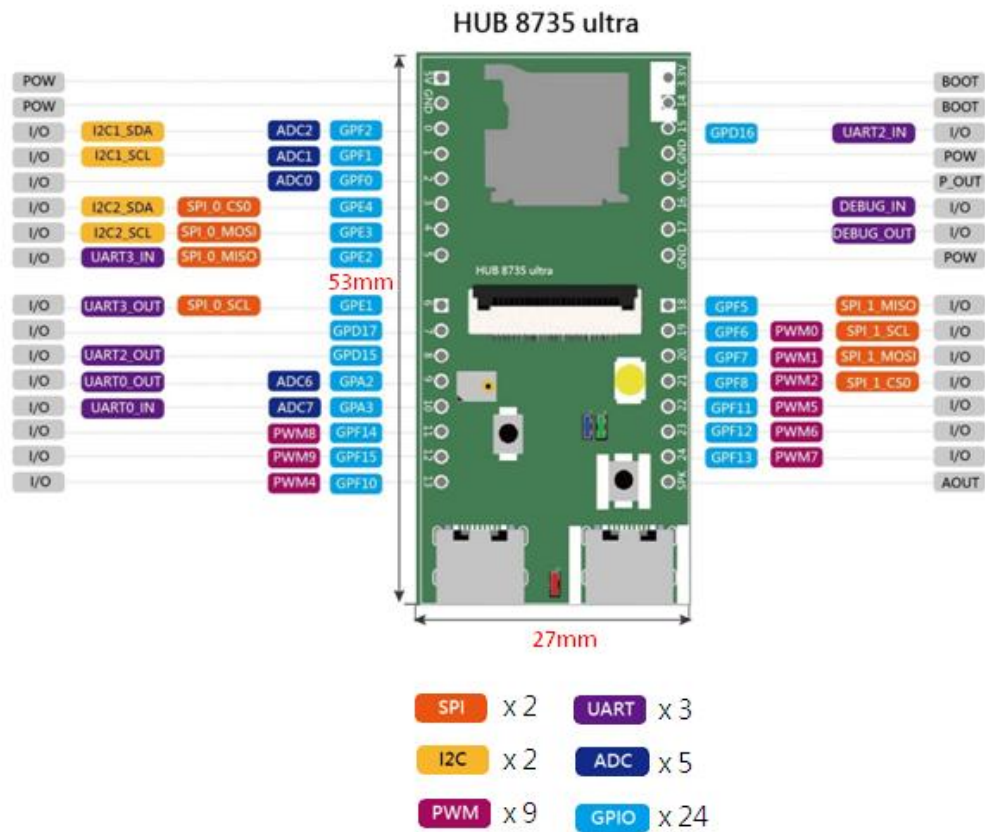## (2) HUB 8735 ultra Pinout and Hardware Interface

Figure 2、HUB 8735 ultra hardware interface

(3) HUB 8735 ultra Pin Functions Description

Table 1、Pin Multiple Functions Table

	GPIO pin	ADC	PWM	UART	SPI	I2C	LED
0	PF2	ADC2				I2C1_SDA	
1	PF1	ADC1				I2C1_SCL	
2	PF0	ADC0					
3	PE4				SPI_SS	I2C_SDK	
4	PE3				SPI_MOSI	I2C_SCL	
5	PE2			SERIAL3_RX	SPI_MISO		
6	PE1			SERIAL3_TX	SPI_SCLK		
7	PD17						
8	PD15			SERIAL2_TX			
9	PA2	ADC6		SERIAL1_TX			
10	PA3	ADC7		SERIAL1_RX			
11	PF14		PWM				
12	PF15		PWM				Button
13	PF10		PWM				Camera Flash LED
14	PA5						Flash Mode
15	PD16			SERIAL2_RX			
16	PF3			LOG_RX			
17	PF4			LOG TX			
18	PF5		PWM		SPI1_MISO		
19	PF6		PWM		SPI1_SCLK		
20	PF7		PWM		SPI1_MOSI		
21	PF8		PWM		SPI1_SS		
22	PF11		PWM				
23	PF12		PWM				
24	PF13		PWM				
25	PE6						LED_G (green)
26	PF9						LED_B (blue)
27	PA0	ADC4				I2C2_SCL	
28	PA1	ADC5				I2C2_SDA	
29	PE5						

(4) HUB 8735 ultra Board Components Placement

Figure 3 shows all key components on the board. HUB8735 ultra built in two USB connectors, one is a USB OTG port, the other is a USB to Serial port; hence, developer can easily to output debug messages and upgrade the firmware by this USB to Serial port.
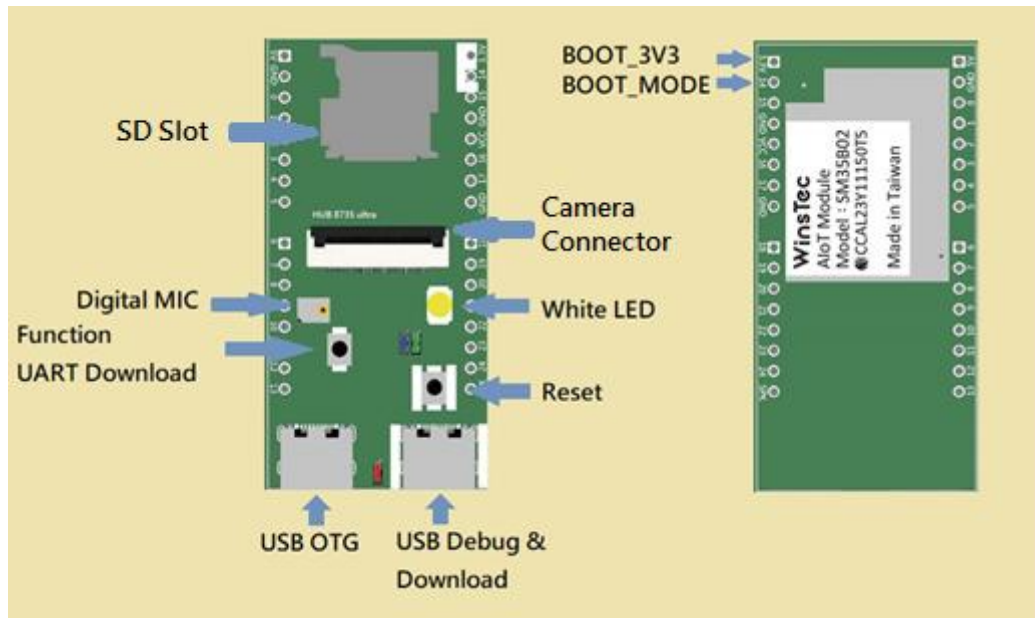

Figure 3、HUB 8735 ultra board components placement

3. Install the development environment

(1) Install Arduino IDE Environment

Download and install the Arduino software IDE (1.8.19 or newer) from Arduino official website (https://www.arduino.cc/en/Main/Software).

(2) Add HUB 8735 ultra board package in Arduino IDE
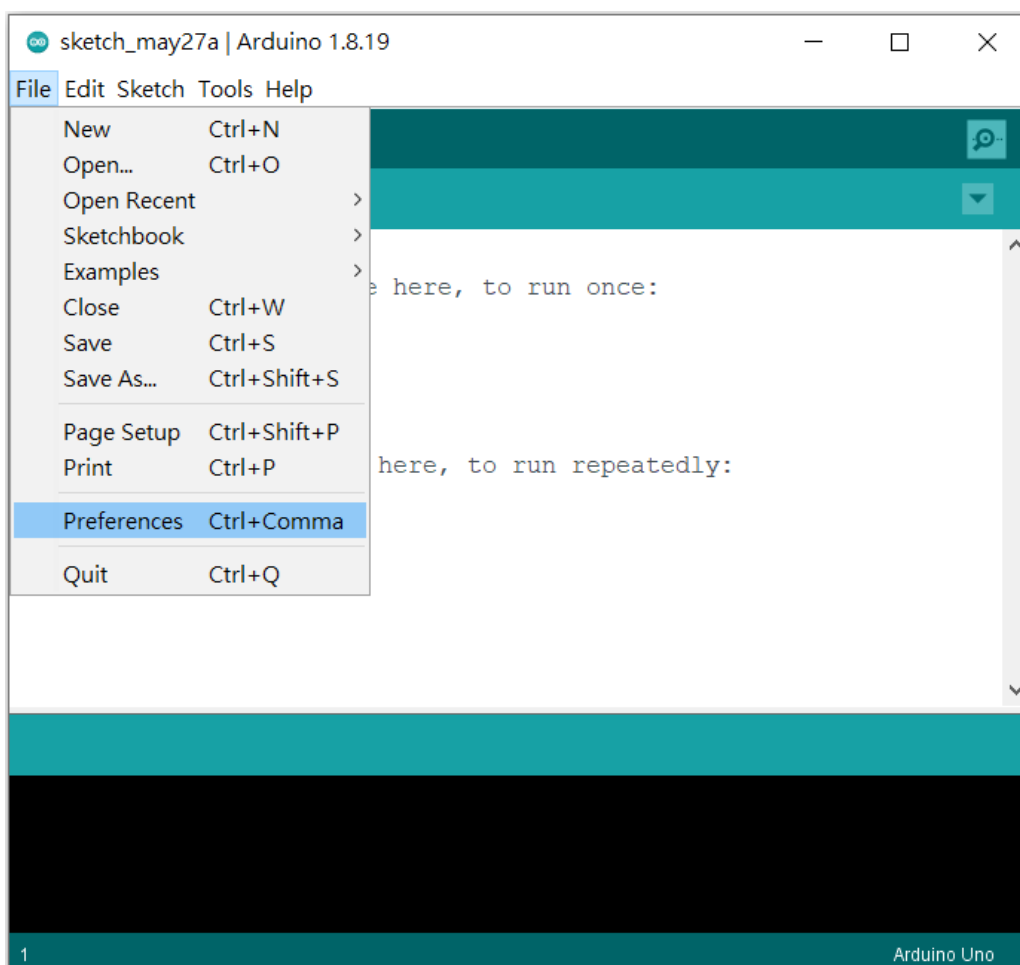
Launch the Arduino software IDE and tap "File" > "Preferences".

Figure 4、Open Preferences using the menu bar

Then, add below platform configure strings in the "**Additional boards manager URLs**" setting (Figure 5).

https://github.com/ideashatch/HUB-8735/raw/main/amebapro2_arduino
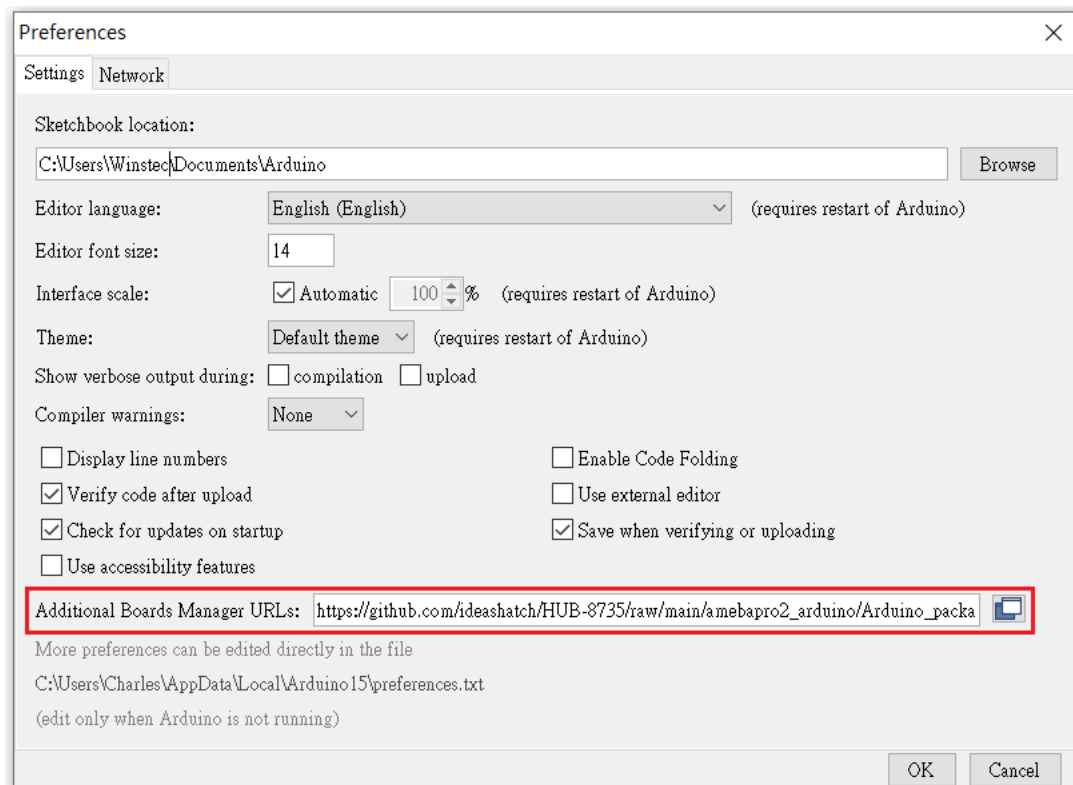/Arduino_package/ideasHatch.json

Figure 5、Add the Additional Boards Manager URLs

Now, you can install the HUB 8735 ultra board package with "**Boards Manager**". Tap "Tools" > "Board:" > "Boards Manager" (Figure 6).
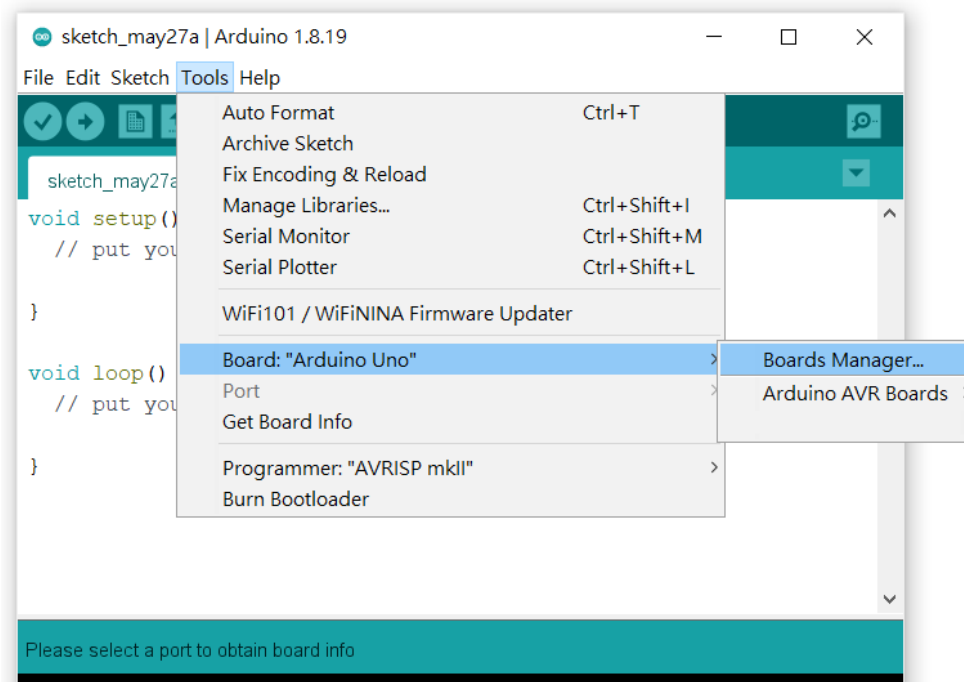

Figure 6、Open Boards Manager…

Search "HUB 8735 ultra" or "ideasHatch" in the Boards Manager, and the HUB 8735 ultra board package will appear, then tap the "install" button (Figure 7).

Figure 7、Install the board package

After HUB 8735 ultra board package is installed, select this board to start your development. Tap "Tools" > "Board: " > "AmebaPro2 ARM(32-bits) Boards – ideasHatch" > "HUB-8735_ultra" on the Arduino IDE (Figure 8).
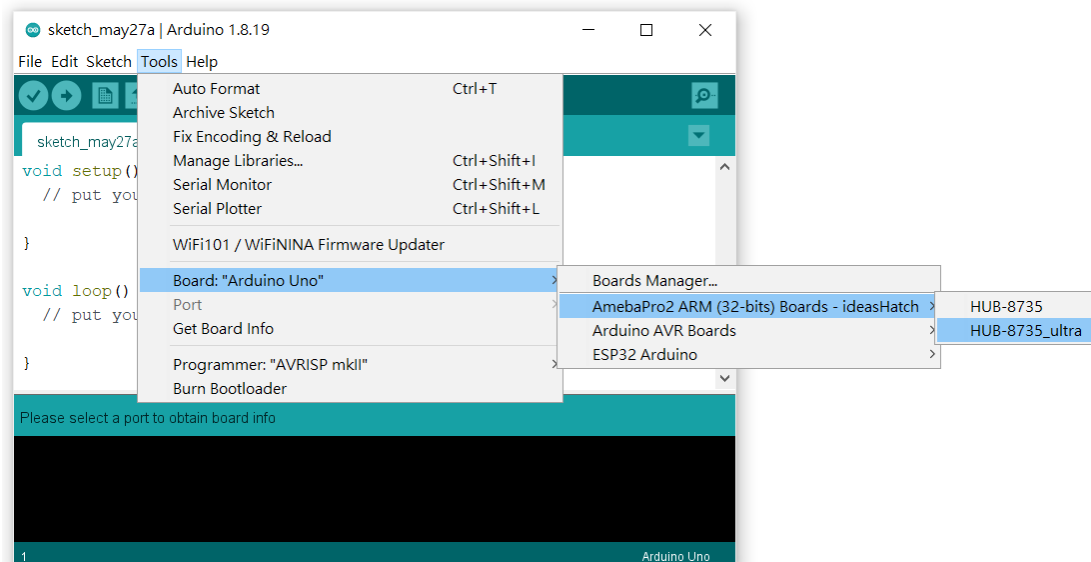

Figure 8、Select HUB 8735 ultra board

(3) HUB 8735 Ultra Debug Output

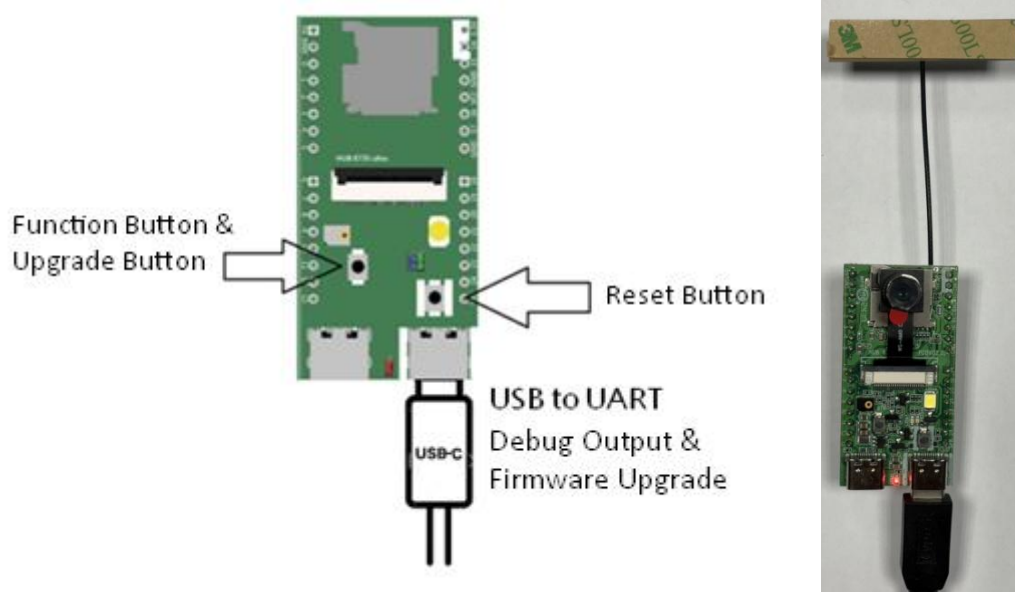Connect the HUB 8735 ultra to PC with USB cable. (Figure 9)

Figure 9、USB connection

Tap "Tools" > "Port" > "COMxx" to set your com port on Arduino IDE (Figure 10). If you don't know which COM port is correct, you can check in the Device Manager (Figure 11) on your PC.
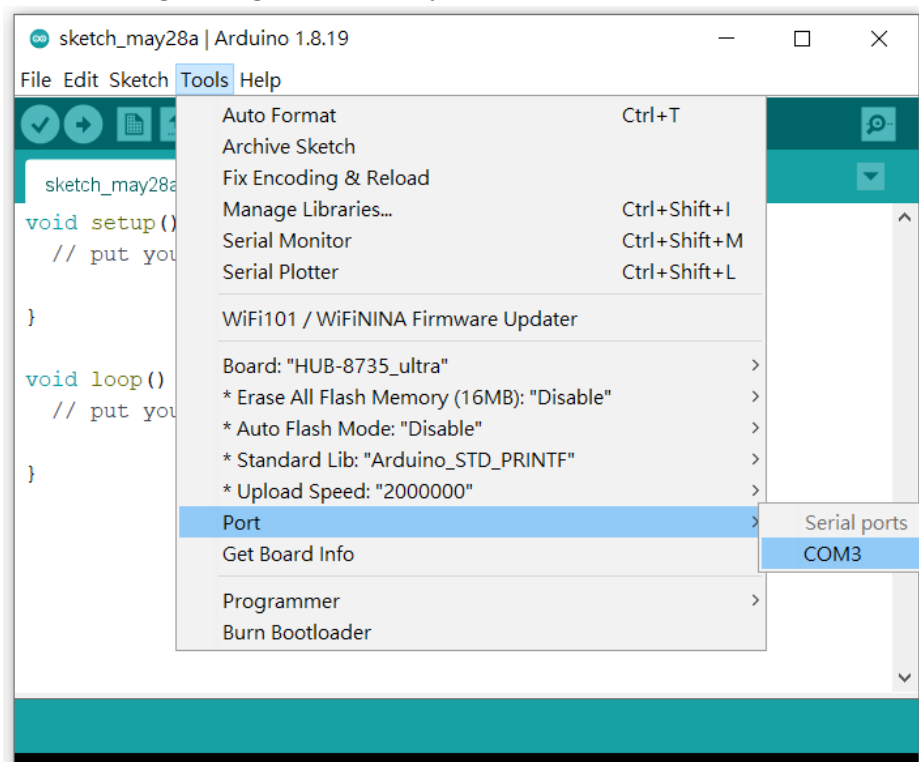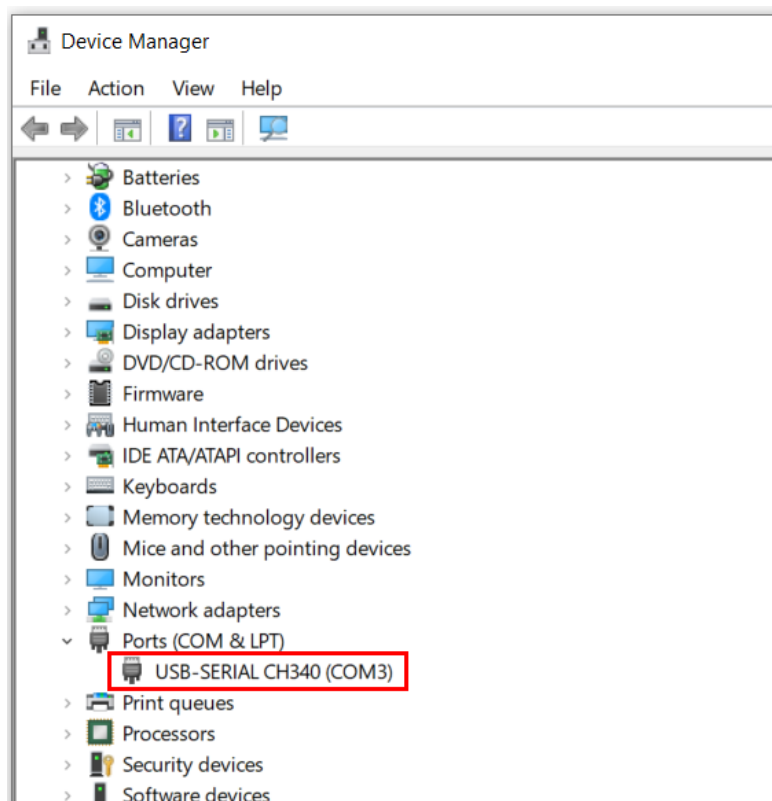

Figure 10、COM Port setting

Figure 11、Check COM Port in Device Manager

Tap "Serial Monitor" button on Arduino IDE (Figure 12), then a new window will be launched. Set the baud rate to 115200 to show the debug strings correctly. Now, the debug output function is ready to use.
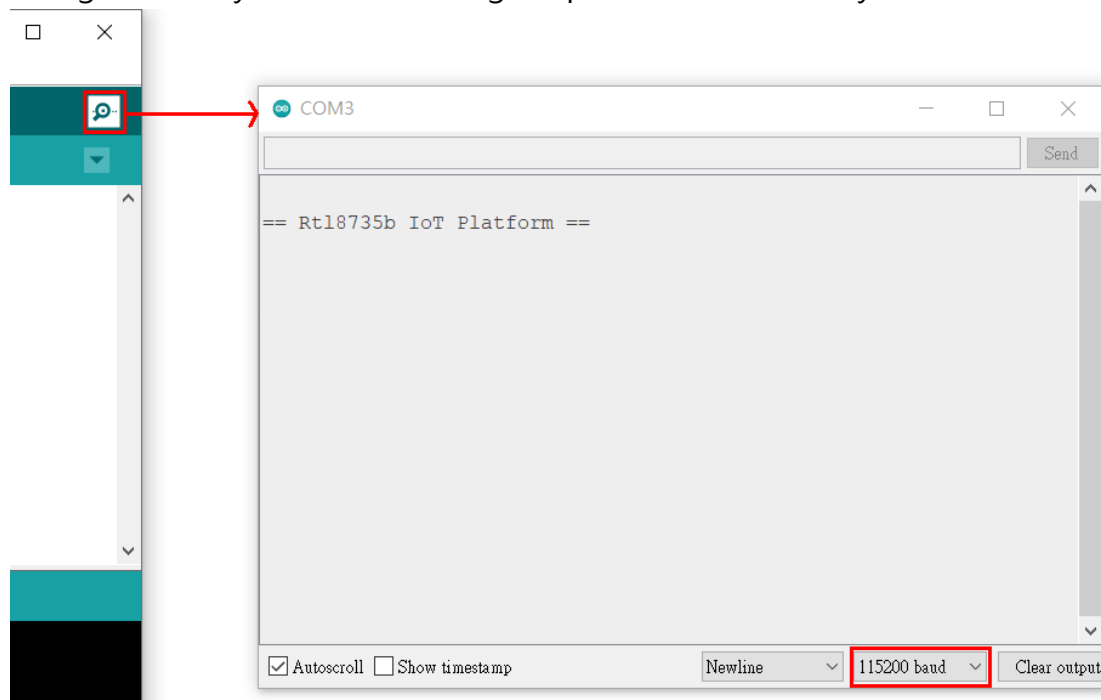

Figure 12、COM Port baud rate setting

(4) HUB 8735 ultra Firmware Upgrade

Please accomplish the COM port setting first (Refer (3) HUB8735 ultra Debug Output). After COM port connection is ready, we can start to upgrade the firmware now. First, long press and hold the upgrade button, then short press the reset button to reset the hardware board. Now, the hardware board should enter the upgrade mode and you can release the upgrade button (Figure 13).
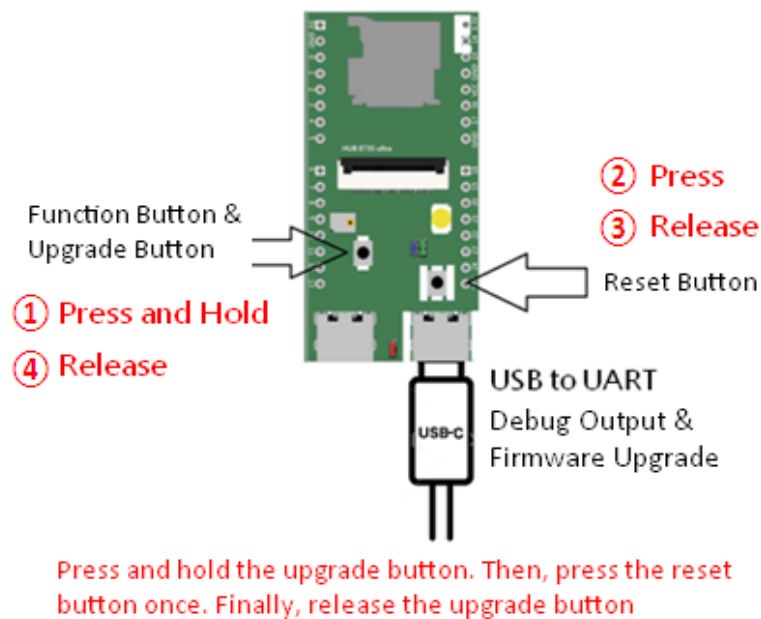

Figure 13、Enable Firmware Upgrade mode

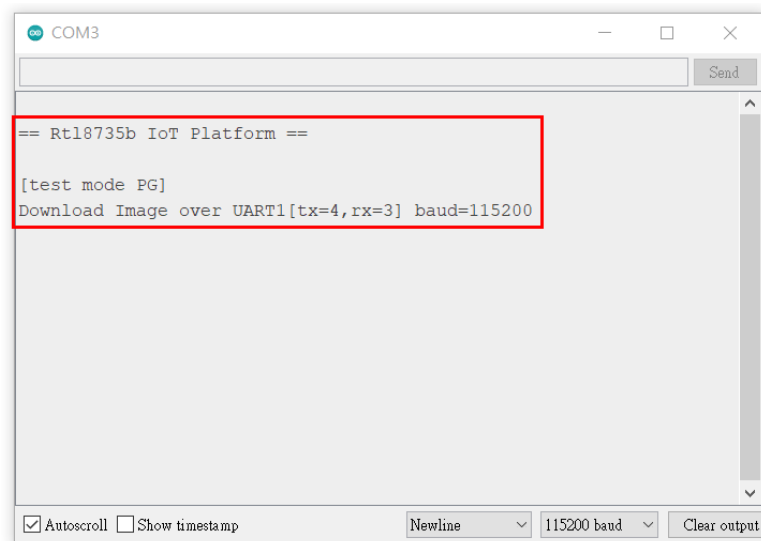If you enter the upgrade mode successfully, you can see the below debug message (Figure 14) in serial monitor window.

Figure 14、Enter Firmware Upgrade mode

Tap the "Upload" button on Arduino IDE (Figure 15). The Arduino IDE will automatically build the software program and upgrade the firmware to HUB 8735 ultra board. You can check the status on the progress bar.
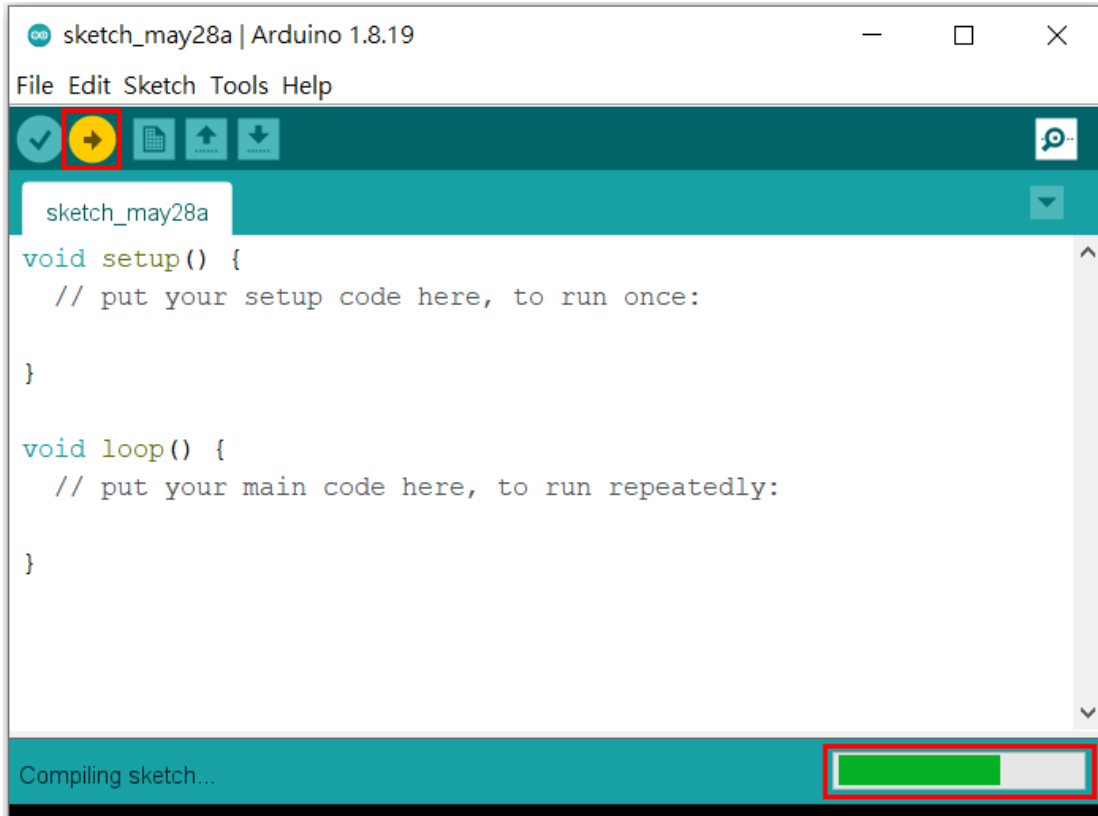

Figure 15、Start Firmware upgrade

After the firmware upgrade complete, you can see the "upload success" debug message on the Arduino IDE output window (Figure 16).
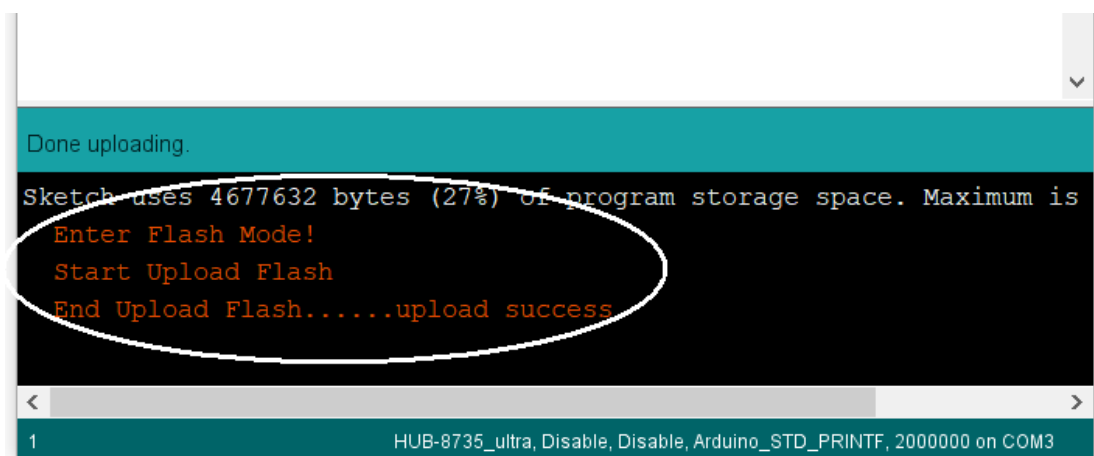

Figure 16、Firmware Upgrade done

4. Built-in Examples for HUB 8735 ultra

All code examples of HUB 8735 ultra board are available directly in Arduino IDE; hence, you can find all examples from "File" > "Examples" (Figure 17).
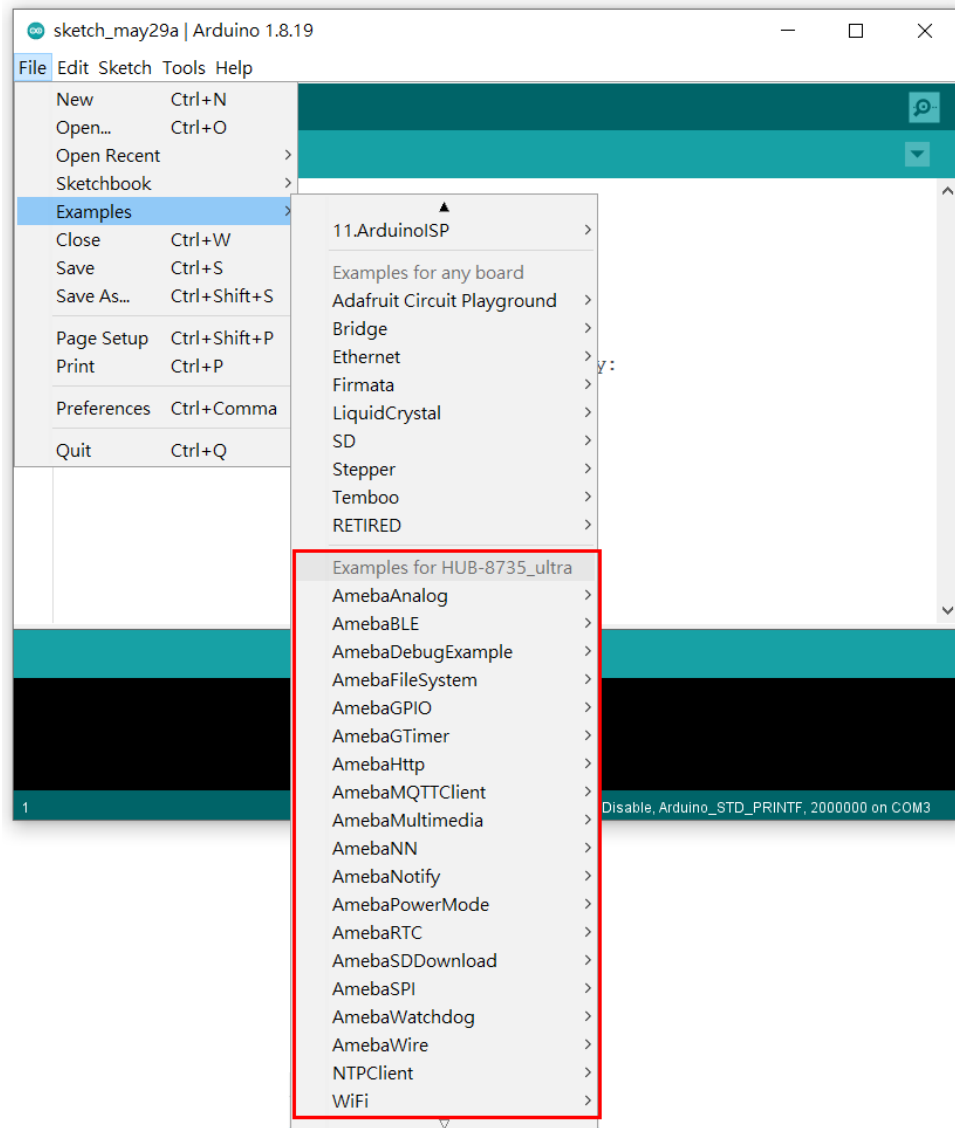

Figure 17、Built-in examples for HUB-8735 ultra

(1) I2C Examples

It will show you relating examples about using I2C functions. For example, let's display strings on LCD 1602. Open the example code from "File" > "Examples" > "AmebaWire" > "LCD_HellowWorld" on Arduino IDE (Figure 18).

Figure 18、LCD 1602 sample code

Connect the LCD 1602 to HUB 8735 ultra as Figure 19. Compile and upload your code to HUB 8735 ultra (Refer (4) HUB 8735 ultra Firmware Upgrade). Reboot the hardware board, and you can see the string "Hello World" and "Ameba" on the LCD 1602.
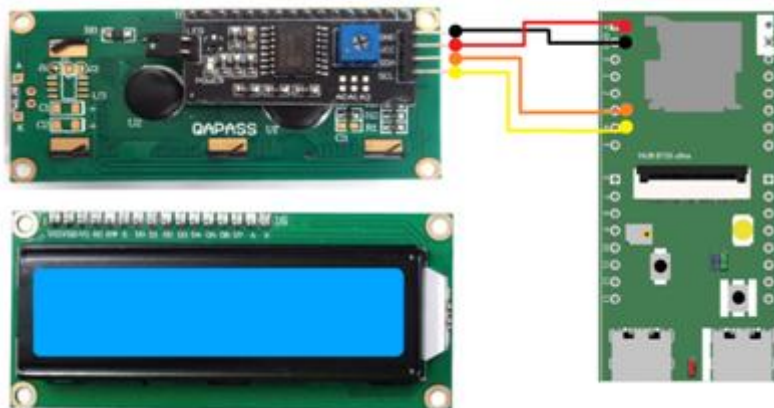

Figure 19、LCD 1602 and HUB 8735 ultra connection

(2) SPI Examples

It will show you relating examples about using SPI functions. For example, let's display color images on ILI9341 TFT LCD. Open the example code from "File" > "Examples" > "AmebaSPI" > "LCD_Screen_ILI9341_TFT" on Arduino IDE (Figure 20).

Figure 20、ILI9341 TFT LCD sample code

Connect the ILI9341 TFT LCD to HUB 8735 ultra as Figure 21. Compile and upload your code to HUB 8735 ultra (Refer (4) HUB 8735 ultra Firmware Upgrade). Reboot the hardware board, and you can see various images on the LCD.
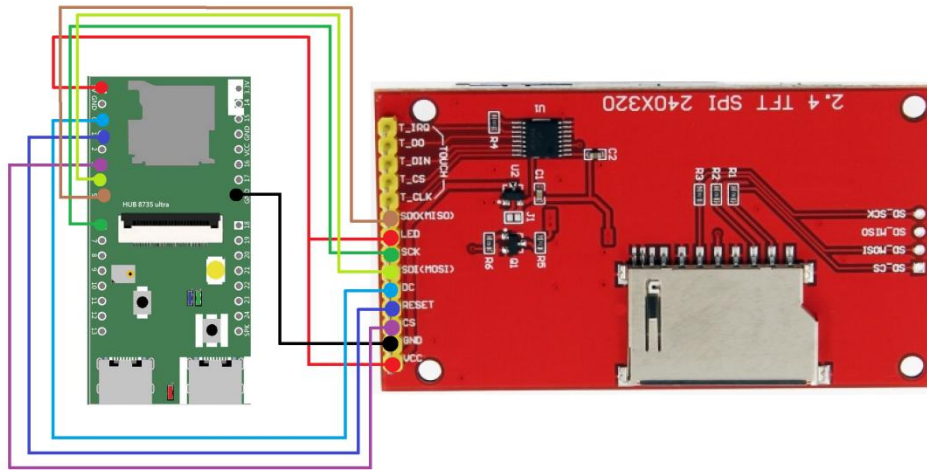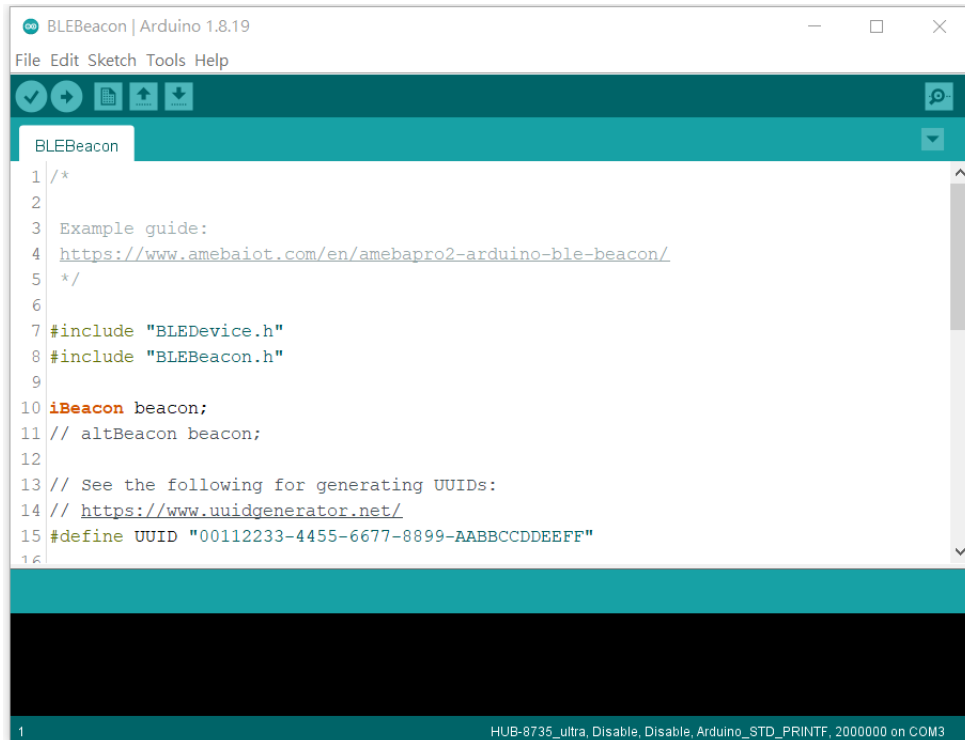
Figure 21、ILI9341 TFT LCD and HUB 8735 ultra connection

Table 2、ILI9341_TFT Pin Definition

Number	Pin Label	Description
1	VCC	5V/3.3V power input
2	GND	Ground
3	CS	LCD chip select signal, low level enable
4	RESET	LCD reset signal, low level reset
5	DC/RS	LCD register / data selection signal, high level: register, low level: data
6	SDI(MOSI)	SPI bus write data signal
7	SCK	SPI bus clock signal
8	LED	Backlight control, high level lighting, if not controlled, connect 3.3V always bright
9	SDO(MISO)	SPI bus read data signal, if you do not need to the read function, you can not connect it
(The following is the touch screen signal line wiring, if you do not need to touch function or the module itself does not have touch function, you can not connect them)		
10	T_CLK	Touch SPI bus clock signal
11	T_CS	Touch screen chip select signal, low level enable
12	T_DIN	Touch SPI bus input
13	T_DO	Touch SPI bus output
14	T_IRQ	Touch screen interrupt signal, low level when touch is detected

(3) BLE Examples

BLE examples will show you relating examples about BLE functions. For example, let's advertise the BLE beacon. Open the example code from "File" > "Examples" > "AmebaBLE" > "BLEBeacon" on Arduino IDE (Figure 22).

Figure 22、BLE sample code

Compile and upload your code to HUB 8735 ultra (Refer (4) HUB 8735 ultra Firmware Upgrade). Reboot the hardware board, and you can see the BLE beacon from BLE scan devices (Figure 23).

Figure 23、Use the APP to scan the BLE beacon

(4) Wi-Fi Examples

Wi-Fi examples will show you relating examples about Wi-Fi functions. For example, let's make Wi-Fi connection with the WPA security password. Open the example code on Arduino IDE from "File" > "Examples" > "Wi-Fi" > "ConnectToWi-Fi" > "WPA_Security" (Figure 24).
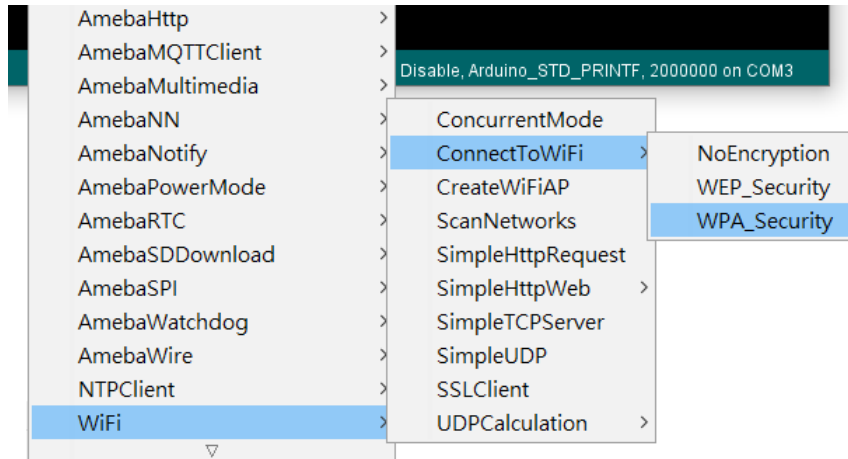

Figure 24、Wi-Fi examples

Add your Network SSID and Password in the example code as below (Figure 25). Then, compile and upload your code to HUB 8735 ultra (Refer (4) HUB 8735 ultra Firmware Upgrade)
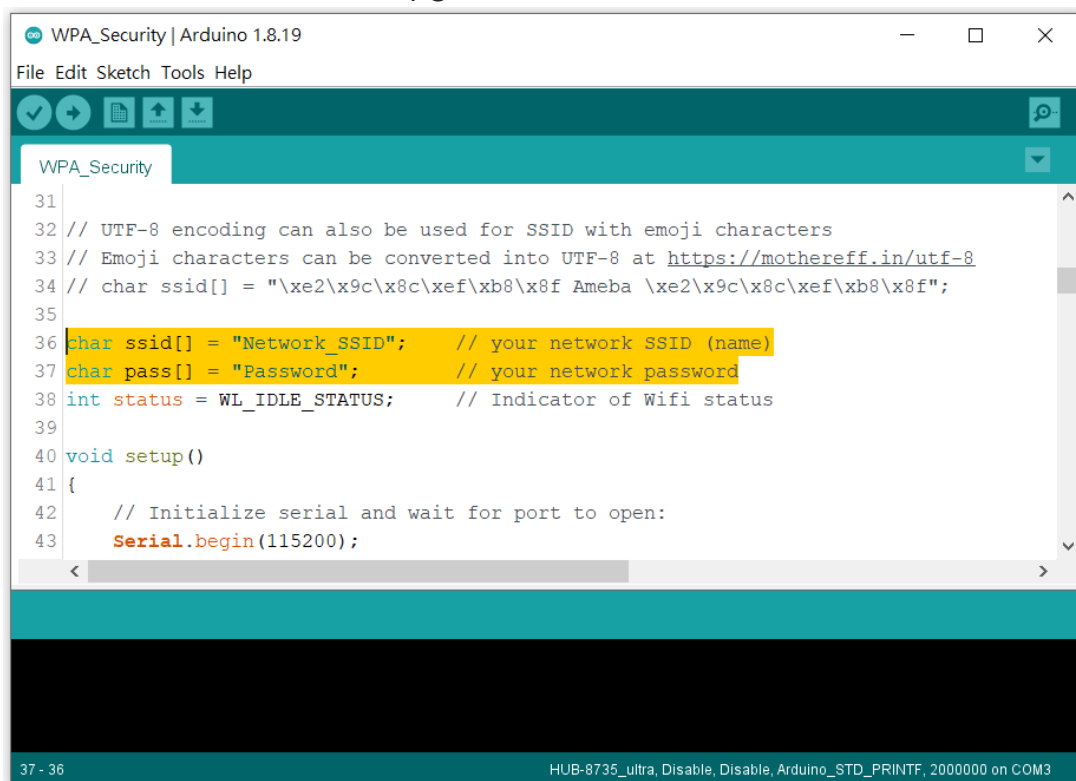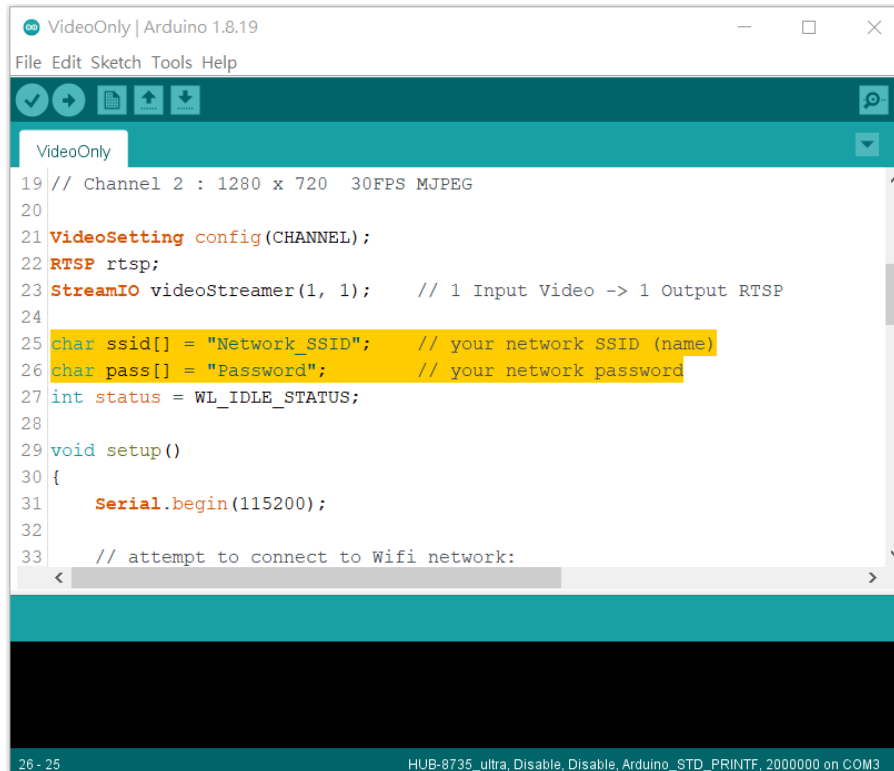

Figure 25、Add your network SSID and Password

(5) Video Streaming Example

It will show you how to output your camera by Wi-Fi. Open the example code on Arduino IDE from "File" > "Examples" > "AmebaMultimedia" > "StreamRTSP" > "VideoOnly".

Add your Network SSID and Password in the example code as below (Figure 26). Then, compile and upload your code to HUB 8735 ultra (Refer (4) HUB 8735 ultra Firmware Upgrade)

Figure 26、RTSP Video Streaming sample code

Compile and upload your code to HUB 8735 ultra (Refer (4) HUB 8735 ultra Firmware Upgrade). Reboot the hardware board, and you can see a RTSP IP address from debug message on Serial Monitor window (Figure 27).
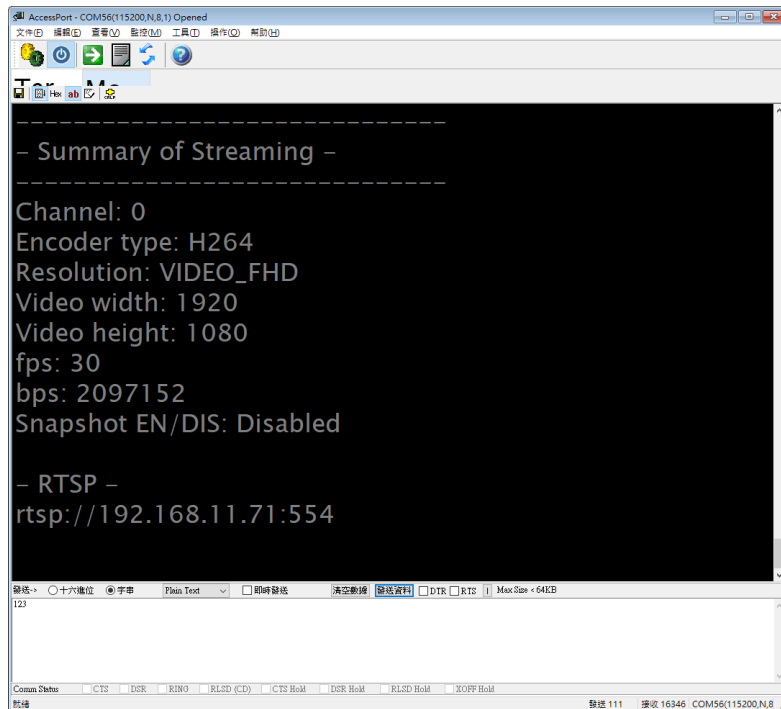
Figure 27、Get the RTSP IP address

Launch RTSP APP on your PC. In this example, we use VLC media player APP. In the VLC media player, tap "Media" > "Open Network Stream..." (Figure 28).
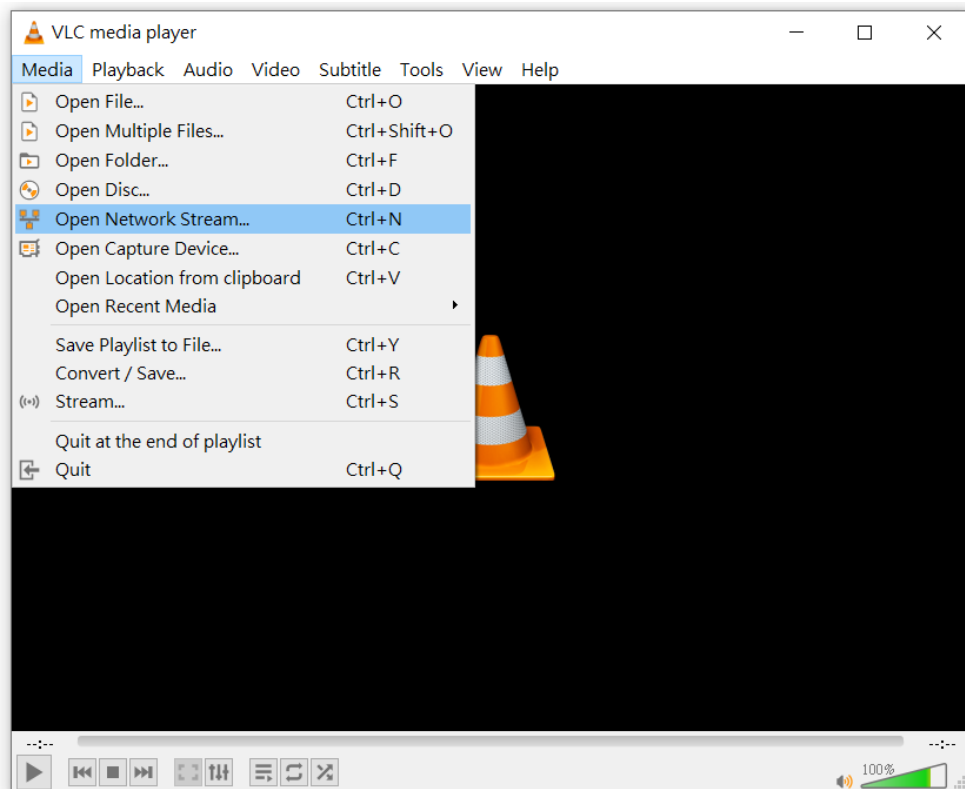

Figure 28、Video Streaming setting on VLC media player

Set the RTSP IP address (Figure 29).

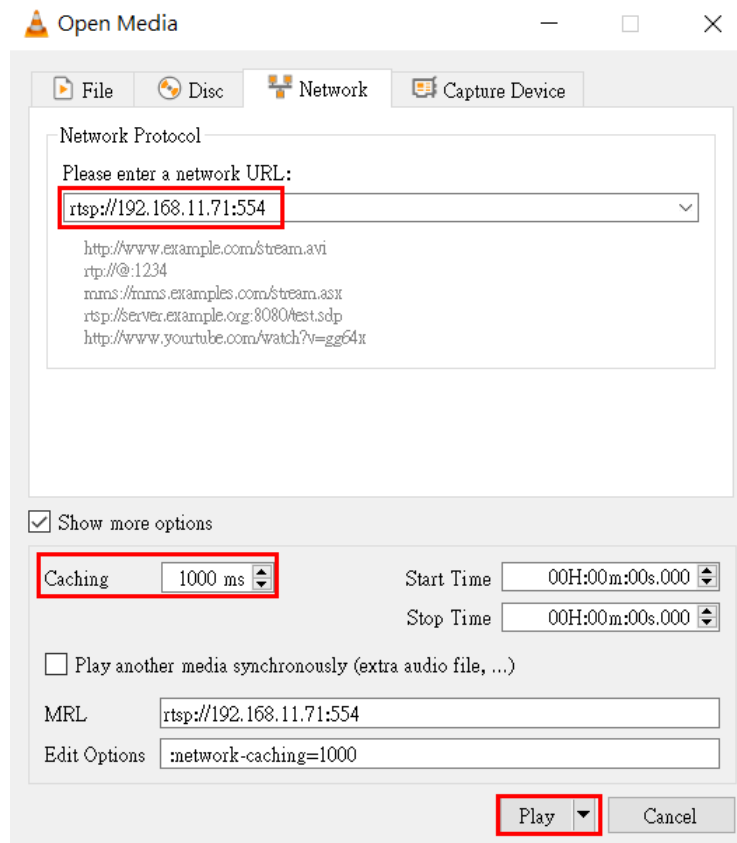Figure 29、Set RTSP IP address

Tap the play button (Figure 29) to see the video from HUB 8735 ultra (Figure 30). You also can reduce the "Caching" time to improve the video latency.

Figure 30、Play streaming video

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5. Reference

1. **IoT Service HUB – MIT IC Manufacturing Toolkit**
   (https://www.ideas-hatch.com/mem_evb.jsp)
2. **Toolkit Information**
   (http://www.winstouch.com.tw/Page/Product/ProductDetail.aspx?ProductCategoryNo=176&ProductNo=89)

6. Revision History

Date	Revision	Comment
2024/05/30	V1.0	Preliminary Revision

7. Contact Information / Technical Support

1. https://www.ideas-hatch.com/contact.jsp

2. sales@winstouch.com.tw