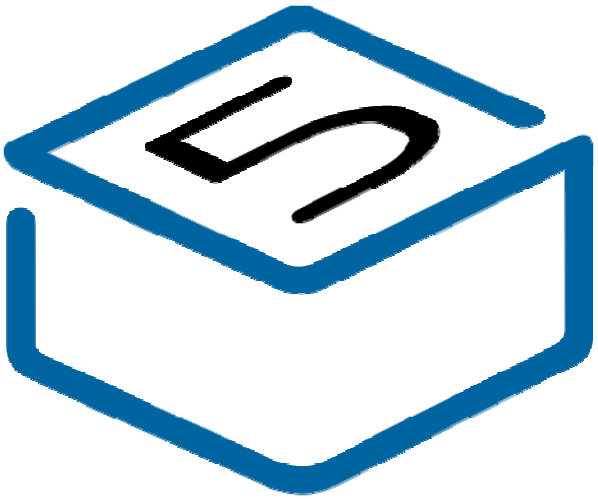
M5STICKC

User Manual



M5STACK

2019

V0.01

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1.OUTLINE

M5StickC is a delicate and tiny IoT development board. It has a built-in ESP32 - PICO - D4 module, integrated 0.96 inch TFT LCD screen, IMU sensors and many more sets of hardware resources. It is covered by a PC + ABS material shell. With the fixing hole interface, M5Stick-C can be hung on any plane. Support multiple software development platforms. The overall outstanding performance will give users a quick and easy development experience.

1.1 Hardware Composition

The hardware of M5StickC: ESP32-PICO-D4 module, TFT screen, IMU, IR transmitter, Red LED, Button, GROVE interface, TypeC-to-USB interface, Power Management chip and 80mAh battery.

ESP32- PICO-D4is a System-in-Package (SiP) module that is based on ESP32, providing complete Wi-Fiand Bluetooth functionalities. The module integrates a 4-MB SPI flash. ESP32-PICO-D4 integrates all peripheral components seamlessly,including a crystal oscillator, flash, filter capacitors and RF matching links in one single package.

TFT Screenis a 0.96-inch color screen driven by Sitronix's ST7735S with a resolution of 80 x 160. Operating voltage range is 2.5~4.8V, working temperature range is -10~45°C.

IMU is Senodia's6-axis attitude sensor named SH200Q. SH200Q is internal integrated 3-axis gyroscope and 3-axis accelerometer. The maximum bandwidth of thegyroscope is 250.32Hz, and the maximum bandwidth of the accelerometer is 1000Hz.The operating temperature range is -10 to 45 °C. The maximum voltage of the power supply is 3.6V.

Power Management chip is X-Powers's AXP192. The operating voltage range is 2.9V~6.3V and the charging current is 1.4A.

M5StickC equips ESP32 with everything needed for programming, everything needed for operation and development

2. PIN DESCRIPTION

2.1. USB INTERFACE

M5CAMREA Configuration Type-C type USB interface, support USB2.0 standard communication protocol.

2.2. GROVE INTERFACE

4p disposed pitch of 2.0mm M5CAMREA GROVE interfaces, internal wiring and GND, 5V, GPIO32, GPIO33 connected.

3. FUNCTIONAL DESCRIPTION

This chapter describes the ESP32-PICO-D4 various modules and functions.

3.1. CPU AND MEMORY

ESP32-PICO-D4 contains two low-power Xtensa® 32-bit LX6 MCU. On-chip memory comprising:

- 448-KB of ROM, and the program starts for the kernel function calls
- For a 520 KB instruction and data storage chip SRAM (including flash memory 8 KB RTC)
- RTC flash memory of 8 KB SRAM, when the RTC can be started in Deep-sleep mode, and for storing data accessed by the main CPU
- RTC slow memory, of 8 KB SRAM, can be accessed by the coprocessor in Deep-sleep mode
- Of 1 kbit of eFuse, which is a 256 bit system-specific (MAC address and a chip set); the remaining 768 bit reserved for user program, these Flash program include encryption and chip ID

3.2. STORAGE DESCRIPTION

3.2.1. External Flash and SRAM

ESP32 support multiple external QSPI flash and static random access memory (SRAM), having a hardware-based AES encryption to protect the user programs and data.

- ESP32 access external QSPI Flash and SRAM by caching. Up to 16 MB external Flash code space is mapped into the CPU, supports 8-bit, 16-bit and 32-bit access, and can execute code.
- Up to 8 MB external Flash and SRAM mapped to the CPU data space, support for 8-bit, 16-bit and 32-bit access. Flash supports only read operations, SRAM supports read and write operations.

ESP32-PICO-D4 4 MB of integrated SPI Flash, the code can be mapped into CPU space, support for 8-bit, 16-bit and 32-bit access, and can execute code. Pin GPIO6 ESP32 of, GPIO7, GPIO8, GPIO9, GPIO10 and GPIO11 for connecting module integrated SPI Flash, not recommended for other functions.

3.3. CRYSTAL

- ESP32-PICO-D4 integrates a 40 MHz crystal oscillator.

3.4. RTC MANAGEMENT AND LOW POWER CONSUMPTION

ESP32 uses advanced power management techniques may be switched between different power saving modes. (See Table5).

- *Power saving mode*

  - Active Mode: RF chip is operating. Chip may receive and transmit a sounding signal.

  - Modem-sleep mode: CPU can run, the clock may be configured. Wi-Fi / Bluetooth baseband and RF

  - Light-sleep mode: CPU suspended. RTC and memory and peripherals ULP coprocessor operation. Any wake-up event (MAC, host, RTC timer or external interrupt) will wake up the chip.

  - Deep-sleep mode: only the RTC memory and peripherals in a working state. Wi-Fi and Bluetooth connectivity data stored in the RTC. ULP coprocessor can work.

  - Hibernation Mode: 8 MHz oscillator and a built-in coprocessor ULP are disabled. RTC memory to restore the power supply is cut off. Only one RTC clock timer located on the slow clock and some RTC GPIO at work. RTC RTC clock or timer can wake up from the GPIO Hibernation mode.

- *Deep-sleep mode*

  - related sleep mode: power save mode switching between Active, Modem-sleep, Light-sleep mode. CPU, Wi-Fi, Bluetooth, and radio preset time interval to be awakened, to ensure connection Wi-Fi / Bluetooth.

  - Ultra Low-power sensor monitoring methods: the main system is Deep-sleep mode, ULP coprocessor is periodically opened or closed to measure sensor data. The sensor measures data, ULP coprocessor decide whether to wake up the main system.

Functions in different power consumption modes: TABLE 5

Power consumption mode	Active	Modem-sleep	Light-sleep	Deep-sleep	Hibernation
Sleep mode	Associated sleep mode			Ultra low-power Sensor measures data	-
CPU	open	open	pause	close	close
Wi-Fi/Bluetooth Radio	open	open	close	close	close
RTC memory	open	open	open	open	close
ULP coprocessor	open	open	open	open/close	close

4. ELECTRICAL CHARACTERISTICS

4.1. LIMIT PARAMETERS

Table 8: Limiting values

Symbol	Parameter	Min	Max	Unit
VDD33	Power supply voltage	–0.3	3.6	V
I_{output}[1]	Cumulative IO output current	-	1,100	mA
T_{store}	Storage temperature	–40	150	°C

1. V_{IO} to the power supply pad, ReferESP32 Technical SpecificationAppendix IO_MUX, as SD_CLKofPower supply for VDD_SDIO.

4.2. WIFI RADIO FREQUENCY

Table 9: Wi-Fi RF characteristics

Description	Min	Typical	Max	Unit
Input frequency	2412		2462	MHz
Output impedance	-	50	-	Ω
Declare power				
Output power of PA for 802.11b mode	-	24.00	-	dBm
Output power of PA for 802.11g mode	-	24.00	-	dBm
Output power of PA for 802.11n-HT20 mode	-	24.00	-	dBm
Output power of PA for 802.11n-HT40 mode	-	20.50	-	dBm
Sensitivity				
DSSS，1Mbps	-	-98	-	dBm
CCK，11Mbps	-	-91	-	dBm
OFDM，6Mbps	-	-93	-	dBm
OFDM，54Mbps	-	-75	-	dBm
HT20,MCS0	-	-93	-	dBm
HT20,MCS7	-	-73	-	dBm
HT40,MCS0	-	-90	-	dBm
HT40,MCS7	-	-70	-	dBm
MCS32	-	-89	-	dBm
Adjacent channel rejection				
OFDM，6Mbps	-	37	-	dB
OFDM，54Mbps	-	21	-	dB
HT20,MCS0	-	37	-	dB
HT20,MCS7	-	20	-	dB

4.3. LOW-POWER BLUETOOTH RADIO

4.3.1.receiver

Table 10: Low-power Bluetooth receiver characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity @30.8% PER	-	-	–97	-	dBm
Maximum received signal @30.8% PER	-	0	-	-	dBm
Co-channel C/I	-	-	+10	-	dB
Adjacent channel selectivity C/I	F = F0 + 1 MHz	-	–5	-	dB
	F = F0 – 1 MHz	-	–5	-	dB
	F = F0 + 2 MHz	-	–25	-	dB
	F = F0 – 2 MHz	-	–35	-	dB
	F = F0 + 3 MHz	-	–25	-	dB
	F = F0 – 3 MHz	-	–45	-	dB
Out-of-band blocking performance	30 MHz ~ 2000 MHz	–10	-	-	dBm
	2000 MHz ~ 2400 MHz	–27	-	-	dBm
	2500 MHz ~ 3000 MHz	–27	-	-	dBm
	3000 MHz ~ 12.5 GHz	–10	-	-	dBm
Intermodulation	-	–36	-	-	dBm

4.3.2.launcher

Table 11: Characteristics of Low Power Bluetooth transmitter

Parameter	Conditions	Min	Typ	Max	Unit
RF declare power	-		4		dBm
Gain control step	-		3		dBm
RF power control range	-	-12	-	+9	dBm
Adjacent channel transmit power	F=F0±2MHz	-	-52	-	dBm
	F=F0±3MHz	-	-58	-	dBm
	F=F0±＞3MHz	-	-60	-	dBm
Δf1avg	-		-	265	kHz
Δf2max	-	247	-	-	kHz
Δf2avg/Δf1avg	-	-	-0.92	-	-
ICFT	-	-	-10	-	kHz
Drift rate	-	-	0.7	-	kHz/50μs
Drift	-	-	2	-	kHz

4.4. BT3.0

Parameter	Conditions	Min	Typ	Max	Unit
RF declare power	-		6.5		dBm

5.QUICK START

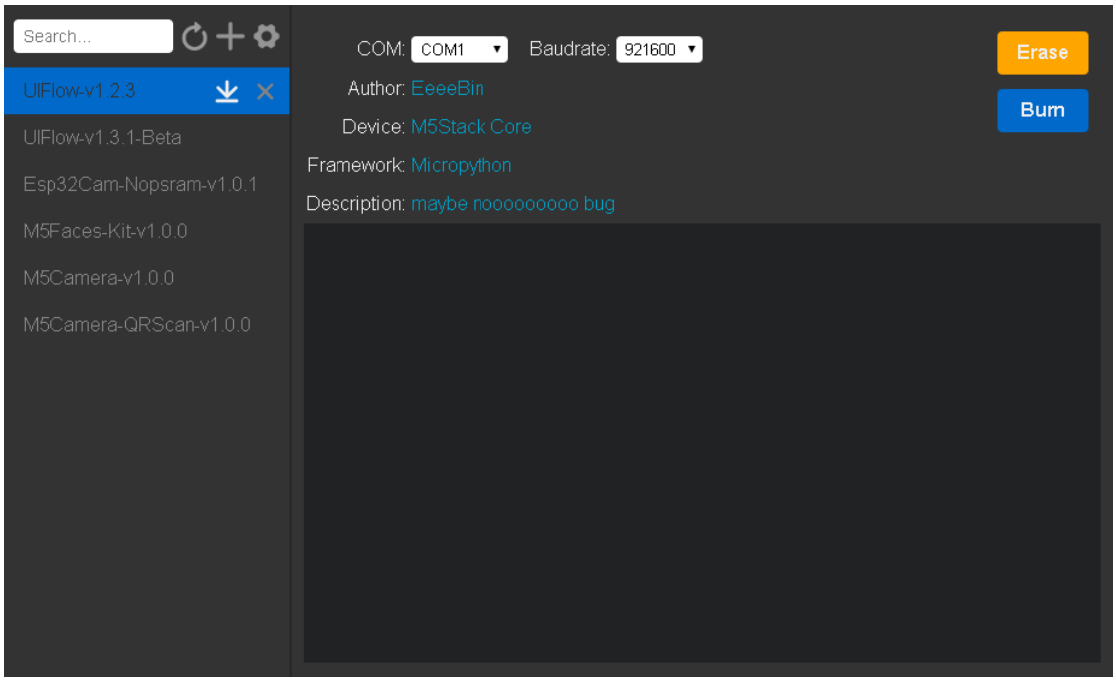
This chapter will teach you how to quick start with M5StickC.

5.1.FLASH FIRMWARE

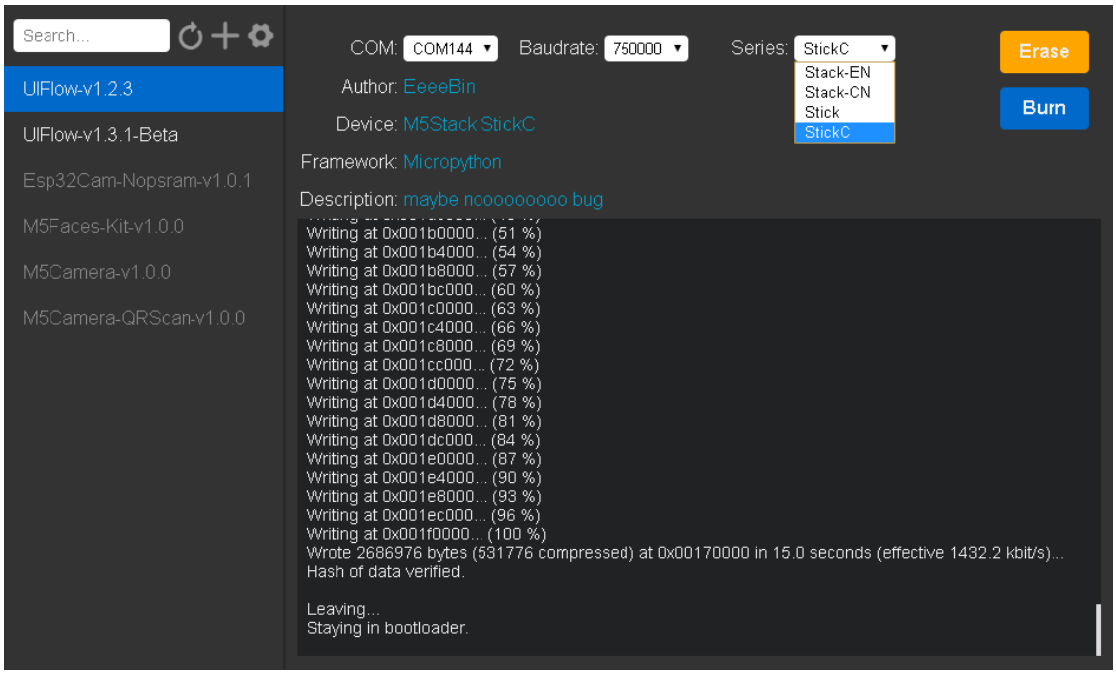
Before program M5StickC on UIFlow IDE, you will need to flash the UIFlow firmare on to the device.

- Visit M5Stack offcial website, navigate to SUPPORT->DOWNLOAD. Download the M5Burner based on your operation system.

- Unzip the compress file and open up M5Burner.exe, select the UIFlow firmware on the list to the left. Click DOWNLOAD icon.



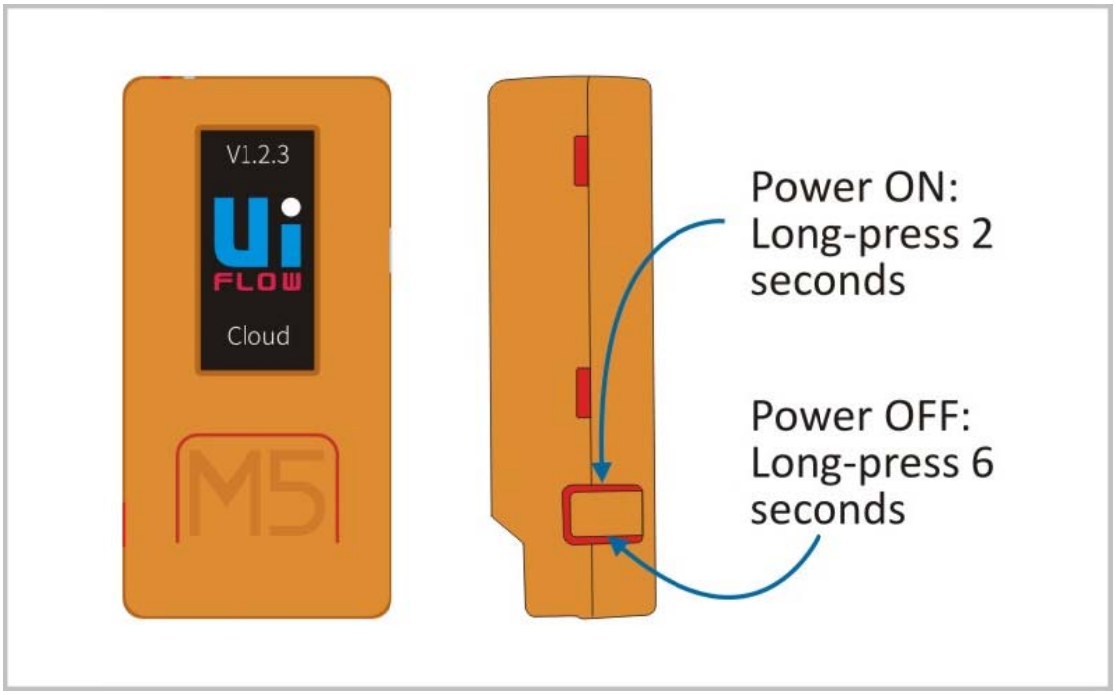
- Connect your M5StcikC to your computer via Type-C cable, select the corresponding COM port, Hit Burn.(Recommend operation: Erase the flash before Burn)



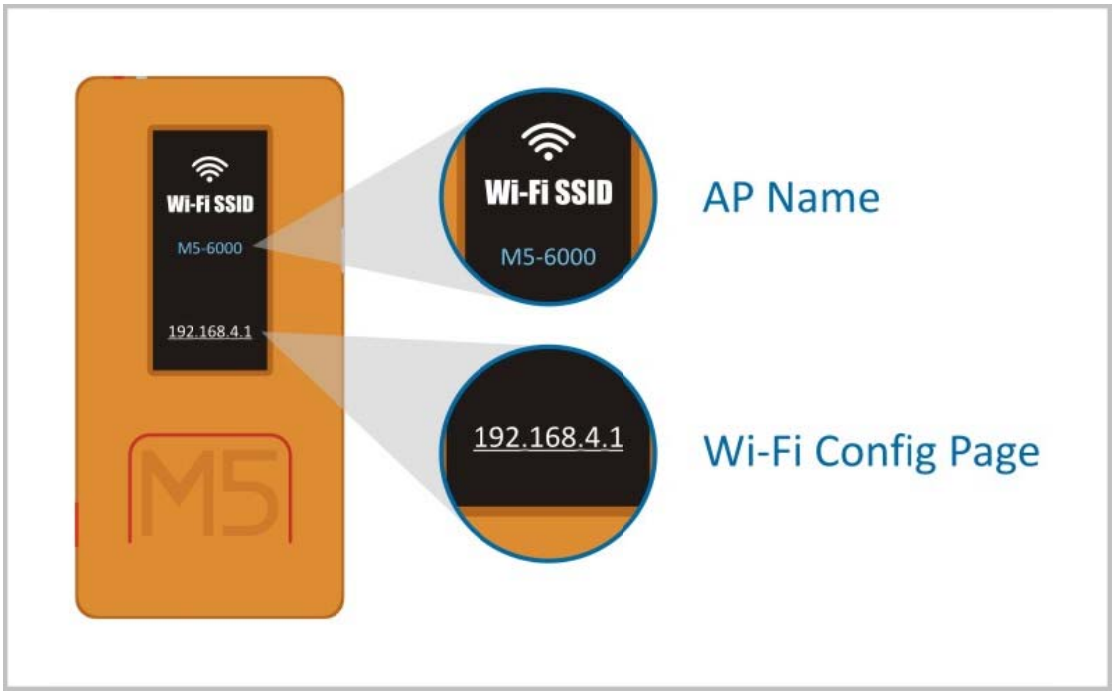
5.2.SETING WIFI

If you want use UIFlow web IDE, you will need to set the M5StickC to Wi-Fi mode:

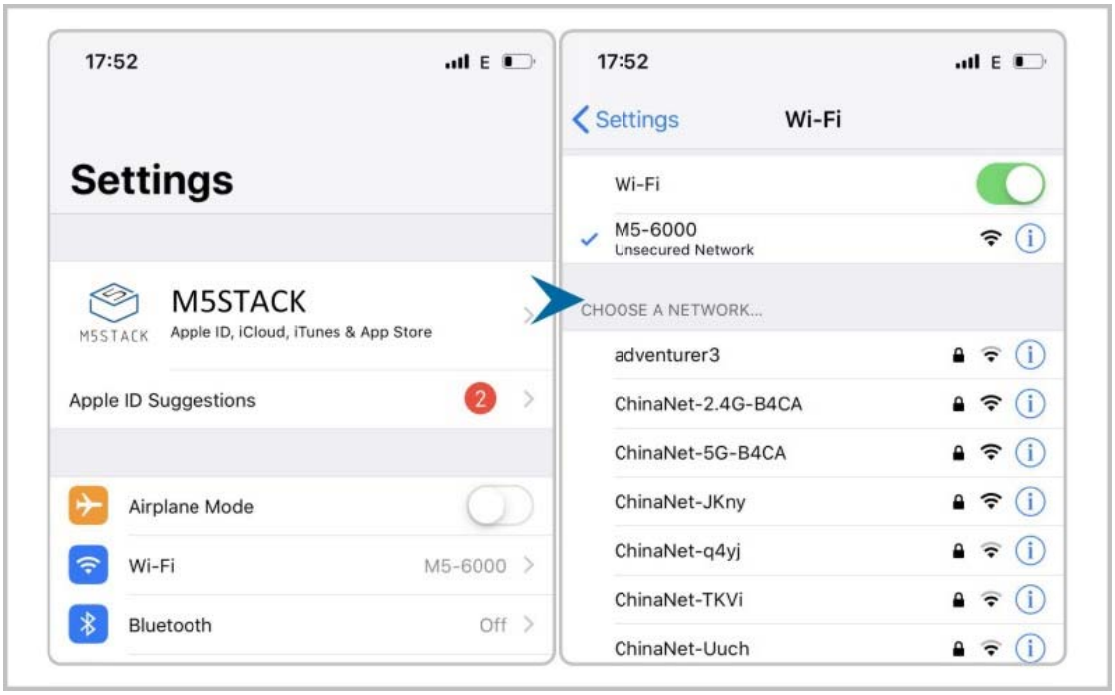
- Long press the left side button for 2 seconds, to Power on.



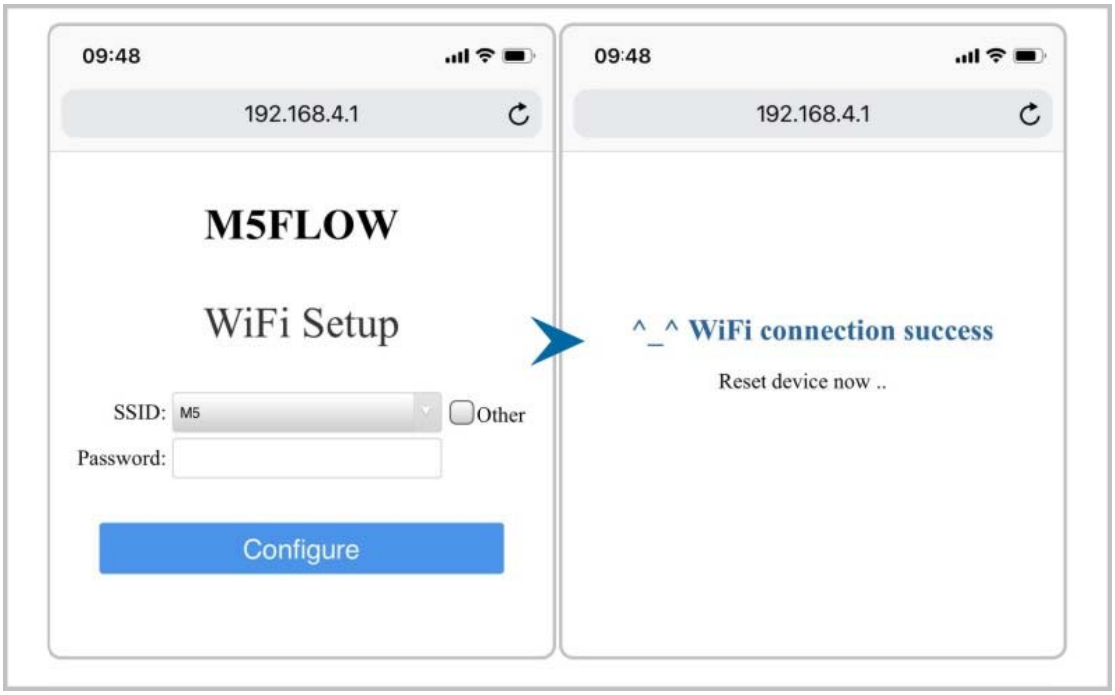
- Fist power on, it will enter into Wi-Fi config mode. The display on the screen shows the Wi-Fi access point name and Wi-Fi configuration page address.



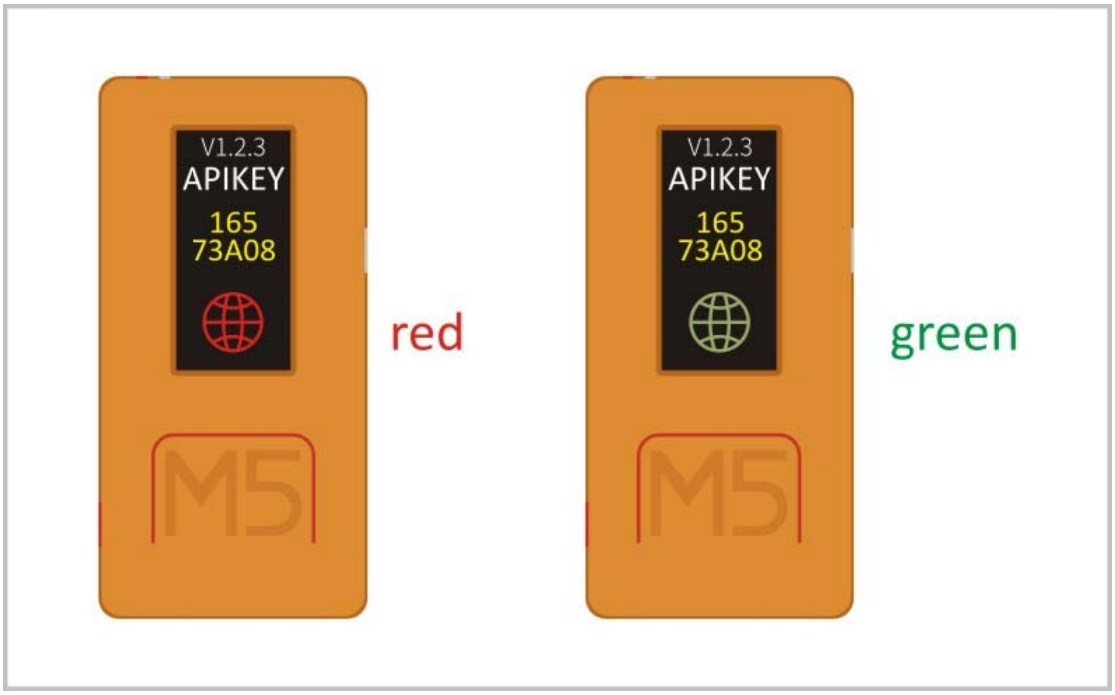
- Use you phone or other terminal device to connect this AP.



- When it is connected, use the browser on your connected terminal device to visit this address 192.168.4.1. In the Wi-Fi configuration page, choose your local Wi-Fi and type in the password.



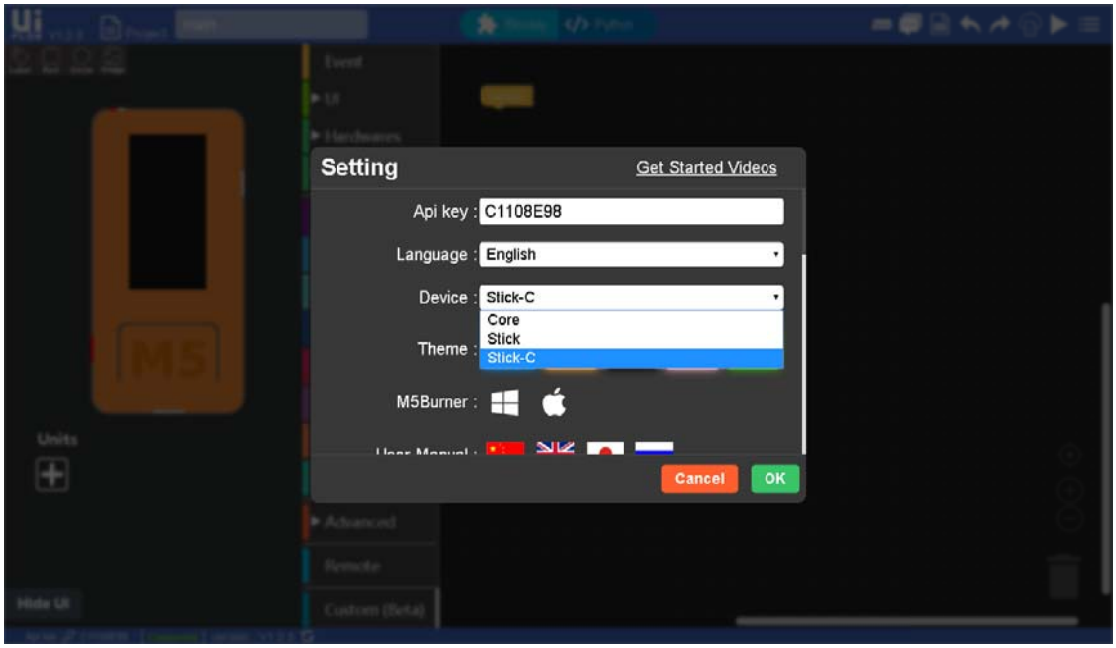
- After finish the Wi-Fi configuration, M5StickC will reboot, and automatically enter into web program mode. When the global icon on the screen turned Green, means it is connected to the UIFlow cloud. The display on the screen will show the API key which is used to pair up your device to the program page.



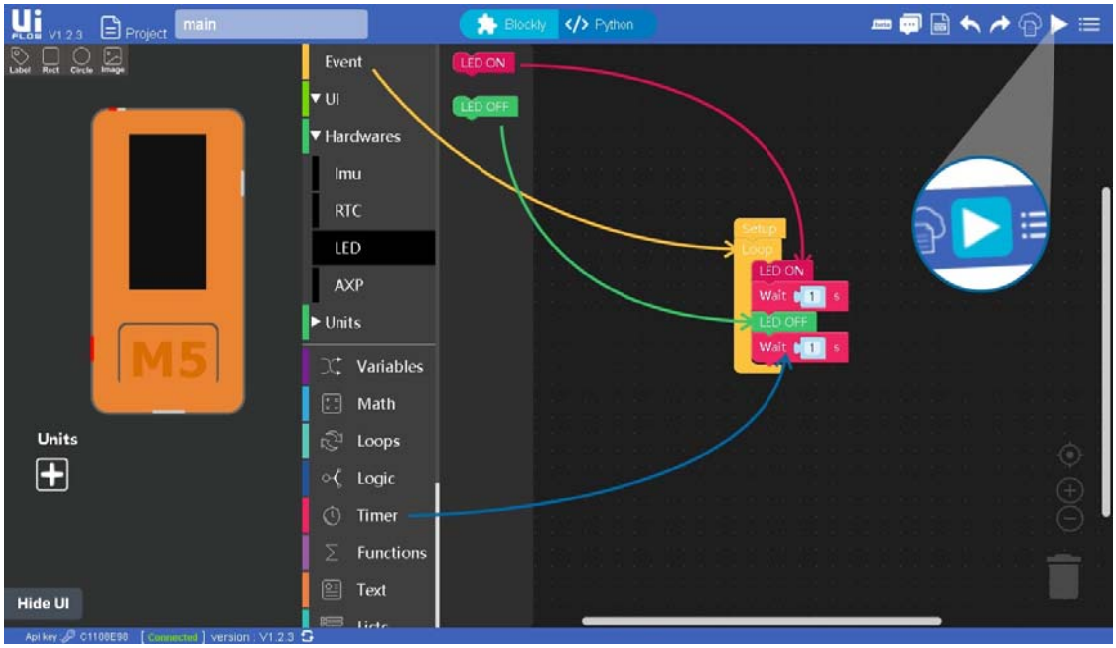
5.3.EXAMPLE

In this part, a demo code about how to light up an LED will be demonstrated :

- Visit UIFlow Web IDE, and enter into the program area, navigate to Setting, hit Setting, and type in the API key into the dialog box. Choose Stick-C, hit OK, and hold on until it specifies Connected.



- Find block 'Loop' (infinite) inside 'Event', drag it onto the program area and attach it underneath Setup .
- Find out to Hardwares -> LED in the middle area, click LED, drag the block inside into the program area, and attach it inside Loop



FCC Statement:

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.