

ESP32 系列教程之二： Linux 搭建 esp-idf 环境

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关于文档

本文档为 ESP32 教程系列，旨在为客户进行 ESP32 系列芯片开发提供环境搭建、工程示例演示等方面的参考文档及视频演示，降低 ESP32 系列芯片、模组开发的入门难度。

ESP32 教程系列文档主要参考于乐鑫官网提供的 ESP32 入门教程：https://docs.espressif.com/projects/esp-idf/zh_CN/latest/esp32/get-started/index.html。由于个人经验有限，文档编写过程中难免存在失误、错漏之处，欢迎广大开发爱好者对本文档提出批评建议。

版本信息：

日期	版本	作者	说明
2021.6.22	V1.0	Amiliya	首次发布
2021.7.09	V1.1	Amiliya	修改部分描述 更改部分图片 增加常见问题处理（章节 4.3） 文档格式调整

文档变更通知：以启明云端官网版本为准，恕不另行通知。

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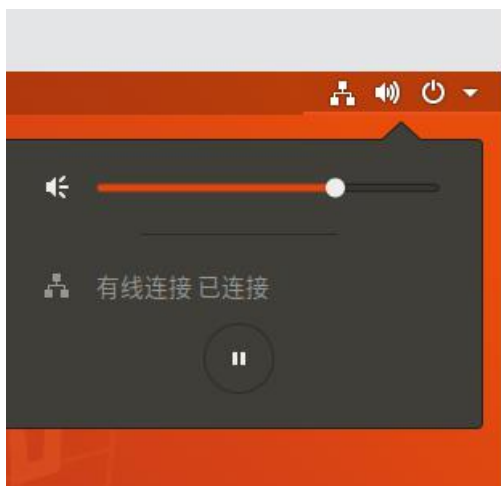
1 搭建 esp-idf 环境

1.1 安装虚拟机与 Ubuntu

本教程 esp-idf 环境搭建默认处于 Linux 环境下，非 Linux 环境请参考 ESP32 系列教程之一：安装虚拟机与 Ubuntu。

1.2 检查网络

打开终端，查看 Ubuntu 是否连接网络

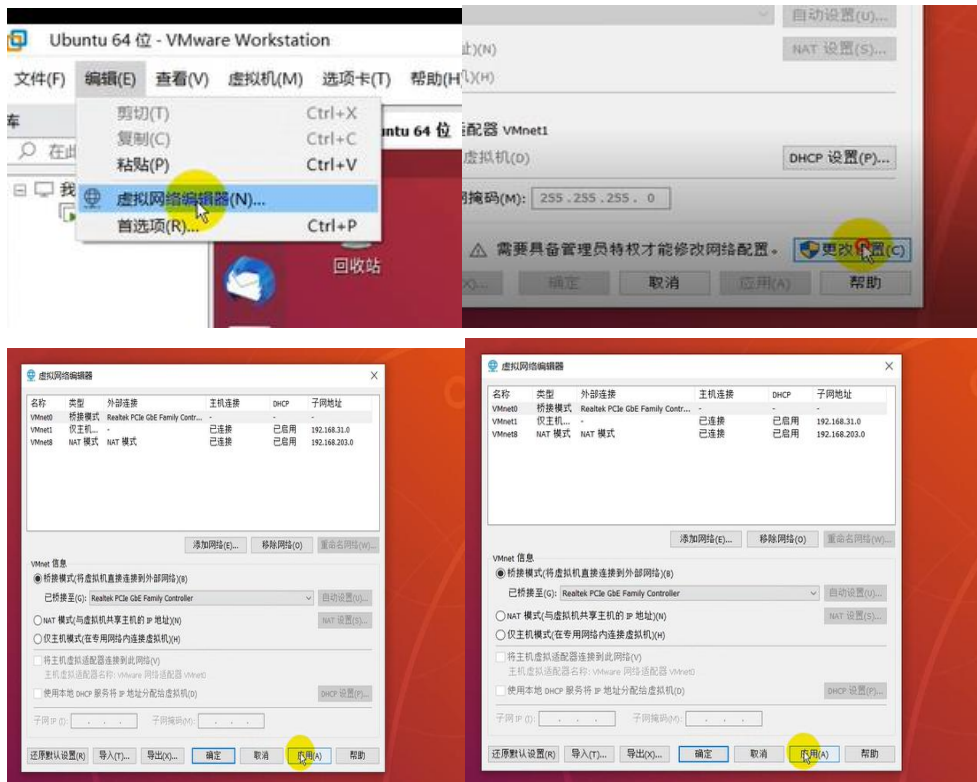


或使用命令检测：`ping www.baidu.com`

```
amiliya@ubuntu:~$ ping www.baidu.com
PING www.a.shifen.com (14.215.177.38) 56(84) bytes of data.
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=1 ttl=55 time=6.46 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=2 ttl=55 time=6.65 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=3 ttl=55 time=7.03 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=4 ttl=55 time=6.83 ms
64 bytes from 14.215.177.38 (14.215.177.38): icmp_seq=5 ttl=55 time=7.51 ms
^C
--- www.a.shifen.com ping statistics ---
```

若未联网，按以下步骤设置：

编辑->虚拟网络编辑器->更改设置->桥接模式(桥接至电脑 ip 描述)->应用->确定



1.3 下载 Python 软件包

```
sudo apt-get install git wget flex bison gperf python3 python3-pip python3-setuptools cmake ninja-build
ccache libffi-dev libssl-dev dfu-util libusb-1.0-0
```

```
antliya@ubuntu:~$ sudo apt-get install git wget flex bison gperf python3 python3-pip python3-setuptools cmake ninja-build ccache libffi-dev libssl-dev dfu-util libu
[sudo] antliya 的密码:
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
正在读取状态信息... 完成
libusb-1.0-0 已经是最新版 (2:1.0.21-2)。
libusb-1.0-0 已设置为手动安装。
python3 已经是最新版 (3.6.7-1~18.04)。
python3 已设置为手动安装。
wget 已经是最新版 (1.19.4-1ubuntu2.2)。
wget 已设置为手动安装。
将会同时安装下列软件包:
build-essential cmake-data cpp-7 dh-python dpkg-dev fakeroot g++ g++-7 gcc gcc-7 gcc-7-base gcc-8-base git-man libalgorithm-diff-perl libalgorithm-diff-xs-perl
libalgorithm-merge-perl libasan4 libatomic1 libbison-dev libc-dev-bin libc6 libc6-dev libc6-i386 libcc1-0 libcilkrts5 libcunl4 libdpkg-perl liberror-perl libexpat1
libfakeroot libffi-dev libffi2 libgcc-7-dev libgcc1 libgomp1 libitm1 libjsncpp1 liblsan0 libmpx2 libpython3-dev libpython3.6-dev libpython3.6-minimal
libpython3.6-stdlib libquadmath0 librtmp0 libsigsegv2 libssl1.1 libstdc++7-dev libstdc++6 libstdc++6 libstdc++6 libstdc++6 libstdc++6 libstdc++6 libstdc++6 libstdc++6
python3-dev python3-distutils python3-lib2to3 python3-wheel python3.6 python3.6-dev python3.6-minimal
建议安装:
bison-doc distcc cmake-doc gcc-7-locales debian-keyring flex-doc g++-multilib g++-7-multilib gcc-7-doc libstdc++6-7-dbg gcc-multilib autoconf automake libtool gcc
gcc-7-multilib libgcc1-dbg libgomp1-dbg libitm1-dbg libatomic1-dbg libasan4-dbg liblsan0-dbg libstdc++6-dbg libstdc++6-dbg libstdc++6-dbg libstdc++6-dbg libstdc++6-dbg
git-daemon-run | git-daemon-sysvinit git-doc git-el git-email git-gui gitk gitweb gitweb-daemon gitweb-dev gitweb-dev gitweb-dev gitweb-dev gitweb-dev gitweb-dev
python3-setuptools-doc python3.6-venv python3.6-doc binfmt-support
下列【新】软件包将被安装:
```

```
python3.6-minimal
升级了 17 个软件包, 新安装了 61 个软件包, 要卸载 0 个软件包, 有 449 个软件包未被升级。
需要下载 91.6 MB/116 MB 的归档。
解压后会消耗 279 MB 的额外空间。
您希望继续执行吗? [Y/n] y
获取:1 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 libsigsegv2 amd64 2.12-1 [14.7 kB]
获取:2 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 m4 amd64 1.4.18-1 [197 kB]
获取:3 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 flex amd64 2.6.4-6 [316 kB]
获取:4 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 libbison-dev amd64 2:3.0.4.dfsg-1build1 [339 kB]
获取:5 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 bison amd64 2:3.0.4.dfsg-1build1 [266 kB]
获取:6 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libc-dev-bin amd64 2.27-3ubuntu1.4 [71.8 kB]
获取:7 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 linux-libc-dev amd64 4.15.0-144.148 [1,003 kB]
获取:8 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libc6-dev amd64 2.27-3ubuntu1.4 [2,585 kB]
获取:9 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libitm1 amd64 8.4.0-1ubuntu1-18.04 [27.9 kB]
获取:10 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libatomic1 amd64 8.4.0-1ubuntu1-18.04 [9,192 B]
获取:11 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libasan4 amd64 7.5.0-3ubuntu1-18.04 [358 kB]
获取:12 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 liblsan0 amd64 8.4.0-1ubuntu1-18.04 [133 kB]
获取:13 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libstdc++6 amd64 8.4.0-1ubuntu1-18.04 [288 kB]
获取:14 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libstdc++6 amd64 8.4.0-1ubuntu1-18.04 [126 kB]
```

1.4 安装 git 工具

```
sudo apt install git
```

1.5 获取 ESP-IDF

使用终端命令创建工程文件夹，文件夹名称可以自己定义，例如我创建的文件夹名称为 esp_4.3

```
mkdir esp_4.3
```

```
cd esp_4.3
```

```
git clone -b release/v4.3 --recursive https://github.com/cnpmjs.org/expressif/esp-idf.git
```

(注: -b release/v4.3 表示 esp-idf 下载版本(最新版)，需要下载其它版本或版本介绍请移至乐鑫官网查看具体介绍)

```
处理 delta 中: 100% (40171/40171), 完成.
克隆到 '/home/amiya/esp_4.3/esp-idf/components/nghttp/nghttp2/third-party/neverbleed'...
remote: Enumerating objects: 234, done.
remote: Total 234 (delta 0), reused 0 (delta 0), pack-reused 234
接收对象中: 100% (234/234), 83.16 KiB | 211.00 KiB/s, 完成.
处理 delta 中: 100% (144/144), 完成.
+ 模组路径 'components/nghttp/nghttp2/third-party/mruby': 检出 '7c91efc1ffda769a5f1a872c646c82b00698f1b8'
+ 模组路径 'components/nghttp/nghttp2/third-party/neverbleed': 检出 'b967ca054f48a36f82d8fcd32e54ec5144f2751'
+ 模组路径 'components/protobuf-c/protobuf-c': 检出 'dac1a65feac4ad72f612aab99f487056fbc5c1a'
+ 模组路径 'components/spiffs/spiffs': 检出 'f5e26c4e933189593a71c6b82cda381a7b21e41c'
+ 模组路径 'components/tinyusb/tinyusb': 检出 '334e95fac52a607150157ae5199a19e11f843982'
+ 模组路径 'components/unity/unity': 检出 '7d2bf62b7e6afaf3815041a9d53c21aecca9a25'
+ 模组路径 'examples/build_system/cmake/import_lib/main/lib/tinyxml2': 检出 '7e8e249990ec491ec15990cf95b6d871a66cf64a'
+ 模组路径 'examples/peripherals/secure_element/atecc608_ecdsa/components/esp-cryptoauthlib': 检出 'bb672b0437485fc7420add178299631692b15ac3'
amiya@ubuntu:~/esp_4.3$
```

若子模组未完全克隆，可参考[章节 4.3.2](#)

1.6 安装其它工具

除了 ESP-IDF 本身，您还需要安装 ESP-IDF 使用的各种工具，比如编译器、调试器、Python 包等！

1.6.1 查看当前 Python 版本

终端输入命令: `ls /usr/bin/python*`

```
amiya@ubuntu:~$ ls /usr/bin/python*
/usr/bin/python  /usr/bin/python2.7  /usr/bin/python2-config  /usr/bin/python3.6  /usr/bin/python3.6m  /usr/bin/python3-config  /usr/bin/python3m-config
/usr/bin/python2  /usr/bin/python2.7-config  /usr/bin/python3  /usr/bin/python3.6-config  /usr/bin/python3.6m-config  /usr/bin/python3m  /usr/bin/python-config
amiya@ubuntu:~$
```

这代表已安装 python3, 输入 `python3` 查看 python 版本为 3.6.9

```
amiya@ubuntu:~/usr/bin$ python3
Python 3.6.9 (default, Jan 26 2021, 15:33:00)
[GCC 8.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information
>>>
```


1.6.2 将 python3 设置为默认 python

进入用户 bin 目录下，将 python3.6 链接到 python 下。

```
cd /usr/bin
ln -s python3.6m python
```

执行命令：python，出现下图，说明链接成功

```
amiliya@ubuntu:/usr/bin$ python
Python 3.6.9 (default, Jan 26 2021, 15:33:00)
[GCC 8.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> 退出（核心已转储）
amiliya@ubuntu:/usr/bin$
```

若系统 python 版本小于 3.6，可参考[章节 4.3.3](#)

安装 python3.6 的 pip:

```
sudo apt-get install python3-pip
```

1.6.3 安装工具

运行 `./install.sh` 最终结果如下:

```
one/amiliya/esp_4.3/esp-idf/requirements.txt (line 15)) (1.1.0)
Requirement already satisfied: MarkupSafe==2.0 in /home/amiliya/.espressif/python_env/ldf4.3_py3.6_env/lib/python3.6/site-packages (from Jinja2==2.4->Flask<1.0,=>0.12.2->gdbgui==0.1
3.2.0->-r /home/amiliya/esp_4.3/esp-idf/requirements.txt (line 15)) (2.0.1)
Requirement already satisfied: zipp==0.5 in /home/amiliya/.espressif/python_env/ldf4.3_py3.6_env/lib/python3.6/site-packages (from Importlib-metadata->click==7.0->-r /home/amiliya/e
sp_4.3/esp-idf/requirements.txt (line 8)) (3.4.1)
Requirement already satisfied: typing-extensions==3.6.4 in /home/amiliya/.espressif/python_env/ldf4.3_py3.6_env/lib/python3.6/site-packages (from Importlib-metadata->click==7.0->-r
/home/amiliya/esp_4.3/esp-idf/requirements.txt (line 8)) (3.10.0)
All done! You can now run:
./export.sh
amiliya@ubuntu:~/esp_4.3/esp-idf$
```

1.6.4 激活 esp-idf 环境

执行 `./export.sh`

```
/home/amiliya/esp_4.3/esp-idf/components/esptool_py/esptool
/home/amiliya/esp_4.3/esp-idf/components/espressif
/home/amiliya/esp_4.3/esp-idf/components/partition_table
/home/amiliya/esp_4.3/esp-idf/components/app_update
/home/amiliya/.espressif/tools/xtensa-esp32-elf/esp-2021r1-8.4.0/xtensa-esp32-elf/bin
/home/amiliya/.espressif/tools/xtensa-esp32s2-elf/esp-2021r1-8.4.0/xtensa-esp32s2-elf/bin
/home/amiliya/.espressif/tools/xtensa-esp32s3-elf/esp-2021r1-8.4.0/xtensa-esp32s3-elf/bin
/home/amiliya/.espressif/tools/riscv32-esp-elf/esp-2021r1-8.4.0/riscv32-esp-elf/bin
/home/amiliya/.espressif/tools/esp32ulp-elf/2.28.51-esp-20191205/esp32ulp-elf-binutils/bin
/home/amiliya/.espressif/tools/esp32s2ulp-elf/2.28.51-esp-20191205/esp32s2ulp-elf-binutils/bin
/home/amiliya/.espressif/tools/openocd-esp32/v0.10.0-esp32-20210401/openocd-esp32/bin
/home/amiliya/.espressif/python_env/ldf4.3_py3.6_env/bin
/home/amiliya/esp_4.3/esp-idf/tools
Done! You can now compile ESP-IDF projects.
Go to the project directory and run:
idf.py build
Traceback (most recent call last):
  File "/home/amiliya/esp_4.3/esp-idf/tools/idf.py", line 812, in <module>
    main()
  File "/home/amiliya/esp_4.3/esp-idf/tools/idf.py", line 730, in main
    cli(sys.argv[1:], prog_name=PROG, complete_var=' _IDF_PY_COMPLETE')
  File "/home/amiliya/.espressif/python_env/ldf4.3_py3.6_env/lib/python3.6/site-packages/click/core.py", line 1137, in call
```

到这一步表明 esp-idf 环境已经基本搭建完成，可以运行示例代码，若需要长期、多次运行 esp32 相关示例代码则建议将 esp-idf 环境加入环境变量。

1.7 将 esp-idf 环境加入环境变量

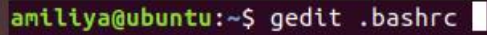
复制并粘贴以下命令到 shell 配置文件中（`.profile`，`.bashrc`，`.zprofile` 等）

```
alias get_idf='. $HOME/esp_4.3/esp-idf/export.sh'
```

(注：文件路径需要正确，如文件夹名称 esp_4.3)

以 .bashrc 为例：

打开 .bashrc 文件



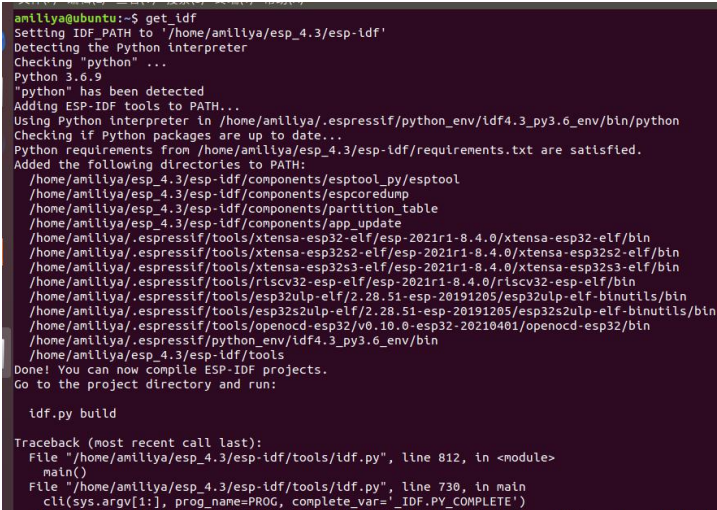
```
amiliya@ubuntu:~$ gedit .bashrc
```

添加命令：（需要不同版本的 IDF 时都可以加入命令，只要变量名 get_idf 不同即可）

```
if ! shopt -oq posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
    . /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
    . /etc/bash_completion
  fi
fi
alias get_idf='. $HOME/esp_4.3/esp-idf/export.sh'
```

保存关闭，重启虚拟机或使用命令刷新配置文件：source ~/.bashrc

最终效果如下：执行 get_idf 便可以让端口进入 esp-idf 环境：



```
amiliya@ubuntu:~$ get_idf
Setting IDF_PATH to "/home/amiliya/esp_4.3/esp-idf"
Detecting the Python interpreter
Checking "python" ...
Python 3.6.9
"python" has been detected
Adding ESP-IDF tools to PATH...
Using Python interpreter in /home/amiliya/.espressif/python_env/idf4.3_py3.6_env/bin/python
Checking if Python packages are up to date...
Python requirements from /home/amiliya/esp_4.3/esp-idf/requirements.txt are satisfied.
Added the following directories to PATH:
/home/amiliya/esp_4.3/esp-idf/components/esptool_py/esptool
/home/amiliya/esp_4.3/esp-idf/components/espcoredump
/home/amiliya/esp_4.3/esp-idf/components/partition_table
/home/amiliya/esp_4.3/esp-idf/components/app_update
/home/amiliya/.espressif/tools/xtensa-esp32-elf/esp-2021r1-8.4.0/xtensa-esp32-elf/bin
/home/amiliya/.espressif/tools/xtensa-esp32s2-elf/esp-2021r1-8.4.0/xtensa-esp32s2-elf/bin
/home/amiliya/.espressif/tools/xtensa-esp32s3-elf/esp-2021r1-8.4.0/xtensa-esp32s3-elf/bin
/home/amiliya/.espressif/tools/riscv32-esp-elf/esp-2021r1-8.4.0/riscv32-esp-elf/bin
/home/amiliya/.espressif/tools/esp32ulp-elf/2.28.51-esp-20191205/esp32ulp-elf-binutils/bin
/home/amiliya/.espressif/tools/esp32s2ulp-elf/2.28.51-esp-20191205/esp32s2ulp-elf-binutils/bin
/home/amiliya/.espressif/tools/openocd-esp32/v0.10.0-esp32-20210401/openocd-esp32/bin
/home/amiliya/.espressif/python_env/idf4.3_py3.6_env/bin
/home/amiliya/esp_4.3/esp-idf/tools
Done! You can now compile ESP-IDF projects.
Go to the project directory and run:

idf.py build

Traceback (most recent call last):
  File "/home/amiliya/esp_4.3/esp-idf/tools/idf.py", line 812, in <module>
    main()
  File "/home/amiliya/esp_4.3/esp-idf/tools/idf.py", line 730, in main
    cli(sys.argv[1:], prog_name=PROG, complete_var='IDF.PY_COMPLETE')
```


2 运行 hello_world 示例

2.1 拷贝工程

将 `esp-idf/examples/get-started/` 目录下的 `hello_world` 示例拷贝到 `esp_4.3` 下

```
cp esp-idf/examples/get-started/hello_world/ ./ -r
```

```
amiliya@ubuntu:~/esp_4.3$ cp esp-idf/examples/get-started/hello_world/ ./ -r
amiliya@ubuntu:~/esp_4.3$ ls
esp-idf  hello_world
amiliya@ubuntu:~/esp_4.3$
```

2.2 工程配置

进入 `hello_world` 示例，进行工程配置：

```
cd ~/esp_4.3/hello_world
```

```
idf.py set-target esp32
```

 (使用其它芯片请选择对应芯片类型，如：esp32c3)

(打开一个新项目后，应首先设置“目标”芯片 `idf.py set-target esp32`。注意，此操作将清除并初始化项目之前的编译和配置（如有）。您也可以直接将“目标”配置为环境变量（此时可跳过该步骤）)

```
idf.py menuconfig
```

如果之前的步骤都正确，则会显示下面的菜单：

```
(Top)
Espressif IoT Development Framework Configuration
SDK tool configuration --->
Build type --->
Application manager --->
Bootloader config --->
Security features --->
Serial flasher config --->
Partition Table --->
Compiler options --->
Component config --->
Compatibility options --->

[Space/Enter] Toggle/enter  [ESC] Leave menu          [S] Save
[O] Load                    [?] Symbol info           [/] Jump to symbol
[F] Toggle show-help mode   [C] Toggle show-name mode [A] Toggle show-all mode
[Q] Quit (prompts for save) [D] Save minimal config (advanced)
```

工程配置 — 主窗口

您可以通过此菜单设置项目的具体变量，包括 Wi-Fi 网络名称、密码和处理器速度等。hello_world 示例项目会以默认配置运行，因此可以跳过使用 menuconfig 进行项目配置这一步骤。

2.3 编译工程

idf.py build

```
amiliya@ubuntu:~/esp_4.3$ cd hello_world/
amiliya@ubuntu:~/esp_4.3/hello_world$ idf.py build
Executing action: all (aliases: build)
Running cmake in directory /home/amiliya/esp_4.3/hello_world/build
Executing "cmake -G Ninja -DPYTHON_DEPS_CHECKED=1 -DESP_PLATFORM=1 -DCCACHE_ENABLE=0 /home/amiliya/esp_4.3/hello_world"...
-- Found Git: /usr/bin/git (found version "2.17.1")
-- IDf TARGET not set, using default target: esp32
-- The C compiler identification is GNU 8.4.0
-- The CXX compiler identification is GNU 8.4.0
-- The ASM compiler identification is GNU
-- Found assembler: /home/amiliya/.espressif/tools/xtensa-esp32-elf/esp-2021r1-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf-gcc
-- Check for working C compiler: /home/amiliya/.espressif/tools/xtensa-esp32-elf/esp-2021r1-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf-gcc
-- Check for working C compiler: /home/amiliya/.espressif/tools/xtensa-esp32-elf/esp-2021r1-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf-gcc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /home/amiliya/.espressif/tools/xtensa-esp32-elf/esp-2021r1-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf-g++
-- Check for working CXX compiler: /home/amiliya/.espressif/tools/xtensa-esp32-elf/esp-2021r1-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf-g++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done

merged 1 ELF section
generated /home/amiliya/esp_4.3/hello_world/build/bootloader/bootloader.bin
983/983 Generating binary image from built executable
esptool.py v3.1-dev
merged 2 ELF sections
generated /home/amiliya/esp_4.3/hello_world/build/hello-world.bin

project build complete. To flash, run this command:
/home/amiliya/.espressif/python_env/idf4.3_py3.6_env/bin/python ../esp-idf/components/esptool.py/esptool/esptool.py -p (PORT) -b 460800 --before default_reset --after hard_reset --c
ip esp32 write_flash --flash_mode dio --flash_size detect --flash_freq 40m 0x1000 build/bootloader/bootloader.bin 0x8000 build/partition_table/partition-table.bin 0x10000 build/he
llo-world.bin
r run 'idf.py -p (PORT) flash'
amiliya@ubuntu:~/esp_4.3/hello_world$
```

从机中移出或按 Ctrl+Alt。

2.4 硬件连接

用 USB 线将 ESP32 模组与电脑连接：



选择连接到虚拟机->Ubuntu 64 位->确定

2.5 查看端口

查看下载端口：`ls /dev/tty*`

```
amiliya@ubuntu:~/esp_4.3/hello_world$ ls /dev/tty*
/dev/tty /dev/tty15 /dev/tty22 /dev/tty3 /dev/tty37 /dev/tty44 /dev/tty51 /dev/tty59 /dev/tty9 /dev/tty14 /dev/tty21 /dev/tty29 /dev/tty58
/dev/tty0 /dev/tty16 /dev/tty23 /dev/tty30 /dev/tty38 /dev/tty45 /dev/tty52 /dev/tty6 /dev/ttyprintk /dev/tty515 /dev/tty222 /dev/tty53 /dev/tty59
/dev/tty1 /dev/tty17 /dev/tty24 /dev/tty31 /dev/tty39 /dev/tty46 /dev/tty53 /dev/tty60 /dev/tty50 /dev/tty516 /dev/tty523 /dev/tty530 /dev/tty580
/dev/tty10 /dev/tty18 /dev/tty25 /dev/tty32 /dev/tty4 /dev/tty47 /dev/tty54 /dev/tty61 /dev/tty51 /dev/tty517 /dev/tty524 /dev/tty531
/dev/tty11 /dev/tty19 /dev/tty26 /dev/tty33 /dev/tty40 /dev/tty48 /dev/tty55 /dev/tty62 /dev/tty510 /dev/tty518 /dev/tty525 /dev/tty54
/dev/tty12 /dev/tty2 /dev/tty27 /dev/tty34 /dev/tty41 /dev/tty49 /dev/tty56 /dev/tty63 /dev/tty511 /dev/tty519 /dev/tty526 /dev/tty55
/dev/tty13 /dev/tty20 /dev/tty28 /dev/tty35 /dev/tty42 /dev/tty5 /dev/tty57 /dev/tty7 /dev/tty512 /dev/tty52 /dev/tty527 /dev/tty56
/dev/tty14 /dev/tty21 /dev/tty29 /dev/tty36 /dev/tty43 /dev/tty50 /dev/tty58 /dev/tty513 /dev/tty520 /dev/tty528 /dev/tty57
amiliya@ubuntu:~/esp_4.3/hello_world$
```

可以看见多出来的端口号为 `/dev/ttyUSB0`，即为下载端口号

2.6 工程烧录

进行烧录：`idf.py -p /dev/ttyUSB0 flash`

出现如下错误说明我们对该端口没有读写权限：

```
_main()
File "/home/amiliya/esp_4.1/esp-idf/components/esptool_py/esptool/esptool.py", line 3415, in _main
main()
File "/home/amiliya/esp_4.1/esp-idf/components/esptool_py/esptool/esptool.py", line 3079, in main
esp = chip_class(each_port, initial_baud, args.trace)
File "/home/amiliya/esp_4.1/esp-idf/components/esptool_py/esptool/esptool.py", line 261, in __init__
self._port = serial.serial_for_url(port)
File "/home/amiliya/.espressif/python_env/idf4.1_py3.6_env/lib/python3.6/site-packages/serial/__init__.py", line 90, in serial_for_url
instance.open()
File "/home/amiliya/.espressif/python_env/idf4.1_py3.6_env/lib/python3.6/site-packages/serial/serialposix.py", line 325, in open
raise SerialException(msg.errno, "could not open port {}: {}".format(self._port, msg))
serial.serialutil.SerialException: [Errno 13] could not open port /dev/ttyUSB0: [Errno 13] Permission denied: '/dev/ttyUSB0'
esptool.py failed with exit code 1
amiliya@ubuntu:~/esp_4.3/hello_world$
```

通过以下命令，将用户添加到 `dialout` 组，从而获许读写权限：

`sudo usermod -a -G dialout $USER`

`reboot`（重启虚拟机）

重新烧录：

```
Flash will be erased from 0x00001000 to 0x00007fff...
Flash will be erased from 0x00010000 to 0x00037fff...
Compressed 3072 bytes to 103...
Writing at 0x00008000... (100 %)
Wrote 3072 bytes (103 compressed) at 0x00008000 in 0.1 seconds (effective 429.2 kbit/s)...
Hash of data verified.
Compressed 25152 bytes to 15450...
Writing at 0x00001000... (100 %)
Wrote 25152 bytes (15450 compressed) at 0x00001000 in 0.7 seconds (effective 278.0 kbit/s)...
Hash of data verified.
Compressed 162976 bytes to 85495...
Writing at 0x00010000... (16 %)
Writing at 0x0001acae... (33 %)
Writing at 0x0002048a... (50 %)
Writing at 0x00025c9f... (66 %)
Writing at 0x0002f4e3... (83 %)
Writing at 0x000360b0... (100 %)
Wrote 162976 bytes (85495 compressed) at 0x00010000 in 2.4 seconds (effective 538.9 kbit/s)...
Hash of data verified.
Leaving...
Hard resetting via RTS pin...
Done
amiliya@ubuntu:~/esp_4.3/hello_world$
```

烧录成功！

2.7 监视工程

查看监视器：`idf.py -p /dev/ttyUSB0 monitor`

```
W (296) spi_flash: Detected size(4096k) larger than the size in the binary image header(2048k). Using the s
I (307) cpu_start: Starting scheduler on PRO CPU.
I (0) cpu_start: Starting scheduler on APP CPU.
Hello world!
This is ESP32 chip with 2 CPU cores, WiFi/BT/BLE, silicon revision 1, 2MB external flash
Restarting in 10 seconds...
Restarting in 9 seconds...
Restarting in 8 seconds...
Restarting in 7 seconds...
Restarting in 6 seconds...
Restarting in 5 seconds...
Restarting in 4 seconds...
```

成功打印 `hello_world`。

3 参考视频

（注：为保证视频质量，演示视频并未录制声音，同时对于一些长时间下载过程进行了缩略录制，视频仅作为本文档参考文件。）



Video_1.wmv



Video_2.wmv

4 后 记

4.1 注意事项

- (1) Ubuntu 版本建议在 16.0 以上，搭建 esp-idf 环境需要保证网络通畅
- (2) python 版本必须保证 3.6 以上且为系统默认 python
- (3) 环境变量可添加多个，可通过调用不同变量名选择不同版本的 IDF
- (4) 工程配置中选择目标芯片的过程对某些芯片是必要的，如 ESP32-C3
- (5) 端口权限也可以通过命令 `chmod` 修改，但那只是暂时的
- (6) 进行 ESP32-C3 的开发必需使用最新版（V4.3）IDF 的支持

4.2 相关建议

使用 Linux 系统进行开发是众多开发爱好者较为普遍的选择，Linux 较强的兼容性是其最大的优势，众多命令的使用让它在开发层面自由度更高。但是由于缺少图形化的文本编辑器，Ubuntu 在代码的查看与编辑方面较为弱势，因此常与其它文本编辑器联合使用，如 VS Code。因此，ESP32 系列教程之三将继续介绍 VS Code 远程连接 Linux 的方法，将代码的编写与烧录变得更加方便与简洁。

除了 Linux 外，ESP32 系列教程后续将介绍在 Windows 搭建 esp-idf 环境的方法，习惯使用 Windows 系统进行开发的开发爱好者可查看 ESP32 系列教程之四(Windows)和 ESP32 系列教程之五（Eclipse）了解相关操作过程。

4.3 常见问题

由于 esp-idf 环境搭建过程中由于各种原因容易遇到各种问题，此章节整理了一些常见的问题以供大家参考，其它相关问题可提交至意见提交邮箱。

4.3.1 ESP-IDF 的获取

部分开发者由于网络等原因无法从 github 获取 esp-idf，可参考下方步骤从国内的 gitee 获取 esp-idf。

(1) 获取 esp-idf

```
git clone -b release/v4.3 https://gitee.com/EsspressifSystems/esp-idf.git
```

```

amiliya@DESKTOP-LDC9RD8:~/esp$ git clone -b release/v4.3 https://gitee.com/EsspressifSystems/esp-idf.git
正克隆到 'esp-idf'...
remote: Enumerating objects: 30044, done.
remote: Counting objects: 100% (30044/30044), done.
remote: Compressing objects: 100% (11812/11812), done.
remote: Total 250881 (delta 20441), reused 24664 (delta 17190), pack-reused 220837
接收对象中: 100% (250881/250881), 139.96 MiB | 5.57 MiB/s, 完成.
处理 delta 中: 100% (185486/185486), 完成.
正在更新文件: 100% (8306/8306), 完成.
amiliya@DESKTOP-LDC9RD8:~/esp$ cd esp-idf/

```

(2) 下载工具

```
git clone https://gitee.com/EsspressifSystems/esp-gitee-tools.git
```

```

amiliya@DESKTOP-LDC9RD8:~/esp$ git clone https://gitee.com/EsspressifSystems/esp-gitee-tools.git
正克隆到 'esp-gitee-tools'...
remote: Enumerating objects: 48, done.
remote: Counting objects: 100% (48/48), done.
remote: Compressing objects: 100% (47/47), done.
remote: Total 48 (delta 19), reused 0 (delta 0), pack-reused 0
展开对象中: 100% (48/48), 15.36 KiB | 249.00 KiB/s, 完成.
amiliya@DESKTOP-LDC9RD8:~/esp$ ls
esp-gitee-tools  esp-idf
amiliya@DESKTOP-LDC9RD8:~/esp$

```

(3) 下载子模块和工具链

进入工具文件夹，保存路径

```
cd esp-gitee-tools
```

```
export EGT_PATH=$(pwd)
```

进入 esp-idf 文件夹，下载子模块和工具链

```
cd ~/esp-idf/
```

```
$EGT_PATH/submodule-update.sh
```

```

amiliya@DESKTOP-LDC9RD8:~/esp$ cd esp-gitee-tools/
amiliya@DESKTOP-LDC9RD8:~/esp-esp-gitee-tools$ export EGT_PATH=$(pwd)
amiliya@DESKTOP-LDC9RD8:~/esp-esp-gitee-tools$ cd ../esp-idf/
amiliya@DESKTOP-LDC9RD8:~/esp-esp-idf$ $EGT_PATH/submodule-update.sh
子模块 'components/asio/asio' (https://gitee.com/esspressif/asio.git) 已对路径 'components/asio/asio' 注册
子模块 'components/bootloader/subproject/components/micro-ecc/micro-ecc' (https://gitee.com/kmackay/micro-ecc.git) 已对
路径 'components/bootloader/subproject/components/micro-ecc/micro-ecc' 注册
子模块 'components/bt/controller/lib_esp32' (https://gitee.com/esspressif/esp32-bt-lib.git) 已对路径 'components/bt/controller/lib_esp32' 注册
子模块 'components/bt/controller/lib_esp32c3_family' (https://gitee.com/esspressif/esp32c3-bt-lib.git) 已对路径 'components/bt/controller/lib_esp32c3_family' 注册
子模块 'components/bt/host/nimble/nimble' (https://gitee.com/esspressif/esp-nimble.git) 已对路径 'components/bt/host/nimble/nimble' 注册
子模块 'components/chor/tinychor' (https://gitee.com/intel/tinychor.git) 已对路径 'components/chor/tinychor' 注册
子模块 'components/cmock/CMock' (https://gitee.com/ThrowTheSwitch/CMock.git) 已对路径 'components/cmock/CMock' 注册
子模块 'components/coap/libcoap' (https://gitee.com/obgm/libcoap.git) 已对路径 'components/coap/libcoap' 注册
子模块 'components/esp_wifi/lib' (https://gitee.com/esspressif/esp32-wifi-lib.git) 已对路径 'components/esp_wifi/lib' 注册
子模块 'components/esptool_py/esptool' (https://gitee.com/esspressif/esptool.git) 已对路径 'components/esptool_py/esptool' 注册

```

```
$EGT_PATH/install.sh
```

```

amiliya@DESKTOP-LDC9RD8:~/esp-esp-idf$ $EGT_PATH/install.sh
Installing ESP-IDF tools
Installing tools: xtensa-esp32-elf, xtensa-esp32s2-elf, xtensa-esp32s3-elf, riscv32-esp-elf, esp32ulp-elf, esp32s2ulp-elf,
f. openocd-esp32
Skipping xtensa-esp32-elf@esp-2021r1-8.4.0 (already installed)
Skipping xtensa-esp32s2-elf@esp-2021r1-8.4.0 (already installed)
Skipping xtensa-esp32s3-elf@esp-2021r1-8.4.0 (already installed)
Skipping riscv32-esp-elf@esp-2021r1-8.4.0 (already installed)
Skipping esp32ulp-elf@2.28.51-esp-20191205 (already installed)
Skipping esp32s2ulp-elf@2.28.51-esp-20191205 (already installed)
Skipping openocd-esp32@v0.10.0-esp32-20210401 (already installed)
Installing Python environment and packages
Python 3.8.10
pip 21.1.3 from /home/amiliya/.espressif/python_env/idf4.3_py3.8_env/lib/python3.8/site-packages/pip (python 3.8)

```



```

Requirement already satisfied: brotli in /home/amiliya/.espressif/python_env/idf4.3_py3.8_env/lib/python3.8/site-packages
s (from Flask-Compress<2.0,>=1.4.0->gdbgui==0.13.2.0->r /home/amiliya/esp/esp-idf/requirements.txt (line 15)) (1.0.9)
Requirement already satisfied: greenlet<0.4.14 in /home/amiliya/.espressif/python_env/idf4.3_py3.8_env/lib/python3.8/site-packages
s (from Flask-Compress<2.0,>=1.4.0->gdbgui==0.13.2.0->r /home/amiliya/esp/esp-idf/requirements.txt (line 15)) (1.0.9)
Requirement already satisfied: MarkupSafe<2.0 in /home/amiliya/.espressif/python_env/idf4.3_py3.8_env/lib/python3.8/site-packages
s (from Jinja2<2.4->Flask<1.0,>=0.12.2->gdbgui==0.13.2.0->r /home/amiliya/esp/esp-idf/requirements.txt (line 15)) (2.0.1)
All done! You can now run:
. /home/amiliya/esp/esp-idf/export.sh
amiliya@DESKTOP-1DCQD8: ~/esp/esp-idf$

```

(4) 其余步骤参照 [章节 1.6-1.7](#)

4.3.2 子模组缺失

绝大多数开发者所遇到的无法启动菜单、工程编译失败等问题都源于 ESP-IDF 子模组未下载完全，因此保证子模组的完全下载对完整搭建 esp-idf 环境至关重要。

```

-- Found assembler: /home/lu/.espressif/tools/xtensa-esp32-elf/esp-2020r3-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf
-- Check for working C compiler: /home/lu/.espressif/tools/xtensa-esp32-elf/esp-2020r3-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf
-- Check for working C compiler: /home/lu/.espressif/tools/xtensa-esp32-elf/esp-2020r3-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /home/lu/.espressif/tools/xtensa-esp32-elf/esp-2020r3-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf
-- Check for working CXX compiler: /home/lu/.espressif/tools/xtensa-esp32-elf/esp-2020r3-8.4.0/xtensa-esp32-elf/bin/xtensa-esp32-elf
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Project is not inside a git repository, or git repository has no commits; will not use 'git describe' to determine project version
-- Project version: 1
-- Building ESP-IDF components for target esp32
-- Project sdkconfig file /home/lu/esp_4.1/hello_world/sdkconfig
CMake Error at /home/lu/esp_4.1/esp-idf/tools/cmake/component.cmake:302 (message):
  Include directory
  "/home/lu/esp_4.1/esp-idf/components/nbdtls/nbdtls/include" is not a
  directory.
Call Stack (most recent call first):
  /home/lu/esp_4.1/esp-idf/tools/cmake/component.cmake:478 (__component_add_include_dirs)
  /home/lu/esp_4.1/esp-idf/components/nbdtls/CMakeLists.txt:3 (idf_component_register)

-- Configuring incomplete, errors occurred!
See also "/home/lu/esp_4.1/hello_world/build/CMakeFiles/CMakeOutput.log".
cmake failed with exit code 1
lu@lu-ThinkPad-T430: ~/esp_4.1/hello_world$

```

缺少相应子模块时的错误 log

在 esp-idf 文件夹下使用以下命令下载缺失子模组

```
git submodule update --init --recursive
```

```

amiliya@ubuntu:~/esp_4.1/esp-idf$ git submodule update --init --recursive
正克隆到 '/home/amiliya/esp_4.1/esp-idf/components/nghttp/nghttp2/third-party/mruby'...
子模组路径 'components/nghttp/nghttp2/third-party/mruby': 检出 '22464fe5a0a10f2b077eaba109ce1e912e4a77de'
子模组路径 'components/nghttp/nghttp2/third-party/neverbleed': 检出 'da5c2ab419a3bb8a4cc6c37a6c7f3e4bd4b41134'
amiliya@ubuntu:~/esp_4.1/esp-idf$

```

若命令长时间无响应可取消后重试，此命令也可用于检测子模组是否下载完全（下载完全则直接返回命令行），也可进入缺失子模组的目录单独克隆该子模组。

4.3.3 python 版本

步骤 1.6.3 (`./install.sh`) 执行过程中需要的 python 版本至少大于 3.6，如果执行 python 后发现 python 版本小于 3.6，则执行以下步骤安装 python3.6 并将其设置为默认 python

```
hu@hu:~/esp/esp-idf$ python
Python 3.5.2 (default, Oct 7 2020, 17:19:02)
[GCC 5.4.0 20160609] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> exit()
hu@hu:~/esp/esp-idf$
```

1、安装依赖包

```
1 $ sudo apt-get update
2 $ sudo apt-get install software-properties-common
```

2、添加 deadsnakes PPA 源

```
1 $ sudo add-apt-repository ppa:deadsnakes/ppa
2 $ sudo apt-get update
```

在进行 sudo apt-get update 时：

如果报错：

正在读取软件包列表... 完成 W: GPG

错误：http://ppa.launchpad.net/fossfreedom/indicator-sysmonitor/ubuntu

xenial InRelease: 由于没有公钥，无法验证下列签名： NO_PUBKEY 82EB5823F4FE239D W: 仓库

"http://ppa.launchpad.net/fossfreedom/indicator-sysmonitor/ubuntu

xenial InRelease" 没有数字签名。 N: 无法认证来自该源的数据，所以使用它会带来潜在风险。 N: 参见

apt-secure(8) 手册以了解仓库创建和用户配置方面的细节。

执行如下命令

```
1 | sudo apt-key adv --keyserver keyserver.ubuntu.com --recv-keys 82EB5823F4FE239D # 这个是填写自己报错后的那一串字符！
```

```
sudo apt-get install python3.6
```

```
cd /usr/bin
```

```
rm python
```

```
ln -s python3.6m python
```

(参考链接: https://blog.csdn.net/weixin_49938318/article/details/113129408?utm_source=app&app_version=4.9.0&code=app_1562916241&uLinkId=usr1mkqgl919blen)

4.3.4 工具链设置

少部分开发者在搭建环境时会遇到此类问题，而这一类问题的形成原因较为复杂，推测可能与所用系统版本有关，因此仅能依据错误提示 log 做出相应处理，暂无完整解决方案，以下仅供参考。

```
Requirement already satisfied: six<1.9.0 in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from python-socketio>=7.1.0
txt (line 21)) (1.16.0)
Requirement already satisfied: python-engineio<4,>=3.13.0 in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from python-so
df/requirements.txt (line 21)) (3.14.2)
Requirement already satisfied: gyp-parser in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from cffi>=1.12->cryptography>=
requirements.txt (line 11)) (2.20)
Requirement already satisfied: Werkzeug<1.0,>=0.7 in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from Flask<1.0,>=0.12.
iliya/esp-idf/requirements.txt (line 15)) (0.16.1)
Requirement already satisfied: itsdangerous<=0.21 in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from Flask<1.0,>=0.12.
iliya/esp-idf/requirements.txt (line 15)) (2.0.1)
Requirement already satisfied: Jinja2<=2.4 in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from Flask<1.0,>=0.12.2->gdbg
sp-idf/requirements.txt (line 15)) (3.0.1)
Requirement already satisfied: brotli in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from Flask-Compress<2.0,>=1.4.0->g
a/esp-idf/requirements.txt (line 15)) (1.0.9)
Requirement already satisfied: greenlet<=0.4.14 in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from event<2.0,>=1.2.2-
iya/esp-idf/requirements.txt (line 15)) (1.1.0)
Requirement already satisfied: MarkupSafe<=2.0 in /home/amiya/.espressif/python_env/idf4.4_py3.8_env/lib/python3.8/site-packages (from Jinja2>=2.4->Flask<1
/home/amiya/.espressif/python_env/idf4.4_py3.8_env/bin/python -m pip install --upgrade pip
WARNING: You are using pip version 21.1.2, however version 21.1.3 is available.
You should consider upgrading via the '/home/amiya/.espressif/python_env/idf4.4_py3.8_env/bin/python -m pip install --upgrade pip' command.
./export.sh
```

按照提示执行相应命令可消除警告（pip 版本问题）