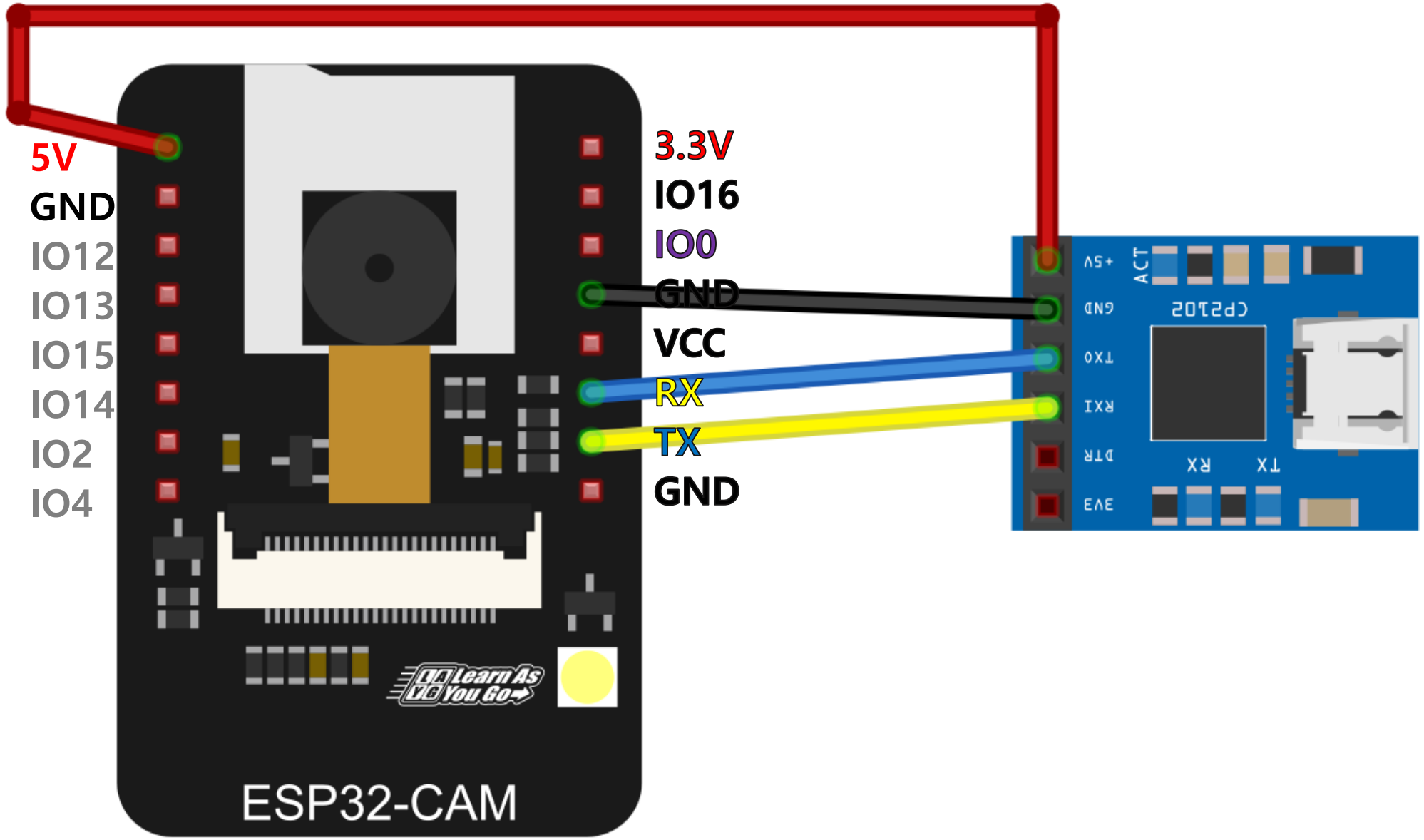
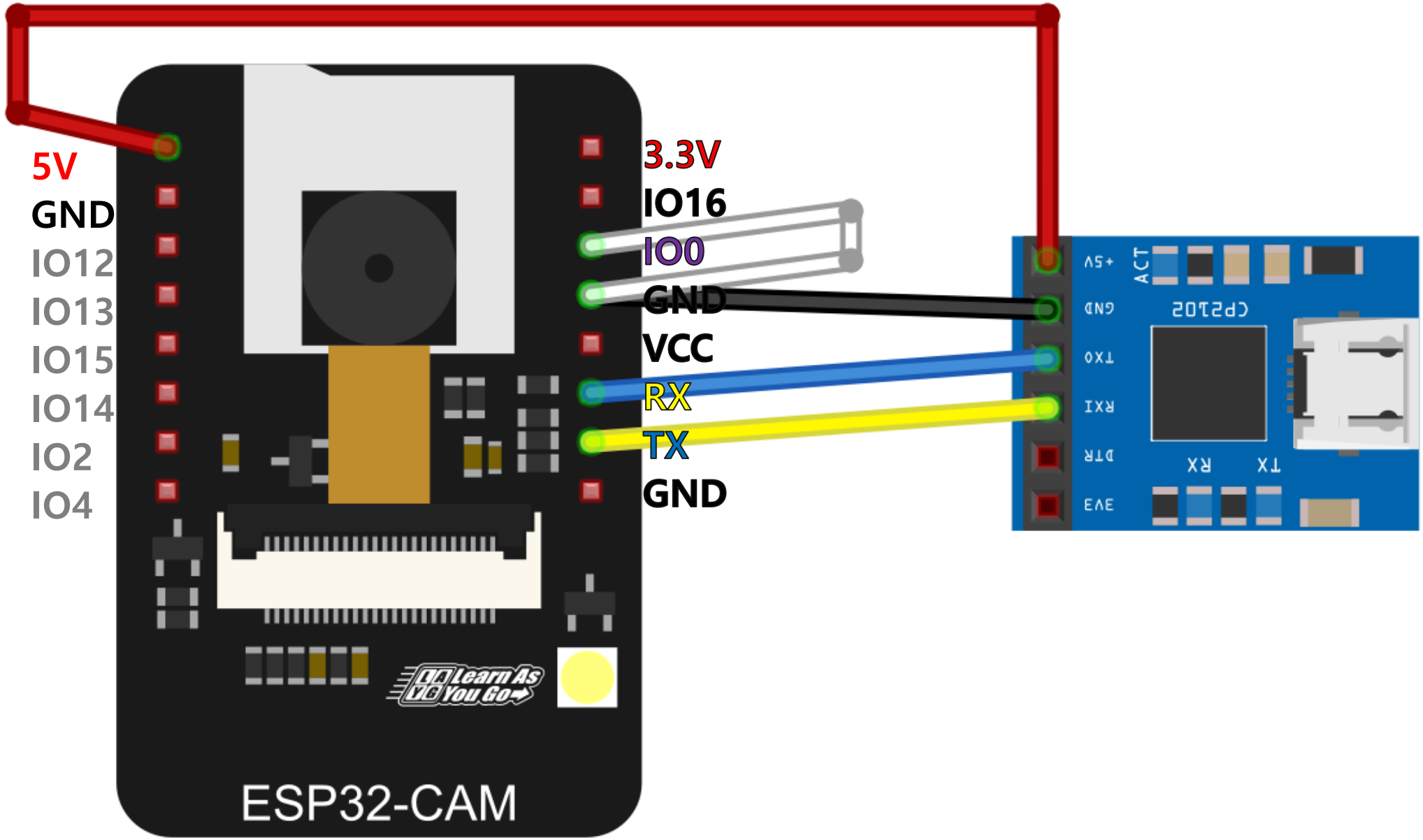
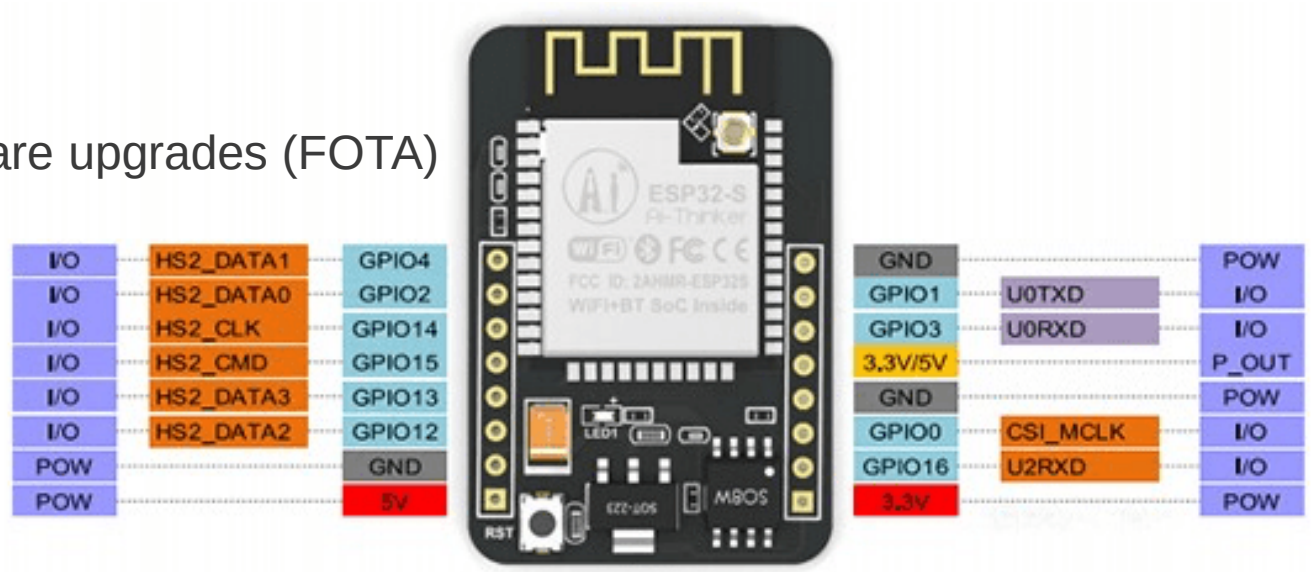

5V
GND
IO12
IO13
IO15
IO14
IO2
IO4
3.3V
IO16
IO0
GND
VCC
RX
TX
GND
ESP32-CAM
Learn As You Go
+5V
GND
TXO
RXI
DTR
3V3
ACT
CP2102
RX
TX


5V
GND
IO12
IO13
IO15
IO14
IO2
IO4
3.3V
IO16
IO0
GND
VCC
RX
TX
GND
Learn As You Go
ESP32-CAM
ACT
+5V
GND
CP2102
TXO
RXI
DTR
3V3
RX
TX

Features

Here is a list with the ESP32-CAM features:

- The smallest 802.11b/g/n Wi-Fi BT SoC module
- Low power 32-bit CPU,can also serve the application processor
- Up to 160MHz clock speed, summary computing power up to 600 DMIPS
- Built-in 520 KB SRAM, external 4MPSRAM
- Supports UART/SPI/I2C/PWM/ADC/DAC
- Support OV2640 and OV7670 cameras, built-in flash lamp
- Support image WiFI upload
- Support TF card
- Supports multiple sleep modes
- Embedded Lwip and FreeRTOS
- Supports STA/AP/STA+AP operation mode
- Support Smart Config/AirKiss technology
- Support for serial port local and remote firmware upgrades (FOTA)

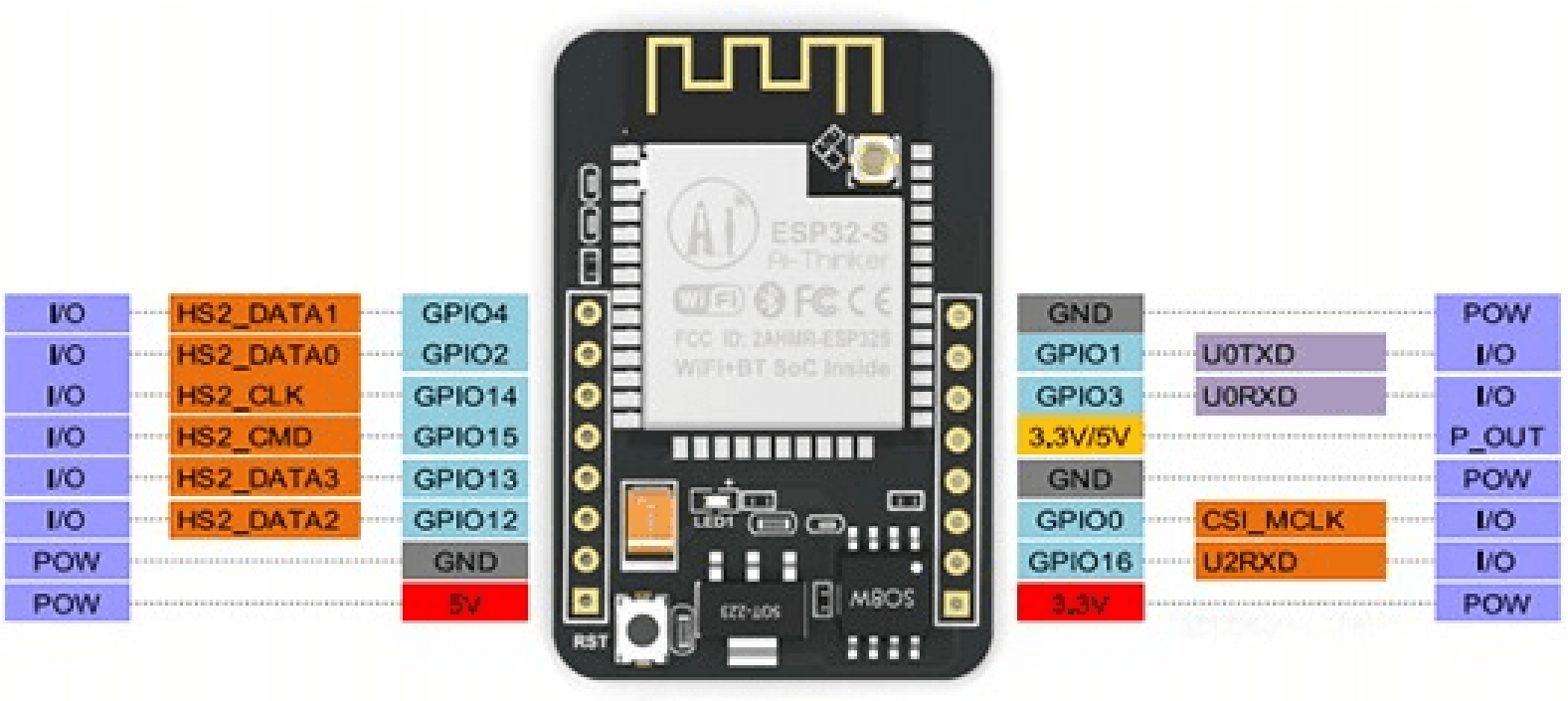


ESP32-CAM Pinout

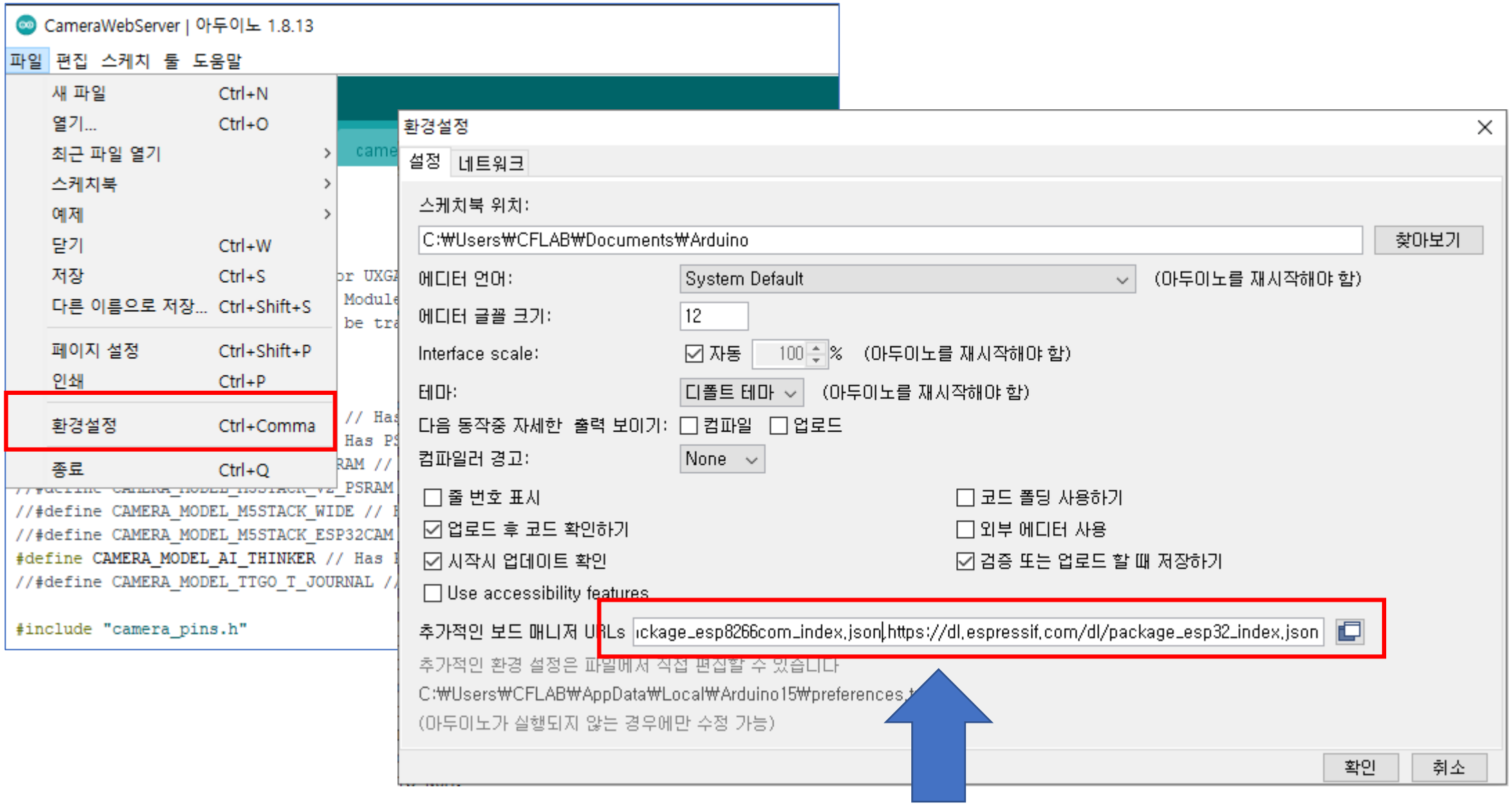
The following figure shows the ESP32-CAM pinout (AI-Thinker module).
There are three GND pins and two pins for power: either 3.3V or 5.5V.

GPIO1 and GPIO3 are the serial pins.
You need these pins to upload code to your board.
Additionally, GPIO 0 also plays an important role, since it determines whether the ESP32 is in flashing mode or not. When GPIO 0 is connected to GND, the ESP32 is in flashing mode.

The following pins are internally connected to the microSD card reader:
•GPIO 14: CLK
•GPIO 15: CMD
•GPIO 2: Data 0
•GPIO 4: Data 1 (also con
•GPIO 12: Data 2
•GPIO 13: Data 3

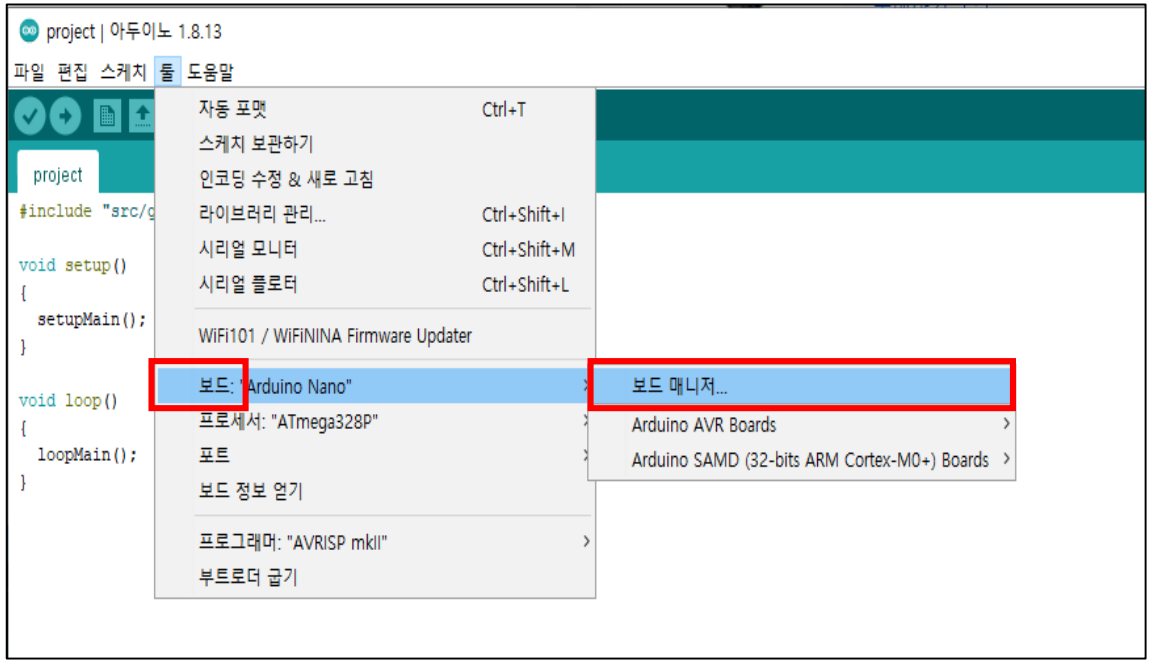


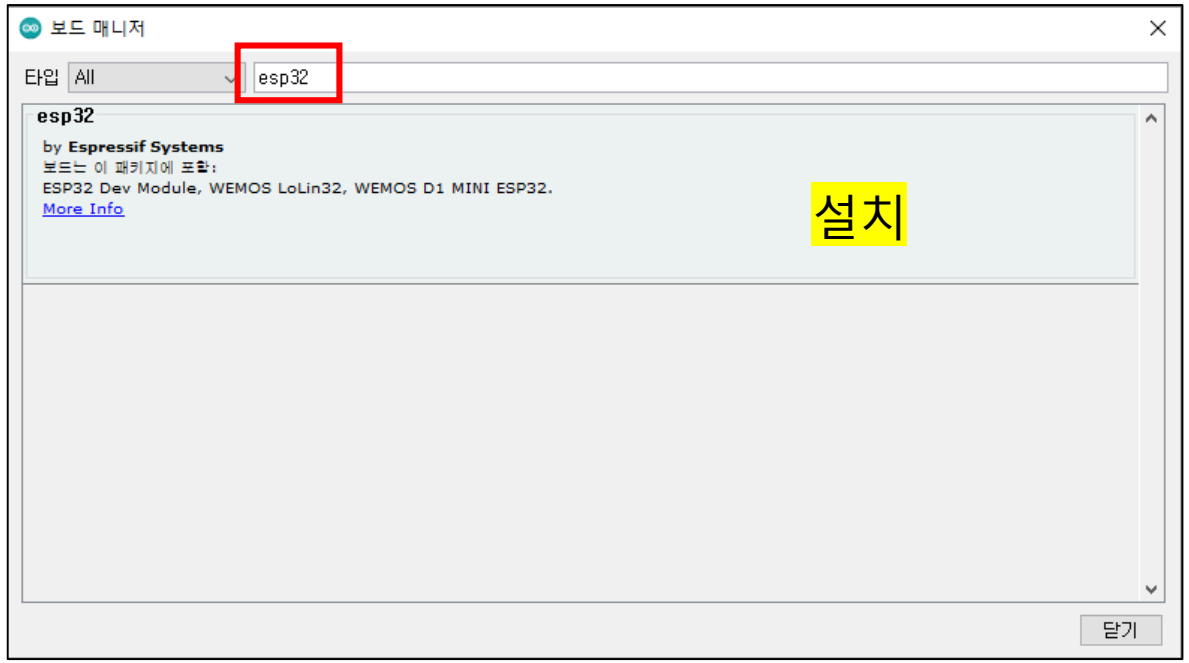
ESP32 CAM 보드 설치 1-3



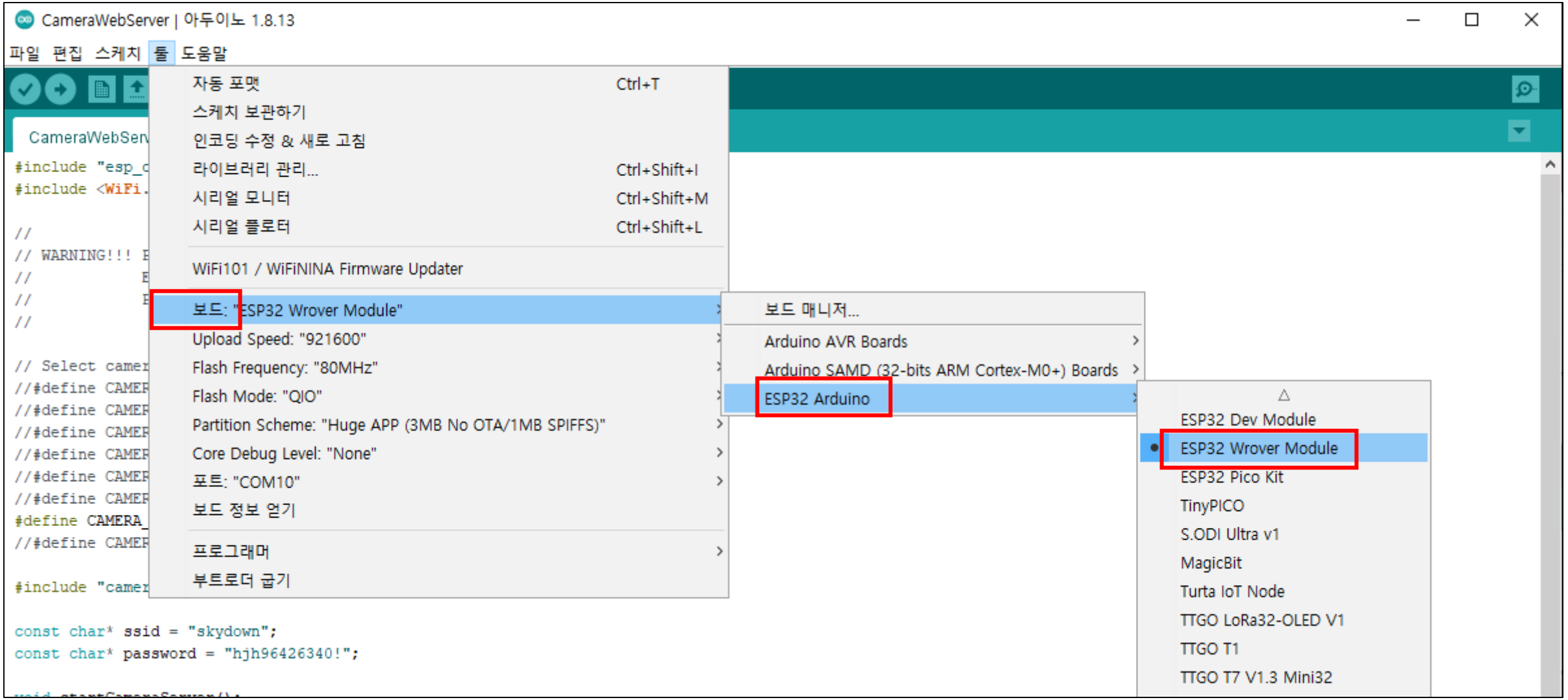
https://dl.espressif.com/dl/package_esp32_index.json,
http://arduino.esp8266.com/stable/package_esp8266com_index.json

ESP32 CAM 보드 설치 2-3

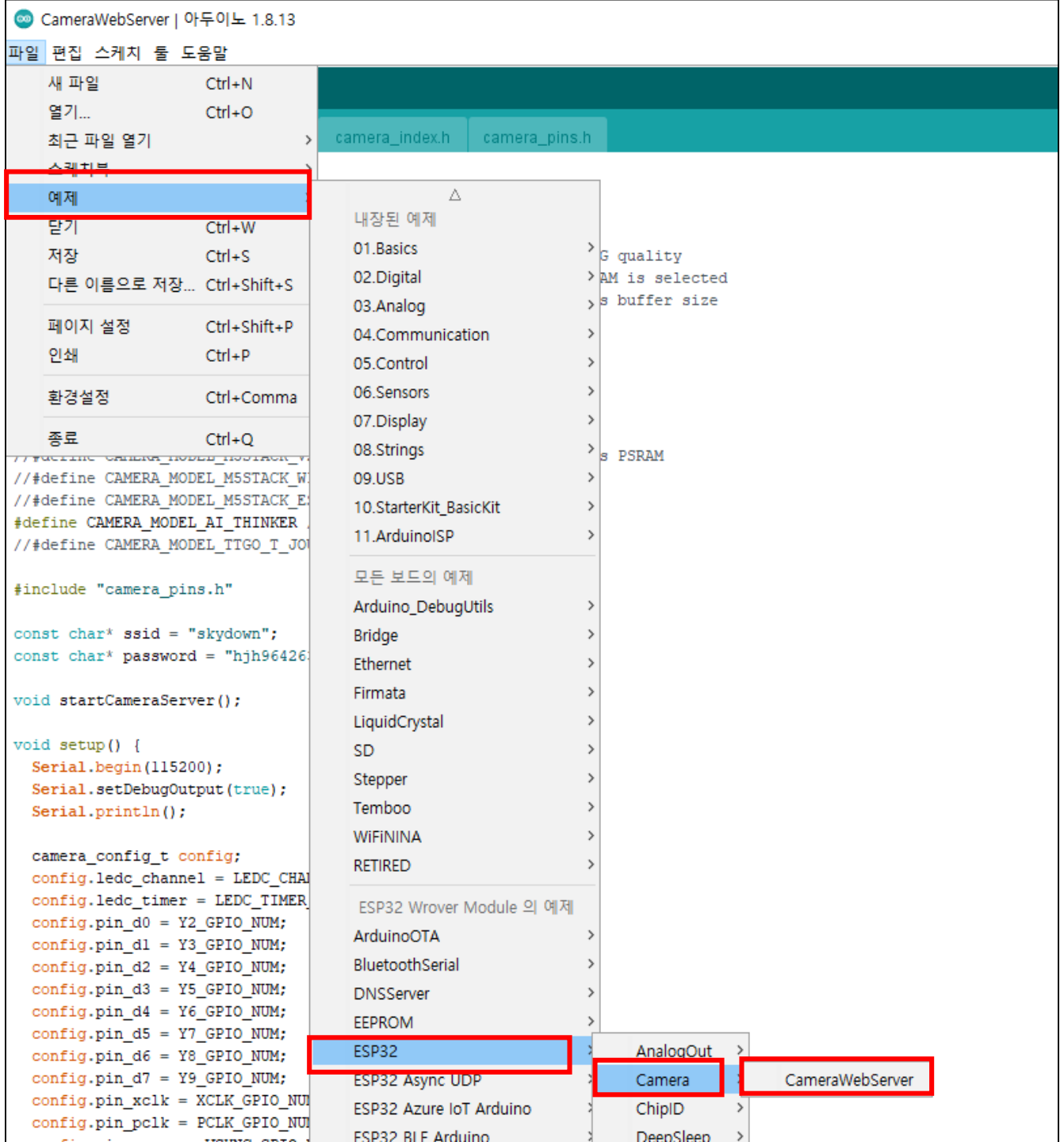




ESP32 CAM 보드 설치 3-3



ESP32 CAM 예제소스



ESP32 CAM 예제소스 테스트

CameraWebServer | 아두이노 1.8.13

파일 편집 스케치 툴 도움말

CameraWebServer | app_httpd.cpp | camera_index.h | camera_pins.h

```
#include "esp_camera.h"
#include <WiFi.h>

//
// WARNING!!! PSRAM IC required for UXGA resolution and high JPEG quality
//            Ensure ESP32 Wrover Module or other board with PSRAM is selected
//            Partial images will be transmitted if image exceeds buffer size
//

// Select camera model
#define CAMERA_MODEL_WROVER_KIT // Has PSRAM
//#define CAMERA_MODEL_ESP_EYE // Has PSRAM
//#define CAMERA_MODEL_M5STACK_PSRAM // Has PSRAM
//#define CAMERA_MODEL_M5STACK_V2_PSRAM // M5Camera version B Has PSRAM
//#define CAMERA_MODEL_M5STACK_WIDE // Has PSRAM
//#define CAMERA_MODEL_M5STACK_ESP32CAM // No PSRAM
//#define CAMERA_MODEL_AI_THINKER // Has PSRAM
//#define CAMERA_MODEL_TTGO_T_JOURNAL // No PSRAM

#include "camera_pins.h"

const char* ssid = "*********";
const char* password = "*********";
```

CameraWebServer | 아두이노 1.8.13

파일 편집 스케치 툴 도움말

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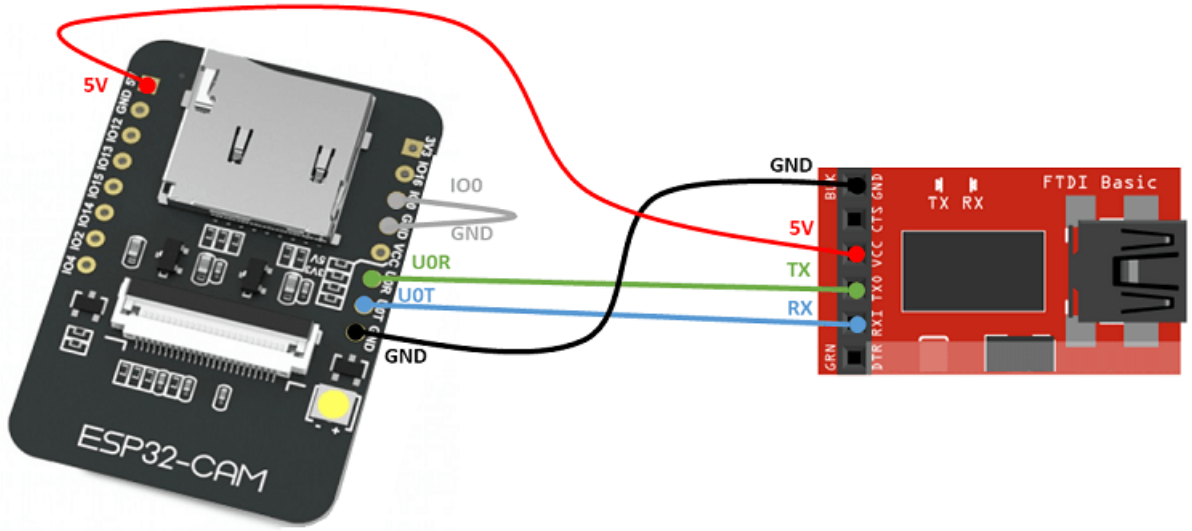
//#define CAMERA_MODEL_M5STACK_ESP32CAM // No PSRAM
#define CAMERA_MODEL_AI_THINKER // Has PSRAM
//#define CAMERA_MODEL_TTGO_T_JOURNAL // No PSRAM

#include "camera_pins.h"

const char* ssid = "[redacted]";
const char* password = "[redacted]";
```

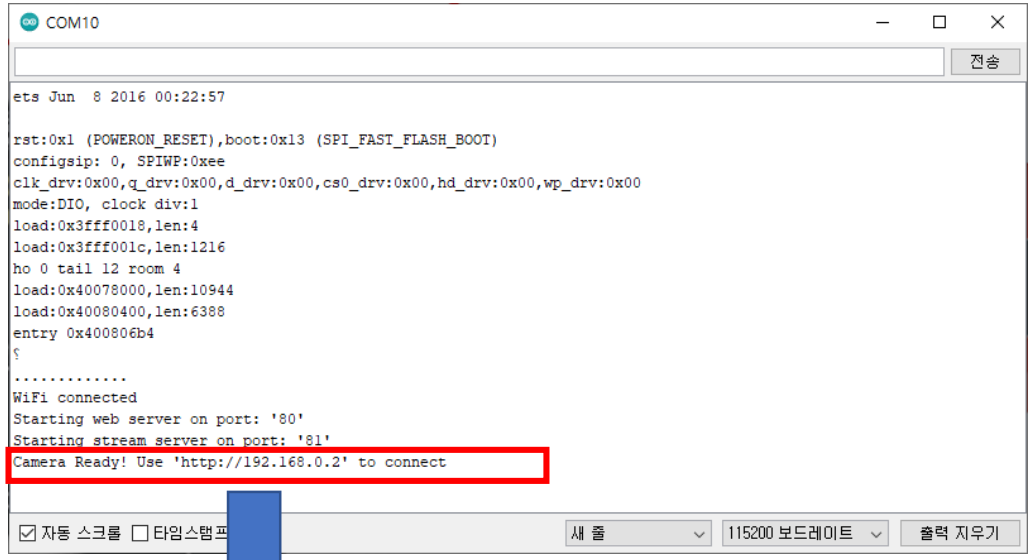
ESP32 CAM Upload Code

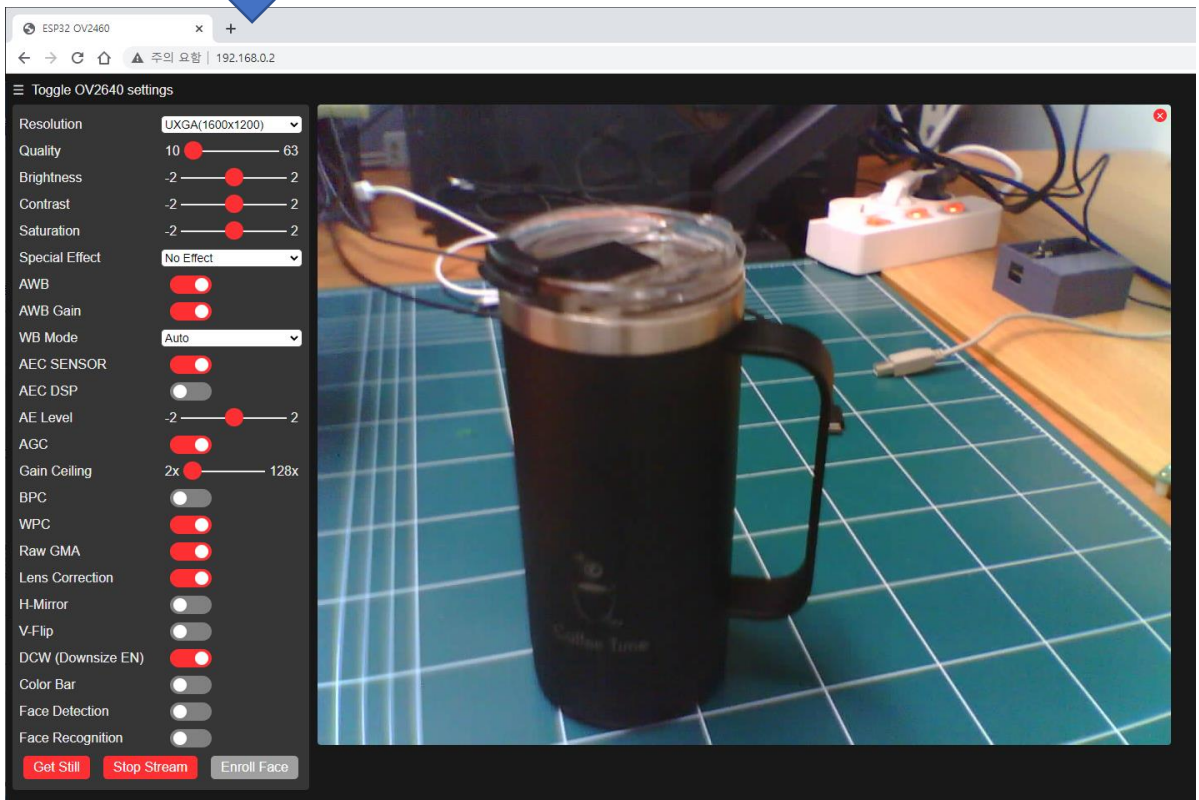
Connect the ESP32-CAM board to your computer using an FTDI programmer.
Follow the next schematic diagram:



ESP32-CAM	FTDI Programmer
GND	GND
5V	VCC (5V)
U0R(RX)	TX
U0T(TX)	RX
GPIO 0 == GND	

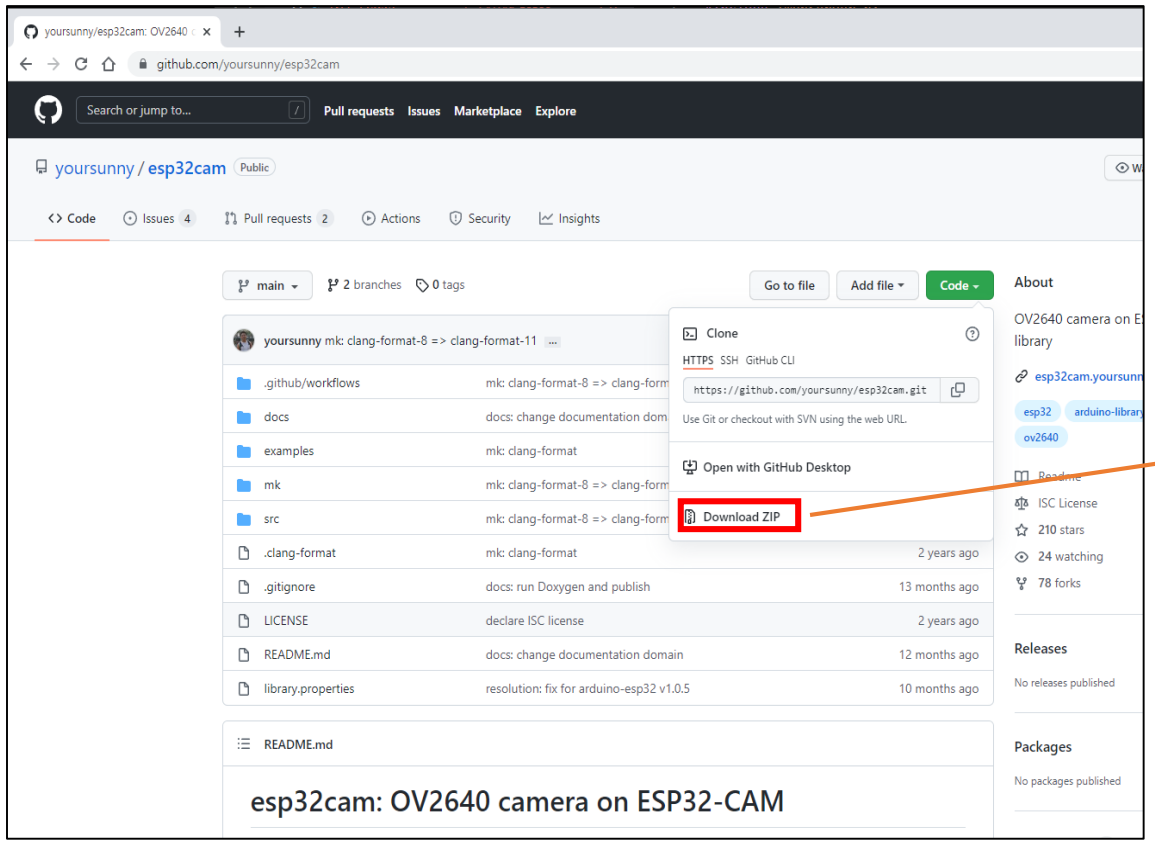
Upload 할 때만 연결

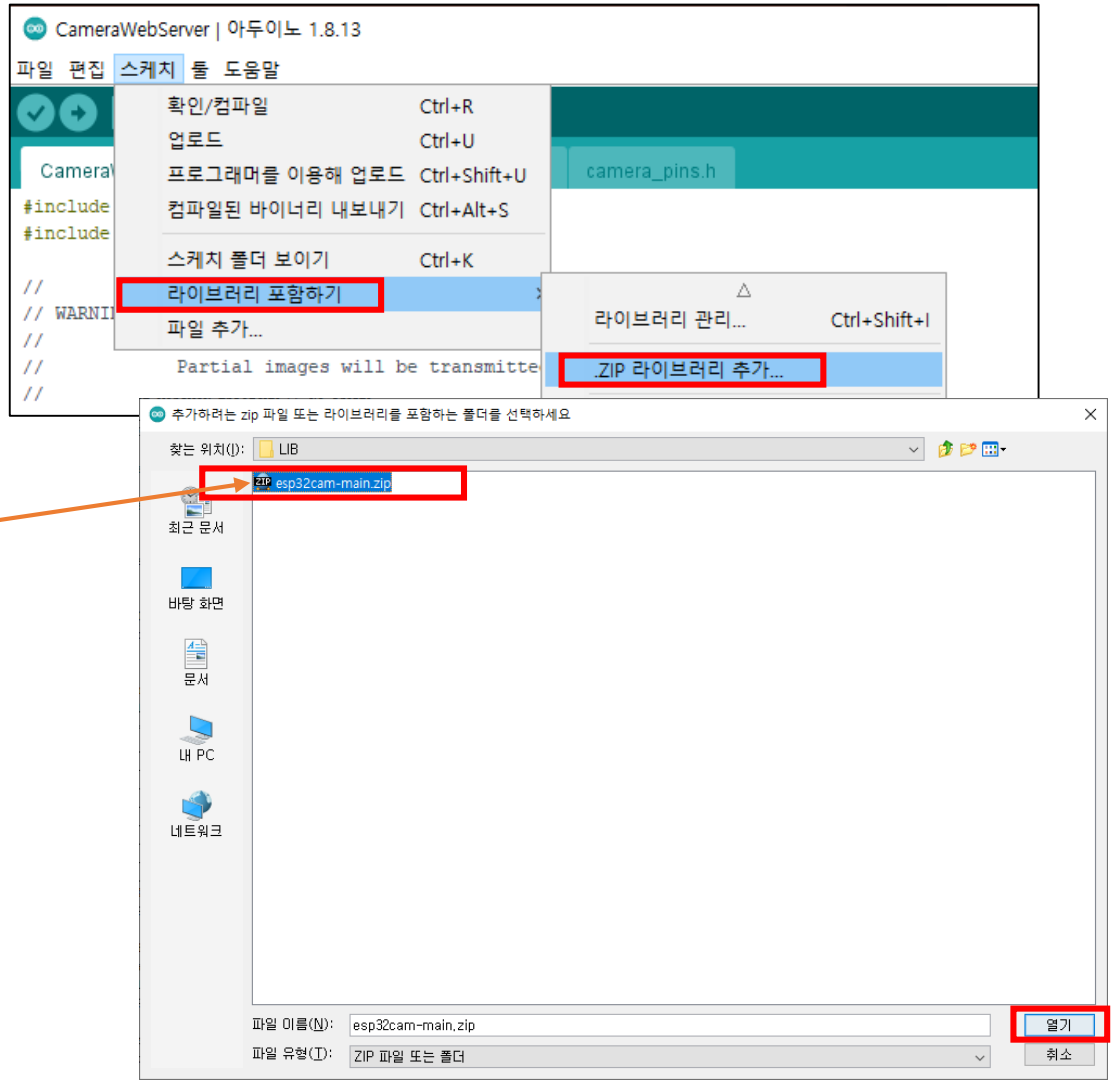




Esp32cam LIB 받기

https://github.com/yoursunny/esp32cam





Esp32cam + OpenCV + YOLO3

1. YOLO(You Only Look Once)와 호환되는 가장 많이 사용되는 프레임워크
   1) Darknet: YOLO를 위해 특별히 제작된 YOLO 개발자가 만든 프레임워크
      장점: 빠르고 GPU또는 CPU와 함께 사용가능
      단점: 리눅스에서 지원
   2) Darkflow: Darknet을 텐서플로우에 적용
      장점: 빠르고 GPU 또는 CPU와 함께 사용 가능하고 리눅스, 윈도우, 맥에서 호환
      단점: 설치 복잡
   3) OpenCV: 최소 3.4.2버전 필요
      장점: 설치가 간단하다(openCV외에 설치할 것이 없다)
      단점: CPU에서만 작동하기 때문에 비디오를 실시간으로 처리하는 데 속도가 느리다.

2.YOLO 주요 파일

1) Weight file
   - 훈련된 model의 값

2) Cfg file :
   - 환경설정 파일
   - 알고리즘에 관한 모든 설정이 있다.

3) Name files :
   - 알고리즘이 감지할 수 있는 객체의 이름들

Esp32cam + OpenCV + YOLO3

3.YOLO가 허용하는 세가지 크기

1) 320 × 320 : 정확도는 떨어지지 만 속도 빠름

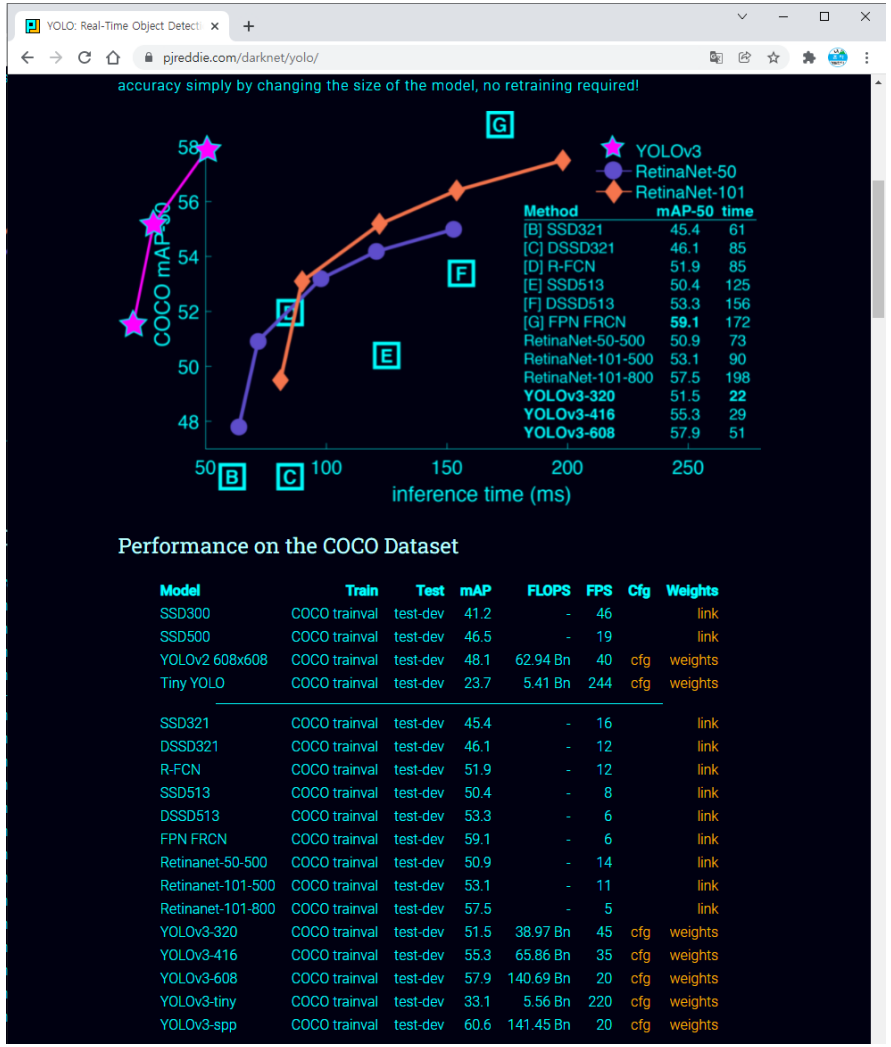
2) 416 × 416 : 중간

3) 609 × 609 : 정확도는 더 높지만 속도 느림

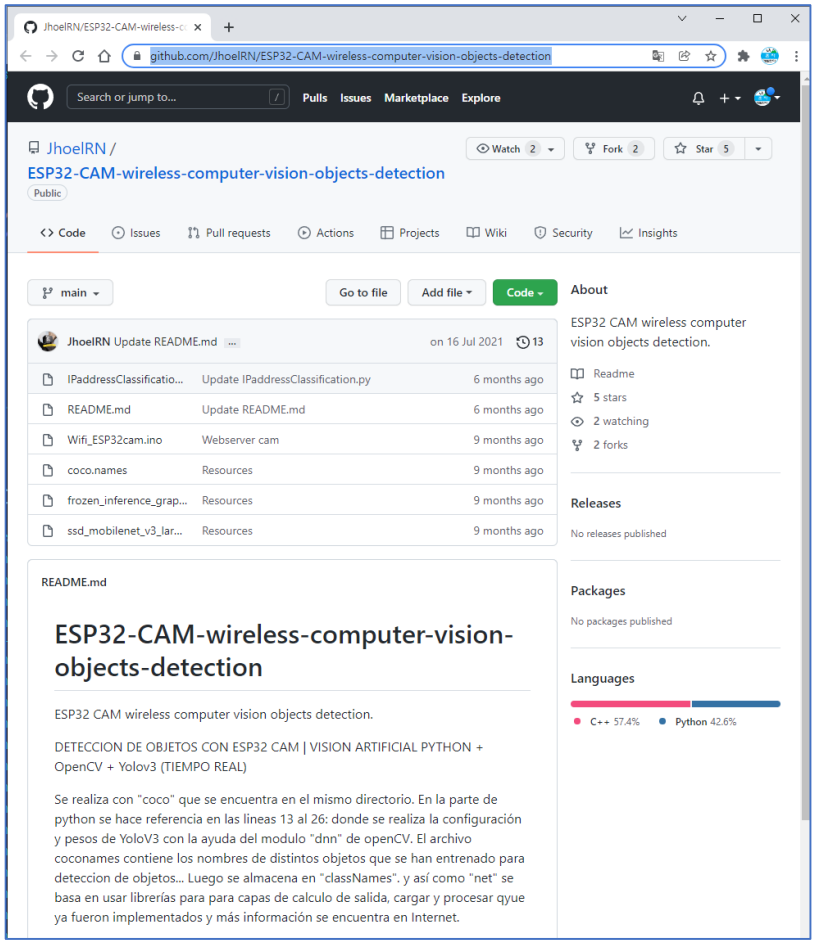
YOLO3 download

Weights data는 학습이 필요함.

https://pjreddie.com/darknet/yolo/



https://github.com/JhoelRN/ESP32-CAM-wireless-computer-vision-objects-detection



어느 정도 학습이 된 weights와 테스트 소스