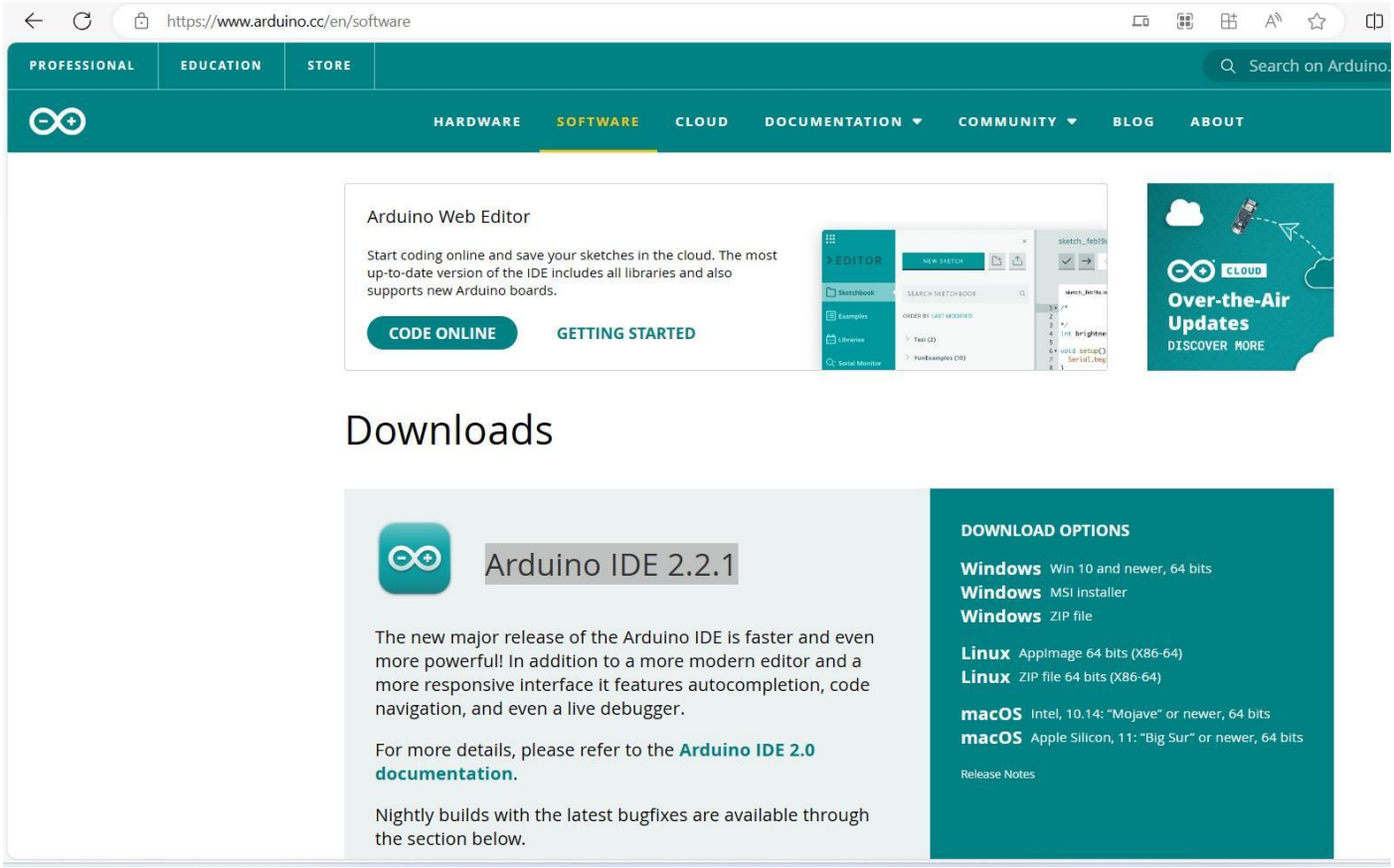
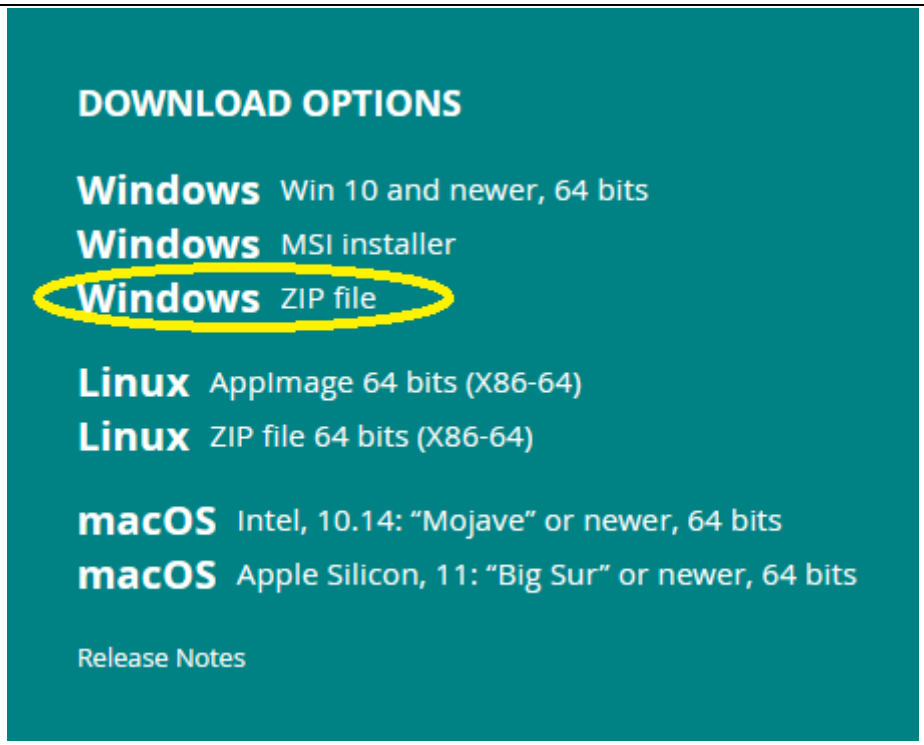
Physical Computing using Tektork IoT Kit (Arduino ESP32 Based)

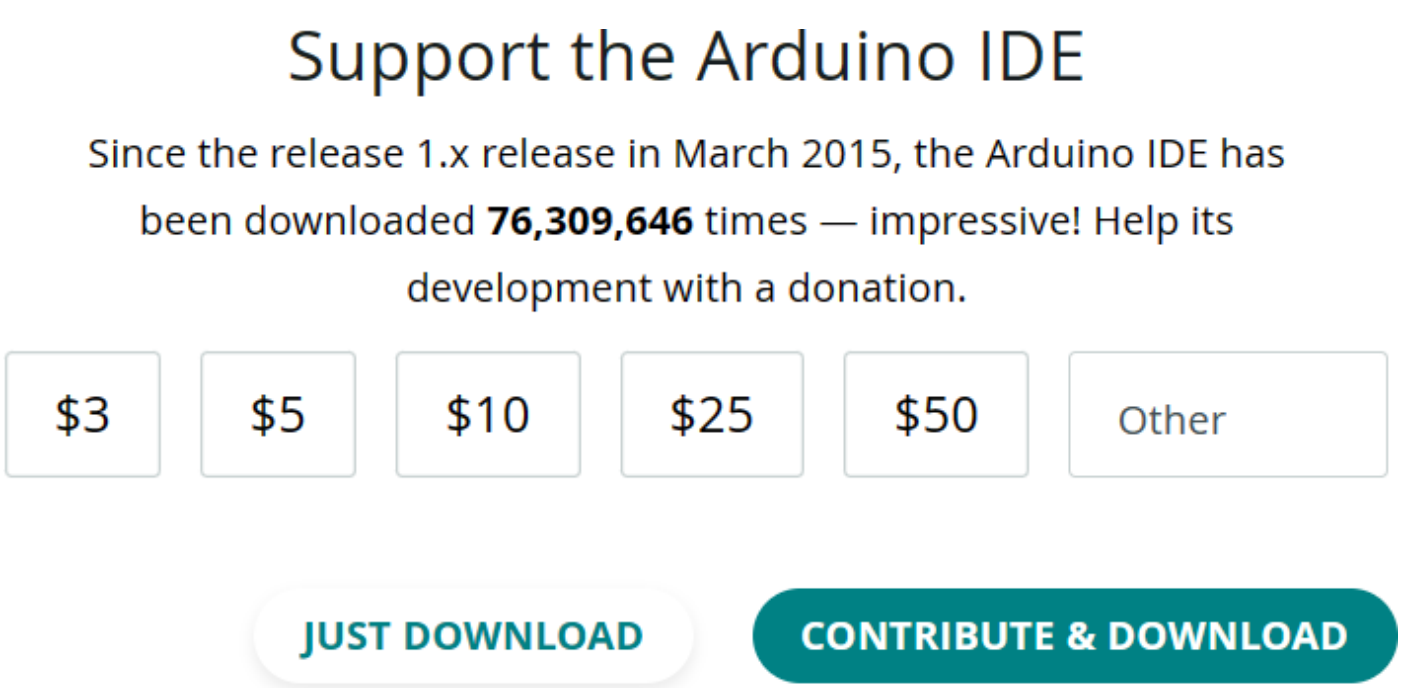
Installation of latest Arduino IDE:

Visit Software | Arduino (https://www.arduino.cc/en/software) and download

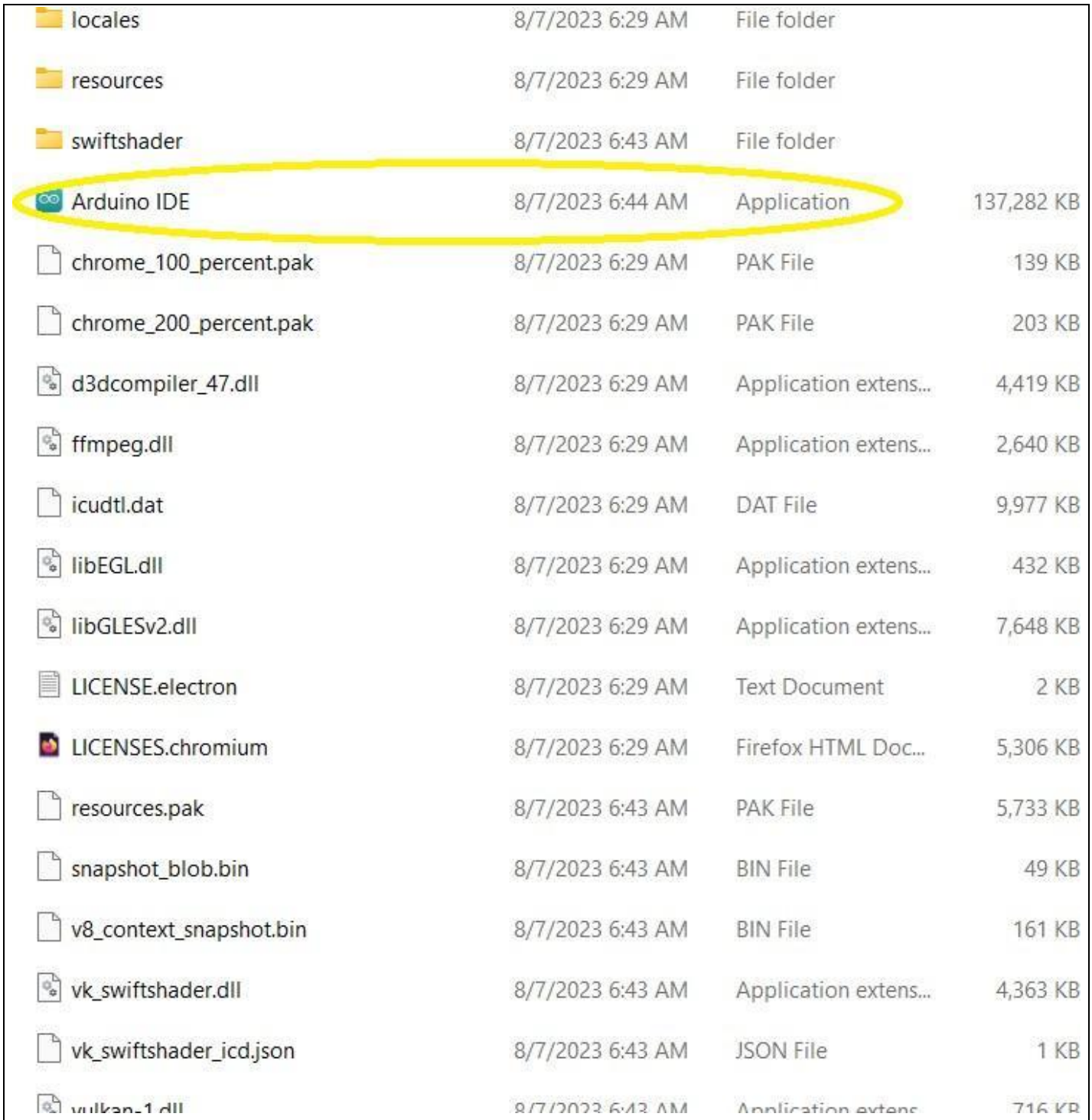
Arduino IDE 2.2.1



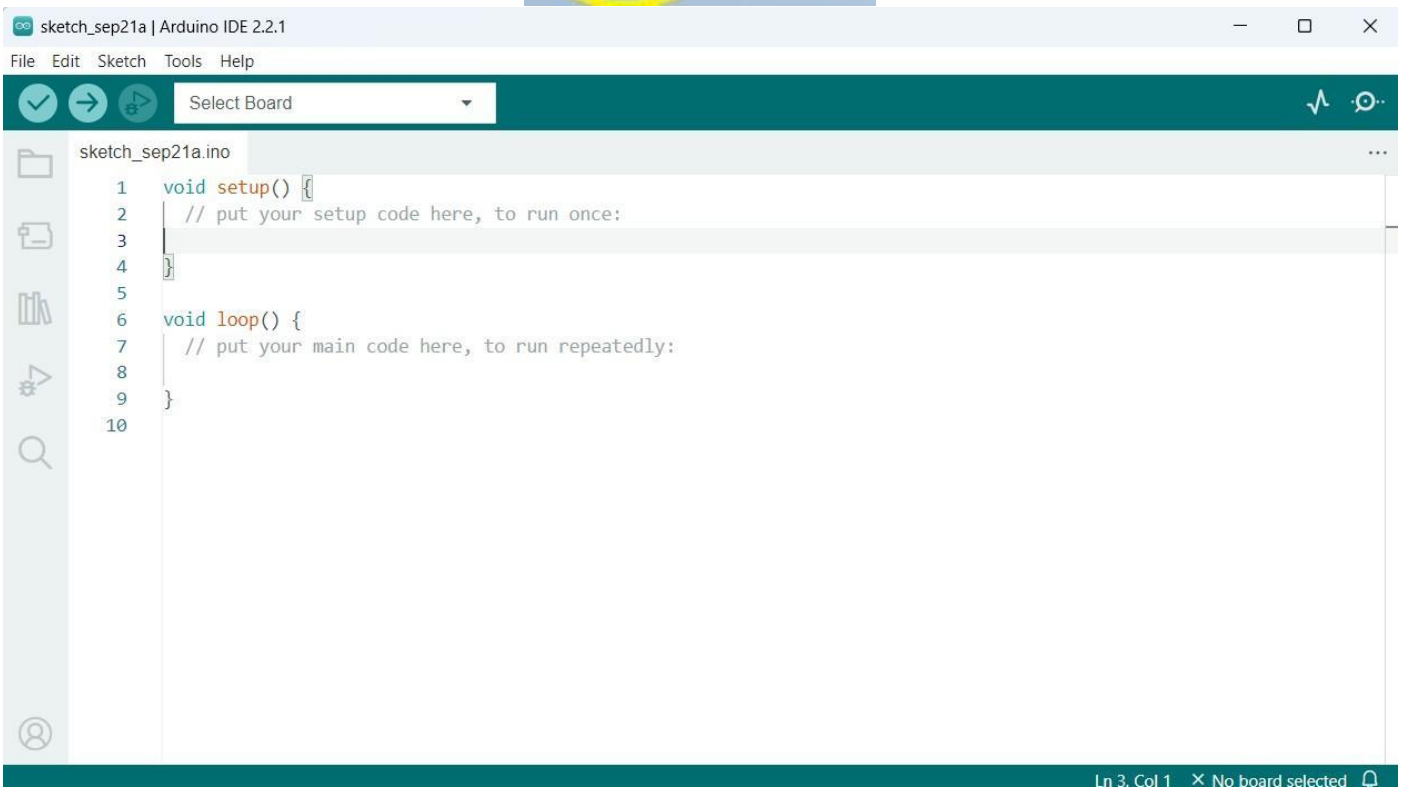




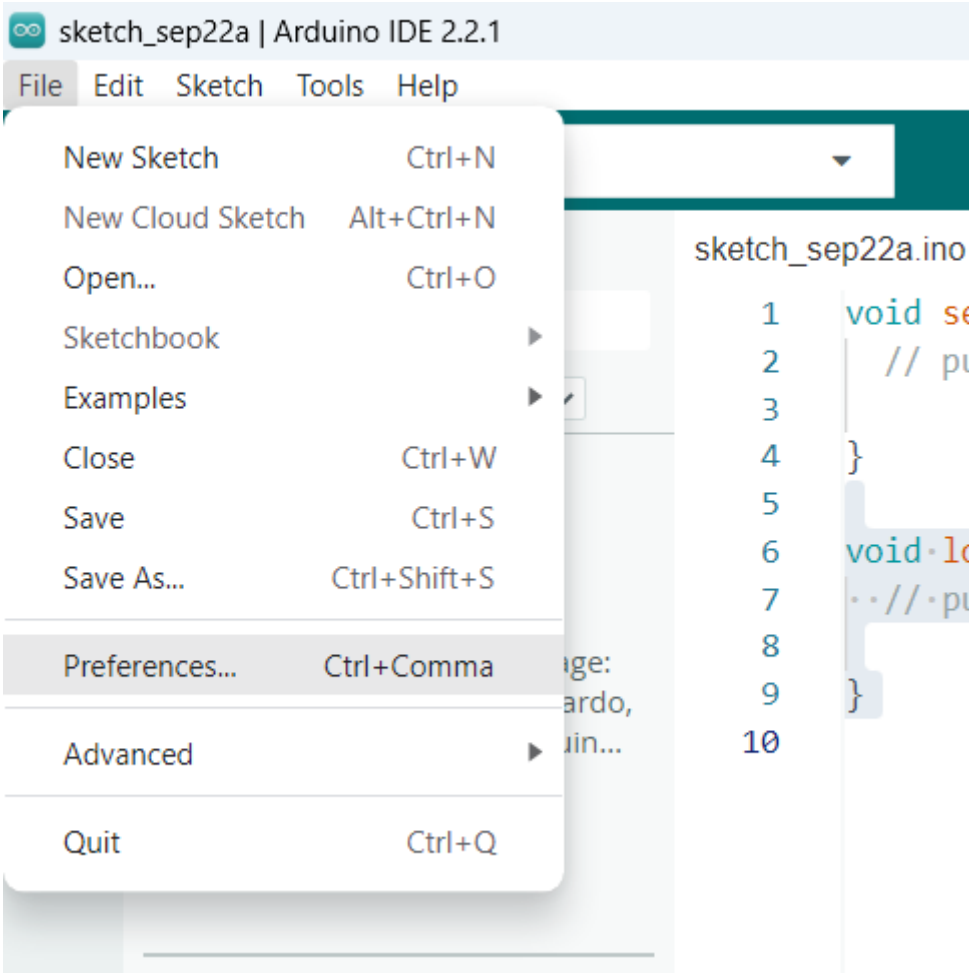
Click Just DOWNLOAD. Arduino-ide_2.2.1_windows_64bit.zip will be downloaded.
Extract this zip.
You will get a folder named Arduino-ide_2.2.1_windows_64bit



In this folder , right click Arduino IDE (Application file) to create a shortcut and place the Short Cut in the Desktop.



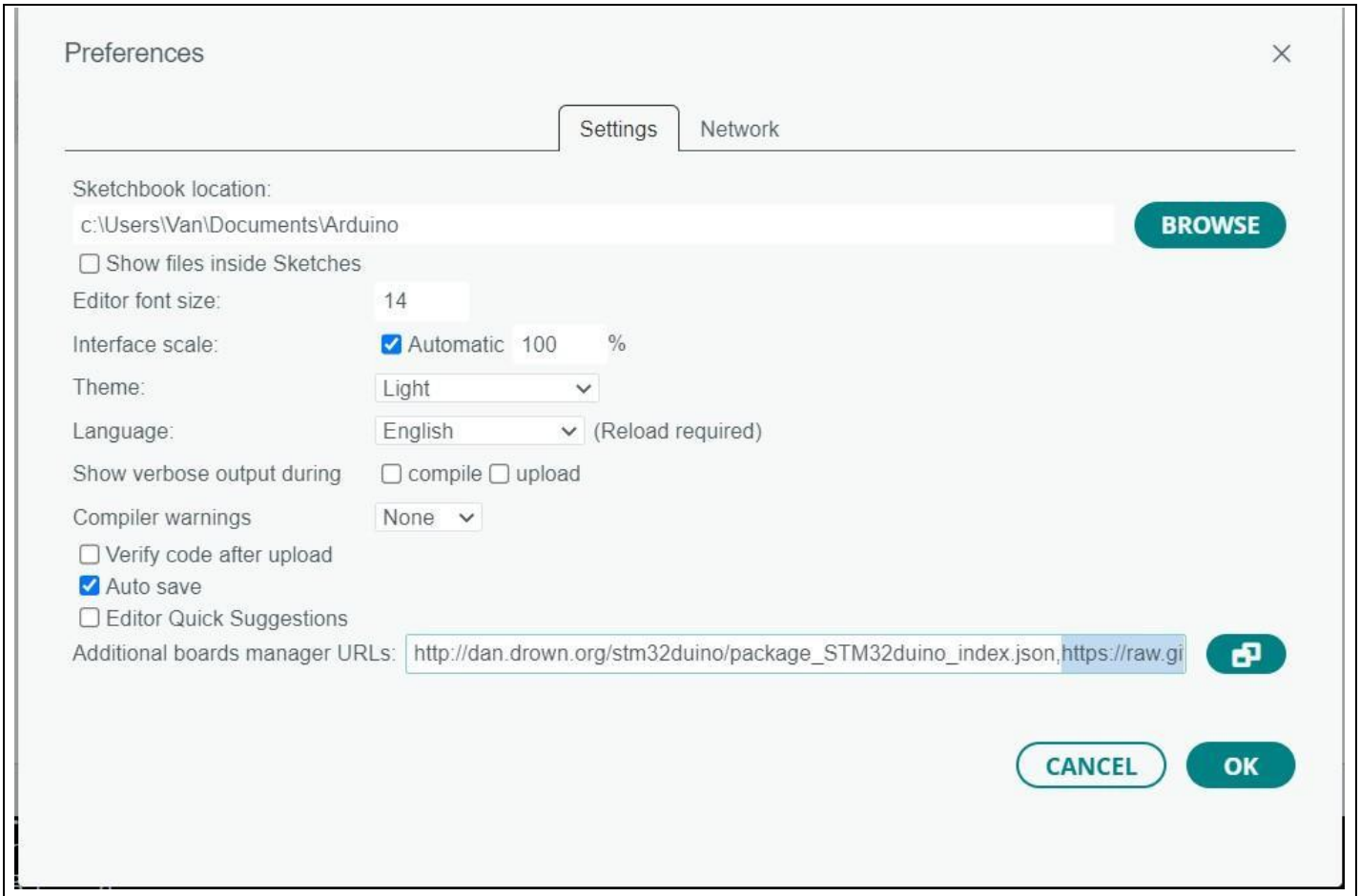
Arduino Installation was successfully completed.
Next we need to install ESP32 Board under the Boards Manager.
Click preferences under file menu.



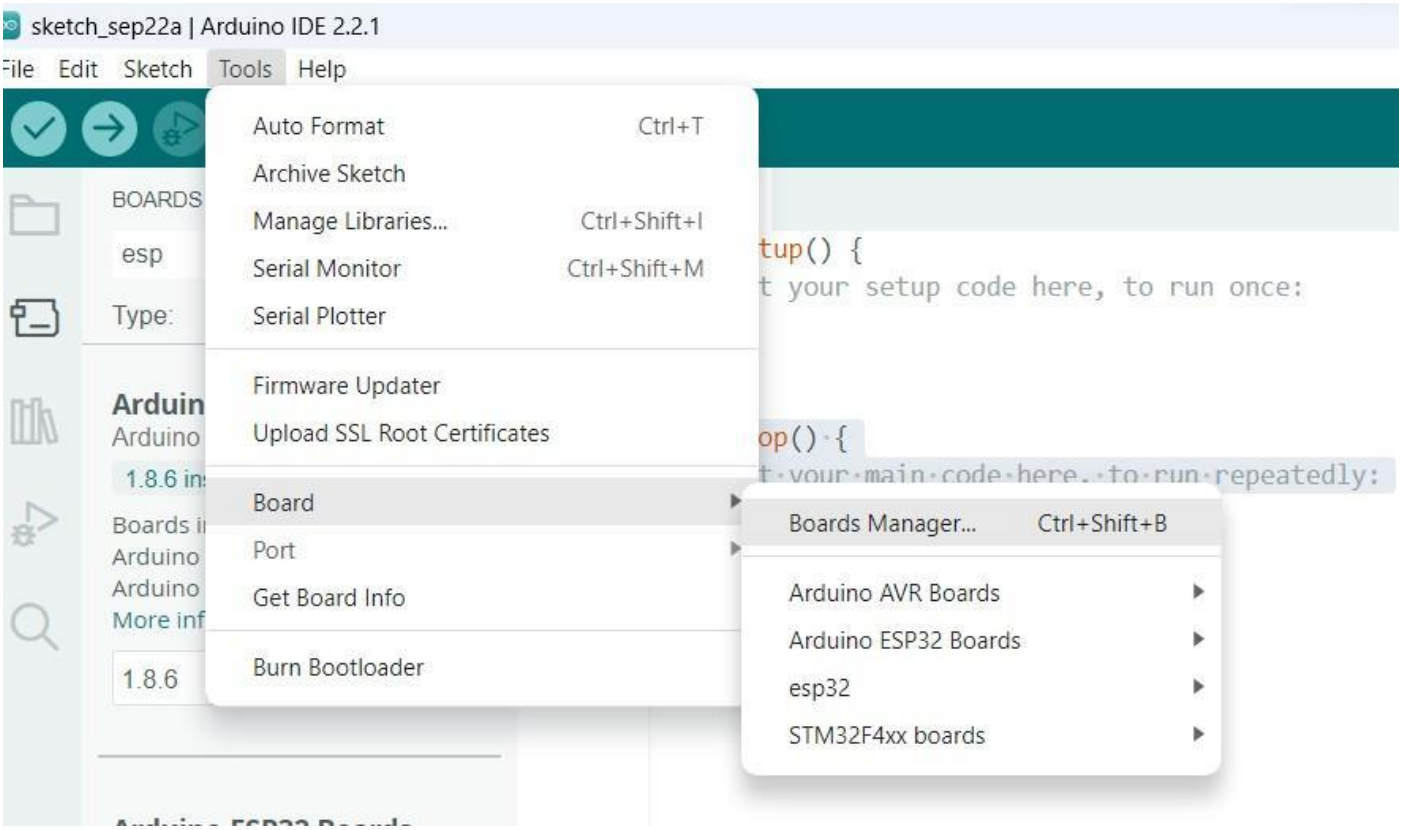
In the Additional boards manager, paste https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json

If some URLs are already there, say http://dan.drown.org/stm32duino/package_STM32duino_index.json

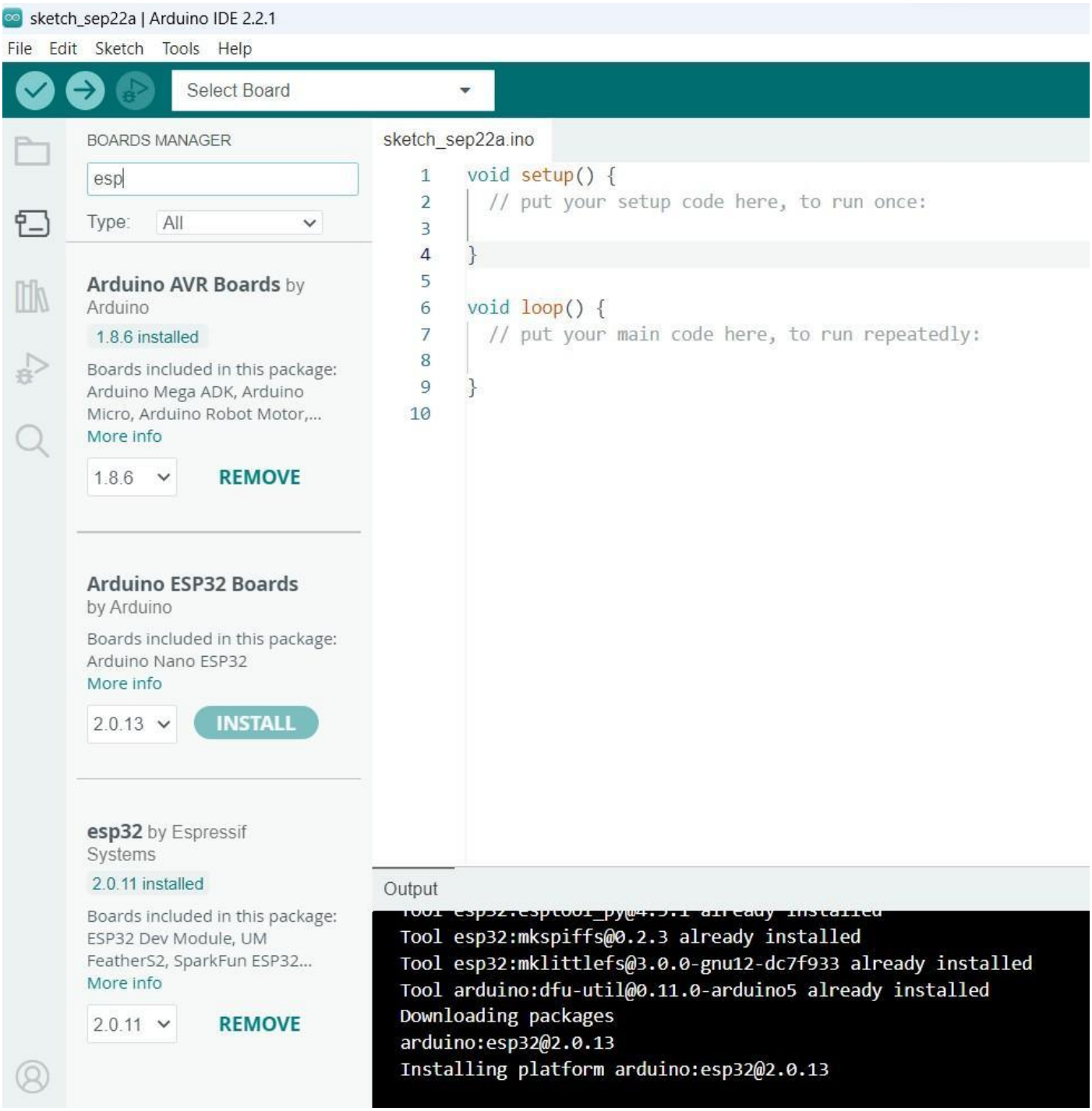
Just put a comma and then paste the URL for ESP32 Installation files.
http://dan.drown.org/stm32duino/package_STM32duino_index.json,https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json



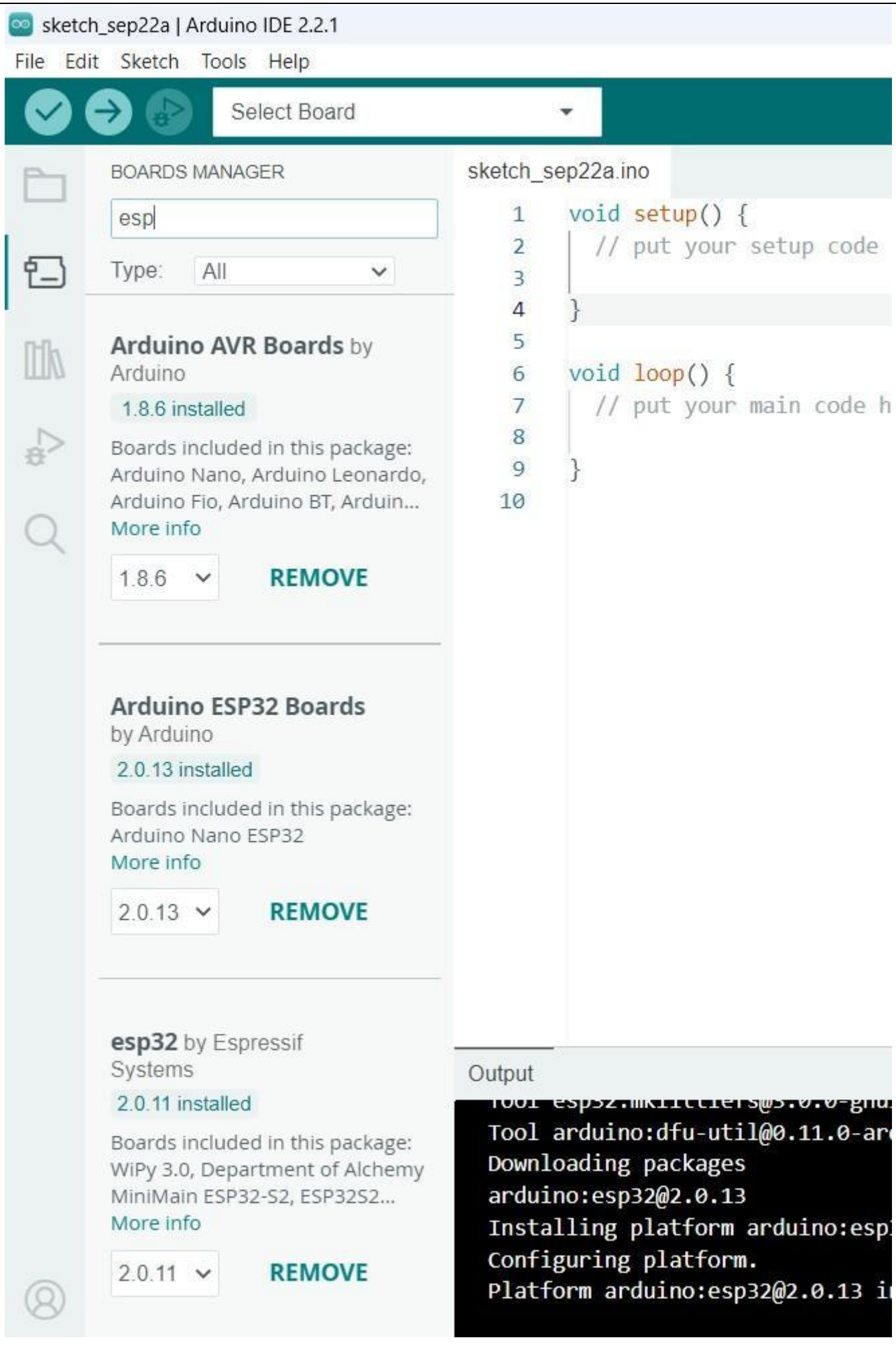
Click OK to proceed Further.
Under Tools menu, Select Board and then Boards Manager.



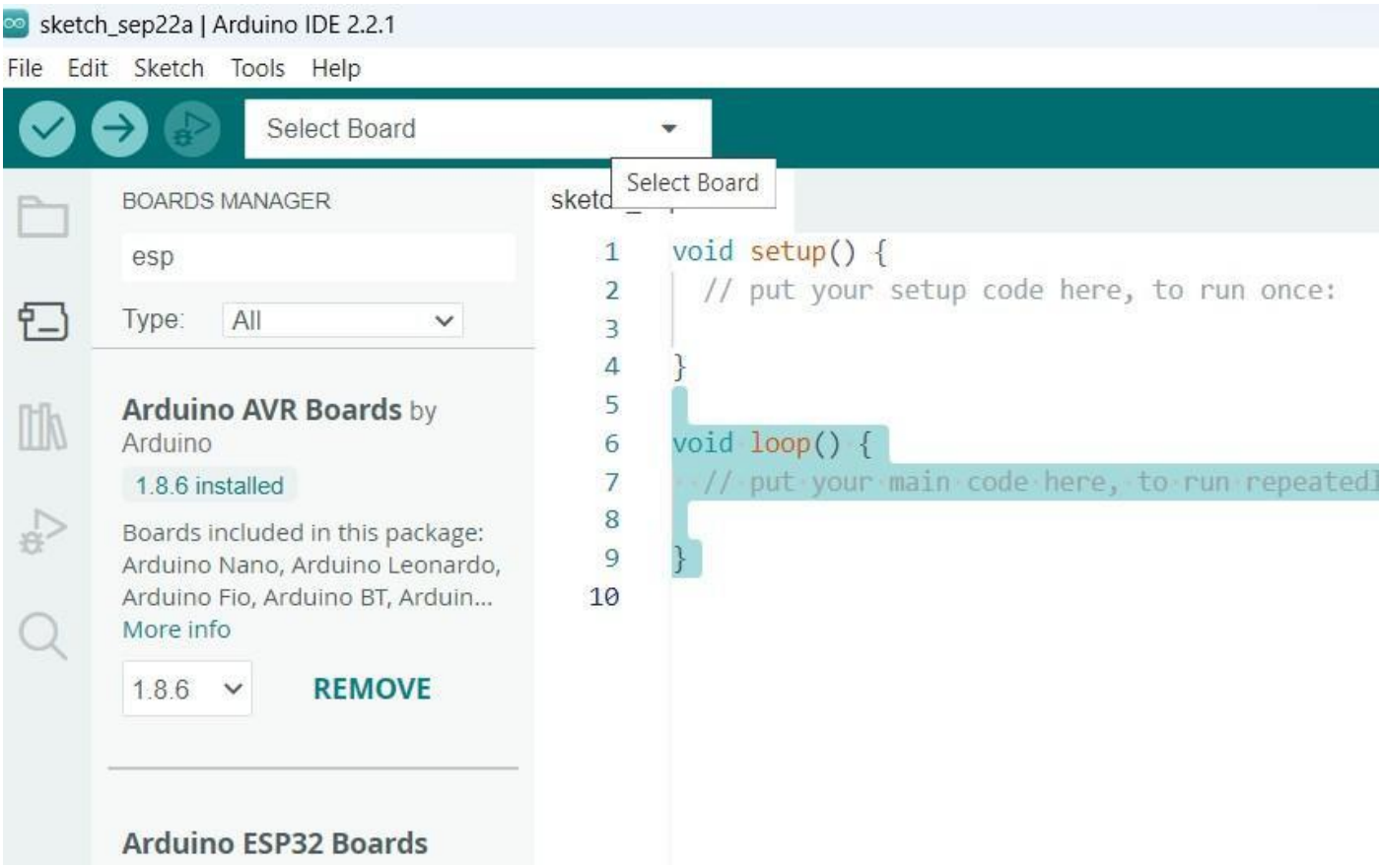
In the following screen, type esp in the text box provided for Boards Manager.



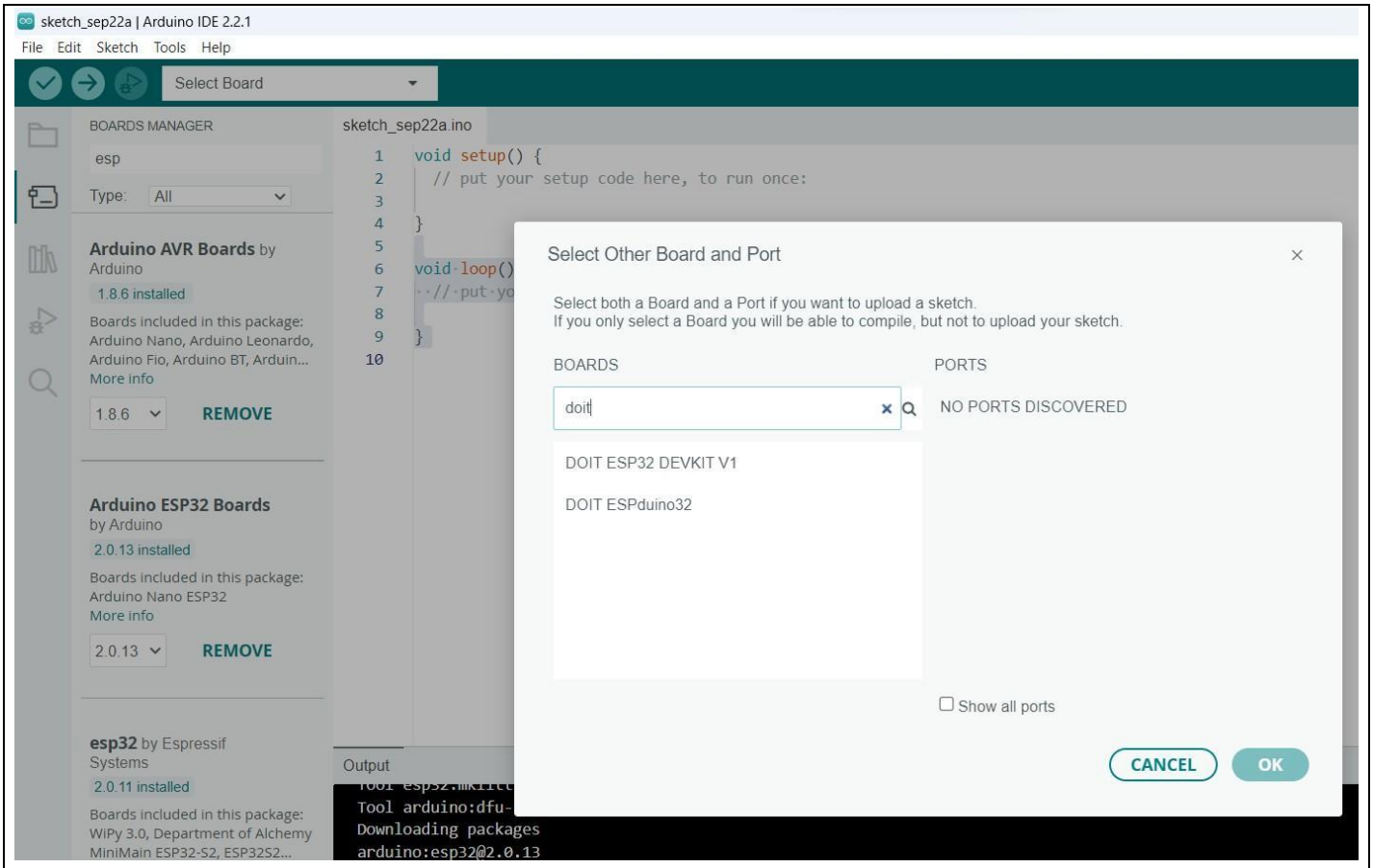
You will have a list of related board packages.
You have to install both esp32 by Espressif and Arduino ESP32 boards by Arduino
After clicking install button, it will take few minutes to install and after successful installation, Install Button will be changed to Remove Button.


sketch_sep22a | Arduino IDE 2.2.1
File Edit Sketch Tools Help
Select Board
BOARDS MANAGER
esp
Type: All
Arduino AVR Boards by Arduino
1.8.6 installed
Boards included in this package: Arduino Nano, Arduino Leonardo, Arduino Fio, Arduino BT, Arduin...
More info
1.8.6
REMOVE
Arduino ESP32 Boards by Arduino
2.0.13 installed
Boards included in this package: Arduino Nano ESP32
More info
2.0.13
REMOVE
esp32 by Espressif Systems
2.0.11 installed
Boards included in this package: WiPy 3.0, Department of Alchemy MiniMain ESP32-S2, ESP32S2...
More info
2.0.11
REMOVE
sketch_sep22a.ino
1 void setup() {
2 // put your setup code
3
4 }
5
6 void loop() {
7 // put your main code h
8
9 }
10
Output
Tool arduino:dfu-util@0.11.0-ar
Downloading packages
arduino:esp32@2.0.13
Installing platform arduino:esp
Configuring platform.
Platform arduino:esp32@2.0.13 i

After installation, click select board



If you are able to see the below screen, your software installation was successfully completed.



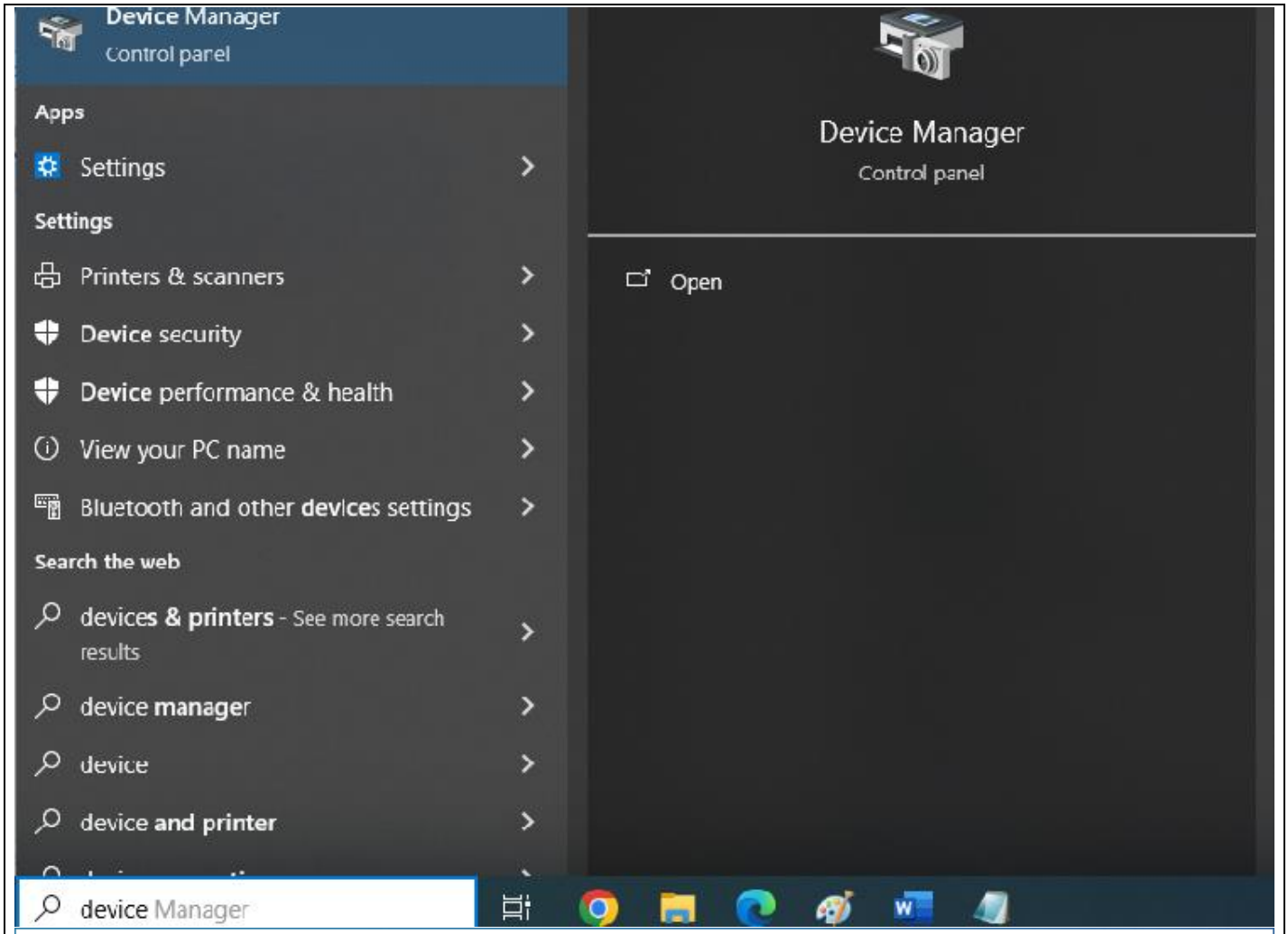
Installation of CH340 USB-UART Bridge driver

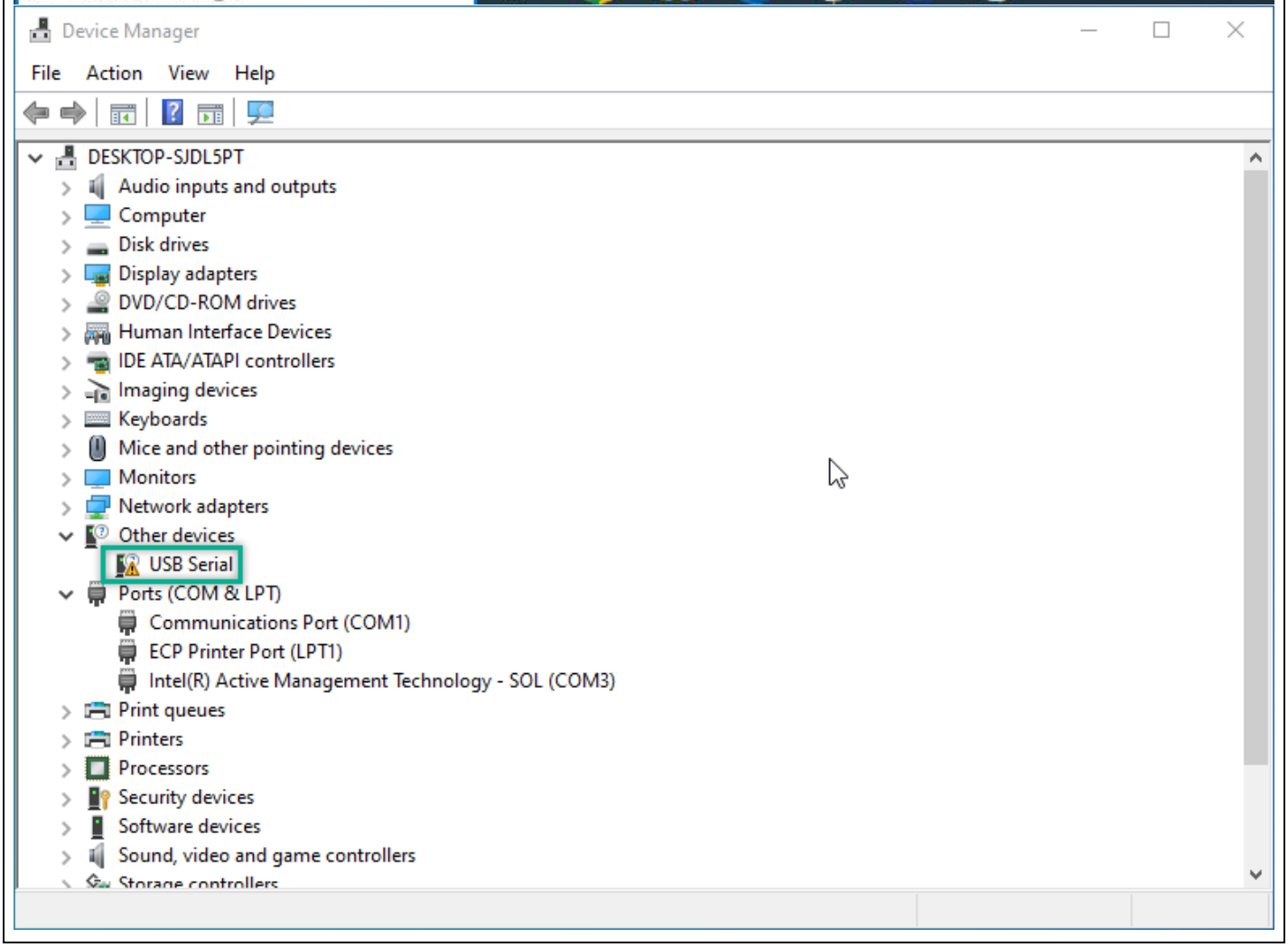
CH340 is a TTL (serial) to USB converter and vice versa. This chip has been used in some boards such as Arduino boards (non-original Arduinos), ESP8266, etc. The boards using the CH340 chip, don't need a programmer in order to access the processor or to program them. But there is a downside. An extra driver must be installed before starting to work with boards having this IC. In this section, you will learn how to install the CH340 driver.

Installing CH340 Driver on Windows

If you connect your board to the computer before installing the driver, your computer will not recognize the board correctly and you will see following image in Device Manager.

To open Device Manager, search for it in the Windows Start menu.


Device Manager
Control panel
Apps
Settings
Settings
Printers & scanners
Device security
Device performance & health
View your PC name
Bluetooth and other devices settings
Search the web
devices & printers - See more search results
device manager
device
device and printer
Device Manager
Control panel
Open
device Manager


Device Manager
File
Action
View
Help
DESKTOP-SJDL5PT
Audio inputs and outputs
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Human Interface Devices
IDE ATA/ATAPI controllers
Imaging devices
Keyboards
Mice and other pointing devices
Monitors
Network adapters
Other devices
USB Serial
Ports (COM & LPT)
Communications Port (COM1)
ECP Printer Port (LPT1)
Intel(R) Active Management Technology - SOL (COM3)
Print queues
Printers
Processors
Security devices
Software devices
Sound, video and game controllers

Follow the steps below to install the CH340 driver:

Step 1: CH340 driver download

To install the CH340 driver for Windows, go to the website How to Install CH340 Drivers - SparkFun Learn (https://learn.sparkfun.com/tutorials/how-to-install-ch340-drivers/all#drivers-if-you-need-them) and download the EXE file for the driver. After the download is complete, execute the file, then select "Install" in the Driver Setup window. Once the installation is successful, you will see a dialog box confirming that the driver install was successful.

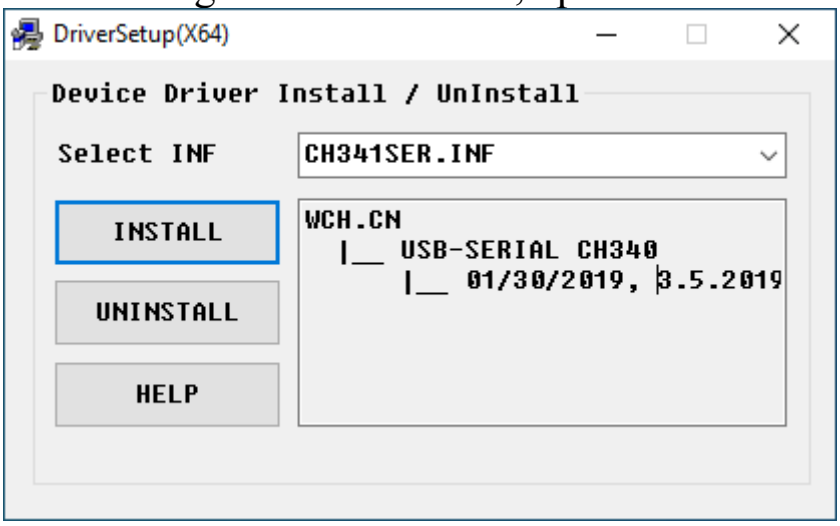
Alternate link for CH340 driver:

http://www.wch.cn/download/CH341SER_ZIP.html

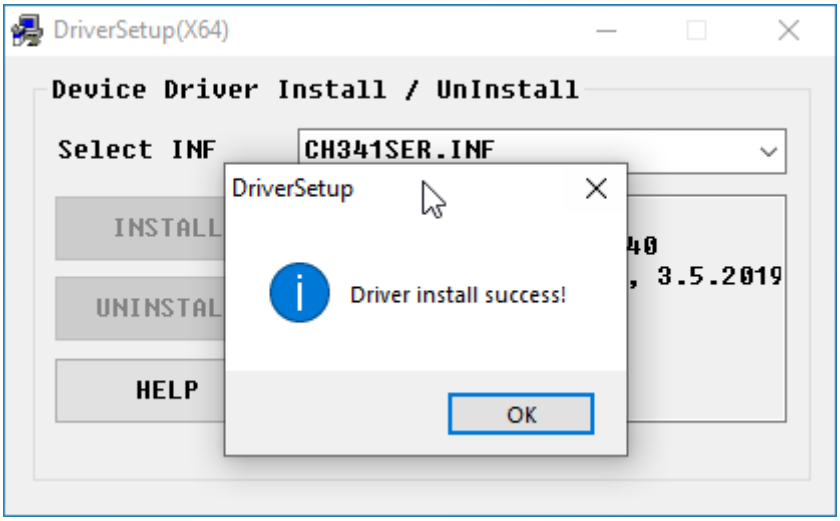
https://electropeak.com/learn/download/ch341ser-zip/

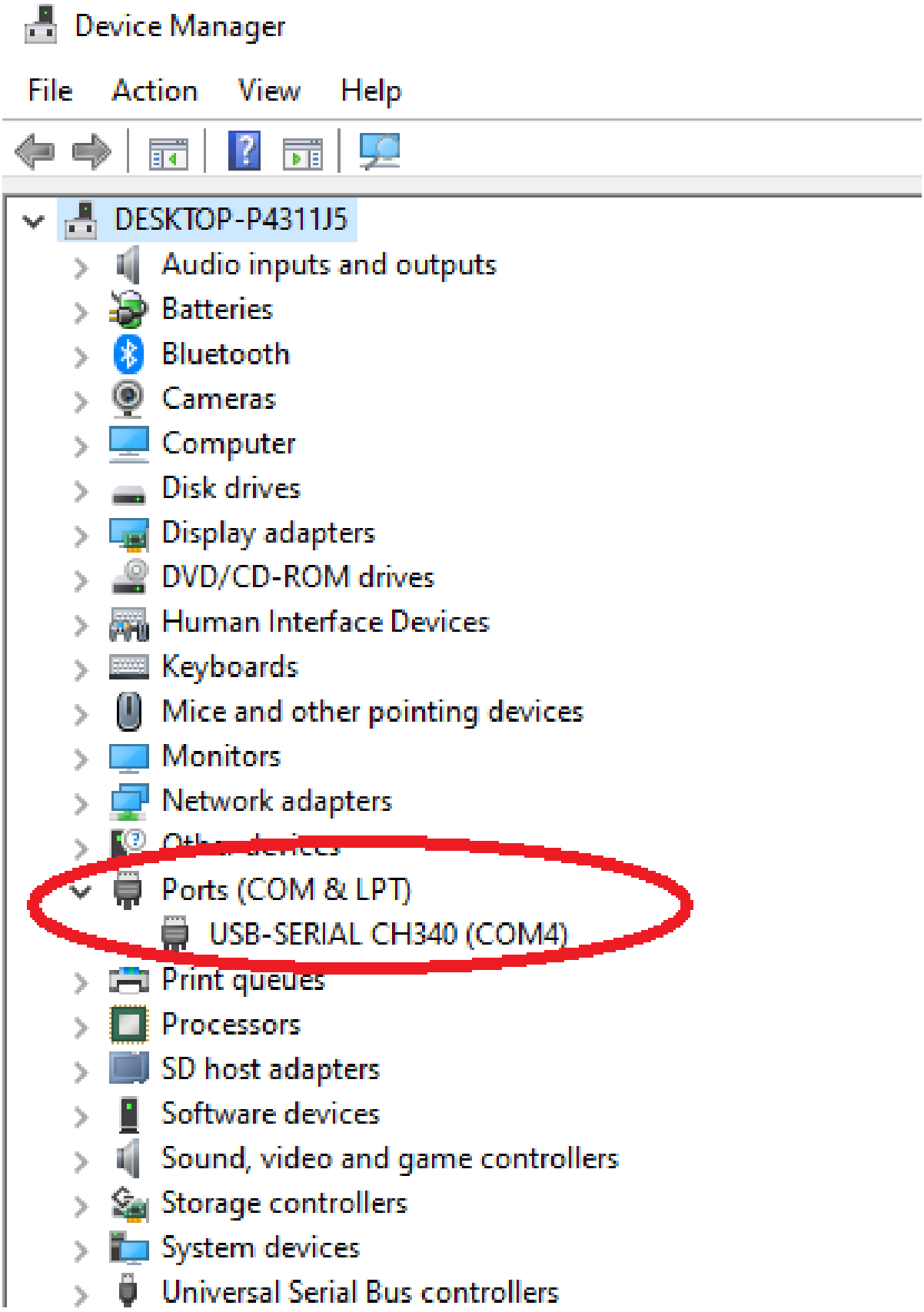
Step 2: Installing the driver

After downloading the CH340driver, open it and click Install.

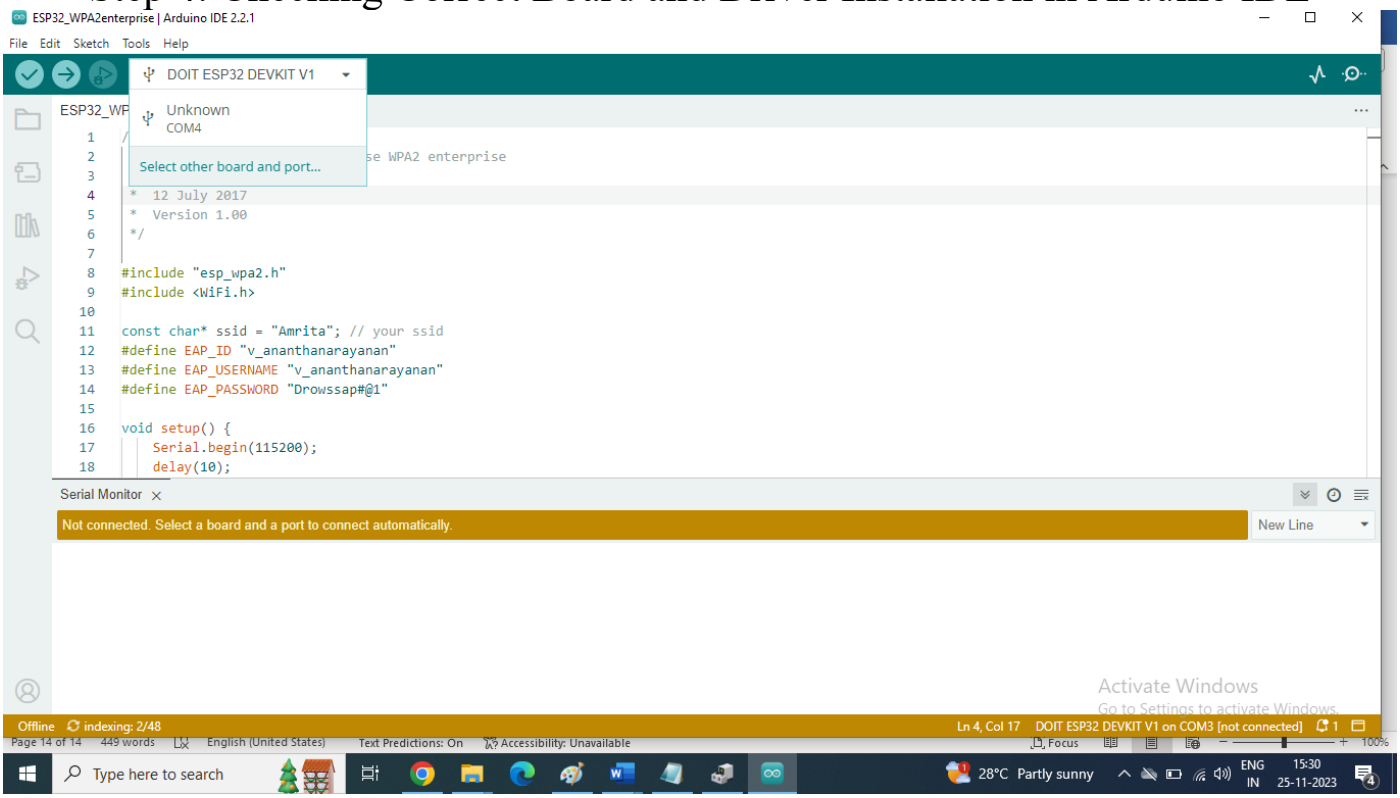


After successful installation you should see this message.



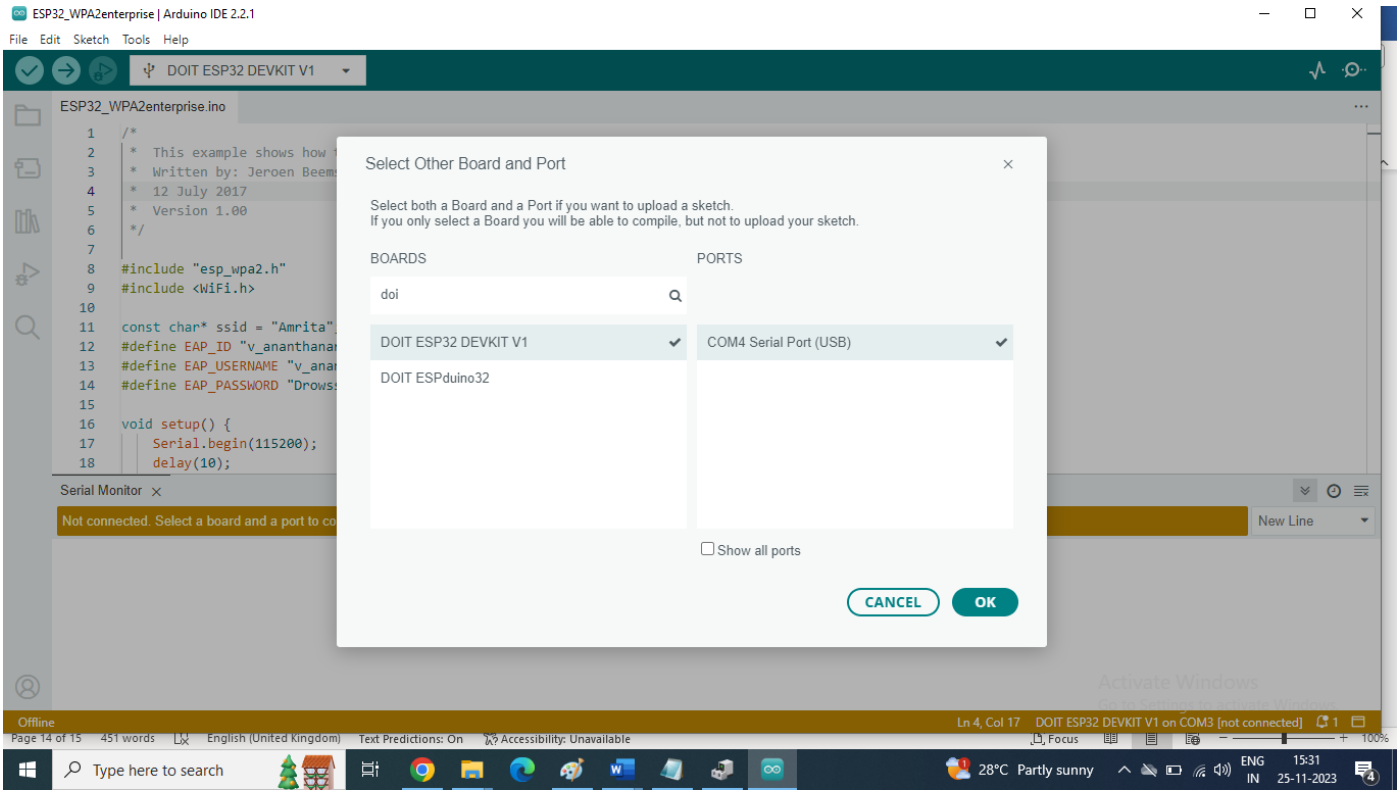

Device Manager
File
Action
View
Help
DESKTOP-P4311J5
Audio inputs and outputs
Batteries
Bluetooth
Cameras
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Human Interface Devices
Keyboards
Mice and other pointing devices
Monitors
Network adapters
Ports (COM & LPT)
USB-SERIAL CH340 (COM4)
Print queues
Processors
SD host adapters
Software devices
Sound, video and game controllers
Storage controllers
System devices
Universal Serial Bus controllers

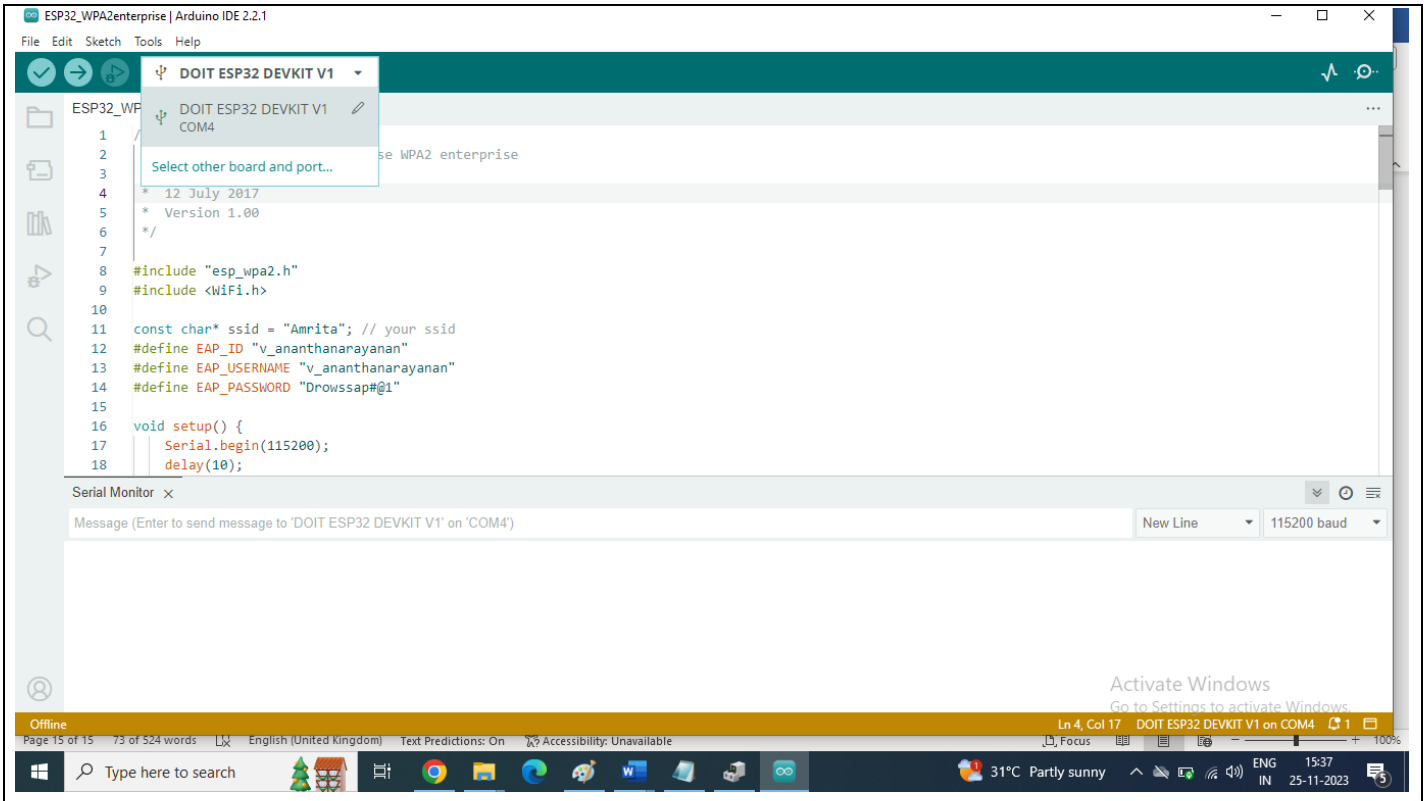
Step 4: Checking Correct Board and Driver Installation in Arduino IDE



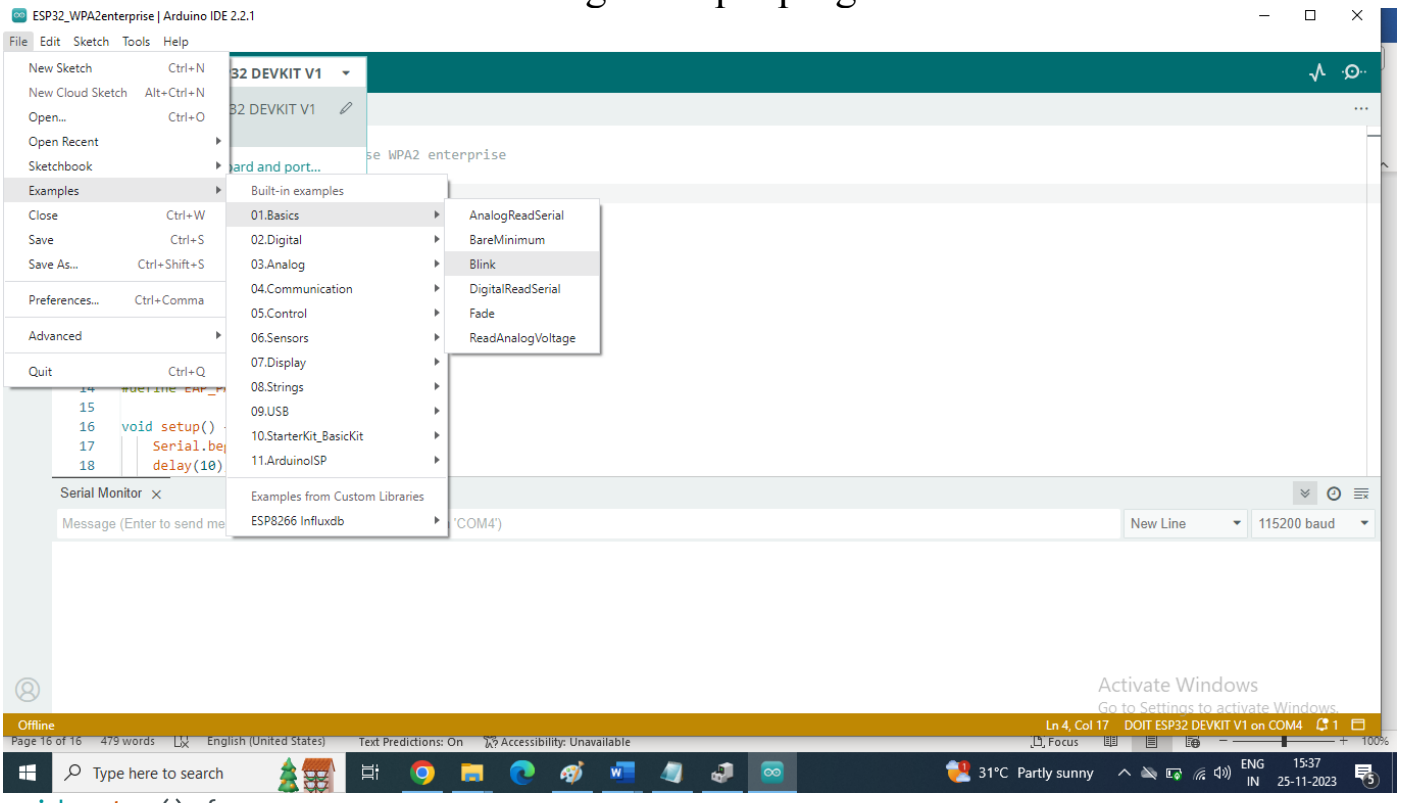
Type DOIT I the search text box for boards and select DOIT ESP32 DEVKIT V1 as well as select COM4 Serial Port (USB)

Note: It should match with the port number for USB-Serial CH340 listed in device Manager. Depends on the system, this COM Port may have various number from 3 on wards. Check your device manager for the COM port through which your IoT Kit is connected to your system / laptop.





Testing a sample program

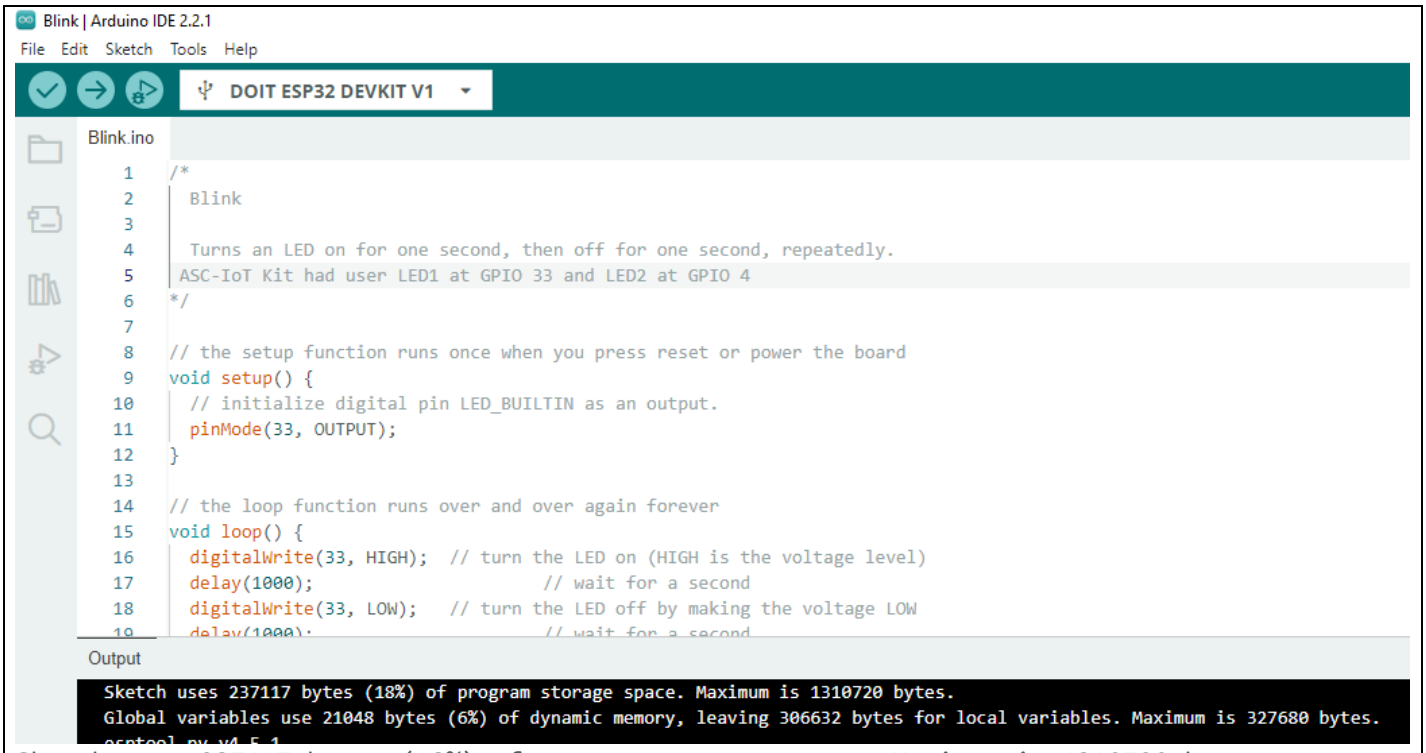



```
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);  // turn the LED on (HIGH is the voltage level)
  delay(1000);                      // wait for a second
  digitalWrite(LED_BUILTIN, LOW);   // turn the LED off by making the voltage LOW
  delay(1000);                      // wait for a second
}
```

In our Tektork IoT Kit, User LED 1 is connected to GPIO Pin 33 and so, LED_BUILTIN is changed to 33.

```
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(33, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(33, HIGH);  // turn the LED on (HIGH is the voltage level)
  delay(1000);                      // wait for a second
  digitalWrite(33, LOW);   // turn the LED off by making the voltage LOW
  delay(1000);                      // wait for a second
}
```

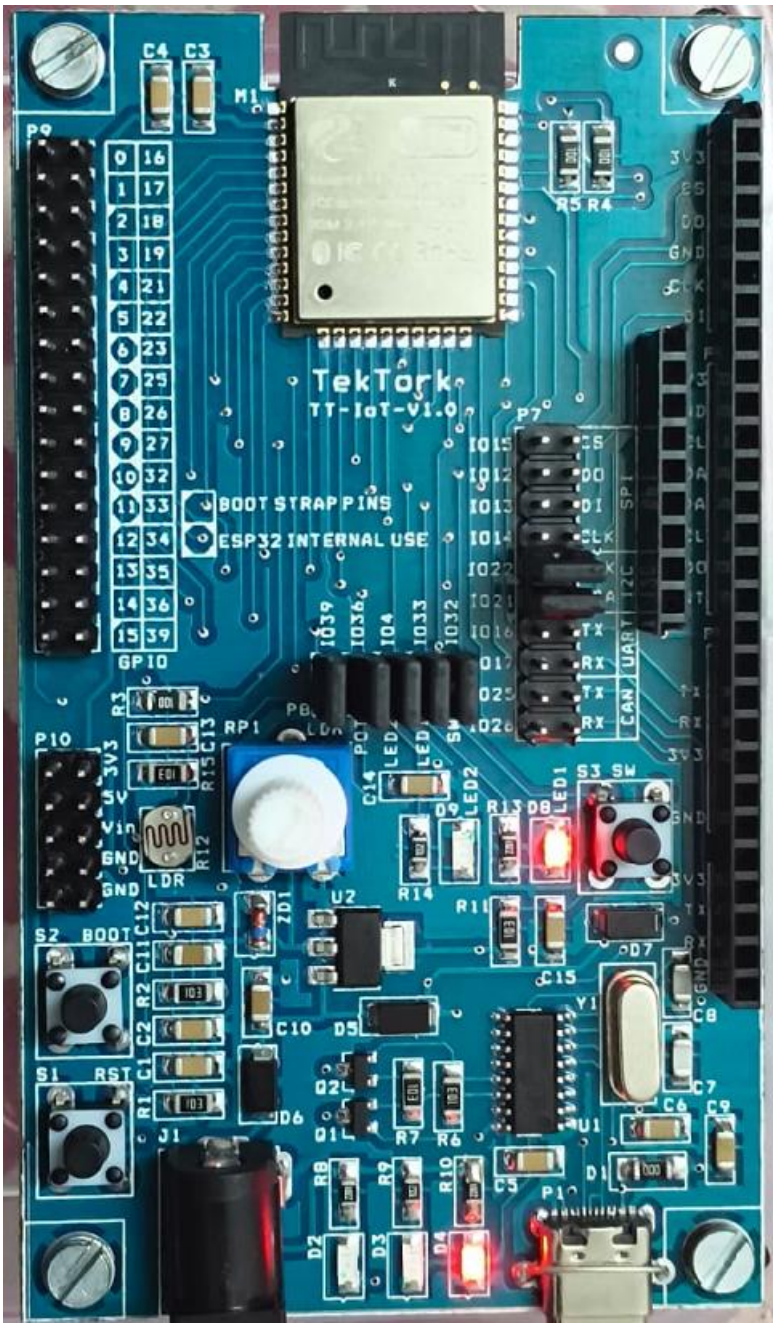
Click Upload Button




```
Sketch uses 237117 bytes (18%) of program storage space. Maximum is 1310720 bytes.
Global variables use 21048 bytes (6%) of dynamic memory, leaving 306632 bytes for local
variables. Maximum is 327680 bytes.
esptool.py v4.5.1
Serial port COM4
Connecting.......
Chip is ESP32-D0WD-V3 (revision v3.0)
Features: WiFi, BT, Dual Core, 240MHz, VRef calibration in efuse, Coding Scheme None
Crystal is 40MHz
MAC: c4:de:e2:10:70:ac
Uploading stub...
Running stub...
Stub running...
Changing baud rate to 921600
Changed.
Configuring flash size...
Flash will be erased from 0x00001000 to 0x00005fff...
Flash will be erased from 0x00008000 to 0x00008fff...
Flash will be erased from 0x0000e000 to 0x0000ffff...
Flash will be erased from 0x00010000 to 0x00049fff...
Compressed 17568 bytes to 12204...
Writing at 0x00001000... (100 %)
Wrote 17568 bytes (12204 compressed) at 0x00001000 in 0.5 seconds (effective 264.9
kbit/s)...
Hash of data verified.
Compressed 3072 bytes to 146...
Writing at 0x00008000... (100 %)
Wrote 3072 bytes (146 compressed) at 0x00008000 in 0.1 seconds (effective 301.9 kbit/s)...
Hash of data verified.
Compressed 8192 bytes to 47...
Writing at 0x0000e000... (100 %)
Wrote 8192 bytes (47 compressed) at 0x0000e000 in 0.2 seconds (effective 428.1 kbit/s)...
Hash of data verified.
Compressed 237488 bytes to 130712...
Writing at 0x00010000... (12 %)
Writing at 0x0001d273... (25 %)
Writing at 0x00024369... (37 %)
Writing at 0x0002953b... (50 %)
Writing at 0x0002eb93... (62 %)
Writing at 0x00037102... (75 %)
```

```
Writing at 0x0003f146... (87 %)
Writing at 0x000447c5... (100 %)
Wrote 237488 bytes (130712 compressed) at 0x00010000 in 2.6 seconds (effective 720.4
kbit/s)...
Hash of data verified.

Leaving...
Hard resetting via RTS pin...
```

After RESET, User LED User LED 1 at GPIO 33 blinks at the rate of 1 Second.



1. Basic LED Blink Program on ESP32
Full Code - Single LED Blink

```
const int ledPin = 33;  // GPIO33 where LED is connected

void setup()
{
  pinMode(ledPin, OUTPUT);  // Initialize GPIO33 as output
}
void loop()
{
  digitalWrite(ledPin, HIGH);  // Turn LED ON
  delay(1000);                 // Wait for 1 second
  digitalWrite(ledPin, LOW);   // Turn LED OFF
  delay(1000);                 // Wait for 1 second
}
```

Step-by-Step Program Explanation
1.1. Pin Declaration

```
const int ledPin = 33;  // GPIO33 where LED is connected
```

- Purpose: Defines which GPIO pin the LED is connected to
- Technical Detail: **const int** creates a constant integer variable that cannot be changed during program execution
- Hardware Connection: The LED is physically connected to GPIO pin 33 on the Tektork IoT board

1.2. Setup Function

```
void setup()
{
  pinMode(ledPin, OUTPUT);  // Initialize GPIO33 as output
}
```

- Purpose: Configures the GPIO pin for output operation
- Technical Detail: pinMode() function sets the pin mode - INPUT or OUTPUT
- Execution: This function runs only once when the ESP32 powers up or resets
- Hardware Effect: Prepares GPIO33 to send voltage signals to control the LED

1.3. Main Loop Function

```
void loop()
{
  digitalWrite(ledPin, HIGH);  // Turn LED ON
  delay(1000);                 // Wait for 1 second
  digitalWrite(ledPin, LOW);   // Turn LED OFF
  delay(1000);                 // Wait for 1 second
}
```

Line-by-Line Breakdown:

digitalWrite(ledPin, HIGH);

- Sets GPIO33 to HIGH voltage (3.3V)
- This turns the LED ON by providing 3.3V to the Anode terminal of LED.

delay(1000);

- Pauses program execution for 1000 milliseconds (1 second)
- LED remains ON during this time

digitalWrite(ledPin, LOW);

- Sets GPIO33 to LOW voltage (0V)
- This turns the LED OFF by making voltage at Anode terminal to 0V

delay(1000);

- Another 1-second pause with LED OFF
- LED blinks at the rate of 1 Second.

1.4. Program Flow

Line-by-Line Breakdown:

- The loop() function repeats continuously after setup() completes
- This creates an endless cycle: LED ON → Wait → LED OFF → Wait → Repeat
- The result is a visible blinking pattern at 1-second intervals

1.5. Expected Result

- The LED will blink ON and OFF repeatedly
- Each ON and OFF state lasts exactly 1 second
- This confirms that the ESP32 is programmed correctly and functioning properly

2. Troubleshooting Tips

Even with clear instructions, you may encounter issues during installation or when uploading your LED blink program. Below are common problems and straightforward solutions to help you get back on track.

2.1. Arduino IDE Won't Launch

- Issue: Double-clicking the IDE icon does nothing or shows an error message.
- Solution:
  Ensure your operating system meets the minimum requirements (Windows 7/8/10, macOS 10.10+, Linux).
  Reinstall the IDE: download the latest version from the Arduino website and install again.
  Run the IDE as Administrator (Windows) or with elevated privileges (macOS/Linux).

ESP32 Board Not Listed in Boards Manager

- Issue: You don't see "ESP32 Dev Module" under Tools → Board.
- Solution:
  In File → Preferences, confirm the Additional Boards Manager URL is exactly https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json.
  After adding the URL, open Tools → Board → Boards Manager, search for "ESP32," and click Install.

2.2. COM Port Doesn't Appear or Is Grayed Out

- Issue: No COM port available under Tools → Port.
- Solution:
  Verify the CH340 driver is installed correctly (check for "USB-SERIAL CH340" in Device Manager on Windows).
  Try a different USB cable or USB port on your computer (some cables are power-only).
  Restart your computer after driver installation.

2.3. Upload Fails with "Failed to Connect to ESP32: Timed Out"

- Issue: The IDE shows an error like A fatal error occurred: Timed out waiting for packet header.
- Solution:
  Press and hold the BOOT button on the ESP32 board just before the upload starts, and release it when you see the "Connecting…" message in the IDE.
  Lower the upload speed: in Tools → Upload Speed, choose a slower baud rate (e.g., 115200).

2.4. LED Doesn't Blink After Successful Upload

- Issue: IDE confirms upload, but the LED stays off or on continuously.
- Solution:
  Confirm you are using the correct LED pin in your code (e.g., GPIO2 for the onboard LED on many ESP32 boards. Tektork IoT kit has LED at GPIO 33).
  Check that the LED is properly connected (long leg to the GPIO pin, short leg to GND via a resistor).
  Verify the resistor value (220 Ω–330 Ω) is appropriate.
- In Tektork IoT Kit, LEDs are available through GPIO 33 and GPIO 4 . Ensure the jumpers are placed appropriately in the Connector P8.

Code Formatting or Syntax Errors in IDE

- Issue: Red error messages in the IDE when compiling.
- Solution:
  Ensure all code lines end with a semicolon (;) where required.
  Verify matching braces {} and parentheses ().
  Copy and paste code into the IDE's text editor to avoid hidden characters or incorrect quotation marks.

2.5. Driver Conflicts on macOS or Linux

- Issue: CH340 driver installation fails or another driver takes precedence.
- Solution:
  On macOS, allow driver in System Preferences → Security & Privacy after installation.
  On Linux, check dmesg logs for USB device errors and install libftdi or cp210x / ch340 modules if needed.
  Uninstall conflicting drivers before installing CH340.

By following these troubleshooting steps, you can quickly resolve the most common hurdles and continue with your Arduino IDE and ESP32 based Tektork IoT to develop any IoT and CPS project development smoothly.

3. Conclusion

By following this guide, you have successfully:

- Installed the Arduino IDE and configured it for ESP32 development.
- Added the ESP32 board package and the CH340 USB-serial driver to enable communication with your board.
- Written, compiled, and uploaded a Basic LED Blink program to GPIO pin 33 on the ESP32.
- Observed the LED blinking on and off at 1-second intervals, confirming that your hardware and software are functioning correctly.

With this foundation, you can confidently explore more advanced projects. Try modifying the blink interval, control multiple LEDs, or integrate sensors and communication modules. Experimenting with different programs will deepen your understanding of embedded systems and prepare you for complex IoT applications.

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