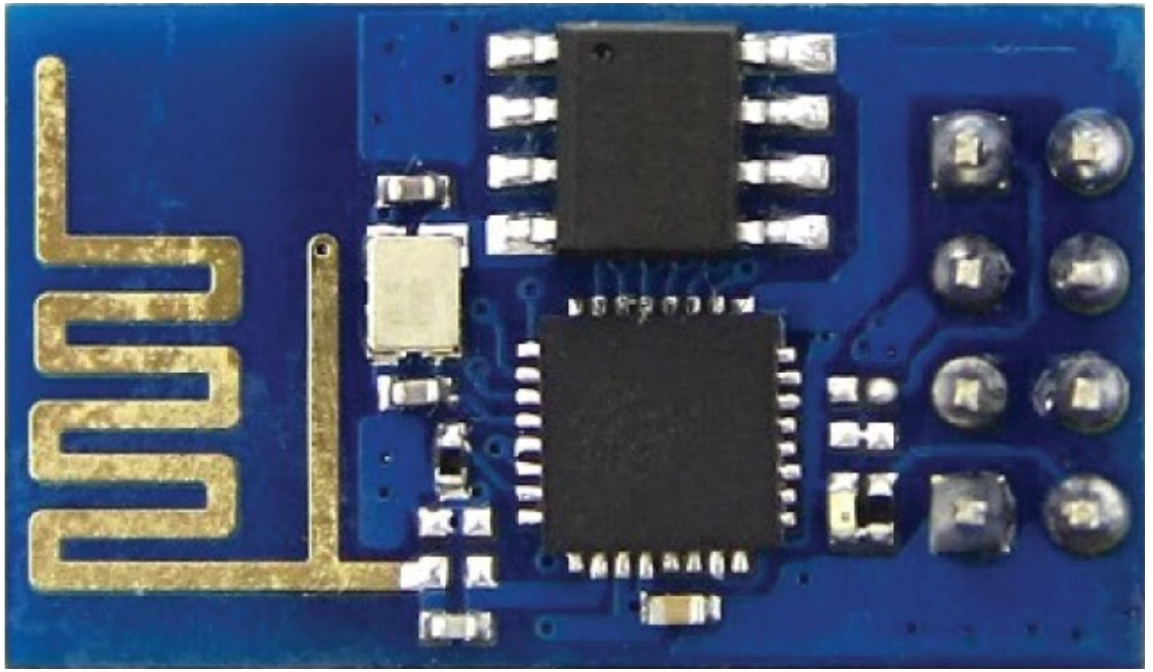
http://goo.gl/W6crOM

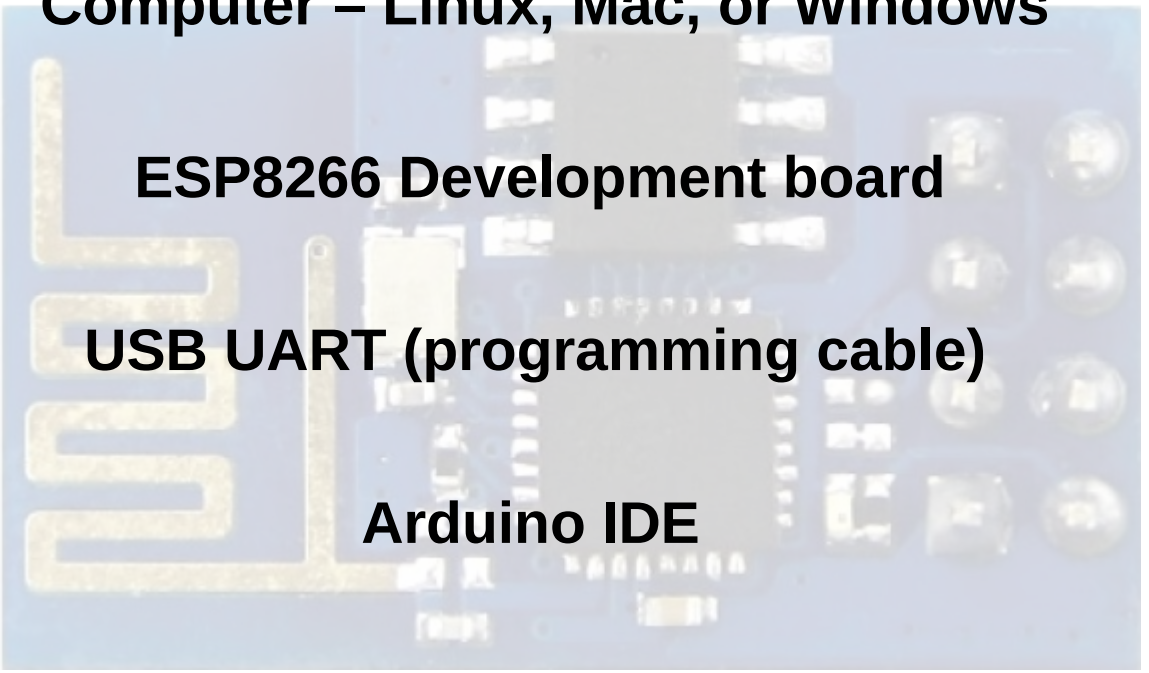
Introduction to The ESP8266



Micro Controller

Requirements for this class

Computer – Linux, Mac, or Windows



ESP8266 Development board

USB UART (programming cable)

Arduino IDE

ESP8266 Arduino Core

Outline for this class

Introduction to Micro Controllers & GPIOs

Overview of the ESP8266 Hardware & Software Development

Introduction to Arduino & Arduino IDE

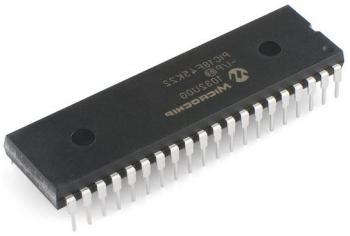
Install the Arduino IDE & Upload a Sketch

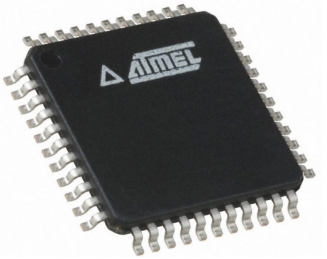
Build a Web Server to control the LED on the ESP8266 remotely over WiFi

How to apply what you learned to your own designs

Resources

What is a Micro Controller?

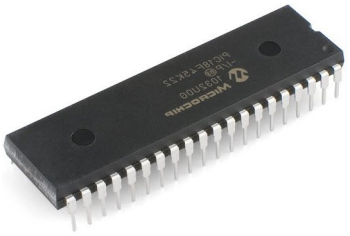


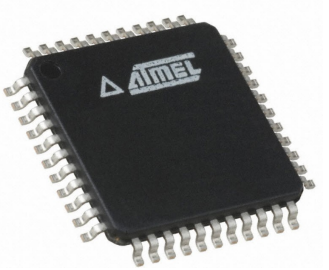


“ A microcontroller (or MCU for microcontroller unit) is a small computer on a single integrated circuit. In modern terminology, it is a System on a chip or SoC. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips.”

~ Wikipedia

What is a Micro Controller?





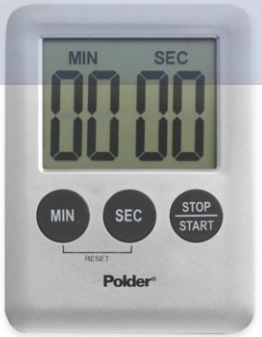
Small Computer in a Chip

Special purpose

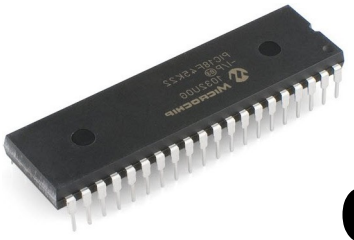
Does one thing well

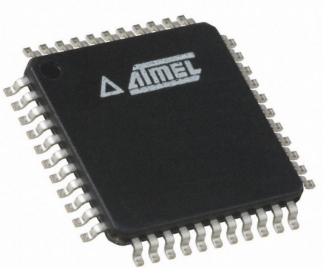
Embedded inside other device

VS



All Micro Controllers have





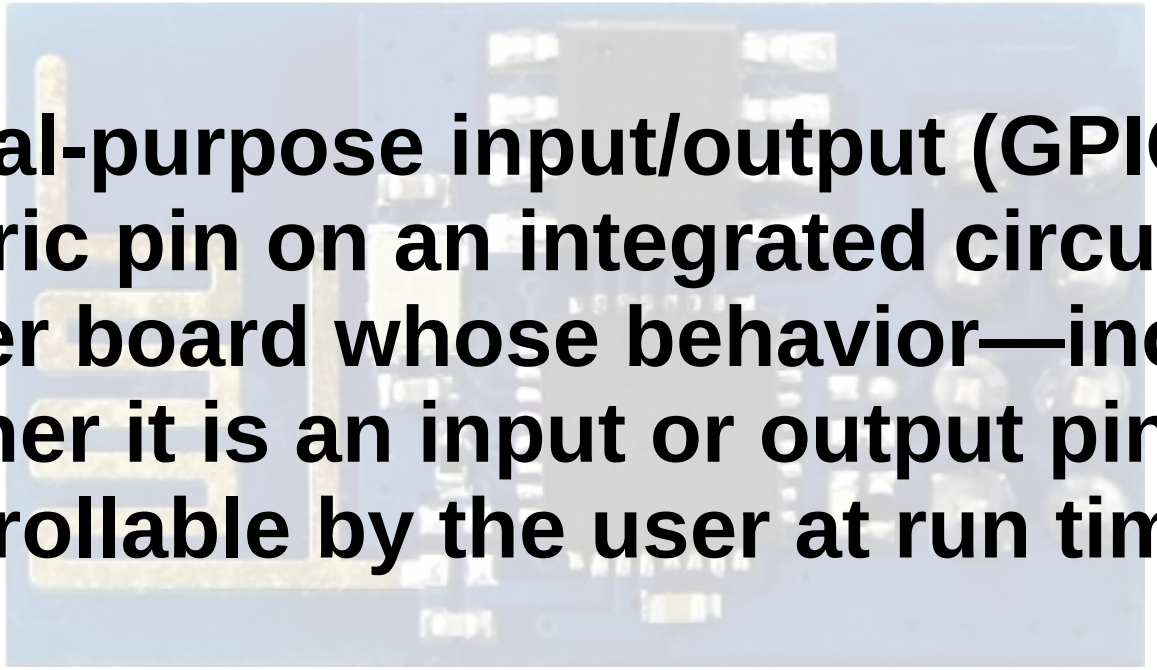
CPU (central processing unit)

RAM (random-access memory)

ROM (read-only memory)

I/O (input and output)

GPIO

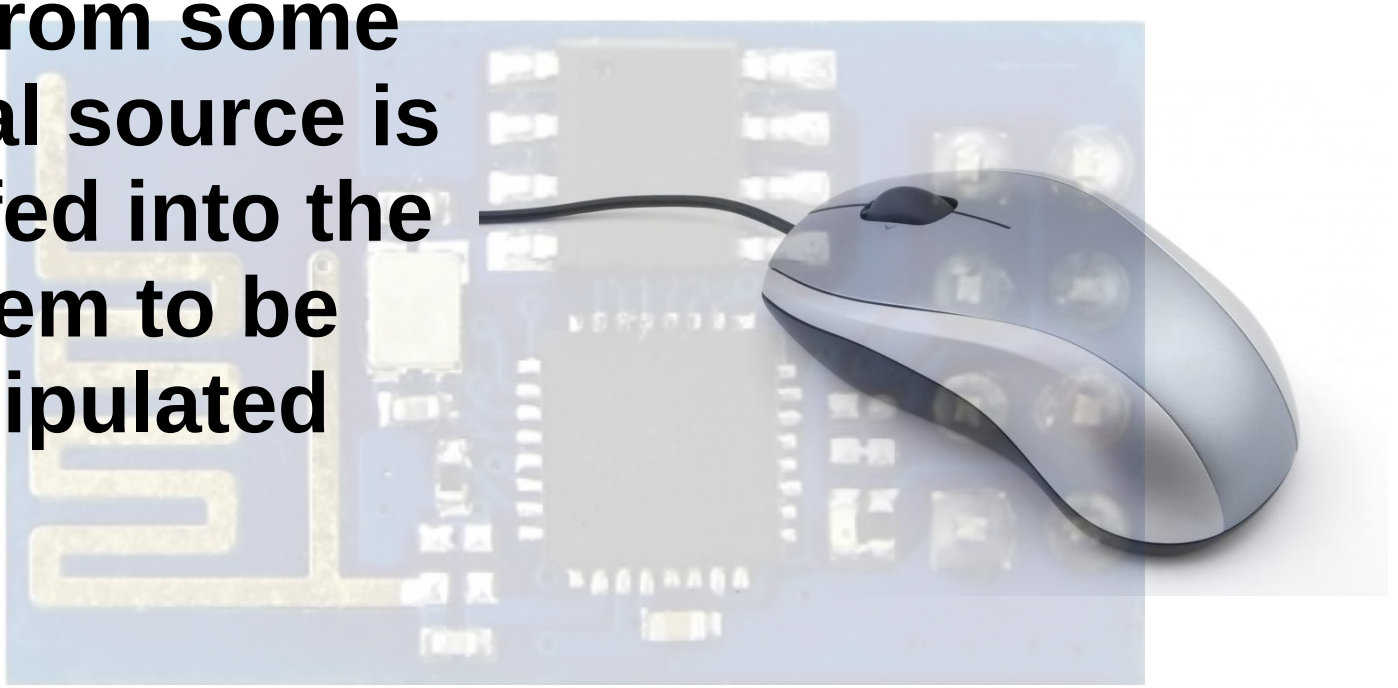


“General-purpose input/output (GPIO) is a generic pin on an integrated circuit or computer board whose behavior—including whether it is an input or output pin—is controllable by the user at run time.”

~ Wikipedia

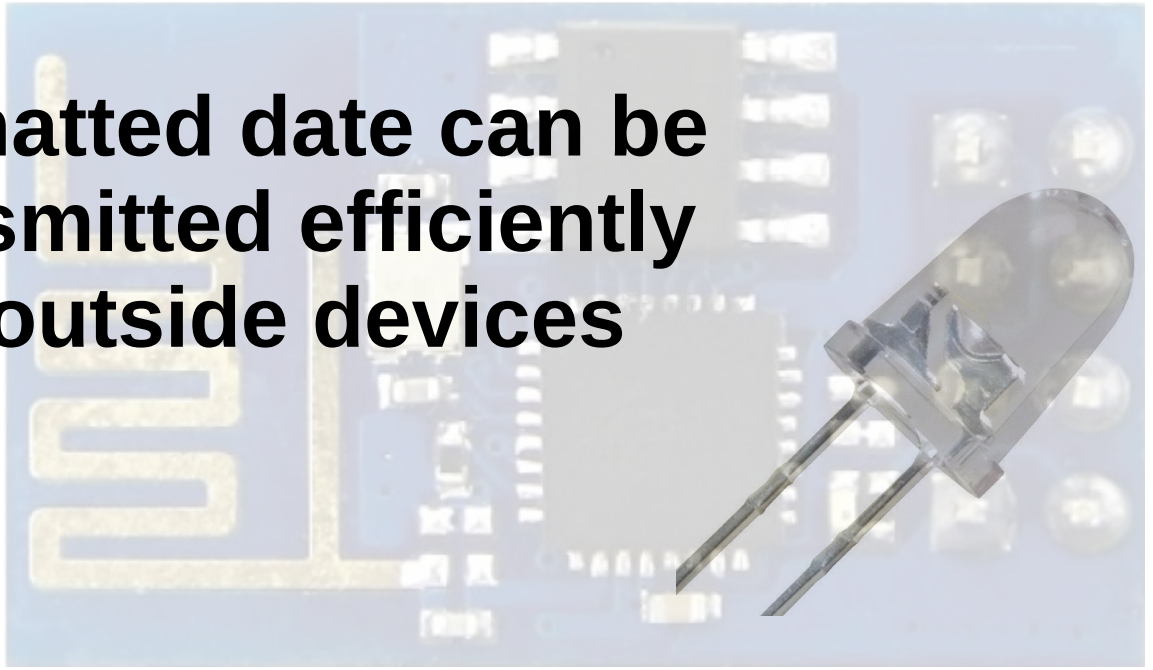
Input

Data from some external source is being fed into the system to be manipulated



Output

Formatted date can be transmitted efficiently to outside devices

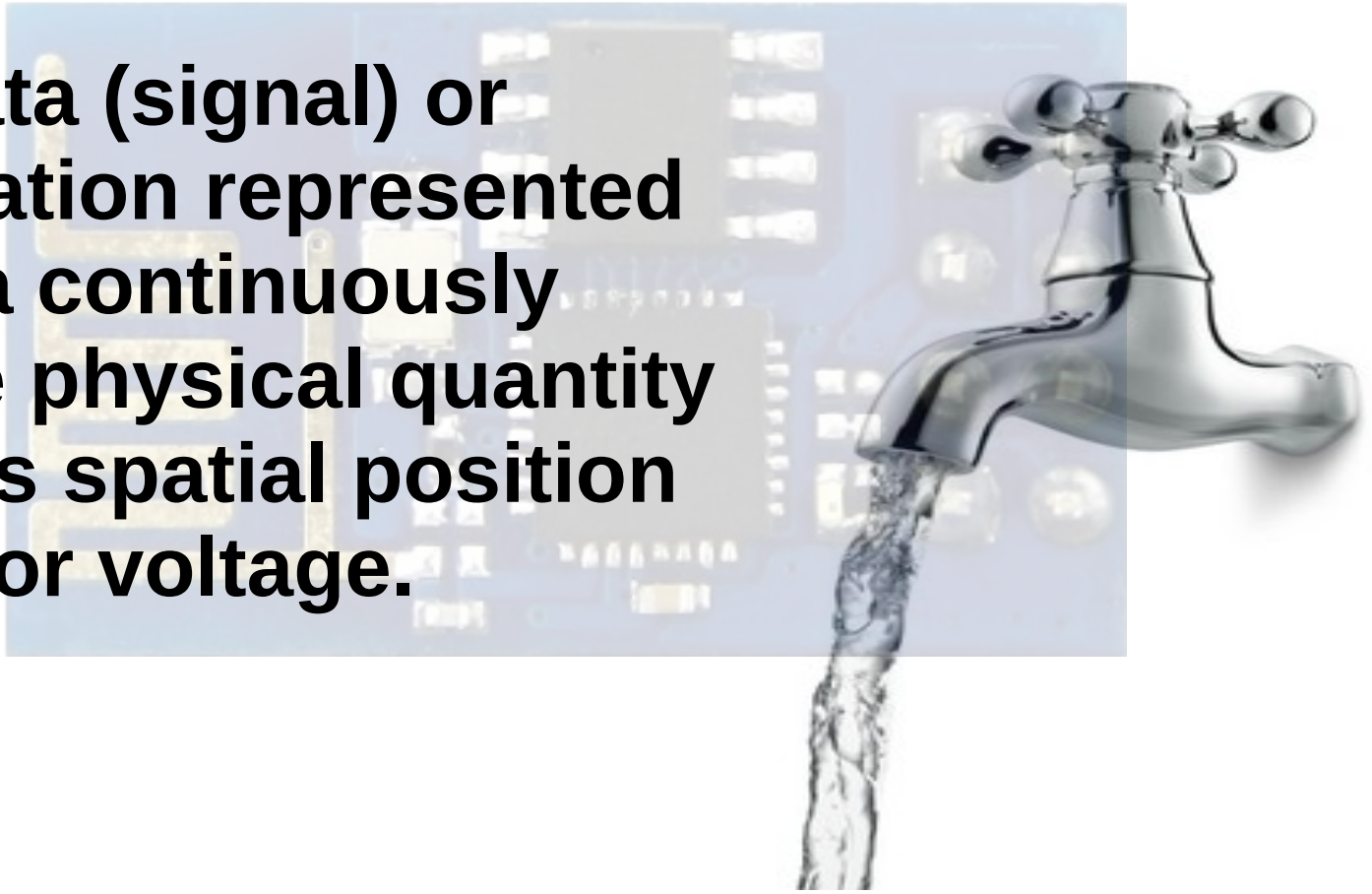


Digital

Data (signal) expressed as series of the digits 0 and 1, typically represented by values of a physical quantity such as voltage or magnetic polarization.

Analog

Data (signal) or information represented by a continuously variable physical quantity such as spatial position or voltage.



Specialized GPIO

UART

universal asynchronous receiver/transmitter

SPI

Serial Peripheral Interface

I2C

Inter-Integrated Circuit

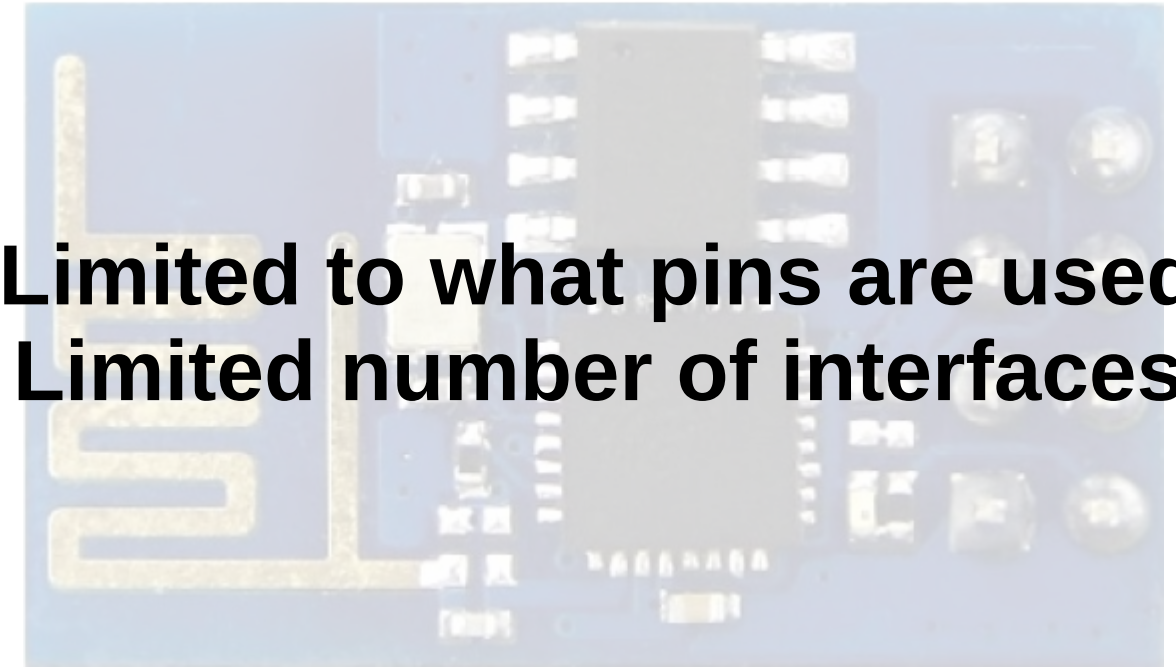
ADC

Analog to Digital Converter

DAC

Digital to Analog Converter (PWM)

Special GPIO



Limited to what pins are used
Limited number of interfaces

The ESP8266

Designed by Espressif Systems.

乐鑫信息科技

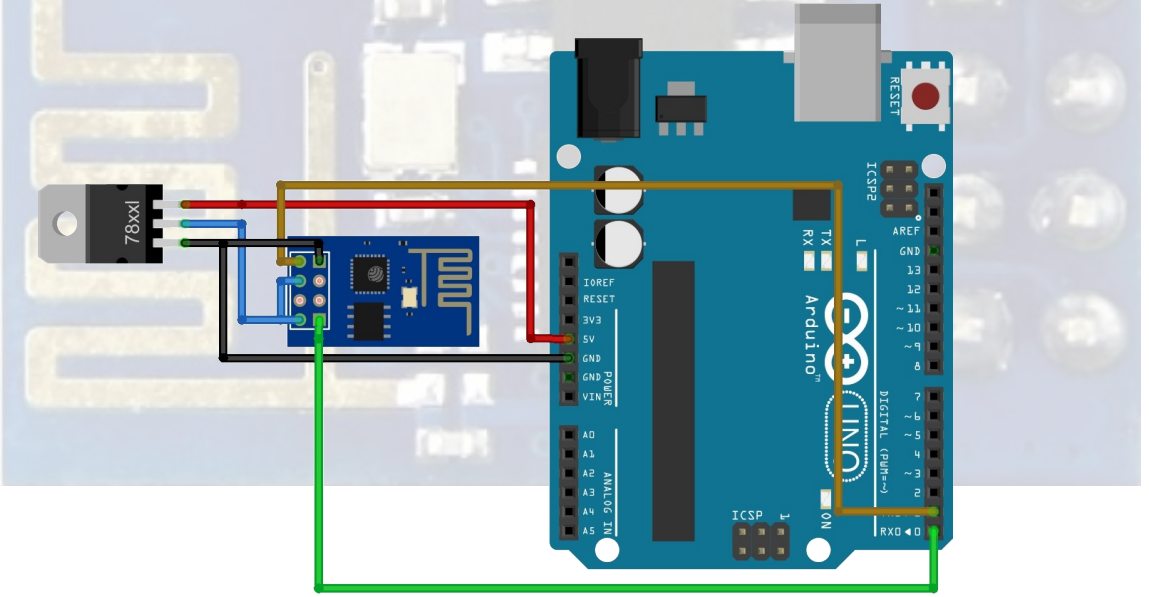
ESPRESSIF SYSTEMS

The ESP8266

The ESP8266 is a self-contained WiFi IoT solution.

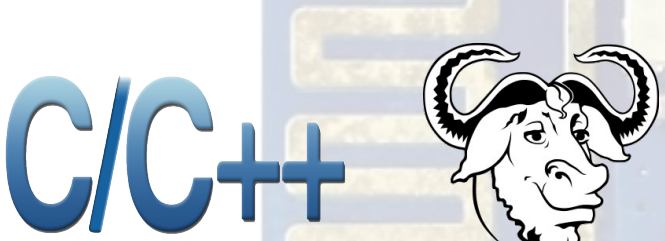
The ESP8266

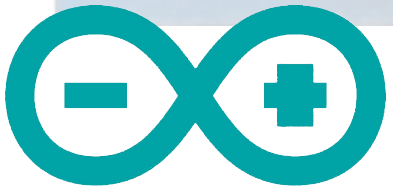
The ESP8266 can be used as a bridge for existing micro controllers to WiFi networks accessible using AT commands



The ESP8266

The ESP8266 is capable of running self contained applications using a variety of development environments





The ESP8266

Voltage	3.3V
Current consumption	10uA – 170mA
Flash memory attachable	16MB max (512K normal)
Processor	Tensilica L106 32 bit
Processor speed	80-160MHz
RAM	32K + 80K
GPIOs	17 (multiplexed)
Analog to Digital	1 input with 1024 steps
802.11 support	b/g/n/d/e/i/k/r
Max concurrent TCP	5

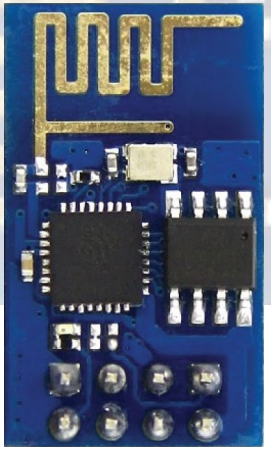
The ESP8266

	ESP8266	Arduino (Uno)
GPIOs	17	14
Analog input	1	6
PWM channels	8	6
Clock speed	80/160MHz	16MHz
Processor	Tensilica	Atmel
SRAM	45KBytes	2KBytes
Flash	512Kb-16MB	32KB (on chip)
Operating Voltage	3.3V	5V
Max current per I/O	12mA	40mA
UART (hardware)	1 1⁄2	1
SPI (hardware)	1(2)	1
I2c	Yes	Yes
I2s	Yes	No
Networking	Built-in (WiFi)	Separate

The ESP8266

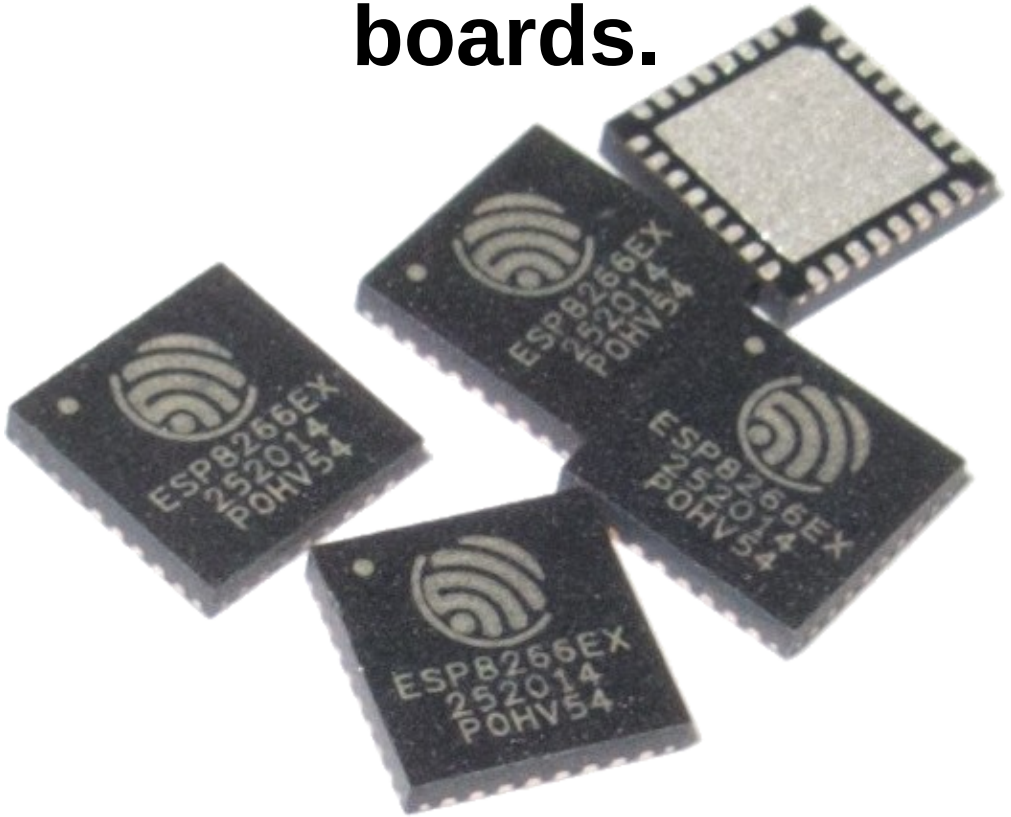
There are a variety of board styles available

ESP-1 and ESP-12



The ESP8266

There is only one ESP8266 processor and it is this processor that is found on ALL breakout boards.



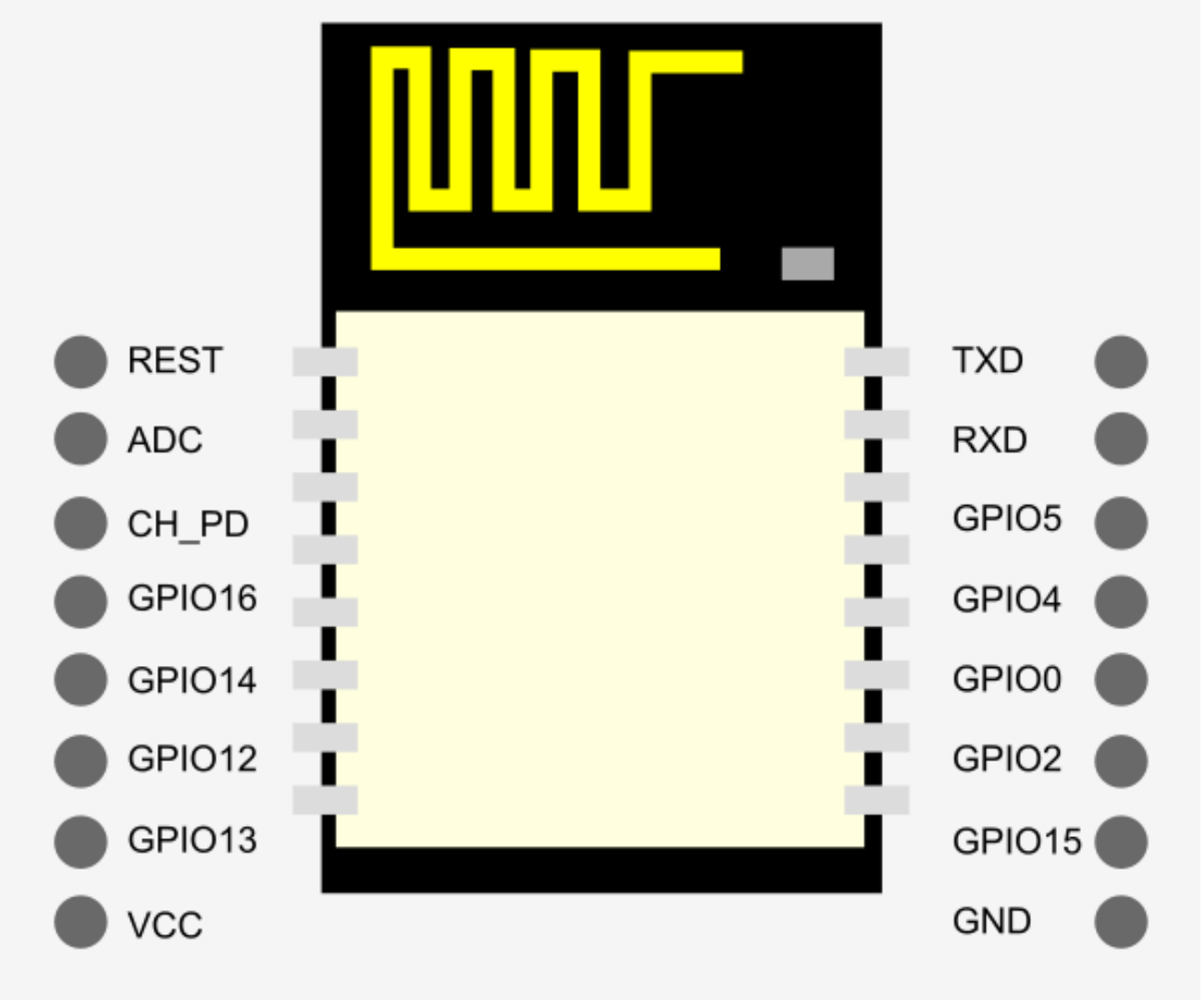
The ESP8266

What distinguishes one board from another?

the number of GPIO pins exposed
the amount of flash memory provided
and the package footprint.

From a programming perspective,
they are all the same.

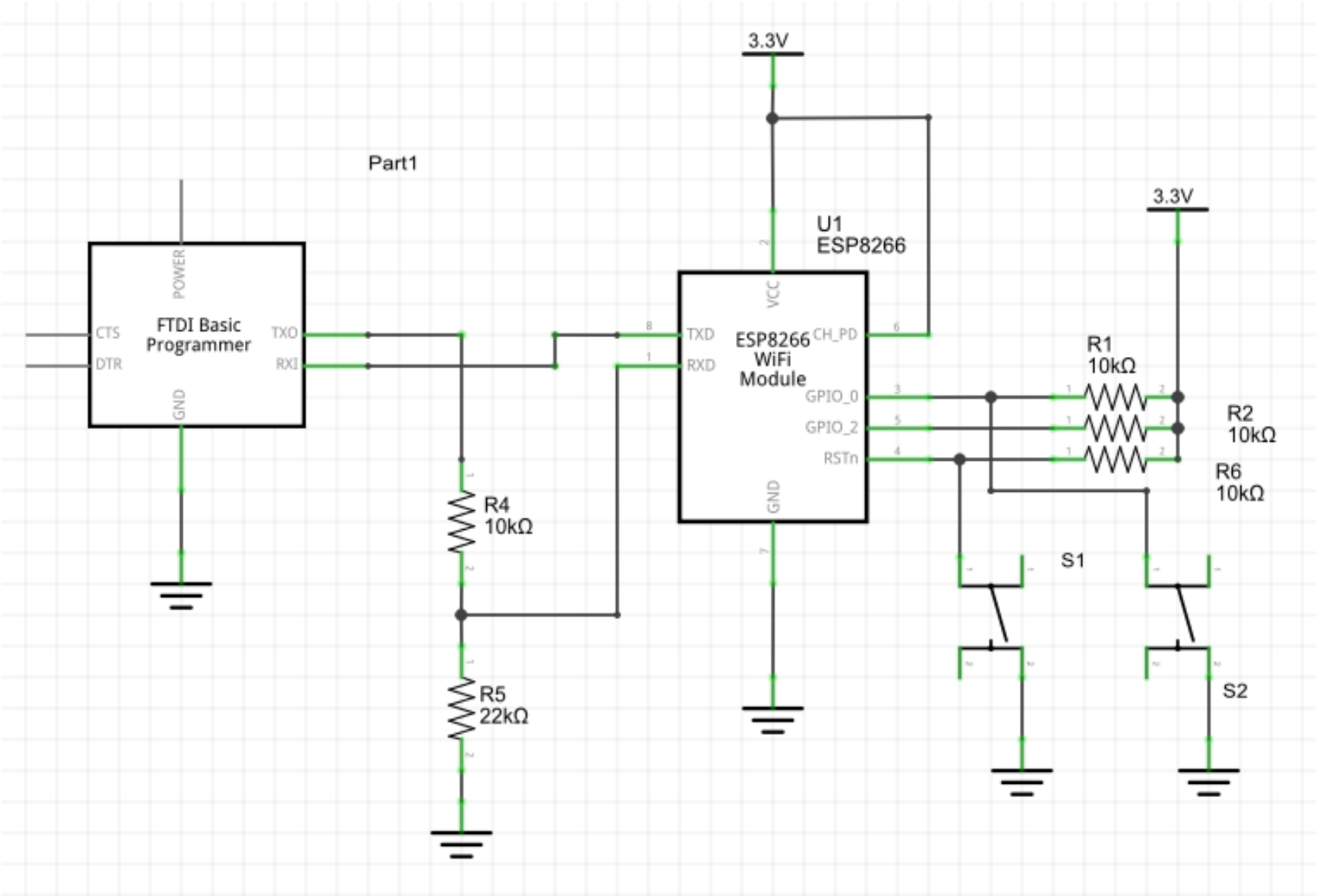
The ESP8266


REST
ADC
CH_PD
GPIO16
GPIO14
GPIO12
GPIO13
VCC
TXD
RXD
GPIO5
GPIO4
GPIO0
GPIO2
GPIO15
GND

The ESP8266

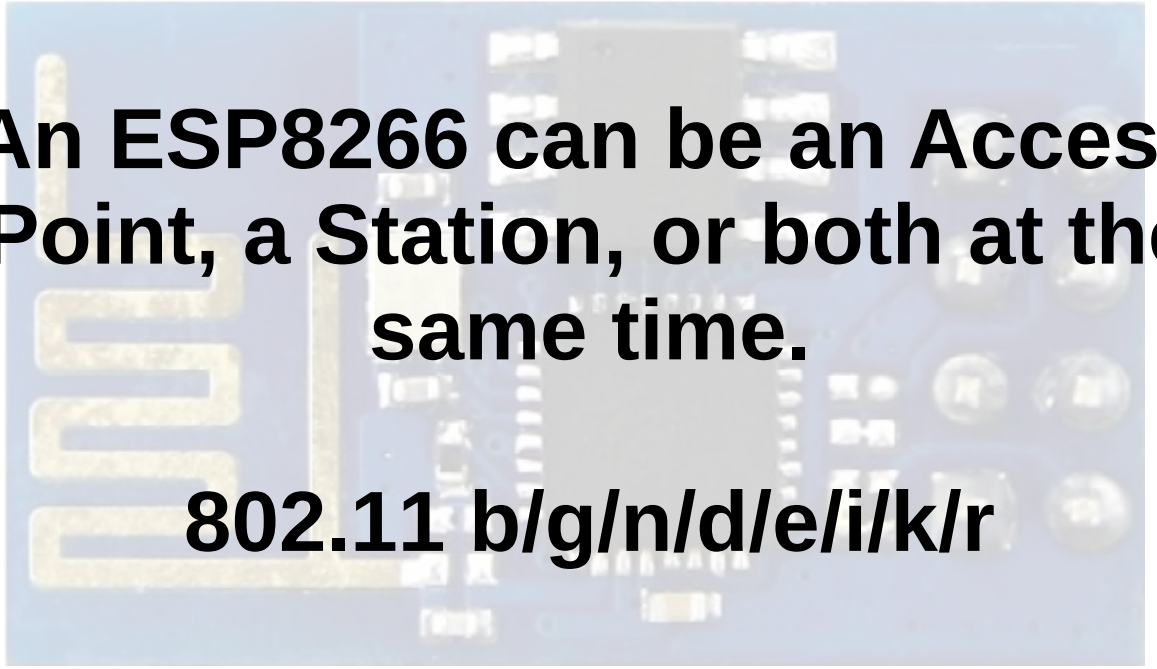
Name	Description
VCC	3.3V
GPIO 13	Also used for SPI MOSI
GPIO 12	Also used for SPI MISO
GPIO 14	Also used for SPI Clock
GPIO 16	Regular GPIO
CH_PD	Chip enable. Should be high for normal operation
ADC	Analog to digital input
REST	External reset 0 – Reset 1 – Normal
TXD	UART 0 transmit (GPIO 1)
RXD	UART 0 Receive (GPIO 3)
GPIO 4	Regular GPIO
GPIO 5	Regular GPIO
GPIO 0	Should be high on boot, low for flash update
GPIO 2	Should be high on boot
GPIO 15	Should be low on boot and flash
GND	Ground

The ESP8266


Part1
3.3V
U1
ESP8266
FTDI Basic
Programmer
POWER
CTS
DTR
GND
TXO
RXI
VCC
TXD
RXD
ESP8266
WiFi
Module
CH_PD
GPIO_0
GPIO_2
RSTn
GND
R1
10kΩ
R2
10kΩ
R6
10kΩ
R4
10kΩ
R5
22kΩ
S1
S2

The ESP8266

WiFi



An ESP8266 can be an Access Point, a Station, or both at the same time.

802.11 b/g/n/d/e/i/k/r

What is Arduino?

Open-Source hardware and software project

User community & support

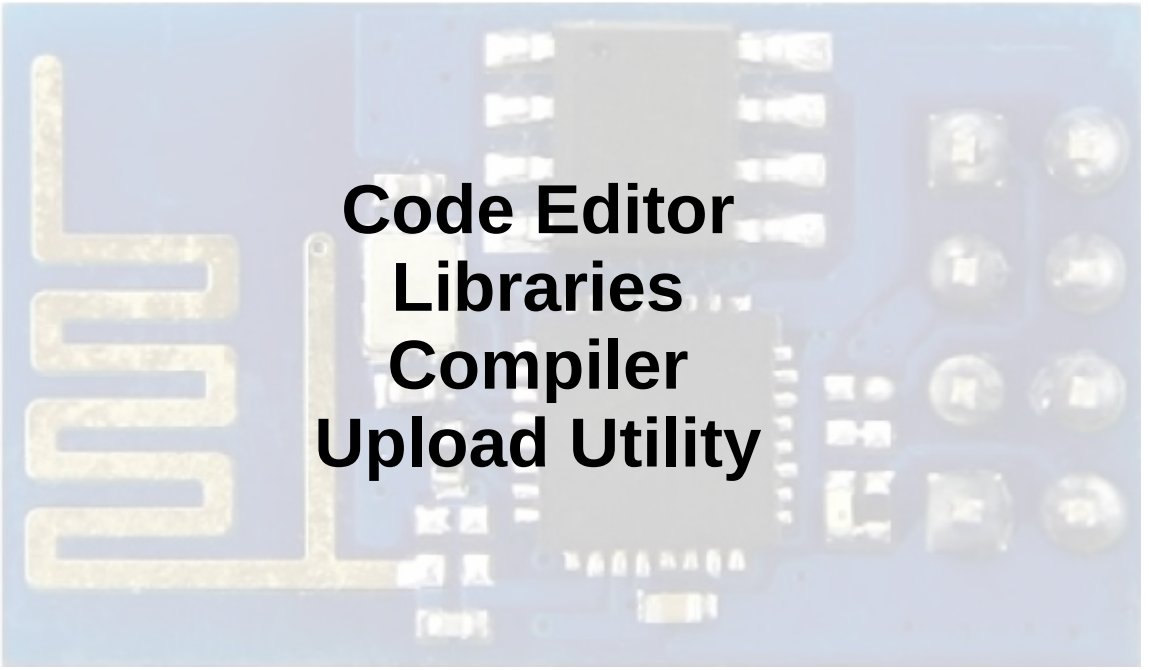
Licensed under the GNU General Public License

Anyone can manufacture Arduino boards and software

Available commercially or as do-it-yourself kits

What is Arduino IDE?

Integrated Development Environment



What is Arduino IDE?

Integrated Development Environment

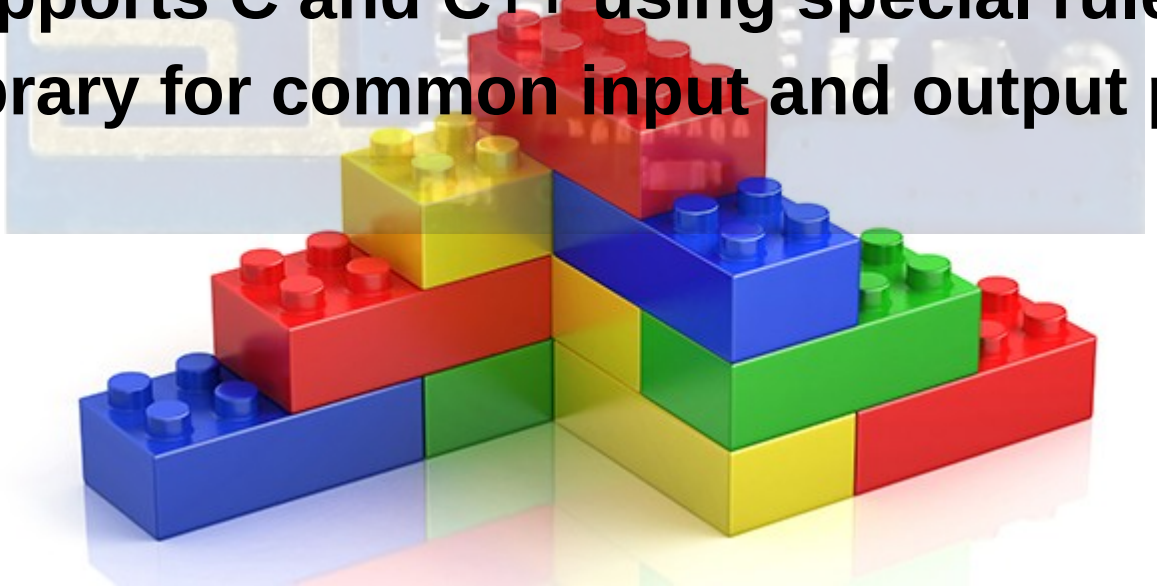
Makes it easy to write code and upload it to the board

Cross-platform application ~ Windows, Mac OS & Linux

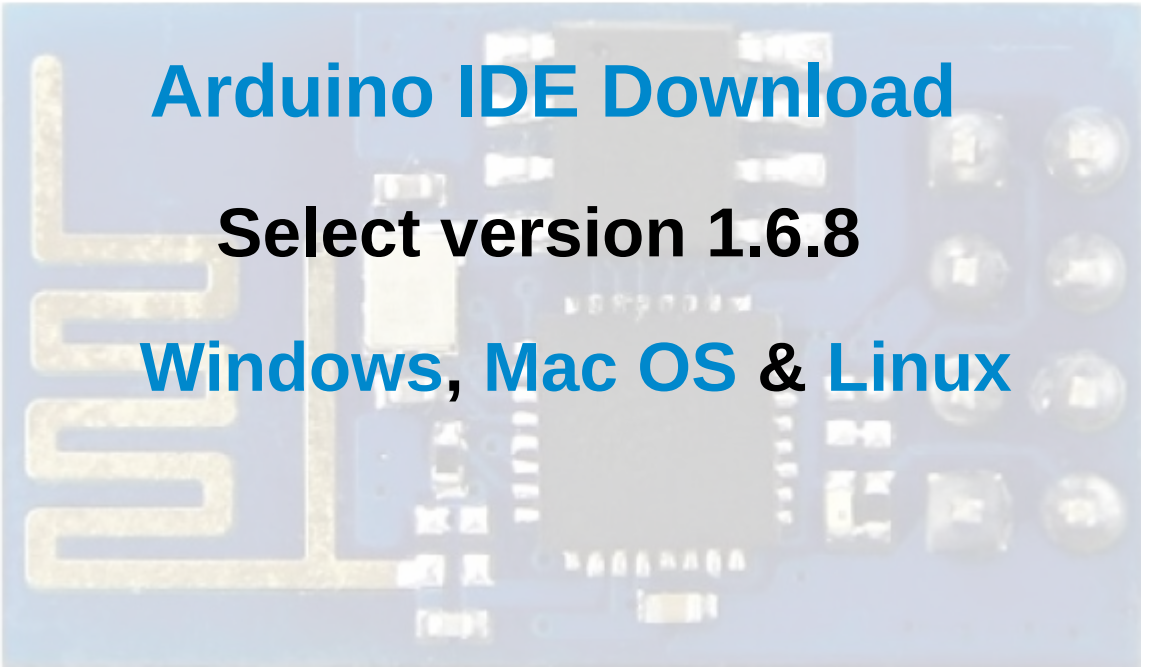
Programs written with the IDE are called a "sketch"

Supports C and C++ using special rules

Software library for common input and output procedures



Install the Arduino IDE



Install the Arduino IDE

Install the ESP8266 Addon With the Boards Manager

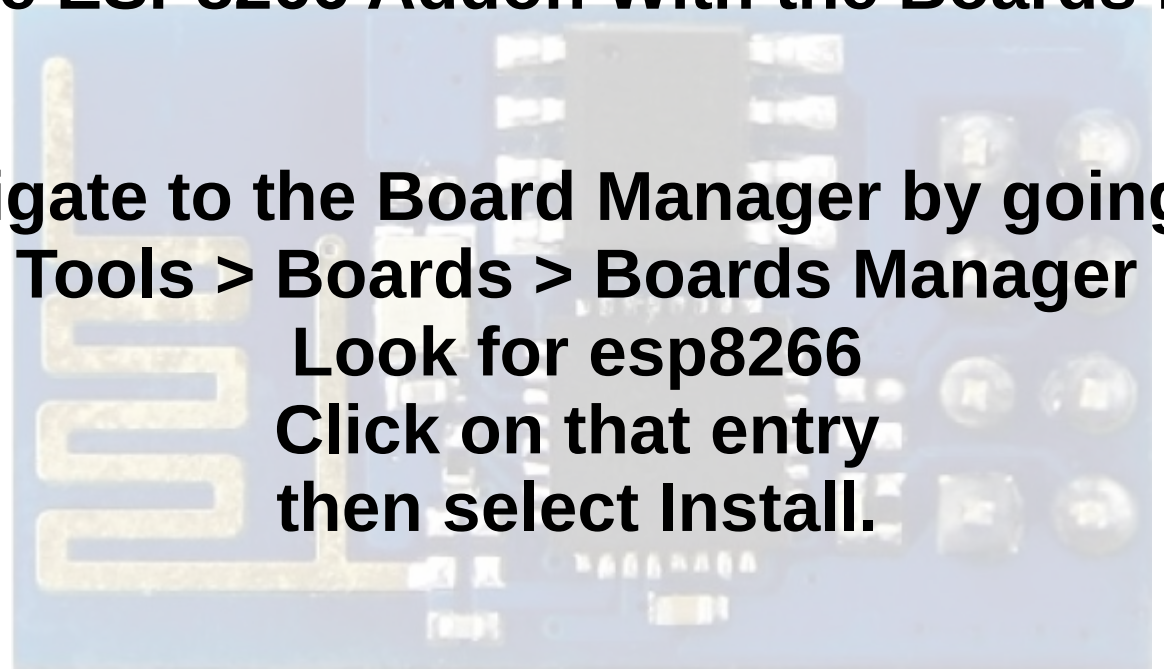
Open up Arduino,
go to the Preferences
(File > Preferences)
Copy this URL into the
“Additional Board Manager URLs” text box

http://arduino.esp8266.com/stable/package_esp8266com_index.json

ESP8266 Arduino Core Github

Install the Arduino IDE

Install the ESP8266 Addon With the Boards Manager

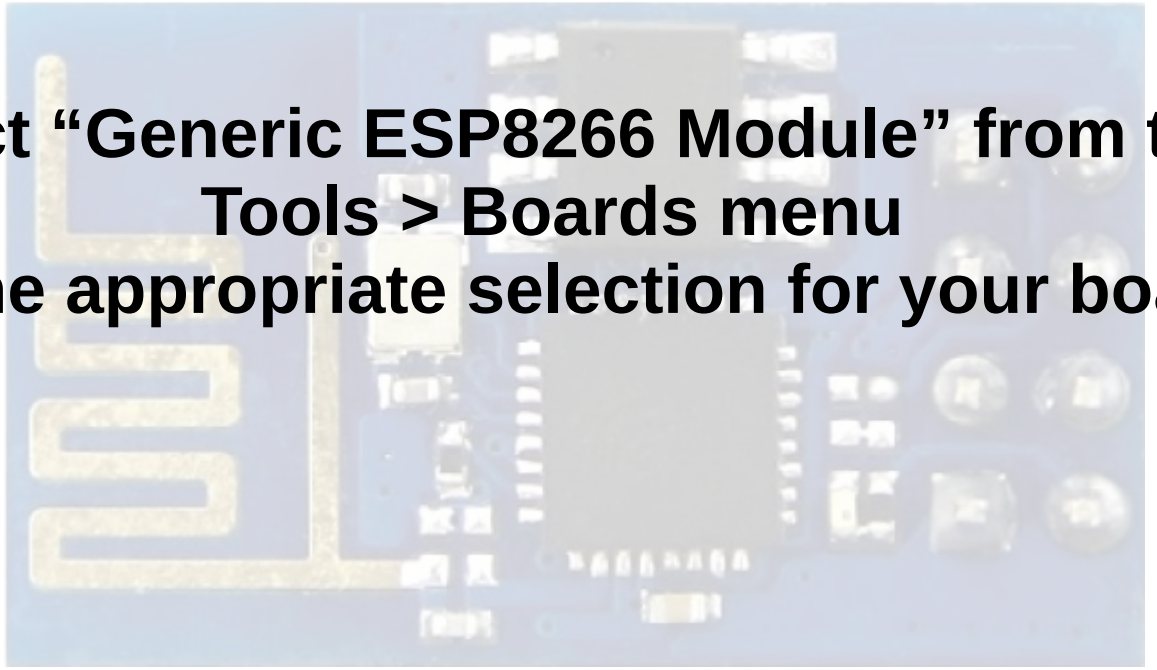


Navigate to the Board Manager by going to
Tools > Boards > Boards Manager
Look for esp8266
Click on that entry
then select Install.

ESP8266 Arduino Core Github

Install the Arduino IDE

Select the ESP8266 Board



select “Generic ESP8266 Module” from the Tools > Boards menu
(Or the appropriate selection for your board)

ESP8266 Arduino Core Github

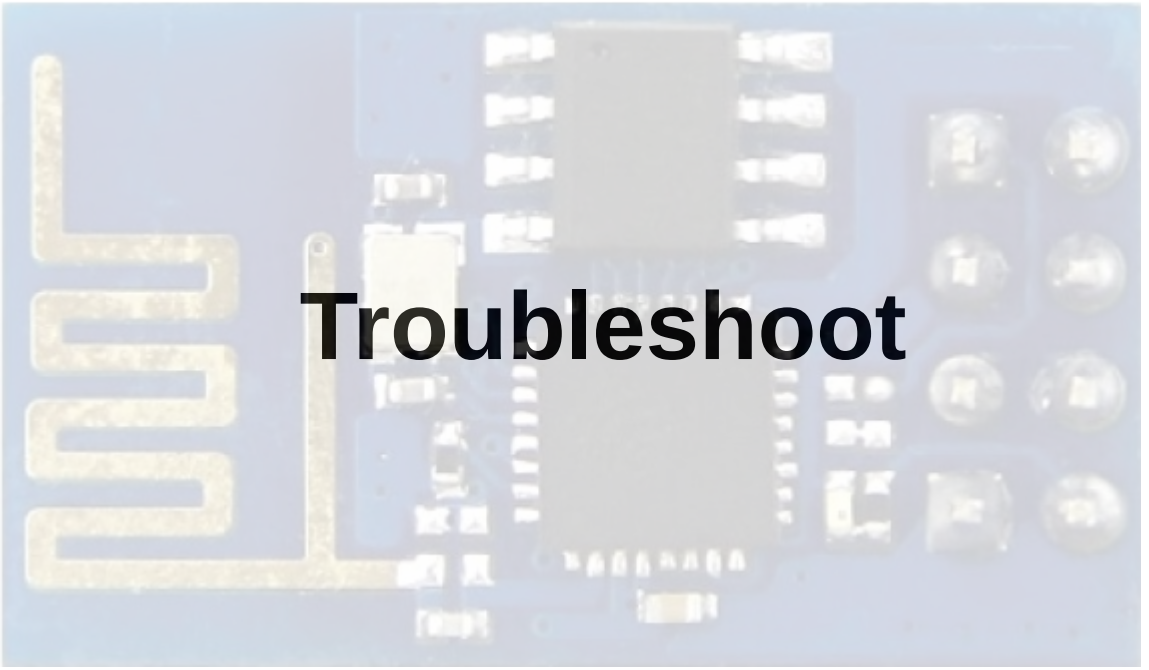
Install the Arduino IDE

Upload Blink sketch

select “Blink” from the
File > Examples > ESP8266 menu

If using ESP-12 Add
#define LED_BUILTIN 2
Just above the line
void setup() {

Install the Arduino IDE



Troubleshoot

Building a Web Server

Create a New Sketch
File > New

Every Arduino Sketch has two basic functions

Startup() And Loop()

Building a Web Server

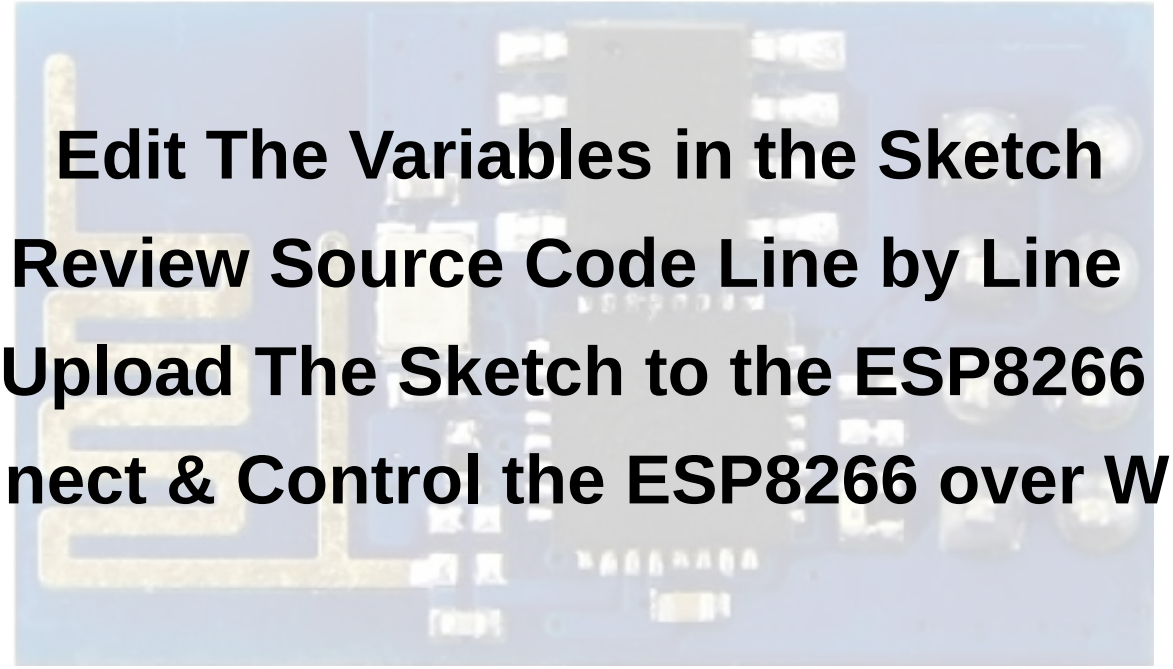
Source Code

Copy & Paste source code into our Sketch
(Use Select All)

GitHub Page

Building a Web Server

Building a Web Server



Edit The Variables in the Sketch

Review Source Code Line by Line

Upload The Sketch to the ESP8266

Connect & Control the ESP8266 over WiFi

Resources

http://bbs.espressif.com/
http://www.esp8266.com/
https://www.arduino.cc/en/Guide/HomePage
https://github.com/esp8266/Arduino

https://leanpub.com/ESP8266_ESP32
Neil Kolban ESP8266 pdf

Conclusion