



# ARDUINO/ESP8266

Microcontrollers and the radio amateur

Ralph Iden, WB9ICF



# DÉJÀ VU

Daily Sentinel - 2/2/1982

"McHenry County Wireless Association meets at the McHenry County Court House, Woodstock. Program by Ralph Iden, WB9ICF, of Crystal Lake, "Computers for the Home and Ham Shack" will be presented. All are invited."

MCWA Program – 8/7/2018

An Introduction to the Raspberry Pi by Ralph, WB9ICF

MCWA Program – 10/1/2019

Ham Shack use of Arduino and ESP-8266 by Ralph, WB9ICF



# WHAT IS ARDUINO?

- The Arduino project began in 2005 at the Interaction Design Institute Ivrea (Italy).
- Its goal: To allow non-engineers (students, hobbyists, Makers, etc.) to create simple and low-cost digital devices.
- Arduino is an open-source hardware & software company and user community that designs and manufactures single-board microcontrollers.

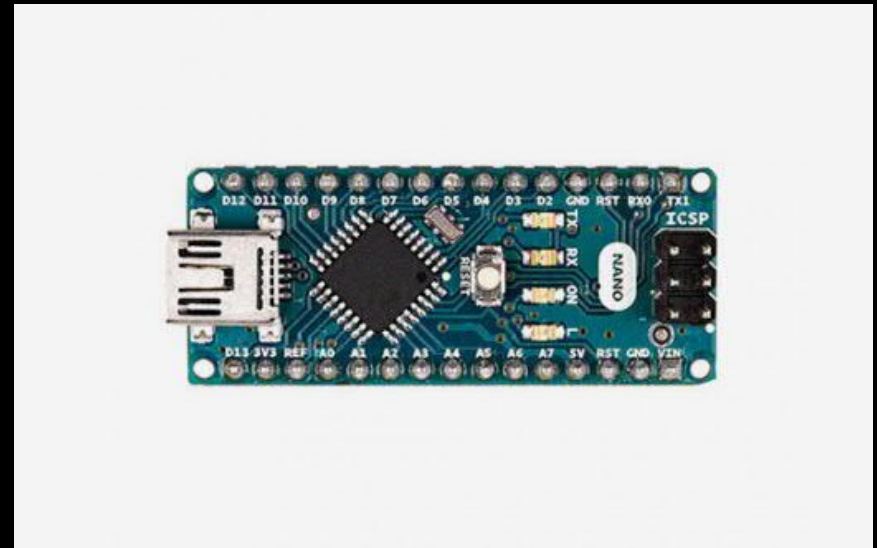


# WHAT IS ARDUINO?

- The boards and software are licensed under the LGPL or GPL licenses that permit the manufacture of Arduino boards and software distribution by anyone.
- There are 17 Arduino project board designs featuring microprocessors from Atmel and a global community of approximately 110 million users.
- Controversy ensued when one of the original founders sold his share to Frederico Musto who had plans to control licensing and monetize the project. An agreement was reached to retain open-source status.

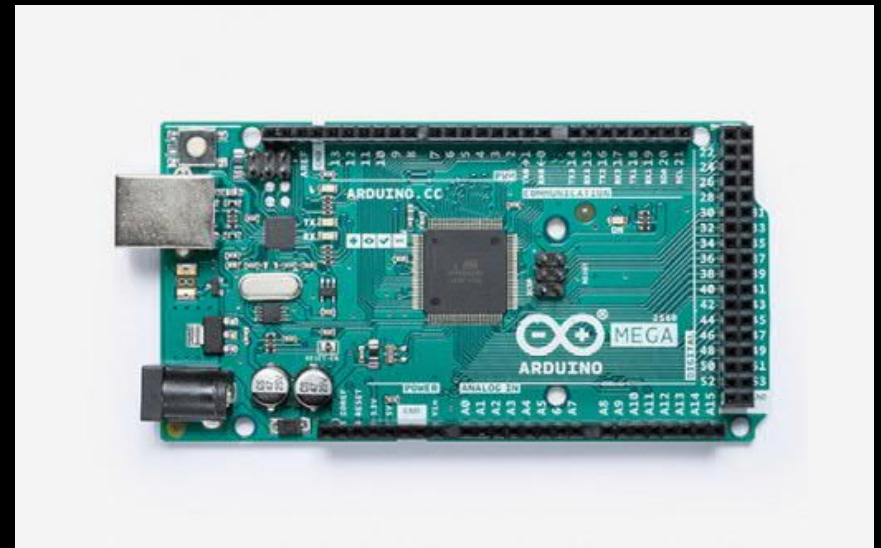
# ARDUINO BOARDS

- <https://www.arduino.cc/en/main/products>



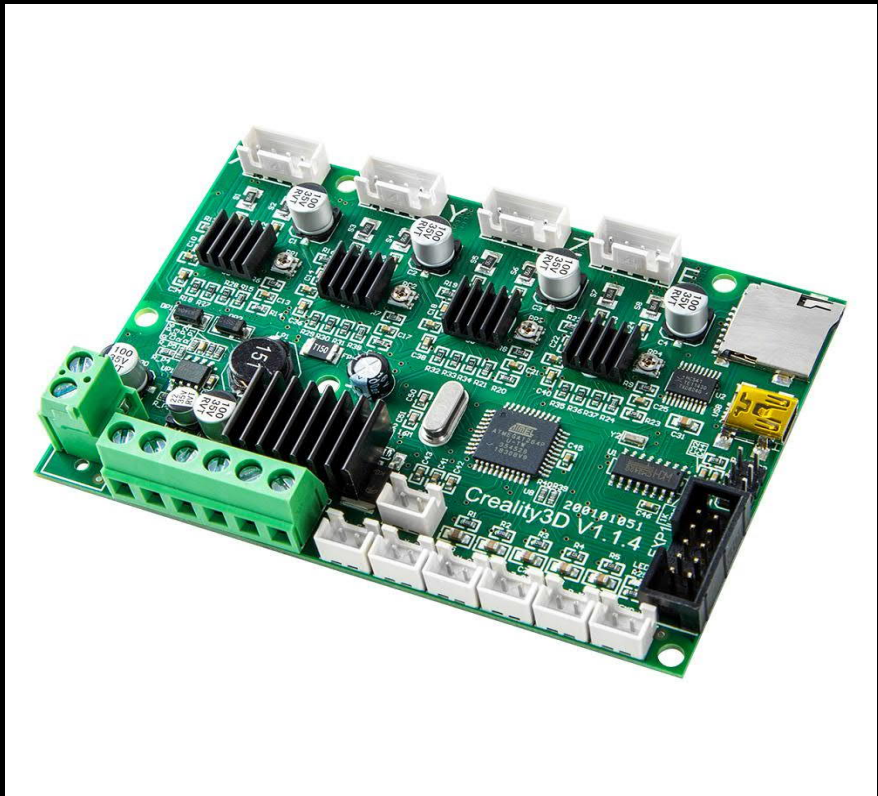
# ARDUINO BOARDS

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# ARDUINO COMPATIBLE BOARDS





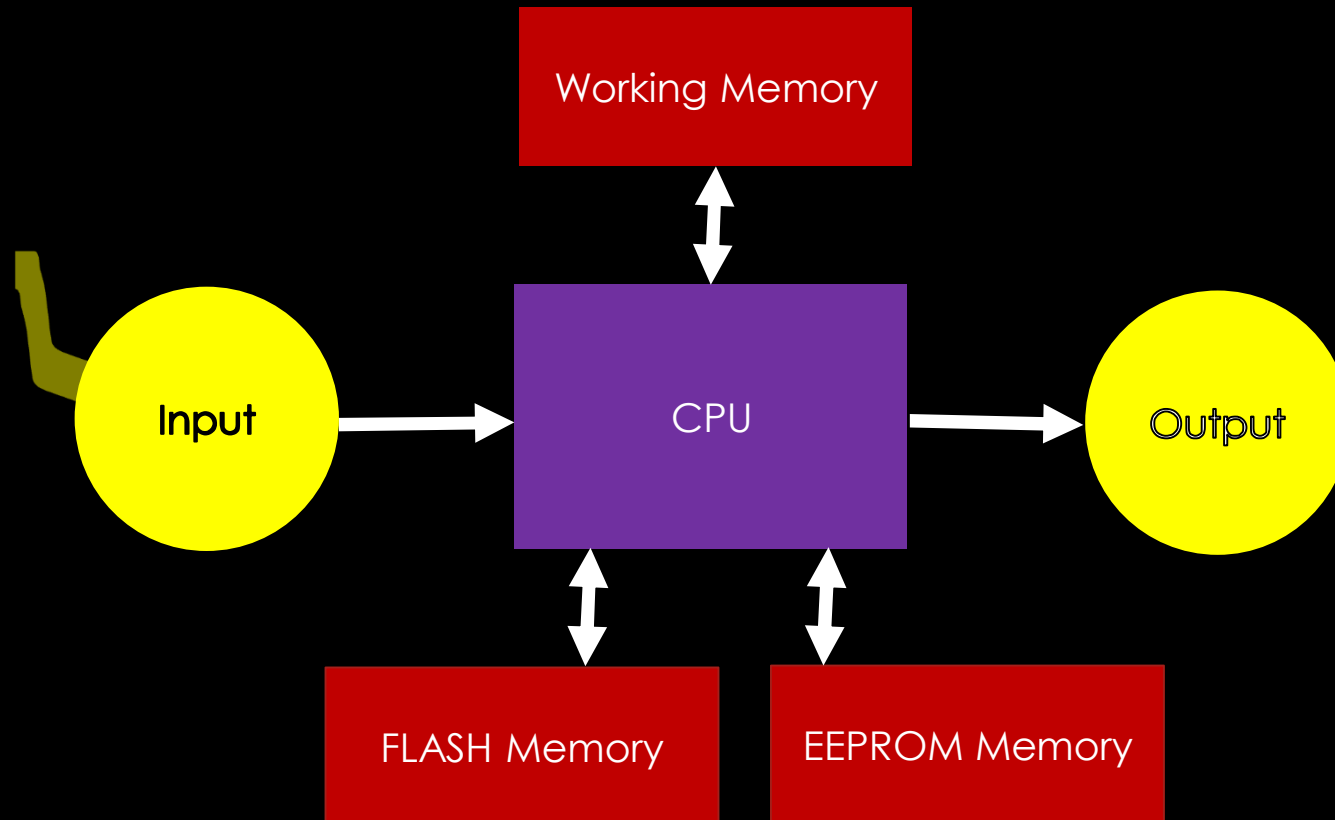
# HAM RELATED PROJECTS

- Mag loop antenna tuner
- CW Keyer
- Weather station
- Fan controller
- Touch sensor
- CAT controller
- Function generator
- Frequency Counter
- LC meter
- SWR meter

Speech recognition/generation  
Plant moisture monitor  
Irrigation controller  
Altimeter  
VFO/Frequency generator  
Data logger  
Geiger Counter



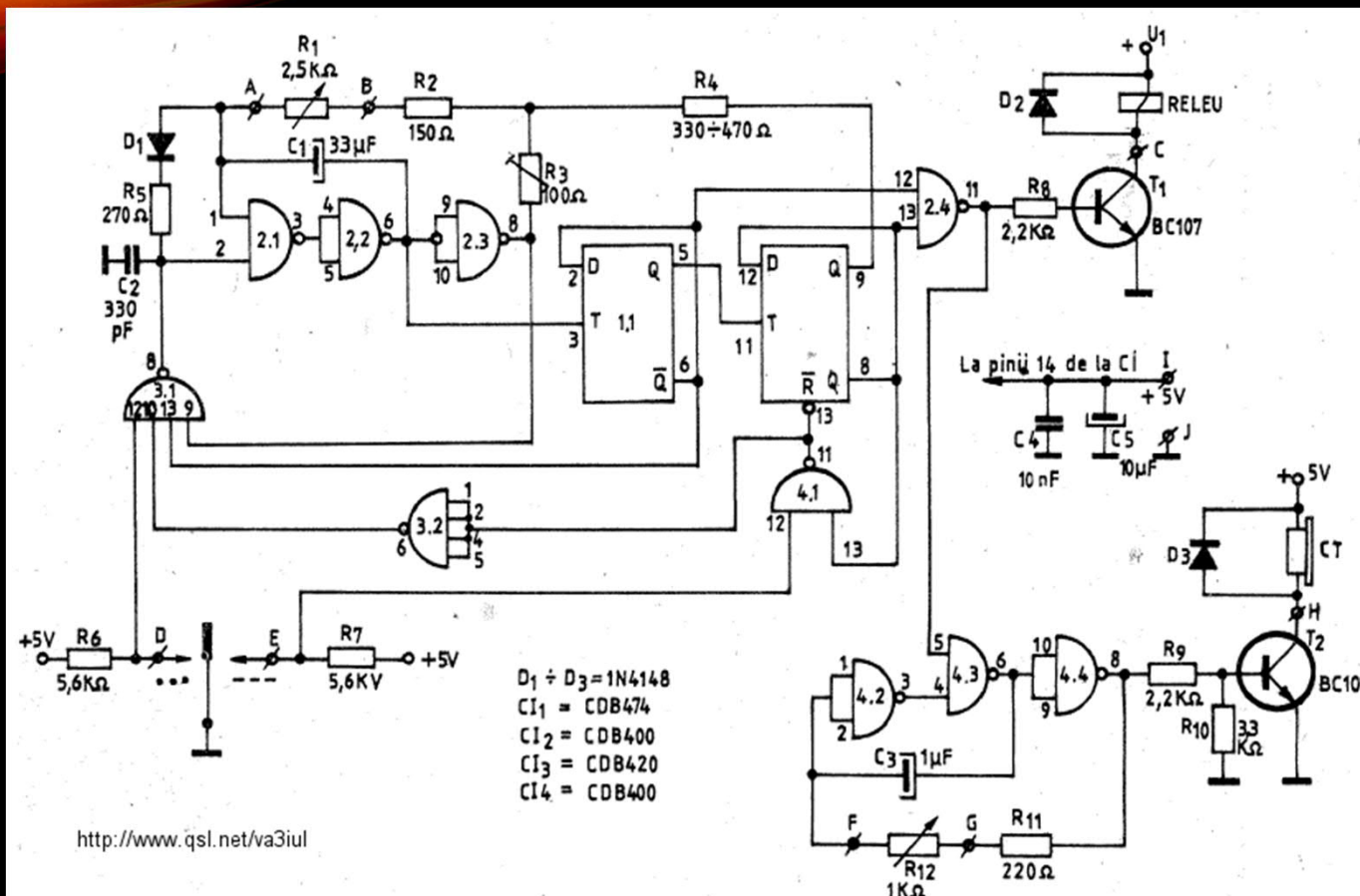
# MICROCONTROLLER BASICS



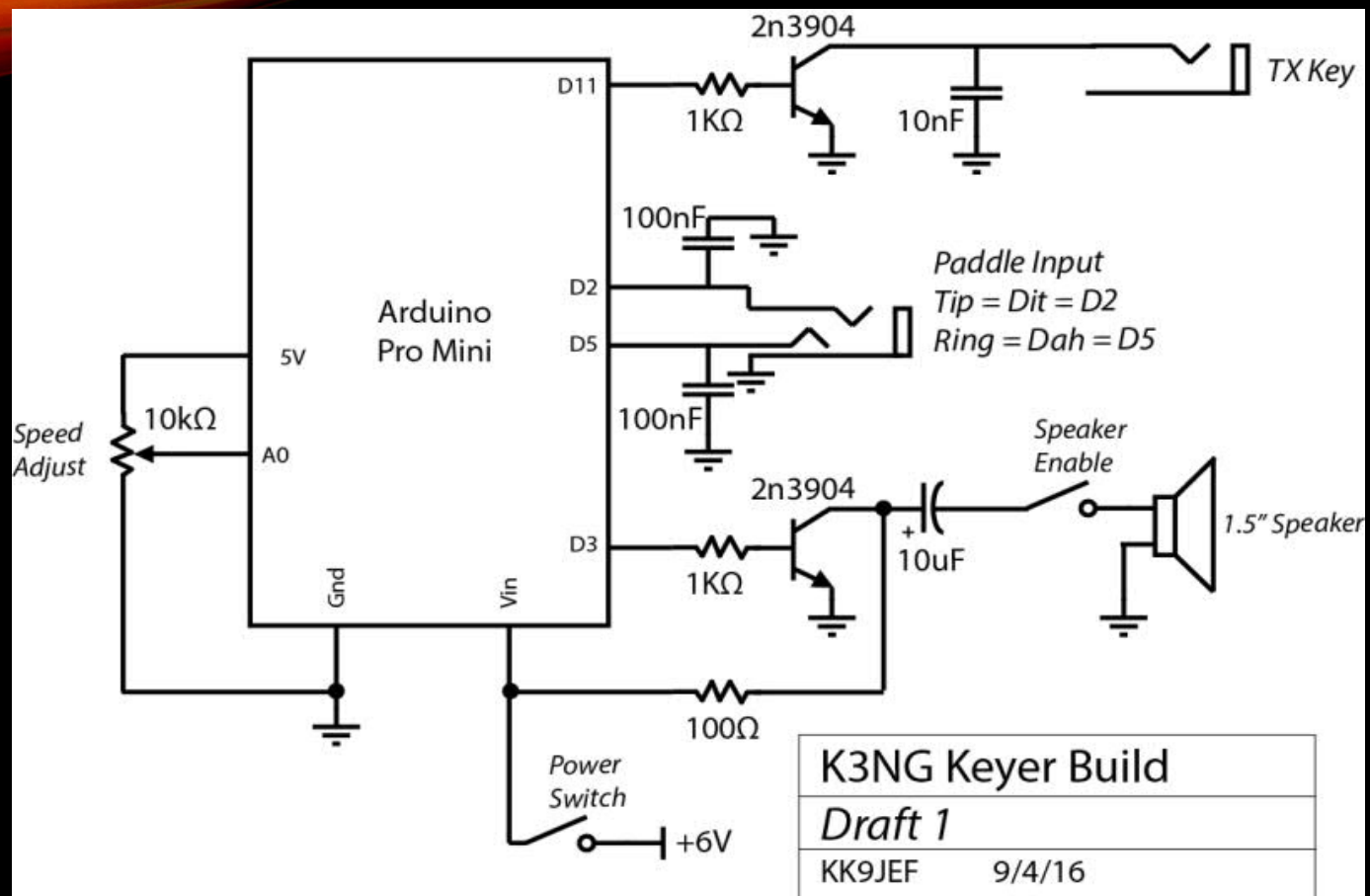


# MICROCONTROLLER BASICS

- Microcontrollers accept input from switches, sensors, serial data, etc.
- Microcontrollers act on a set of rules that are contained in its program. It can do that very, very quickly.
- Microcontrollers, under control of its program, can output data to relays, LEDs, serial ports, etc.
- Once the inputs and outputs have been wired, often a variety of features and behaviors can be added without requiring wiring changes.



CW Keyer – Discrete



CW Keyer – Microcontroller



CW Keyer – Microcontroller (OK1RR Tiny Keyer)



BEFORE WE MOVE TO  
SOFTWARE...

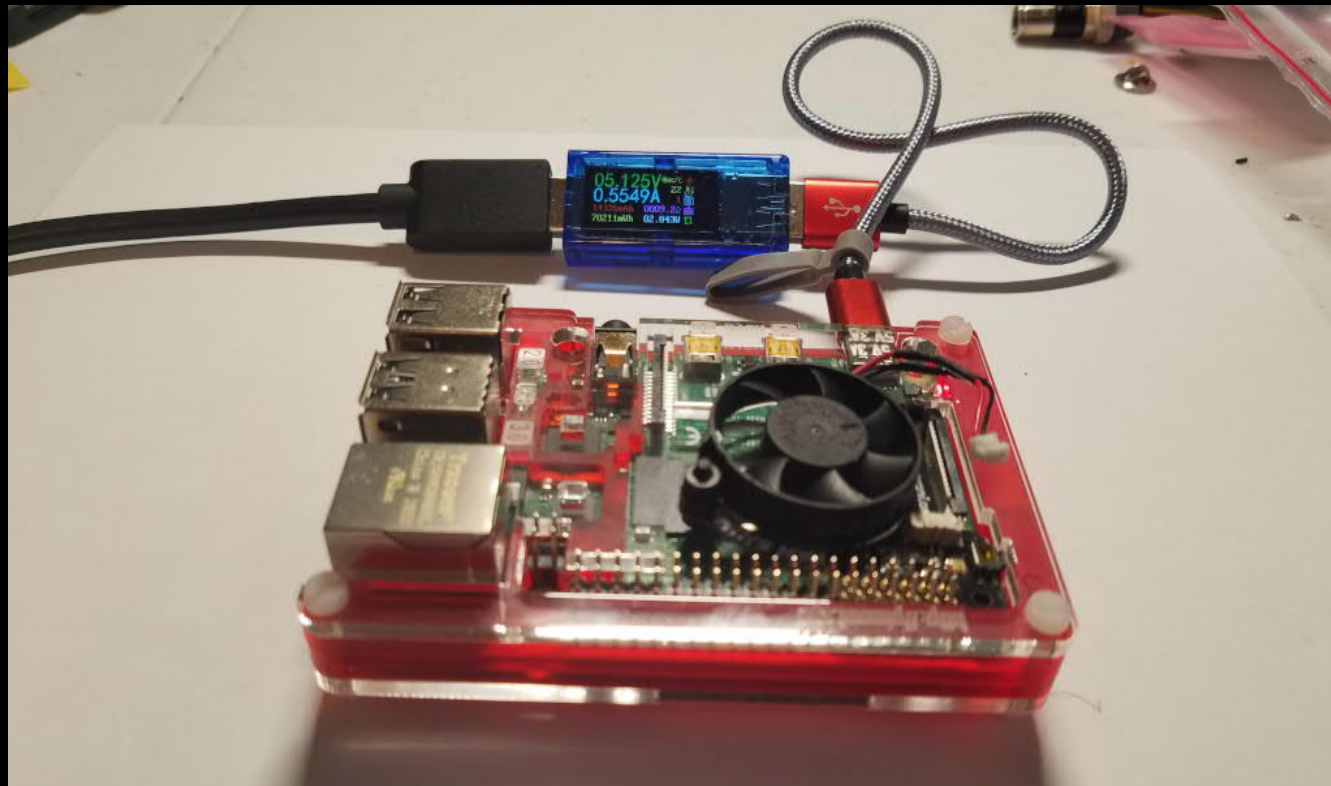




# PI OR ARDUINO?

- A Raspberry Pi should be considered more a microcomputer than microcontroller. They are more closely related to a desktop/laptop or tablet than the device that controls your microwave oven.
- The Raspberry Pi does have an extensive set of general-purpose input and output pins and can be used in the same way as an Arduino can be.
- Certain applications, especially those requiring small physical footprints and low power consumption may not be suitable for a Pi.
- As a controller, the Arduino is generally an easier path for beginners.

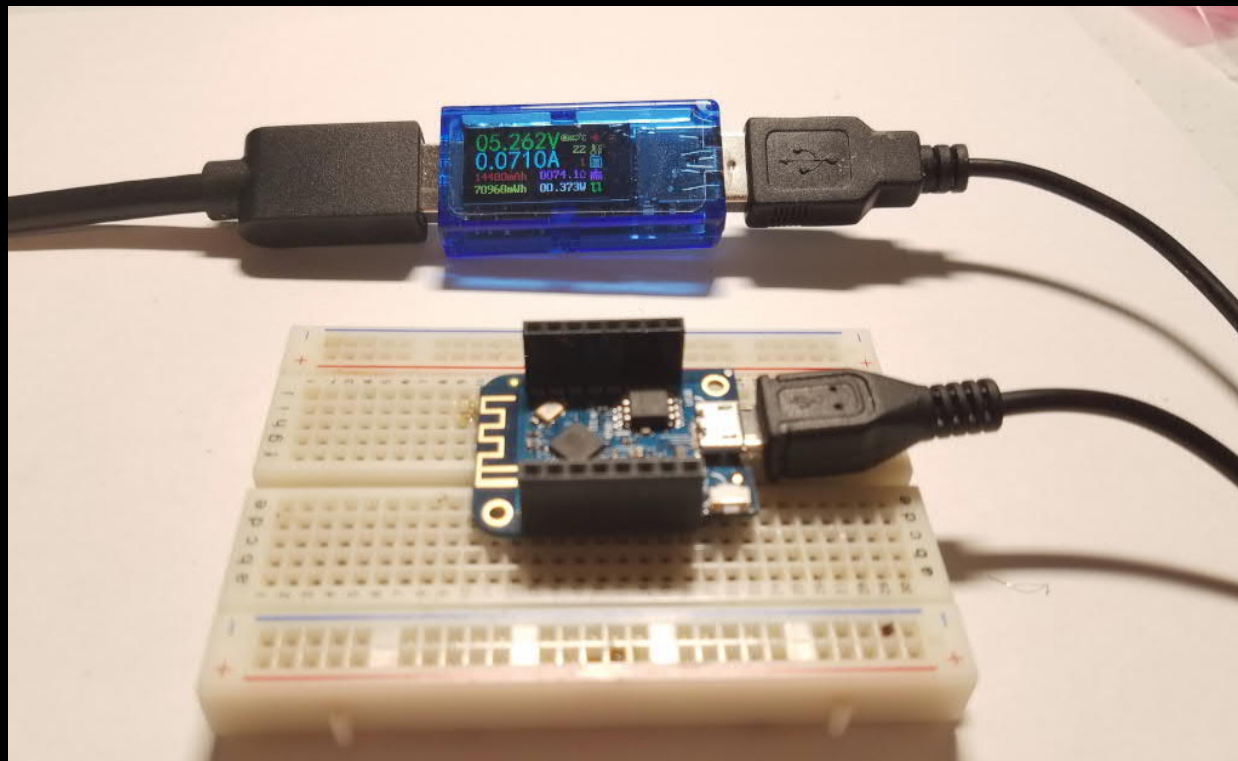
# RPI 4 POWER USAGE



# RPI ZERO POWER USAGE



# LOLIN D1 MINI POWER USAGE







PROGRAMMING THESE THINGS



# ARDUINO IDE

Where do I find this too?

IDE walkthrough

Minimal sketch

Let's make something



# ESPRESSIF ESP-X

- ESP-8266 system on a chip (SoC)
- Big time game changer
- Affordable, hackable, and best technology/price ratio available
- 32 bit microcontroller, ~36K of RAM, 1 Mbyte or more Flash, GPIO, UART
- WiFi 2.4GHz 802 b/g/n FCC certified (most modules) radio
- WPA/WPA2 with WEP/TKIP/AES encryption
- Integrated TCP/IP stack (IPv4, TCP/UDP/HTTP/FTP)
- Low power standby (deep sleep < 10uA)
- Wakeup and transmit packets in less than 2ms



# OUT OF THE BOX FUNCTIONALITY

- Serial I/O
- WiFi station, access point, or both
- WiFi scanner
- HTTP/HTTPS client
- HTTP Server
- NTP time services

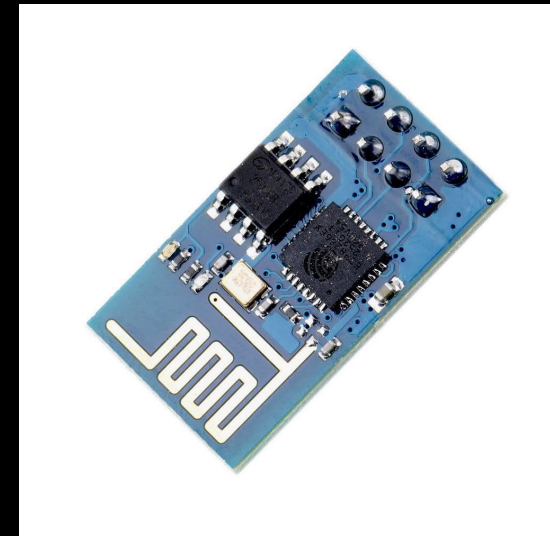


# PROGRAMMING OPTIONS

- Not restricted to a single programming platform
- AT command set (just like the old Hayes modems)
- Lua – Adafruit's Huzzah comes with Lua flashed into memory
- Arduino!

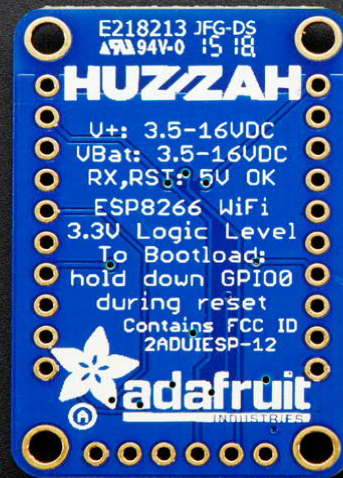
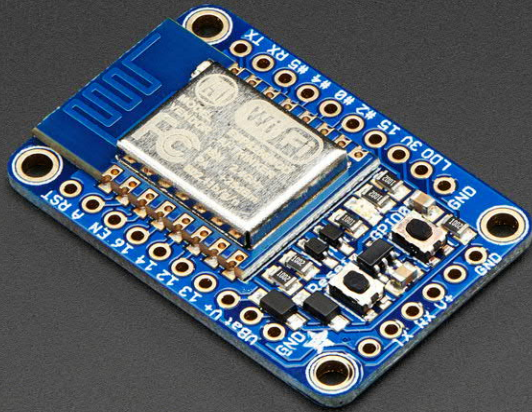


# ESP-8266 FAMILY



\$5- \$2 USD

# ADAFRUIT'S HUZZAH



\$10 USD



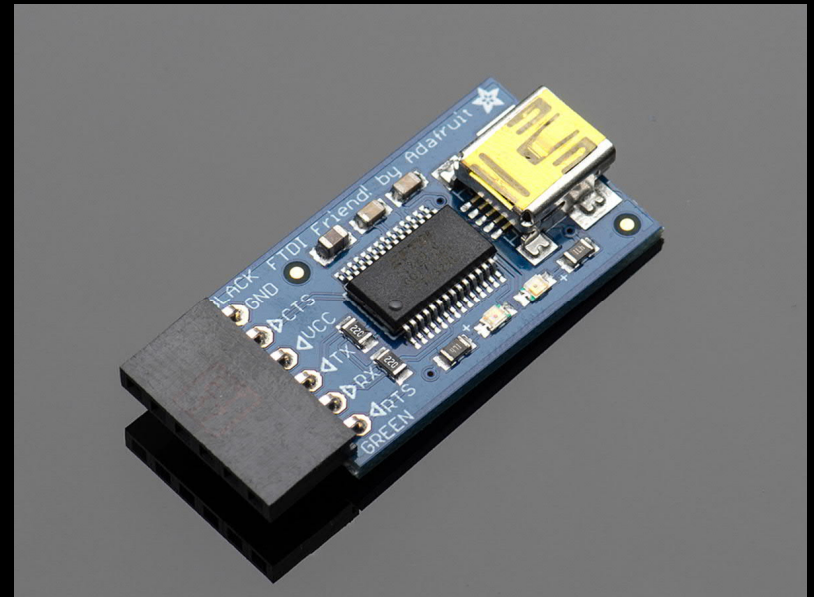
LOLIN BOARDS



# FTDI USB TO SERIAL SOLUTIONS



Adafruit/FTDI cable  
\$15-20 USD



FTDI Friend  
\$15 USD



Let's see the ESP8266 in action...





QUESTIONS?