ARDUINO

AN OPEN-SOURCE ELECTRONICS PLATFORM BASED ON EASY-TO-USE HARDWARE AND SOFTWARE.

HTTPS://WWW.ARDUINO.CC

MICROCONTROLLER / SINGLE BOARD COMPUTER

- The Arduino's are Microcontrollers, designed to run a single application.
- Raspberry Pi's (except for the new Pico which is a microcontroller) are single board computers. They can be just like your laptop or desktop with additional I/O opportunities.

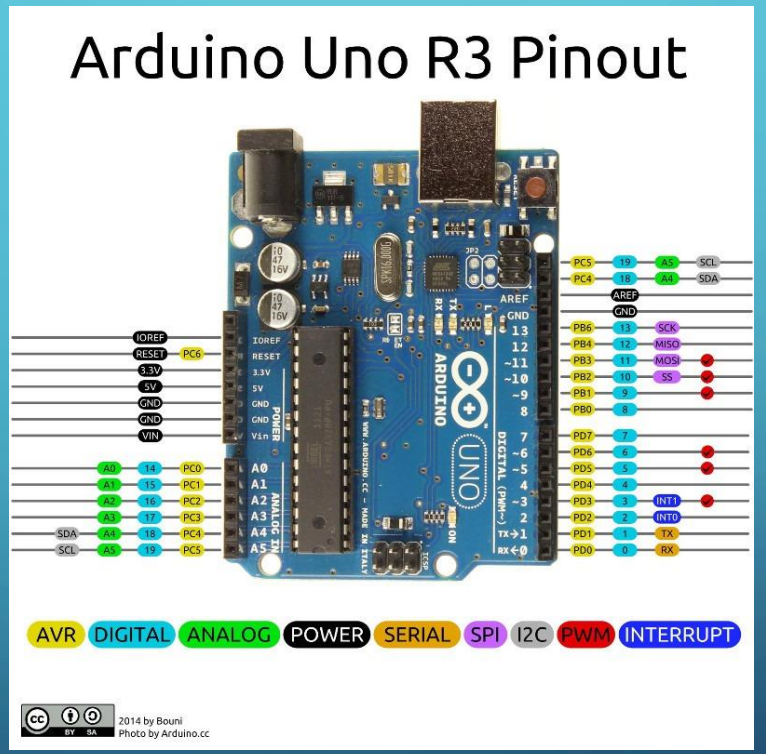
OTHER MICROCONTROLLERS

- Teensy
- ESP32 / ESP8266
- Micro:bit
- Seeeduino
- Beetle
- Raspberry Pi PICO (new)

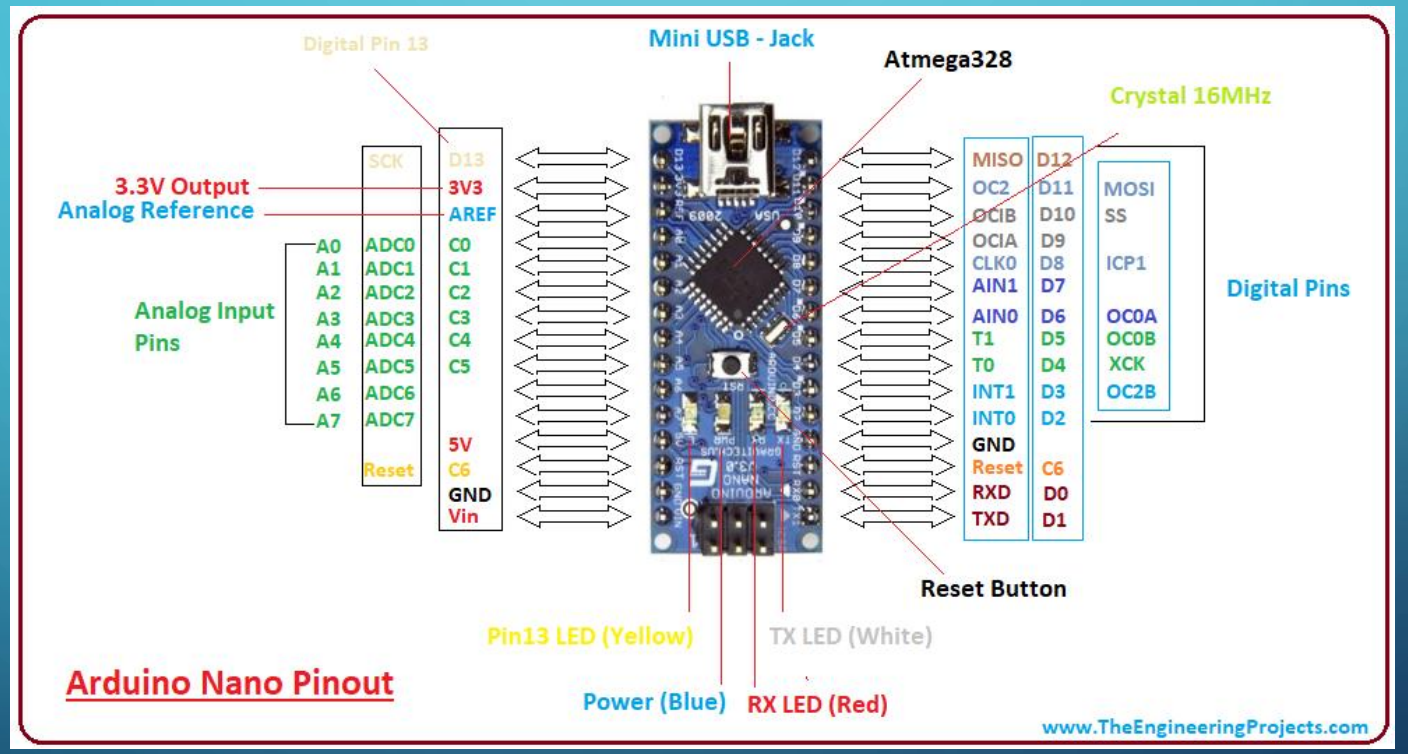
NEXT STEP IN CONTROLLER EVOLUTION

- PIC
- Basic STAMP
- PIXAXE

ARDUINO UNO R3



ARDUINO NANO



COMPLETE DEVELOPMENT ENVIRONMENT

Early microcontrollers (such as the PIC and BASIC Stamp) required development boards. You would attach the controller to the development board and use a program (sometimes just a serial terminal) on a PC to program (and possibly test) it. You would then remove the controller and install it in your custom hardware which had to provide additional support (such as power, memory and timing).

The development board included hardware to program the chip.

COMPLETE DEVELOPMENT ENVIRONMENT

In contrast, the Arduino's are complete. All you have to do is connect it via USB to your computer. All the basic support (power, memory, timing) is included.

When your project is complete, you can either use the entire Arduino board (they're inexpensive enough) or you can create your own custom PCB and use the same controller chip.

SOC – SYSTEM ON A CHIP

One of the hardware advances that made the Arduino and others possible was SoC (system on a chip). A single chip contains RAM, Flash, EEPROM and timing.

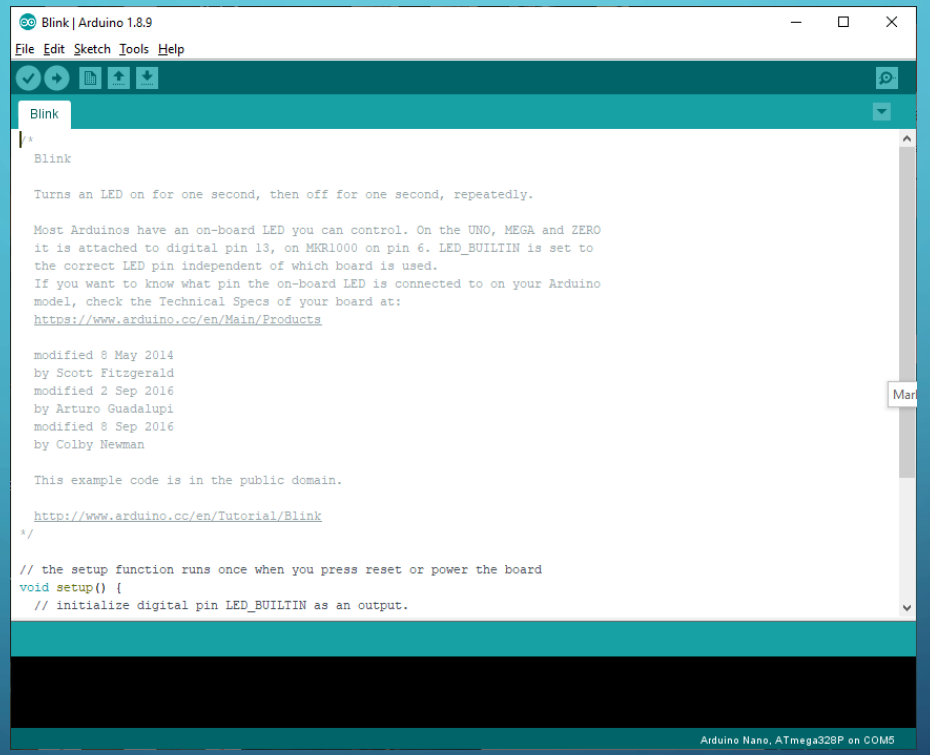
BUILT-IN INTERFACES

- USB / Serial
- I2C (SDA – serial data / SCL – serial clock)
- Serial Peripheral Interface: SPI (SCLK, MOSI, MISO, CS)
- Two Wire
- A/D
- PWM

INEXPENSIVE

Since the “official” hardware from Italy is open source, many Chinese vendors are selling clones. Clone Nano’s are available from Amazon for less than $5 each in quantity 3 and even less on eBay.

OPEN SOURCE PROGRAMMING ENVIRONMENT



OPEN SOURCE PROGRAMMING ENVIRONMENT

- Free to download https://www.arduino.cc/en/software
- Available for Windows / Mac / Linux

THE PROGRAMMING LANGUAGE IS C++ WITH MACROS AND SCAFFOLDING

- setup() function: called once at start
- loop() function: called repeatedly forever

BLINK – SETUP()

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

BLINK – LOOP()

```
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);   // turn the LED on
  delay(1000);                       // wait for a second
  digitalWrite(LED_BUILTIN, LOW);    // turn the LED off
  delay(1000);                       // wait for a second
}
```

LIBRARY CODE AVAILABLE

- Device control

HARDWARE – NANO AND UNO

- AtMega 328P microcontroller
- Clock crystal
- USB port
- Voltage regulator

CAPACITY - NANO

- 32K Flash (for program storage)
- 2K SRAM (for variables during program execution)
- 1K EEPROM (for persistent storage)

SLIGHTLY LARGER CAPACITY BOARDS

- Nano Every
- Mega

NOT MUCH COMPARED TO A MODERN PC BUT QUITE USABLE

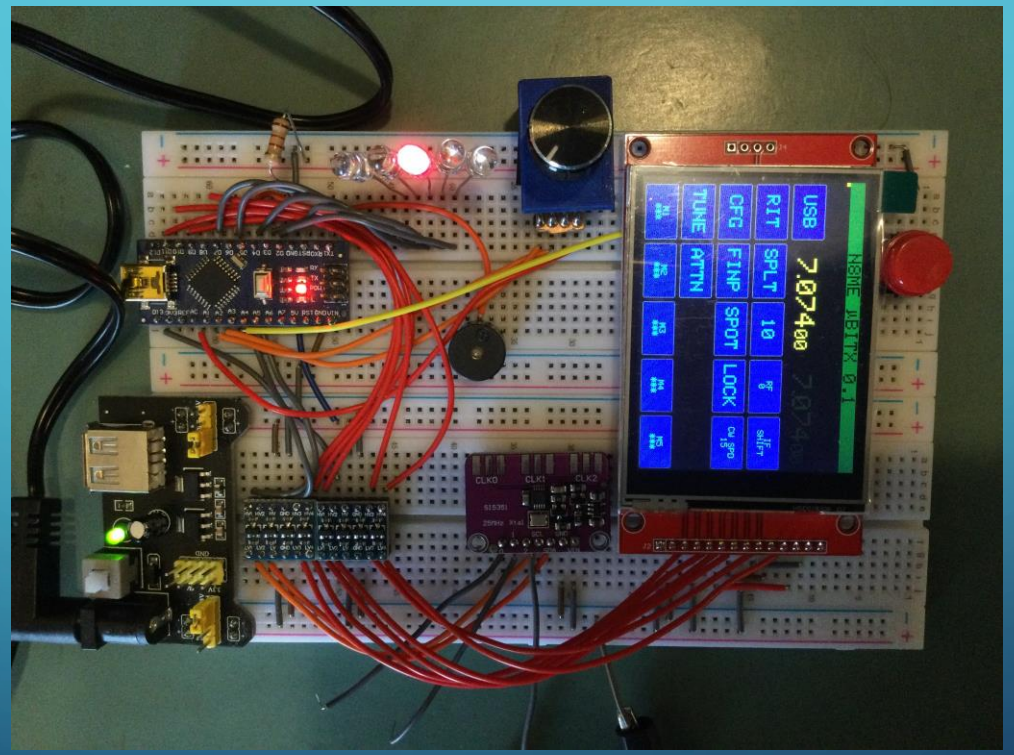
- 3D printer (open source Marlin software)
- Desktop CNC (open source GRBLS software)
- µBITX 80-10m QRP transceiver

SHIELDS

Boards designed to mate with the pins (primarily on the larger Arduino's to provide added functionality

- Sensors
- Relays
- Displays

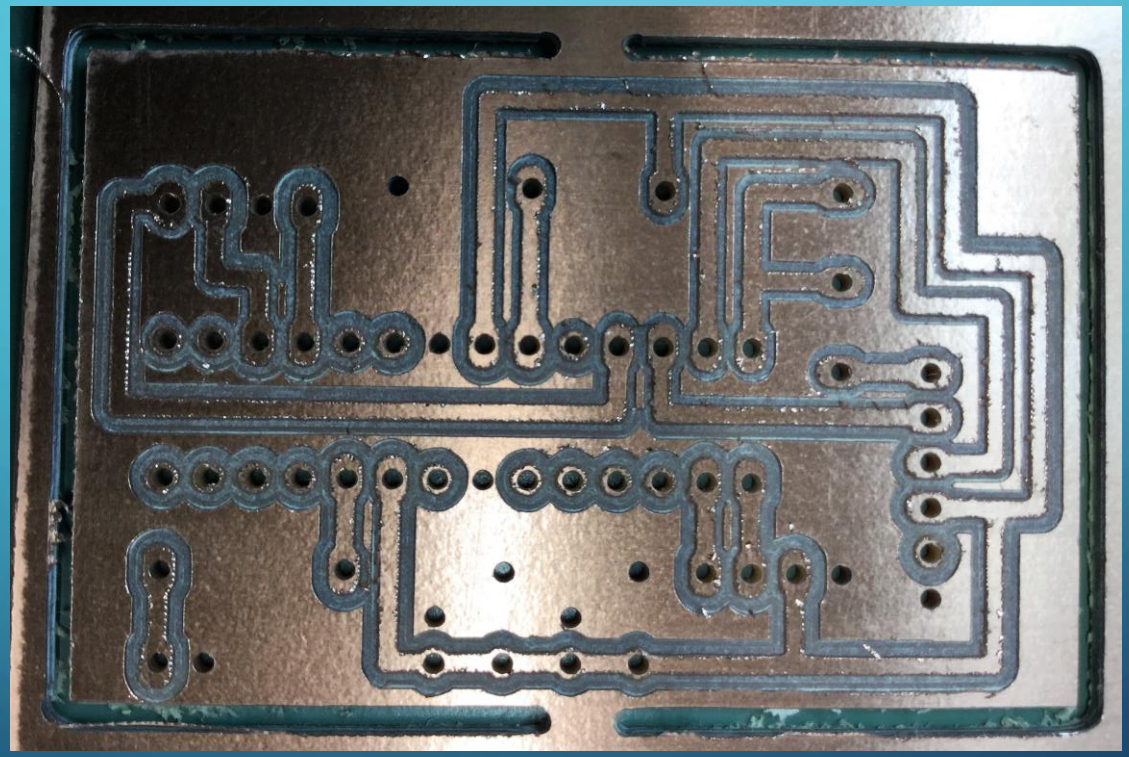
INTERFACE YOUR OWN HARDWARE RADUINO PROTOTYPE



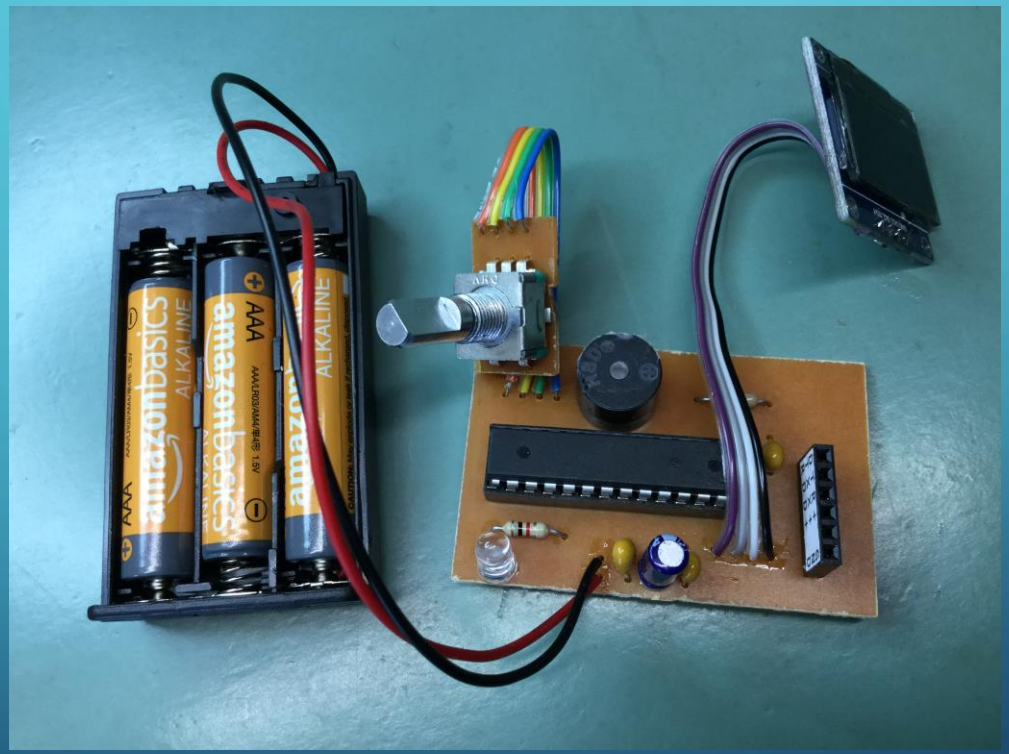
ARDUINO PINS CAN ONLY SOURCE OR SINK ONLY A FEW MILLIAMPS

- Relay boards available
- use transistors or FETs for larger power handling

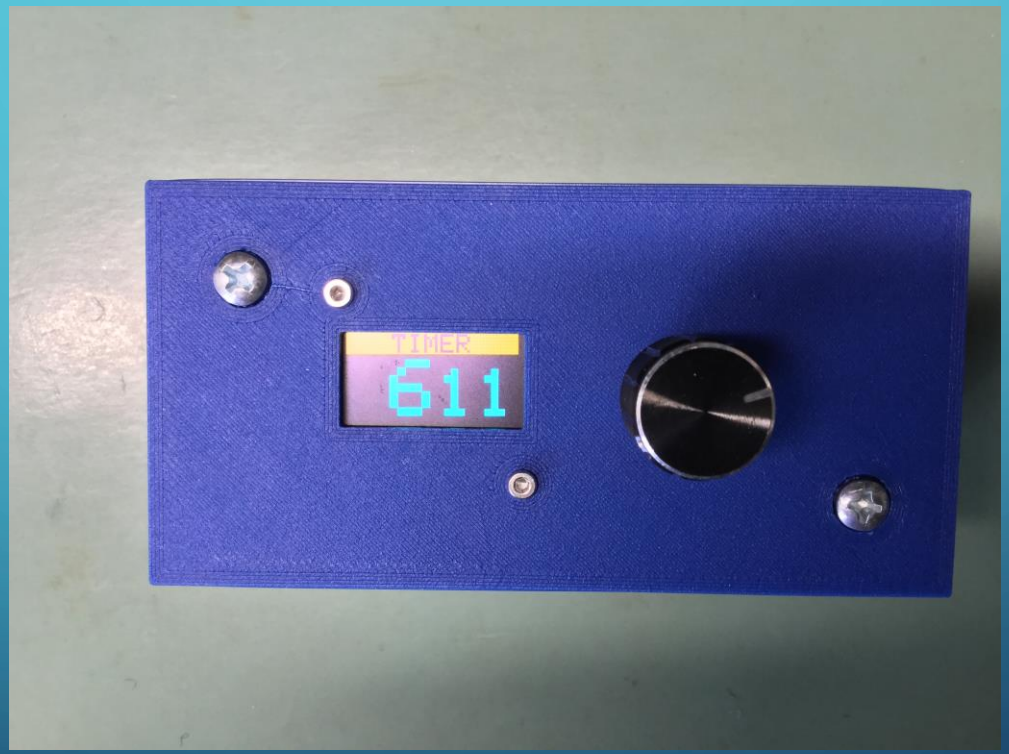
HAM TIMER PCB
DESKTOP CNC



HAM TIMER POPULATED BOARD



HAM TIMER ASSEMBLED – V1SOFTWARE



HAM TIMER ASSEMBLED – V2 SOFTWARE