Arduino for Hams
PAARA 2014-03-06

Leigh WA5ZNU

Remember the 1980's?



Not *those* 1980's

- That's Lynard Skynard!

I mean the Apple][



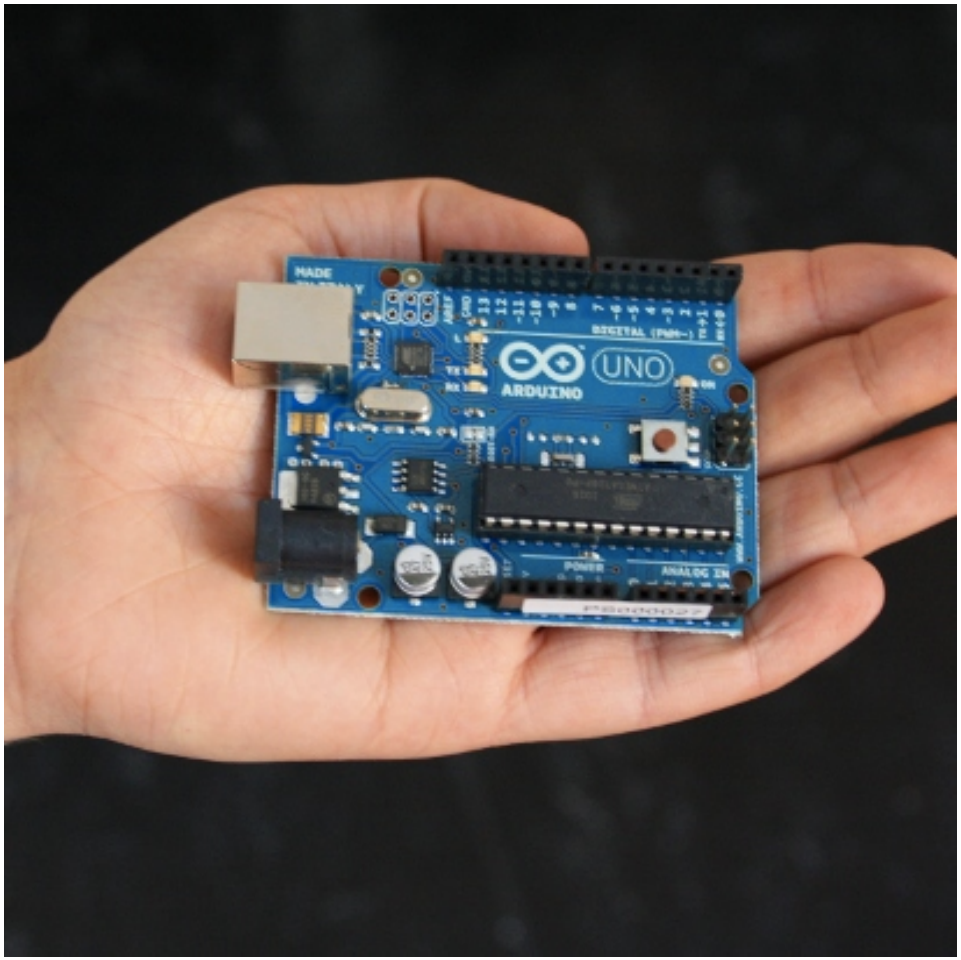
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It had

- ✓ 8-bit CPU
- ✓ 32K Memory
- ✓ Expansion Cards
- ✓ Lots of Software
- ✓ Low Cost
- ✓ Extreme Popularity

So Does the Arduino

- About as powerful as an Apple II



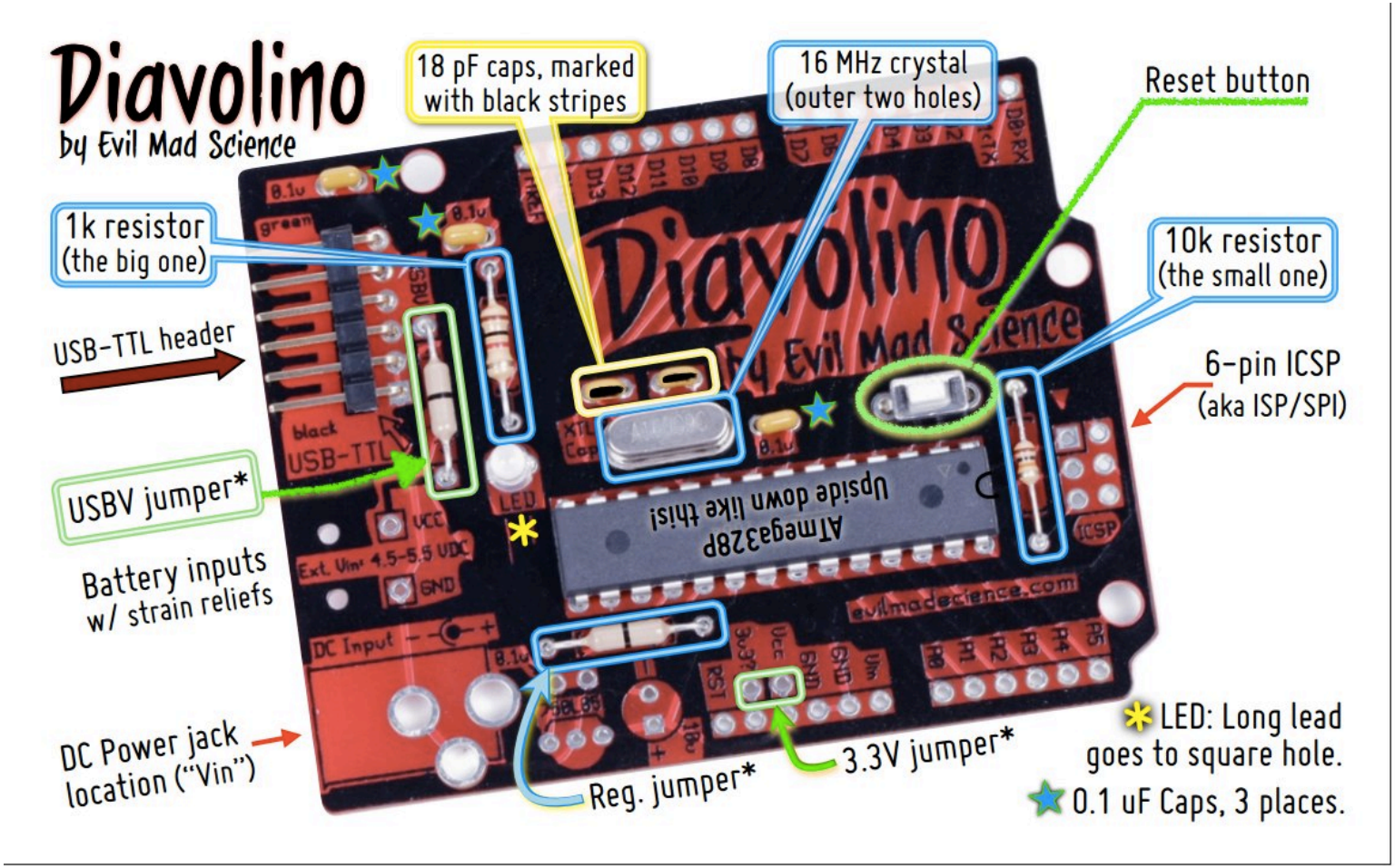
Arduino.cc

But for $29!

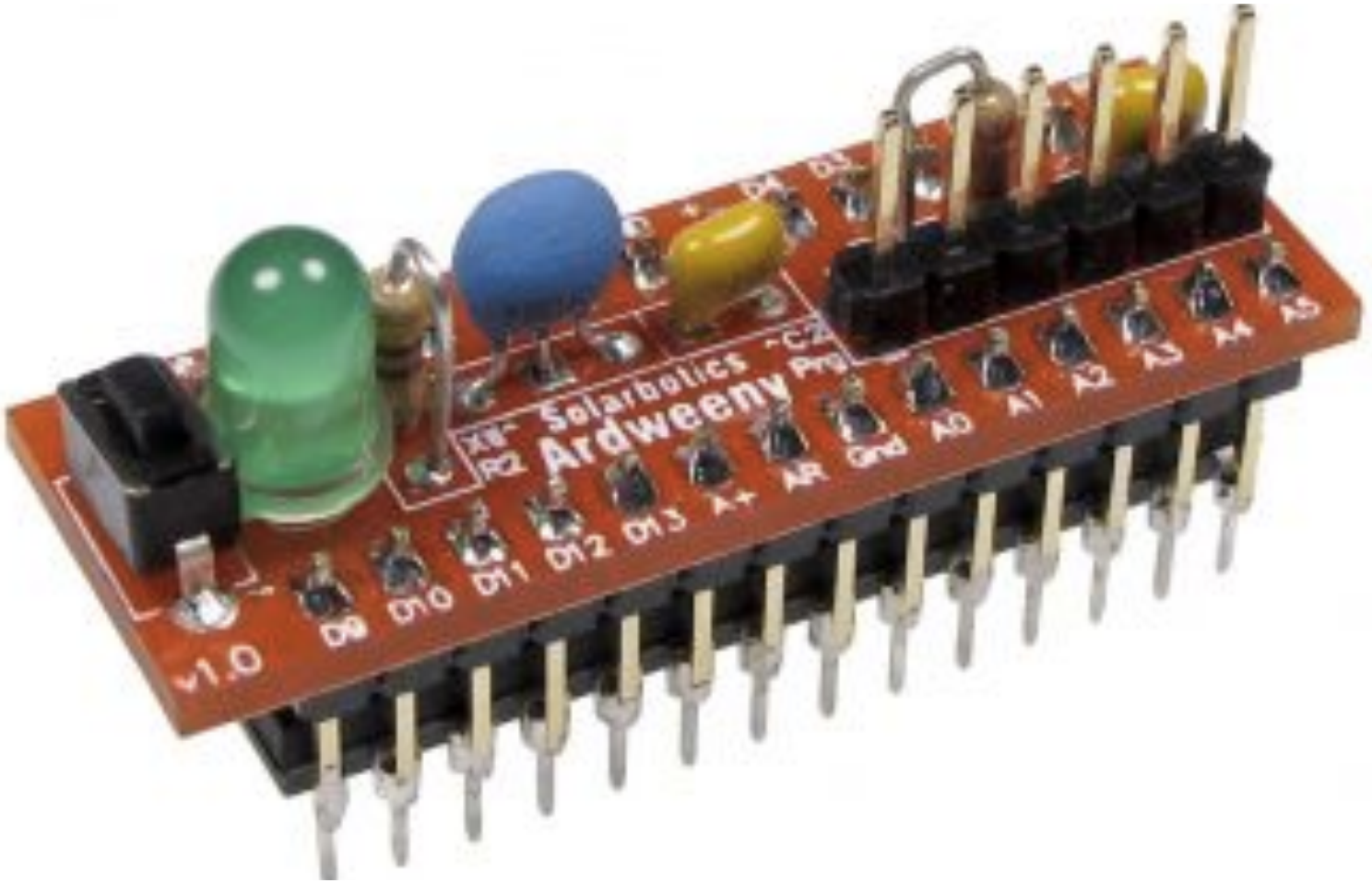


Arduino.cc

Or for $12…


Diavolino
by Evil Mad Science
18 pF caps, marked with black stripes
16 MHz crystal (outer two holes)
Reset button
1k resistor (the big one)
10k resistor (the small one)
USB-TTL header
6-pin ICSP (aka ISP/SPI)
USBV jumper*
Battery inputs w/ strain reliefs
ATmega328P
Upside down like this!
evilmadscience.com
DC Power jack location ("Vin")
Reg. jumper*
3.3V jumper*
* LED: Long lead goes to square hole.
0.1 uF Caps, 3 places.

Or even $9.95…



Solarbotics.com

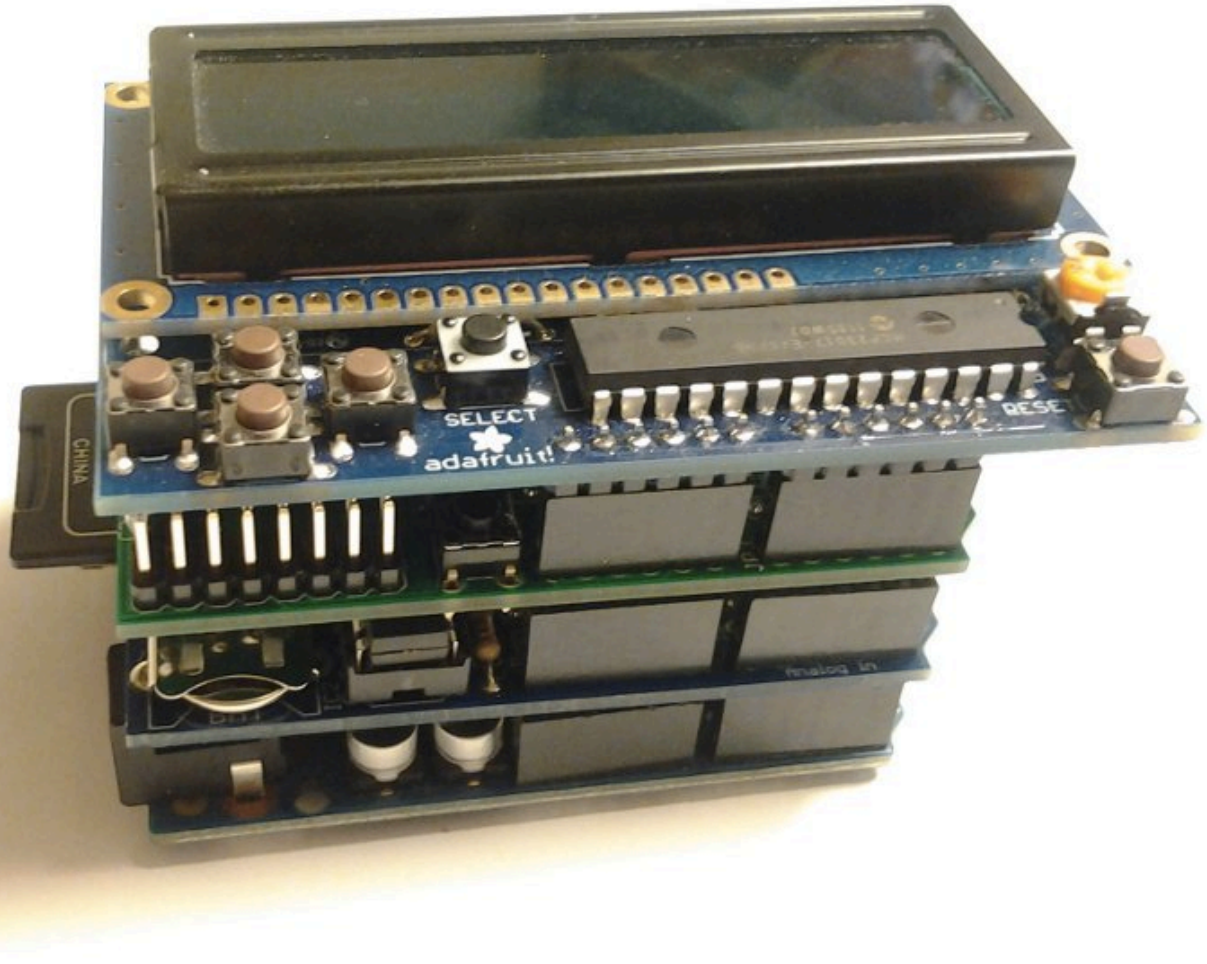
Would you believe $3.65?



http://www.aliexpress.com/

Arduino Peripherals

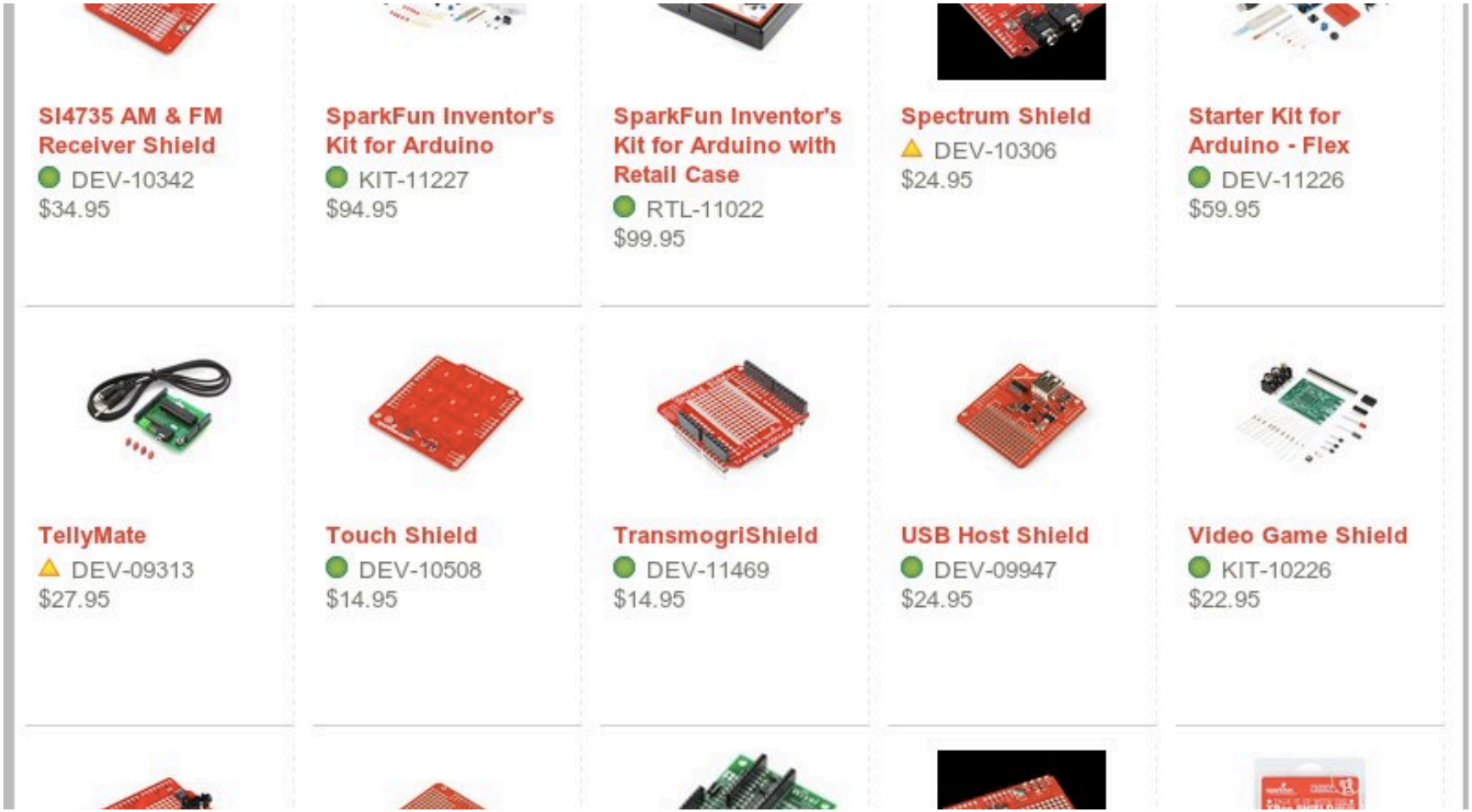
- Instead of *expansion cards* the Arduino has *shields*



Lots of Shields



Lots of Shields



Sparkfun.com

LOTS of Shields!

	NFC Shield	$29.50	1 Add: Max: 18 ADD TO CART
	Orbshield v1.0 kit	$24.95	... more info ADD TO CART
	Protoshield Kit for Arduino	$9.90	1 Add: Max: 13 ADD TO CART
	Relay shield	$20.00	1 Add: Max: 34 ADD TO CART
	Renbotics ServoShield Rev 1.1	$15.00	... more info ADD TO CART

SeeedStudio.com

And Software Libraries to use them:

Displays and LEDs:

- GFX - base class with standard graphics routines (by Adafruit Industries)
- GLCD - graphics routines for LCD based on the KS0108 or equivalent chipset.
- Improved LCD library fixes LCD initialization bugs in official Arduino LCD library
- LedControl - for controlling LED matrices or seven-segment displays with a MAX7221 or MAX7219.
- LedControl - an alternative to the Matrix library for driving multiple LEDs with Maxim chips.
- LedDisplay - control of a HCMS-29xx scrolling LED display.
- Matrix - Basic LED Matrix display manipulation library
- PCD8544 - for the LCD controller on Nokia 55100-like displays (by Adafruit Industries)
- Sprite - Basic image sprite manipulation library for use in animations with an LED matrix
- ST7735 - for the LCD controller on a 1.8", 128x160 TFT screen (by Adafruit Industries)

Audio and Waveforms:

- FFT - frequency analysis of audio or other analog signals
- Tone - generate audio frequency square waves in the background on any microcontroller pin

Motors and PWM:

- TLC5940 - 16 channel 12 bit PWM controller.

Timing:

Arduino.cc

Even Radio Shack Sells Them

ack Collections ▸ Shields ▸ Make MakerShield Prototyping Kit



Make MakerShield Prototyping Kit

Model: MakerShield Kit | **Catalog #:** 276-138

$16.99

Like 5 +1 0

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Getting Started with Arduino Kit v2.0

Jameco Part no. 2121121	
Manufacturer	JAMECO KITPRO
Manufacturer no.	KIT-GSA

RoHS compliant

Catalog 141 , page 159

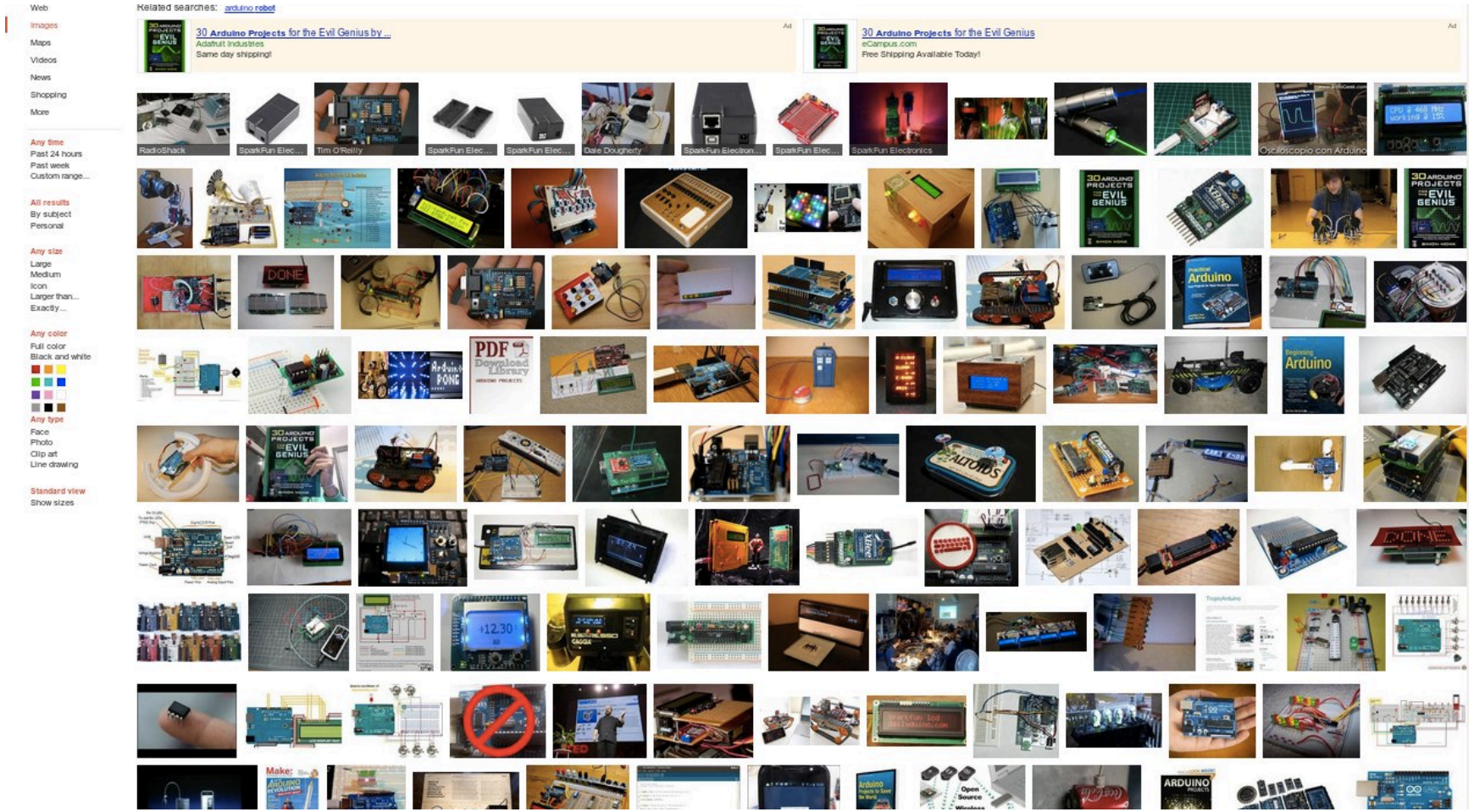


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The Arduino Advantage: Community

- The Arduino has a community of diverse disciplines and interests
  - *Art, Music, Robotics, Sensors, and now Amateur Radio*
- All using the same tools and software
  - *Sharing software libraries, hardware designs, techniques, and know-how*

Plenty of Projects to Choose From



Google image search for “Arduino Project”

Build your own projects

- Fit your needs, not someone else's
- Software, Modules, and Know-How is available
  - Start from scratch
  - Adopt someone else's project and adapt it to your needs

Using higher level programming than the micros that hams used in the past

```
void send_h() {
  dit(); dit(); dit(); dit();
  letter_space();
}

void send_i() {
  dit(); dit();
  letter_space();
}
```

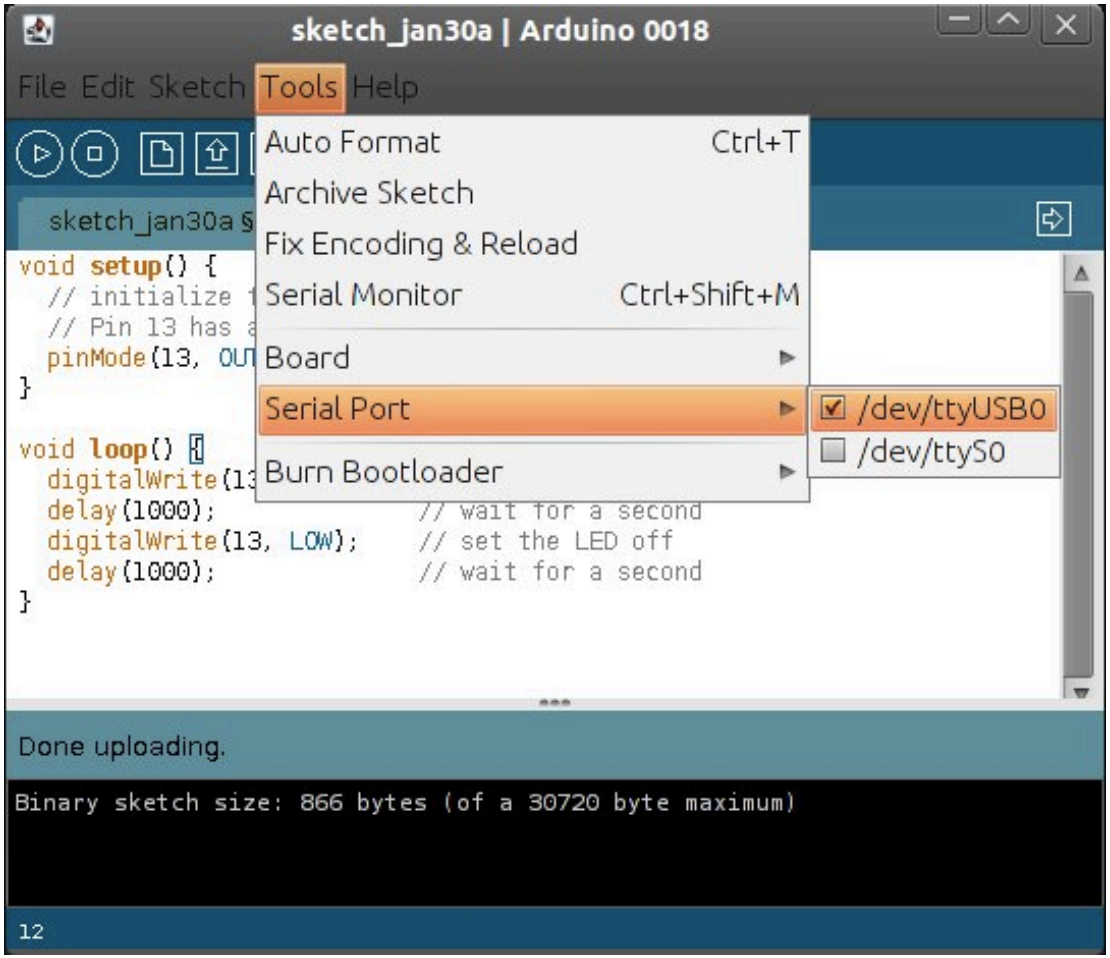
But gives the full power of C/C++ for experts

```
// Initialize sine_table
for (i = 0; i < 256; i++) {
  sine_table[i] = 127 * sin((2*M_PI*i)/256.0);
}

// The PWM frequency is 62.5KHz.  The 3dB corner of the filter is
// about 16KHz.  (R = 10K, C = .001uF) The default modulation
// frequency for the code signal is 600Hz (can be changed up or down
// with pushbuttons).

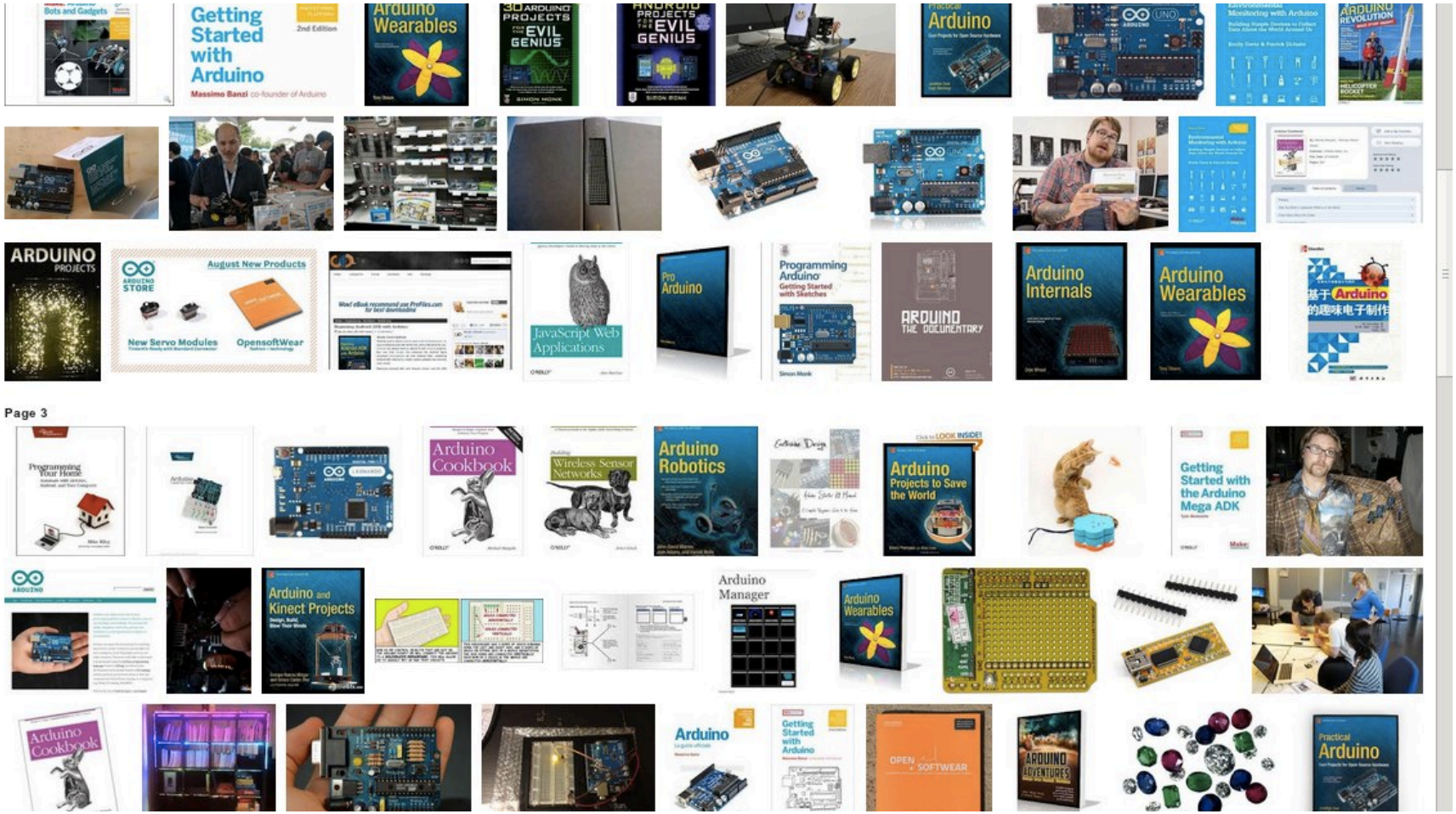
if (((PINB & _BV(PORTB0)) == 0) || ((PINB & _BV(PORTB1)) == 0)) {
  // change frequency
  if (PINB & _BV(PORTB0)) frequency -= 10; else frequency += 10;
  if (frequency <= 300) frequency = 300;
  if (frequency >= 1200) frequency = 1200;
  delta_phase = round((256.0*256.0*16.0*frequency)/1000000.0); // 1/16uS sample rate
  update_display();
  dot(0);
}
```

Develop with free tools on Linux, Mac, and Windows



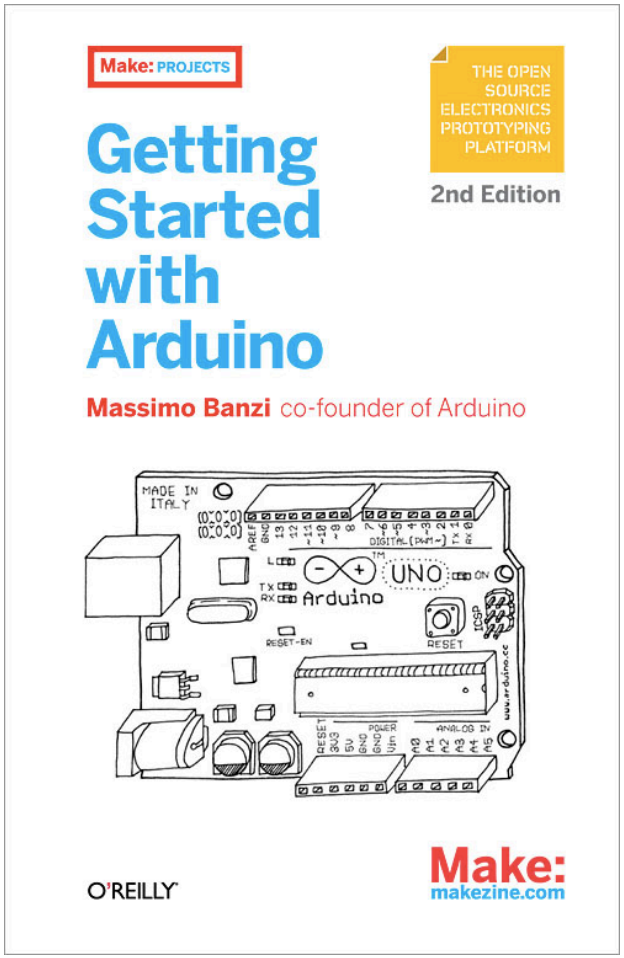
robotmill.com/

Books!



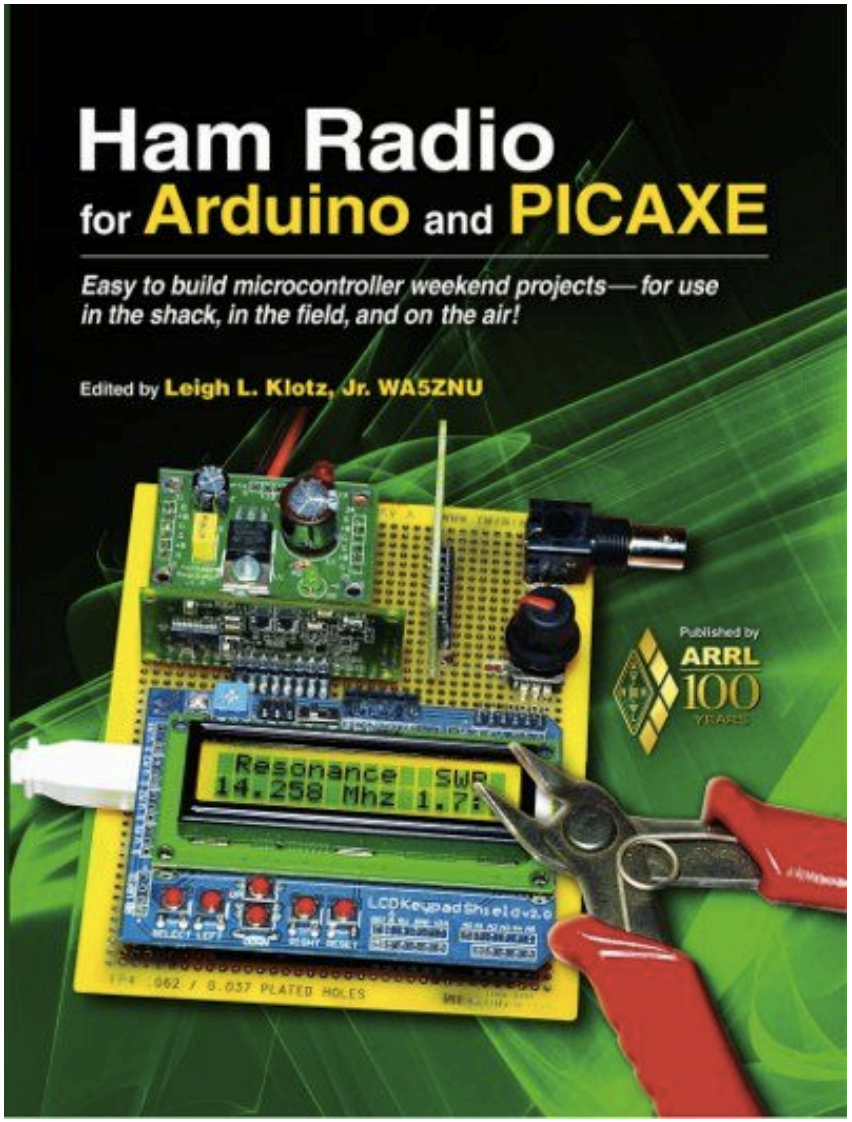
Google image search for “Arduino Books”

Start with this book…



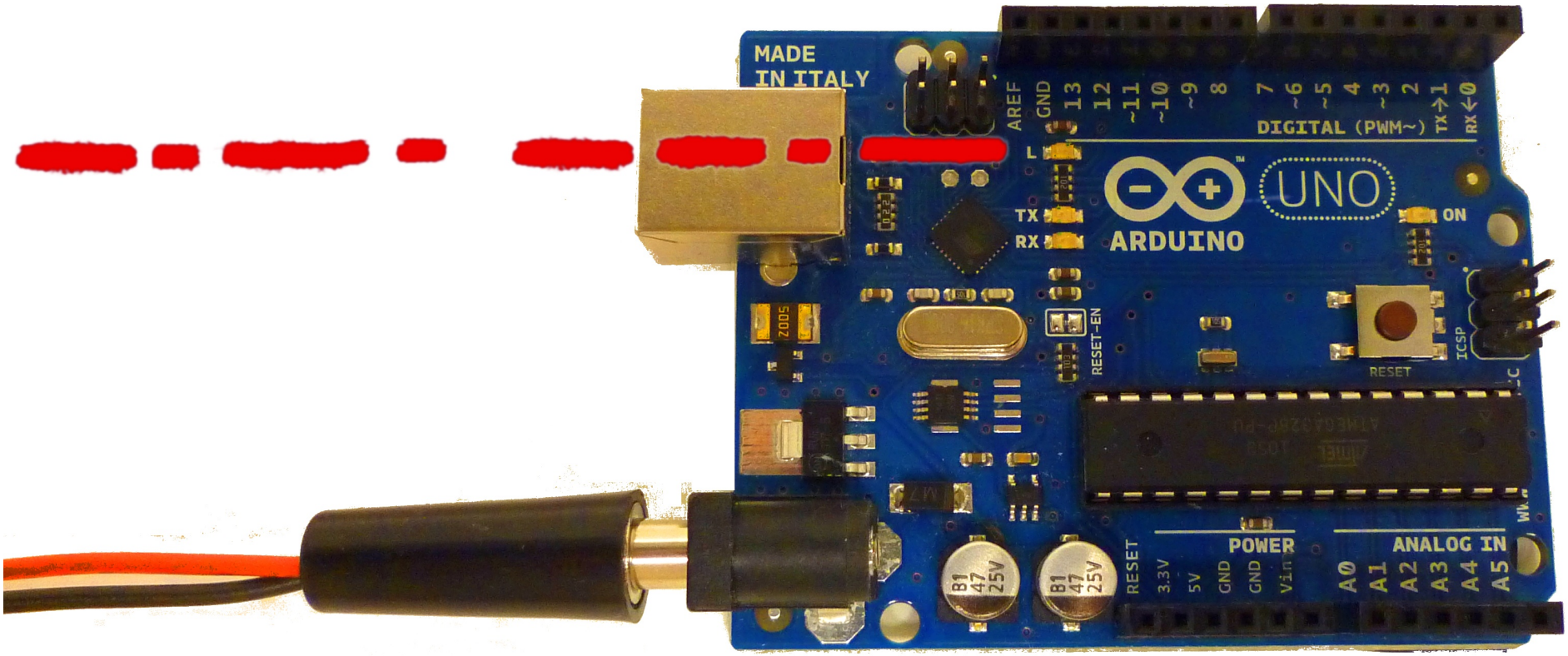
Or This One ;-)

The one and only Arduino and PICAXE Ham Radio Book!

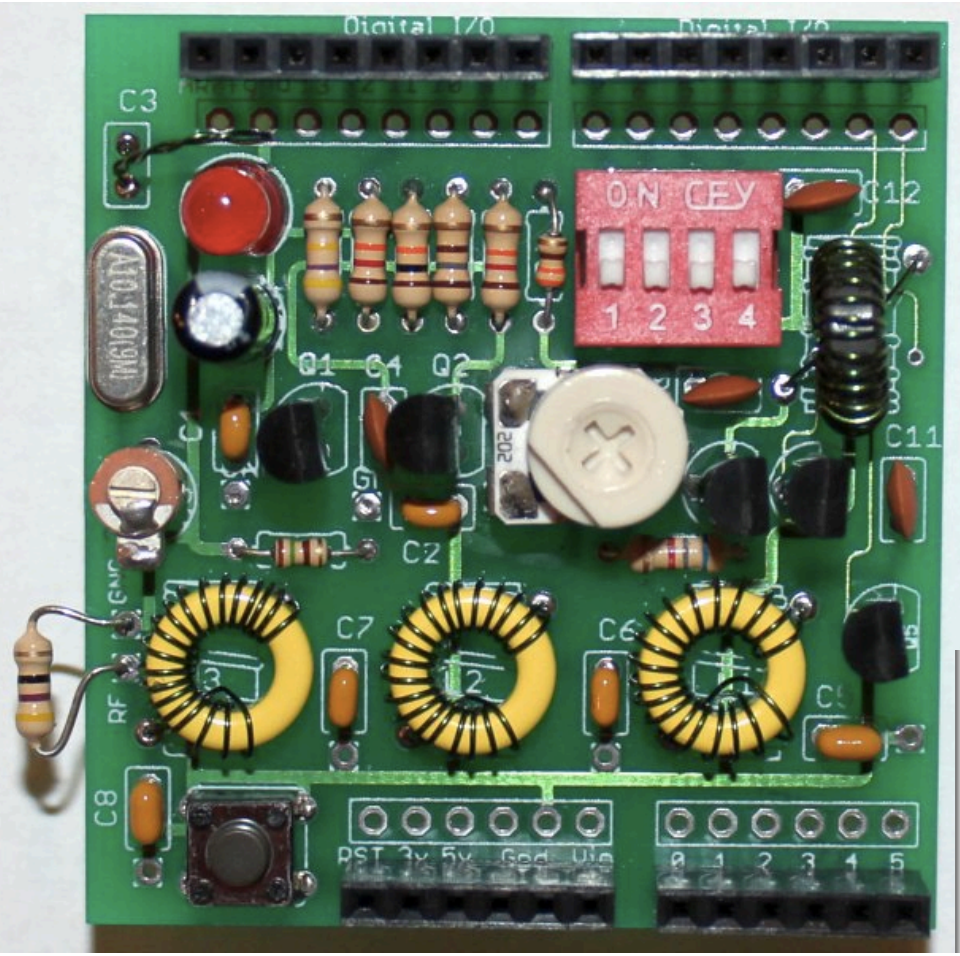


First Book Project: CQ DX

- A Ham's "Hello World:"
  - Blink CQ DX on an LED



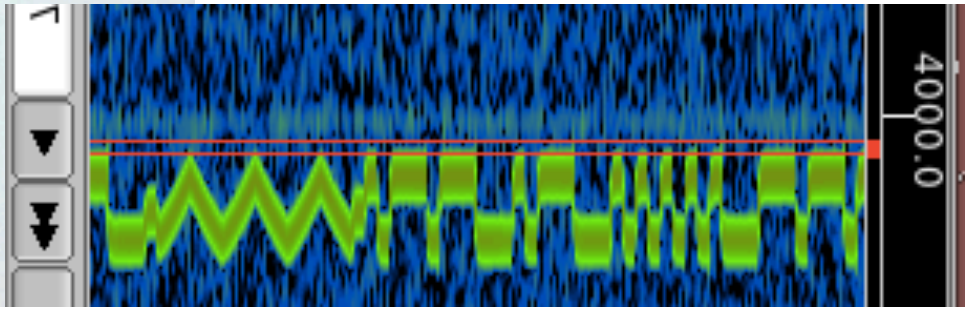
Book Project: QRSS Transmitter by Hans Summers G0UPL



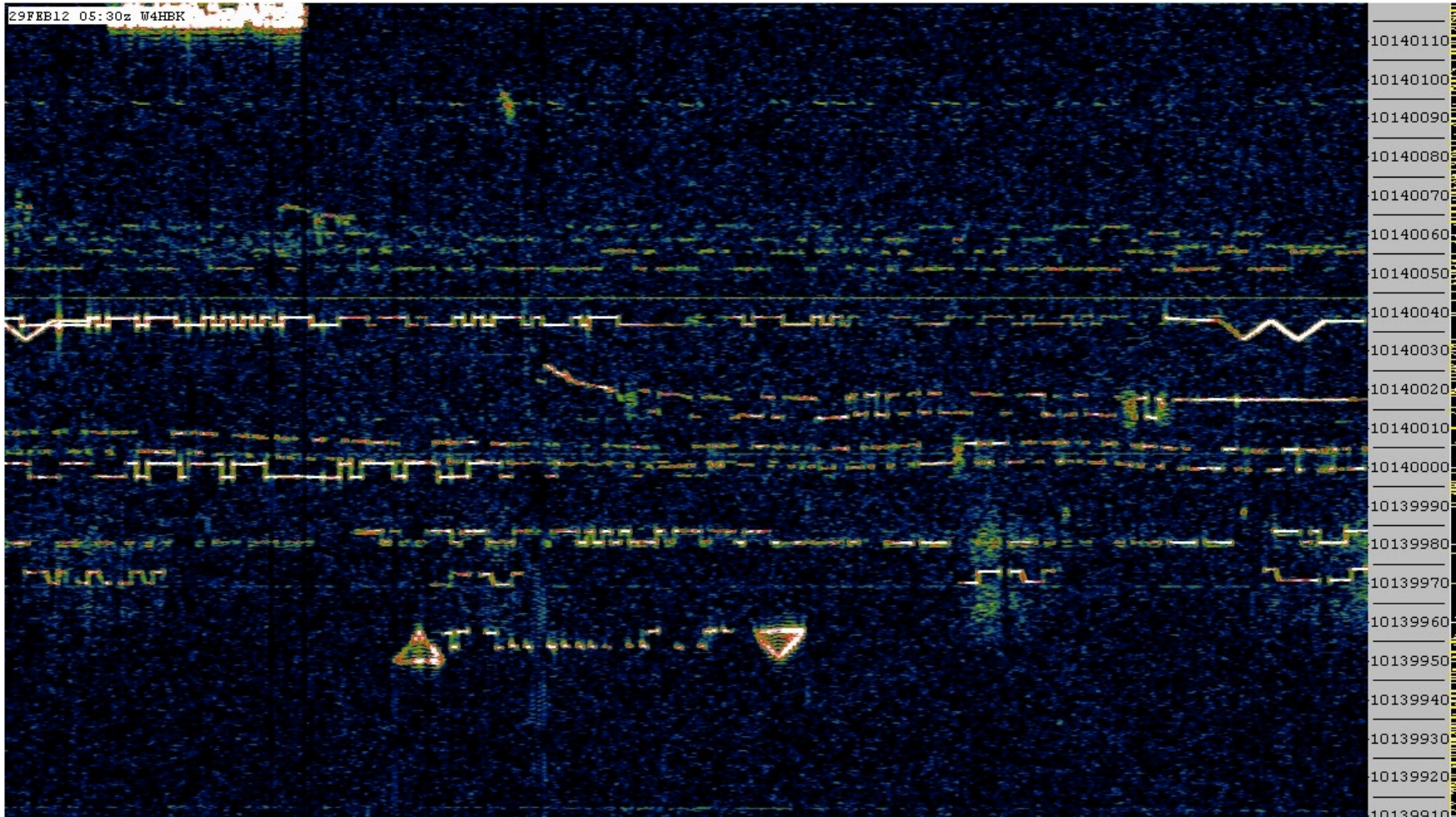
QRSS is an ultra-slow, ultra-low bandwidth, ultra QRP mode…send your callsign in 10 minutes and see it on a waterfall around the world on milliwatts.

A great weak-signal mode for propagation experiments, even Technician class.

10-50mW enough to cross continents.

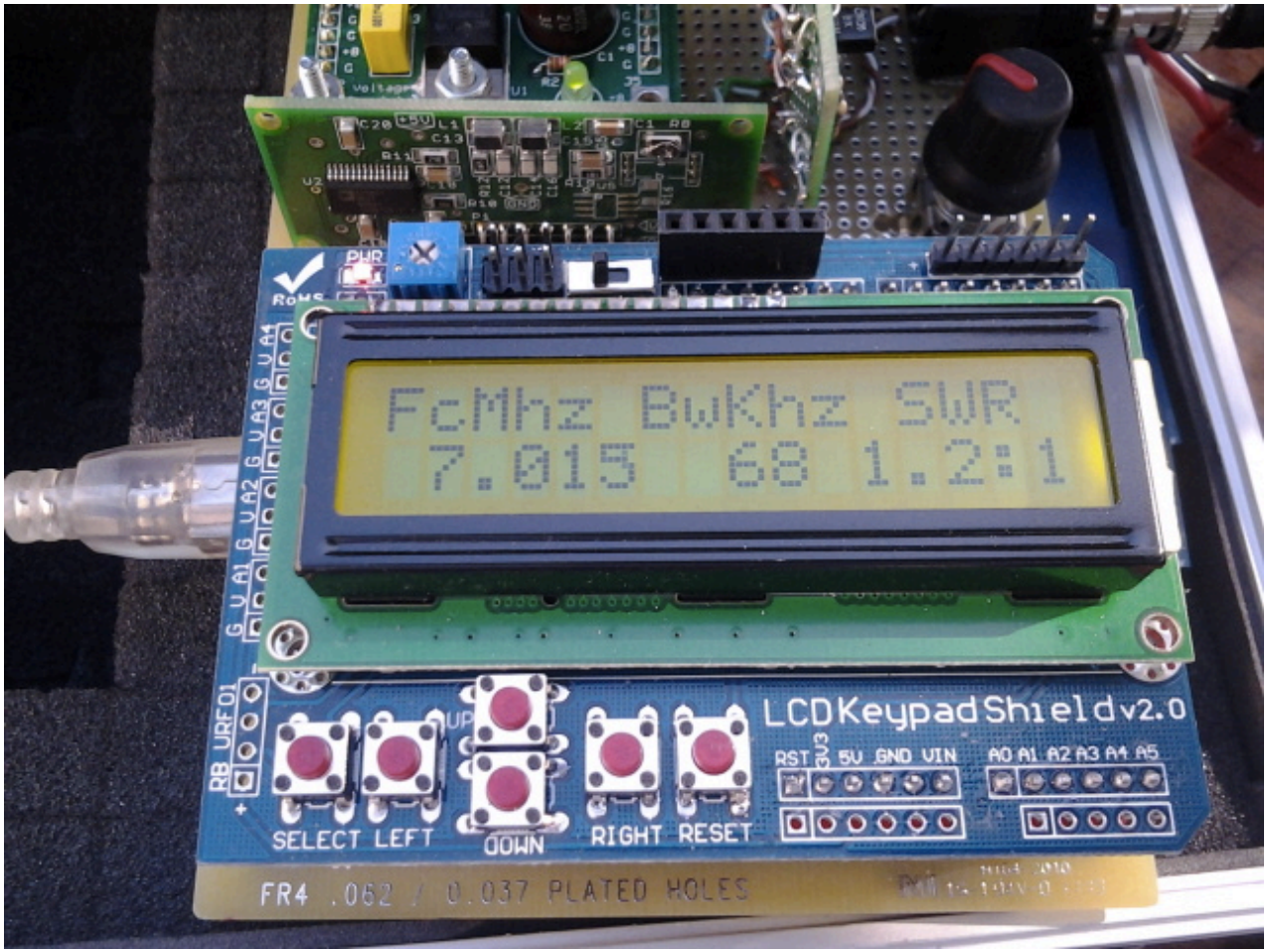


QRSS Grabbers on the web

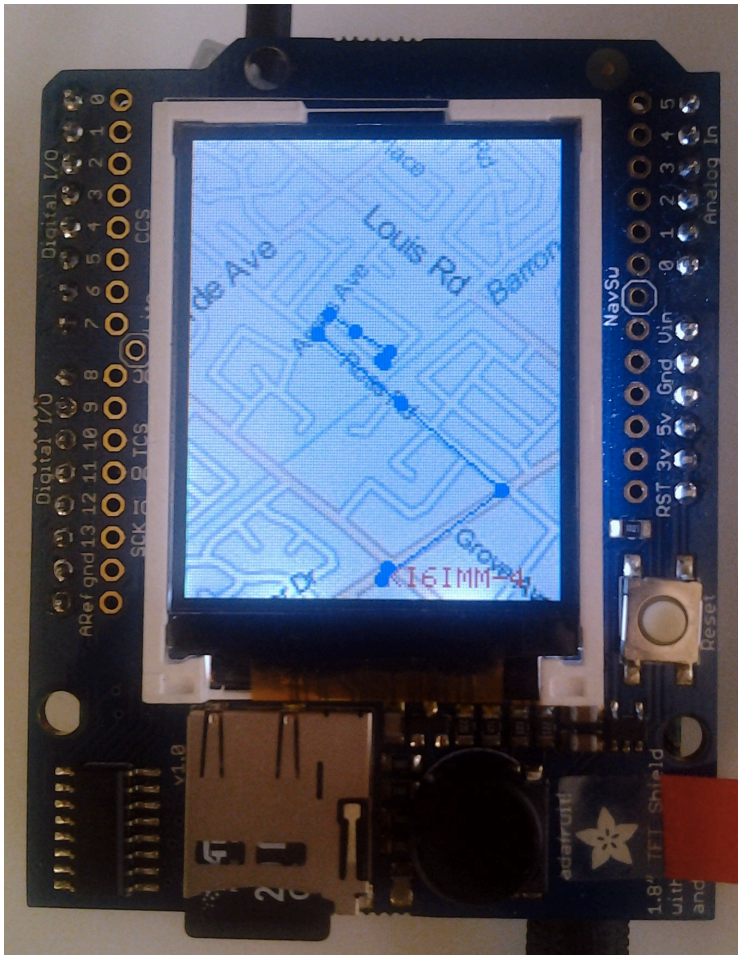


W4HBK

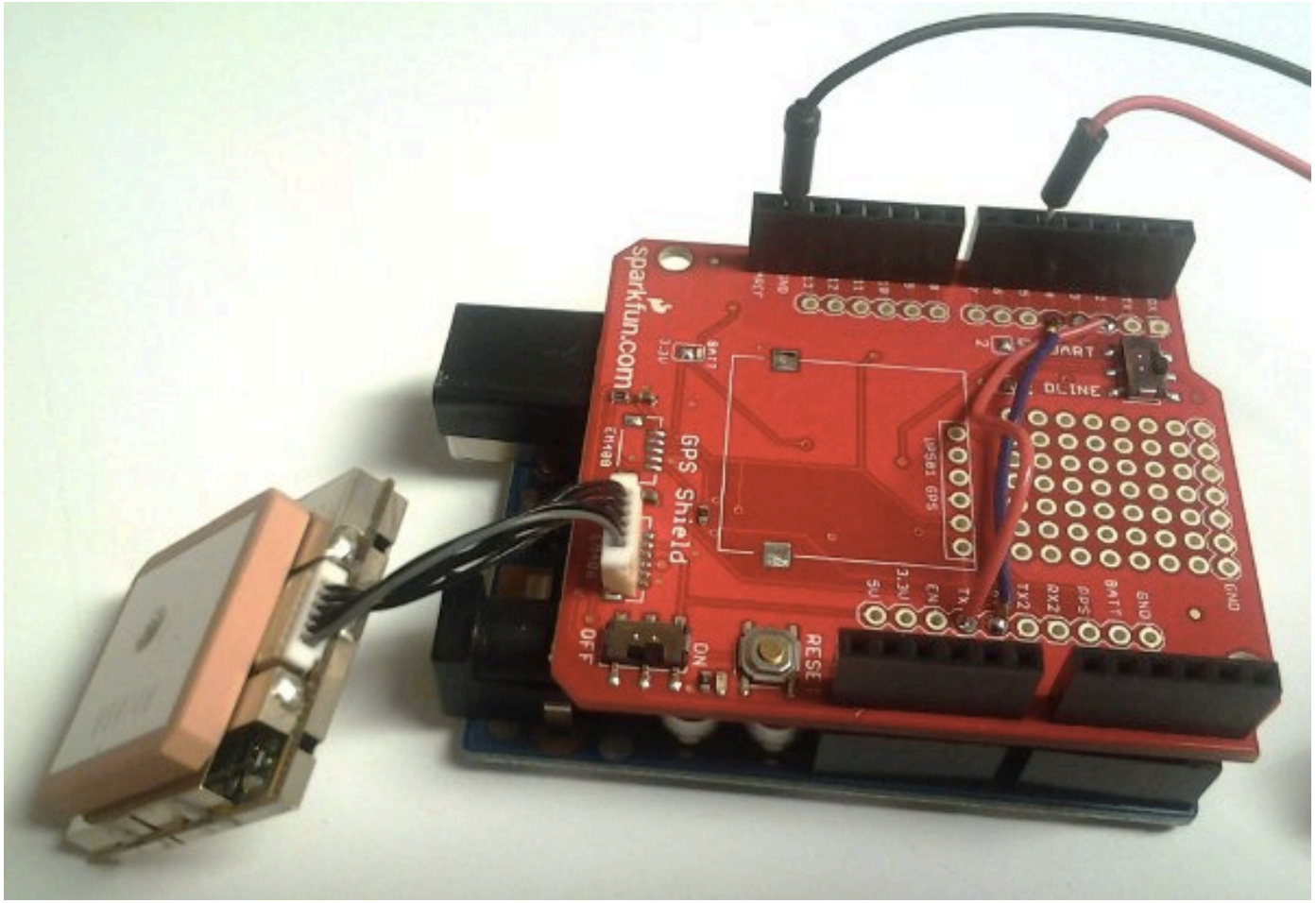
Book Project: Sweeper by Alan Biocca W6AKB



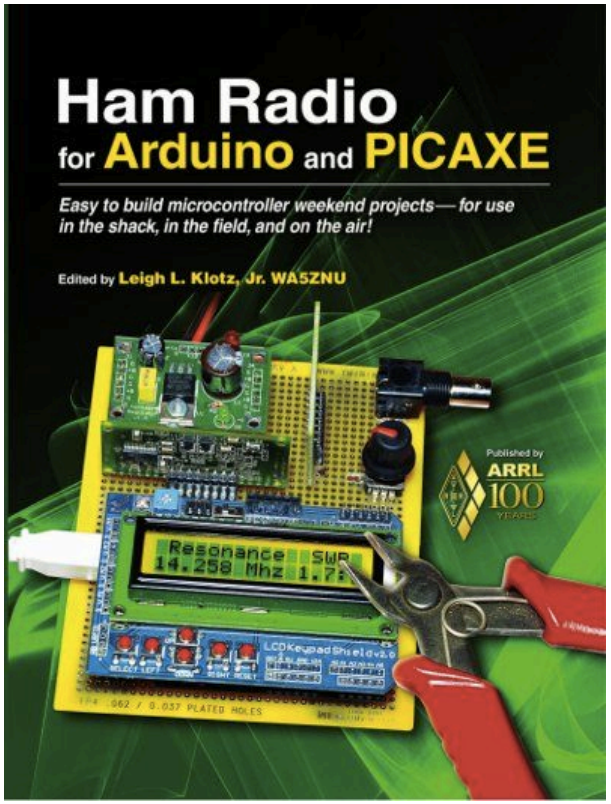
Book Project: Marinus Portable APRS Display

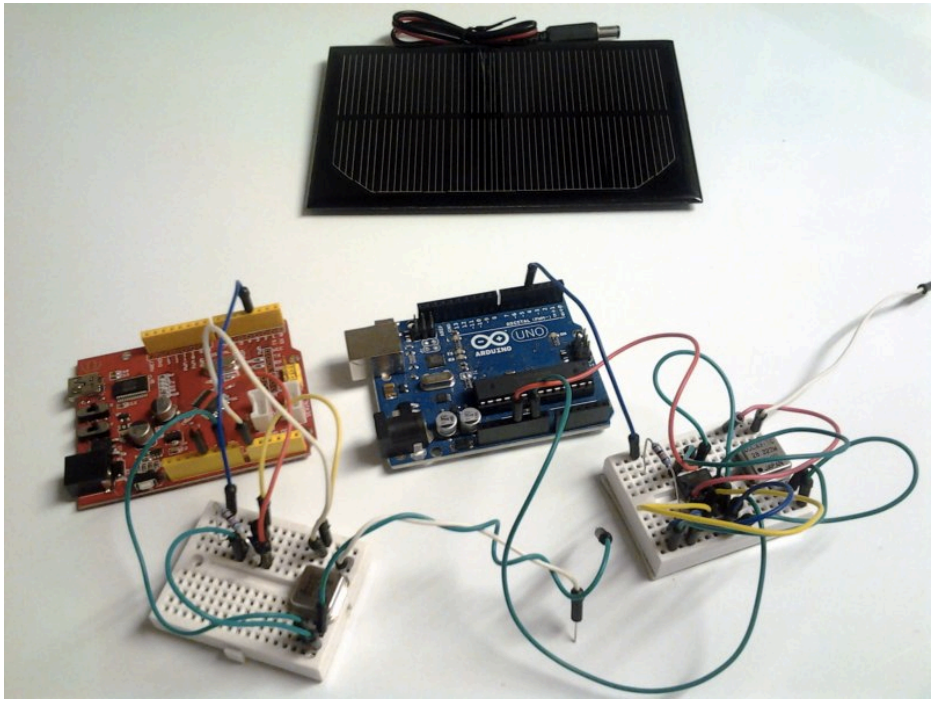


Book Project: Buddy
Grid Square Annunciator



Buy the Book & Build your own!





Thank you!

Slides and more at
http://hamradioprojects.com