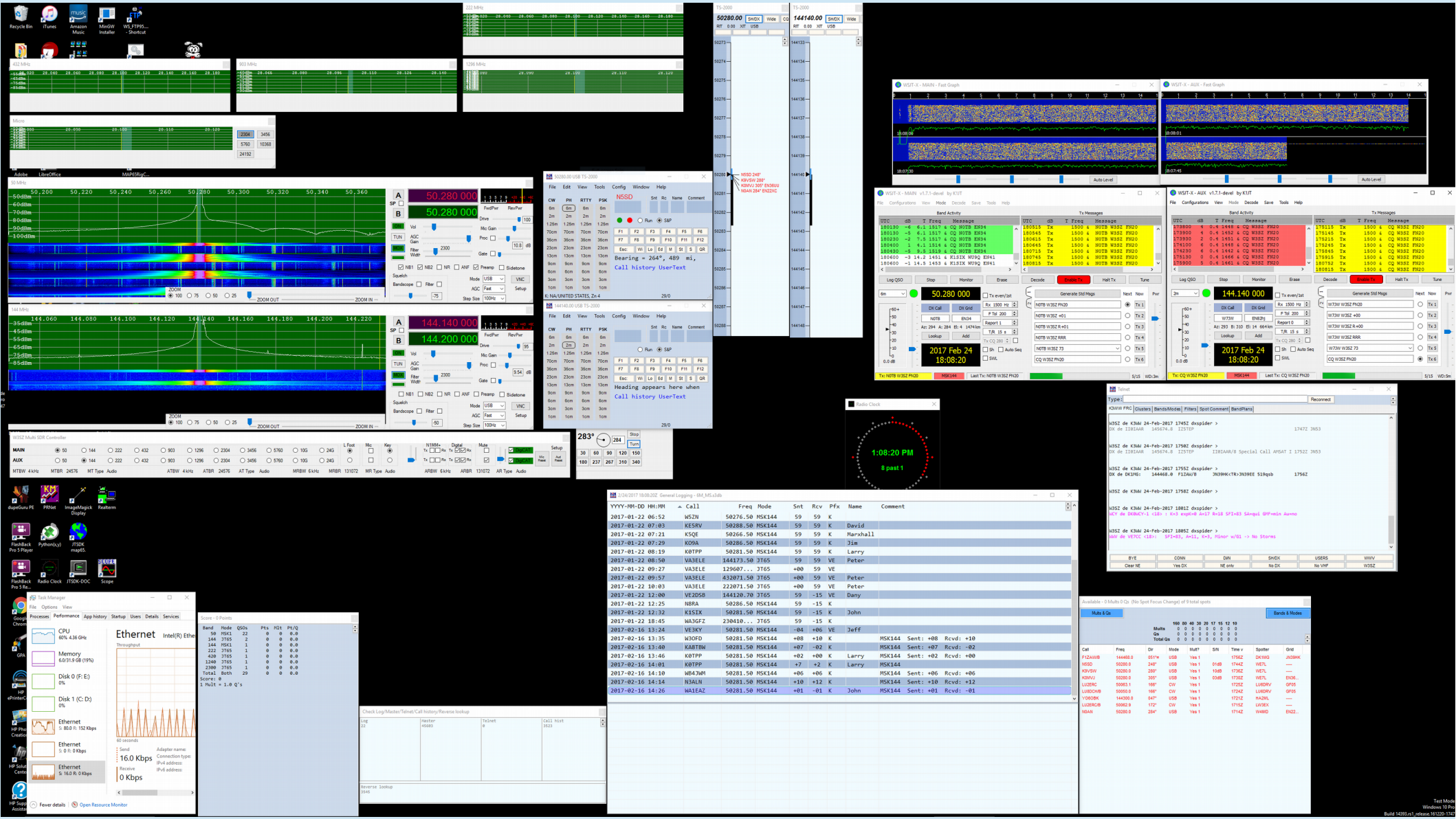
Station Automation
--W3SZ



IF/Transverter Band Switching - Serial Port

- Are there options besides using MK2R/MK2R+ or OTRSP-compatible devices such as YCCC MOAS II or CanaKit?
- Yes!
  - Use either off-the-shelf MCUs (Microcontrollers) or SBCs (Single Board Computers)
  - They will require programming (coding)
  - It is NOT as hard as it sounds; it is actually quite simple!
  - Google is your friend!

IF/Transverter Bandswitching
USB-Serial or Serial
Microcontrollers (MCUs) and Single Board Computers (SBCs)

- Code required:
  1) Read band data from logger or radio
  2) Parse band data from logger or radio
  3) Bandswitch using parsed band data from logger or radio
- Hardware required:
  - MCU or SBC
  - SainSmart 16-Relay board or your chosen alternative
  - RF relays
  - If use BBB or RPi may need buffer/driver for relay board

Introduction to MCUs and SBCs

MCUs and SBCs

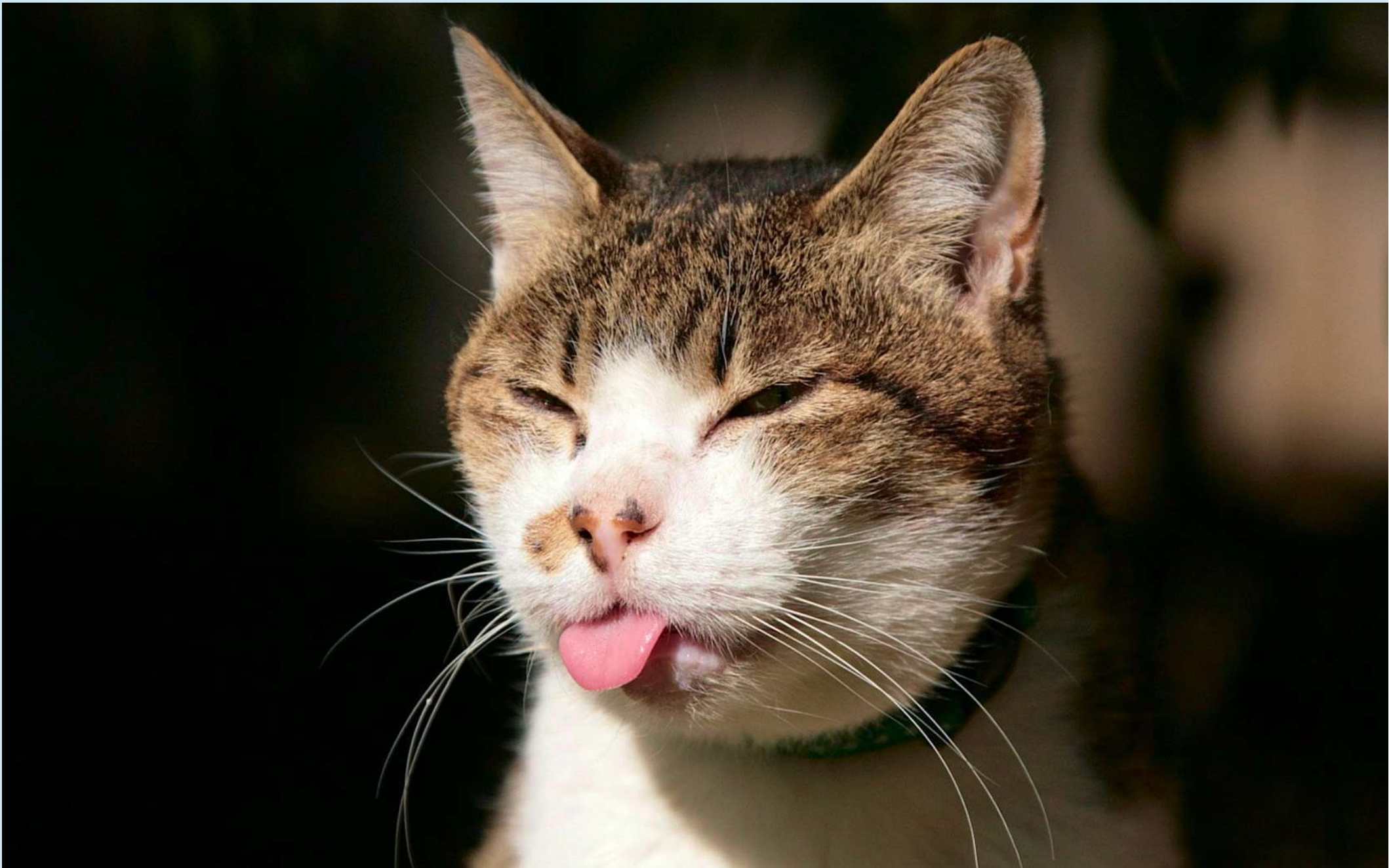
- **MCUs – cheaper, less capable than SBCs, but hardier**
  - **Arduino – LPT, USB-Serial, and Ethernet (with shield)**
  - **Parallax Propeller** – LPT and USB-Serial
  - **Basic Stamp** 2p24 – LPT and USB-Serial
- **SBCs – more expensive, more capable, more fragile**
  - **Raspberry Pi 3B** -LPT, USB-Serial, and Ethernet
  - **BeagleBone Black** – LPT, USB-Serial, and Ethernet

- **USING ANY OF THESE DEVICES WILL REQUIRE WRITING CODE**
- **Use MCU if it meets requirements in terms of # of IO pins, memory**
- **Use SBC for more complex tasks requiring more IO pins, more memory than MCUs can provide**
  - **Or where ability to use high level language like python is useful**

MCUs

MCUs

SBCs



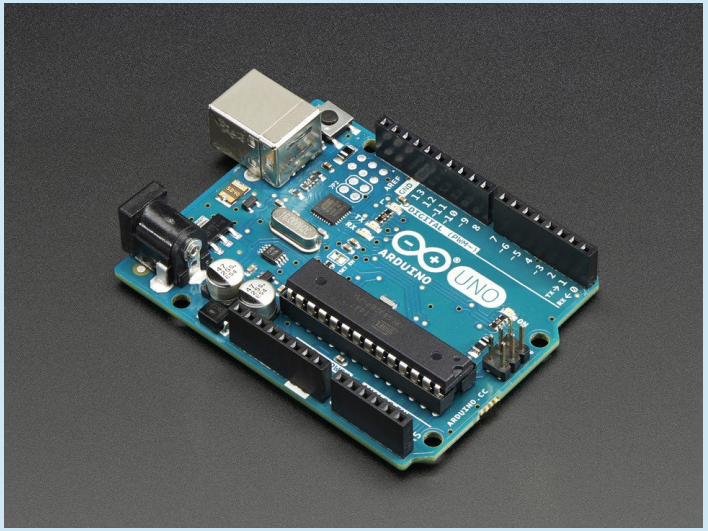
MCUs vs SBCs

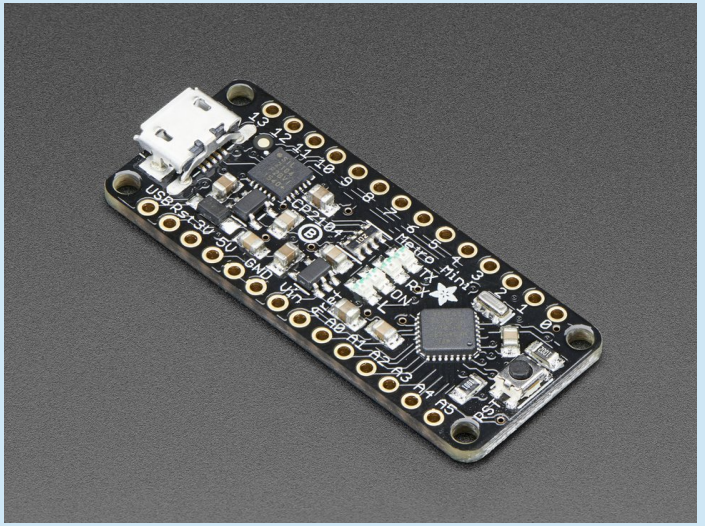
MCU	GPIO	Analog I/O	LPT	USB	Enet	Max ma sourced	SRAM	GPIO V	$$$$
Arduino UNO	20	6/0	Y	Y	N	20	2 KB	5	5.13
Arduino Mega 2560 R3	54	16/0	Y	Y	N	40	8 KB	5	10.43
Arduino Due	54	12/2	Y	Y	N	3-15 so	96 KB	3.3	15.10
SBC									
Raspberry Pi 3B	40	0/0	Y	Y	Y	3	1 GB	3.3	40.00
BeagleBone Black Rev C	65	7 12bit	Y	Y	Y	6	512 MB	3.3	50.00

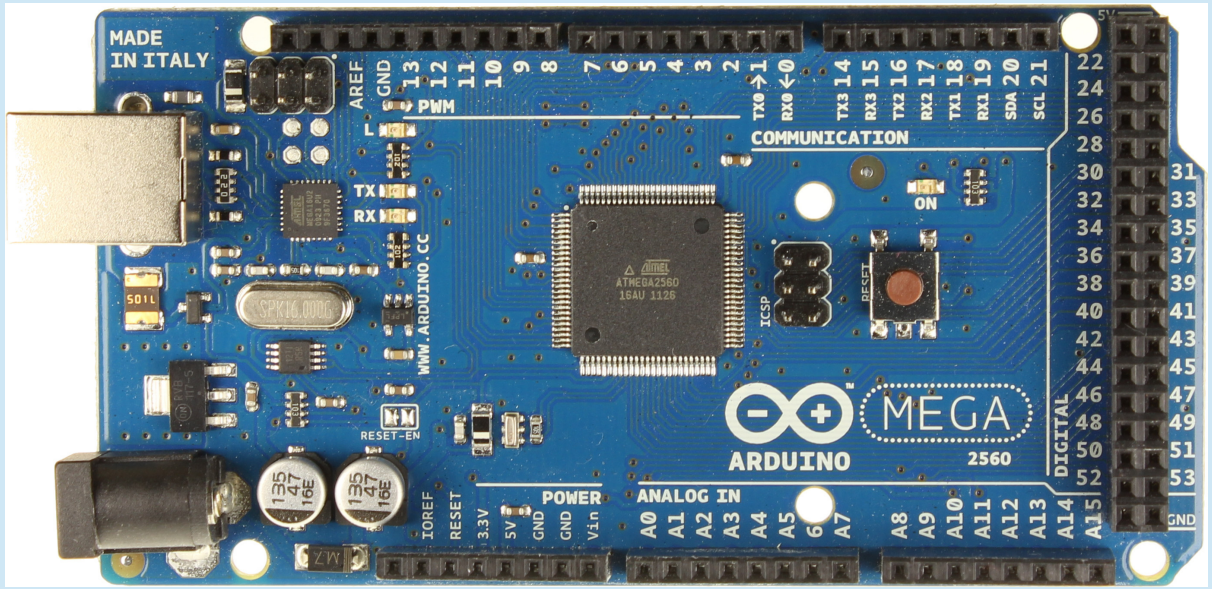
GOOD

BAD

Arduino


ARDUINO
UNO




MADE
IN ITALY
PWM
COMMUNICATION
DIGITAL
POWER
ANALOG IN
ARDUINO
MEGA
2560
WWW.ARDUINO.CC

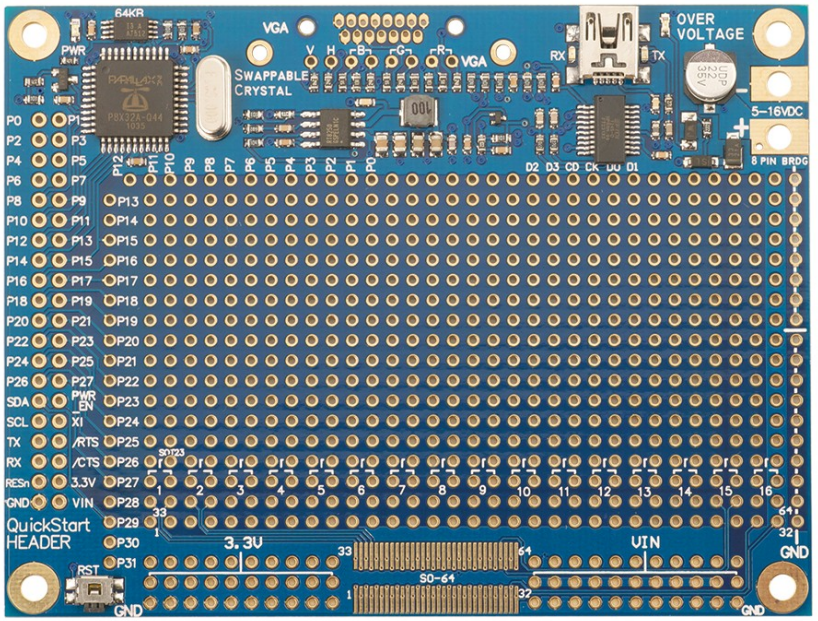

LEONARDO
ARDUINO
DIGITAL (PWM~)
POWER
ANALOG IN

MCU	GPIO	Analog I/O	LPT	USB	Enet	Max ma sourced	SRAM	GPIO V	$$$$
Arduino UNO	20	6/0	Y	Y	N	20	2 KB	5	5.13
Arduino Nano	22	8/0	Y	Y	N	40	2 KB	5	2.93
Arduino Leonardo	20	12/0	Y	Y	N	40	2.5 KB	5	10.93
Arduino Duemilanove (328)	14	6/0	Y	Y	N	40	2 KB	5	8.66
Arduino Metro Mini 328	20	6	Y	Y	N	20 (40)	2 KB	5 (3.3)	17.94
Arduino Mega 2560 R3	54	16/0	Y	Y	N	40	8 KB	5	10.43
Arduino Due 32bit	54	12/2	Y	Y	N	3-15 so	96 KB	3.3	15.10
Arduino Zero 32bit	20	6/1	Y	Y	N	7	32 KB	3.3	15.00
Parallax Propeller	28	28/28	Y	Y	N	40	32 KB	3.3	29.95
Basic Stamp 2p24	16	0/0	Y	Y	N	30	166 B	5	99.00

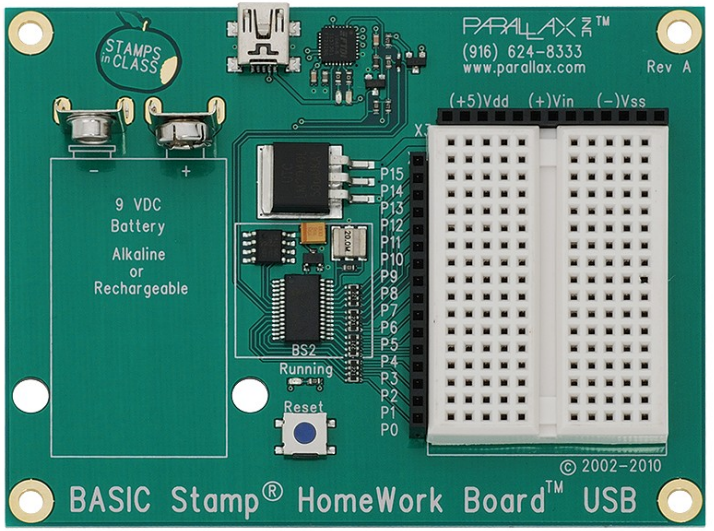
GOOD

BAD

Parallax Propeller



Basic Stamp


STAMPS in CLASS
PARALLAX
(916) 624-8333
www.parallax.com
Rev A
(+5)Vdd (+)Vin (−)Vss
9 VDC
Battery
Alkaline
or
Rechargeable
P15
P14
P13
P12
P11
P10
P9
P8
P7
P6
P5
P4
P3
P2
P1
P0
BS2
Running
Reset
© 2002–2010
BASIC Stamp® HomeWork Board™ USB

SBCs

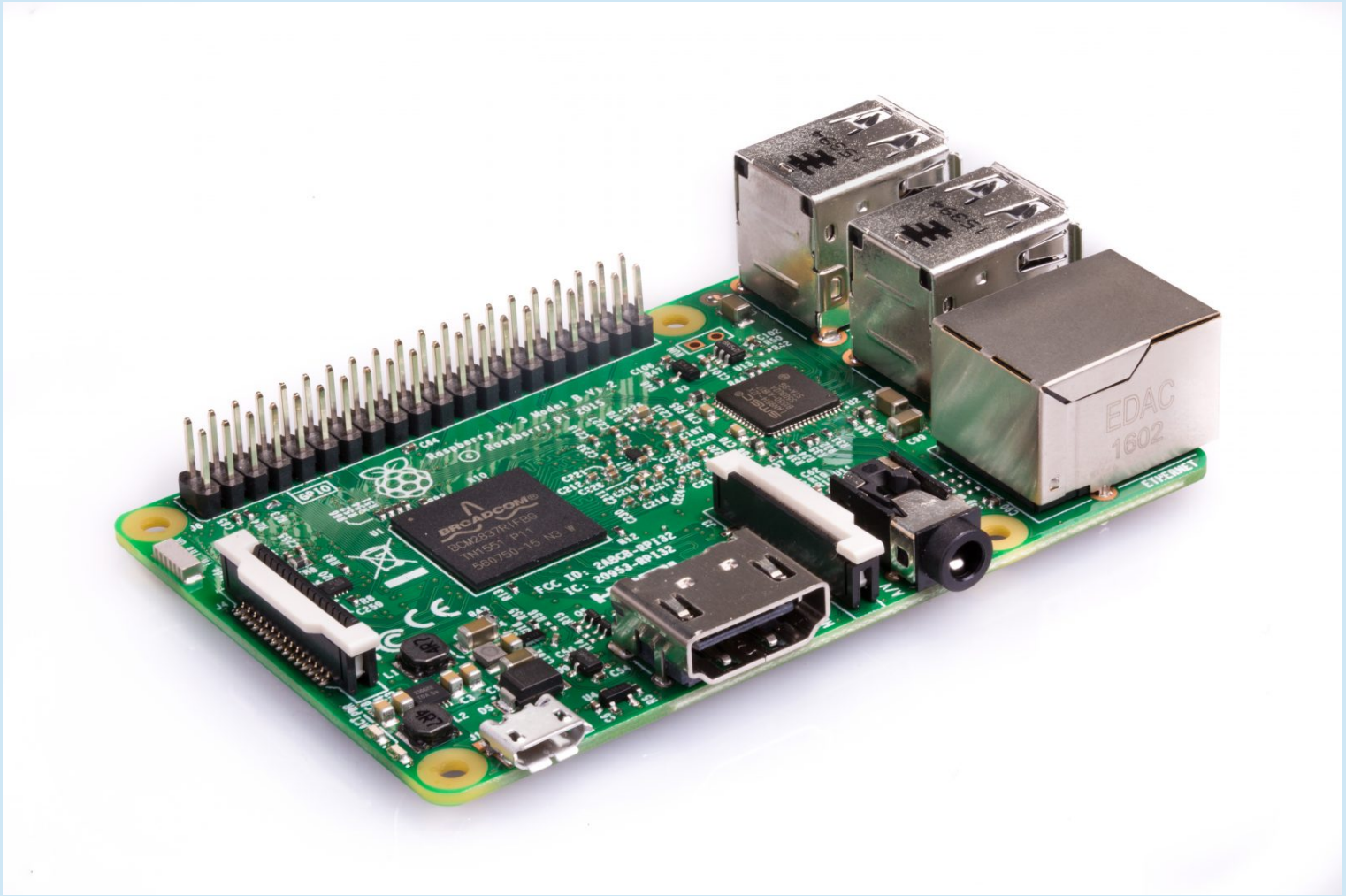
- Single Board Computers
  - **Beaglebone Black**
  - **Raspberry Pi** / Raspberry Pi 2 Model B / etc.
  - Usually **Linux** operating system
  - Can use languages like Python in addition to C, C++
  - BeagleBones Come with both Ethernet and USB
  - Have video, audio capabilities
  - **GPIO pins 3.3 V**
  - BBB: most **GPIO pins can source 6 ma, sink 8 ma** (a few pins can only source 4 ma)
  - RPi: **recommended max current 3 ma per pin** though some sources say 16 ma max for 1 pin, 50 ma max for all pins
  - Can add Capes (BBB) / Hats (RPi) to extend capability (similar to Shields for Arduino)

Raspberry Pi

Product	Speed	RAM	USB	GPIO	Enet	Wifi/BT	$$
RPi Model A+	700MHz	512MB	1	40	No	No	25
RPi Model B+	700MHz	512MB	4	40	Yes	No	30
RPi 2 Model B	900MHz	1GB	4	40	Yes	No	40
RPi3 Model B	1200MHz	1GB	4	40	Yes	Yes	40
RPi Zero	1000MHz	512MB	1	28	No	No	5
RPi Zero W	1000MHz	512MB	1	40	No	Yes	10

Prices from Adafruit: https://www.adafruit.com/category/105

Raspberry Pi 3B



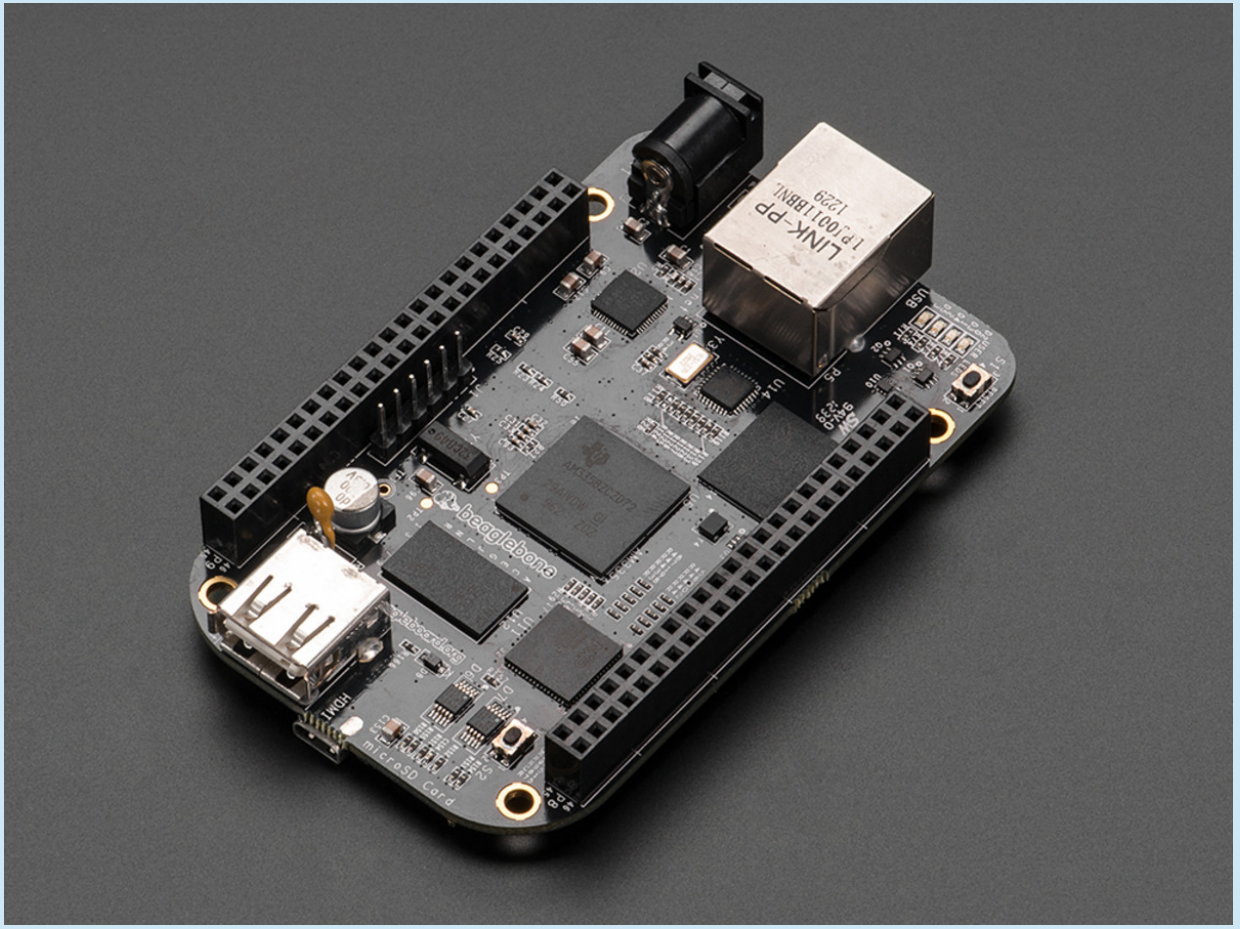
Beaglebone

Product	Speed	RAM	USB	GPIO	Enet	Wifi/BT	$$
BeagleBone Green	1 GHz	512MB	2	65	Yes	No	44
Green Wireless	1 GHz	512MB	2	65	Yes	Yes	50
BeagleBone Black	1 GHz	512MB	2	65	Yes	No	55
Black Wireless	1 GHz	512MB	2	65	Yes	Yes	69
BeagleBone Blue	1 GHz	512MB	2	8	Wifi	Yes	82
BeagleBoard-xM	1 GHz	512MB	5	53	Yes	No	151
BeagleBoard-X15	1 GHz	2GB	2	TBD	Yes	No	264

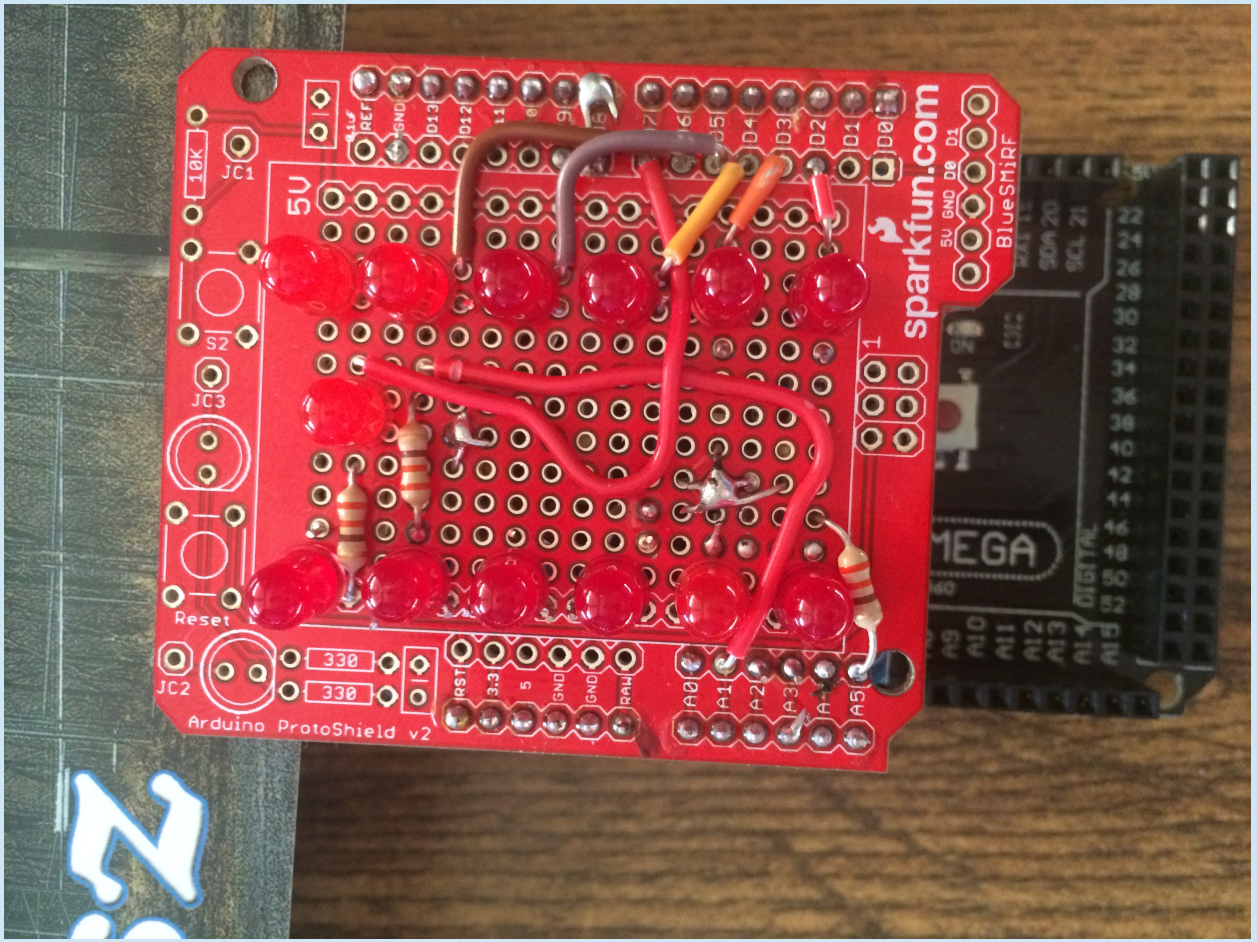
Prices are from Mouser

Green is like Black but without onboard HDMI Support

BeagleBone Black



Shields, Capes, and Hats

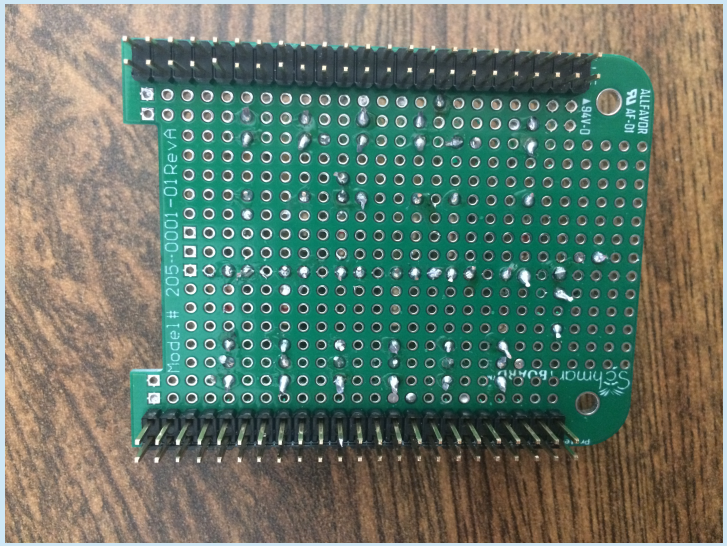


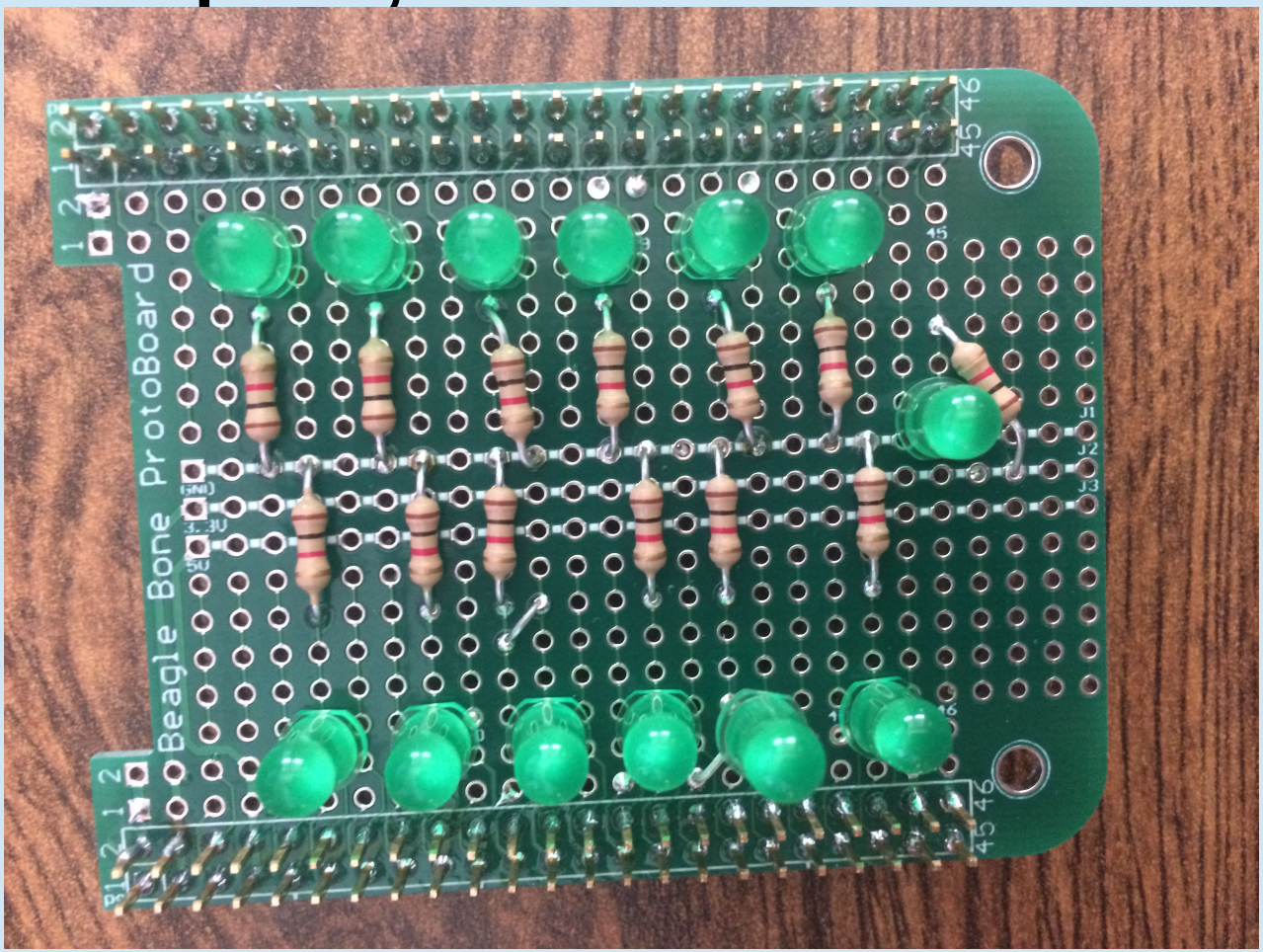
Arduino ProtoShield – Bare PCB $4.95 from Sparkfun
https://www.sparkfun.com/products/11665

Shields, Capes, and Hats

Arduino Ethernet Shield
Ebay $7.36

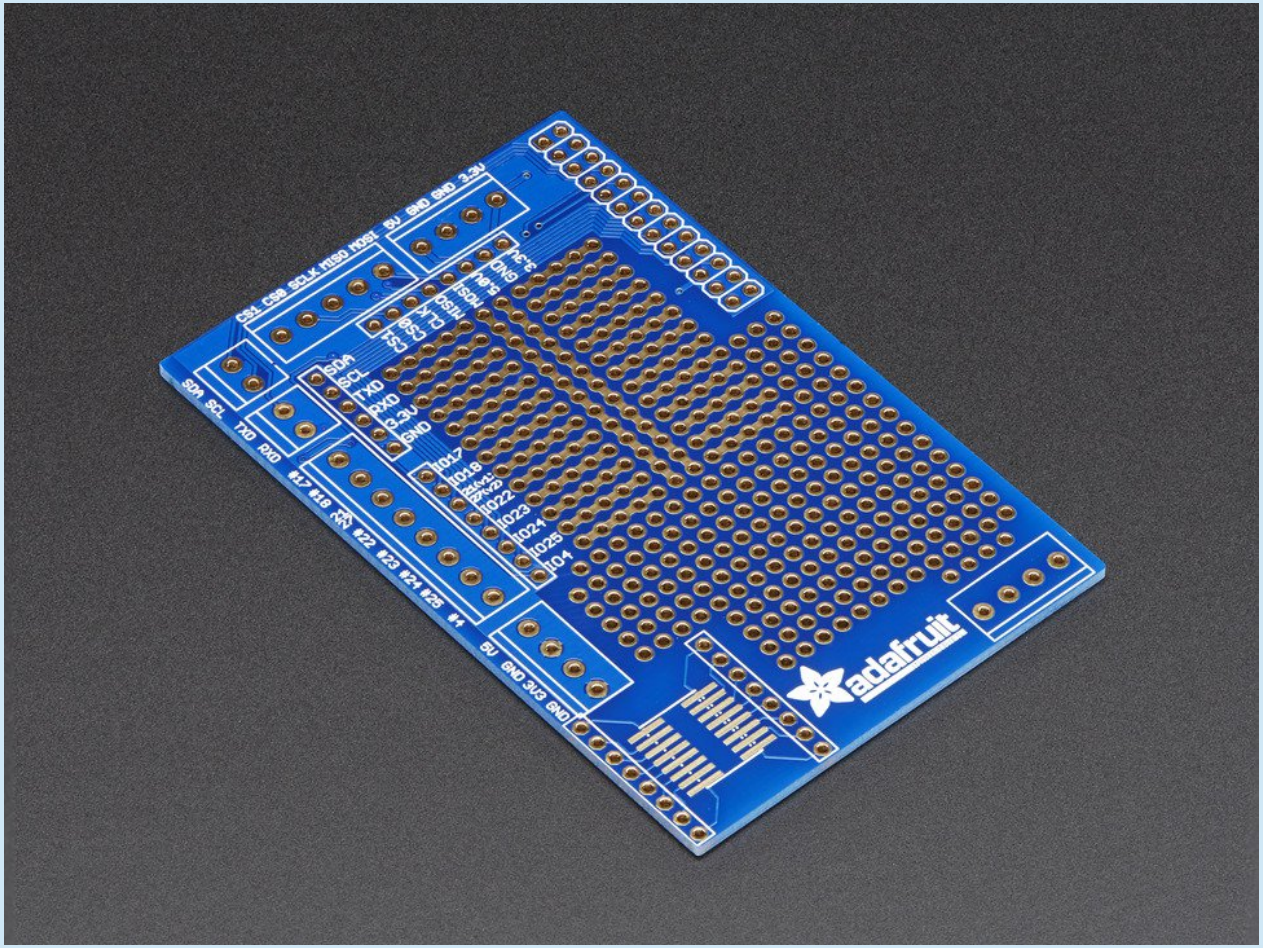
Shields, Capes, and Hats





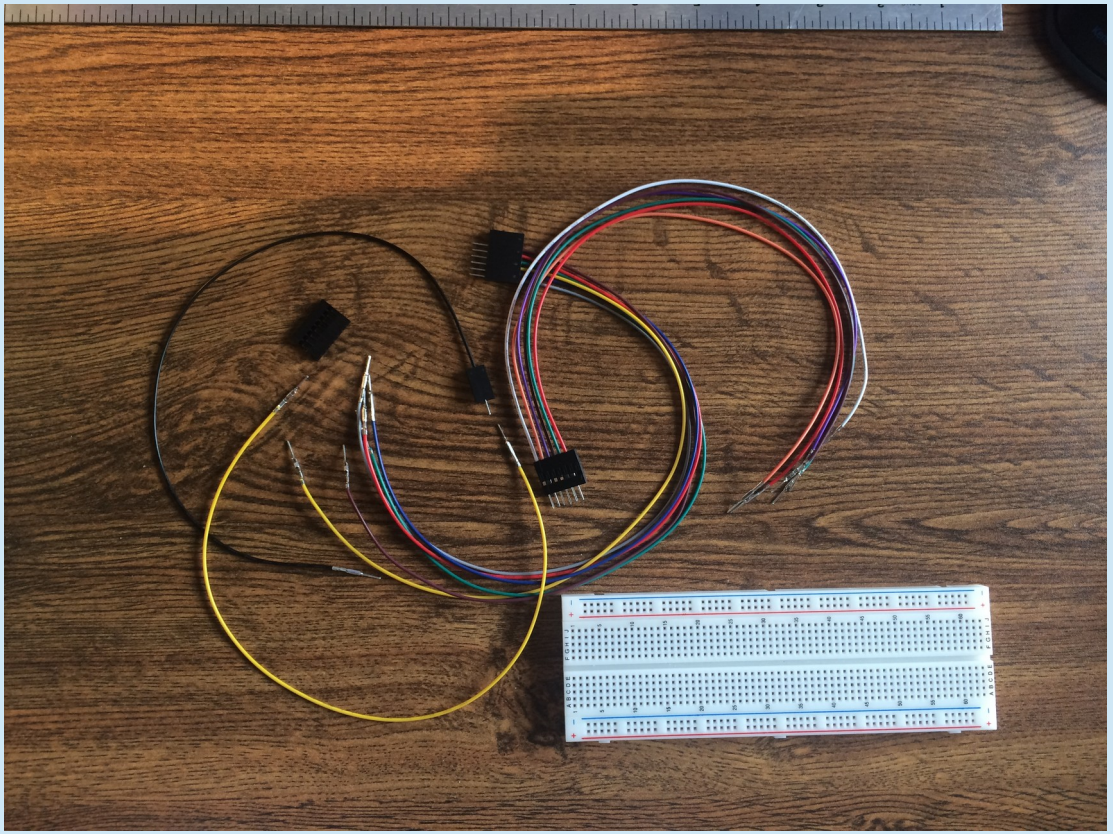
SchmartBoard from Mouser $13.00
http://www.mouser.com/search/ProductDetail.aspx?r=872-205-0001-02

Shields, Capes, and Hats



Adafruit Prototyping Pi Plate $15.95
https://www.adafruit.com/product/801

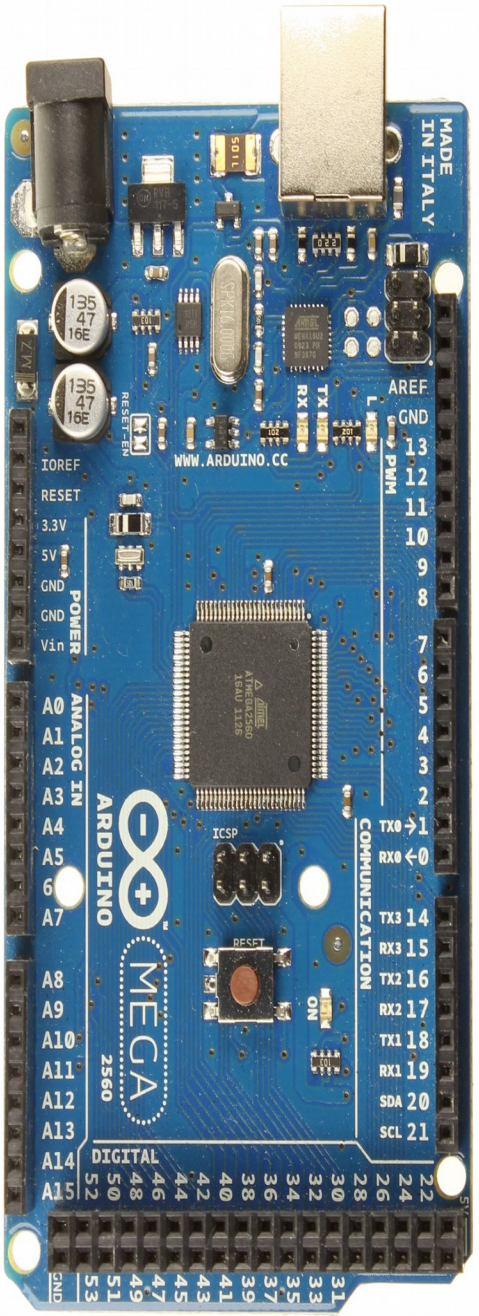
Prototyping Before You Make a Shield / Cape / Hat



Wires with Pre-Crimped Terminals -and- Crimp Connector Housings
https://www.pololu.com/category/39/cables-and-wire

Inputs:

GPIO Pins
Analog Pins
Serial
Ethernet



Outputs:

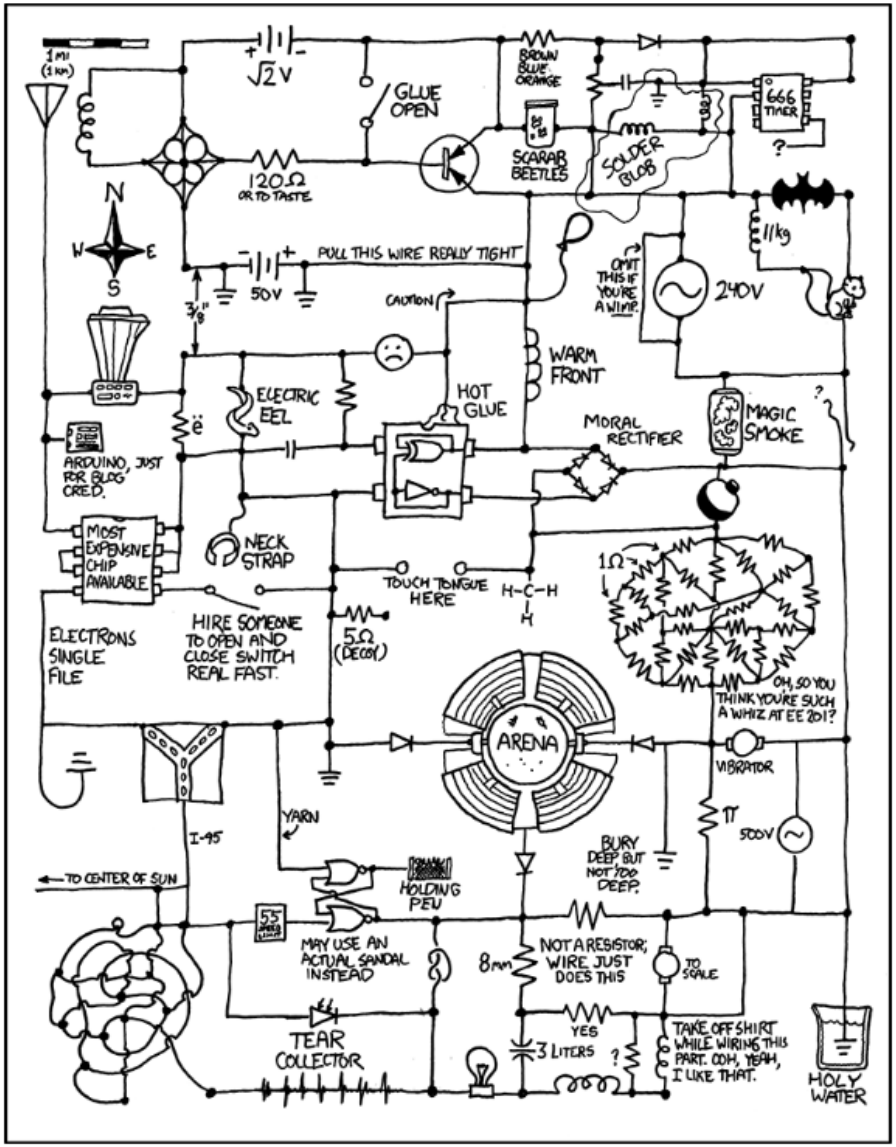
GPIO Pins --> Relays
Analog Pins --> PWM
motor
control
Serial --> USB-Serial
Ethernet --> Browser
Database

Station Automation Coding

- Very Simple:
  - Get Some Input
  - Do Something With It
  - Produce Some Output

Station Automation Coding

- Google is Your Friend
- No Matter What You Want to Do:
  - Someone has already done something like it
- Use Google to Get Their Code
  - Read it
  - Understand it (Optional)
  - Use it
  - Modify it
- Don’t Reinvent the Wheel


1 MI (1 KM)
√2 V
GLUE OPEN
BROWN BLUE ORANGE
SCARAB BEETLES
SOLDER GLOB
666 TIMER
120Ω OR TO TASTE
N
W
E
S
PULL THIS WIRE REALLY TIGHT
50V
3/8"
CAUTION
OMIT THIS IF YOU'RE A WIMP.
240V
1/kg
WARM FRONT
HOT GLUE
ELECTRIC EEL
MORAL RECTIFIER
MAGIC SMOKE
ARDUINO, JUST FOR BLOG CRED.
MOST EXPENSIVE CHIP AVAILABLE
NECK STRAP
TOUCH TONGUE HERE
H-C-H
H
1Ω
5Ω (DECOY)
ELECTRONS SINGLE FILE
HIRE SOMEONE TO OPEN AND CLOSE SWITCH REAL FAST.
OH, SO YOU THINK YOU'RE SUCH A WHIZ AT EE 201?
ARENA
VIBRATOR
π
500V
YARN
I-95
BURY DEEP, BUT NOT TOO DEEP.
TO CENTER OF SUN
HOLDING PEN
55 MPH SPEED LIMIT
MAY USE AN ACTUAL SANDAL INSTEAD
8mm
NOT A RESISTOR; WIRE JUST DOES THIS
TO SCALE
YES
3 LITERS
TEAR COLLECTOR
TAKE OFF SHIRT WHILE WIRING THIS PART. OOH, YEAH, I LIKE THAT.
HOLY WATER