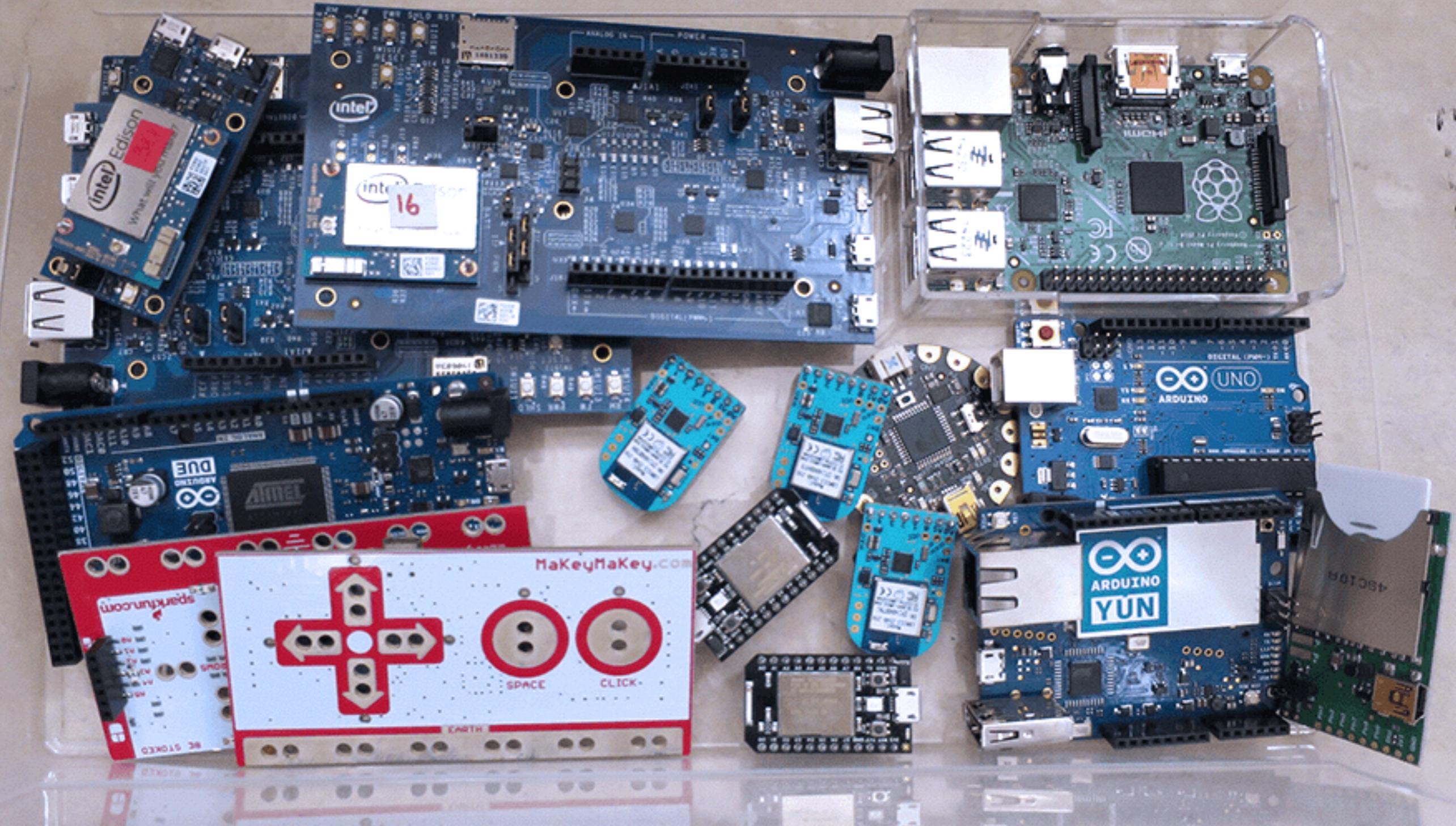


# JavaScript for the Physical World

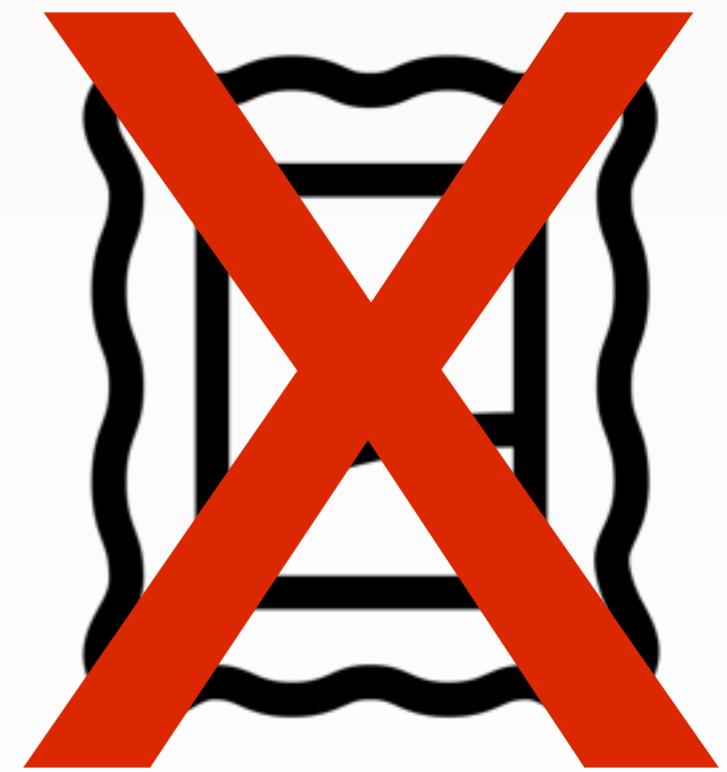
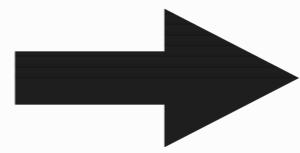
PEARL CHEN  
JAVASCRIPT OPEN DAY 2015

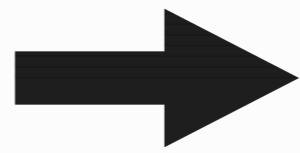
# Hello! My Name Is

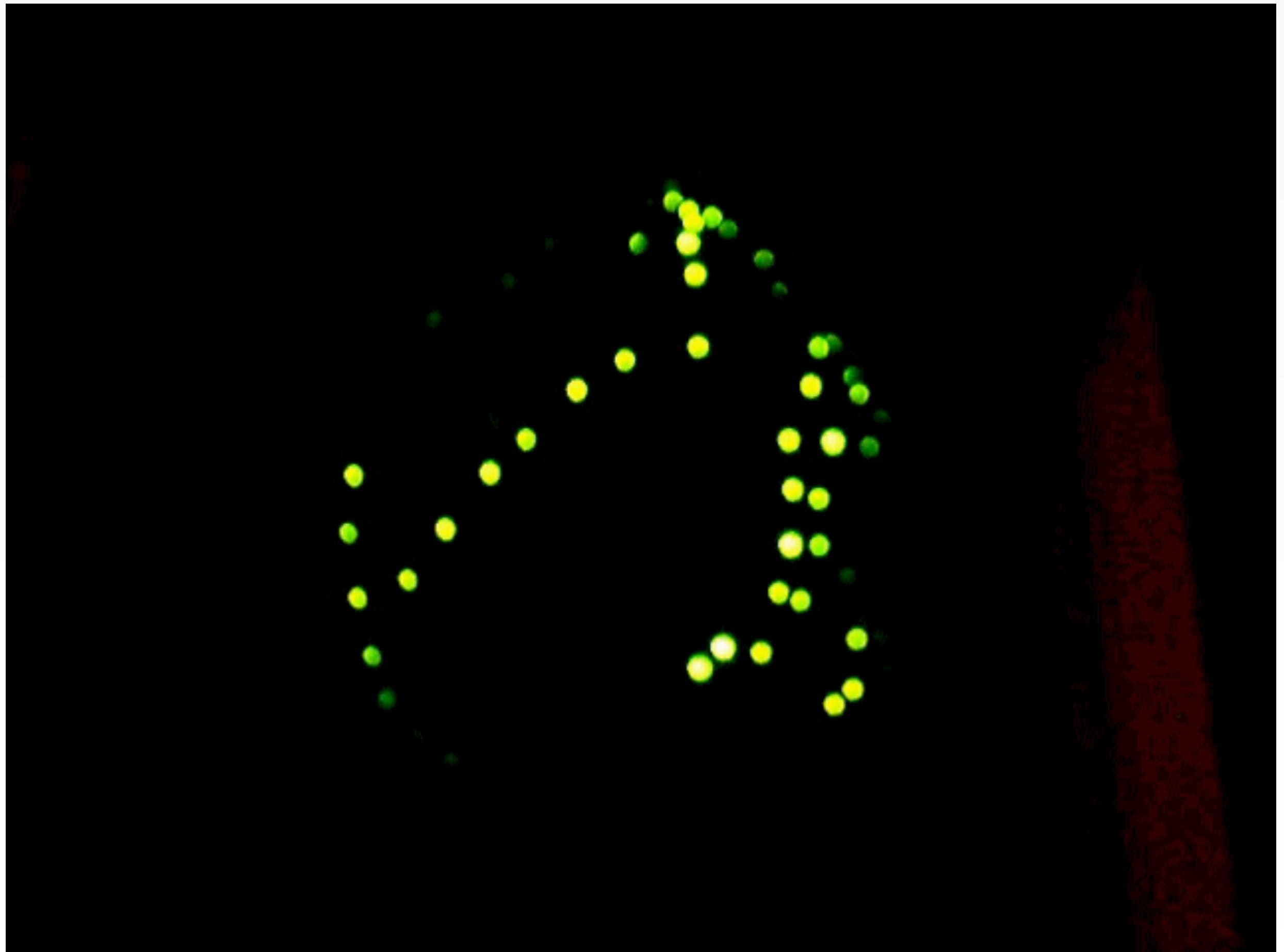




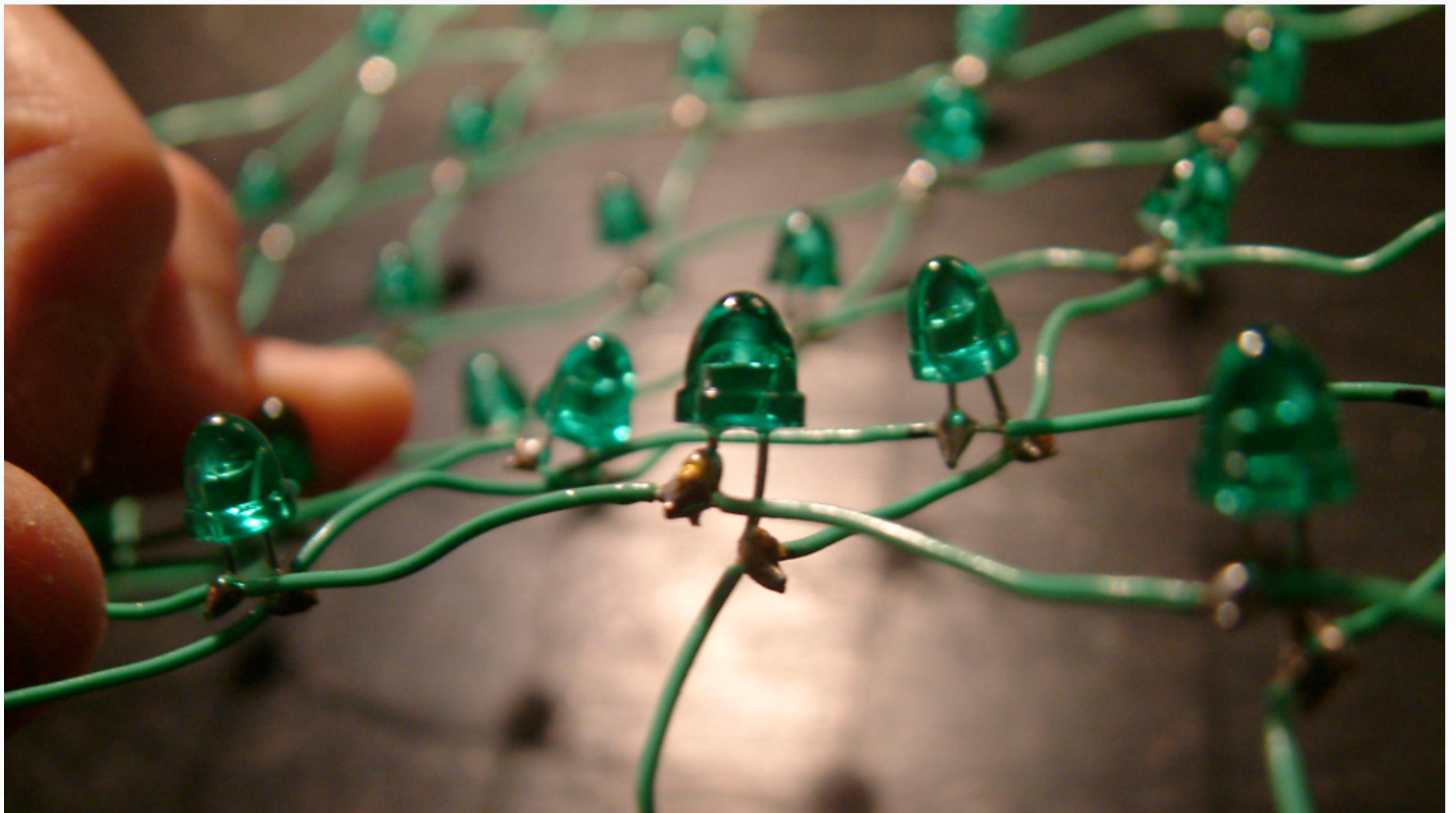
Only *some* of my microcontrollers...



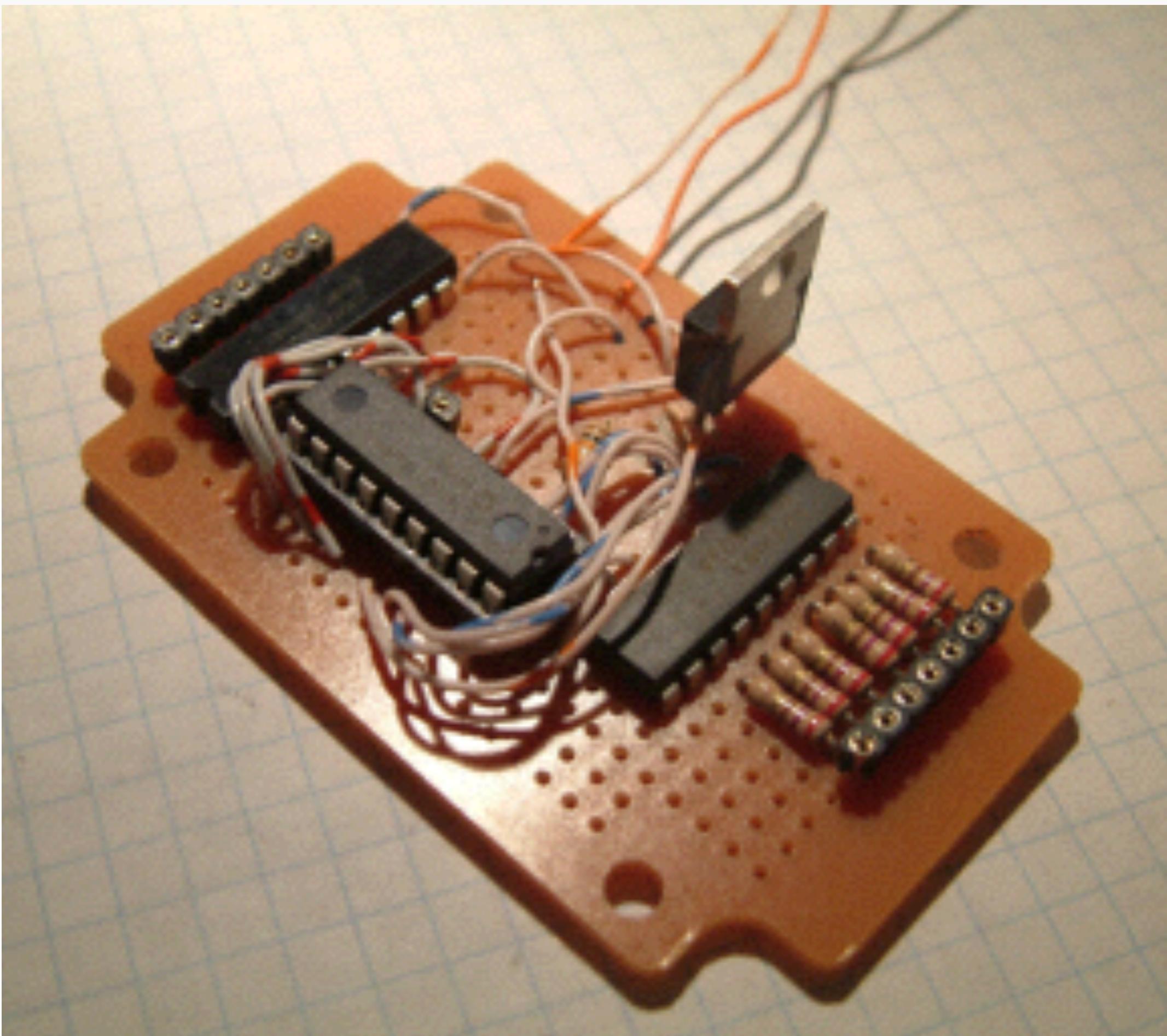




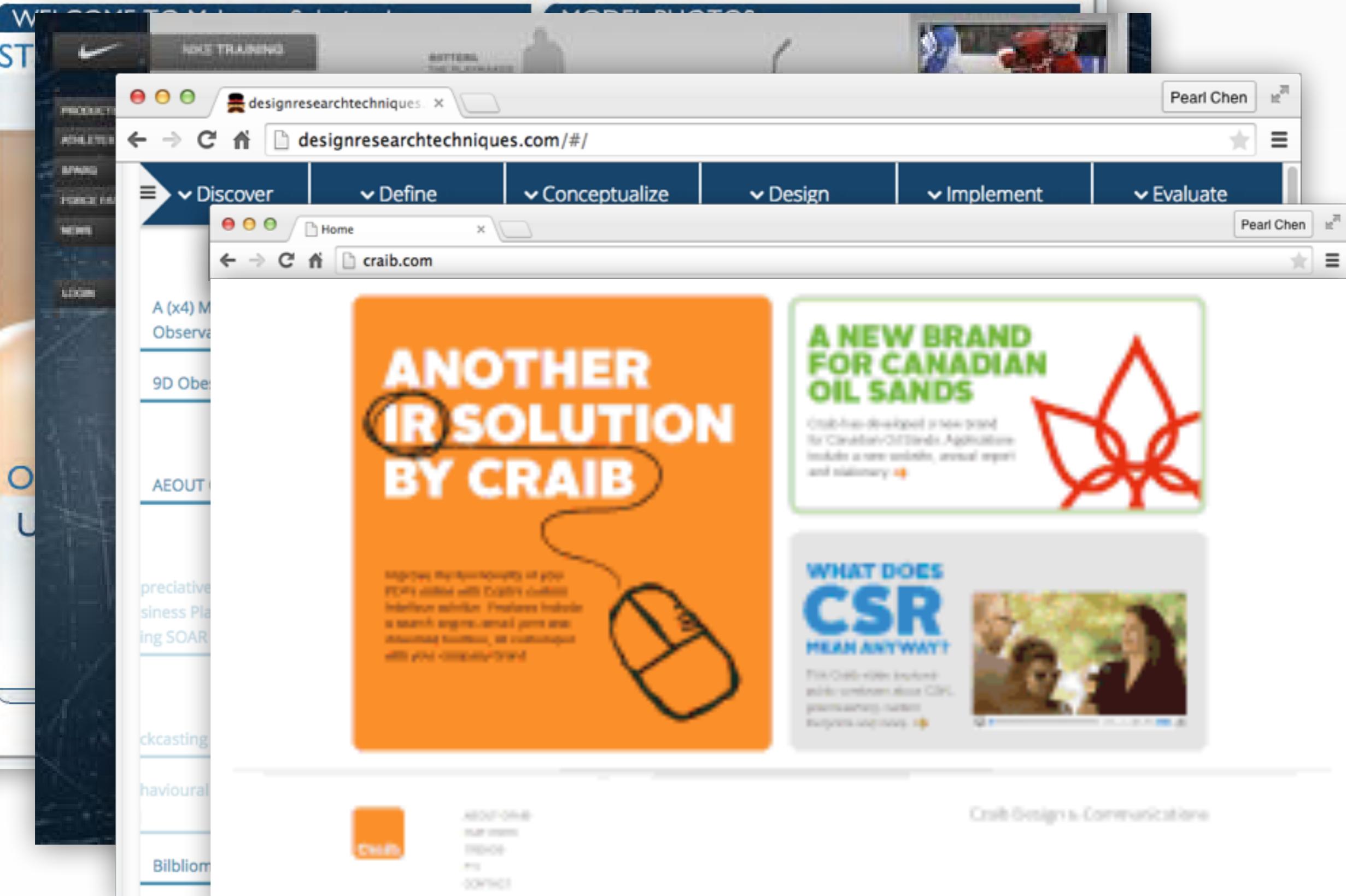
(fly)light LED sculpture by **Pearl Chen**



(fly)light LEDs by Pearl Chen



(fly)light circuits  
by Pearl Chen



WELCOME TO MAKEOVERSOLUTIONS

HOME | MY ACCOUNT | LOG OUT

Discover Define Conceptualize Design Implement Evaluate

Pearl Chen

Pearl Chen

A (x4) M Observations

9D Observations

AEOU

predictive business Planning SOAR

casting

havioural

Bibliom

ABOUT CRAIB  
OUR TEAM  
MEDIA  
PR  
CONTACT

Craib Design & Communications

The image displays two side-by-side screenshots of the HTML5rocks website, both featuring a yellow cat icon in the top right corner.

**Left Screenshot:** The title is "Built-in Browser Support for Responsive Images". It includes a sidebar with a "Table of Contents" section containing links to "Introducing the <picture> element", "View a live demo", "The <picture> syntax", and "Try it out today". Below the title is a circular profile picture of a woman and author information: "By Pearl Chen", "Published: September 2nd, 2014", "Updated: September 2nd, 2014", and "Comments: 10".

**Right Screenshot:** The title is "Debugging Asynchronous JavaScript with Chrome DevTools". It includes a sidebar with a "Table of Contents" section. Below the title is a circular profile picture of the same woman and author information: "By Pearl Chen", "Published: March 26th, 2014", "Updated: July 4th, 2014", and "Comments: 37".

Two of my HTML5Rocks articles.

Pearl Chen

IoT

https://iotroadshow.intel.com/en/home/

intel Software

# Explore. Innovate. Create a New World.

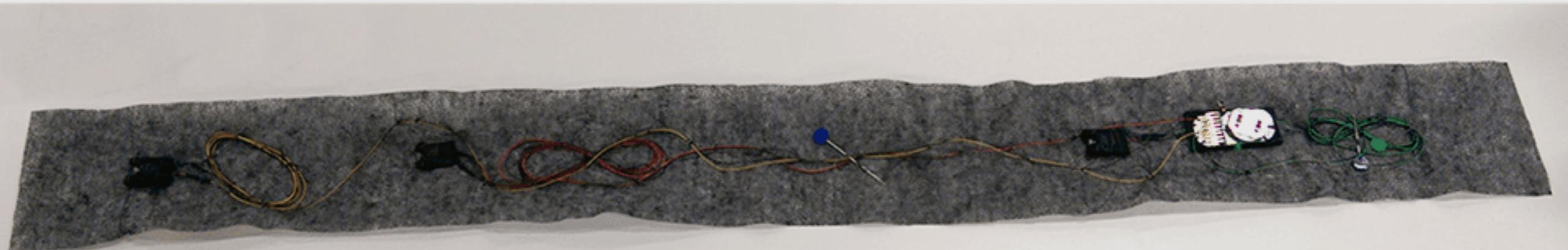
Attend an Intel® IoT Roadshow and join us in this exploration of the Internet of Things

REGISTER NOW

I mostly work on IoT hackathon on boarding materials.

## WHY AM I INTERESTED?

- sense the world around me → CONTEXT is KING
- add internet: dumb things → smart things
- screen-less experiences / ambient notifications
- body and location awareness → wearables

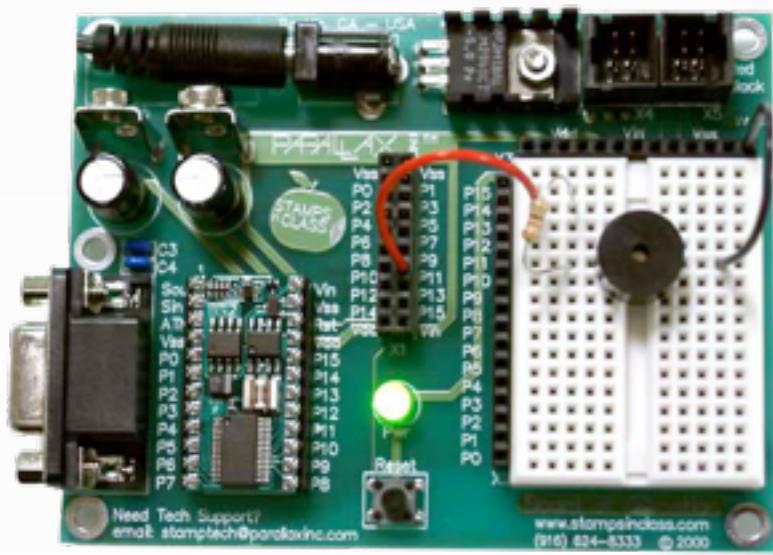


Haptic navigator prototype by Pearl Chen, Connie Leung, Harold Treen

## 2 TRUTHS

Hardware  
is hard.

Hardware  
is becoming more like  
software.



Basic Stamp

2002

2003

2004

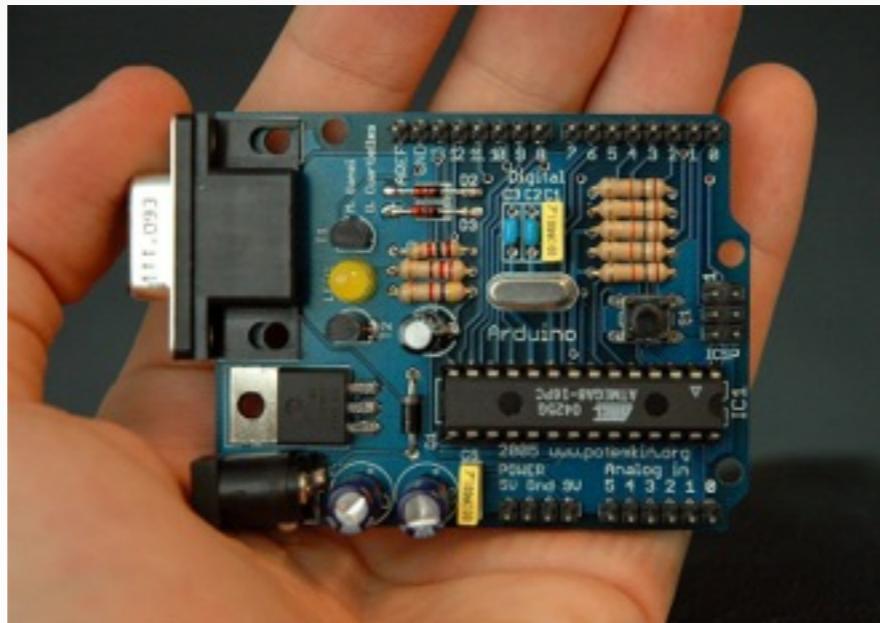
2005

2006

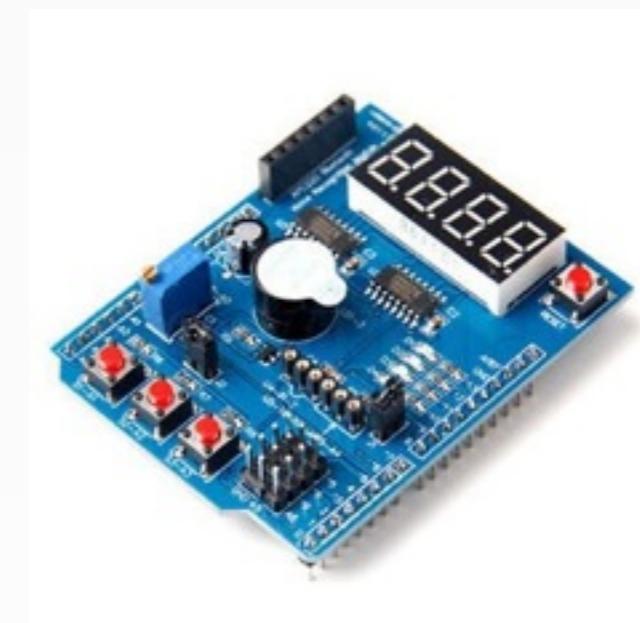
2007

2008

2009



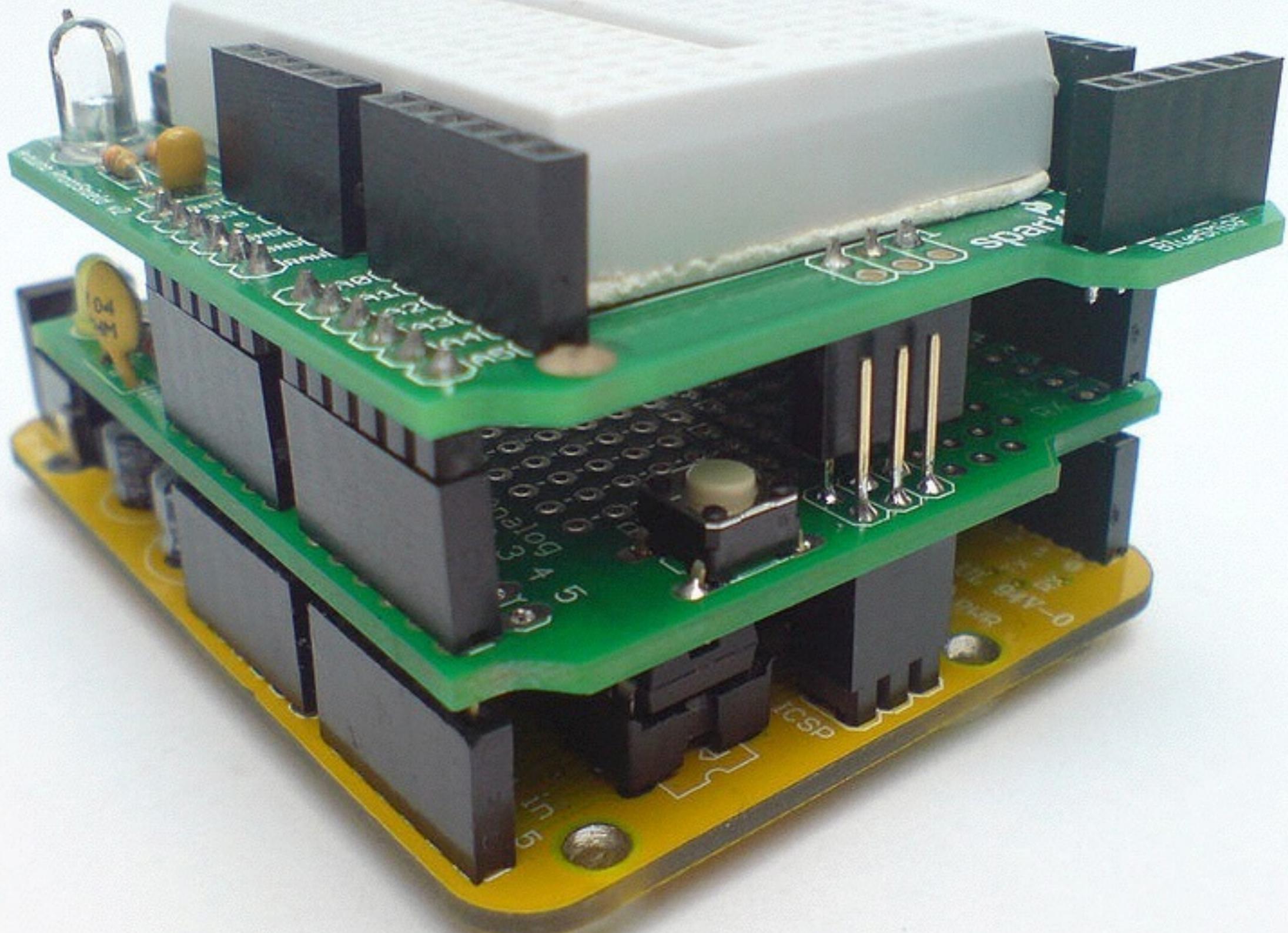
Arduino



example Arduino shield

← 1975: Microchip PIC





stacked shields (via [wikipedia](#))

## HOW DO YOU CHOOSE?

- Price?  
\$100+, < \$100 USD, < \$80, < \$50, < \$30, < \$20, < \$10
- Form factor?  
Dedicated space, tight space, wearable
- Connectivity?  
Ethernet, Wi-Fi, Bluetooth, BLE, none
- Programming language?  
Arduino, JavaScript, C++, Python, no programming
- Run-time environment and processing speed?  
Arduino/Embedded vs. Linux
- Community?  
Can you get help when you need it?

## 2 PATHS FOR JAVASCRIPT-COMPATIBLE BOARDS

JavaScript-only  
boards

Linux-based  
operating systems

JavaScript-only boards

# TESSEL

The screenshot shows a web browser window displaying the Tessel 2 product page at <https://tessel.io>. The page features a large image of the Tessel 2 development board, which is red with various electronic components and labeled "TESSEL 2". To the left of the main content area, there's a sidebar with a "TESSEL" logo and some text about getting involved and pre-ordering.

**Tessel 2**

Tessel 2 is a development platform you can embed in a product. Build fast with Node.js/io.js, then optimize the hardware and build thousands.

- \* 802.11bgn built in WiFi
- \* 2 USB ports
- \* 2 Module Ports (16 pins GPIO)
- \* Ethernet

Est. ship date: August 2015.

Your pre-order will not be charged until Tessel 2 is in production. Don't worry, we'll ask for address updates before we ship.

You will have the chance to add 10-pin and USB modules to your order closer to when Tessel 2 ships.

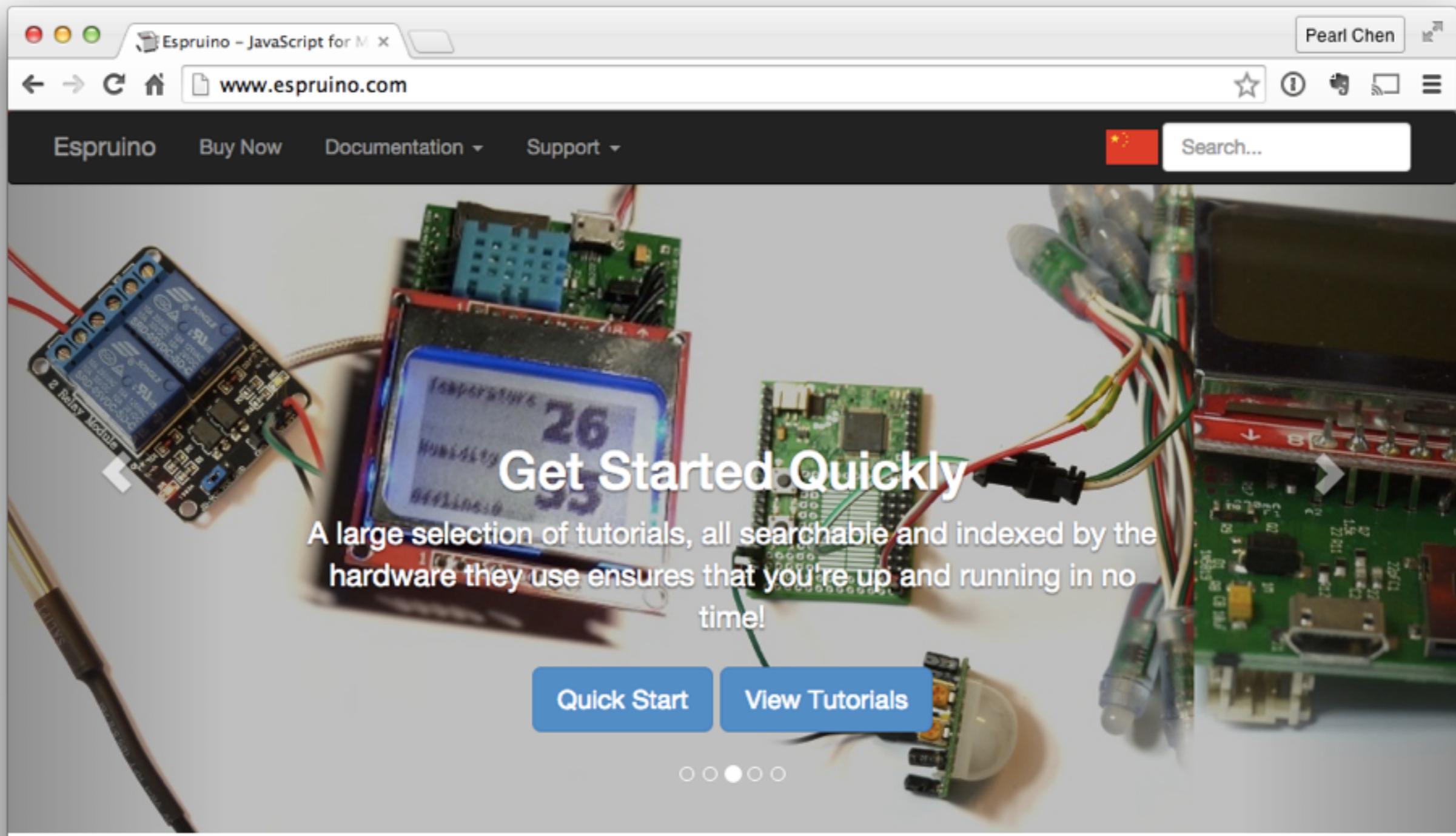
Pearl Chen

Start Docs Modules Projects Forums Shop Blog

Get in on the **995/3500** se

SCALE

# ESPRUINO



After a weekend of playing, have to say I'm extremely impressed with the @Espruino pico! Definitely need to get my hands on a few more...

Linux-based  
operating systems

# ARDUINO YUN

Screenshot of a web browser displaying the Arduino Yún product page on arduino.cc.

The browser window title is "Arduino - ArduinoBoardYun". The user is signed in as "Pearl Chen". The URL in the address bar is "arduino.cc/en/Main/ArduinoBoardYun?from=Products.ArduinoYUN".

The page features the Arduino logo and a search bar. The main navigation menu includes Home, Buy, Download, Products (selected), Learning, Forum, Support, and Blog. There are also links for LOG IN and SIGN UP.

A note at the top states "(redirected from [Products.ArduinoYUN](#))".

## Arduino Yún

Two images of the Arduino Yún board are shown:

- A front-facing view of the board, showing its blue PCB, the central Atmega32u4 microcontroller with the Arduino logo, and various connectors including a USB port and an Ethernet port.
- A back-side view of the board, showing the component side with surface-mount components, the Atmega32u4 microcontroller, and the "ARDUINO.YUN" text printed on the board.

# RASPBERRY PI

The screenshot shows the official Raspberry Pi website ([www.raspberrypi.org](http://www.raspberrypi.org)) viewed in a web browser. The top navigation bar includes links for BLOG, DOWNLOADS, COMMUNITY, HELP, FORUMS, and RESOURCES. A search icon is also present. On the left, there's a large, whimsical illustration of a brown dog wearing a space helmet, looking out at a satellite in orbit against a starry sky. A green button labeled "WHAT IS A RASPBERRY PI?" is overlaid on the bottom right of the illustration. To the right, a sidebar features a thumbnail for the "LATEST BLOG POST" titled "A PI'S EYE VIEW OF THE SOLAR ECLIPSE", which includes a small image of a solar eclipse and a brief description. Other blog posts are visible below it. At the bottom, there are four cards for "MORE FROM THE BLOG...": "PiNet" (17 posts), a project with a breadboard and smartphone (11 posts), a close-up of a Raspberry Pi screen displaying a message (11 posts), and a map of the "Path of Totality" for a solar eclipse (25 posts).

Pearl Chen

www.raspberrypi.org

BLOG DOWNLOADS COMMUNITY HELP FORUMS RESOURCES

LATEST BLOG POST

A PI'S EYE VIEW OF THE SOLAR ECLIPSE

Photos, videos and measurements captured during Friday's partial eclipse

MORE FROM THE BLOG...

PiNet | Centralised user accounts and file storage system for a Raspberry Pi classroom. 17

11

Ding Dong at 15-02-2015 00:54

Path of Totality 25

# INTEL EDISON

A screenshot of a web browser showing the Intel Edison Platform website. The address bar displays the URL: [www.intel.com/content/www/us/en/do-it-yourself/edison.html](http://www.intel.com/content/www/us/en/do-it-yourself/edison.html). The page header includes the Intel logo, a 'Menu' dropdown, 'Find Content' and 'Search' bars, and language options for 'USA (English)' and 'Sign In'. The main content area features a large heading 'Prototype quickly and get to market faster.' followed by several paragraphs of text describing the Intel Edison platform's purpose and benefits.

## Prototype quickly and get to market faster.

The Intel® Edison platform is a solution designed to lower the barriers to entry for quick prototyping and productizing the connected computing devices driving the next industrial revolution.

This wave of connected devices will be a diversified collection of products invented for specific consumers and consumer needs.

Intel® Edison technology was designed specifically for the creators of these devices—emerging entrepreneurs eager to invent the future. It combines a small, powerful, adaptable hardware platform and partner-enabled ecosystem with extended software compatibility and supportive online environment.

With the solution offered by the Intel Edison platform, your imagination is the only obstacle between you and your invention.



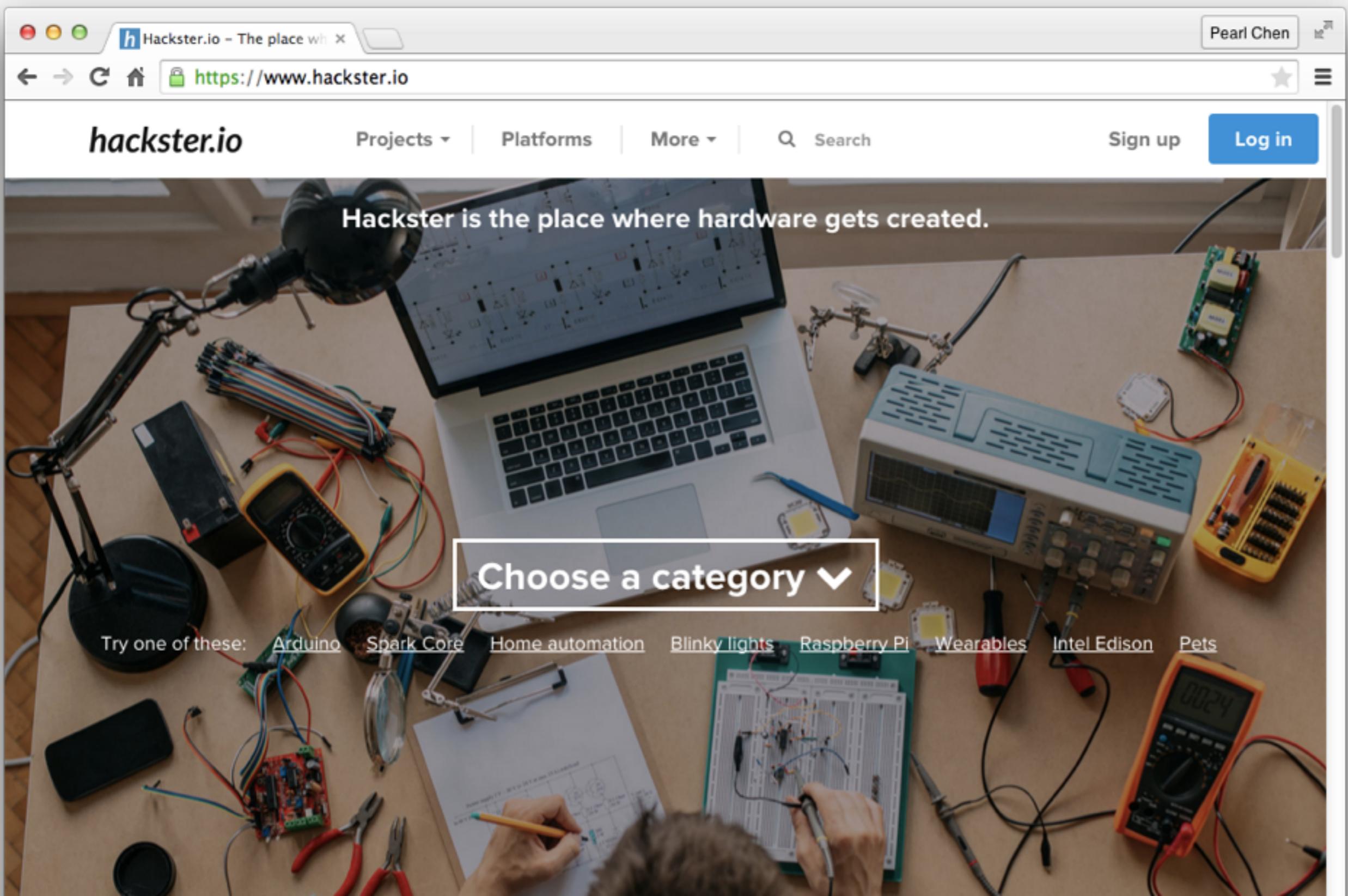
Stay Informed

Get news and product updates for the Intel® Edison platform.

[Sign up](#)

# Getting started & other resources

# HACKSTER.IO



# INSTRUCTABLES

A screenshot of the Instructables website homepage. The page features a large banner image of a plant growing out of a repurposed camera lens. Overlaid on the banner is the text "Let's Make reuse" in a stylized font. The Instructables logo is in the top left corner. The top navigation bar includes links for Explore, Create, Contests, Community, a search bar, and Login/Sign Up. A secondary navigation bar below the main one includes links for Intel IoT, Gardening, Bikes, and Robots. To the right of the banner, there is a vertical column of categories: EVERYTHING, TECHNOLOGY, WORKSHOP, LIVING, FOOD, PLAY, and OUTSIDE, each accompanied by a small icon.

Pearl Chen

www.instructables.com

instructables

Explore ▾ Create ▾ Contests ▾ Community ▾ let's make

shape what you make >

Intel IoT Gardening Bikes Robots

Let's Make reuse

EVERYTHING TECHNOLOGY WORKSHOP LIVING FOOD PLAY OUTSIDE

SparkFun Electronics Pearl Chen

https://www.sparkfun.com

Need Help? \$ USD

sparkfun SHOP LEARN AVC FORUM DATA

START A PROJECT PRODUCTS BLOG TUTORIALS VIDEOS WISH LISTS DISTRIBUTORS SUPPORT

search...

New Products  
Top Sellers  
Open Hardware  
SparkFun Originals  
Actobotics  
Sale  
Gift Certificates  
Arduino +  
Audio  
Books  
Breakout Boards  
Cables +  
Components +  
Development + Tools  
Dings and Dents  
Educators  
GPS +

AVC 2015: Part of SparkHacks

Join us at SparkFun on June 20th for robot races, combat robots, prizes, food trucks, tours, and tomfoolery!

BOT REGISTRATION SPECTATOR SIGN UP

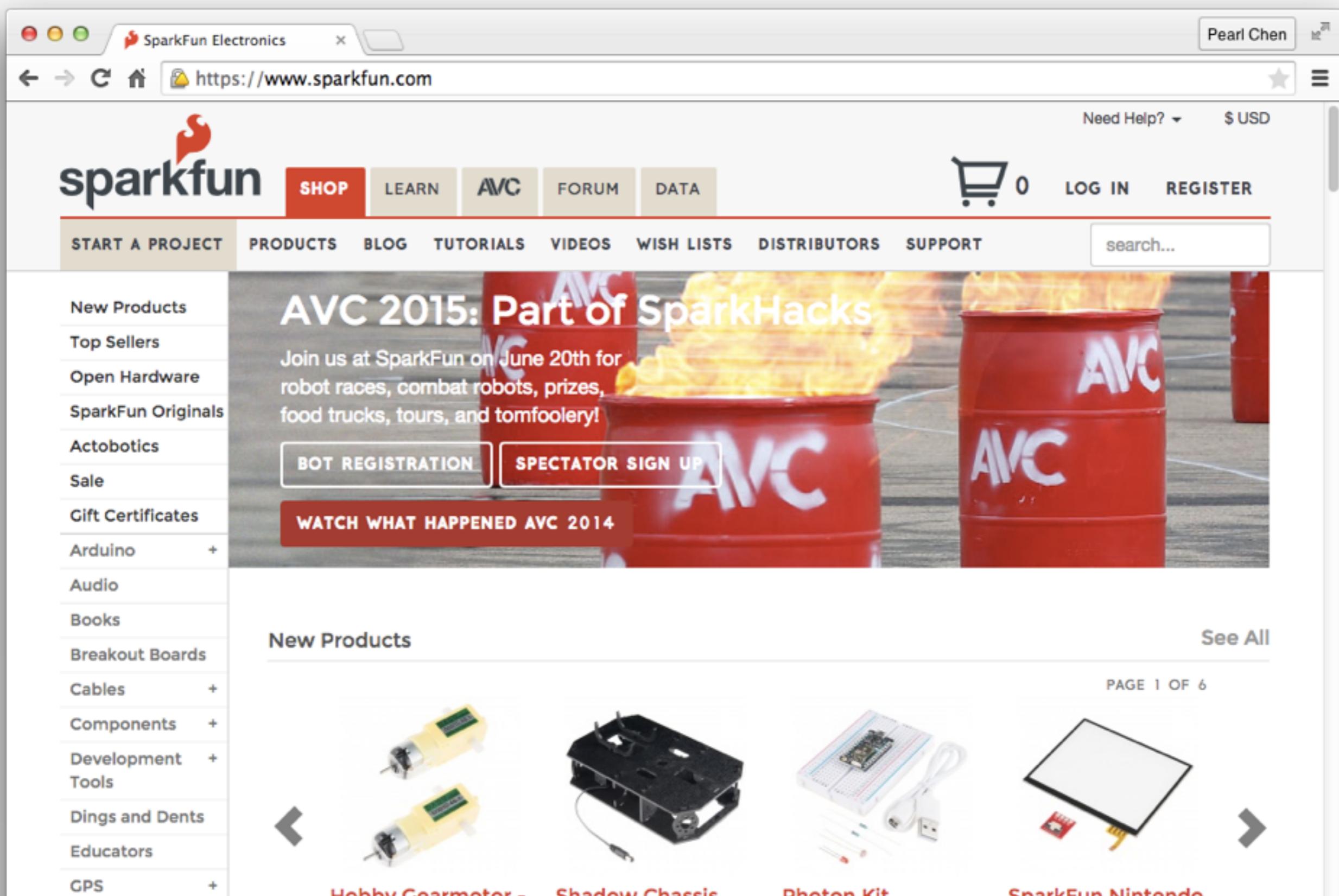
WATCH WHAT HAPPENED AVC 2014

Red barrels with "AVC" written on them, one of which is on fire.

New Products See All

Hobby Gearmotor - Shadow Chassis Photon Kit SparkFun Nintendo

PAGE 1 OF 6



ADAFRUIT

The screenshot shows the Adafruit website homepage. At the top, there's a navigation bar with links for SHOP, BLOG, LEARN, FORUMS, and VIDEOS. A search bar is located on the right side of the header. Below the header, there's a large graphic featuring a hand-drawn style illustration of a flower and a heart, crossed by a large 'X'. The text 'WEARABLE ELECTRONICS' is prominently displayed in the center of the 'X'. Below this, it says 'LIVE WEARABLE ELECTRONICS SHOW' and 'WITH BECKY STERN EVERY WEDNESDAY 2PM ET'. At the bottom of the page, there are two featured product images: a blue PowerBoost 500 module and a black RF module. Both products have a blue 'FEATURED' ribbon in the top right corner.

Pearl Chen

www.adafruit.com

Sign In 0 Items

adafruit

SHOP BLOG LEARN FORUMS VIDEOS

WEARABLE ELECTRONICS

LIVE WEARABLE ELECTRONICS SHOW

WITH BECKY STERN

EVERY WEDNESDAY 2PM ET

LATEST NEWS: Ladyada interview with Paul Horowitz - The Art of Electronics (48 minute video) @adafruit @electronicsbook

PowerBoost 500

RF

FEATURED

# GROVE STARTER KITS

Find Grove - Starter Kit - X Pearl Chen

www.seeedstudio.com/depot/s/Grove%2520-%2520Starter%2520Kit.html?search\_in\_description=0

Feedback & Ideas | Help

**seeed** Grow the Difference Wish Bazaar Recipe Fusion Propagate

Bazaar Categories ▾ Grove - Starter Kit  Sign In Account ▾ 

Home Bazaar » Search Results » Search Results

### Search Results for "Grove - Starter Kit"

**Products 3**

Sort By: New Arrivals Best Sellers Price 



Grove - Starter Kit for Arduino  
SKU: ELB00100M  
**\$49.90**

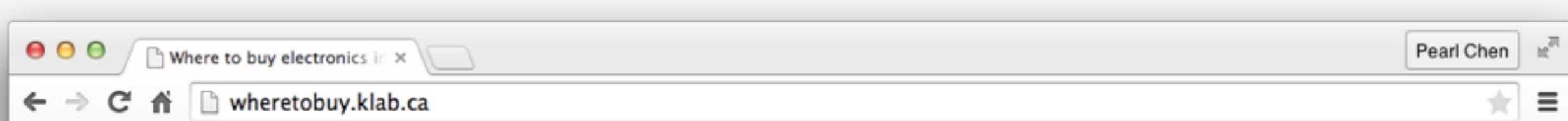


Grove - Starter Kit Plus  
SKU: KIT11021P  
**\$49.90**



Grove - Starter Kit  
SKU: ELB152D2P  
**\$39.00**

# WHERE TO BUY ELECTRONICS (IN TORONTO)



## Online Retailers

### Adafruit Industries

<http://adafruit.com>

Adafruit has done tons for the maker community. Easy website to shop on with tutorials for both individual electronics components and their own custom kits like the MintyBoost. (U.S. based so be careful of customs.)

---

### Brickyard Ceramics & Crafts

<http://brickyardceramics.com>

Closest retailer of Amaco's "Friendly Plastic" (polymorph plastic) – they are actually in the same building! If you have a GST account, call them directly and they can offer a 30% discount. (U.S. based so be careful of customs; and if you want next day or 3 day shipping, be prepared to pay \$80, otherwise only \$15 for regular 5-7 day standard shipping.)

---

### Digikey

<http://digikey.ca>

U.S. based company that offers a Canadian retail portal; Prices are in CAD\$ and customs/duty charges are already worked in so you won't be surprised with a \$30 FedEx bill for a \$10 purchase. Shipping is cheap and

WALK THROUGH

# Smart Clock

Built with: NodeJS + Intel Edison



## Intel® Edison Development Platform



- 500 MHz dual-core, dual-threaded Intel® Atom™ CPU
- 32-bit Intel® Quark™ microcontroller at 100 MHz
- 1 GB RAM
- 4 GB onboard flash memory
- built-in Wi-Fi and Bluetooth 4.0
- Yocto Linux OS

## ESSENTIALLY...

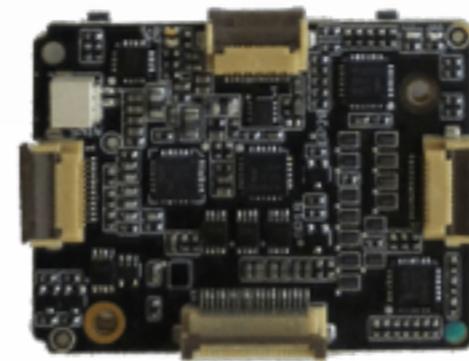
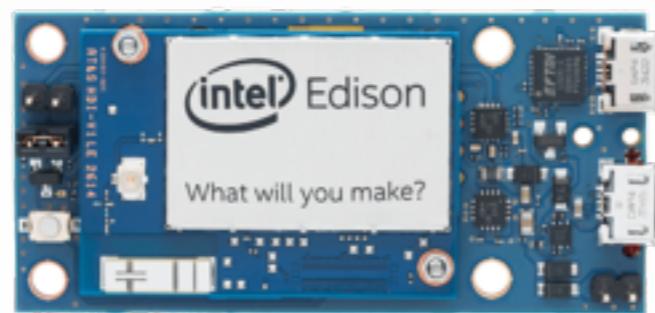
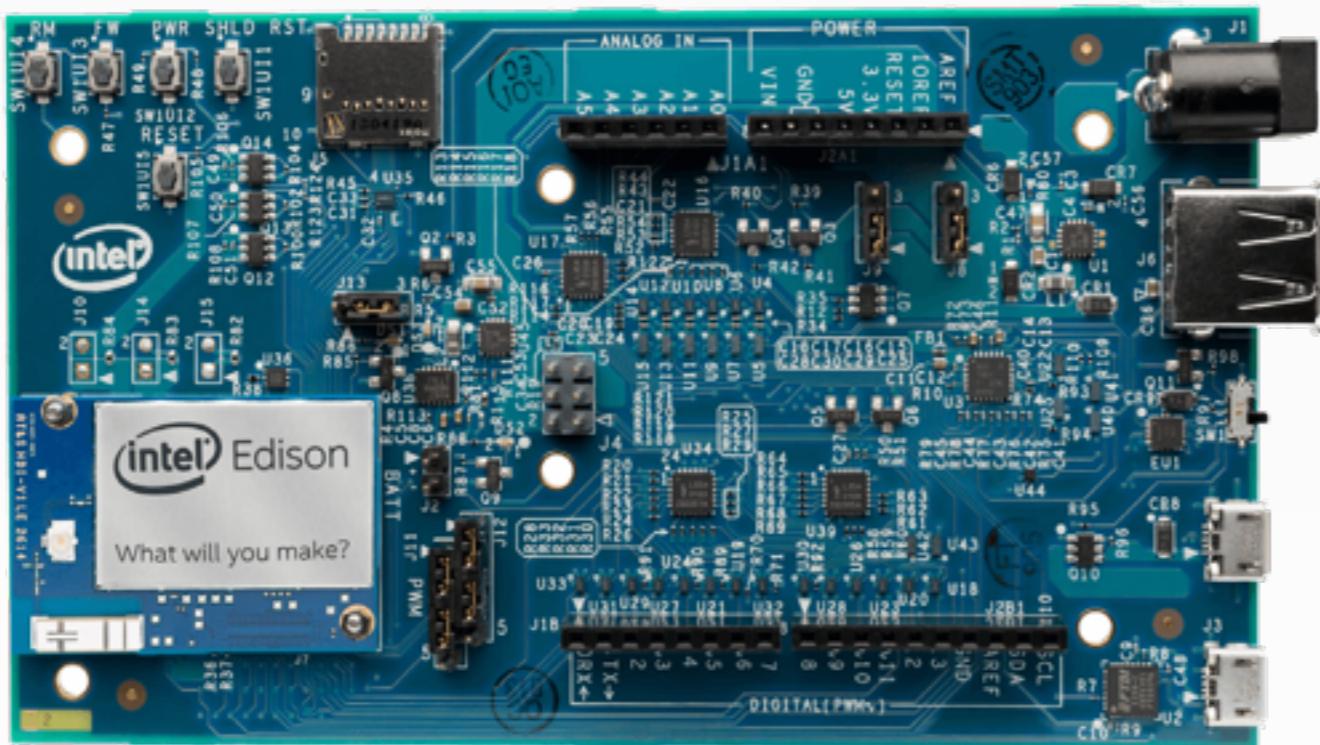
It's a postage-sized computer  
that can control electricity.

```
pearl — user3-213-93:~ — screen — 113x30
Starting USB Ethernet gadget...
Starting Watchdog sample daemon...
[ 8.707200] dwc3-device dwc3-device.1: dwc3-gadget is already bound to g_multi
[ OK ] Started Watchdog sample daemon.
Starting Permit User Sessions...
[ OK ] Started Network Service.
[ OK ] Started Disable the Runtime power management of SPI.
[ OK ] Started Permit User Sessions.
[ OK ] Started USB Ethernet gadget.
[ OK ] Started Login Service.
Starting Serial Getty on ttyMFD2...
[ OK ] Started Serial Getty on ttyMFD2.
Starting Getty on tty1...
[ OK ] Started Getty on tty1.
[ OK ] Reached target Login Prompts.
[ OK ] Reached target Network.
Starting Intel_XDK_Daemon...
[ OK ] Started Intel_XDK_Daemon.
Starting Mosquitto - lightweight server implementati...SN protocols...
[ OK ] Started Mosquitto - lightweight server implementatio...T-SN protocols.
Starting Zero-configuration networking...
[ OK ] Started Zero-configuration networking.
Starting The Edison status and configuration service...
[ OK ] Started The Edison status and configuration service.
Starting Network Name Resolution...
[ OK ] Started Network Name Resolution.

Poky (Yocto Project Reference Distro) 1.6 edison ttyMFD2
edison login: █
```

# ACCESSING GENERAL PURPOSE INPUT OUTPUT (GPIO)

# Breakout boards



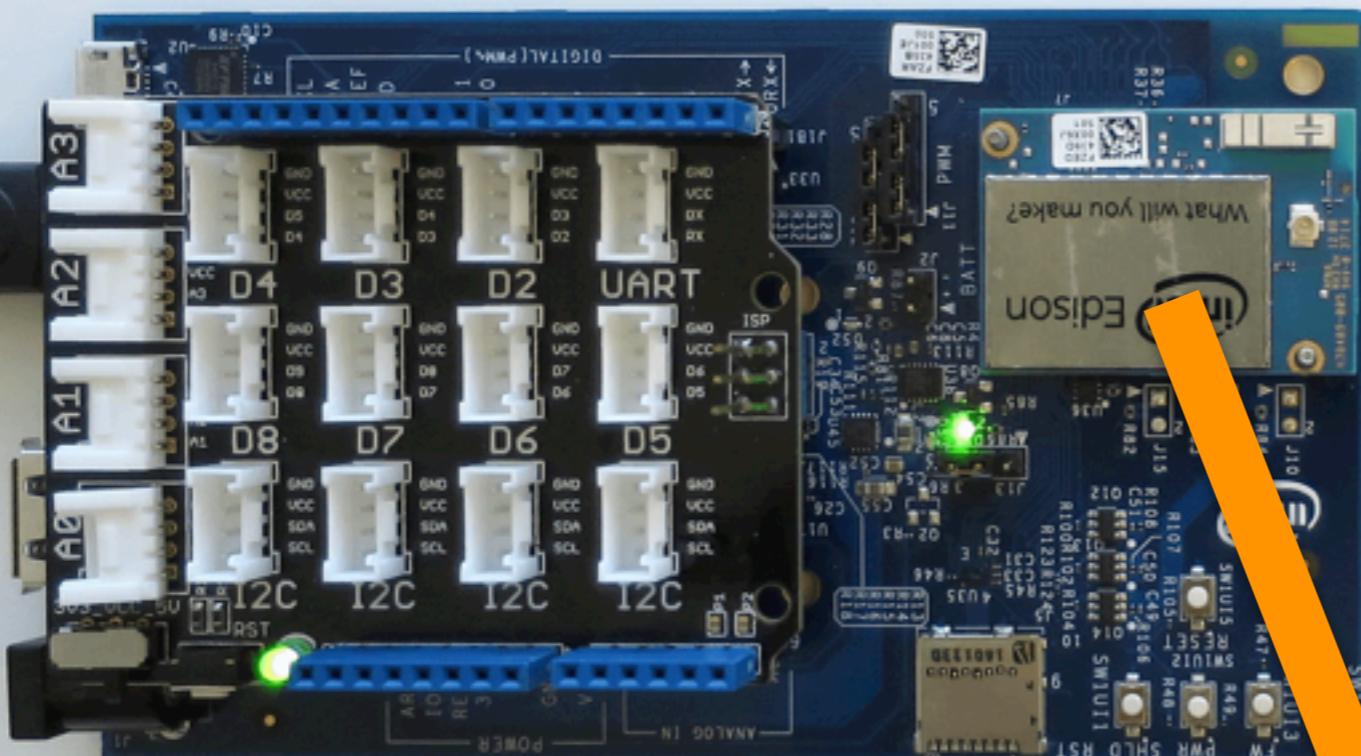
## GETTING STARTED

# Set up the board

1. Connect cables & power up
2. Install USB drivers (if needed)
3. Gain remote command line access of board
4. Update firmware
5. Get board online
6. Install an IDE (optional)

# ACCESSING GENERAL PURPOSE INPUT OUTPUT (GPIO)

## Clock



10 minutes until  
your meeting!



Google Calendar API

## DESKTOP PROTOTYPE

# Node Google Calendar API app

Follow the tutorial on Google Developers:

1. Enable Calendar API & download secret.json.
2. Install two Node libraries:  
Google Client Library & Google Auth Library
3. Copy their sample code & run it.
4. Get authorization token.

## MICROCONTROLLER PORT

# Run Node app on board

Follow my Instructables tutorial from [Step 6](#):

1. Create/import Node app into Intel XDK.
2. Create a package.json  
& install dependencies directly on board.
3. Run Node app using command line.
4. Code Tweak: Update file path references.
5. Get authorization token.

## SOFTWARE TO CONTROL HARDWARE

# Add electronics

Use MRAA & UPM libraries to talk to GPIO pins.

- GPIO = General Purpose Input/Output
- MRAA = low level library to talk to GPIO
- UPM = higher level abstraction library (builds on top of MRAA) for various sensors

More info: [go.klab.ca/js-grove-samples](http://go.klab.ca/js-grove-samples)

## SOFTWARE TO CONTROL HARDWARE

# Add LCD screen

Add LCD UPM library:

```
var jsUpmI2cLcd = require ('jsupm_i2c_lcd');
var lcd = new jsUpmI2cLcd.Jhd1313m1(6, 0x3E, 0x62);
lcd.setColor(255, 0, 0);
lcd.setCursor(1,5);
lcd.write('Hello!');
```

More info: [https://github.com/intel-iot-devkit/upm/  
blob/master/examples/javascript/rgb-lcd.js](https://github.com/intel-iot-devkit/upm/blob/master/examples/javascript/rgb-lcd.js)

## INTEGRATION

# The rest is JS code

A screenshot of a GitHub repository page for the project "pearlchen / iot-smart-desk-clock". The repository name is "iot-smart-desk-clock" and the specific branch is "iot-version". The commit history shows five commits made by user "pearlchen" on April 20, all of which are additions of JavaScript files ("google\_calendar\_event\_fetcher.js", "lcd\_text\_helper.js", "main.js", "package.json") intended to run on the Intel Edison. The commits were made 2 months ago.

File	Description	Time Ago
google_calendar_event_fetcher.js	Added the code that is run from the Intel Edison.	2 months ago
lcd_text_helper.js	Added the code that is run from the Intel Edison.	2 months ago
main.js	Updated link to helper files in comments	2 months ago
package.json	Added the code that is run from the Intel Edison.	2 months ago

DEMO

Smart ~~Clock~~ Watch  
Built with: NodeJS + Intel Edison

## CODE TWEAKS



### Tweaks

- **update:**  
var lcd =  
new jsUpmI2cLcd.SSD1308(0, 0x3C);
- **remove .**  
setColor()

DEMO

Remote cat toy

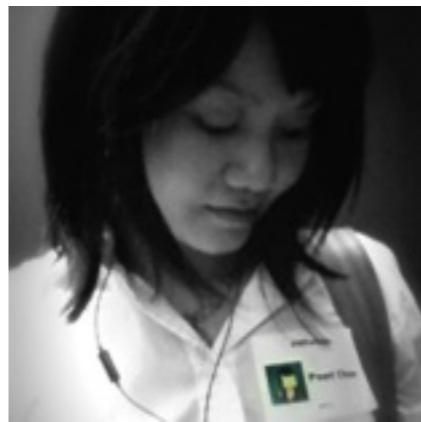
Built with: NodeJS + Express + Intel  
Edison

## WEB SERVER

Scare your cat remotely

- Express server: <http://expressjs.com/starter/hello-world.html>
- Motor UPM library: <https://github.com/intel-iot-devkit/upm/blob/master/examples/javascript/es08a.js>

Thanks!



PEARL CHEN

TWITTER @PearlChen

GOOGLE+ klab.ca/+