Internet of Things Prototyping Workshop

STARTHack.ch 2016, St. Gallen
thomas.amberg@yaler.net
twitter.com/tamberg

1.5 hours to boost your hackathon project...

IoT - what is it?

Example applications

A simple reference model

Quick end-to-end prototyping

IoT platforms to get the job done

Sharing and presenting your results

What next? From prototype to product...

Internet of Things (IoT)

Internet-connected computers with sensors & actuators

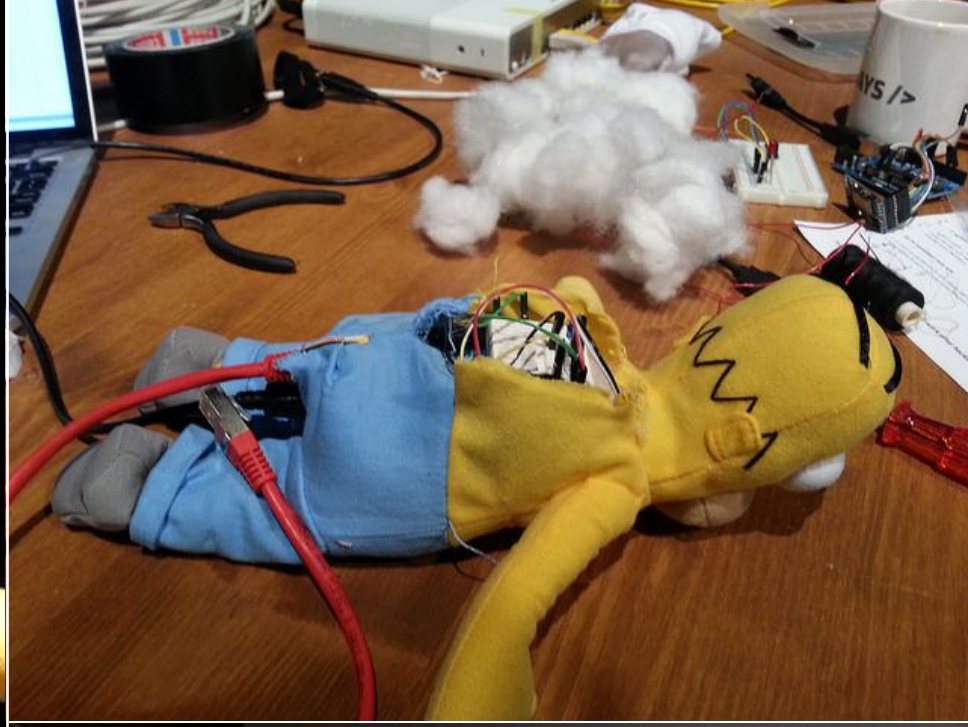
"Physical objects with an API" - @hansamann

Internet reaches into the real world

Your definition?

IoT examples


bubblino.com, flickr.com, Alex Ingram, CC BY-NC-ND



IoT consequences

Efficiency goes up

Comfort is enhanced

Products become a service

Intelligence moves to the cloud

Same effort, more data, new insight

What could be negative consequences?

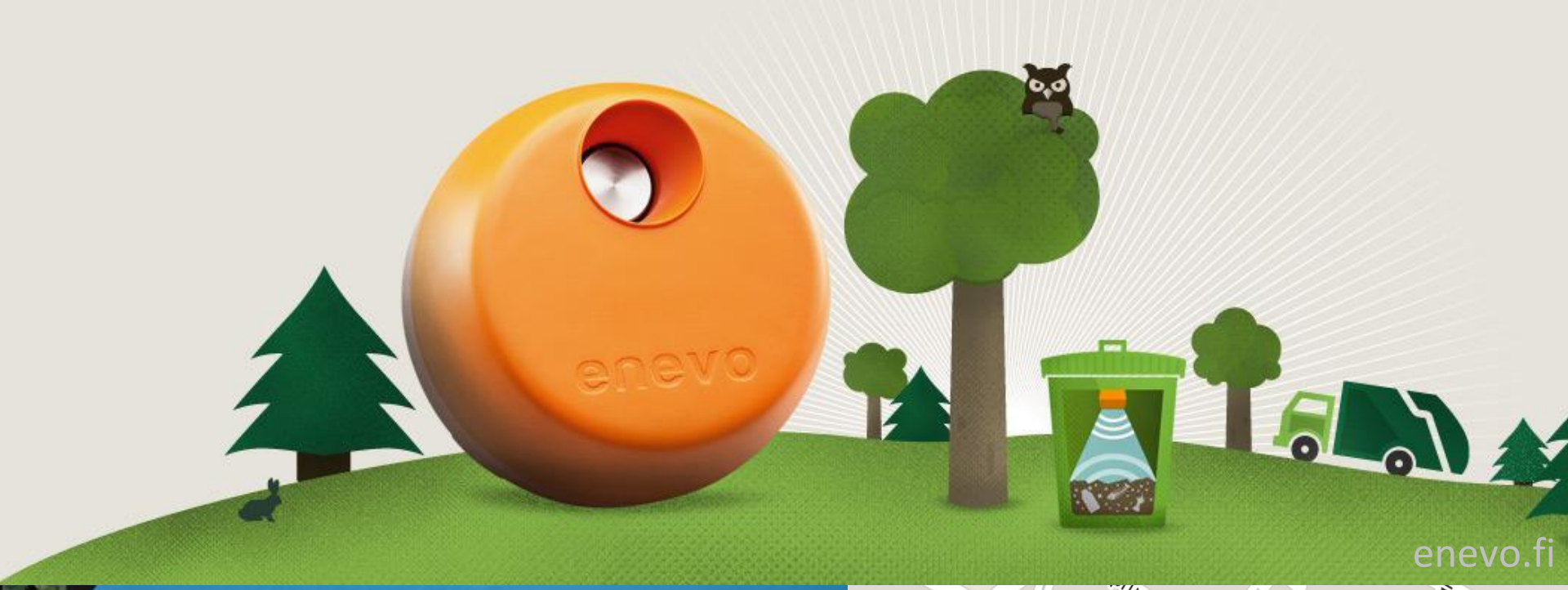
withings.com

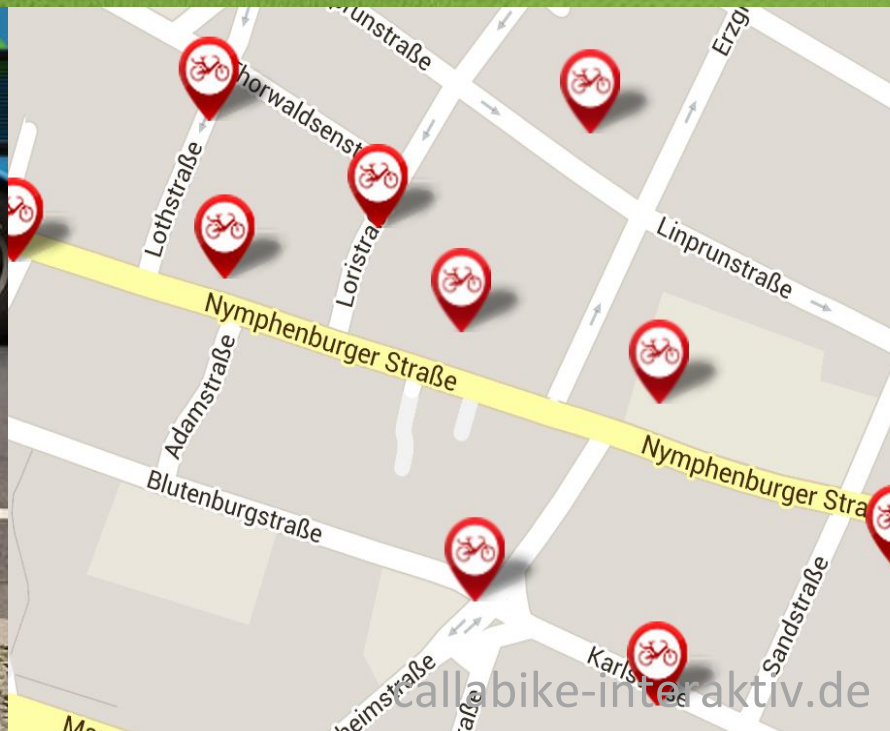
Visualize Your Progress

Play With Friends

Next Milestone 100k

nikeplus.nike.com






Honda Jazz Hybrid
5
3
A
Economy
mobility.ch

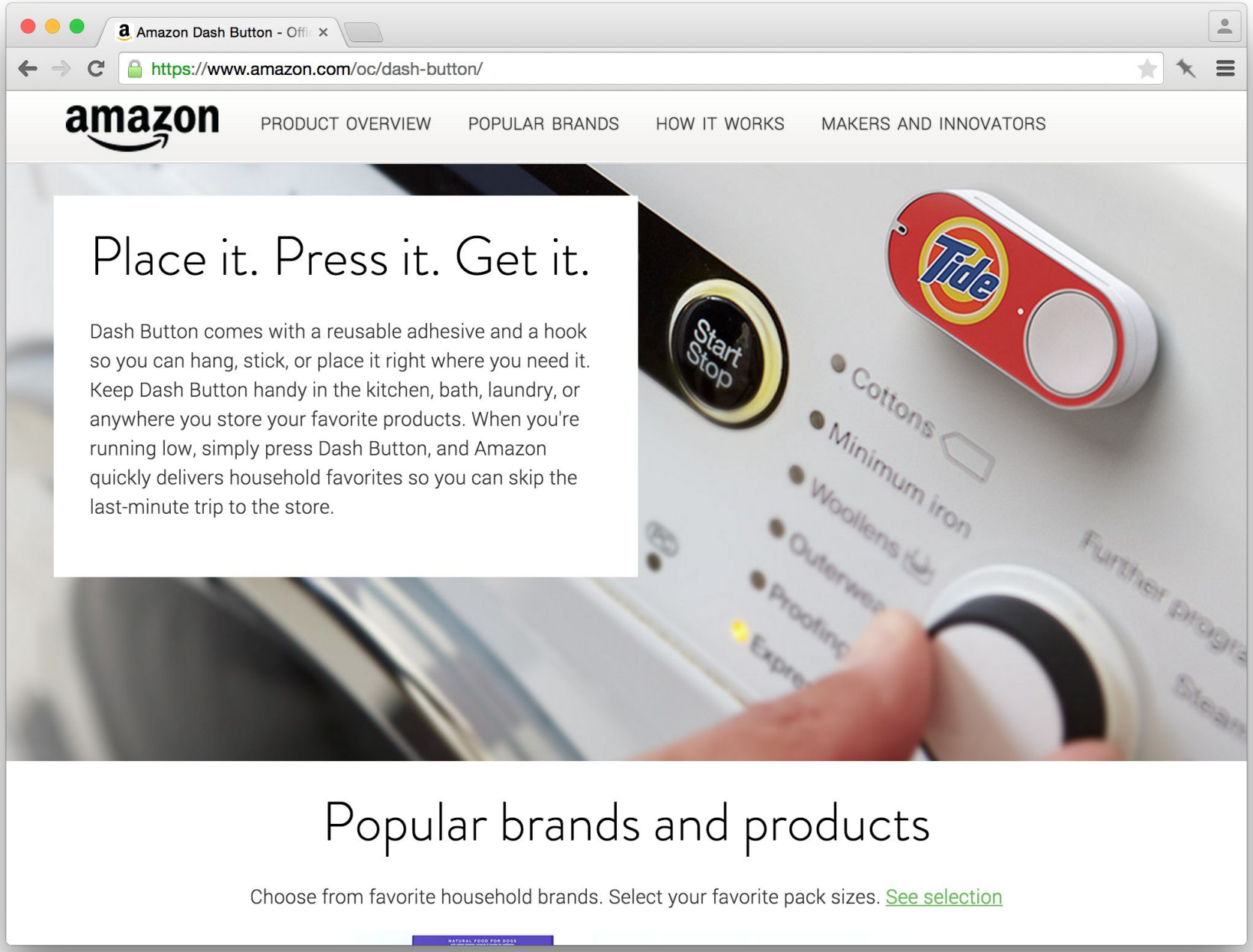

amazonkindle
Past is Prologue
"Buy once, read everywhere"
amzn.com/kindle

Mike Kuniavski: Service Avatars

CC BY-NC-ND Martin Eian, Flickr

CC BY Mike Mozart, Flickr

CC BY-NC-SA SpareBank 1, Flickr


Amazon Dash Button - Offi
https://www.amazon.com/oc/dash-button/
amazon
PRODUCT OVERVIEW
POPULAR BRANDS
HOW IT WORKS
MAKERS AND INNOVATORS
Place it. Press it. Get it.
Dash Button comes with a reusable adhesive and a hook so you can hang, stick, or place it right where you need it. Keep Dash Button handy in the kitchen, bath, laundry, or anywhere you store your favorite products. When you're running low, simply press Dash Button, and Amazon quickly delivers household favorites so you can skip the last-minute trip to the store.
Tide
Start
Stop
Cottons
Minimum iron
Woollens
Popular brands and products
Choose from favorite household brands. Select your favorite pack sizes. See selection

CogniToys Leverages Watson's Brain to Befriend, Teach Your Kids

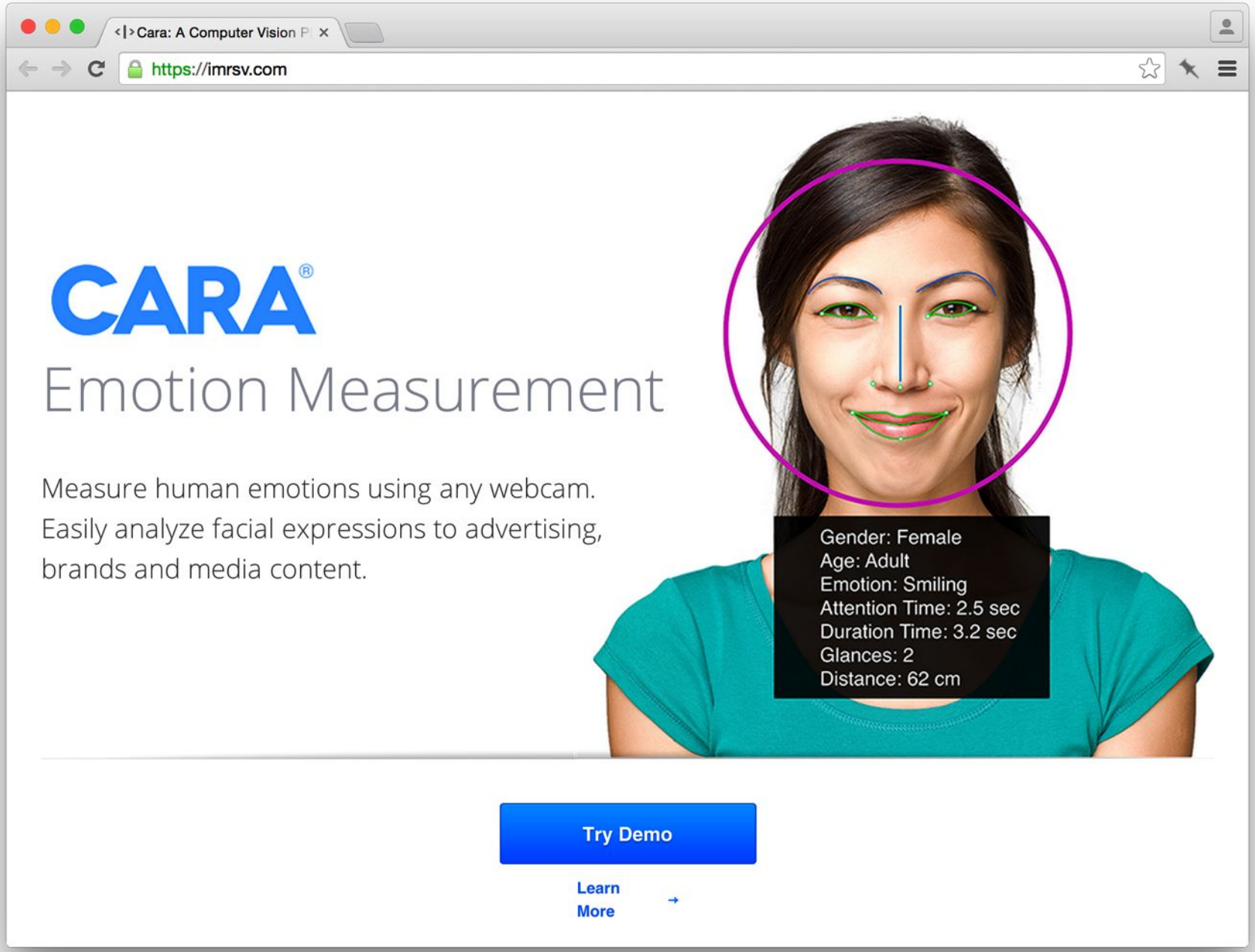
By Evan Ackerman
Posted 20 Feb 2015 | 0:19 GMT

Tech Talk

IEEE Spectrum's general technology blog, featuring news, analysis, and opinions about engineering, consumer electronics, and technology and society, from the editorial staff and freelance contributors.

Subscribe to RSS Feed

Follow @IEEESpectrum


Cara: A Computer Vision P
https://imrsv.com
CARA®
Emotion Measurement
Measure human emotions using any webcam.
Easily analyze facial expressions to advertising,
brands and media content.
Gender: Female
Age: Adult
Emotion: Smiling
Attention Time: 2.5 sec
Duration Time: 3.2 sec
Glances: 2
Distance: 62 cm
Try Demo
Learn
More

SceneTap | View Age, Crow

scenetap.com

SceneTap

Augusta, ME | Map | Places | Pictures | Login | Sign Up

SceneTap lets you check out the scene in real-time.

What is SceneTap?

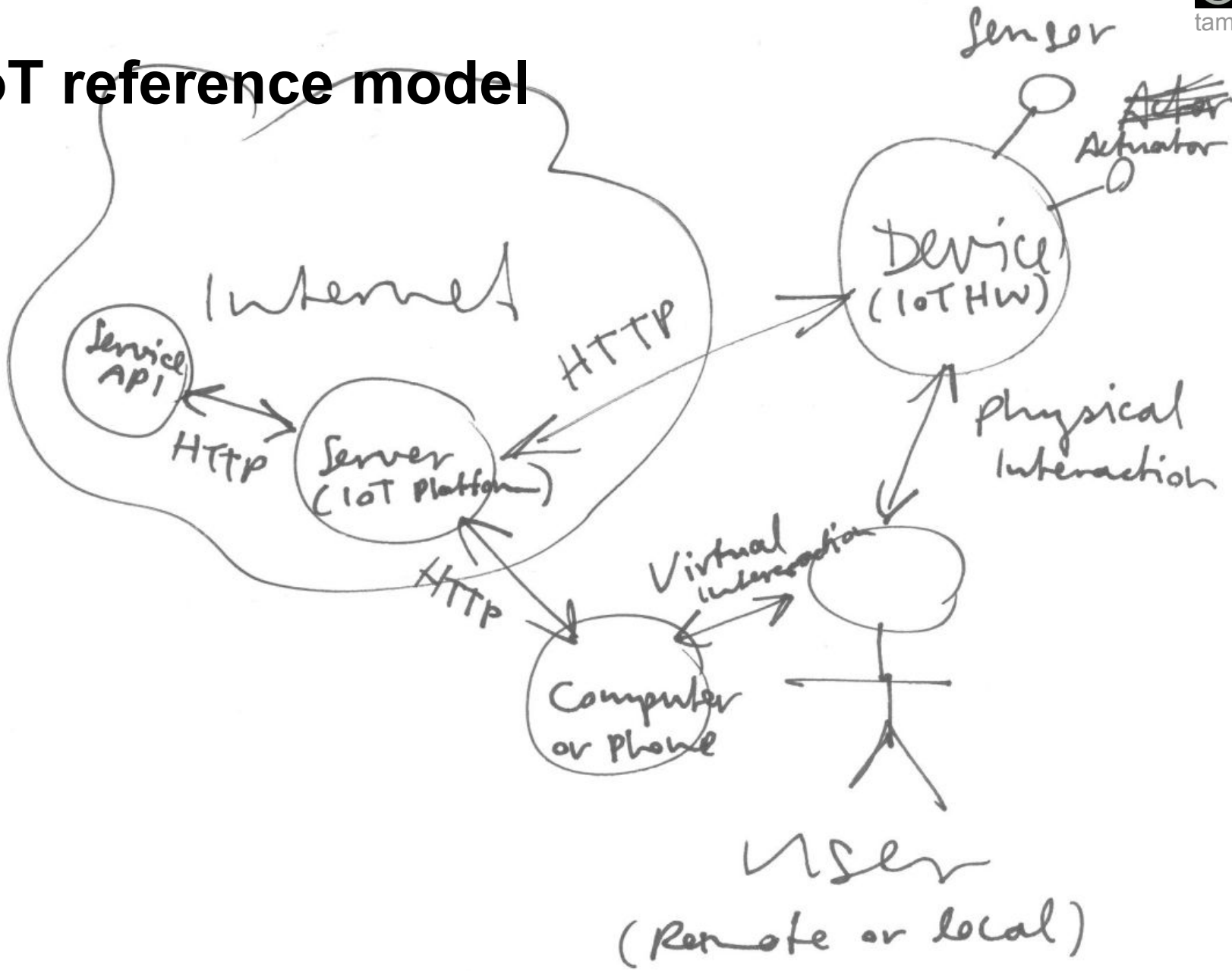
With the tap of a button, view information on how many people are at a place, the male to female ratio, and the average age of everyone inside.

Start using desktop app

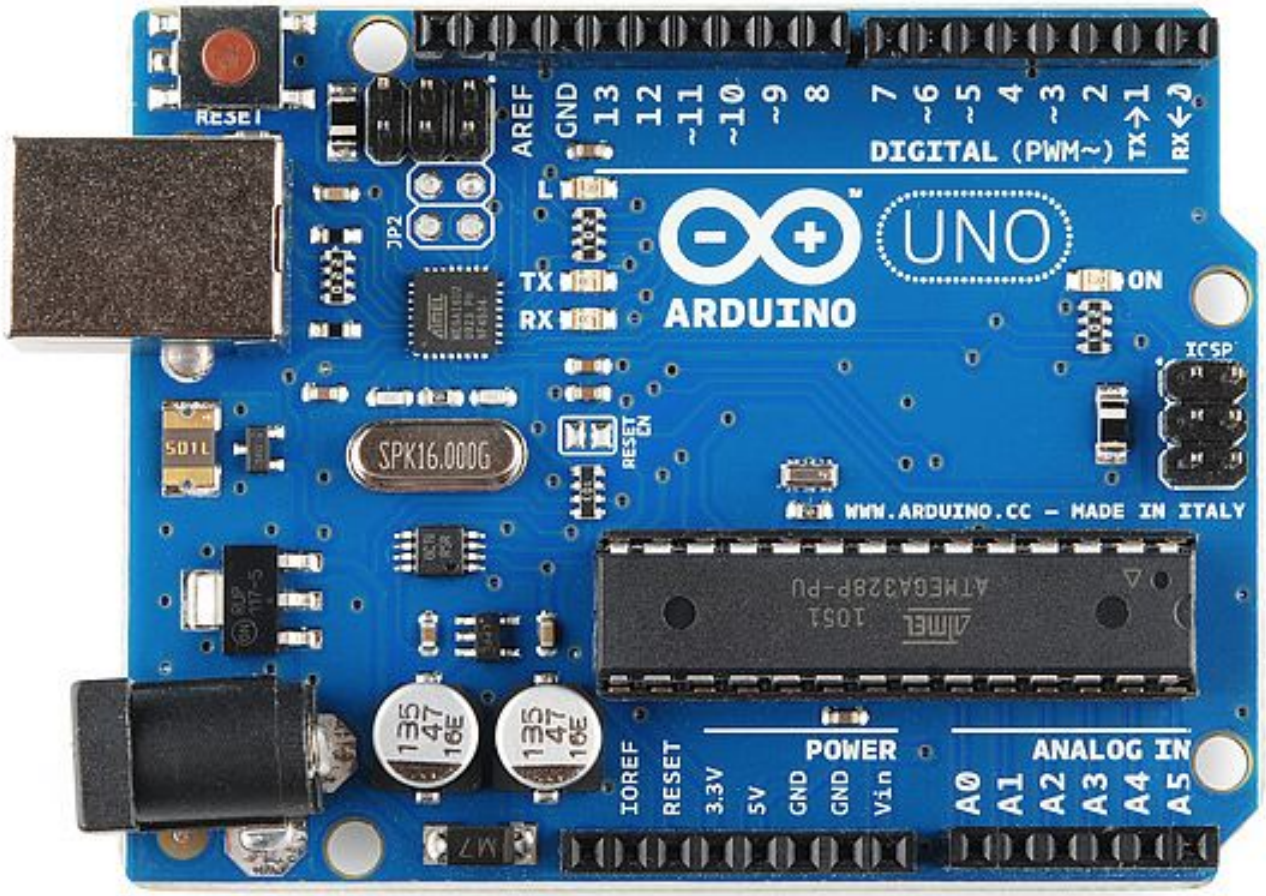
Download mobile app

Learn more about SceneTap here

IoT reference model



IoT prototyping hardware


RESET
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM~)
JP2
TX
RX
ARDUINO
UNO
ON
ICSP
SPK16.000G
RESET
WWW.ARDUINO.CC – MADE IN ITALY
ATMEGA328P-PU
IOREF
RESET
3.3V
5V
GND
GND
Vin
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN

Werner Vogels on Twitter:

Twitter, Inc. [US] https://twitter.com/Werner/status/634233523013091328

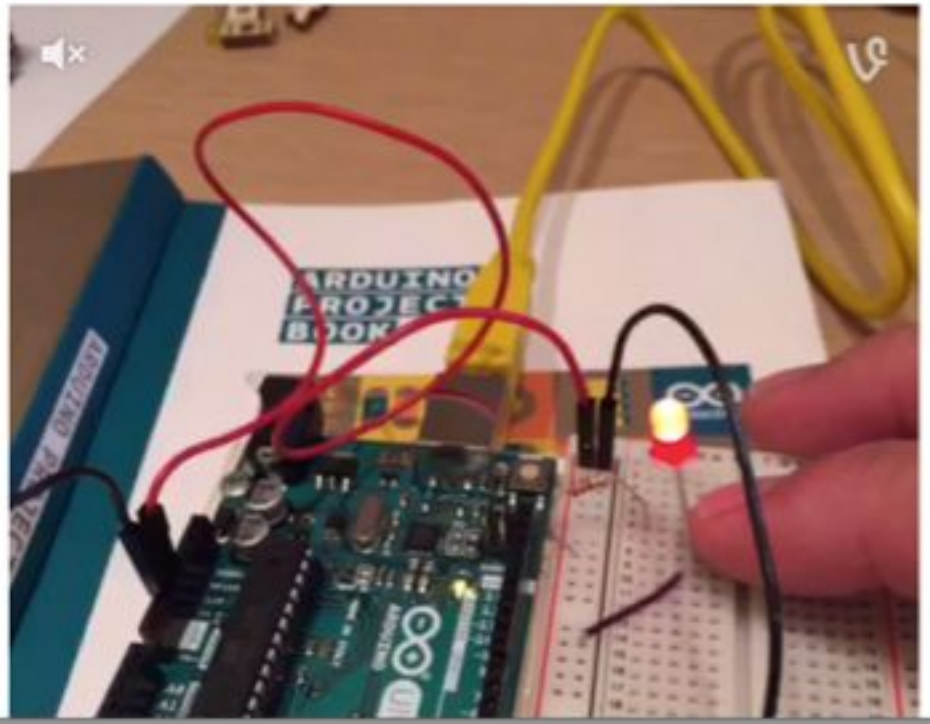
Home Notifications Messages Search Twitter

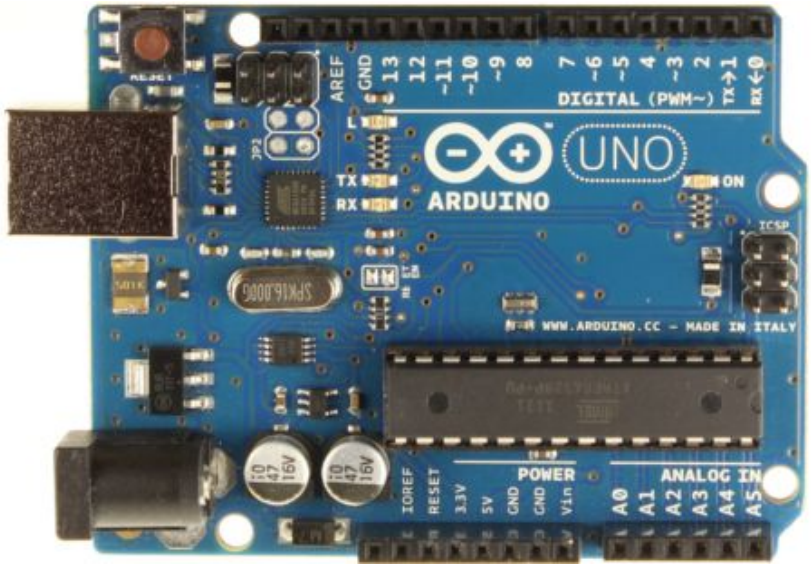
Werner Vogels
@Werner

Following

The giddiness when your first @arduino circuit works

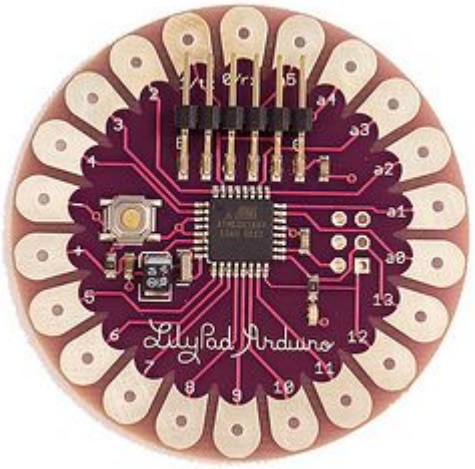
Vine





arduino.cc/en/Main/arduinoBoardUno

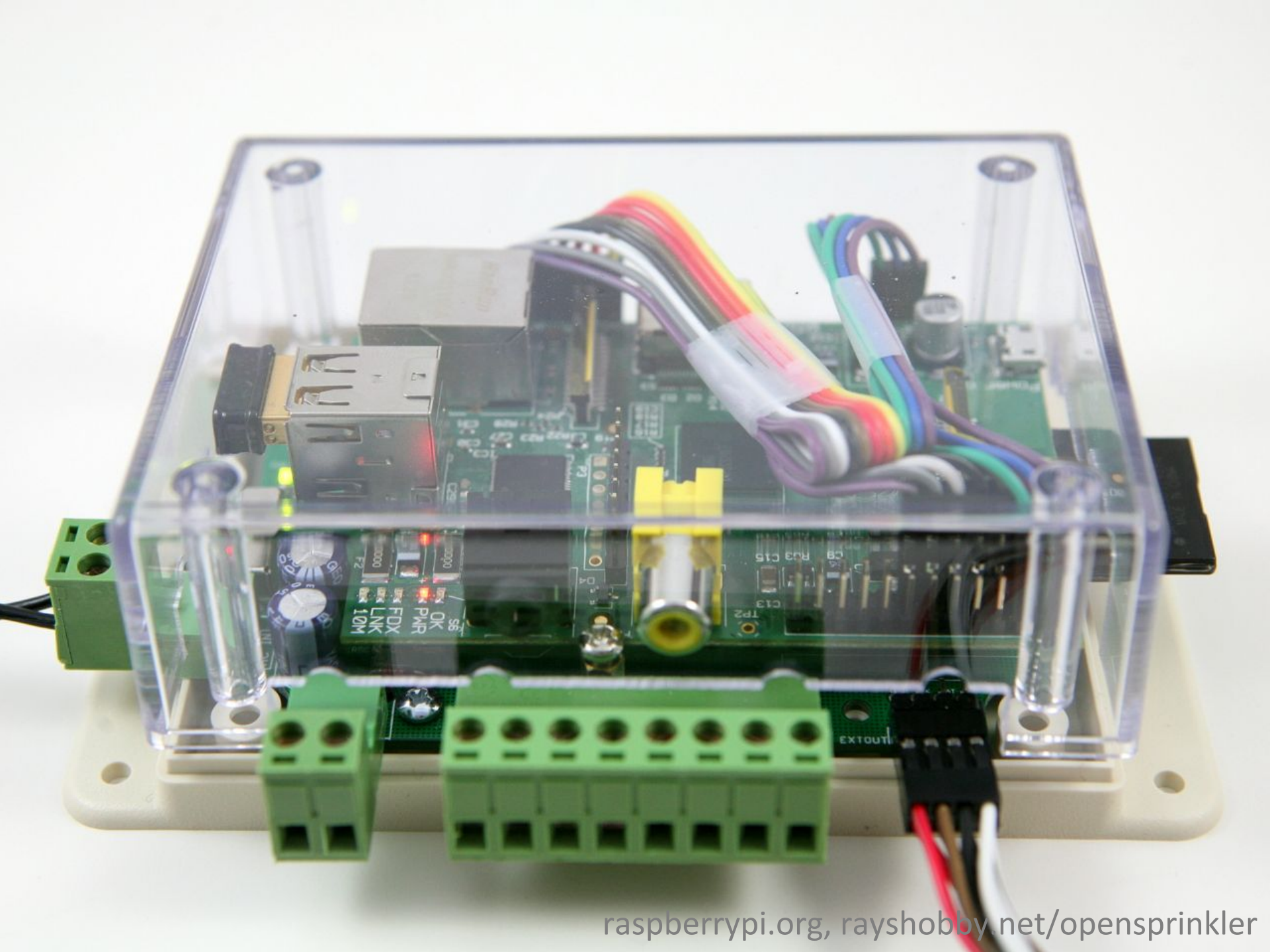
tiny-circuits.com/products/tinyduino



arduino.cc/en/Main/ArduinoBoardLilyPad

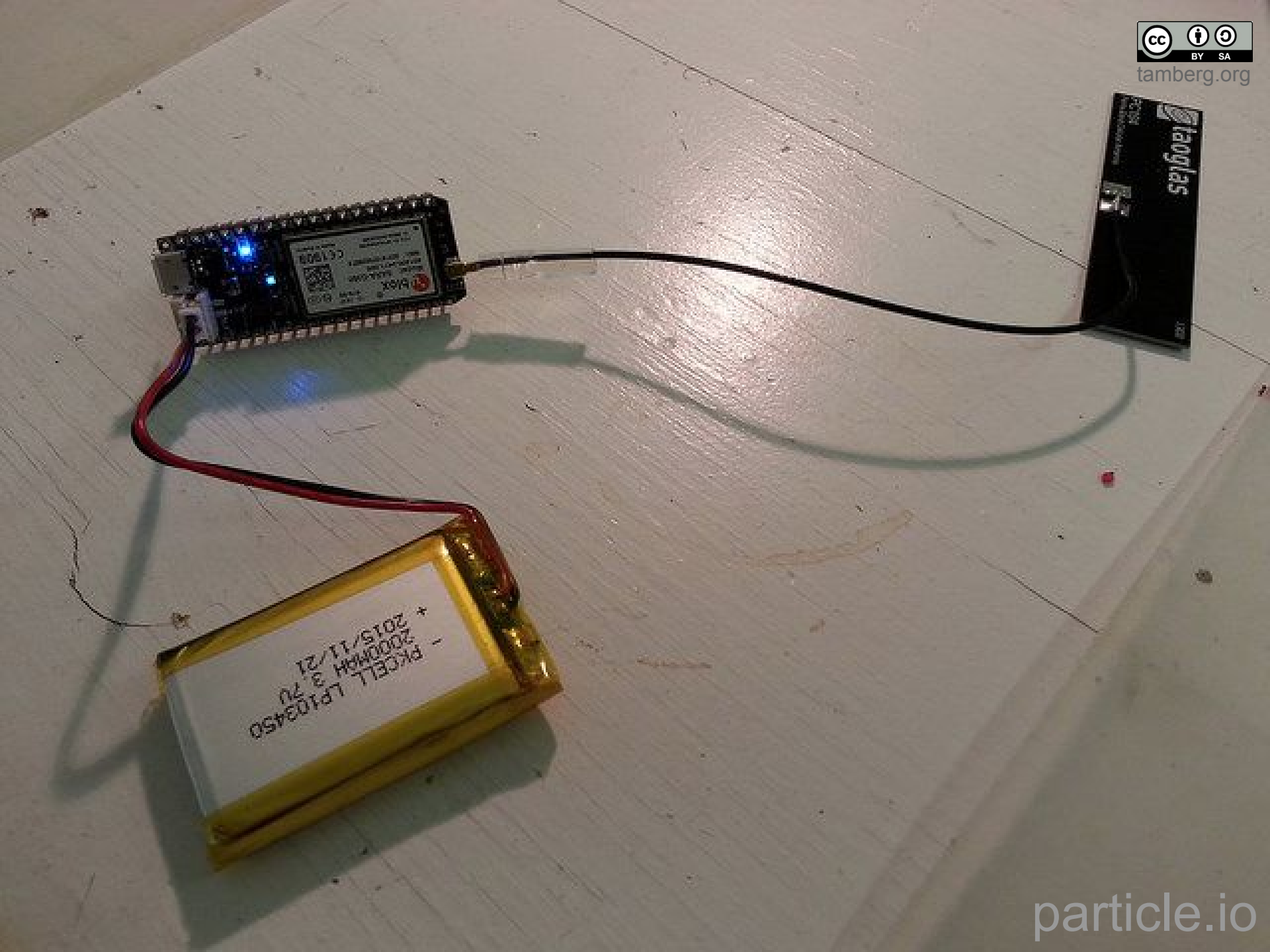
hlt.media.mit.edu/?p=2182

industruino.com



raspberrypi.org, rayshobby.net/opensprinkler


tamberg.org
getchip.com



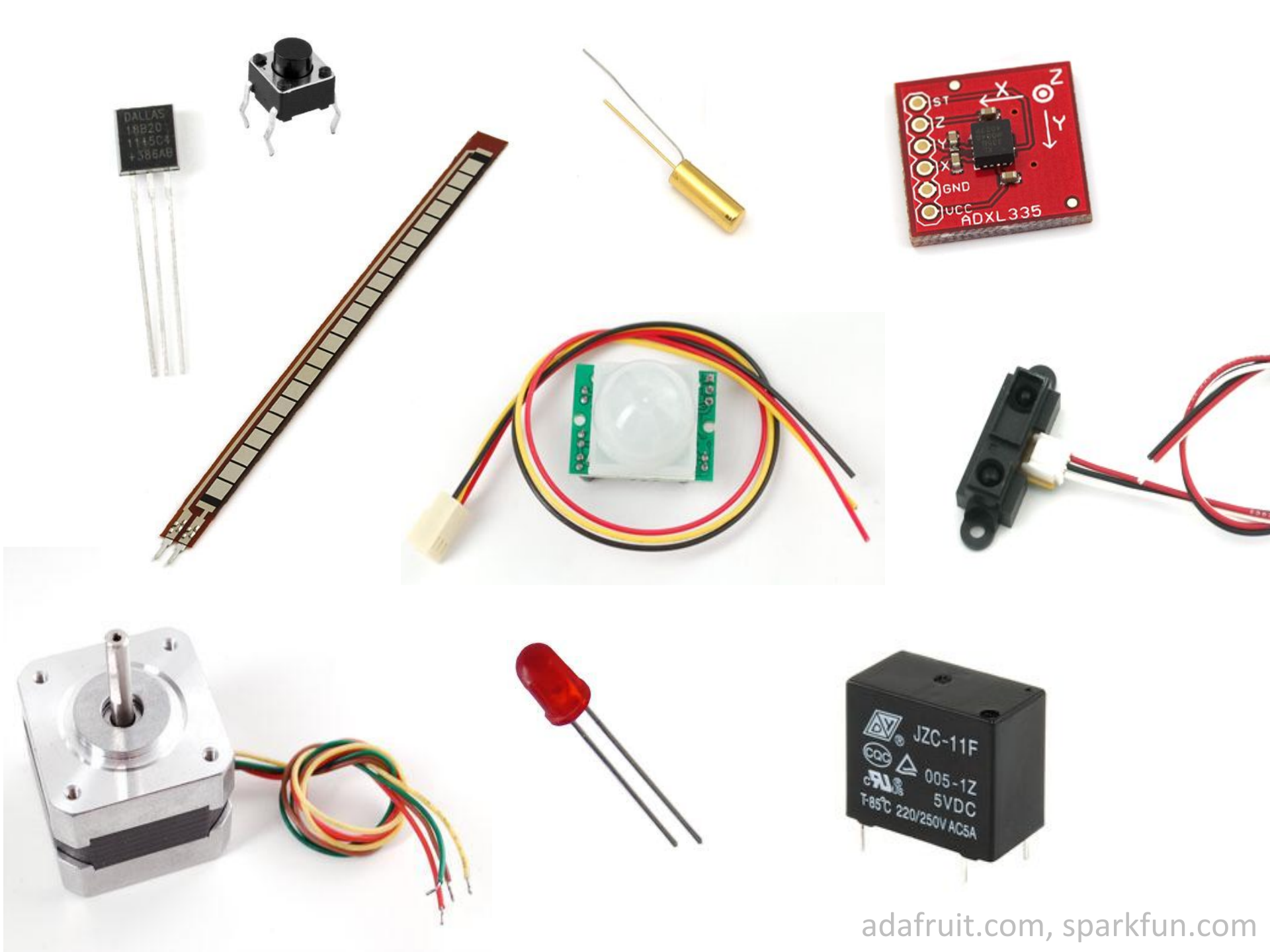
Sensors & actuators

Electical signal to / from physical properties

Search for "arduino + sensor name"

Find tutorials and wiring tips

Citizen sensing



adafruit.com, sparkfun.com

arduino dht22 - Google Se ×

Thomas

https://encrypted.google.com/search?hl=en&q=arduino%20dht22

Google

arduino dht22

Thomas

All Shopping Images Videos News More Search tools

About 281,000 results (0.24 seconds)

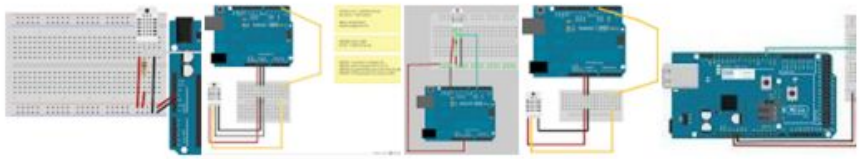
Arduino Playground - DHTLib

playground.**arduino**.cc/Main/DHTLib ▾ Arduino ▾

Nov 6, 2015 - The DHT11, DHT21 and **DHT22** are relative cheap sensors for measuring temperature and humidity. This article describes a library for reading ...

Images for arduino dht22

Report images



More images for arduino dht22

Sensor tutorials - DHT11/DHT21/DHT22 low cost ...

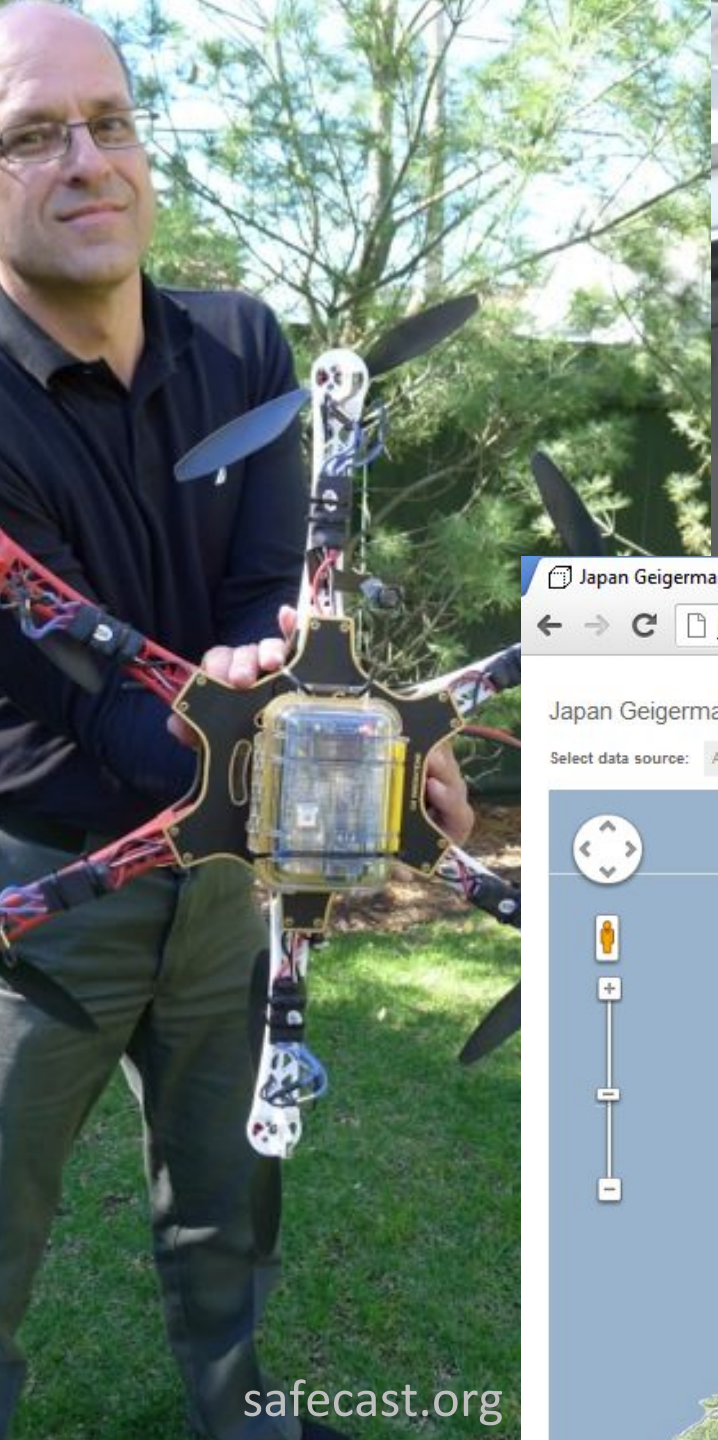
www.ladyada.net/learn/sensors/dht.html ▾ Limor Fried ▾

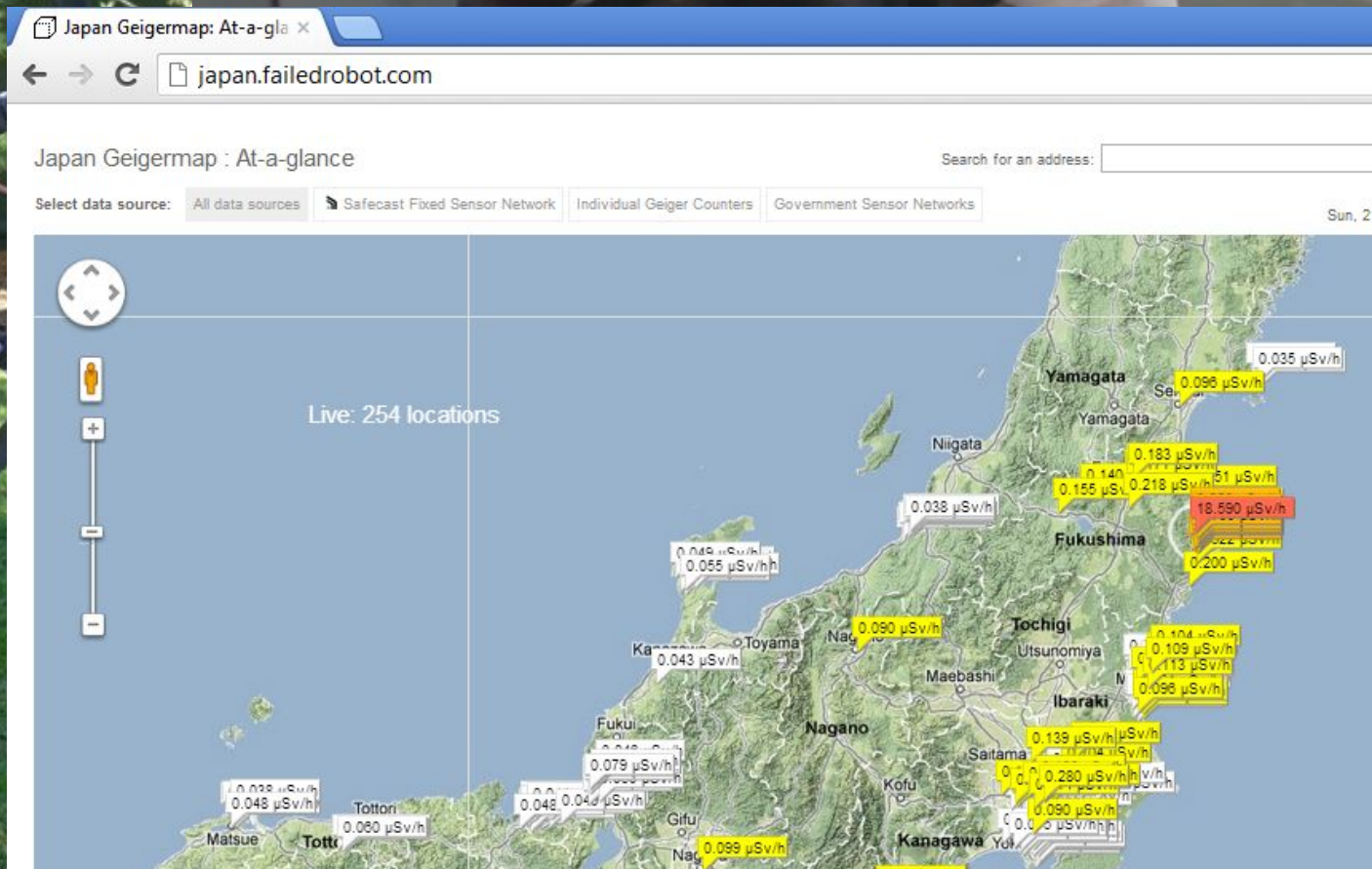
Jun 30, 2012 - DHTxx Sensors DHT11/DHT21/**DHT22** etc. Temperature & Humidity sensors. Overview · FSR · Photocell · Temp. Tilt · PIR · T-Couple.

How to use DHT-22 sensor - Arduino Tutorial - Instructables

www.instructables.com/.../How-to-use-**DHT-22**-sensor-**Ardu**... ▾ Instructables ▾

The **DHT-22** (also named as AM2302) is a digital-output relative humidity and temperature sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin. In this tutorial you will learn how to use this ...

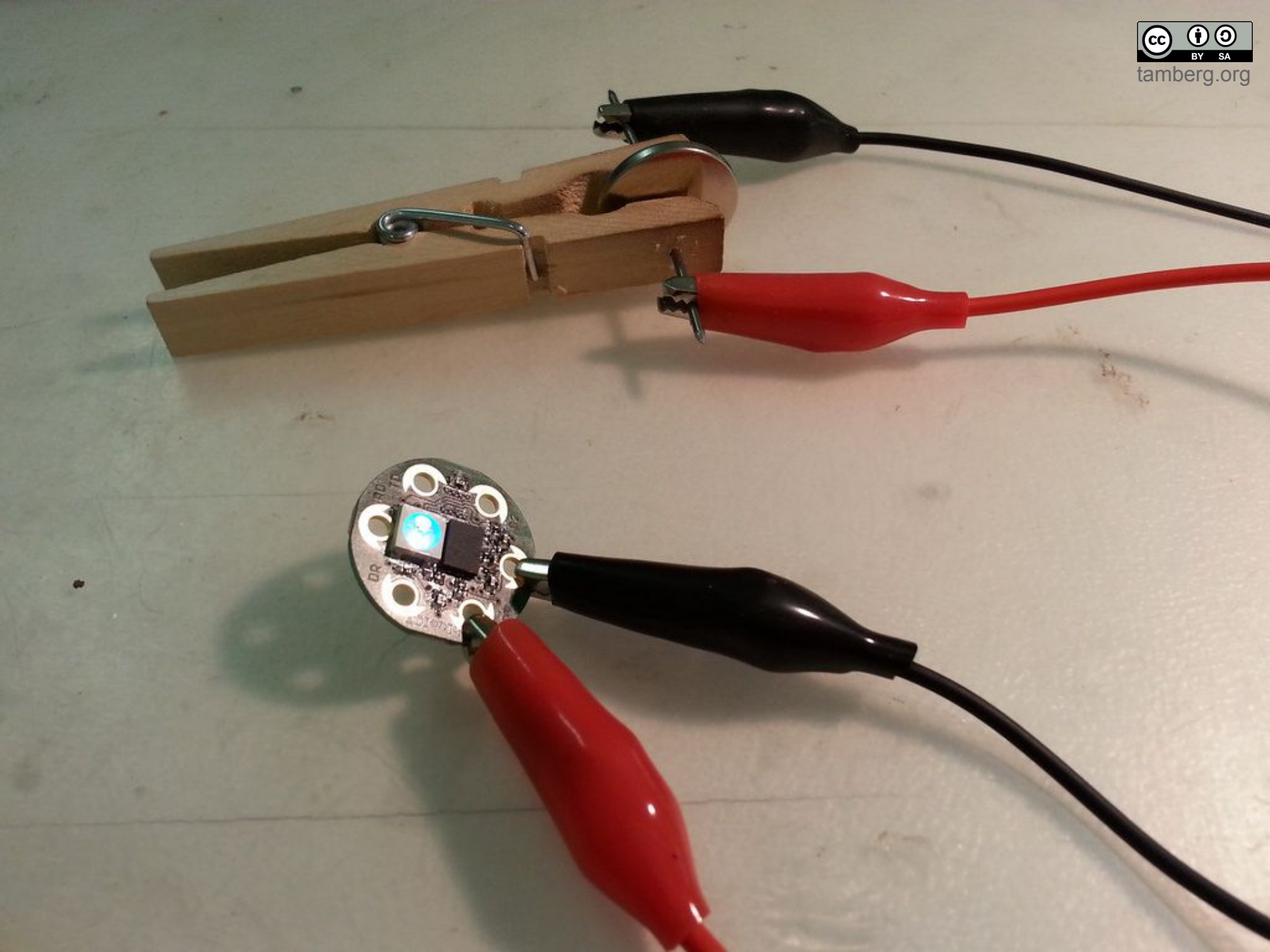




Hacker mindset

Affordance - what an object is capable of vs. intended for

Constraints - embrace them, limits of the design space vs. niche to thrive in



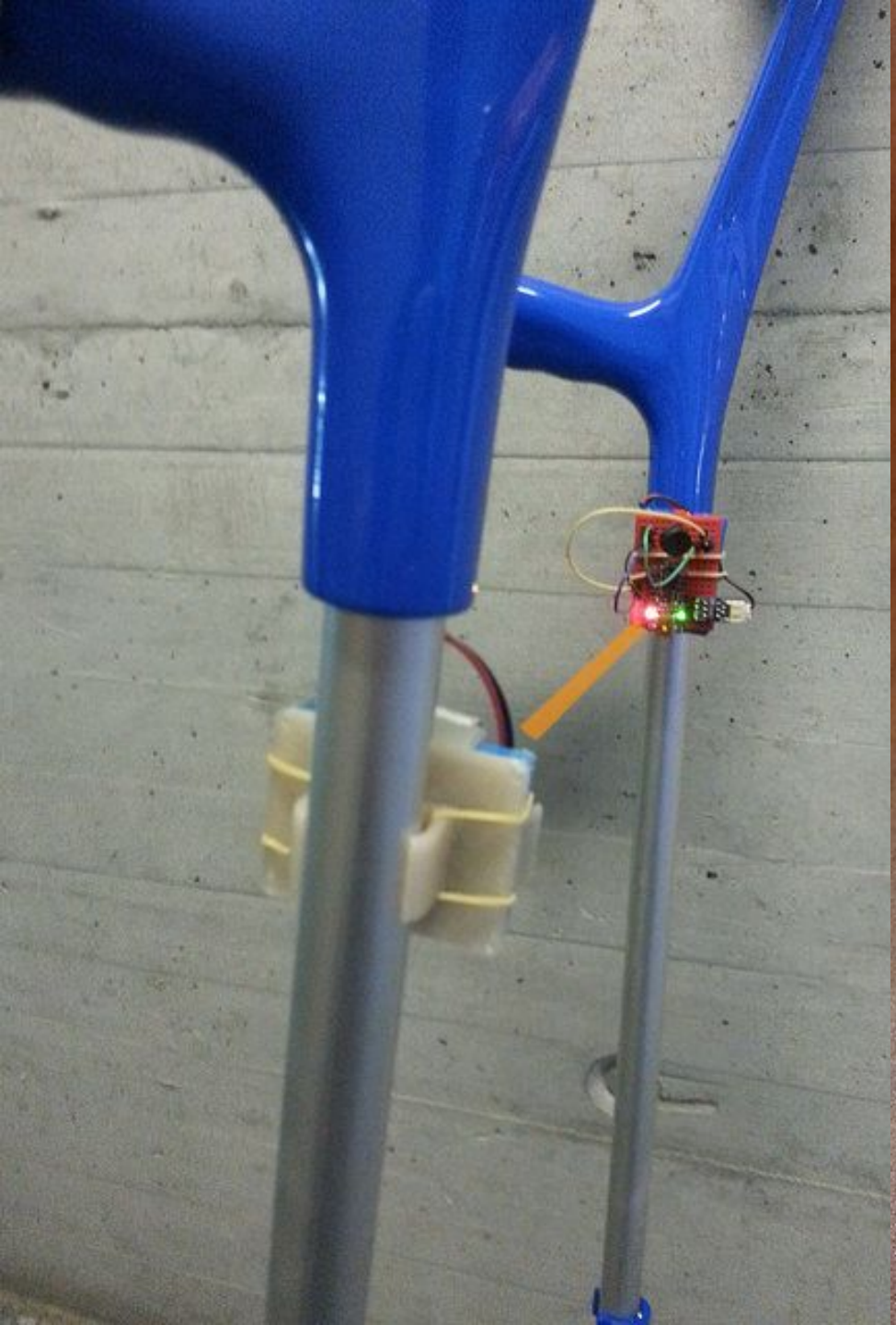
EXEMPLE -- Détection d'u

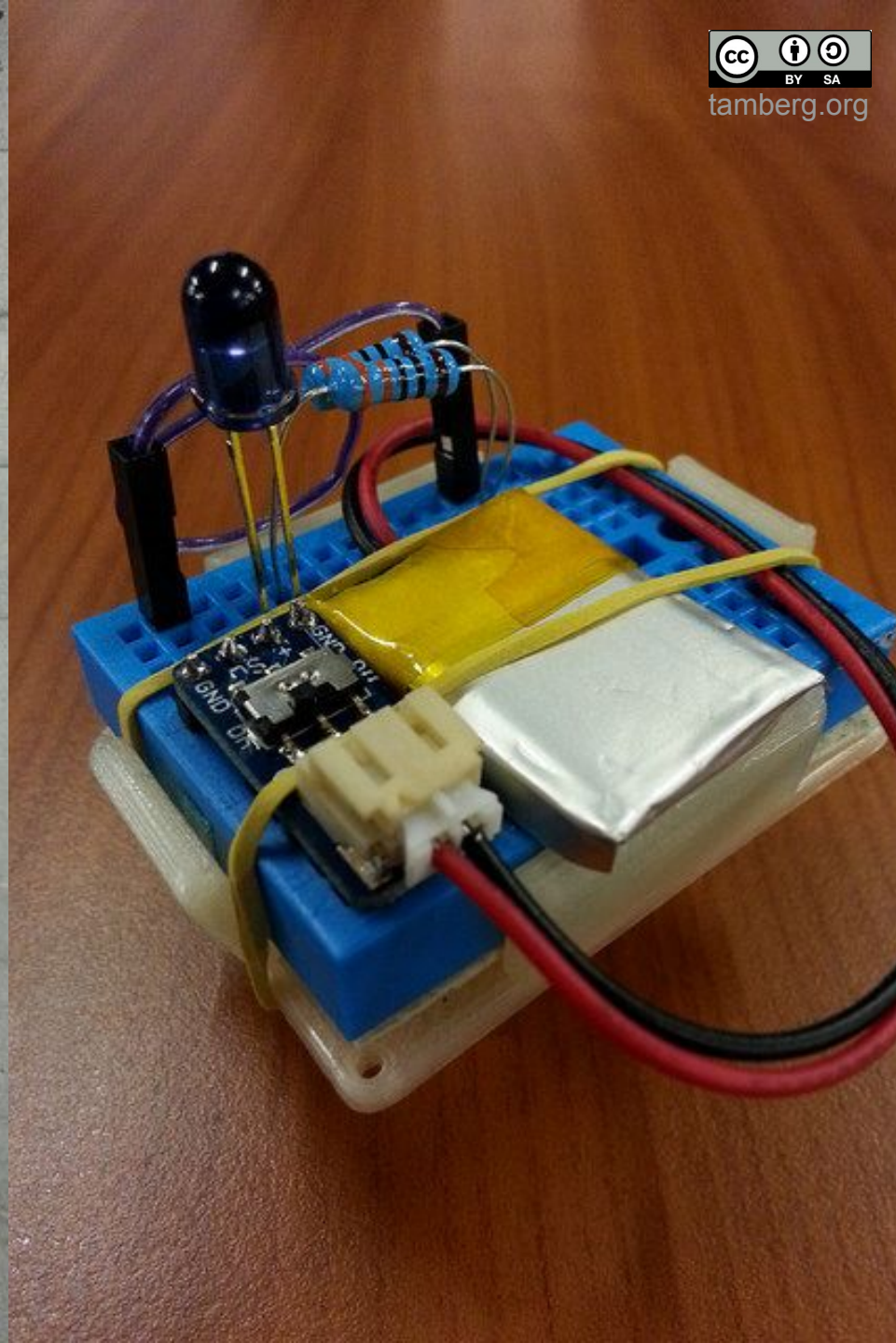
hhvalais.sparkboard.com/project/551b9ccf3896270300000004

Detection of alternating walking with aids

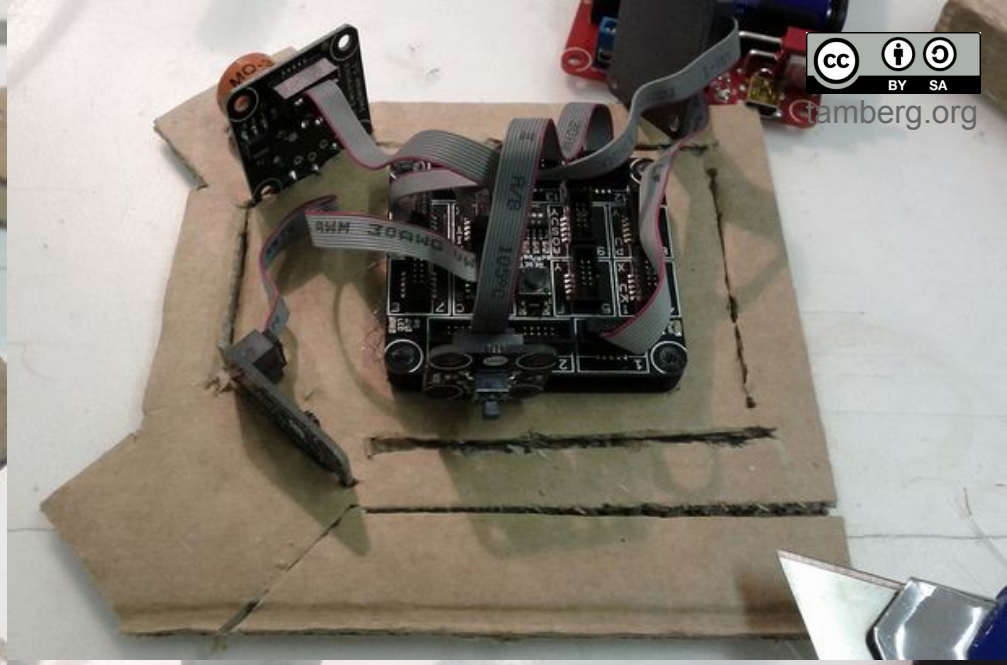
Create an application which can analyze in real time if the patient uses an alternate walk when walking on crutches or walking sticks.

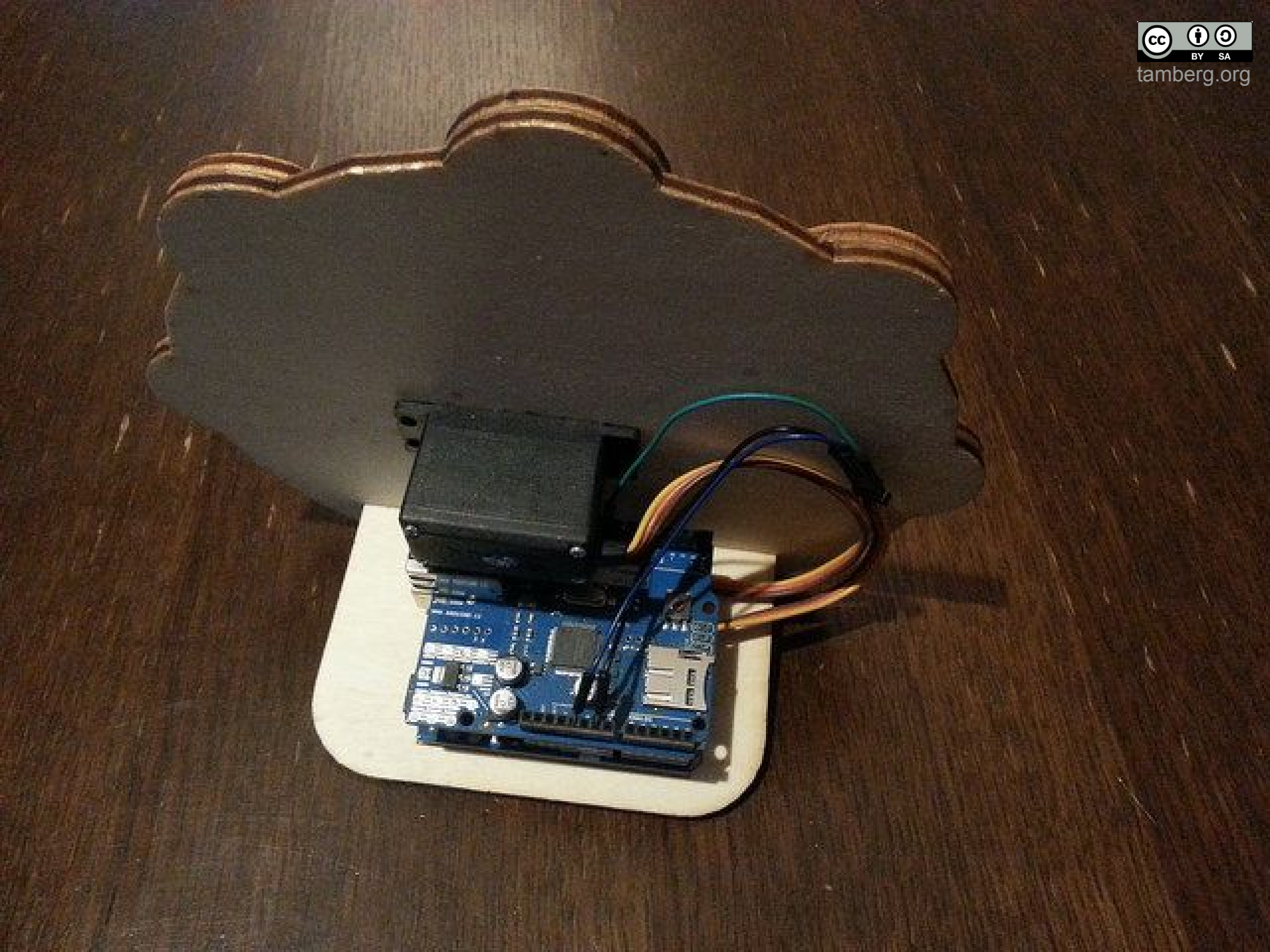
What is the problem you're trying to solve?

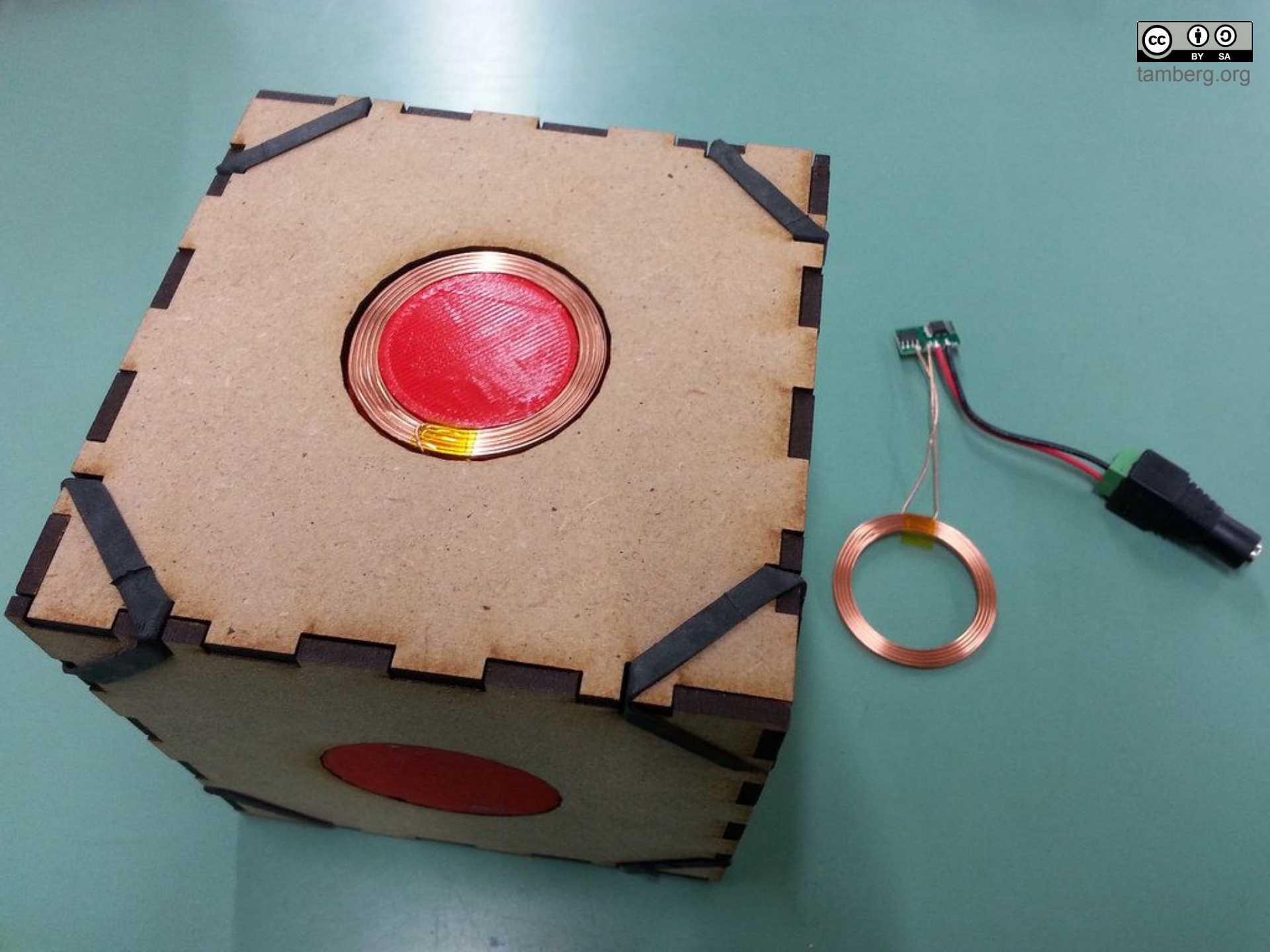


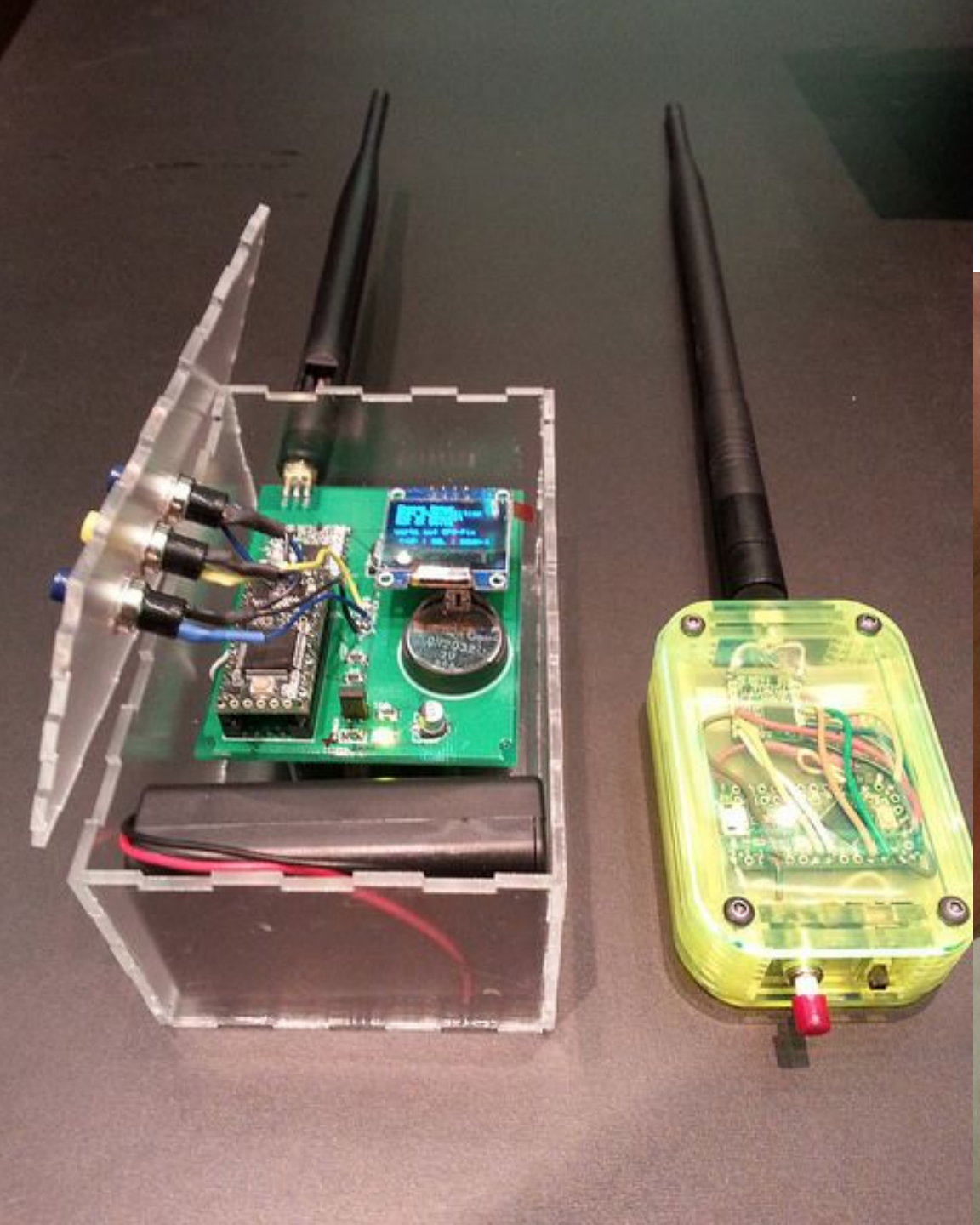


Prototyping the physical design

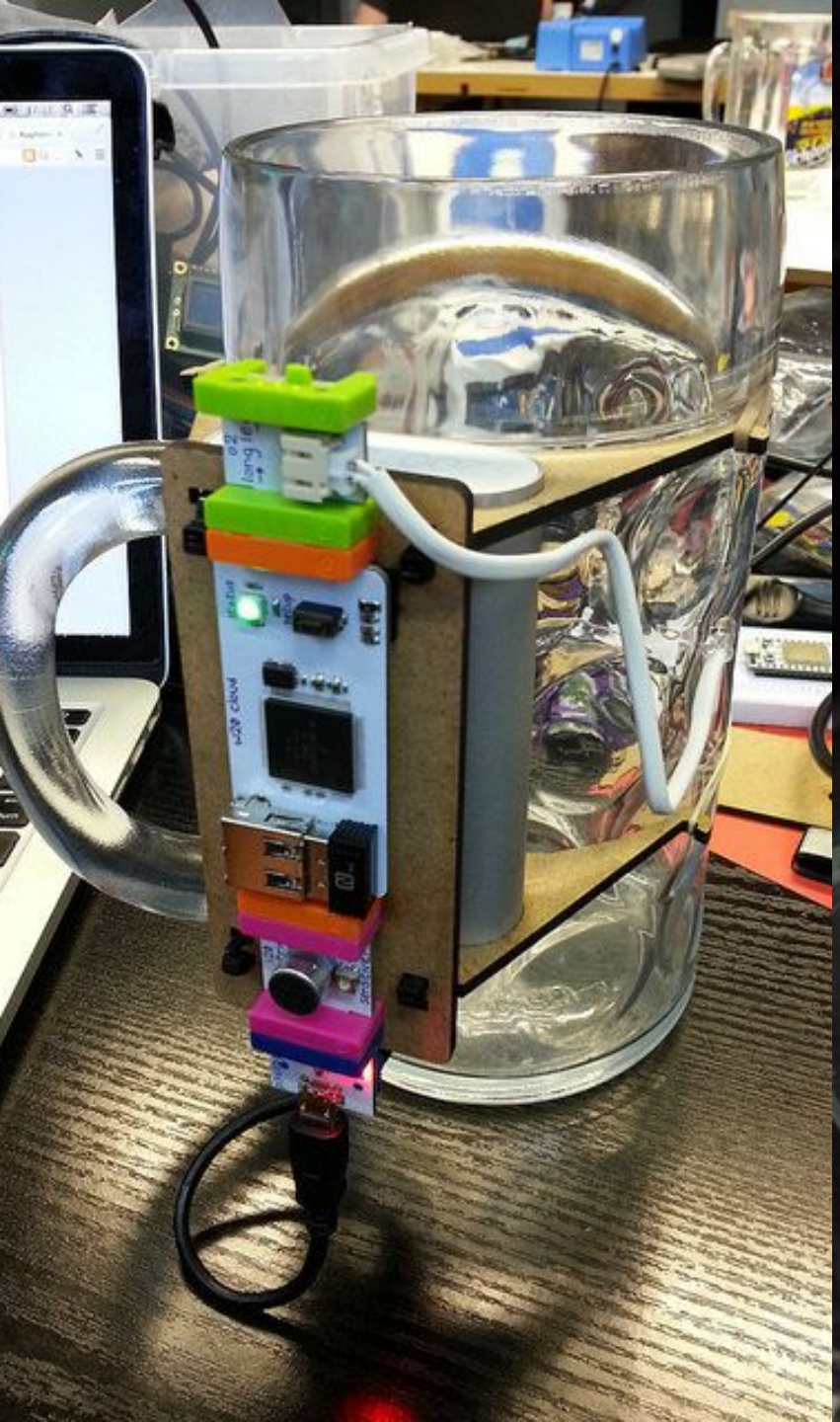


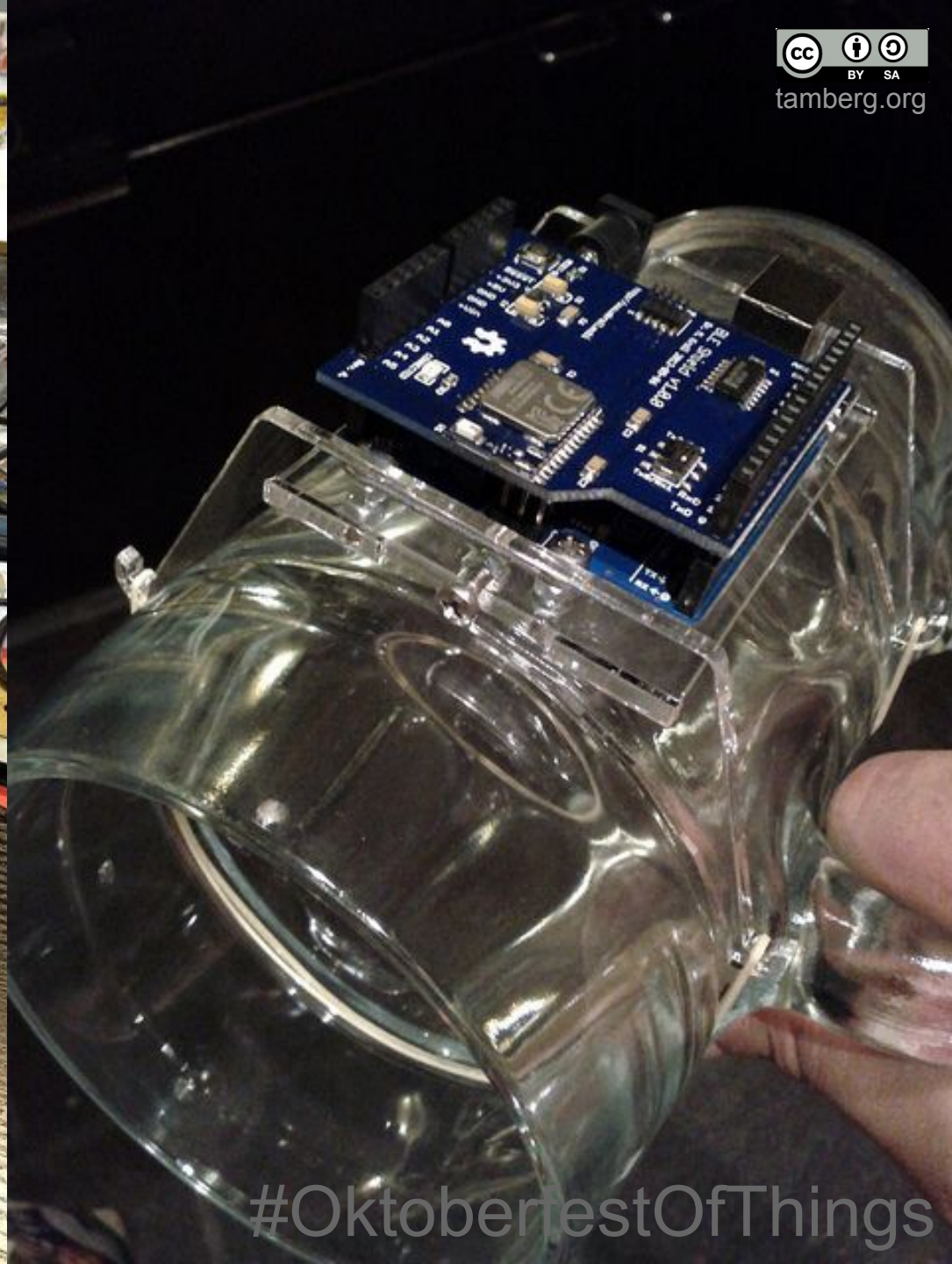







BY SA
tamberg.org
#OktoberfestOfThings





#OktoberfestOfThings

#OktoberfestOfThings

IoT platforms to get the job done

ThingSpeak to store and display sensor data

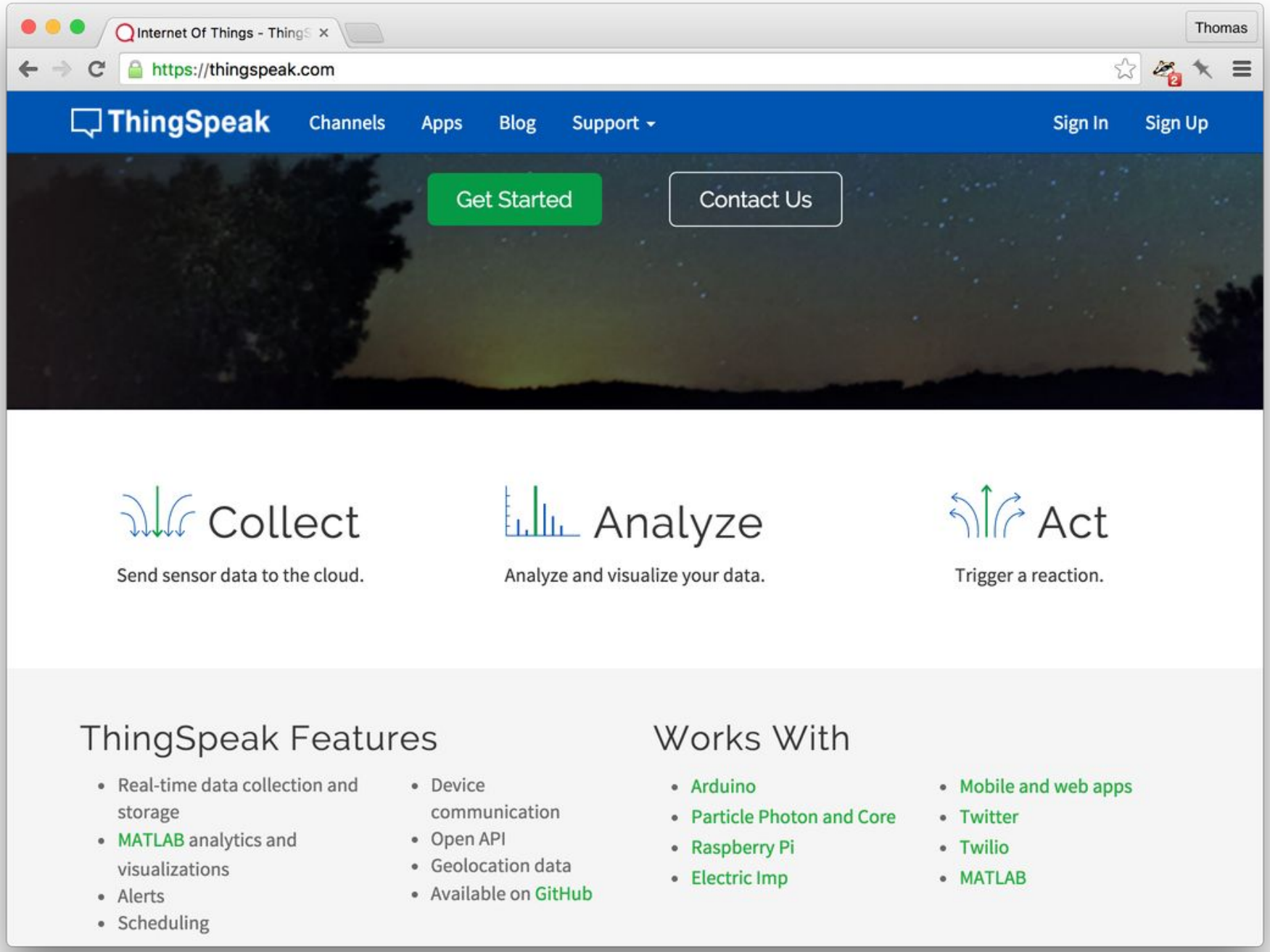
Dweet.io for super simple HTTP messaging

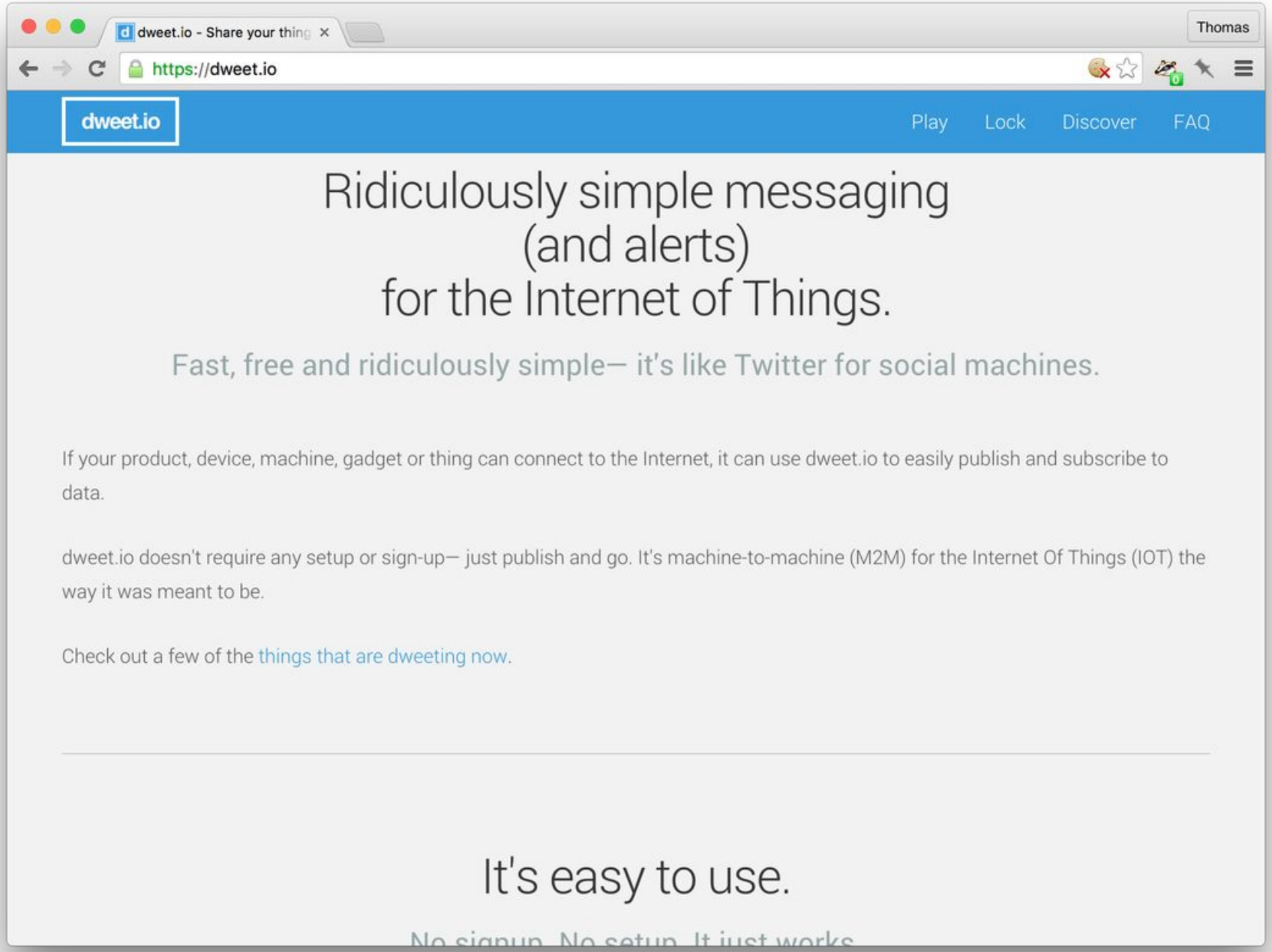
Yaler.net for remote Web (and SSH) access

NodeRed as a local hub for MQTT, Twitter, etc.

IFTTT Maker channel for mash-ups w/ 3rd party

AWS, Azure for stream analysis, messaging


Internet Of Things - ThingS
Thomas
https://thingspeak.com
ThingSpeak
Channels
Apps
Blog
Support
Sign In
Sign Up
Get Started
Contact Us
Collect
Send sensor data to the cloud.
Analyze
Analyze and visualize your data.
Act
Trigger a reaction.
ThingSpeak Features
Real-time data collection and storage
MATLAB analytics and visualizations
Alerts
Scheduling
Device communication
Open API
Geolocation data
Available on GitHub
Works With
Arduino
Particle Photon and Core
Raspberry Pi
Electric Imp
Mobile and web apps
Twitter
Twilio
MATLAB


dweet.io - Share your thing
Thomas
https://dweet.io
dweet.io
Play
Lock
Discover
FAQ
Ridiculously simple messaging
(and alerts)
for the Internet of Things.
Fast, free and ridiculously simple— it's like Twitter for social machines.
If your product, device, machine, gadget or thing can connect to the Internet, it can use dweet.io to easily publish and subscribe to data.
dweet.io doesn't require any setup or sign-up— just publish and go. It's machine-to-machine (M2M) for the Internet Of Things (IOT) the way it was meant to be.
Check out a few of the things that are dweeting now.
It's easy to use.
No signup. No setup. It just works.

Yaler.net - access devices

Thomas

https://yaler.net

Yaler.net

Status Docs & Help Pricing & Sign up **Log in**

Access devices from the Web

Yaler is a relay infrastructure for secure access to embedded systems

Get Started with Yaler

Trusted by makers, small business and enterprise customers

SIEMENS PHONAK decentLab ZAAK ZURICH

Why Yaler? (relay spelled backwards)

Connectivity as a service

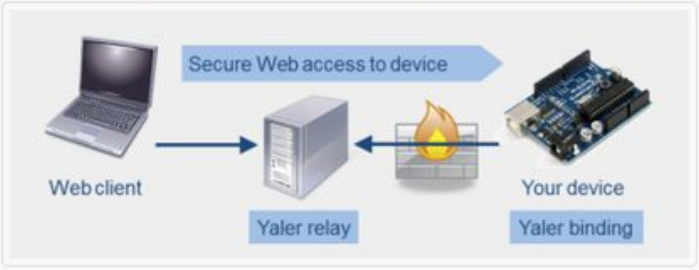
Get secure Web and SSH access to your embedded systems, no matter if they're located behind a firewall, a NAT or a mobile network router. Pay-per-use, with premium enterprise support.

Works with your hardware of choice

Yaler works with any device that provides a TCP socket. Get

How it works

Yaler relay provides addressability and accessibility



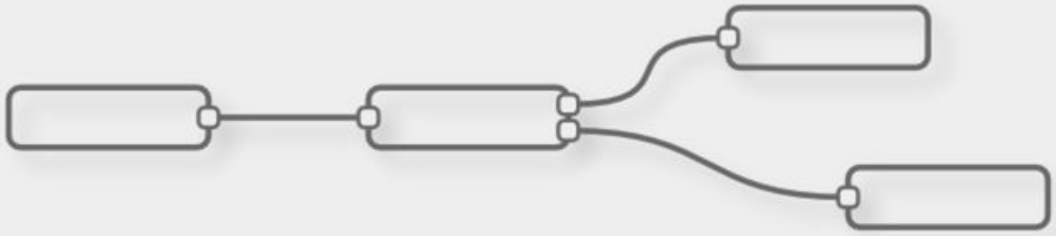
Node-RED

Thomas

nodered.org

Node-RED

A visual tool for wiring the Internet of Things



Node-RED is a tool for wiring together hardware devices, APIs and online services in new and interesting ways.

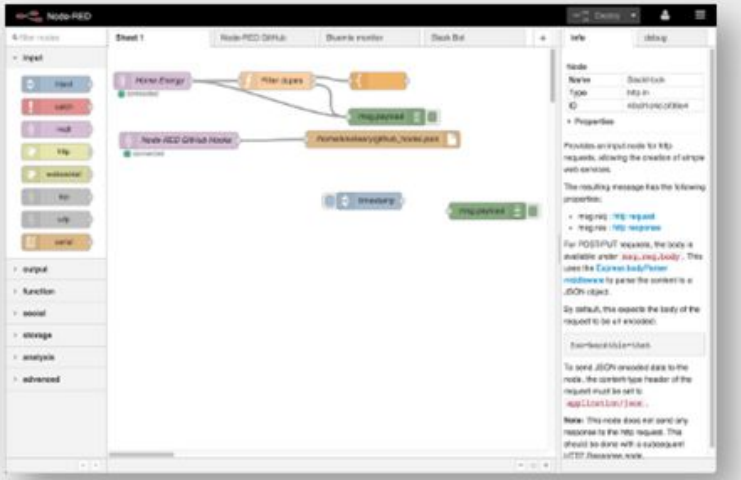
Getting Started

For Linux/OS X, if you already have Node.js installed, run:

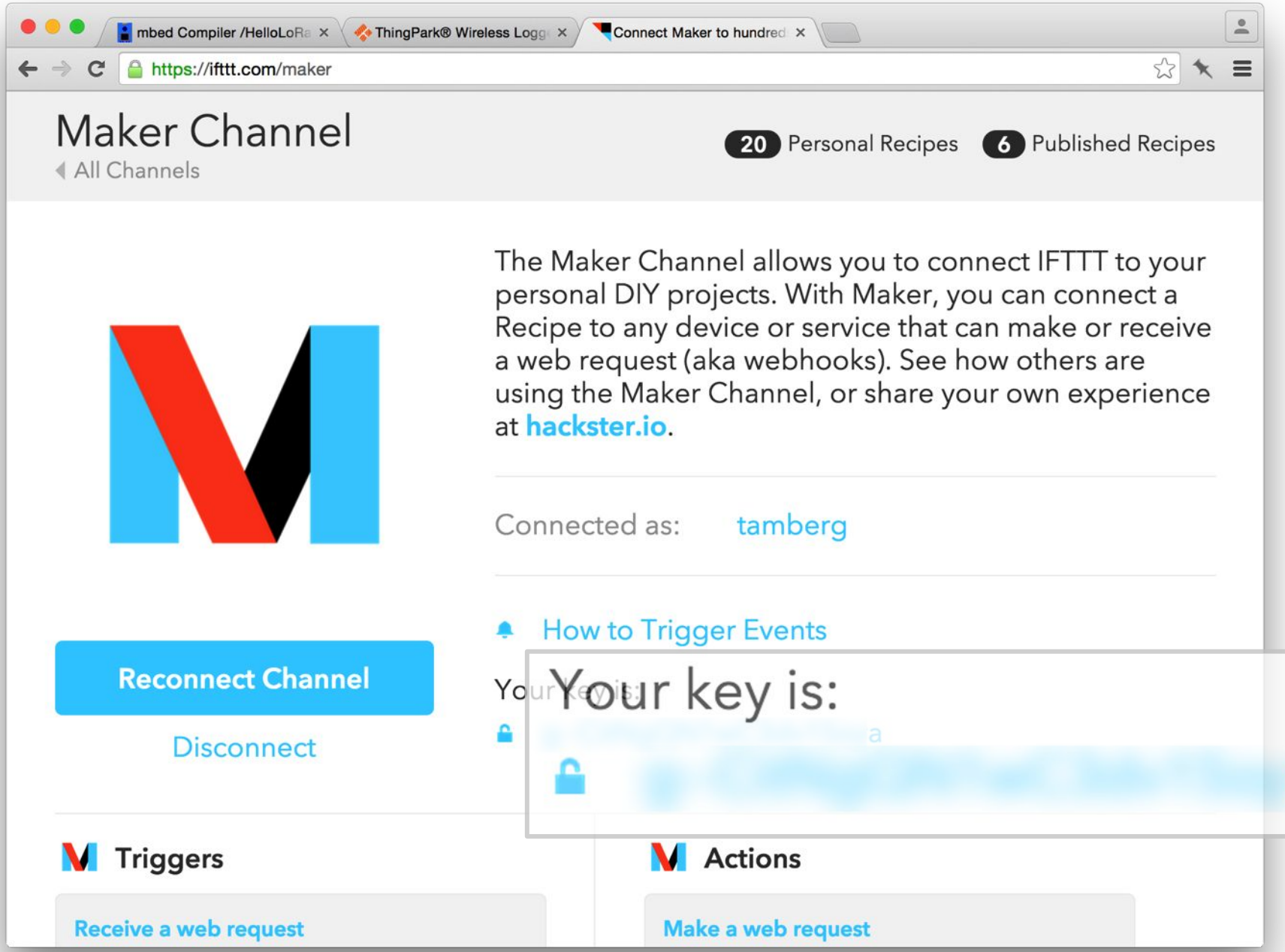
```
$ sudo npm install -g node-red
$ node-red
```

Otherwise, head over to the Getting Started guide.

Already got Node-RED installed and wonder where the download button has gone? Head over to the Upgrading guide.



Latest version: v0.13.3 (npm)


mbed Compiler /HelloLoRa
ThingPark® Wireless Logg
Connect Maker to hundred
https://ifttt.com/maker
Maker Channel
All Channels
20 Personal Recipes
6 Published Recipes
The Maker Channel allows you to connect IFTTT to your personal DIY projects. With Maker, you can connect a Recipe to any device or service that can make or receive a web request (aka webhooks). See how others are using the Maker Channel, or share your own experience at hackster.io.
Connected as: tamberg
How to Trigger Events
Reconnect Channel
Disconnect
Your key is:
Triggers
Receive a web request
Actions
Make a web request

Local or cloud-hosted glue code

Receive Webhook (outgoing HTTP) calls

Parse and transform data formats

Forward calls in target format

Use Yaler.net, Pagekite or Ngrok to host locally

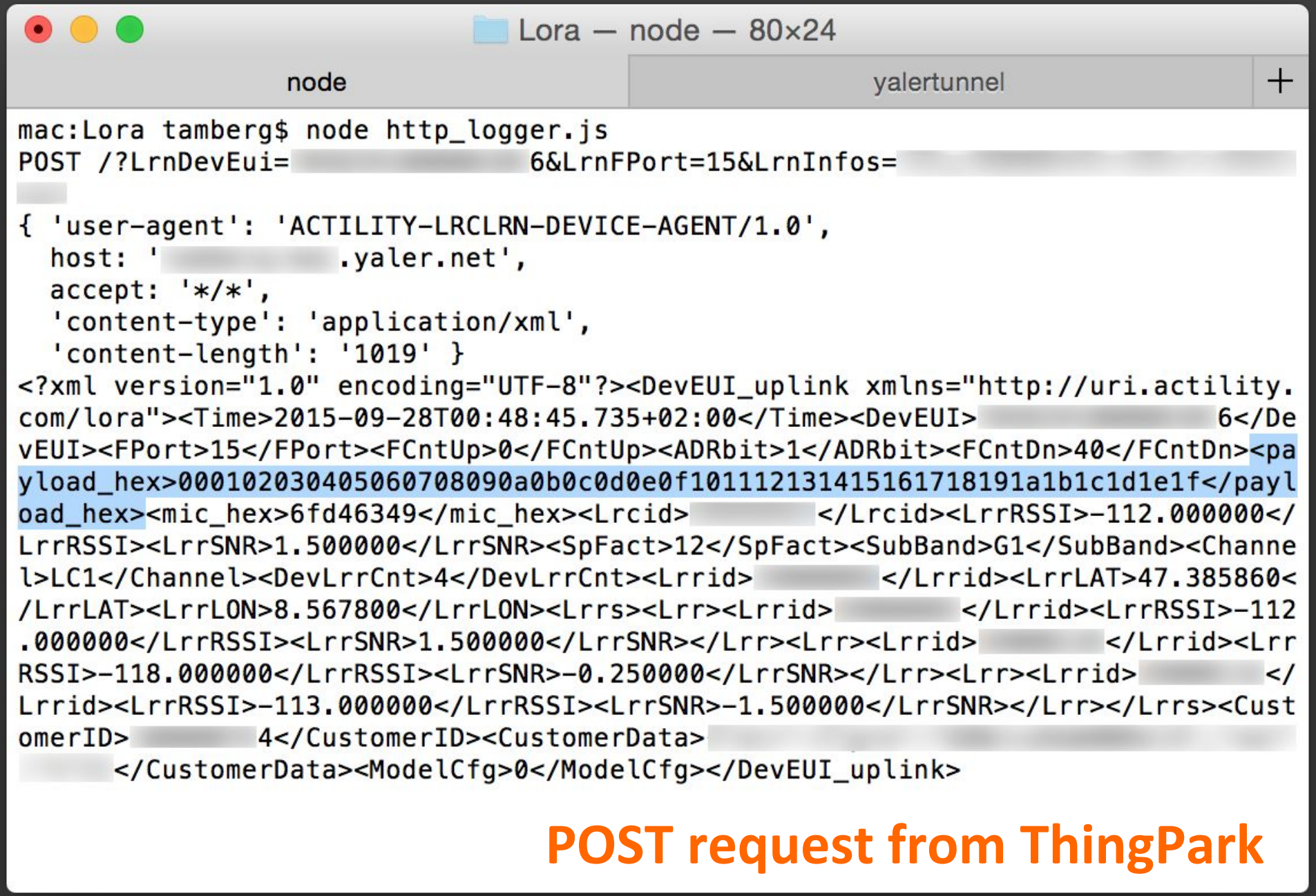
Use Curl to test and debug HTTP calls

http_logger.js

```
1   var http = require('http');
2   var requestListener = function (req, res) {
3     var body = "";
4     req.on('data', function (chunk) {
5       body += chunk;
6     });
7     req.on('end', function () {
8       console.log(req.method + ' ' + req.url);
9       console.log(req.headers);
10      console.log(body);
11      res.writeHead(200);
12      res.end('200 OK');
13    });
14  }
15
16  var server = http.createServer(requestListener);
17  server.listen(8080);
```

Listen for incoming HTTP requests, log request content to console


Lora — node — 80×24
node
mac:Lora tamberg$ node http_logger.js
GET /
{ host: 'localhost:8080',
connection: 'keep-alive',
'cache-control': 'max-age=0',
accept: 'text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;
q=0.8',
'upgrade-insecure-requests': '1',
'user-agent': 'Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_5) AppleWebKit/537
.36 (KHTML, like Gecko) Chrome/45.0.2454.99 Safari/537.36',
dnt: '1',
'accept-encoding': 'gzip, deflate, sdch',
'accept-language': 'en-US,en;q=0.8,de;q=0.6,id;q=0.4' }
GET request from the browser


Lora — node — 80×24
node
yalertunnel
mac:Lora tamberg$ node http_logger.js
POST /?LrnDevEui= 6&LrnFPort=15&LrnInfos=
{ 'user-agent': 'ACTILITY-LRCLRN-DEVICE-AGENT/1.0',
host: '.yaler.net',
accept: '*/*',
'content-type': 'application/xml',
'content-length': '1019' }
<?xml version="1.0" encoding="UTF-8"?><DevEUI_uplink xmlns="http://uri.actility.com/lora"><Time>2015-09-28T00:48:45.735+02:00</Time><DevEUI> 6</DevEUI><FPort>15</FPort><FCntUp>0</FCntUp><ADRbit>1</ADRbit><FCntDn>40</FCntDn><payload_hex>000102030405060708090a0b0c0d0e0f101112131415161718191a1b1c1d1e1f</payload_hex><mic_hex>6fd46349</mic_hex><Lrcid> </Lrcid><LrrRSSI>-112.000000</LrrRSSI><LrrSNR>1.500000</LrrSNR><SpFact>12</SpFact><SubBand>G1</SubBand><Channel>LC1</Channel><DevLrrCnt>4</DevLrrCnt><Lrrid> </Lrrid><LrrLAT>47.385860</LrrLAT><LrrLON>8.567800</LrrLON><Lrrs><Lrr><Lrrid> </Lrrid><LrrRSSI>-112.000000</LrrRSSI><LrrSNR>1.500000</LrrSNR></Lrr><Lrr><Lrrid> </Lrrid><LrrRSSI>-118.000000</LrrRSSI><LrrSNR>-0.250000</LrrSNR></Lrr><Lrr><Lrrid> </Lrrid><LrrRSSI>-113.000000</LrrRSSI><LrrSNR>-1.500000</LrrSNR></Lrr></Lrrs><CustomerID> 4</CustomerID><CustomerData> </CustomerData><ModelCfg>0</ModelCfg></DevEUI_uplink>
POST request from ThingPark

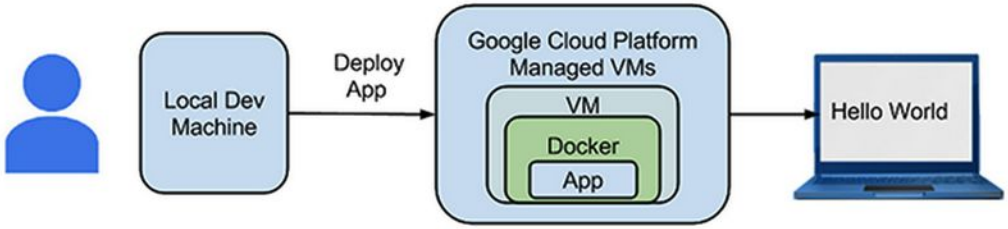
http_logger.js | payload_logger.js | payload_forwarder.js

```
9     req.on('end', function () {
10      var startTag = "<payload_hex>";
11      var i = body.indexOf(startTag, 0);
12      var j = body.indexOf("</payload_hex>", i);
13      var payload = body.substring(i + startTag.length, j);
14      console.log((new Date()).toISOString() + ' ' + payload);
15      if (payload != "") {
16        var options = {
17          host: 'maker.ifttt.com',
18          path: '/trigger/lora_packet_sent/with/key/          ',
19          method: 'POST',
20          headers: { 'Content-Type': 'application/json' }
21        };
22        var fwReq = https.request(options, null);
23        fwReq.write('{"value1":"' + payload + '"}');
24        fwReq.end();
25      }
26      res.writeHead(200);
27      res.end('200 OK');
28    });
29  }
30
31  var server = http.createServer(requestListener);
32  server.listen(8080);
```

ThingPark XML in, IFTTT JSON out

Running Hello World on Google Cloud Platform

The following diagram shows the process of deploying the app on Cloud Platform.



Managed VMs runs your application in containers that can automatically scale to handle your application's load. Behind the scenes, this utilizes both Google Compute Engine and Docker. To learn more, see the Managed VMs documentation.

Deploy the app to Google Cloud Platform

In your terminal window, enter the following command to deploy the sample:

```
$ gcloud preview app deploy app.yaml --set-default
```

Answer `y` when prompted to continue. It can take a short time to deploy the app. When it's done, you will see a message telling you that the update of the app is completed.

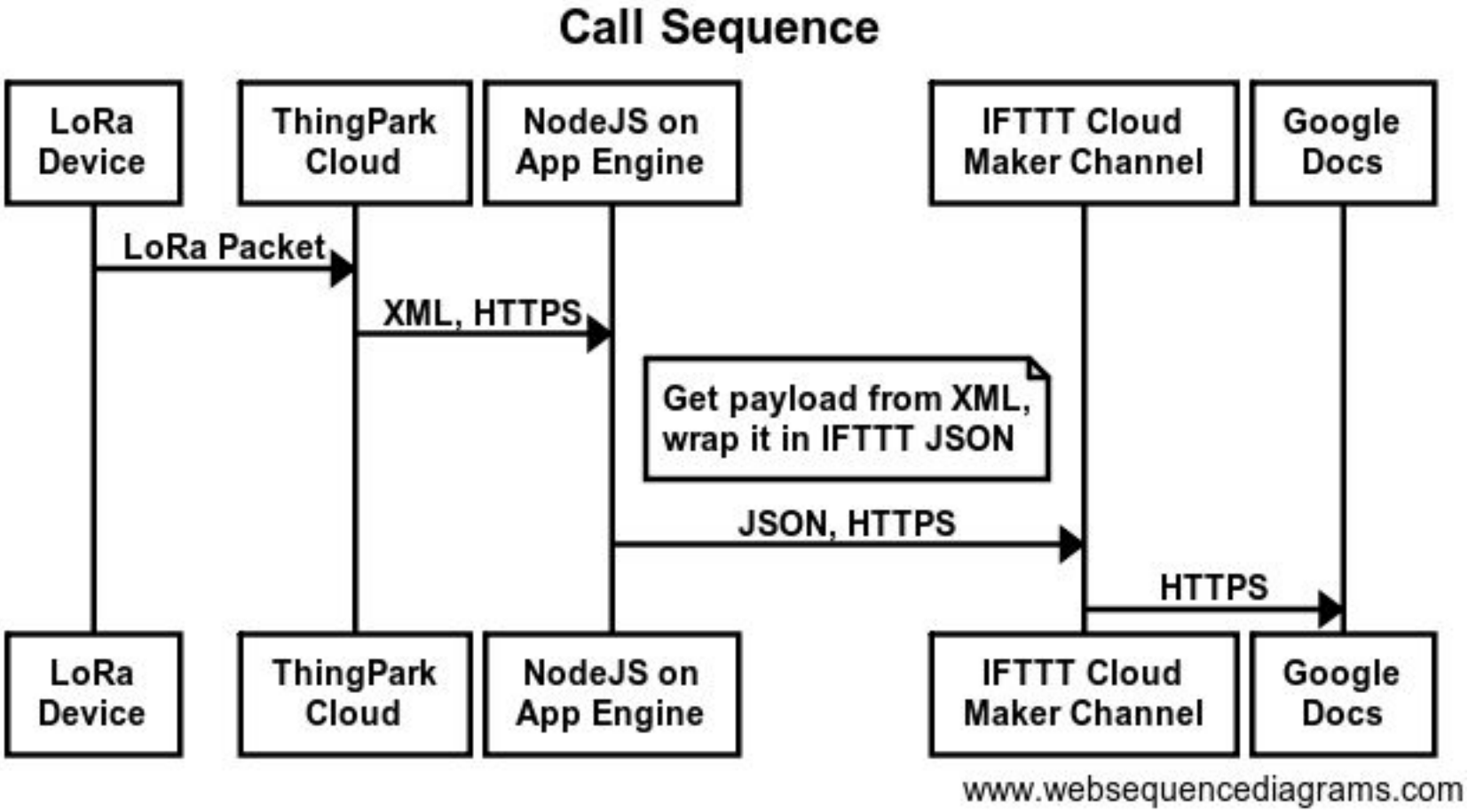
See the app run in the cloud

In your web browser, enter the following address:

Lora — bash — 80×24

bash

```
mac:Lora tamberg$ gcloud preview app deploy app.yaml --set-default
```



NodeJS on Google App Engine

Sharing and presenting results

Take (focused) pictures all along, pick a few later

Powerpoint / Google Slides for easy UI mockups

Use websequencediagrams.com for diagrams

Github for source code, MIT license, README

Thingiverse for physical designs, CC BY license

Cross-link everything, Tweet it w/ #STARTHack

SRF Hackdays, 09.2014 | F

Thomas

https://www.flickr.com/photos/tamberg/sets/72157647476487916

flickr You Explore Create Photos, people, or groups

Bosch #BCX16 - Google Sl

Thomas

https://docs.google.com/presentation/d/1YmeJE1tqdSkoXNZX3zWIg9f96avz65bj2kwcuvoTeXM/edit#slide=id.g10d39...

Bosch #BCX16

amberg.oberon.ch@gmail.com

File Edit View Insert Slide Format Arrange Tools Table Help Last edit was yesterday at 1...

Present Comments Share

Image options... More

1

2

3

4

5

Click to add notes

https://www.websequence ×

Thomas

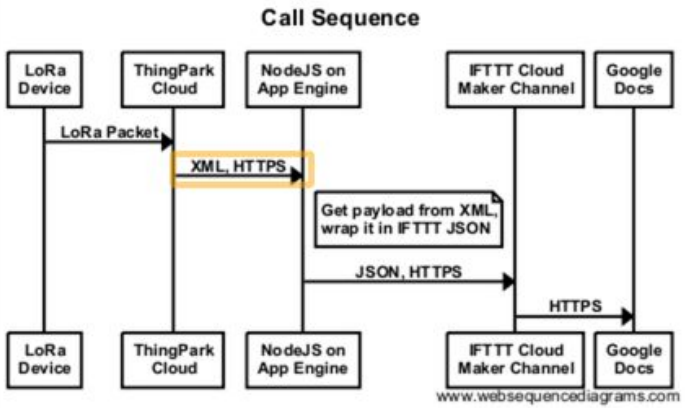
https://www.websequencediagrams.com

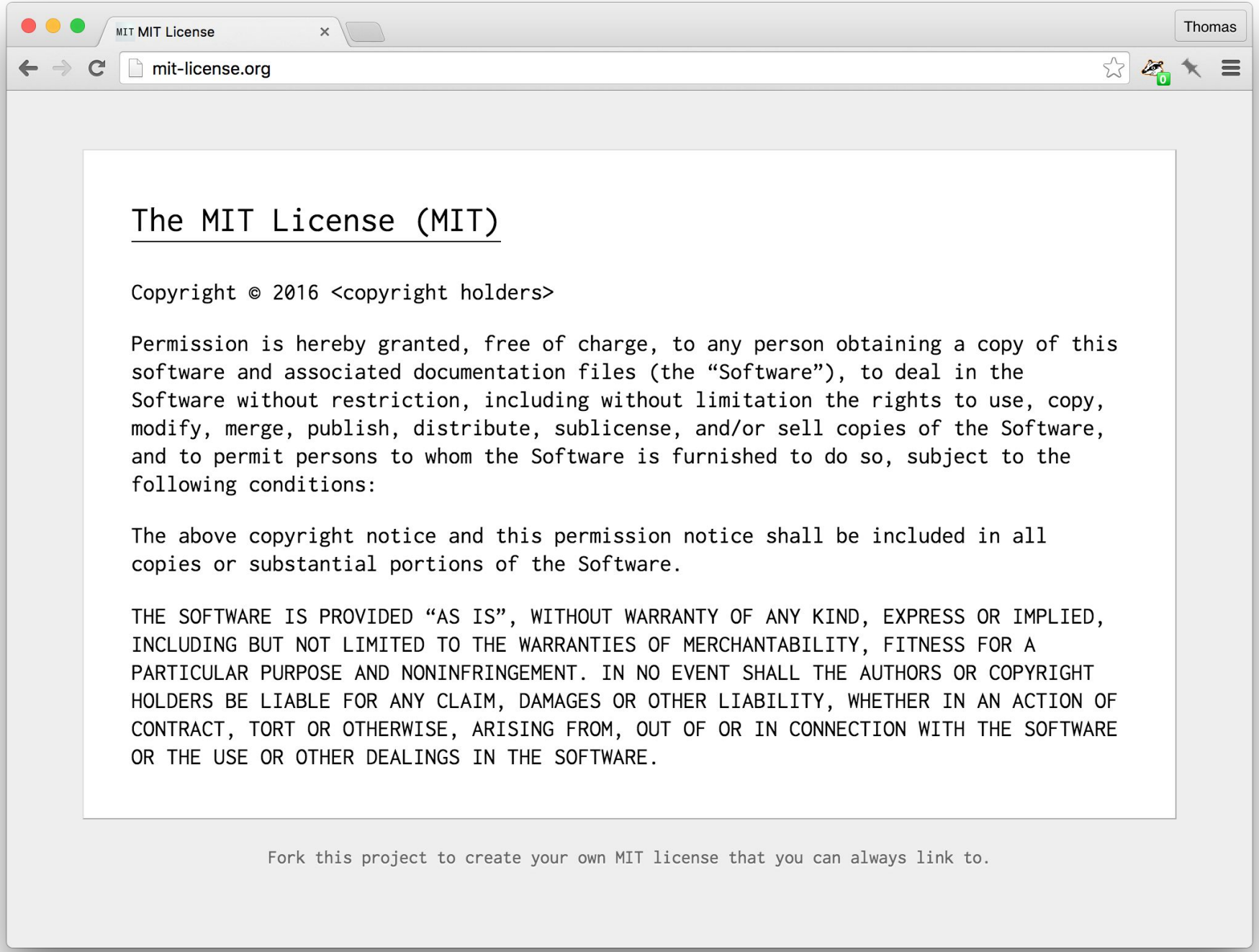
WebSequenceDiagrams

Sign in with Google

Account Styles Zoom in Share More

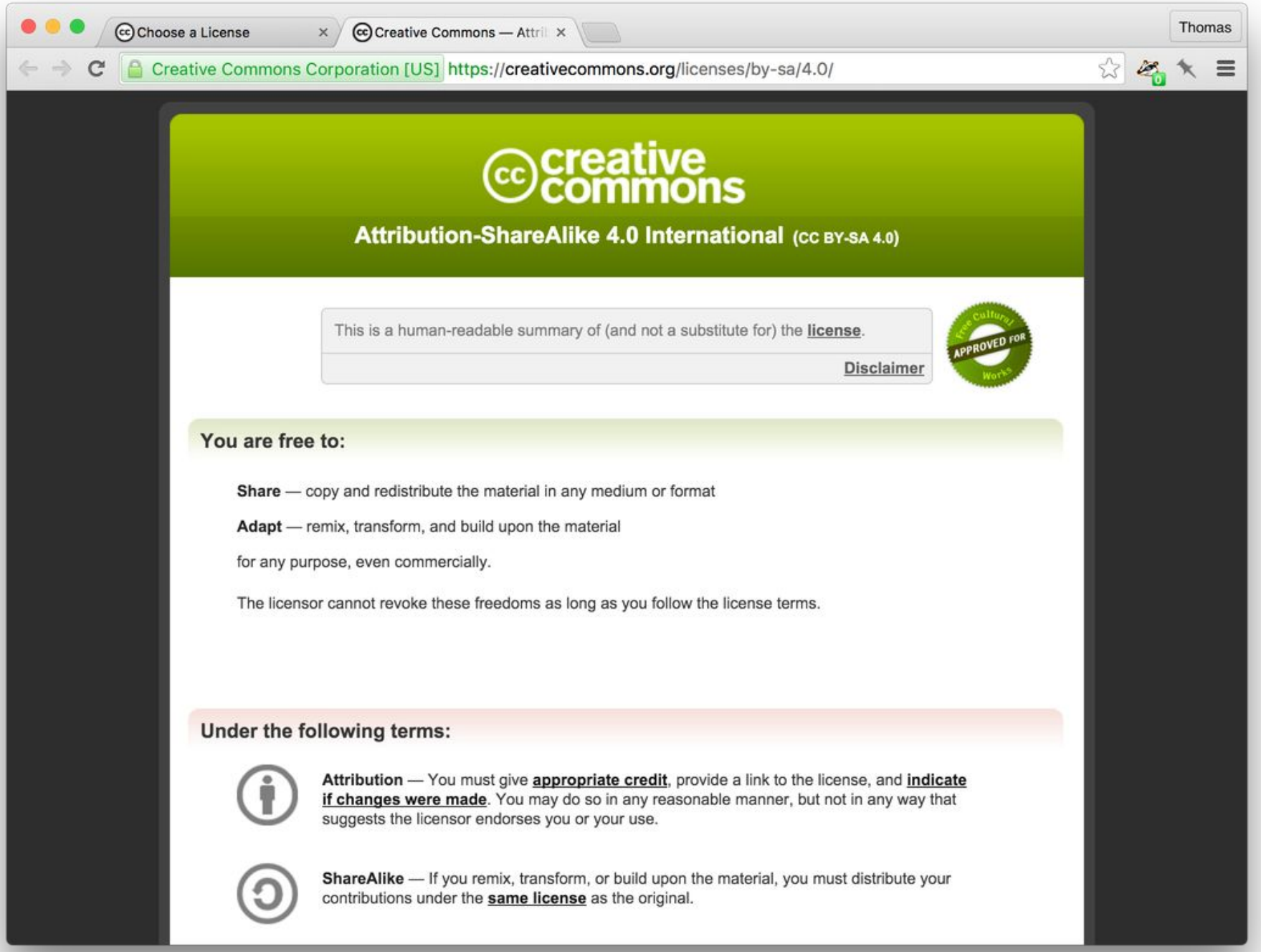
```
1  title Call Sequence
2
3  LoRa\nDevice->ThingPark\nCloud: LoRa Packet
4  ThingPark\nCloud->NodeJS on\nApp Engine: XML, HTTPS
5  note right of NodeJS on\nApp Engine: Get payload from XML,\nwra
6  NodeJS on\nApp Engine->IFTTT Cloud\nMaker Channel: JSON, HTTPS
7  IFTTT Cloud\nMaker Channel->Google\nDocs:HTTPS
8
```





The MIT License (MIT)

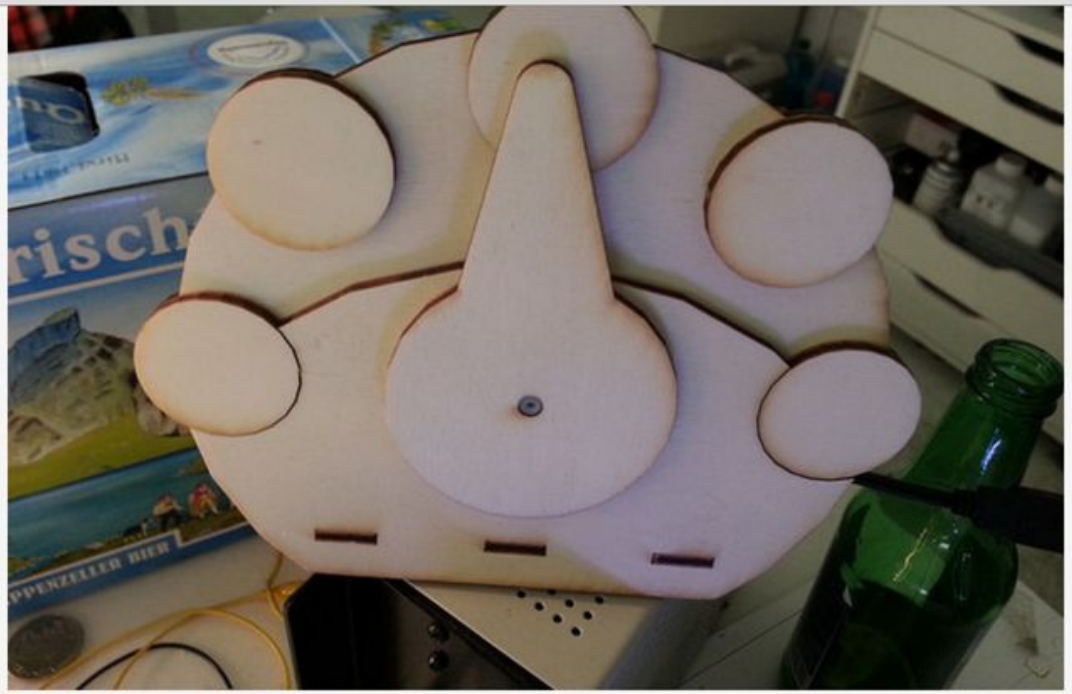
Fork this project to create your own MIT license that you can always link to.


Choose a License
Creative Commons — Attri
Thomas
Creative Commons Corporation [US]
https://creativecommons.org/licenses/by-sa/4.0/
creative commons
Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)
This is a human-readable summary of (and not a substitute for) the license.
Disclaimer
Free Cultural
APPROVED FOR
Works
You are free to:
Share — copy and redistribute the material in any medium or format
Adapt — remix, transform, and build upon the material
for any purpose, even commercially.
The licensor cannot revoke these freedoms as long as you follow the license terms.
Under the following terms:
Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.

IoT Gauge by tamberg - Th

Thomas

https://www.thingiverse.com/thing:453788



Collect 3

Comment 0

I Made One 0

Remix It 0

Share

Download This Thing!

Thing Details | Thing Files | 0 Comments | 0 Made | 3 Collections | 0 Remixes

Summary

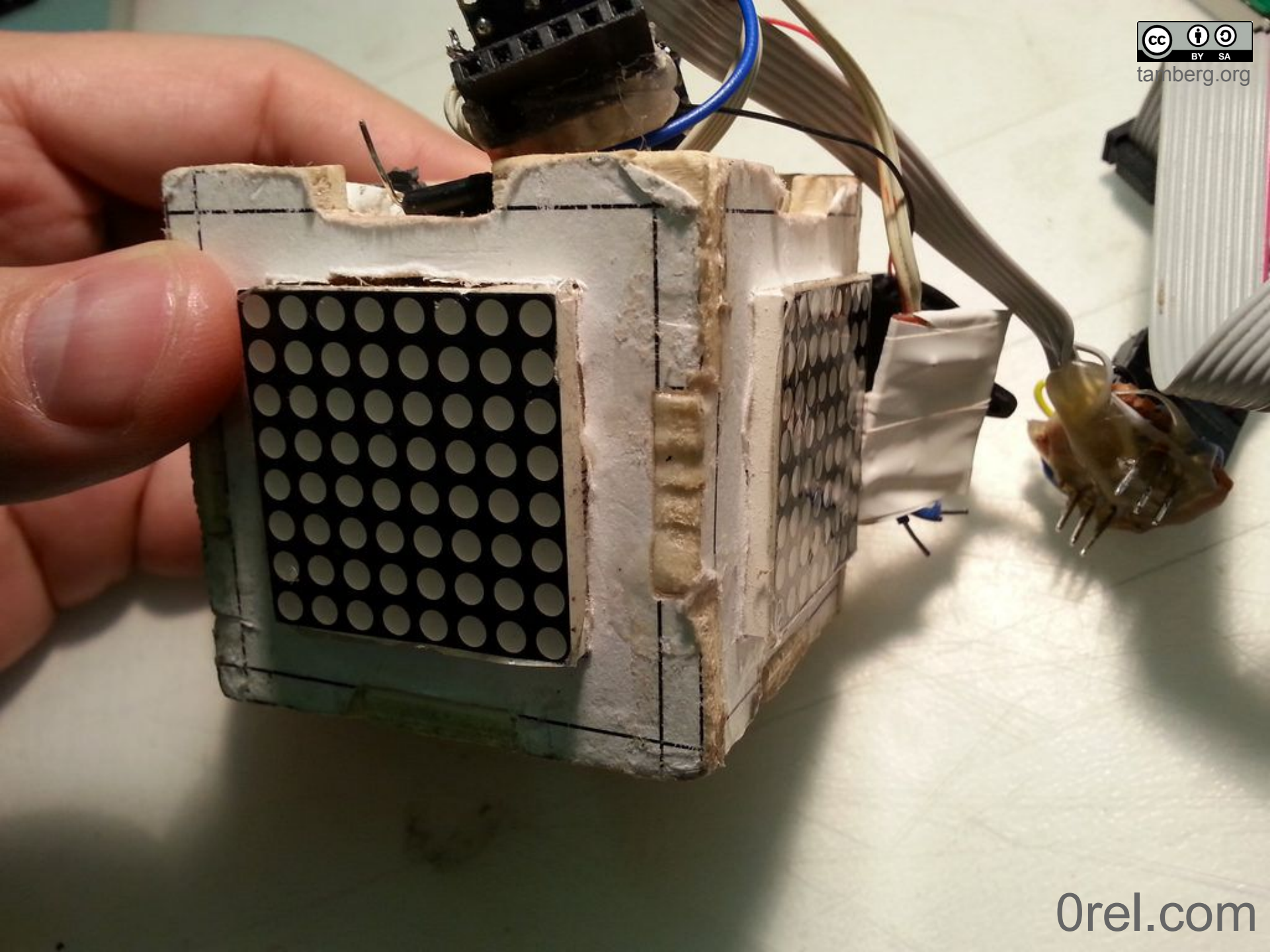
Design files for a Web-enabled servo gauge kit by **@tamberg** for **@iotzh** workshops. Add Arduino Uno, Ethernet shield and a **Servo**, then upload **IoTGaugeWebService.ino** to use it with Curl, any Browser or the new IFTTT Maker Channel. Here's a **detailed Instructable**.

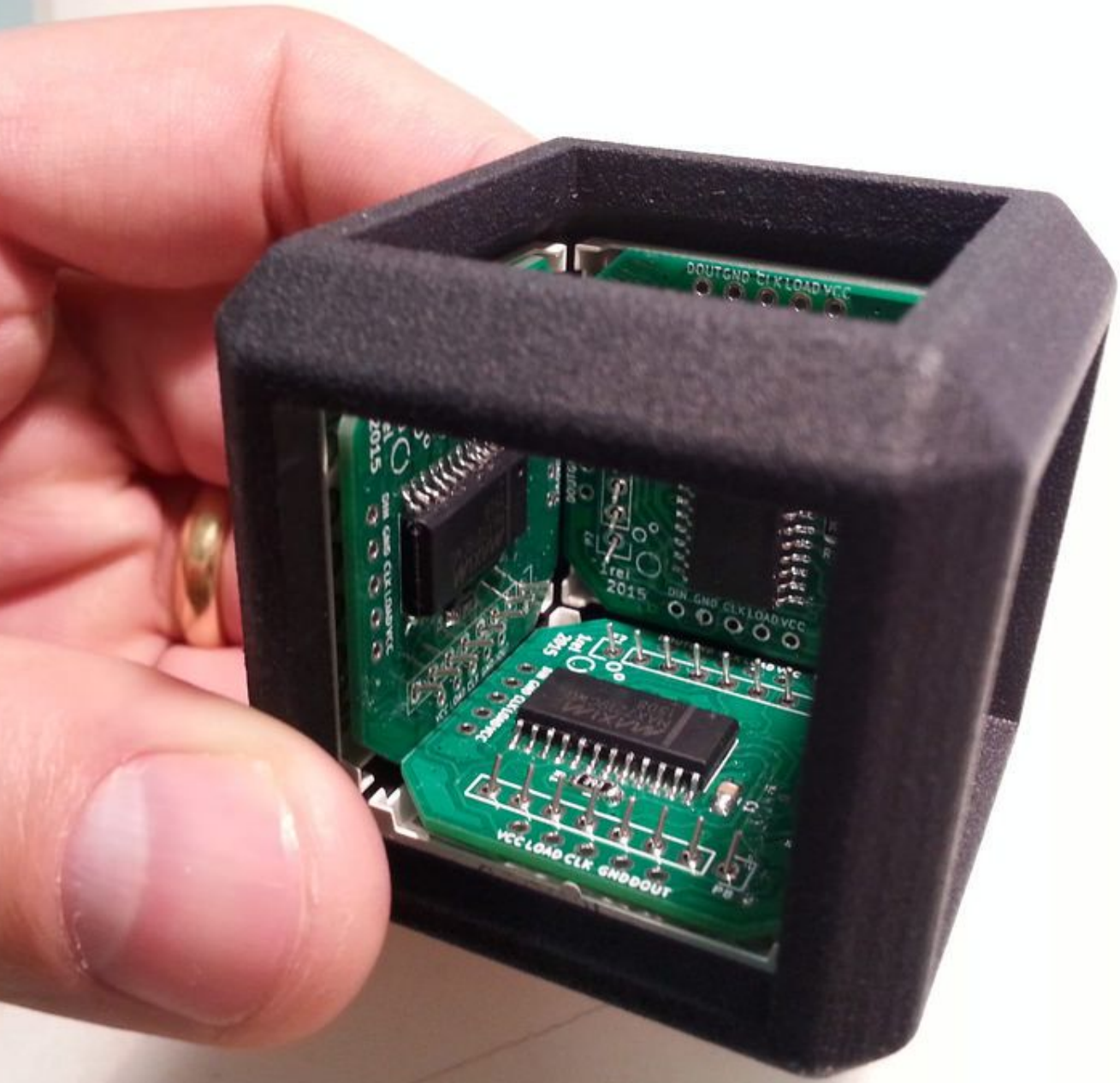
Thing Info

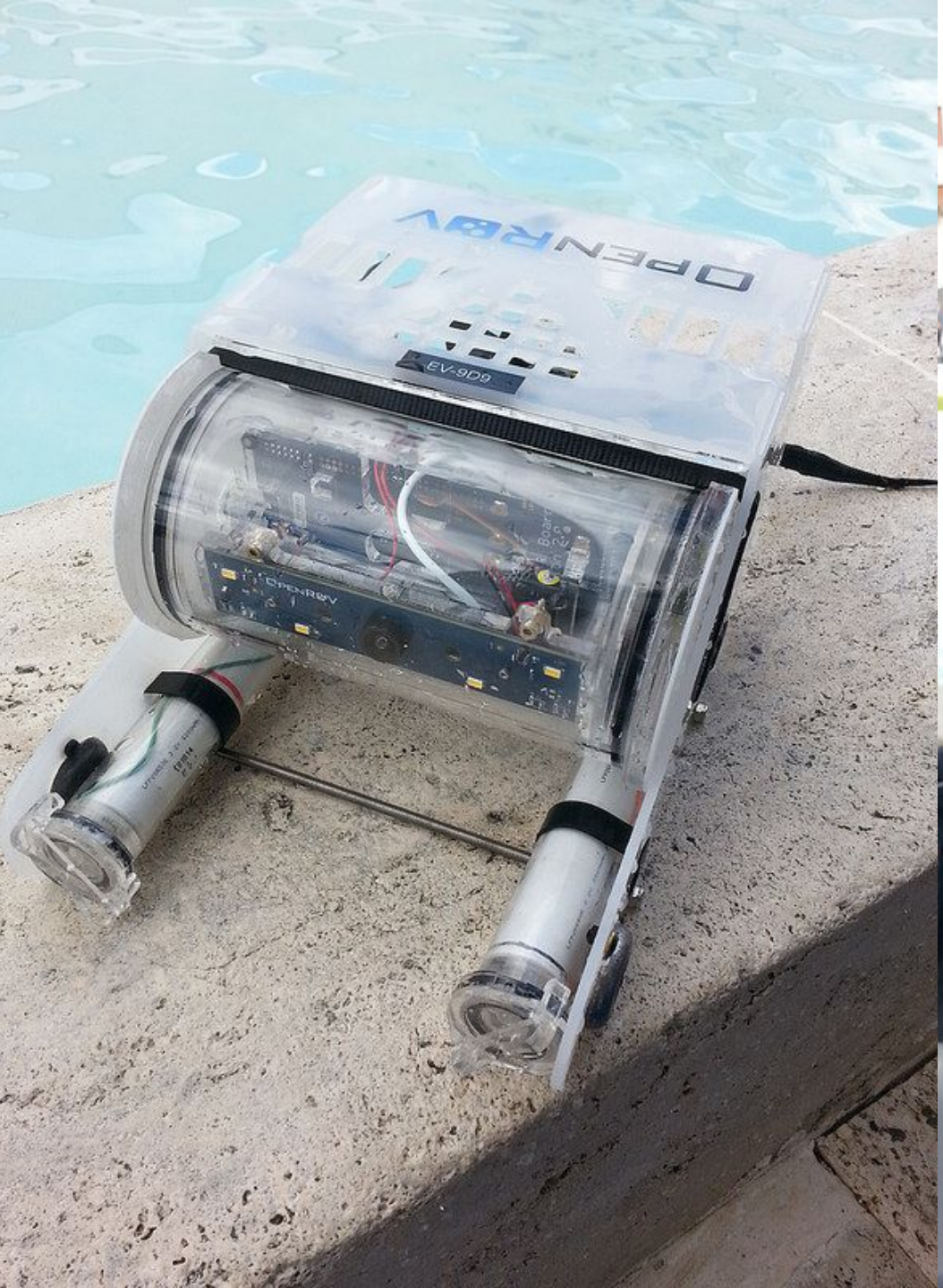
1072 Views

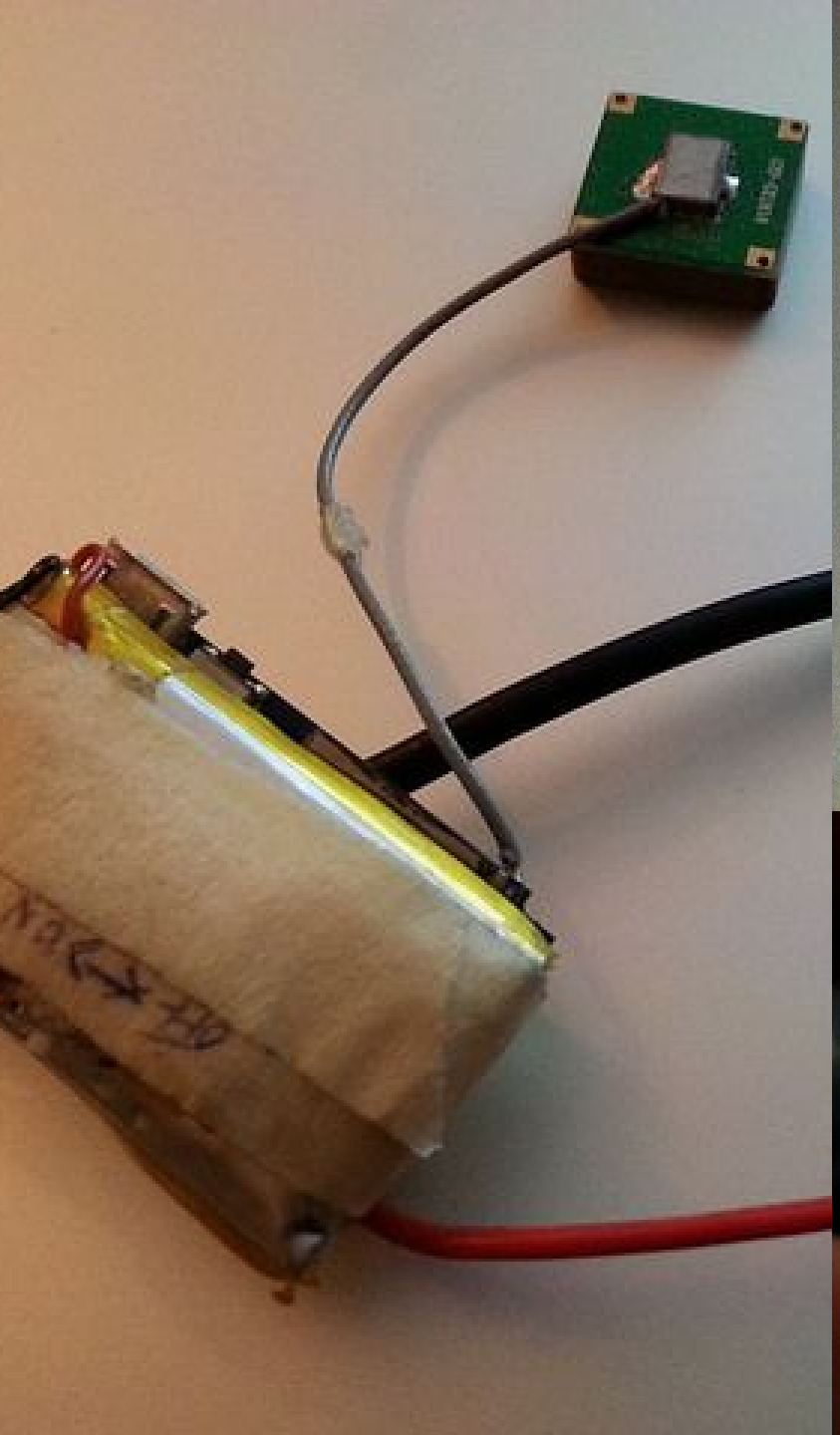
272 Downloads

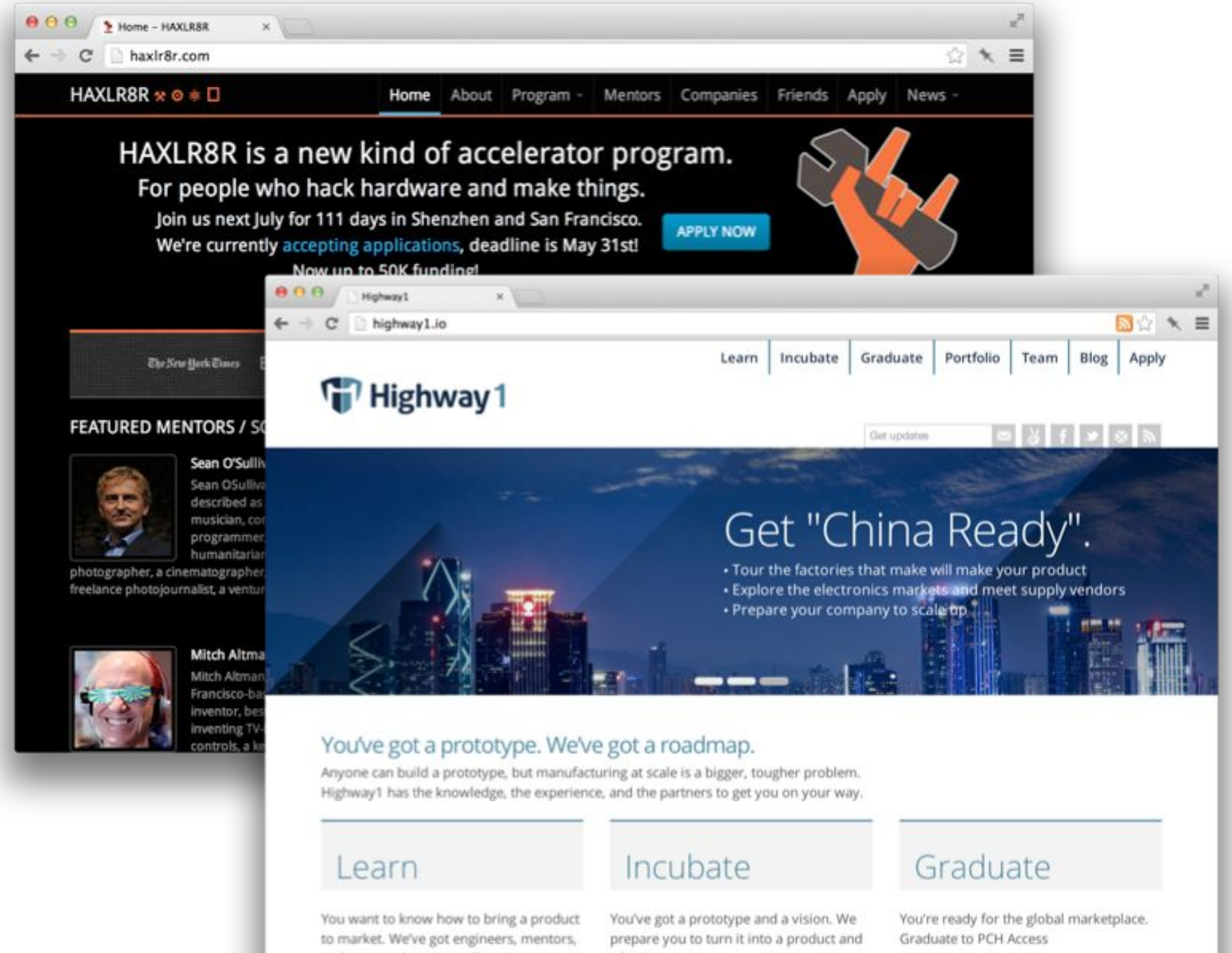
From prototype to product







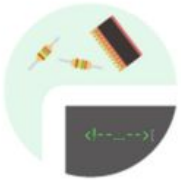



Home – HAXLR8R
haxlr8r.com
HAXLR8R
Home
About
Program
Mentors
Companies
Friends
Apply
News
HAXLR8R is a new kind of accelerator program.
For people who hack hardware and make things.
Join us next July for 111 days in Shenzhen and San Francisco.
We're currently accepting applications, deadline is May 31st!
Now up to 50K funding!
APPLY NOW
The New York Times
FEATURED MENTORS / SC
Sean O'Sulliv
Sean OSulliva
described as
musician, co
programmer
humanitarian
photographer, a cinematographer
freelance photojournalist, a ventur
Mitch Altma
Mitch Altman
Francisco-ba
inventor, bes
inventing TV-
controls, a ke
Highway1
highway1.io
Learn
Incubate
Graduate
Portfolio
Team
Blog
Apply
Highway 1
Get updates
Get "China Ready".
• Tour the factories that make will make your product
• Explore the electronics markets and meet supply vendors
• Prepare your company to scale up
You've got a prototype. We've got a roadmap.
Anyone can build a prototype, but manufacturing at scale is a bigger, tougher problem.
Highway1 has the knowledge, the experience, and the partners to get you on your way.
Learn
You want to know how to bring a product to market. We've got engineers, mentors,
Incubate
You've got a prototype and a vision. We prepare you to turn it into a product and
Graduate
You're ready for the global marketplace. Graduate to PCH Access

Seeed Studio Propagate is

Thomas

www.seeedstudio.com/propagate/



Codesign&Prototype（0.1→1）

ODM/ Prototyping /Open Parts Library recommendation

New product integration (1→100)

Design for manufacture/Engineering introduction/Testing developing and introduction

Agile manufacture（100→10000）

Sourcing/OPL/Project management/Quality control

Maker-Friendly Supply chain

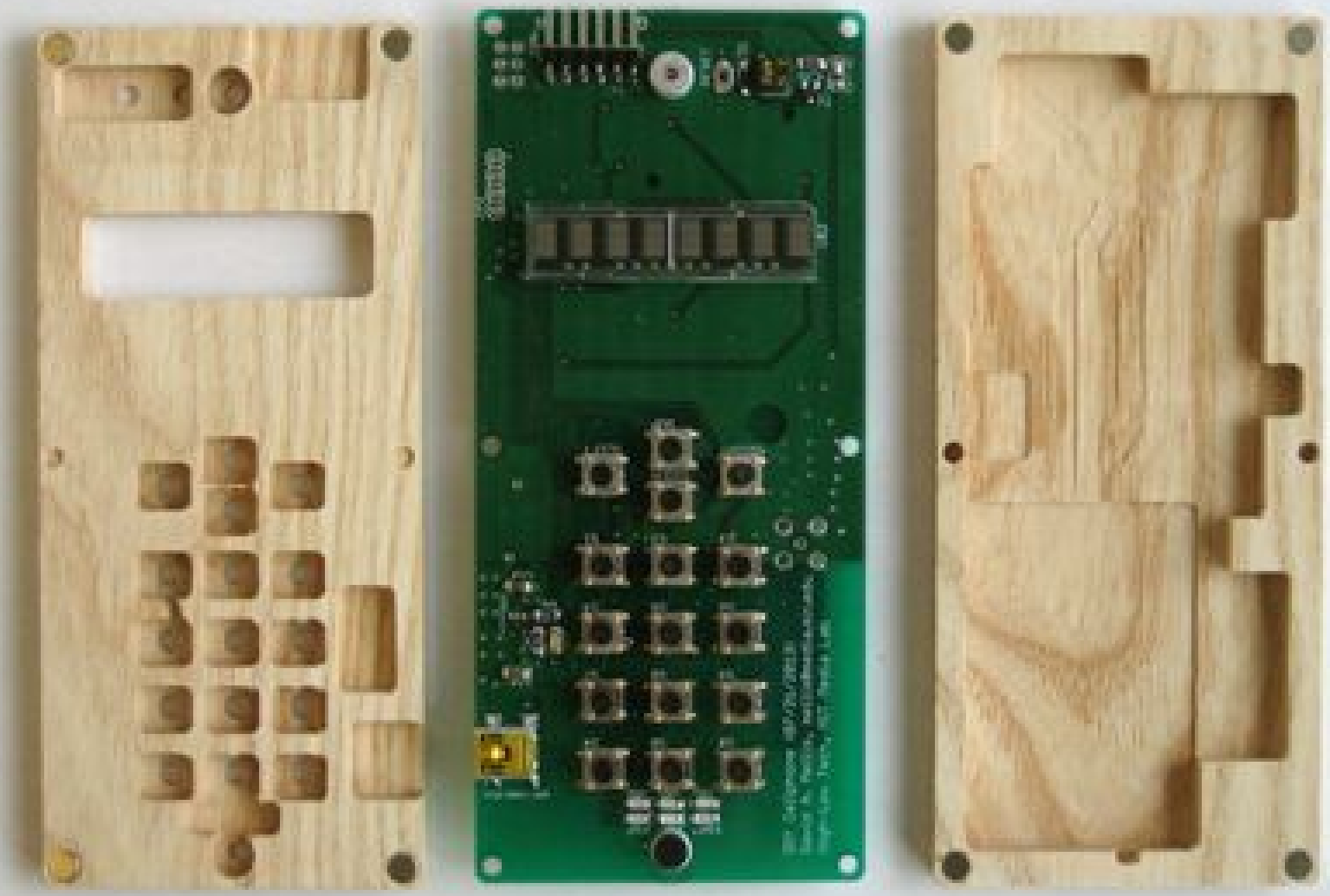
Sales on Bazaar/Banner promotion / Distributor/Drop shipping

Decentralised production at any Fablab

3D printer, laser-cutter, CNC are standard tools

User creates or downloads a design, then just presses a button, accuracy is handled by the tool, complexity has no extra cost

What was built at a Fablab, can be (re-)produced at any other Fablab



Thanks for your time

thomas.amberg@yaler.net

twitter.com/tamberg

yaler.net

Slides are online → **goo.gl/tlb5uk**