

'Binary' starts with a 'Bee'

Measuring a hive

Presented by j.jakim
10/12/18

Hive management

“You can’t manage what you can’t measure.”

- W. Edwards Deming

How do you know your hive is ‘OK’?

Count the bees - too hard, too detailed.

Look at one bee - not enough information.

Look at debris (storyboard) - too much delay.

Measure the harvest - just *once* a year??

Lift the hive - not ‘calibrated’ - gut feel.

Open the hive - every week?, day?, hour?

If you could, what to ‘measure’?

Weight?

Temperature?

Humidity?

Sound?

Smell?

Shock (bear attack)?

????

What's it worth?

If a 'package' or 'nuc' costs \$175-200...
What would you pay to prevent it's loss?
\$0? (I caught a swarm.)
\$175 (What I paid.)
\$250 (Cost of wood.)
\$\$\$

Back up a second....

What do the ‘pros’ do?

- Commercial operators expect losses.
- Universities spend unlimited cash for research.
- Hobbyists are left out in the cold.

TMI !

Ok, there are too many variables here.

So,

Today I will focus on weight.

(With a short shoutout to temperature.)

What does a bee weigh?

- .00025lbs or 4,000 for a pound.
- A full honey super (deep Langstroth) is upwards of 50lbs.
- A full Langstroth or TBH can be easily a couple hundred.

'Old School'

'Feed Scales'



Bathroom Scale

Needs a periscope.
Not weather
resistant.

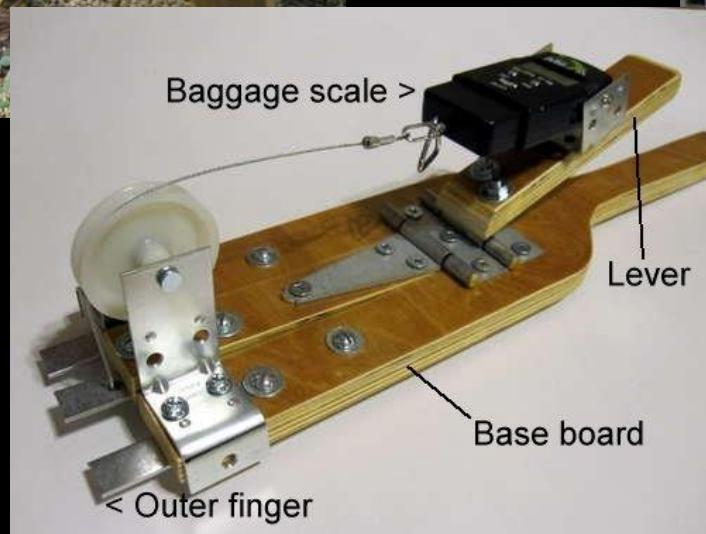


What else is heavy?

Luggage!

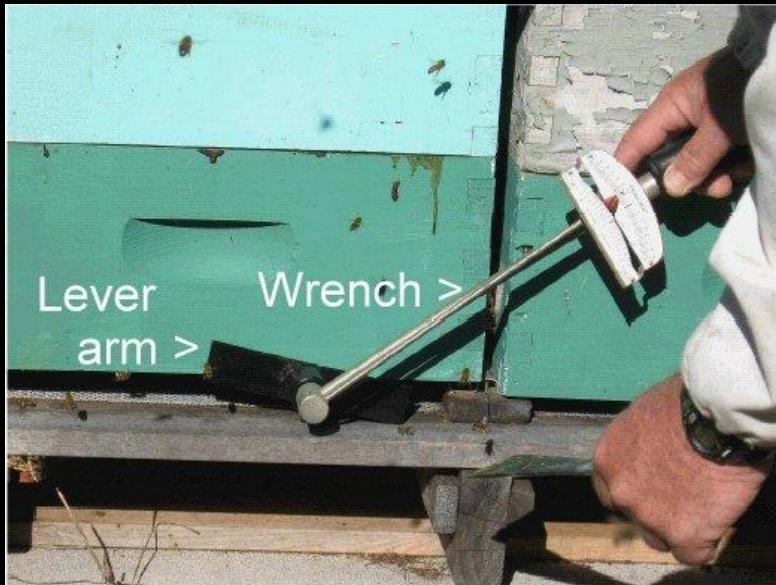


source:
Makezine

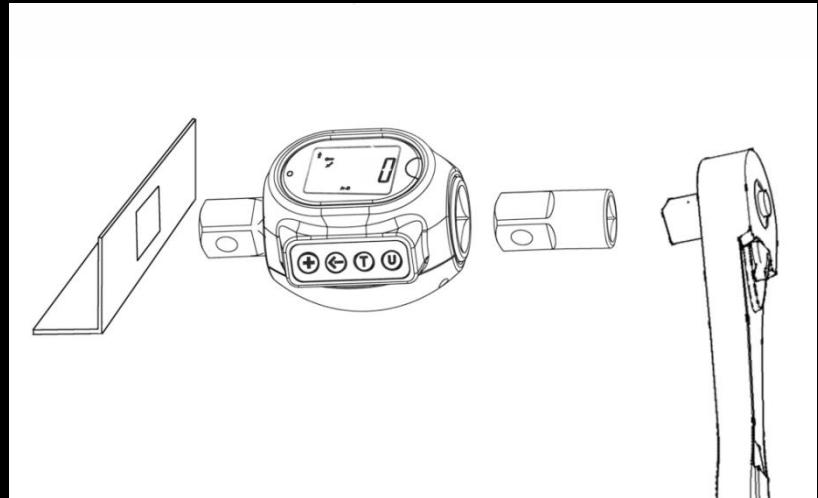


What ‘tools’ could we use?

Torque wrench?



Nectar Detector - \$125



What's out there?

Solutionbee - B-have - ~\$450 (est.)

<http://seedstock.com/2014/07/23/students-develop-commercial-hive-sensor-to-allow-keepers-to-bee-informed/>

Brushy Mountain Hive scale - \$525 (1 hive)

<http://www.brushymountainbeefarm.com/Hive-Scale/productinfo/714/>

Ames TCM-13 - \$467.20 (~conv. euros)

http://www.ames.si/eng/cat/products/tcm_13_measurement_station_for_honey_collection_control/l:2

WiFi Bees \$330 (incl ship - failed fundraiser)

<https://www.indiegogo.com/projects/wifi-bees-hive-scale-and-smartphone-app#/story>

BroodMinder \$179 (½ hive)

<http://broodminder.com/#BroodMinder-W>

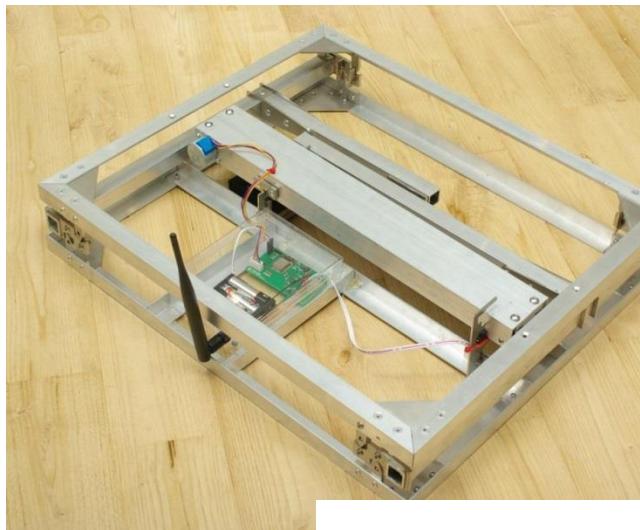
Ok, there has to be a better way!



A variety of ‘Scale-looking’ scales.



And remote read scales:



Why?

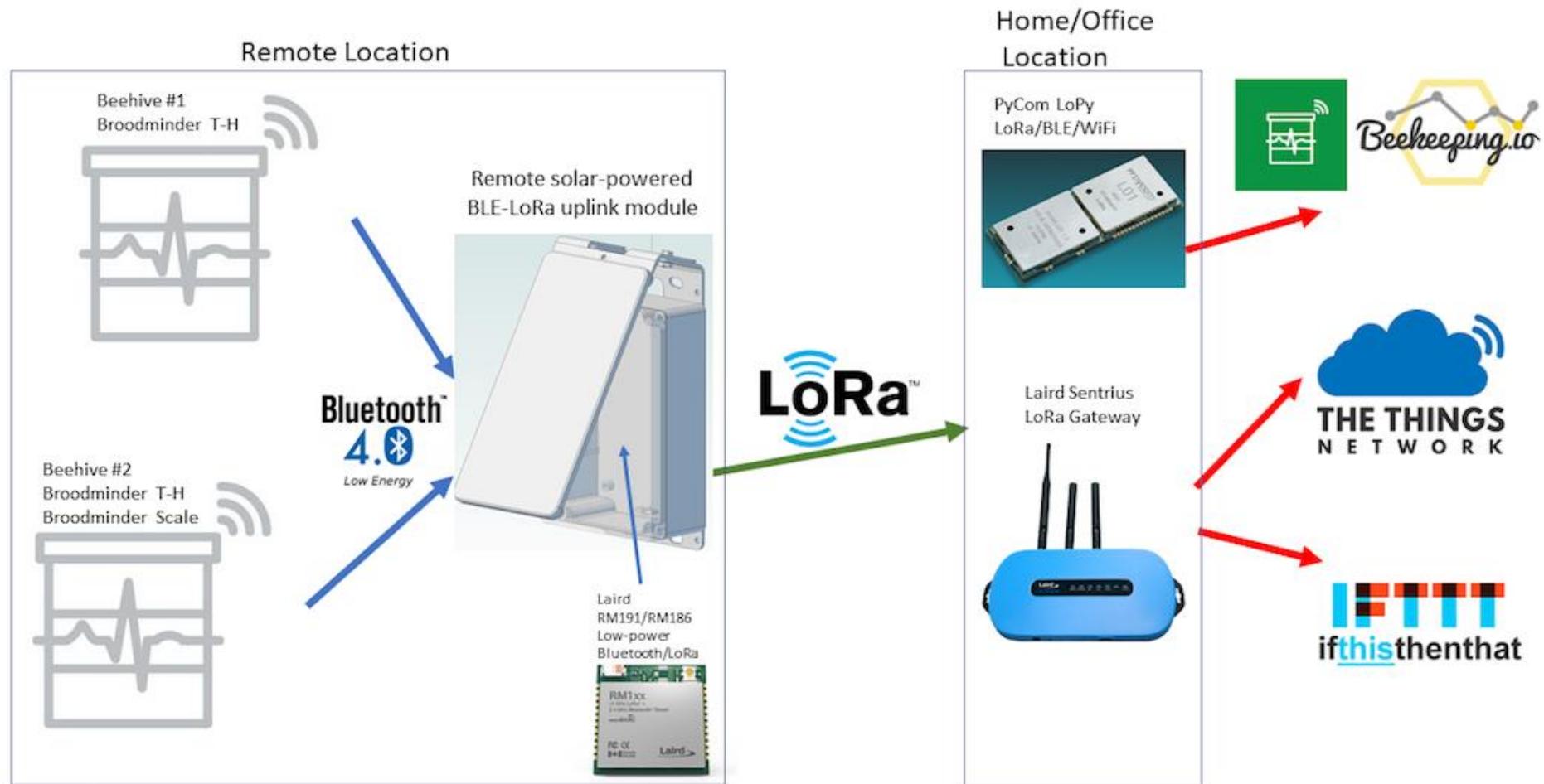
- Can determine a swarm (in the past)
- Can determine when the flow is on.
- Lost queen

OK, I'm sold. How do I buy one?



How much do you want?

Beehive data uplink Topology



Arnia

- Data subscription required for remote monitoring and alerts at \$5 – \$10 per month (multi network SIM card supplied). This charge does not apply if data is downloaded locally.
- Cost
- \$380 for first scale including the data transfer unit. Each additional scale afterwards is \$300

BeeBot
\$189 + \$18/yr

- Monthly
 - \$2⁰⁰*monthly*
- Yearly
 - \$18⁰⁰*yearly*



SolutionBee

\$267 (Brushy Mtn)



ApiScale

95 Euro (\$110)

- Best price – in Slovenia....



BroodMinder

\$179



BROODMINDER

Every Hive Counts

Just a scale
Couple hundred.

- Mann Lake had one in the on-line catalog, two or three hundred, but it is no longer listed.
- Brushy Mountain's offering mentions that the current offering is greatly reduced!
- Most looked like mailing scales.

Why can't I just use a bathroom scale?

- electronic shut-off
- periscope and a scale.



Another bathroom application.

<https://www.slideshare.net/frank.linton/fast-cheap-hive-scale>

(sorry, I tried to integrate into this slide-show,
the author has disabled that ability.)

Alright, so what do we have?

- Cheap (& sometimes rinky-tink) manual systems.
- Expensive systems with subscription fees.
- And then there is the ‘creep’ issue.

My dilemma...

- Why invest MORE than the cost of a colony to protect a colony?
 - Would you pay more than the value of your car in auto insurance?
 - Would you pay more than the value of your washing machine for a service policy?

Some history.....

“An early goal of Hivetool was to develop a \$50 scale. A developers kit to get beta units in the field for testing, gather user feedback, and provide a platform to foster open source community development is available at cost plus a voluntary contribution.”

Hivetool website South Carolina Hive Instrumentation Project

I

So what does it take?

- Something to change weight to (voltage, deflection,... something measurable)
- Something to convert that deflection/voltage into a storable form & then store it.
- Somehow display this collected information.

Display it.

- Starting at the ends.– Excel or Google Docs can draw great graphs, but not on the web.
- The web has a variety of graphing tools from simple to complex.
- So there are a variety of (FREE) graphing tools out there.
- (This is the easy part – presentation.)

Measure it.

- Converting the deflection – let's look at the sensor first.

Load cells

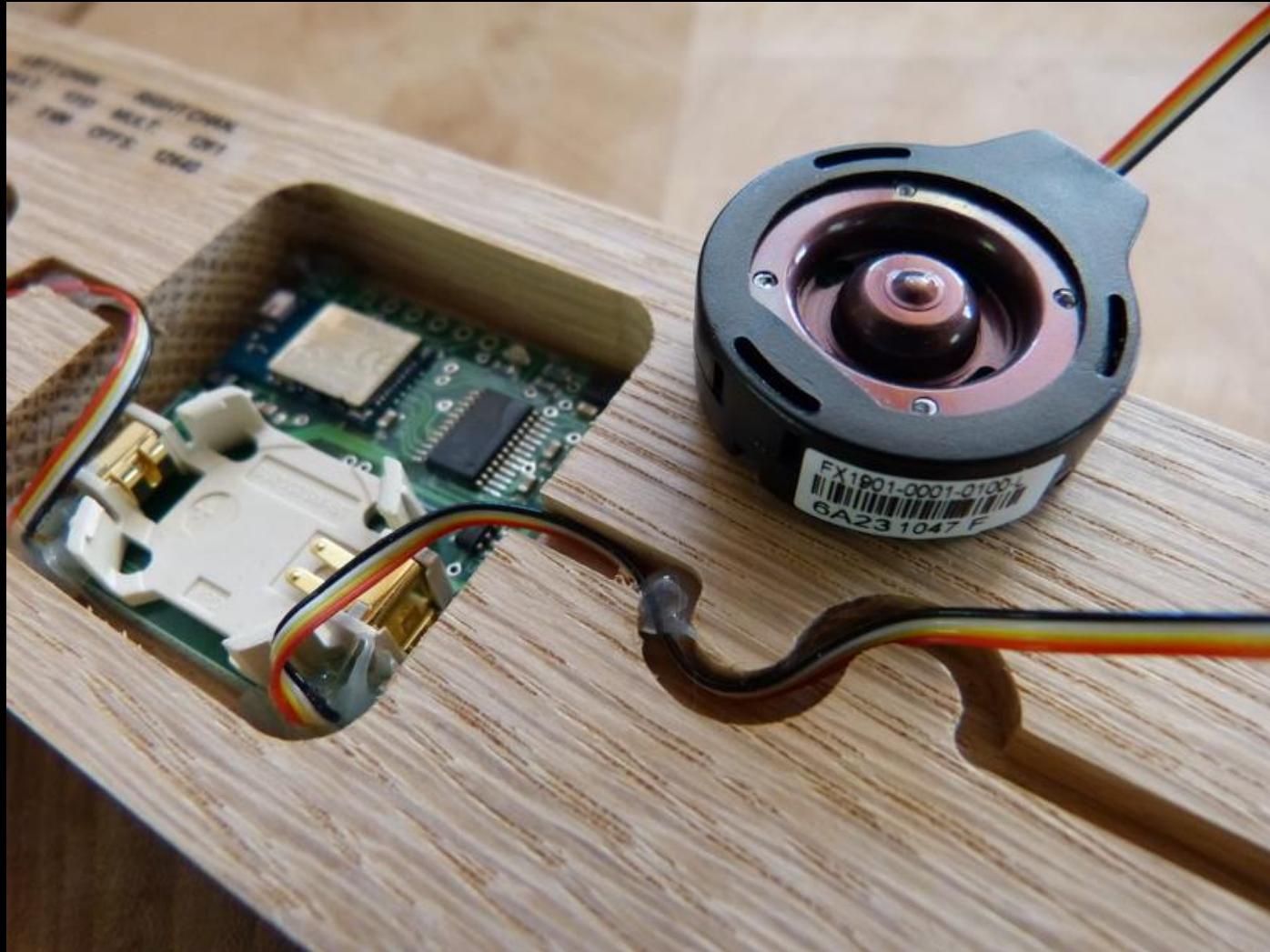
- The go-to tool for industrial to personal weight measurement.
- In principle; weight stretches the material, a wire has been bonded to this material.
- As the wire stretches, it gets thinner. When a wire gets thinner, it is harder for electricity to flow through it.
- We can measure this ‘resistance’ change.

Hivetool sells a set of load cells for \$50
(there is the whole budget)

http://hivetool.org/dev_kit_order.pl



BroodMinder cells



Another source

- I bought a ‘spiderman’ bathroom scale at Fry’s for \$18. It contained four load cells Weight limit of 350lbs, should be enough.
- I also bought an Ikea Grundtal scale – it’s not on sale any more.

Got a signal, now what?

- Ok, the output signal is dinky, like REAL dinky!
- So you will need an amplifier.
 - The HX711 amplifies, digitizes, all for \$1.50
 - Available on Amazon or ebay.

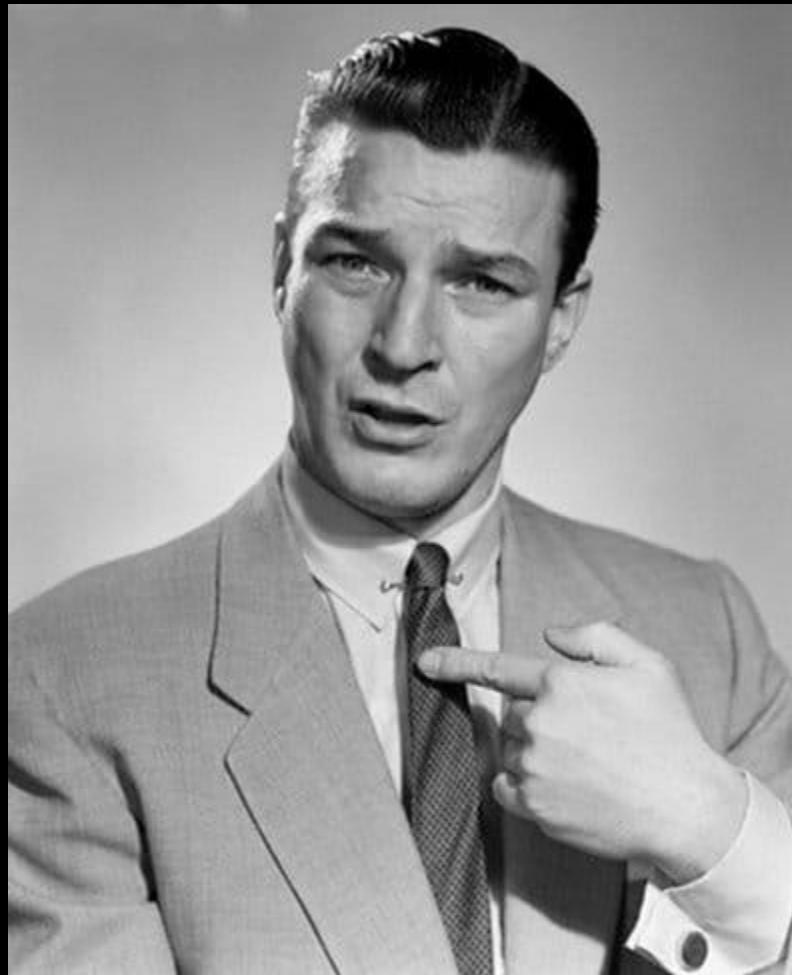
Smarts?

- Now we have a way to convert the weight, and a way to present it, we still need a controller and storage device.
- I chose the Raspberry Pi _ about \$35. It's a full fledged computer.

Down to (a) zero.

- An Update: IF you are willing to pass on the networking capabilities and just STORE the data...
- The RasPi Zero can be had for \$5!!! NOW, we CAN have a \$50 scale.

Alright enough Theory, What did I do?



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Rev1 (with Ikea elements)

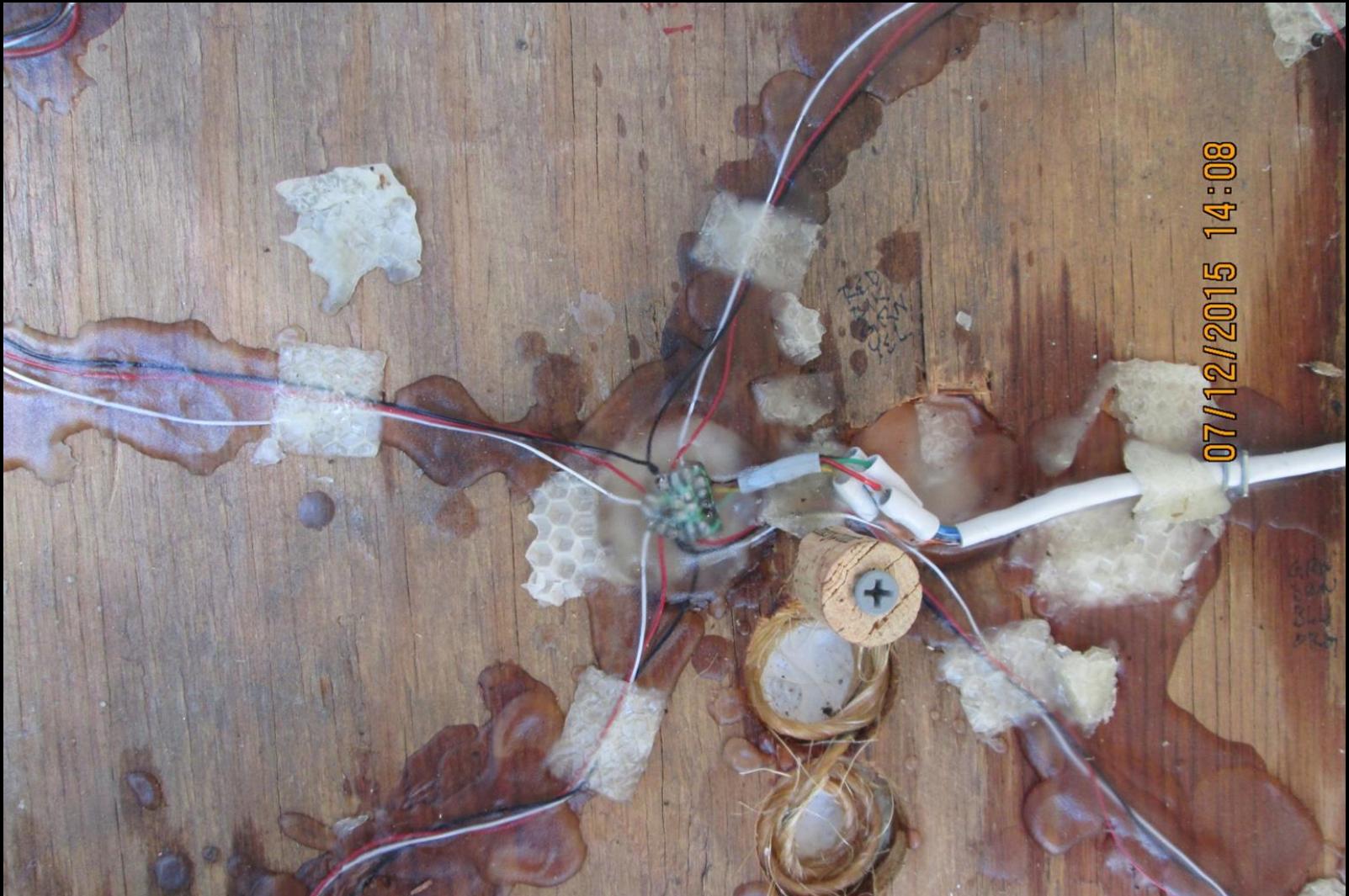




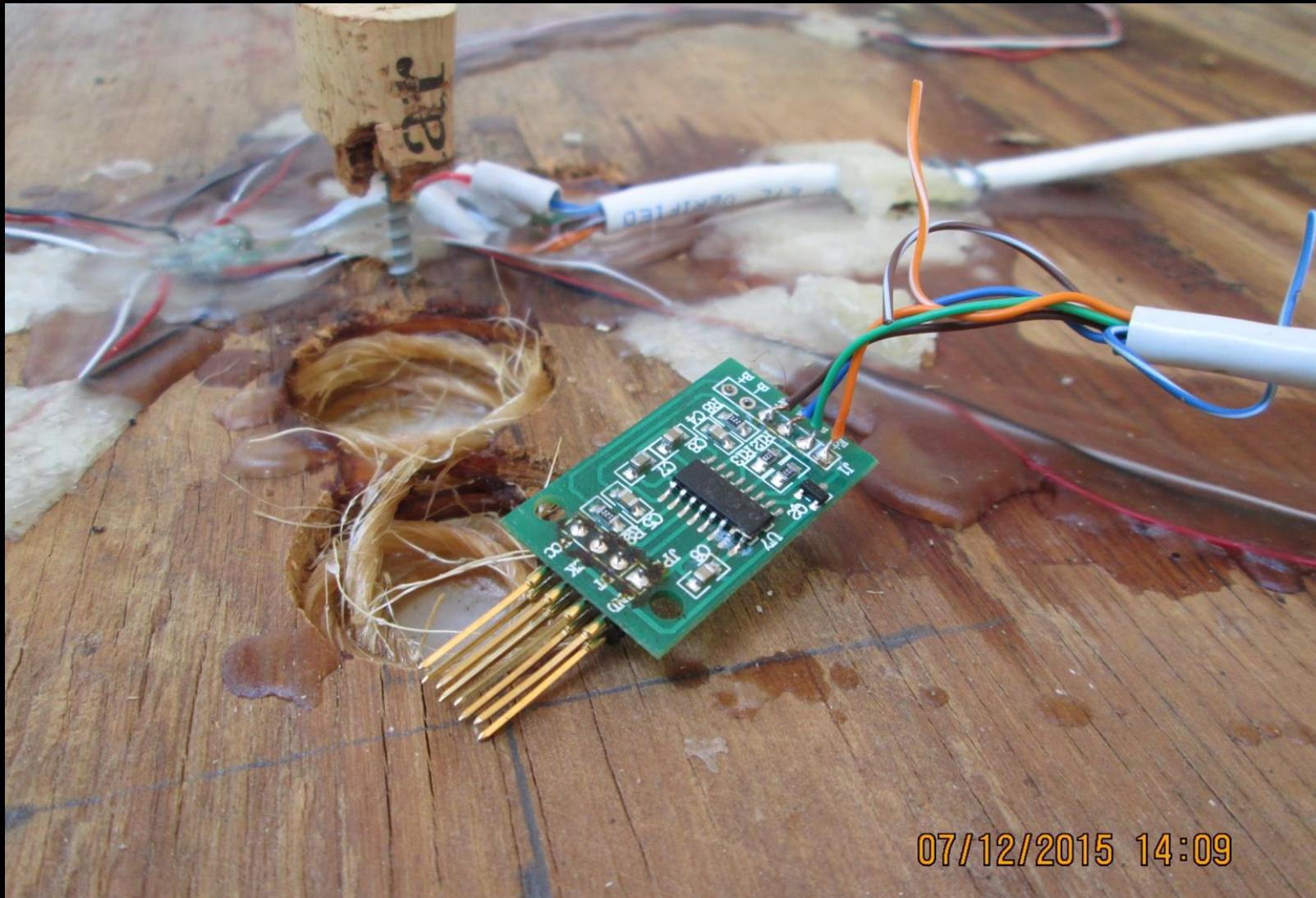
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Close up on wax attachments

Closeup on attachments

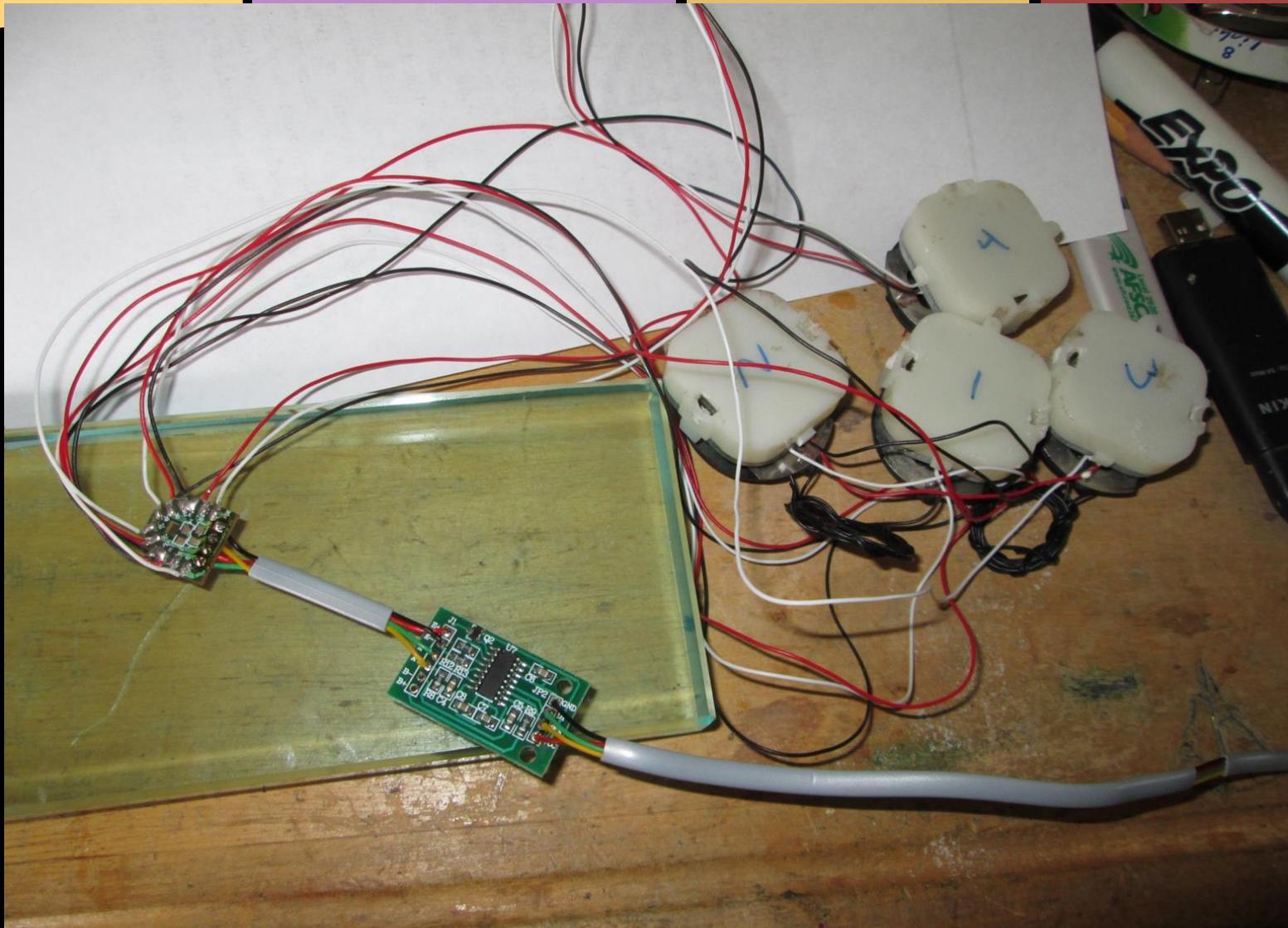


HX711 amplifier

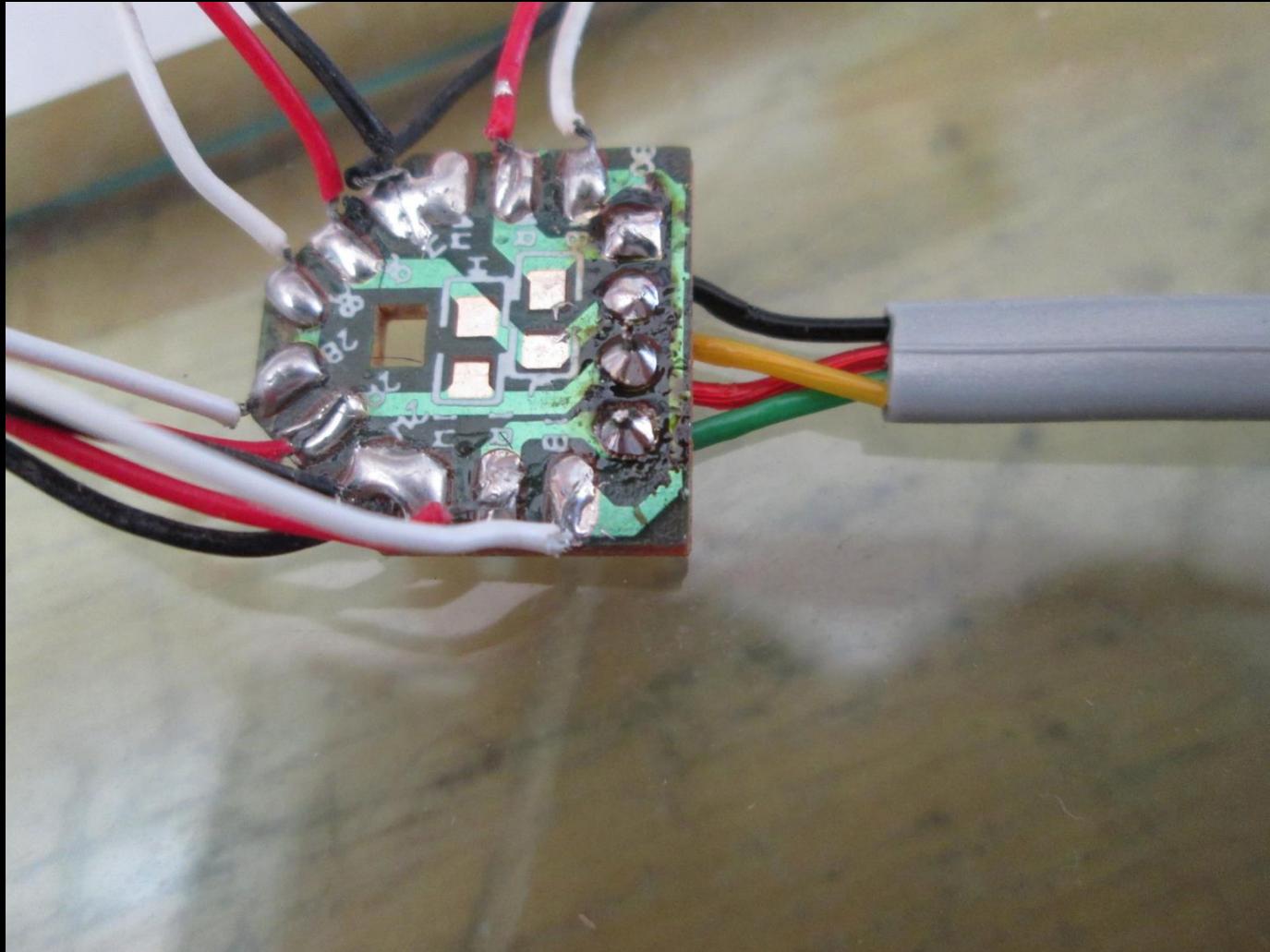


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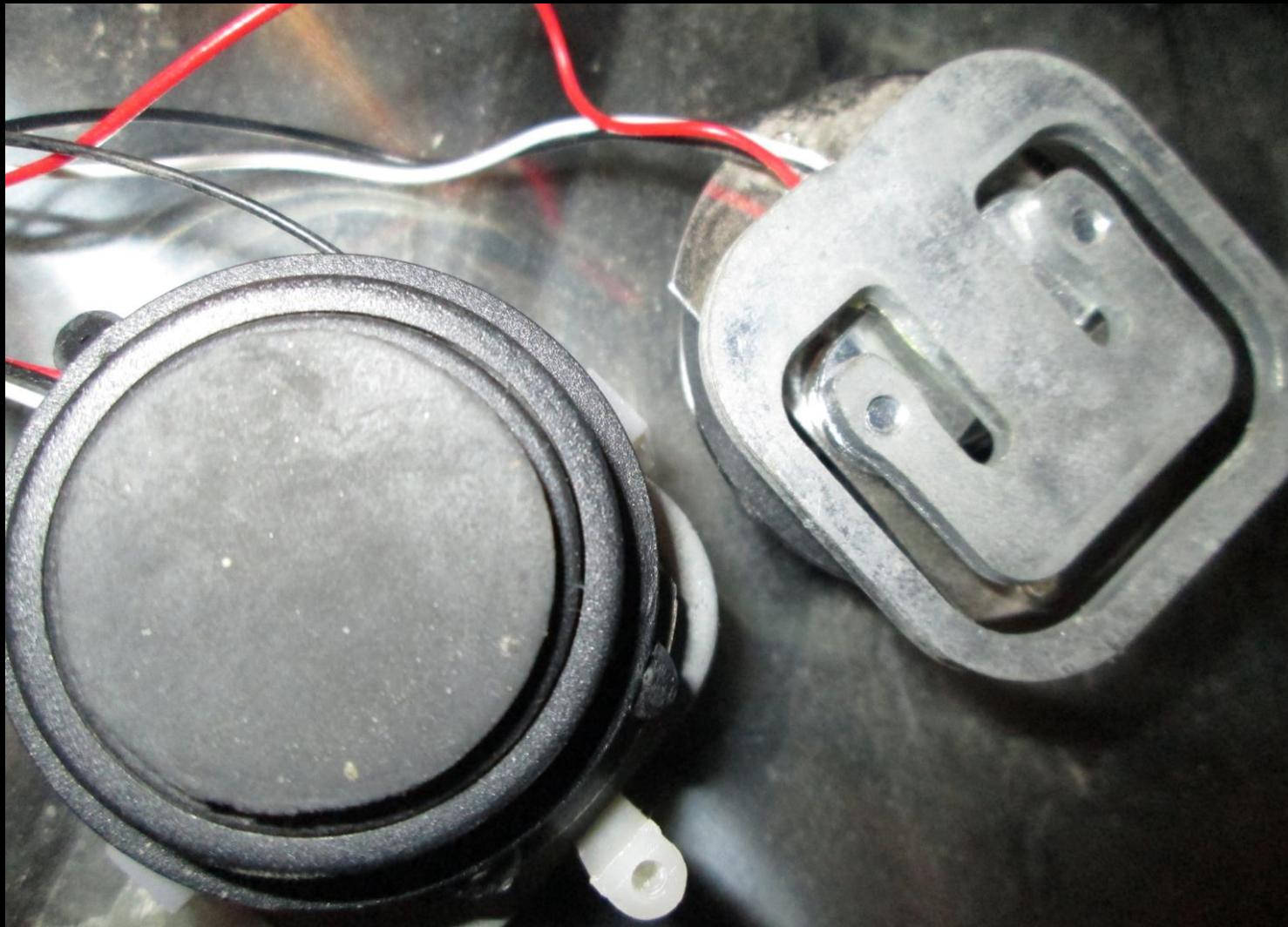
The Scale 'kit'



Wire ‘spider’



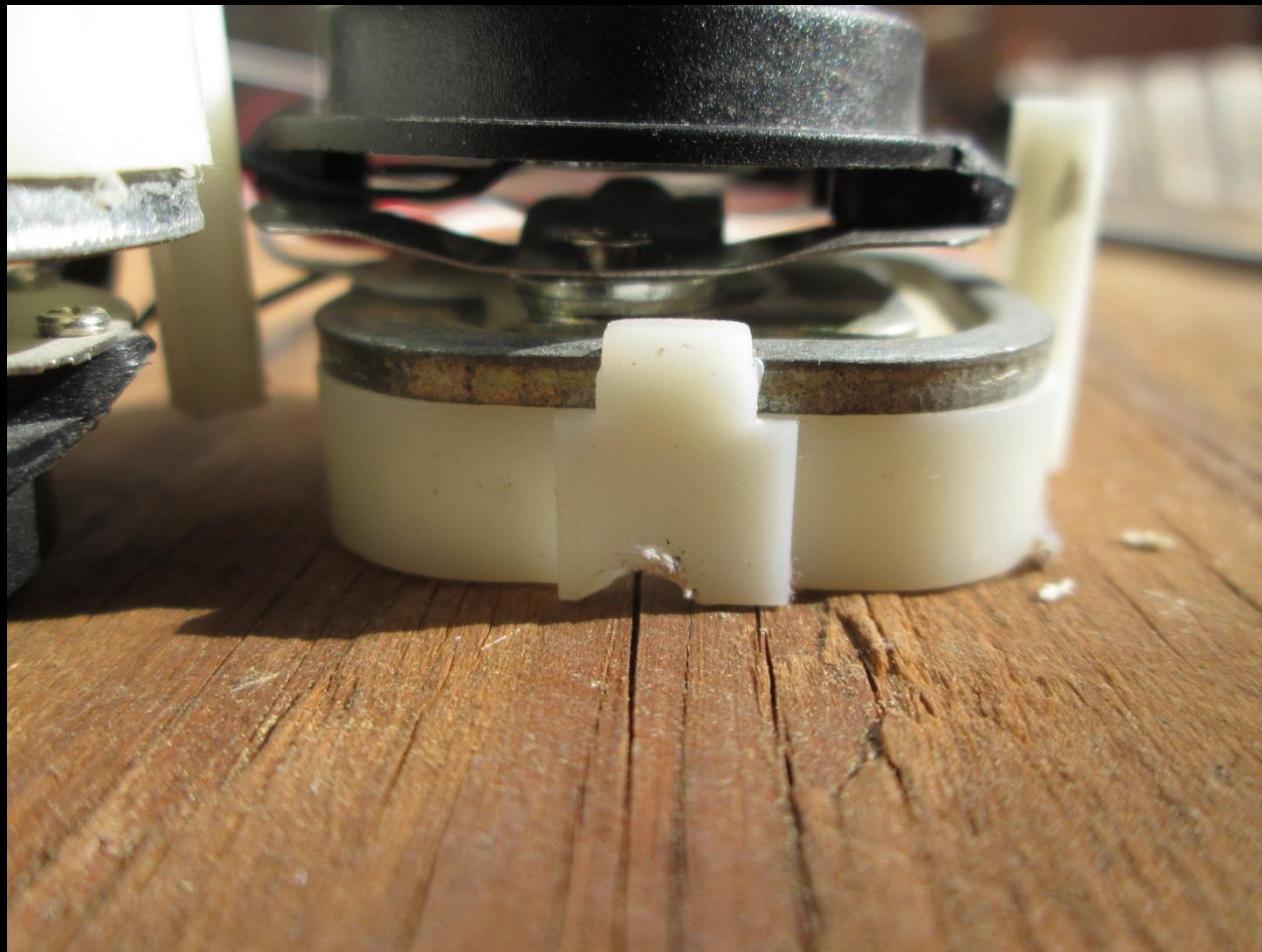
Load cells

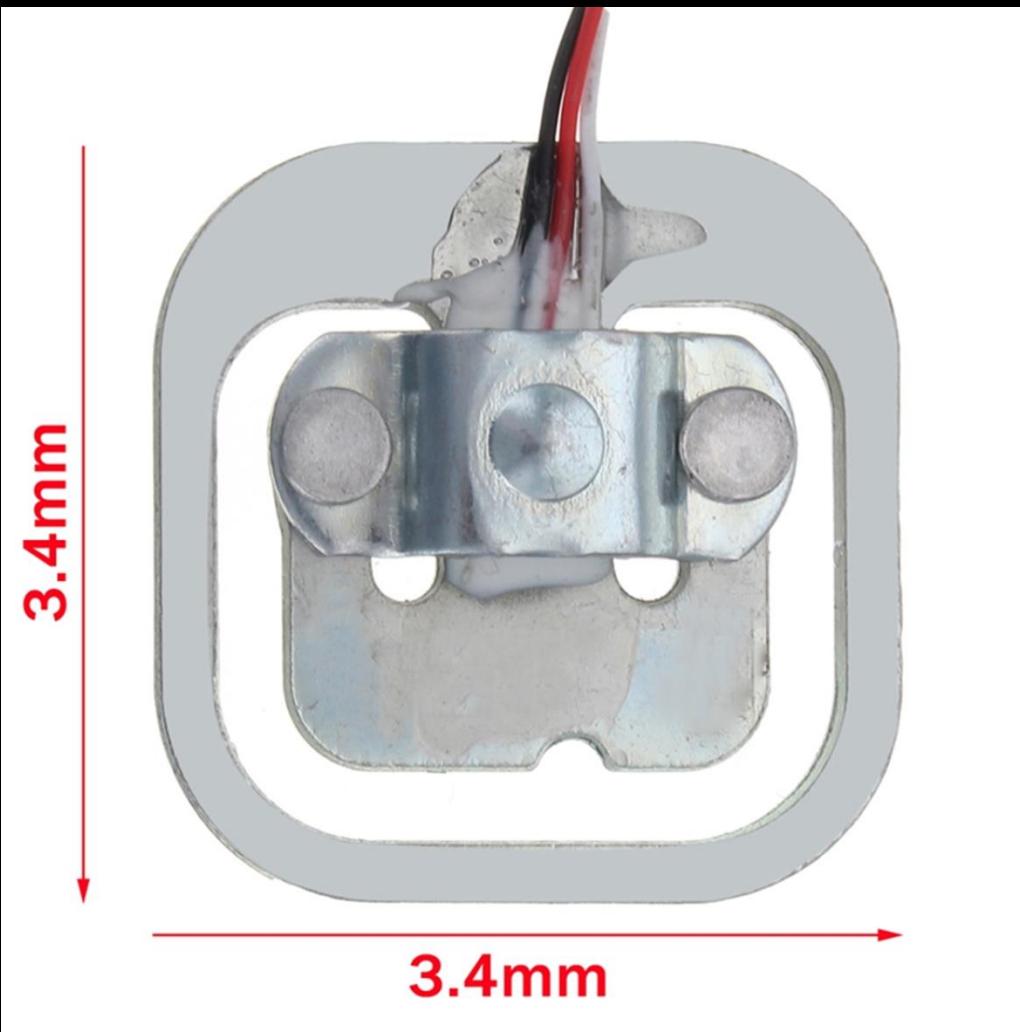


cells



Cell side view





3.4mm

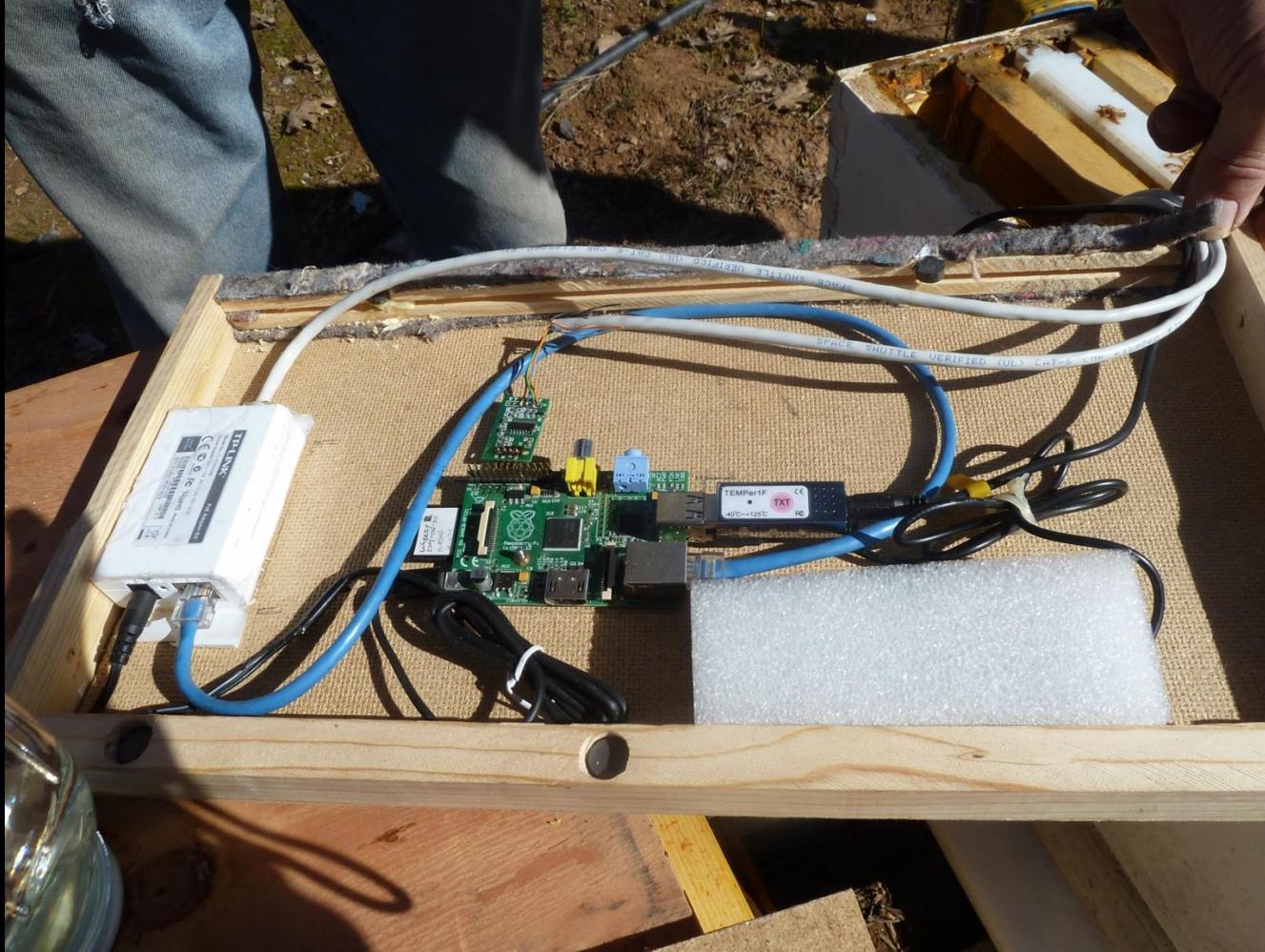
3.4mm

The 'Brains'.

Raspberry pi



Hivetul v1



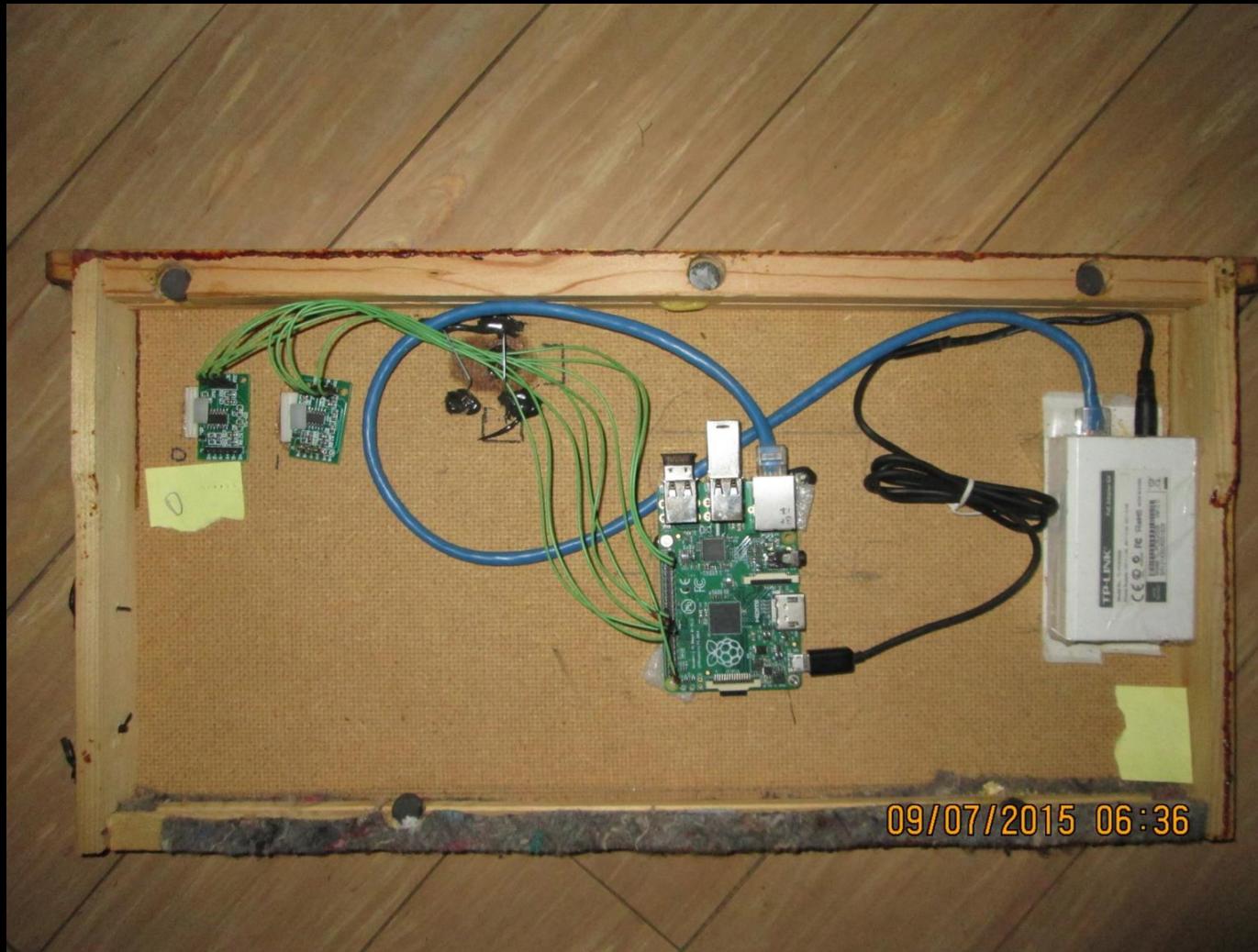
V1 hooking up



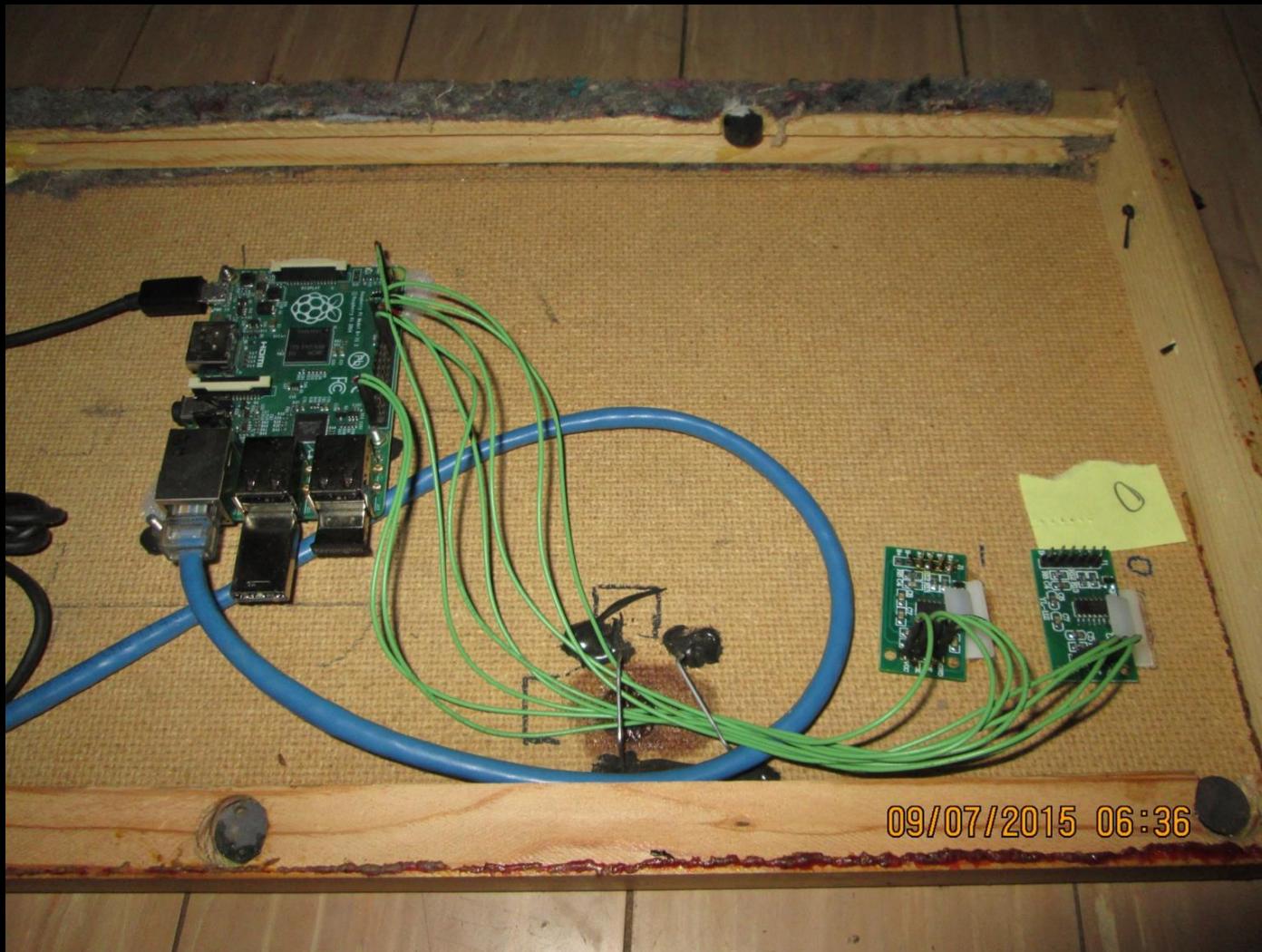
V1 installation



'DualTul' on frame



DualTul detail



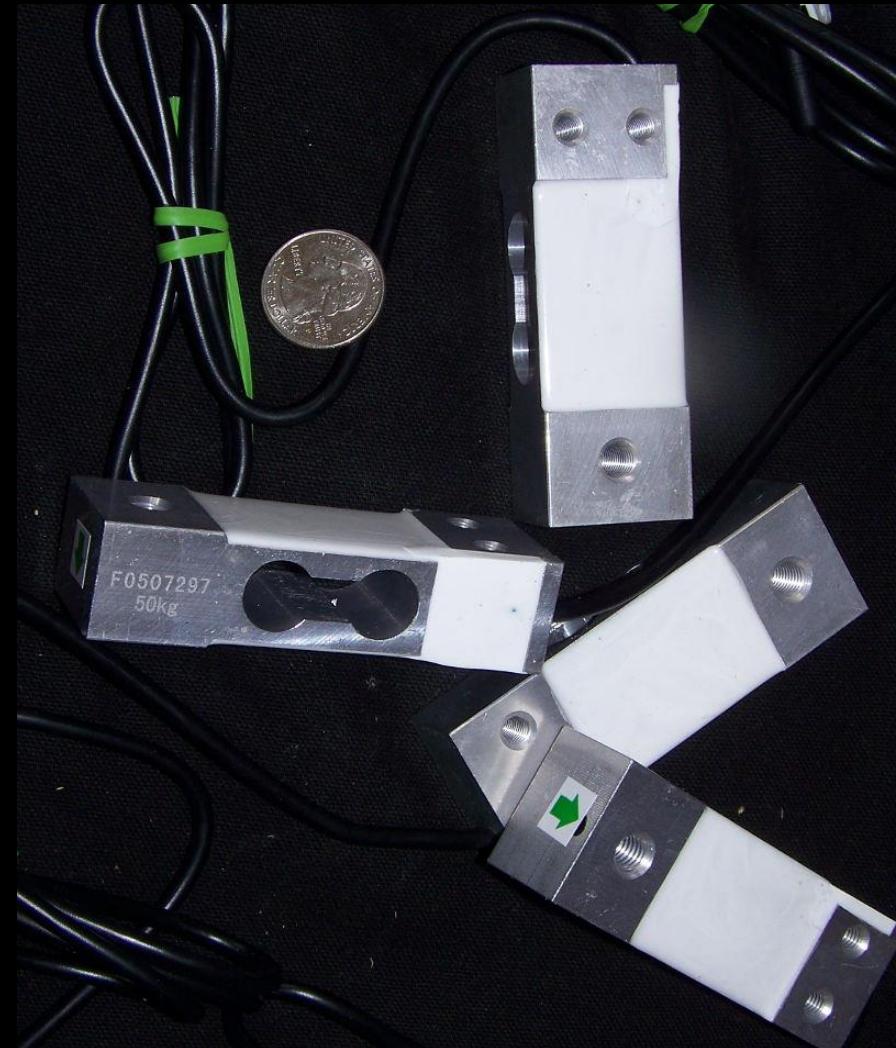
How to power this thing?

- Wired?
- Solar?
- Battery?

(Consider radio, distance from house, etc.)

Hivetool Load cells.

\$50 for the set – but
they are far more
rugged!



Software??? Code?? Perl?

The software used was Perl. It is portable to ANY processor or hardware, it is rather old (read stable), no-one ‘owns’ it, so no license issues.

It is moderately english like and doesn’t need to be ‘compiled’.

Since the Pi has a desktop, everything can be done on one box.

What does the code look like?

This is the code for collecting the data in my dual-hive-scale system.

```
#!/usr/bin/perl -w

#####
#
# v0.0.1 dualtul.pl
#
#read and store dual weights as text file
#
# v.0.0.2 changed drivepath for single drive implementation
#
#####

use strict;
use warnings;

#TODO: add log4perl

my $raw0 =0;
my $raw1 =0;
my $datestr;
my $weight0;
my $weight1;
my $cpuTemp;

# read the scales

$weight0 = `sudo /media/usbstick/www/hx711/hx711-0 1`;
$weight0 = $weight0/9200;

$weight1 = `sudo /media/usbstick/www/hx711/hx711-1 1`;
$weight1 = $weight1/7300;

$cpuTemp = `vcgencmd measure_temp`;
$cpuTemp =~ m/d+\.\d/;
$cpuTemp = $&;

# $datestr = localtime();
# $datestr = time();

# write the file
# my $csvlog = '/media/usbstick/dual-091215.csv';
my $csvlog = '/media/usbstick/www/data0.csv';
```

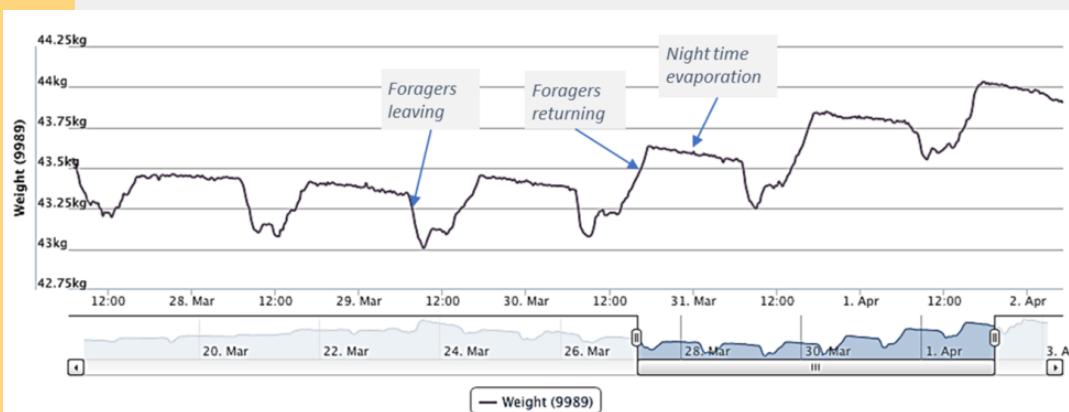
Ok, Put it together & turn it on.



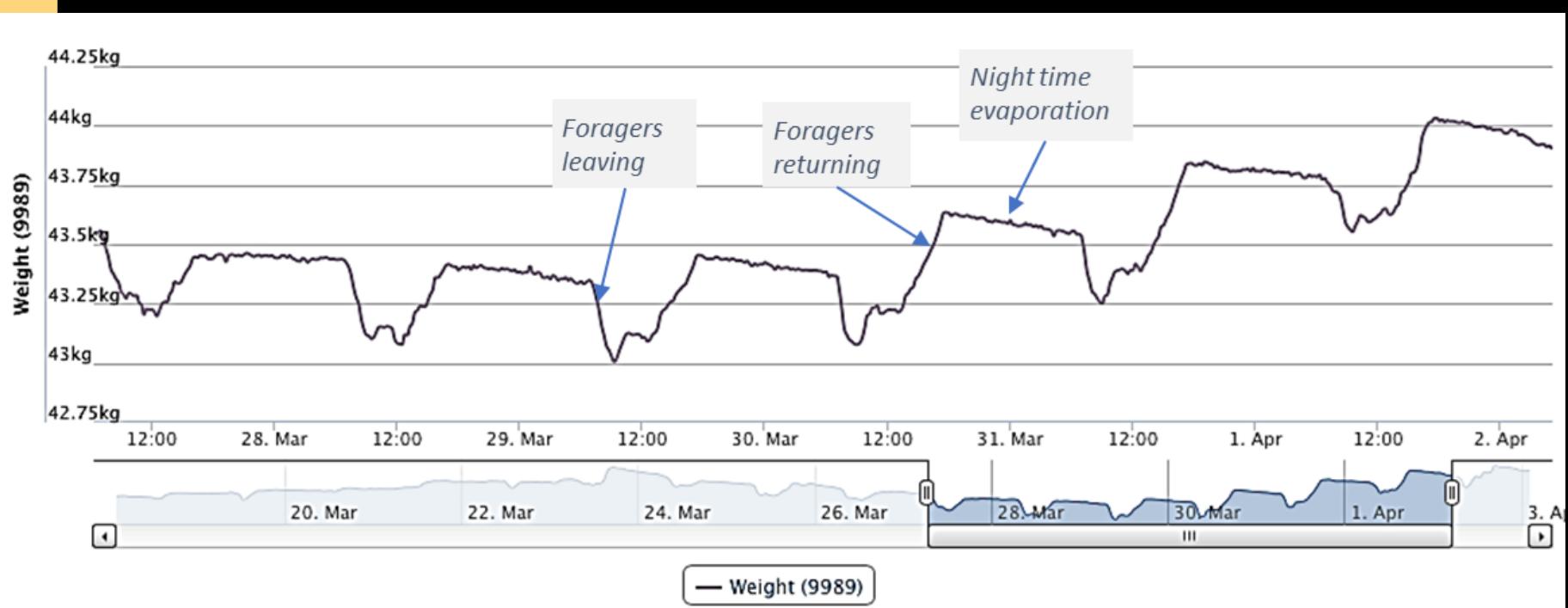
Q: What did I learn? (A: The real world is tough!)

The ideal.

My data.



Nice display (dygraph) with clean data.



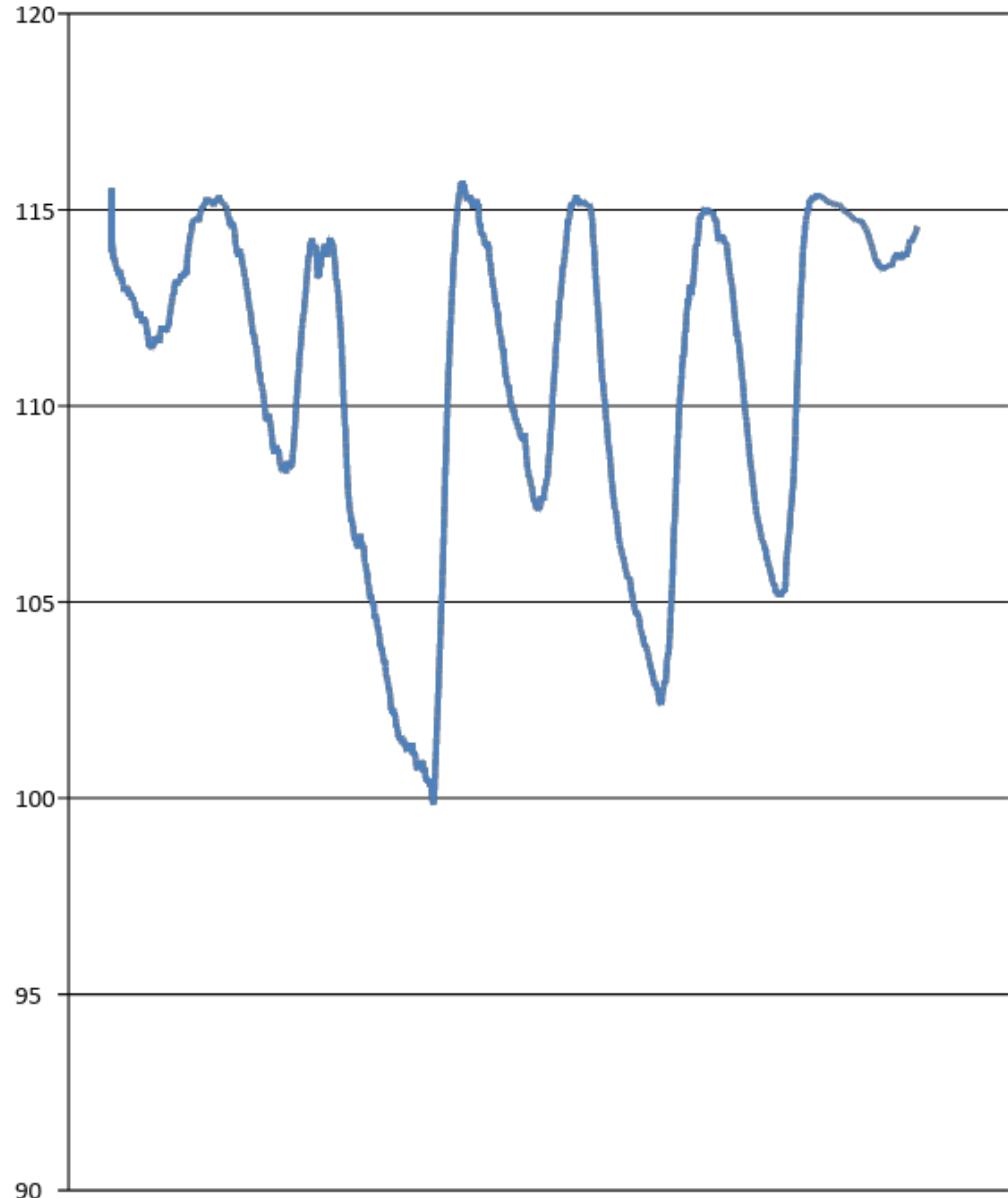
And sometimes, just more questions....

What's this mean?

Best guess, foragers went out but came back with little.

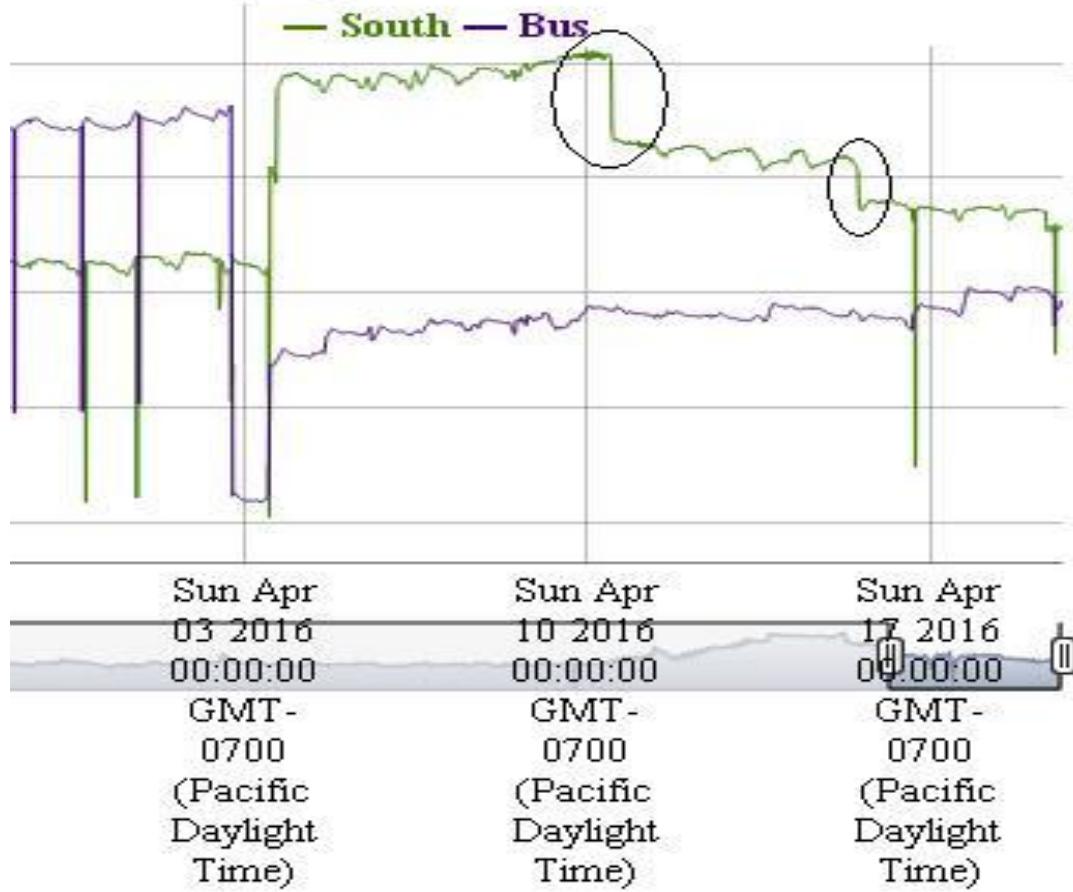
7-15 lbs of bees went out, but the hive weight did not change.

This was from early September '15.



Swarm 12 & 8 lbs.

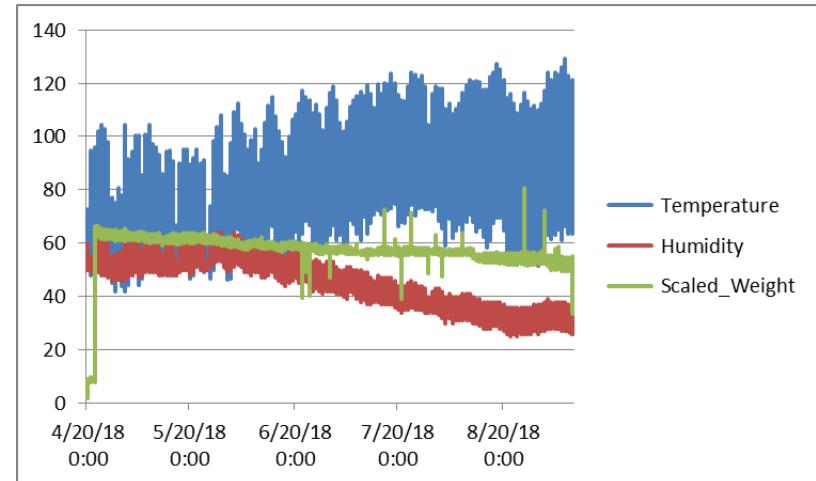
Hive weights as of



Sometimes the data is not reflective of real world.

This hive was treated for mites with MAQS.

It killed the hive. Can you tell where?

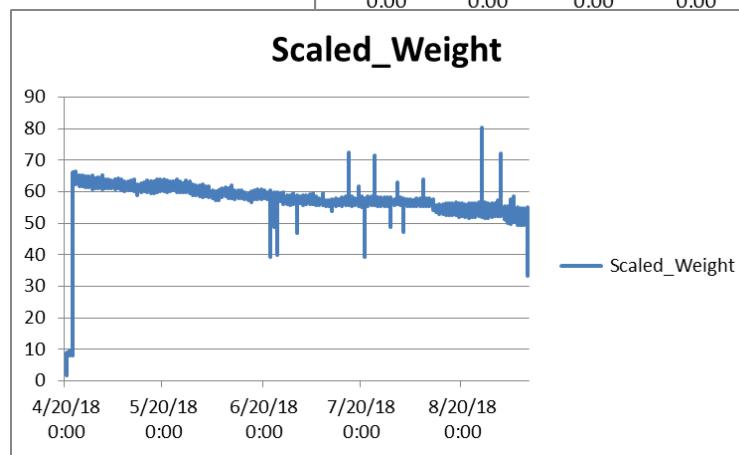
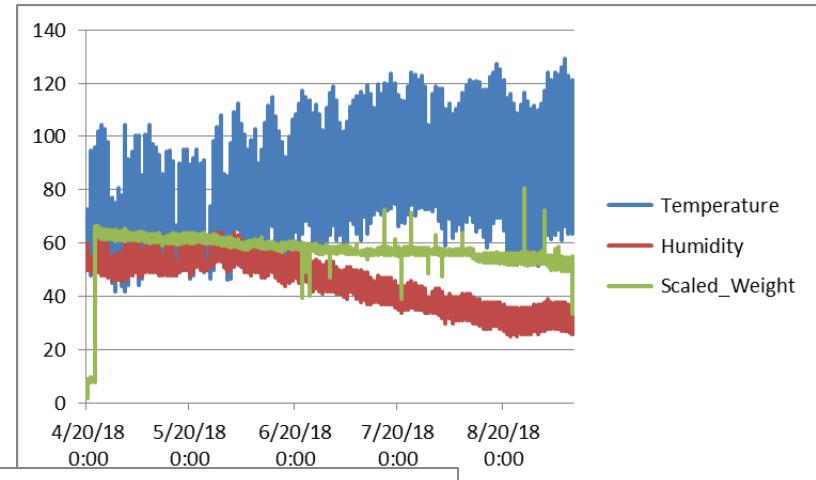


Sometimes the data is not reflective of real world.

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Let's remove the extraneous data.



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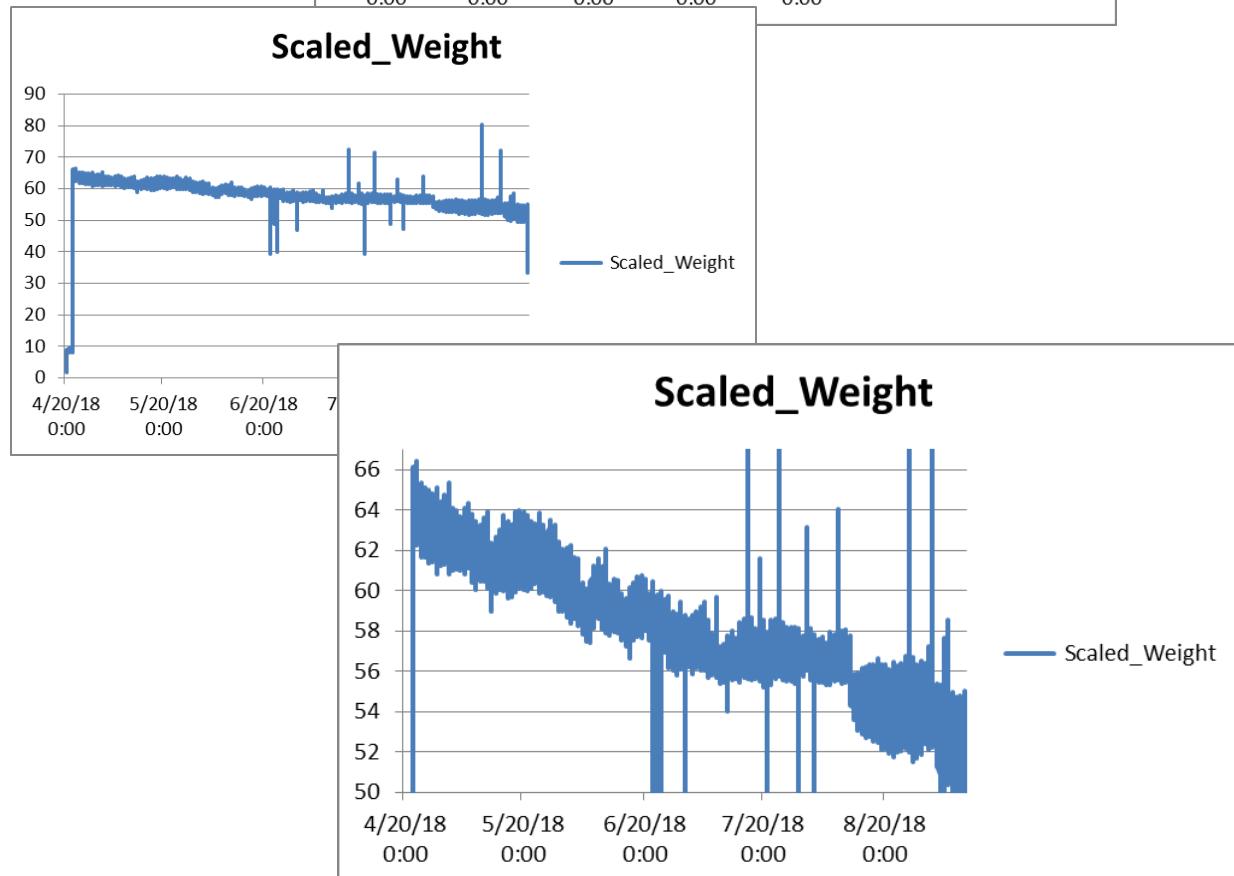
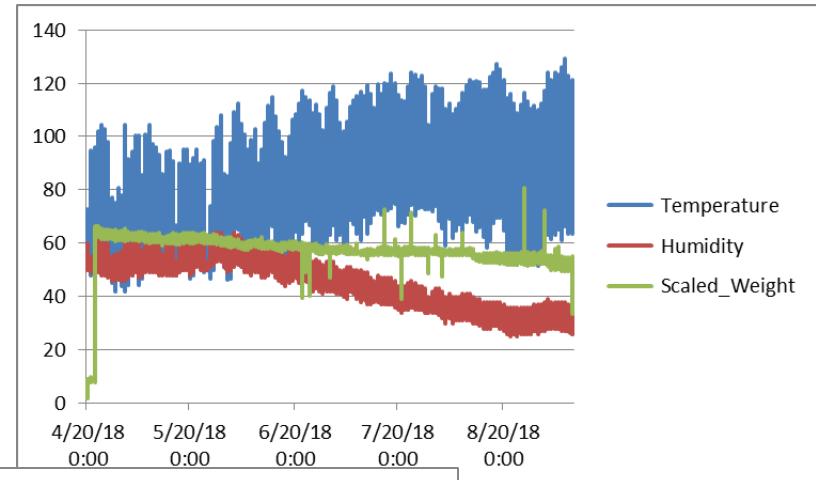
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Doesn't help...

Let's increase the scale.



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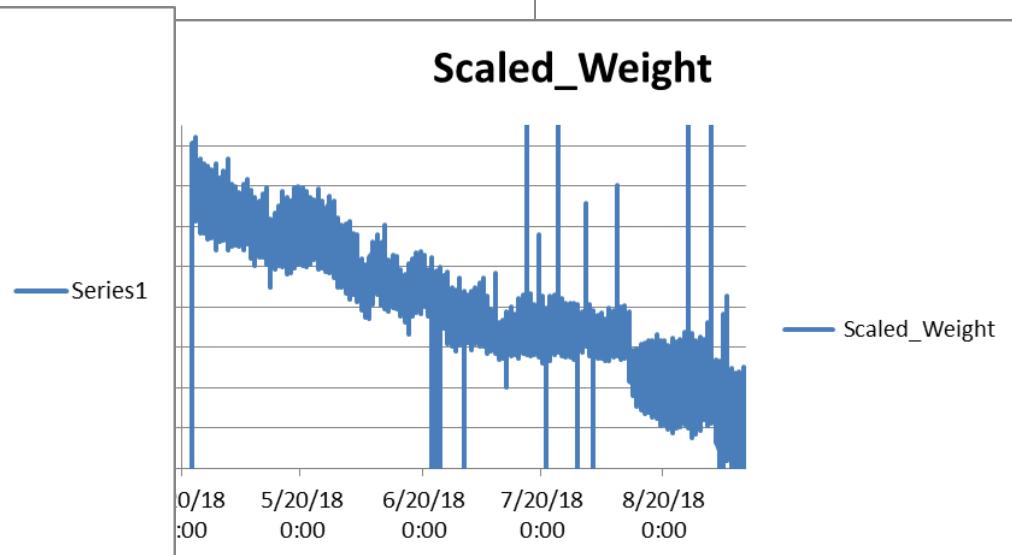
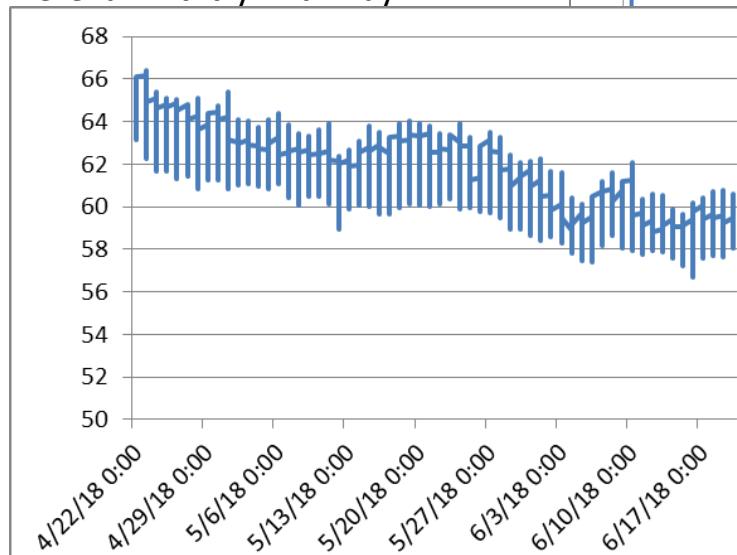
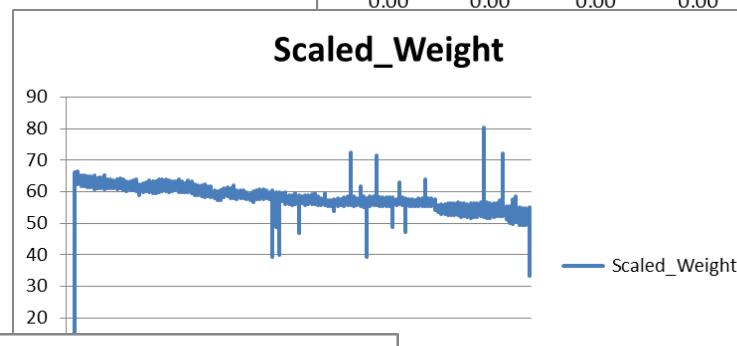
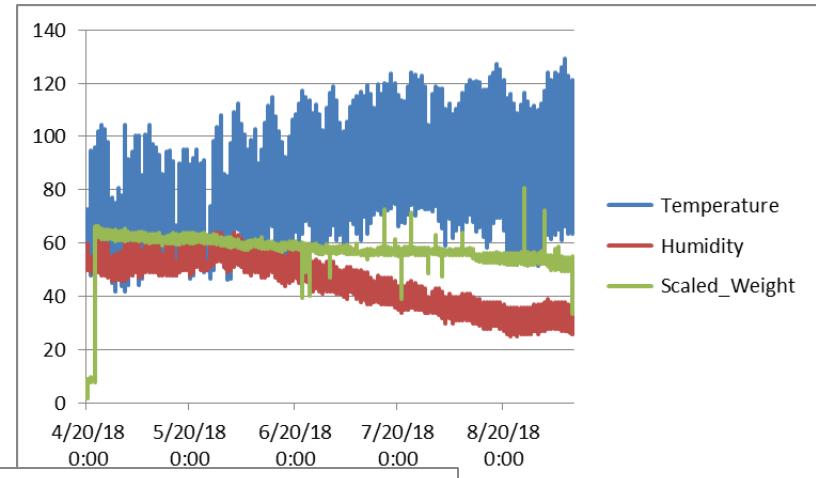
It killed the hive. Can you tell where?

Let's remove the extraneous data.

Doesn't help...

Let's increase the scale.

Here's a hint: try mid-May.....



Moving forward?

- Any other options (under \$50?)
- Repurpose something out there.
- ‘Big Data’ to turn this into climate data (NASA).
- Small data – can any of this be useful to the hobbyist beekeeper?

Nuc scale

'Doctors' balance scale can be had for around \$50 (+/-\$10) at the hospice. Ideal for watching a single nuc in a nursery. Up or down can be seen from 5-10 yards away.

There were two at the big hospice as of last Wednesday (9/19).



Other data options....

Introducing **Broodminder-T2**



The Broodminder-T2 is a compact, cost-effective temperature tracking device designed for beekeepers. It features a replaceable coin cell battery, records temperature in the hive box 24/7, is hermetically sealed, and stores up to 1 year of data wirelessly via Bluetooth. It is compatible with the full Broodminder line and application.

Replaceable Coin Cell Battery

Most Cost Effective tracker on the market

Stores up to 1 Year of data transferrable wirelessly to app via Bluetooth

Records Temperature in hive box 24/7

Hermetically Sealed

Compatible with Full Broodminder Line & Application

On 'sale' @ Indiegogo

Perks



Broodminder-T2

PRE-ORDER 4-PACK

For 1-4 hives

\$100

\$25 PER Unit (16% OFF Retail)

Reg Retail Price - \$30.00 per Unit



Broodminder-T2

PRE-ORDER 10-PACK

For 5-10 hives

\$250

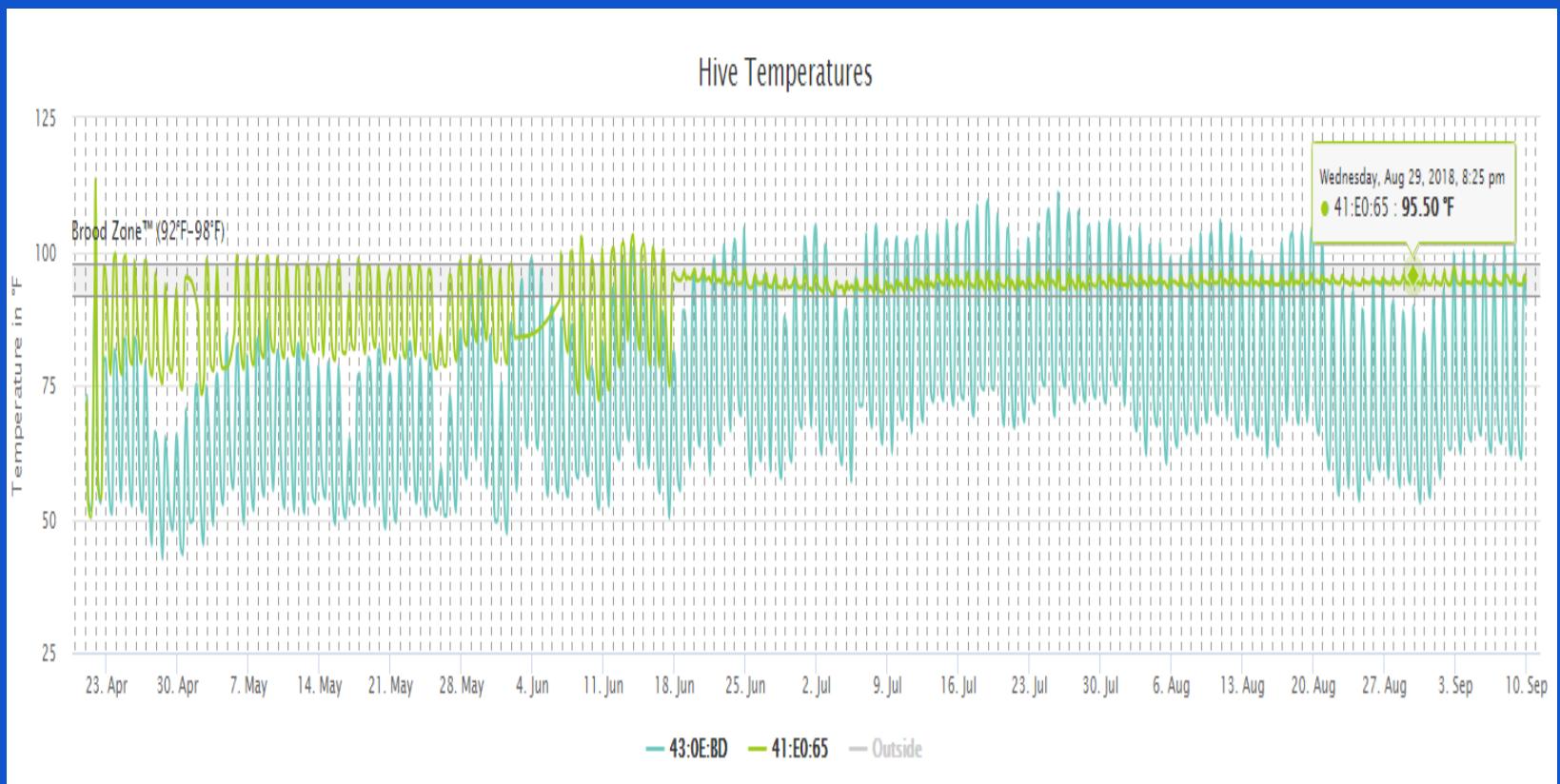
\$25 PER Unit (16% OFF Retail)

Reg Retail Price - \$30.00 per Unit

Estimated Shipping Date: Early November

This is what JUST temperature tells you.

(distorted) Find where I put it above brood?



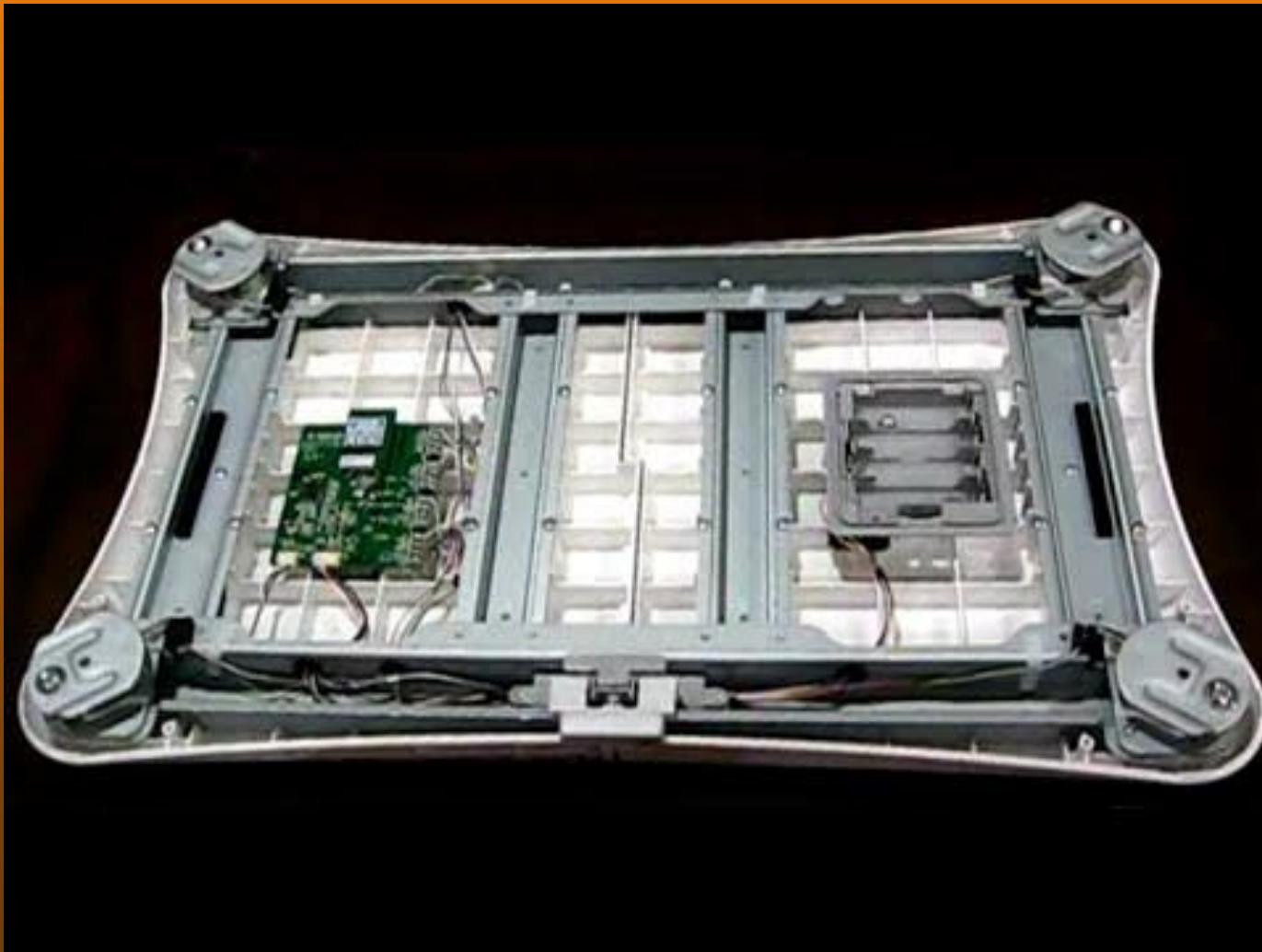
Another option – needs development.



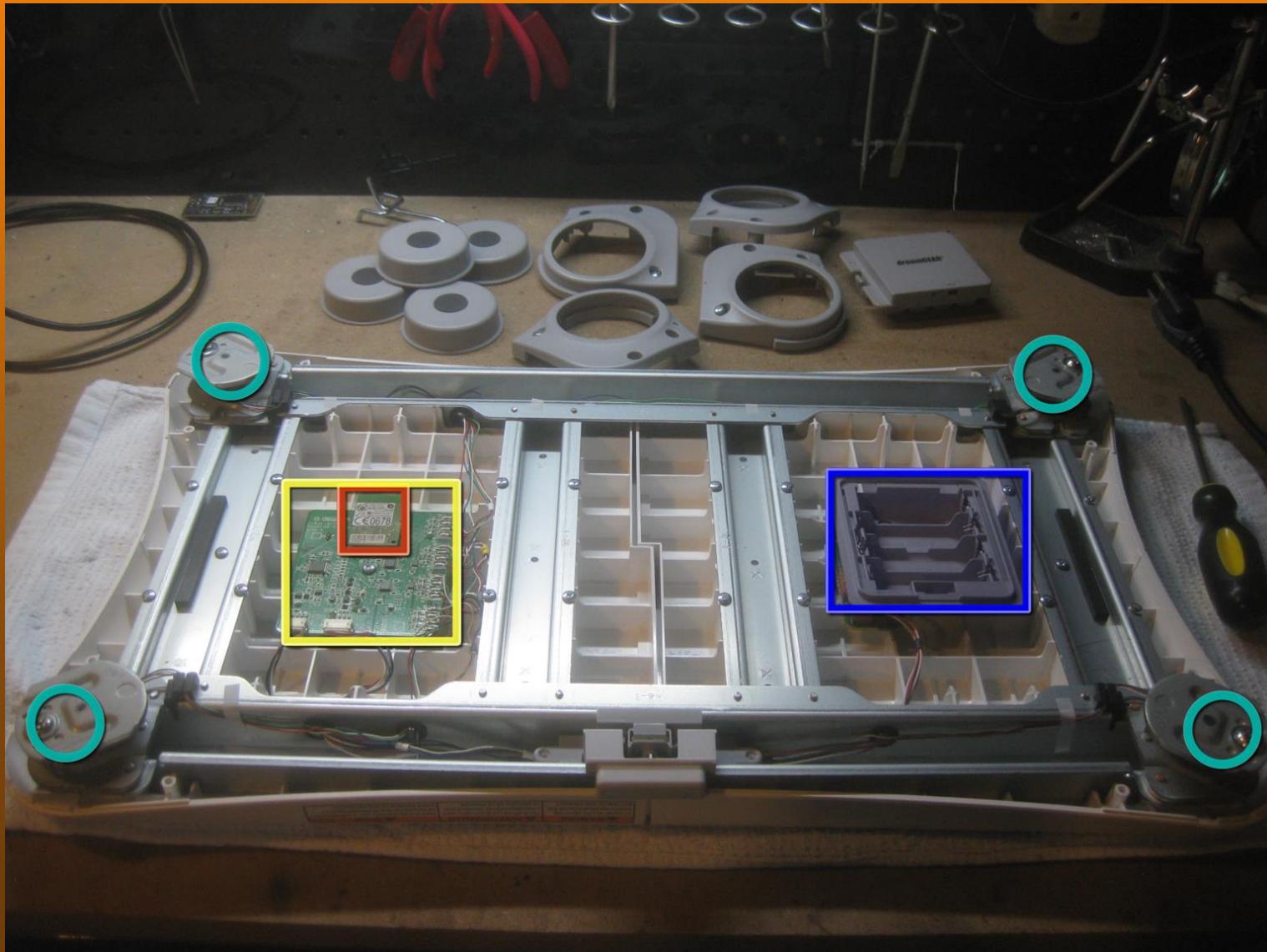
Ok, it's not THIS easy, but....



The Wii Fit, avail for ~\$8 at most Goodwills.



Better Pix



Wii Fit to Bluetooth interface.

There is one Google App out there, but it only works on 'IceCreamSandwich' and 'JellyBean'.

WiiBrew has done a good breakdown of the interface and registers.

There is some code out there, but it is in Python, I am not fluent.

...If there is someone who will translate Python to Perl, I will donate two Balance boards for development.
Today.

Jim Jakim
jjjakim@gmail.com

- <https://play.google.com/store/apps/details?id=com.zarli.stabilupdemo>
- http://wiibrew.org/wiki/Wii_Balance_Board
- <https://www.mattcutts.com/blog/linux-wii-balanceboard/>

The \$50 Scale? Just out of reach?

