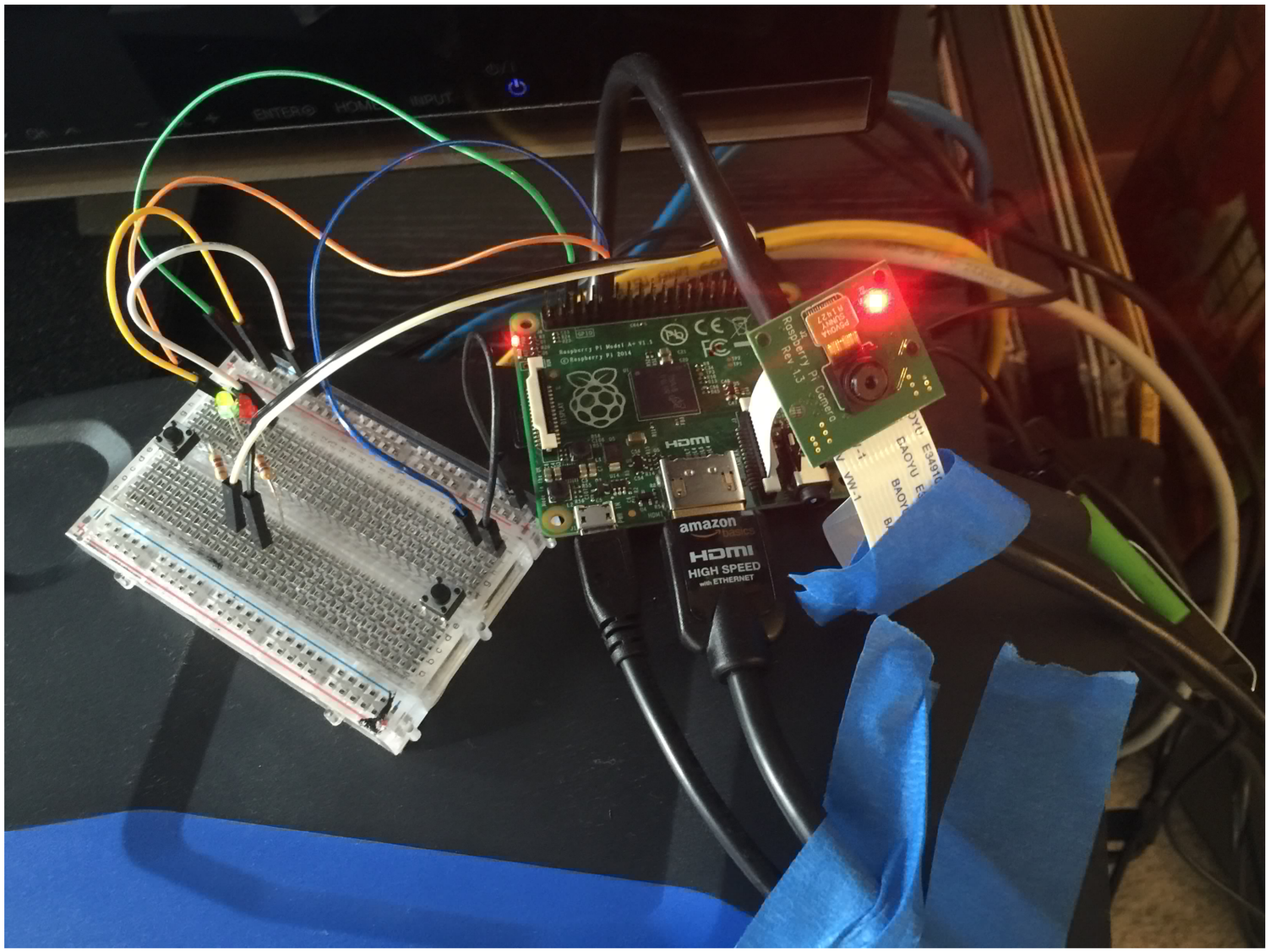
Controlling the World with Python
(Talking to hardware)

J.R. Leeman

September 6, 2016



LEEMANGEOPHYSICAL
CONSULTING & INSTRUMENTATION

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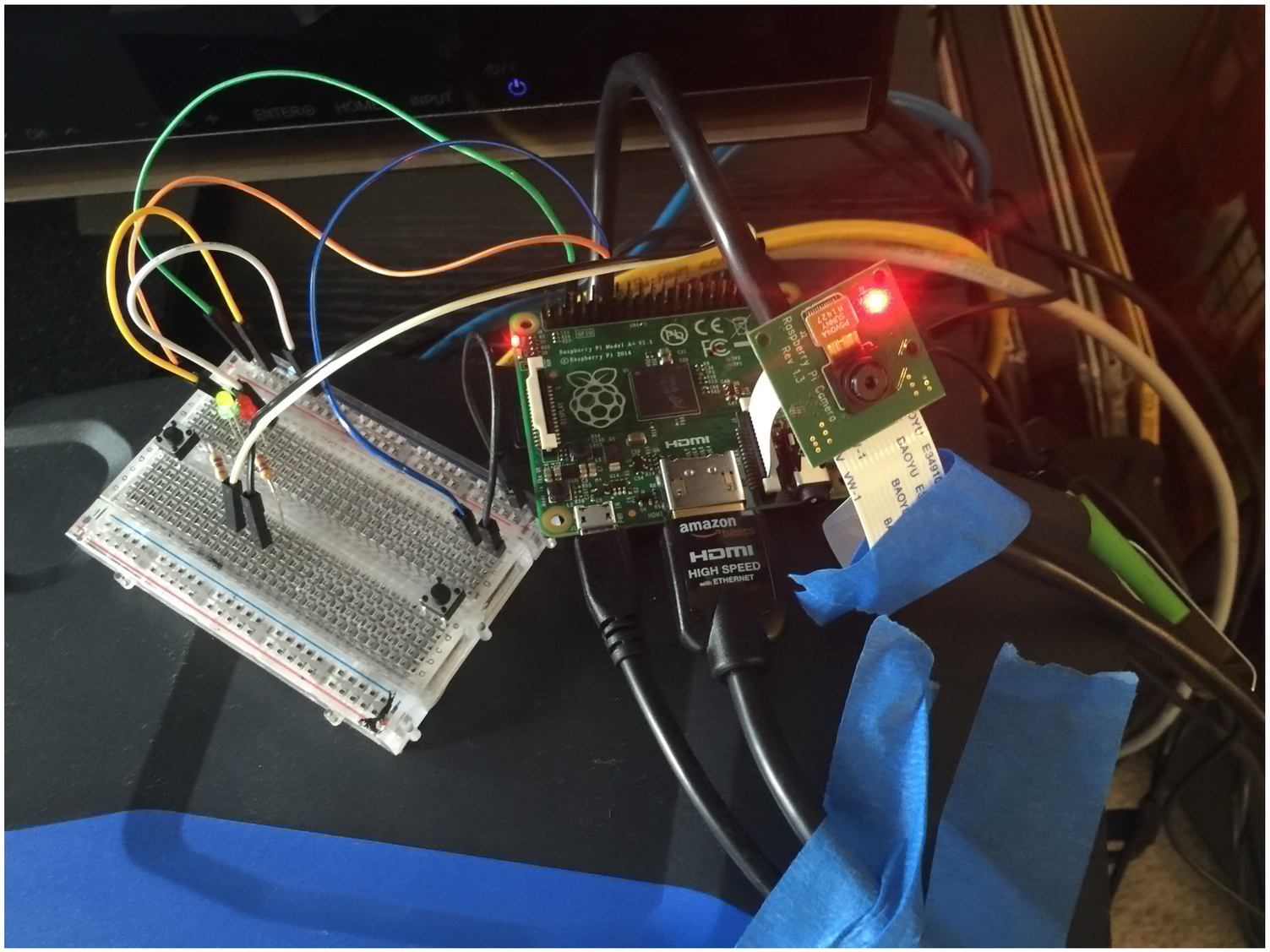

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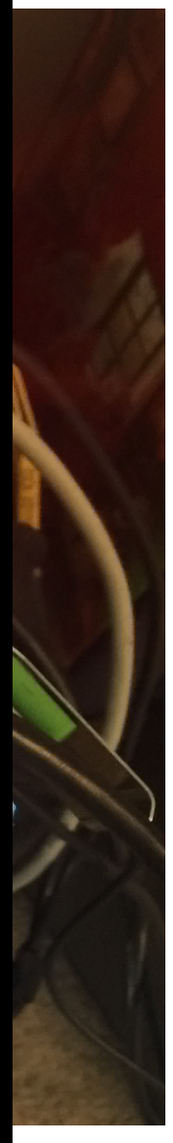

J.R. Le

Septe

CONSULTING & INSTRUMENTATION

My name is John, and I’m a nerd

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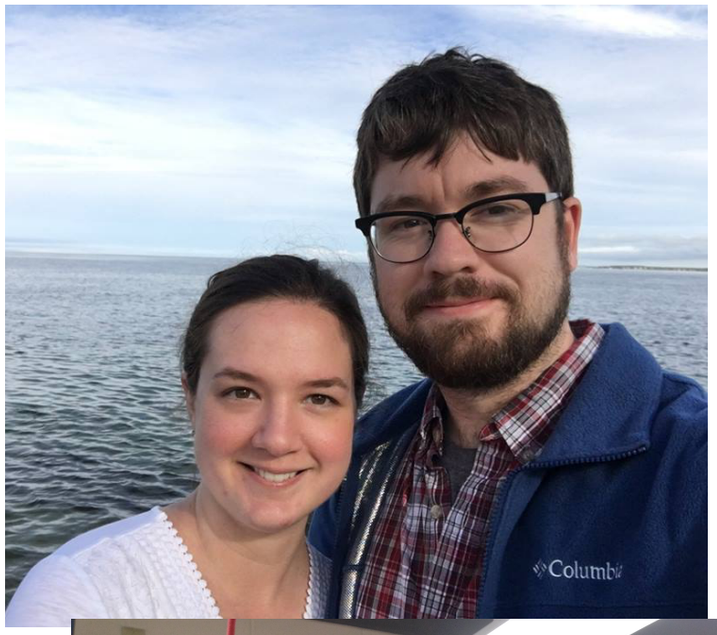

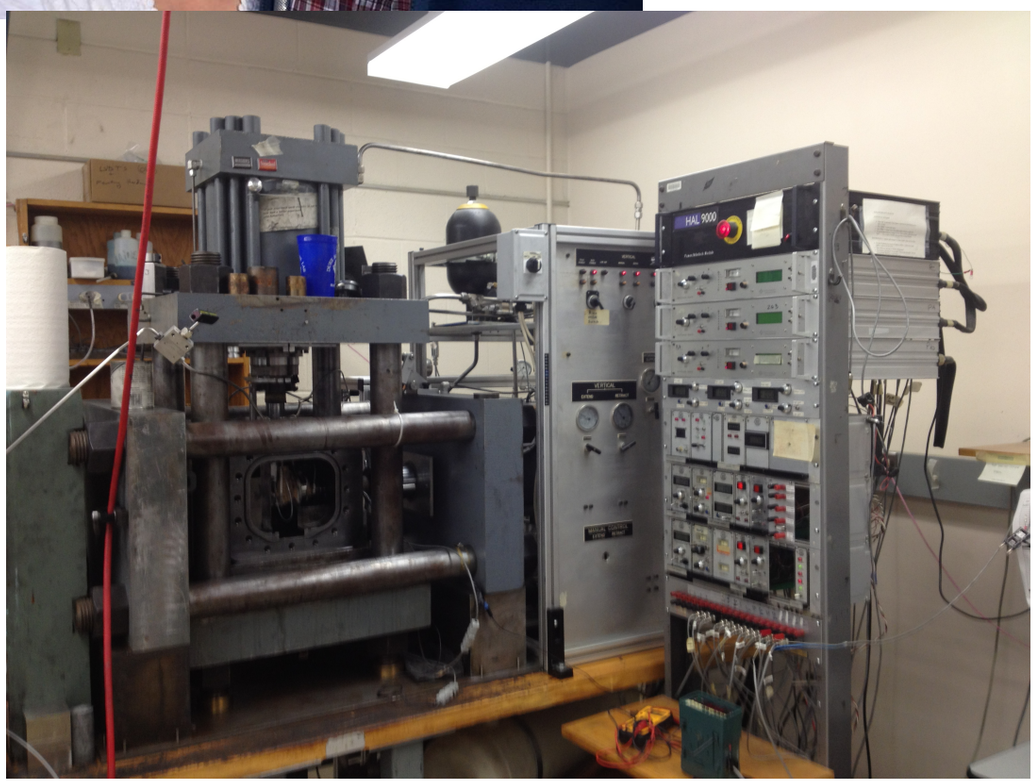

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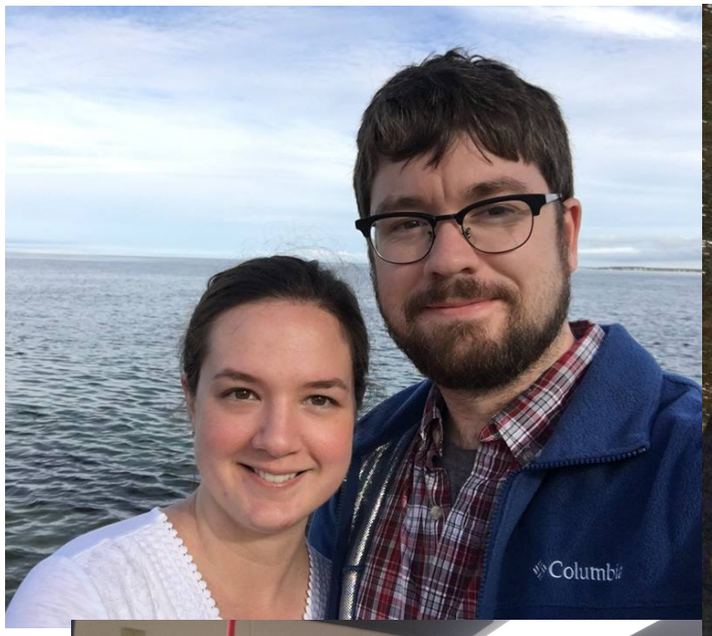

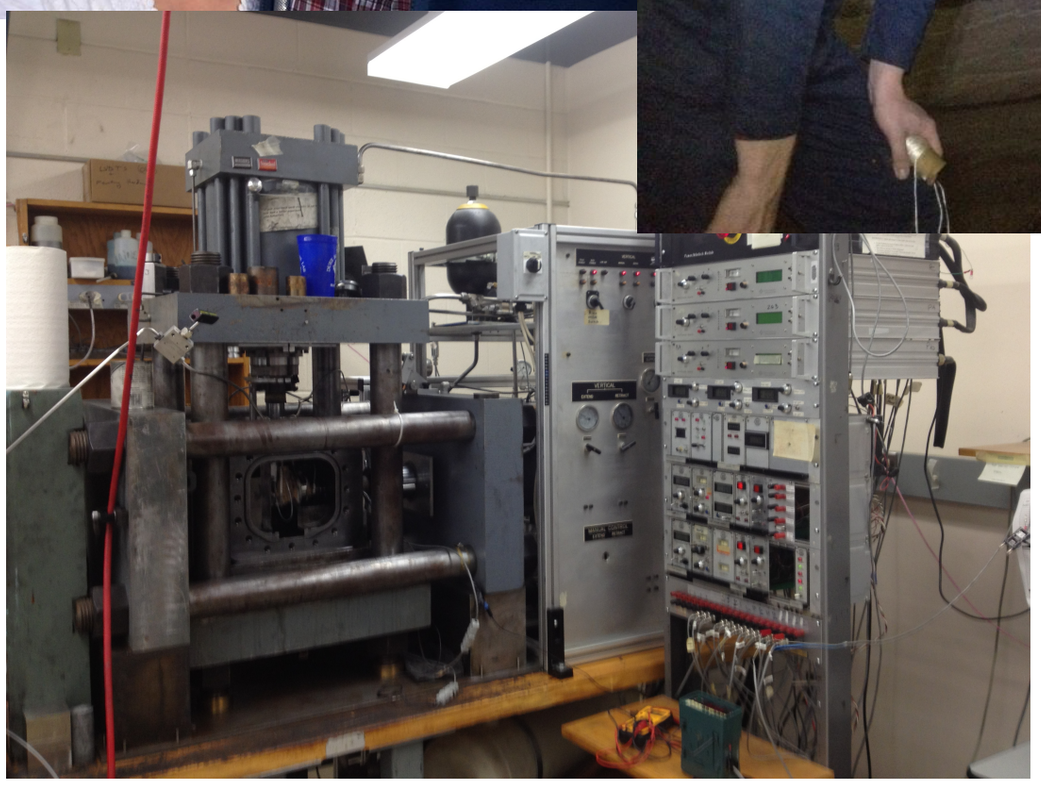

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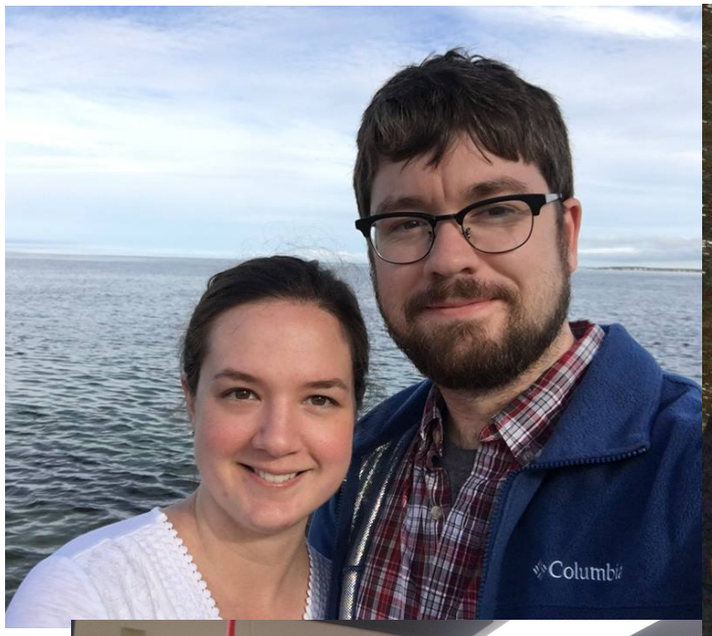

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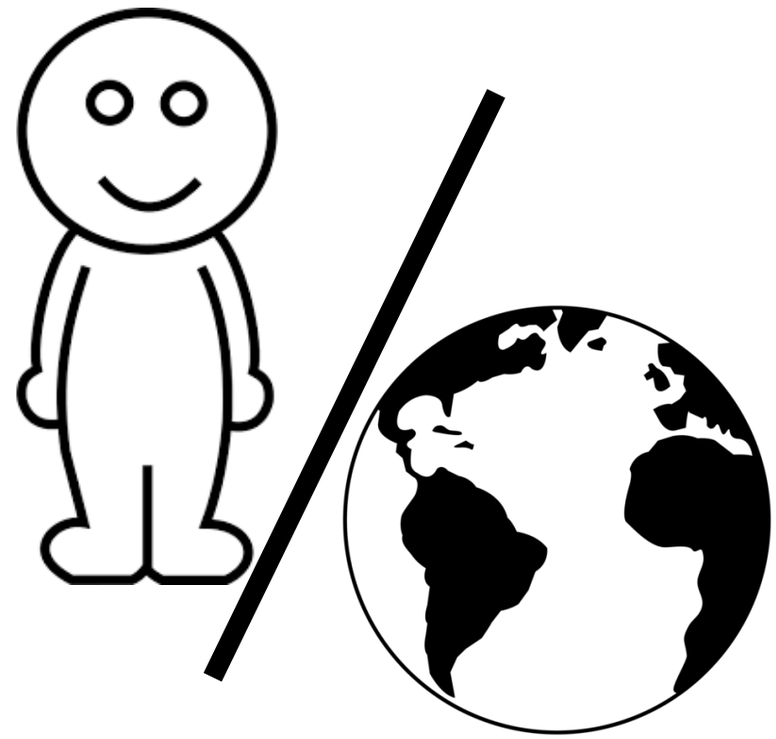
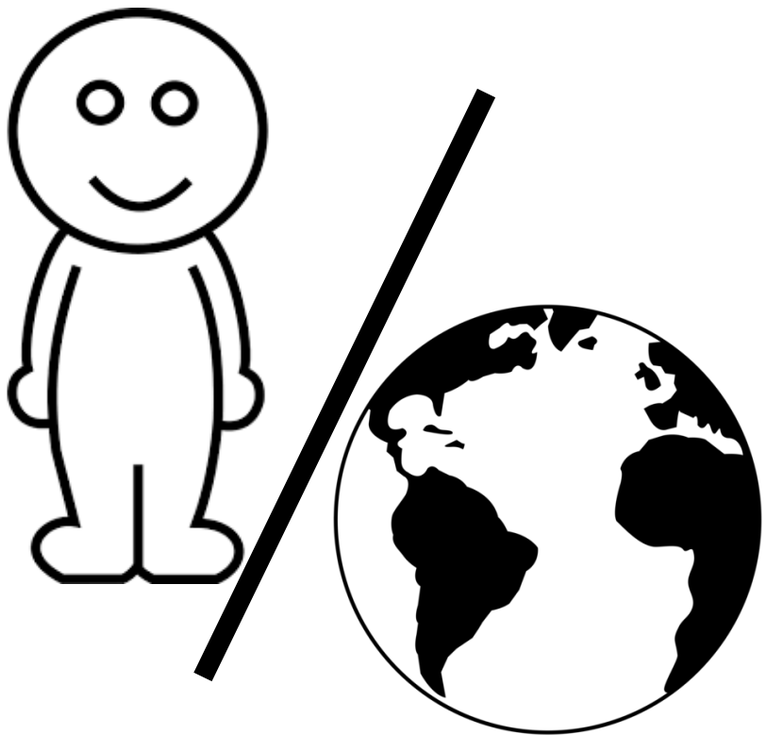
Hardware interaction goes in two directions

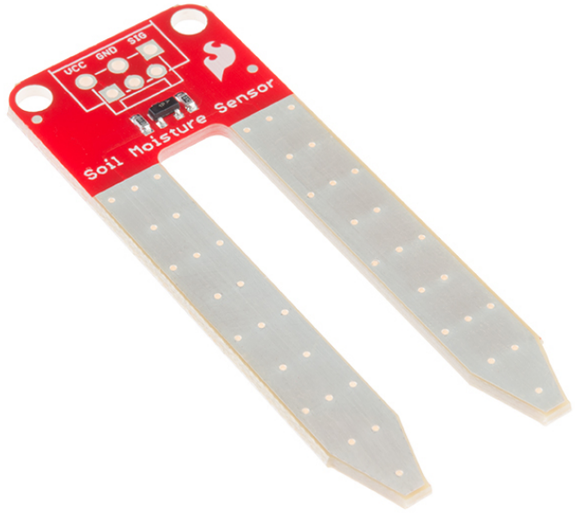
Actuators / Displays

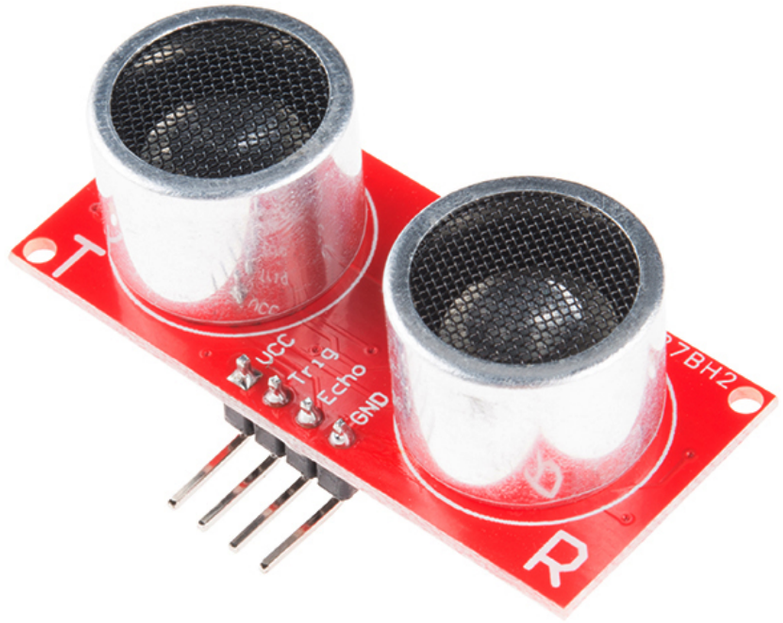


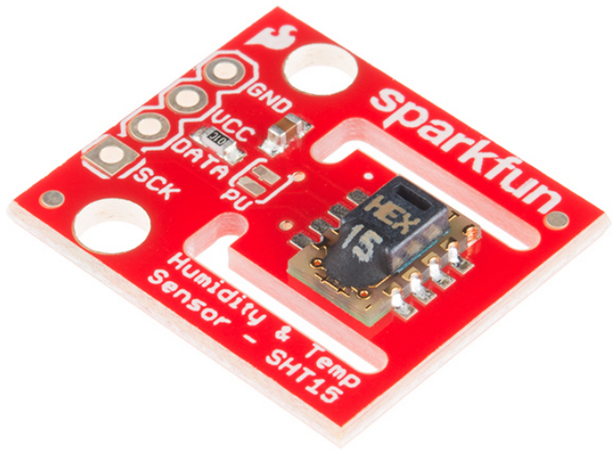


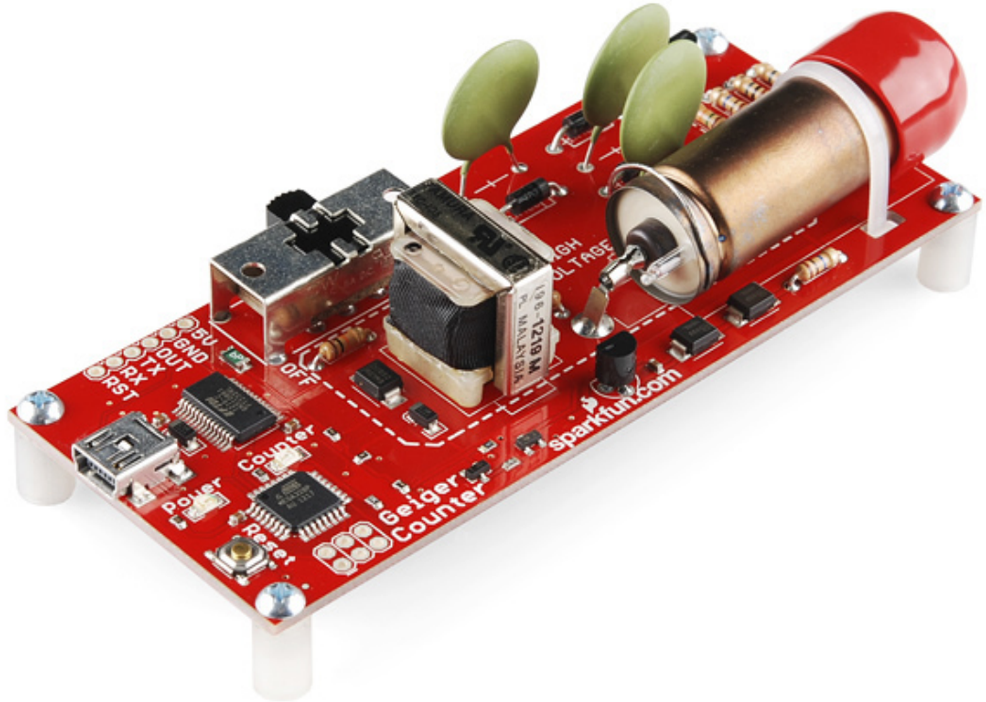
Sensors / Transducers

Transducers get the physical world into the electronic world

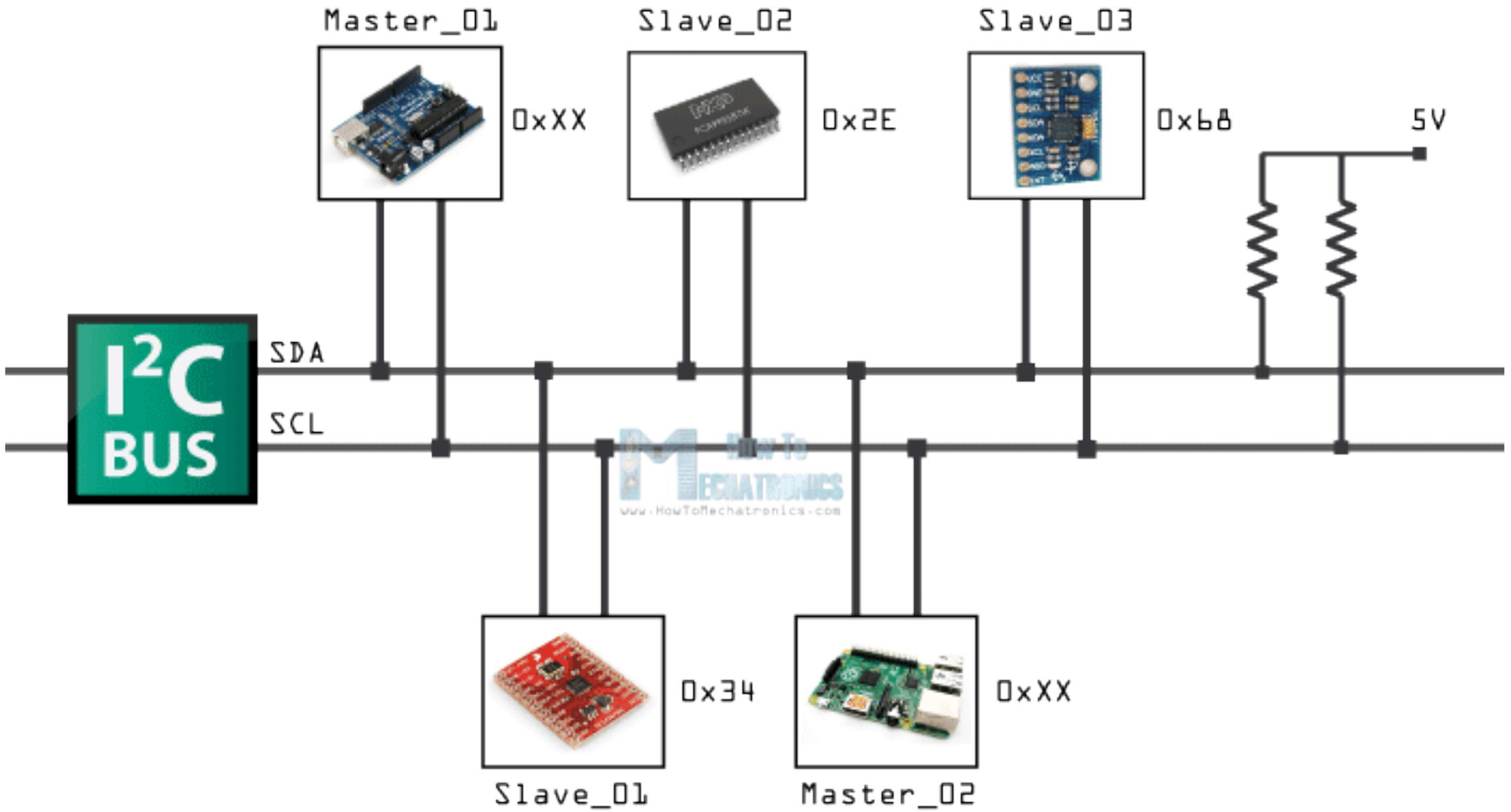






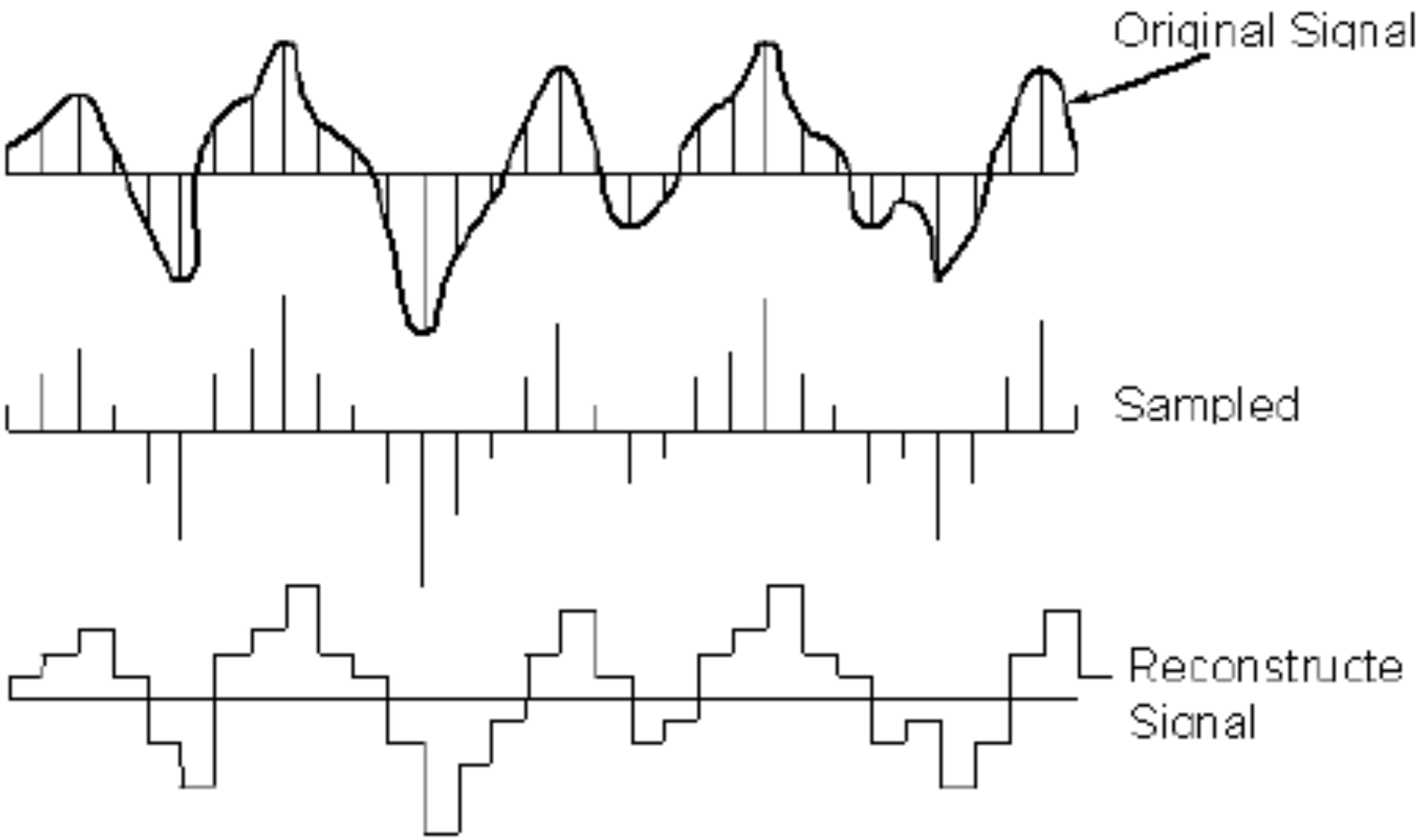


There are a number of digital to digital communications protocols



I2C, SPI, CAN…..

Analog-to-digital conversion converts the transducer output into a digital representation



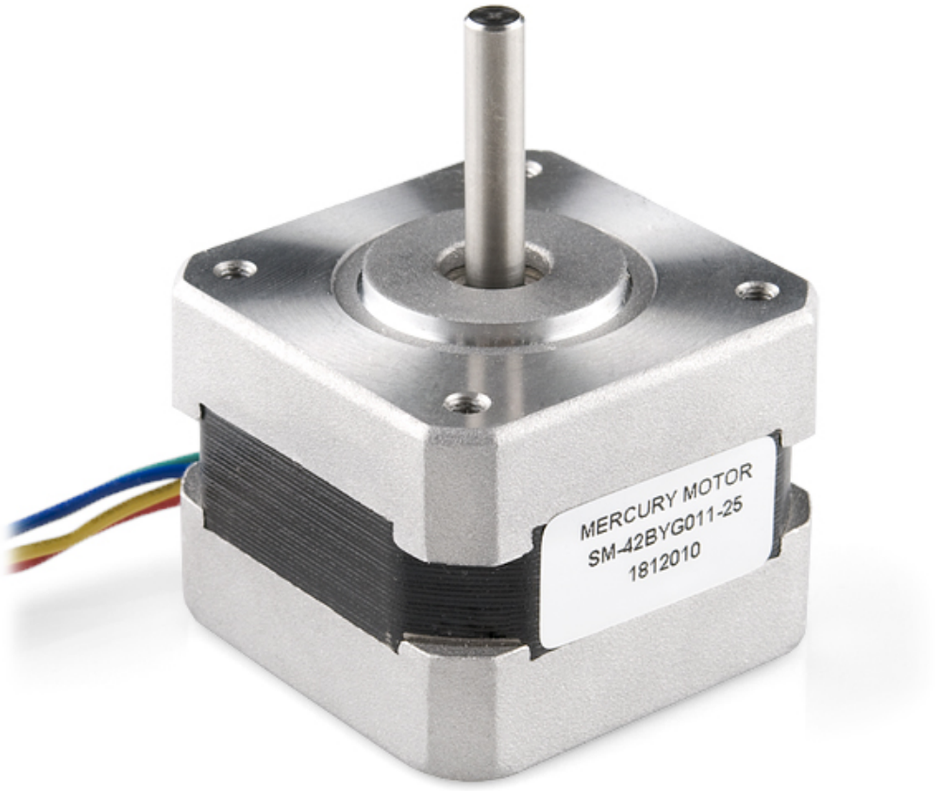
Finally we apply calibrations to convert the digital back to the physical units we actually wanted

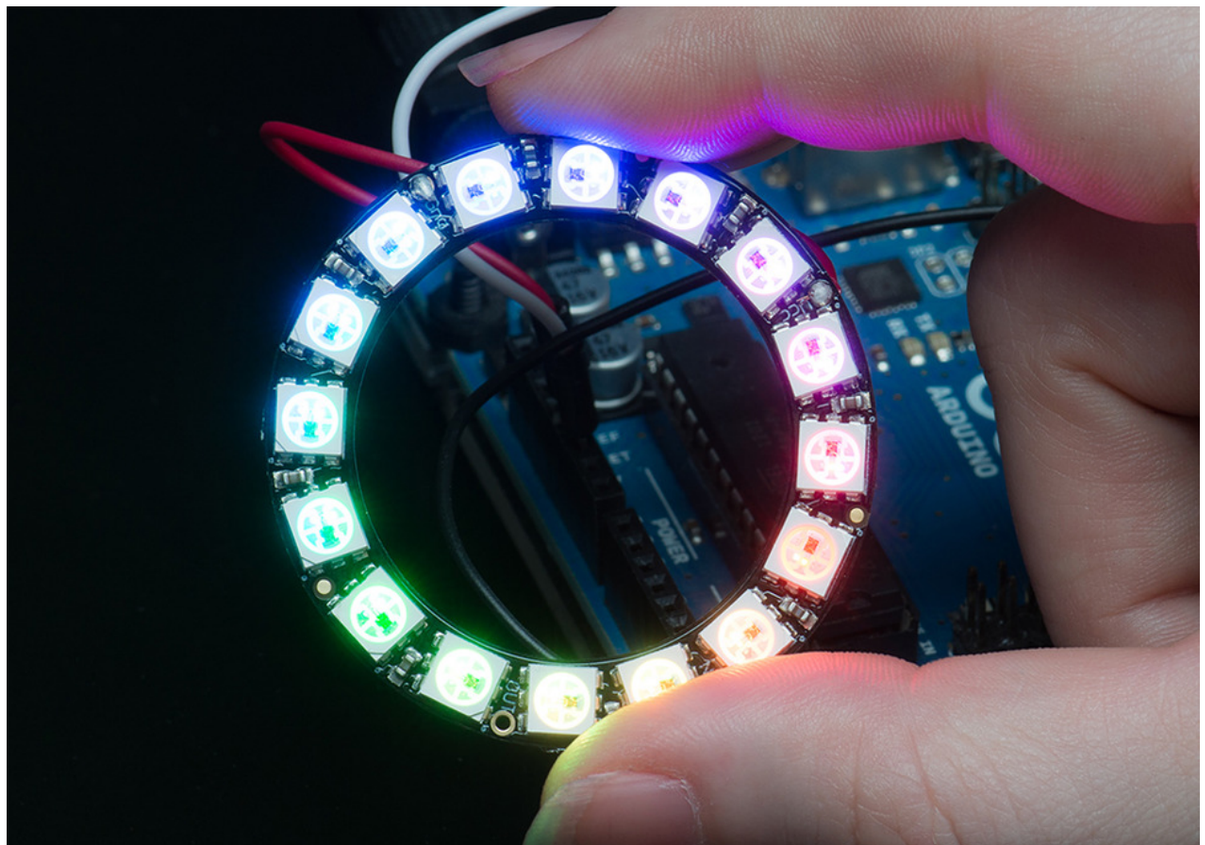
2.45 Volts

0.01483 Volts/lbs
67.4 lbs/Volt

165.2 lbs

Taking the computer out into the real world uses various actuators





There are services like Phant that let you post data to an IOT stream

DATA.SPARKFUN.COM

data.sparkfun.com
a place
to push
your data.

Why are you building this?
We want to bring a dose of reality to the Internet of Things hype. data.sparkfun.com is a free, robust service for use with all of your projects. The underlying engine is open source so if you don't want to use our servers you can install phant on the server of your choice.

Wait, this is totally free? What's the catch?
Yep. There are limits, but we wanted to give our users a good, free place to store data and give data scientists more fun things to analyze. Our hope is that you buy a SparkFun widget to connect your next beehive.

How do I use it?
We thought data storage should be as easy as string concatenation

Create a free data stream immediately at data.sparkfun.com — CREATE

Explore all of the public data streams on data.sparkfun.com — EXPLORE

Learn how to create data — DOCS

Mayflower Ice Sensor 2

A Sensor containing a HTU 21 and 10k thermistor monitoring ice conditions at the Mayflower Curling Club in Halifax, Nova Scotia

Manage | Export to Analog.io

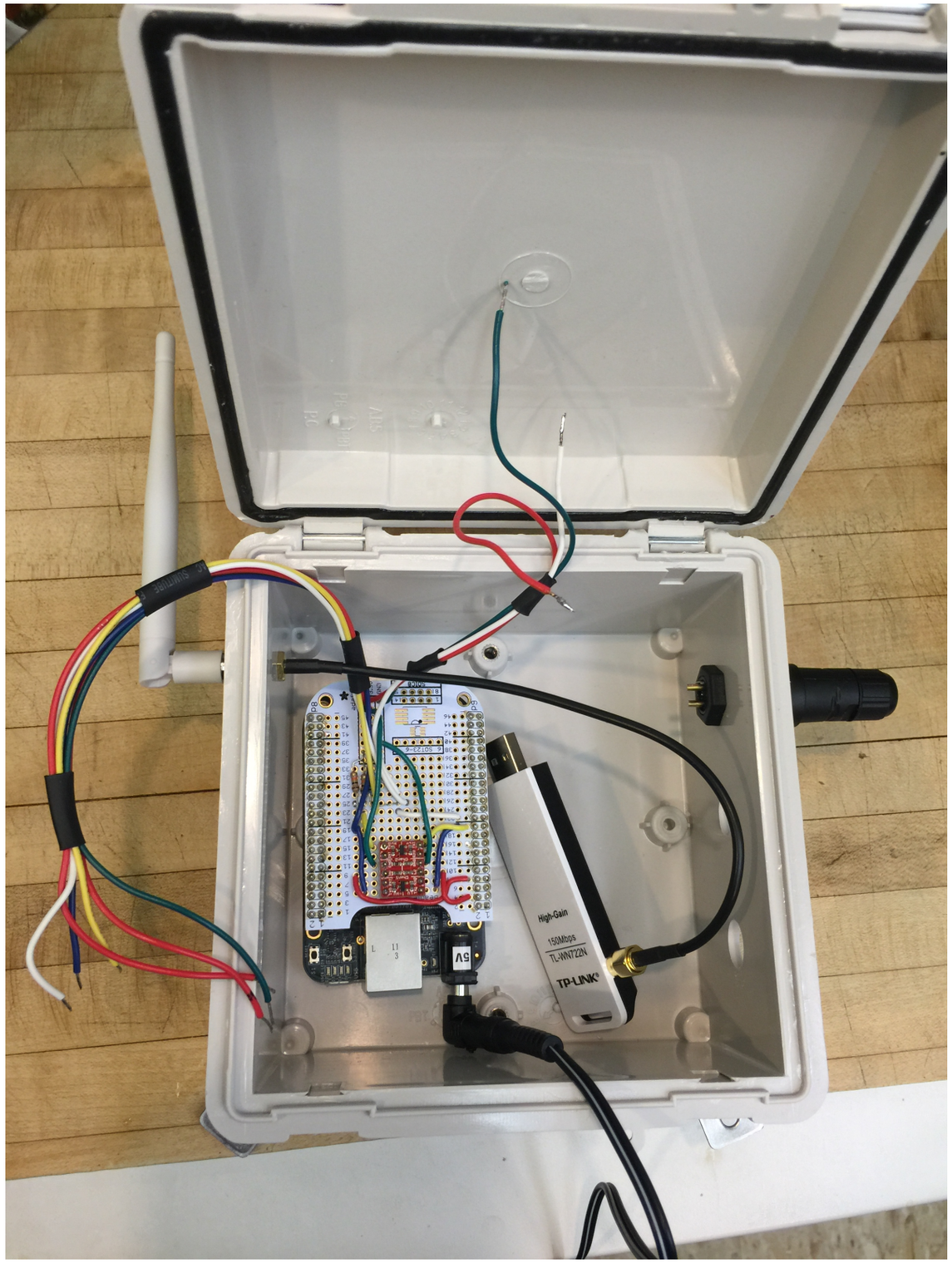
JSON | CSV | MySQL | PostgreSQL | Atom

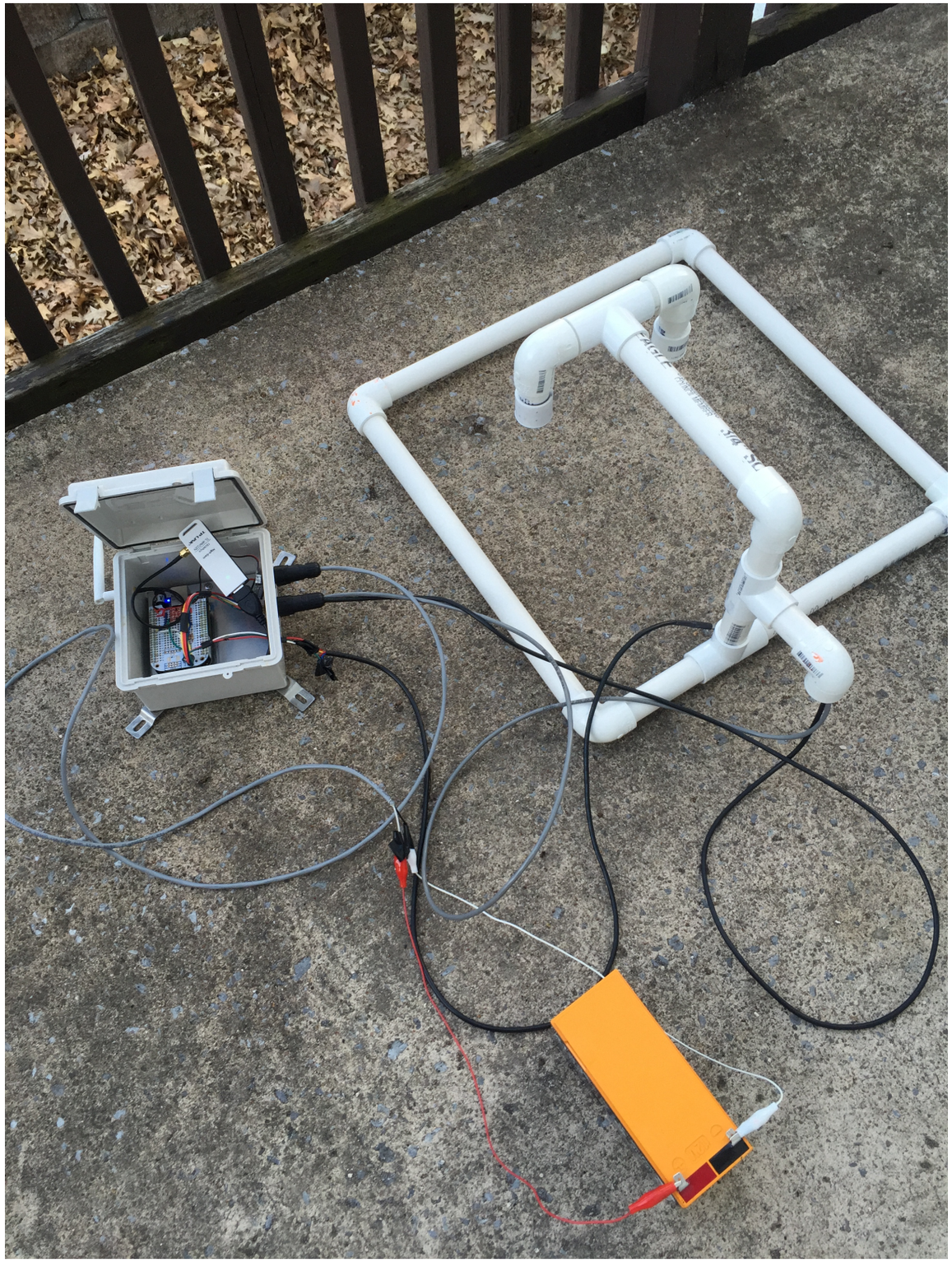
TAGS curling dewpoint humidity ice temperature

92% (45.51 of 50 MB) remaining.

air_temperature	dew_point	humidity	ice_temperature	timestamp
46.13	25.35	43.87	19.24	2016-09-04T18:31:37.019Z
46.13	25.33	43.84	19.30	2016-09-04T18:31:21.606Z
46.13	25.33	43.83	19.27	2016-09-04T18:31:06.505Z
46.13	25.36	43.88	19.27	2016-09-04T18:30:51.837Z
46.11	25.32	43.85	19.24	2016-09-04T18:30:37.896Z
46.15	25.35	43.84	19.24	2016-09-04T18:30:23.628Z
46.15	25.37	43.88	19.22	2016-09-04T18:30:09.884Z
46.11	25.38	43.95	19.26	2016-09-04T18:29:55.372Z
46.15	25.41	43.94	19.24	2016-09-04T18:29:40.932Z

BeagleBone, Pi, Arduino, etc can all push to these services





Setup the datastream

```
server = "data.sparkfun.com"  # base URL of your feed
publicKey = "[redacted]"  # public key, everyone can see this
privateKey = "[redacted]"  # private key, only you should know

p = phant.Phant(publicKey, 'air_temp', 'ir_ambient', 'ir_object',
                'pavement_temp', private_key=privateKey)
```

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```

<Collect Data>

Post the data

```
ir_ambient_temperature = round(np.mean(ir_ambient_temperature)., 2)
ir_object_temperature = round(np.mean(ir_object_temperature), 2)
air_temp = round(np.mean(air_temp), 2)
pav_temp = round(np.mean(pav_temp), 2)

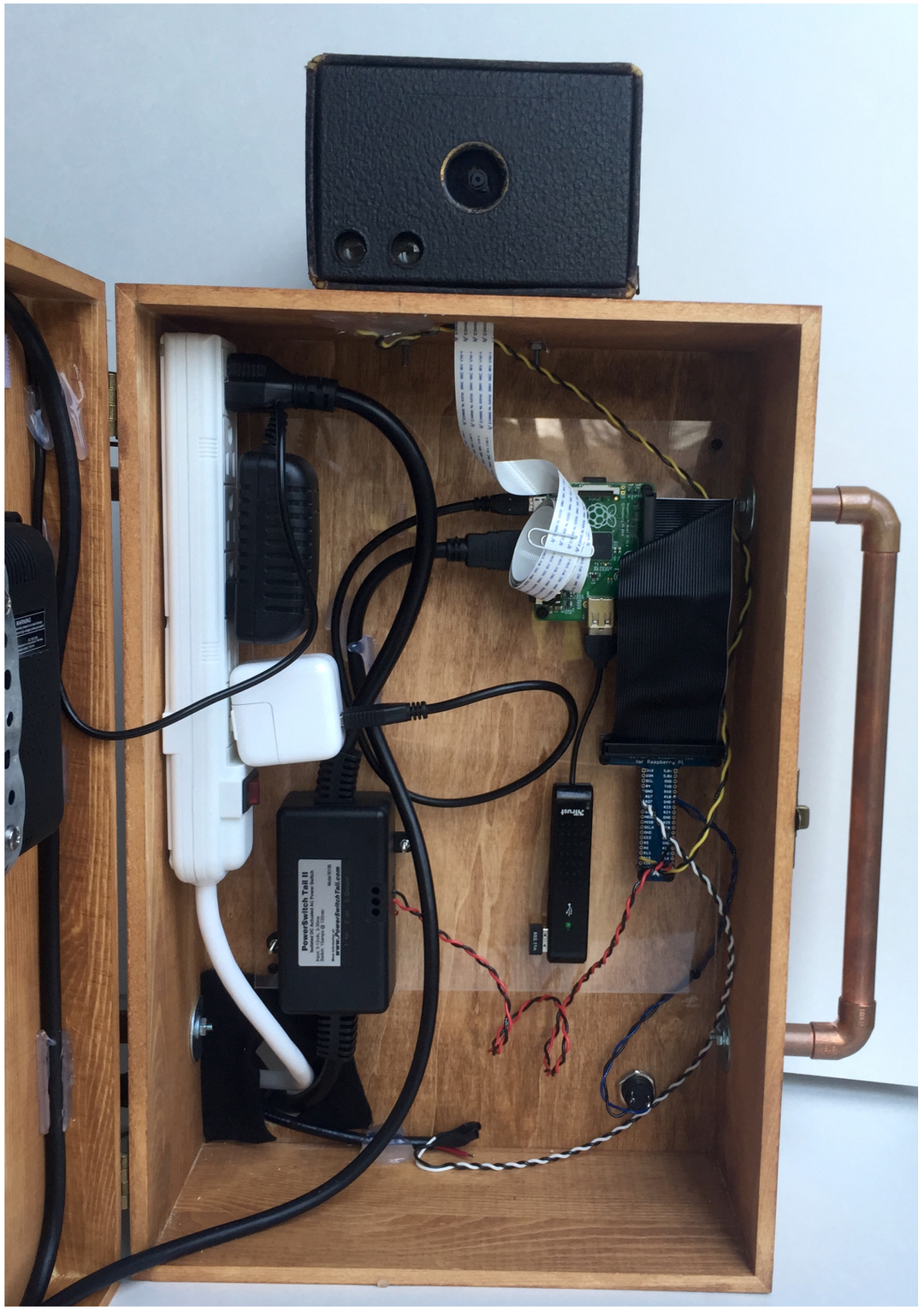
p.log(air_temp, ir_ambient_temperature, ir_object_temperature, pav_temp)
```

PiBooth - a Photo Booth for parties and events


Good Luck!

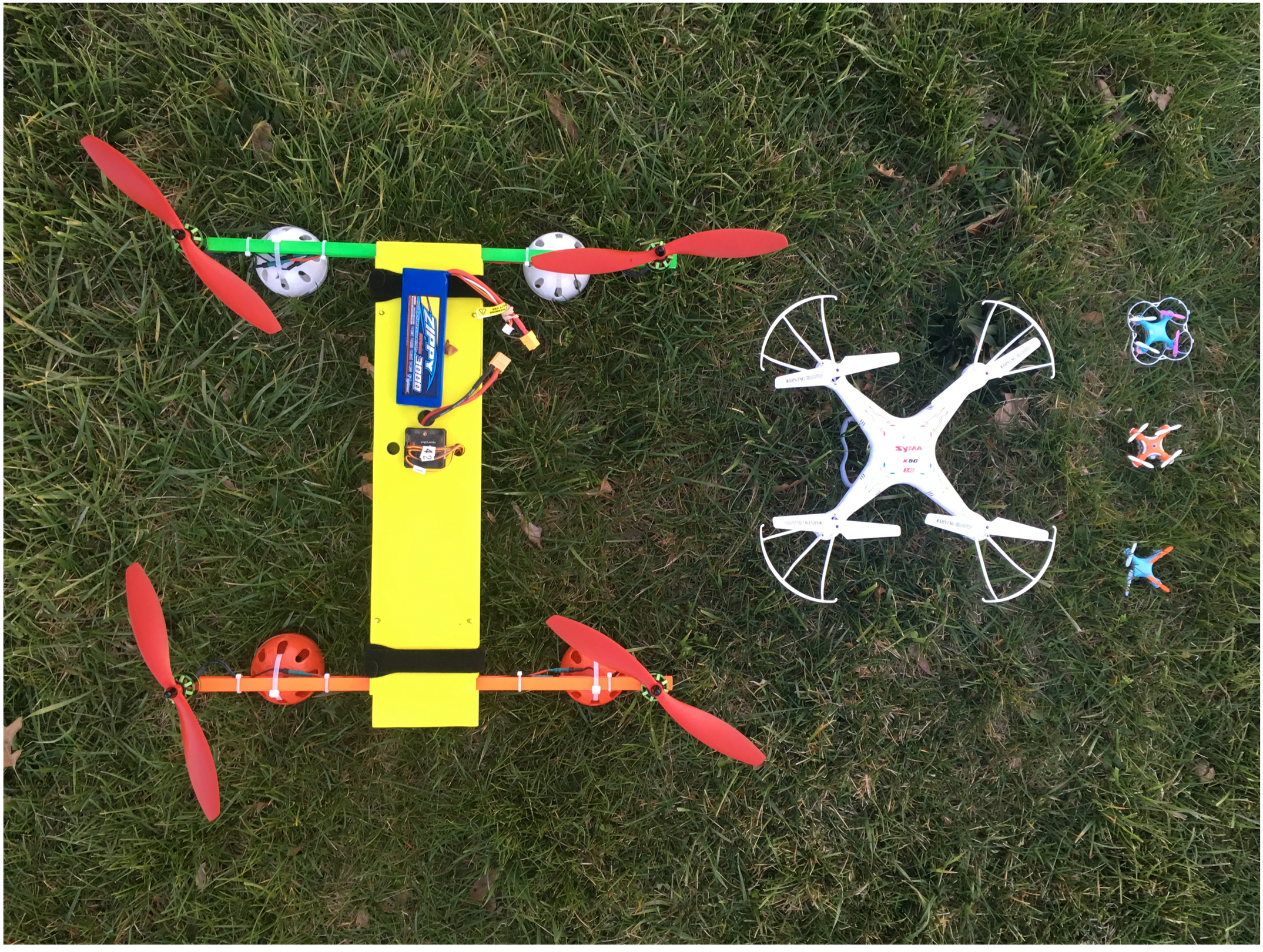

I came for cake!
Good Luck!

PiBooth - a Photo Booth for parties and events

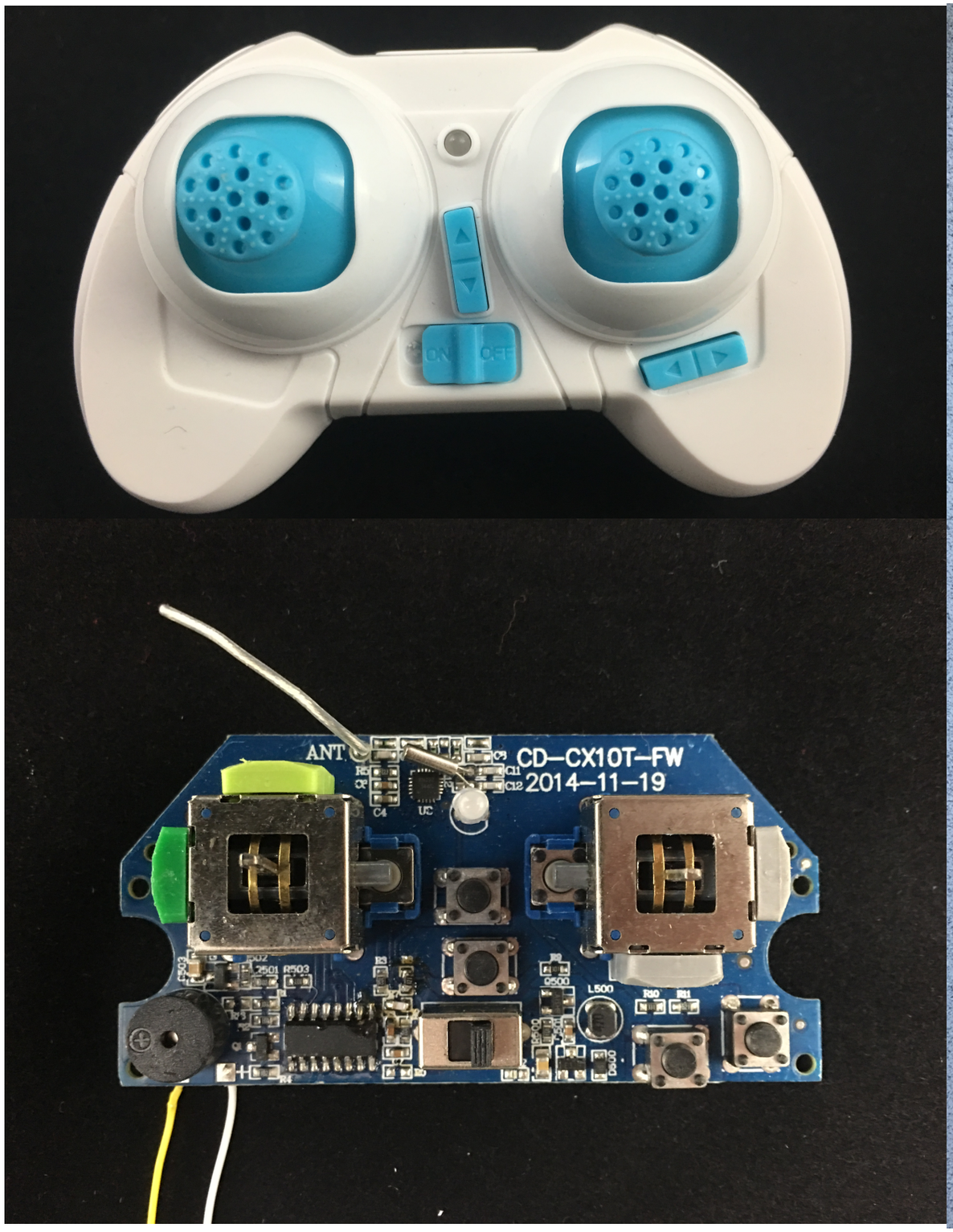


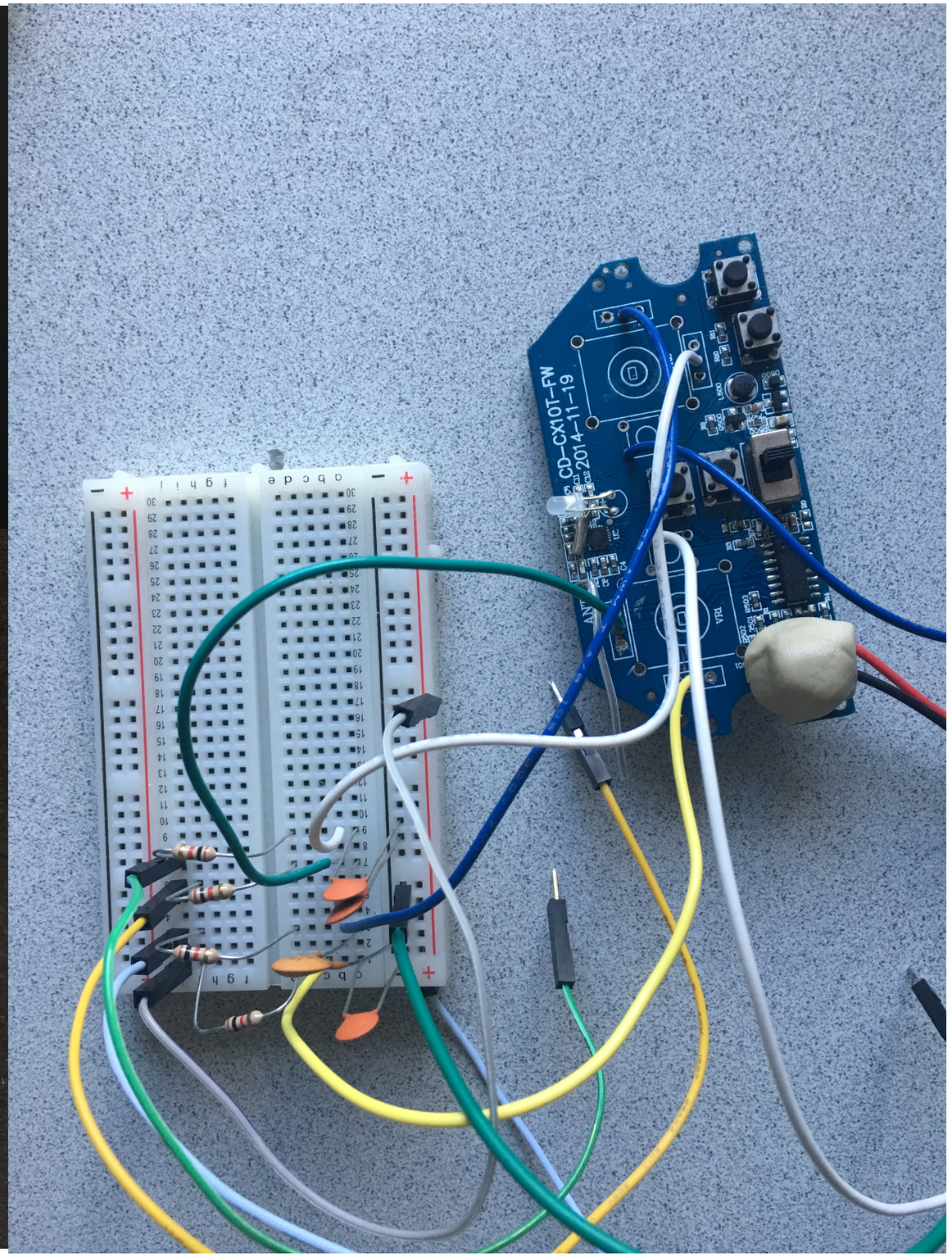
Testing different types of rain gages quickly and simply

Drone control and data collection is a hot topic currently



Hacking controls can be easy with Python





Python can serve as a client to a WiFi data package

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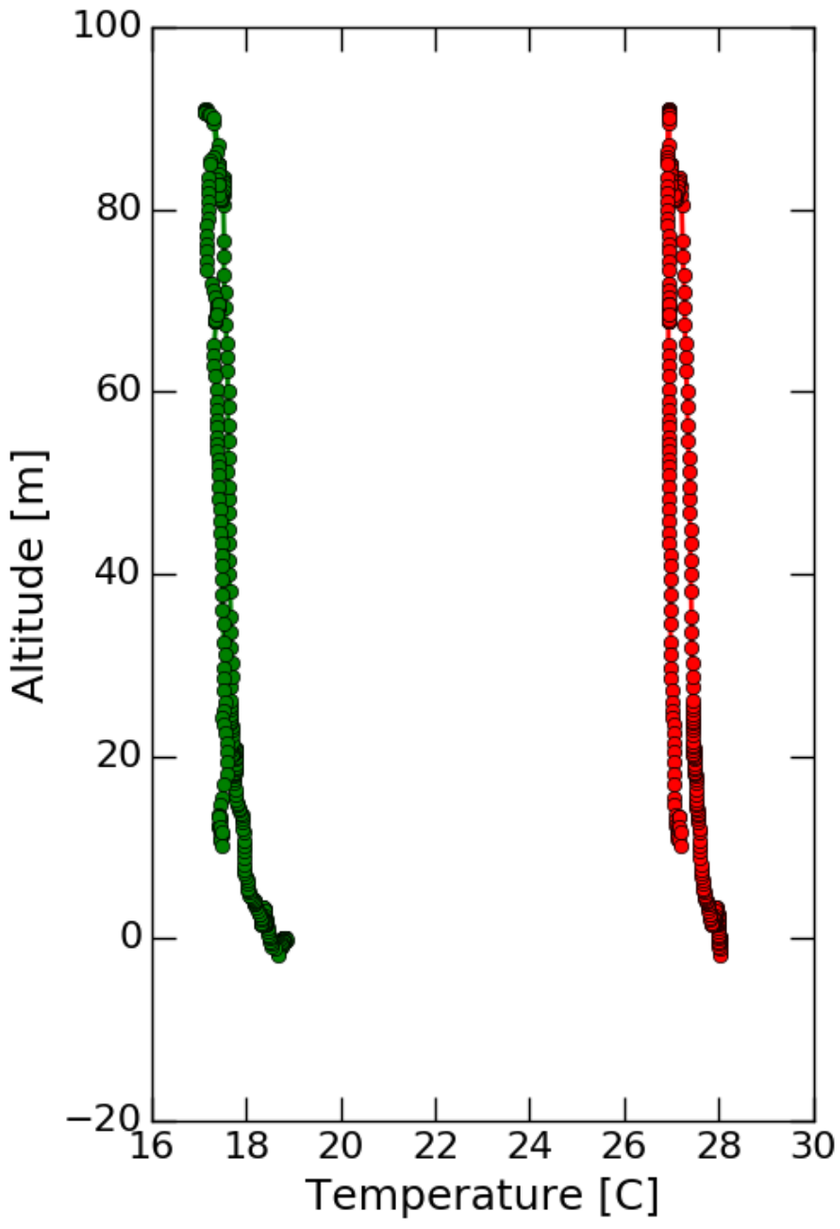

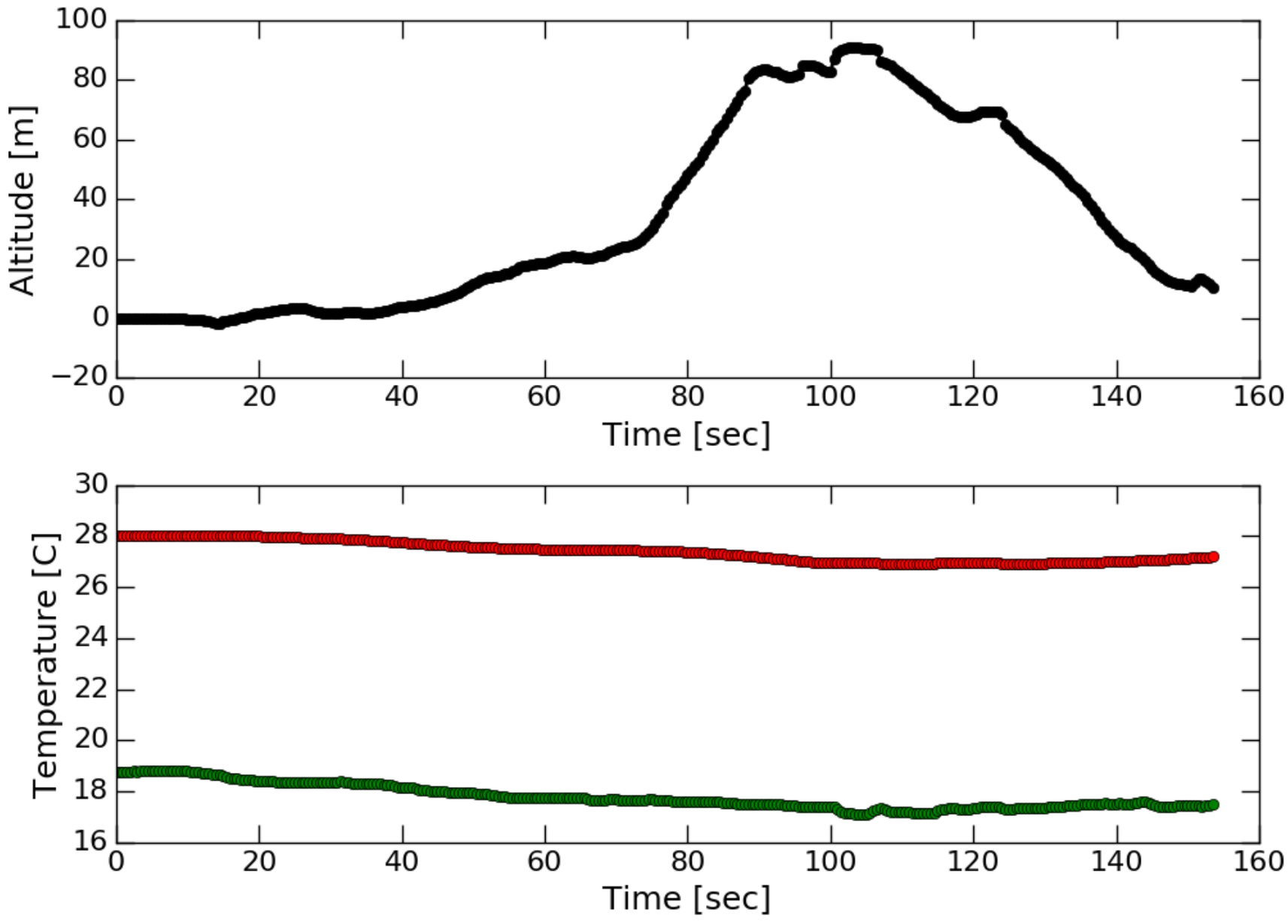

Demo Time