

IOT TECHNOLOGIES FOR RAPID DEVELOPMENT, AD-HOC PROTOTYPING & PUBLIC PERFORMANCE

JONATHAN.SANDERSON@NORTHUMBRIA.AC.UK

KV6006 INTERNET OF THINGS - WEEK 07

IOT: MISUSING TECHNOLOGY FOR FUN & PROFIT

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DIGITAL TINKERING

"Tinkering is about hands-on experiences, learning from failures, and unstructured time to explore and invent. Through the processes of exploration and invention lies the potential for innovation."

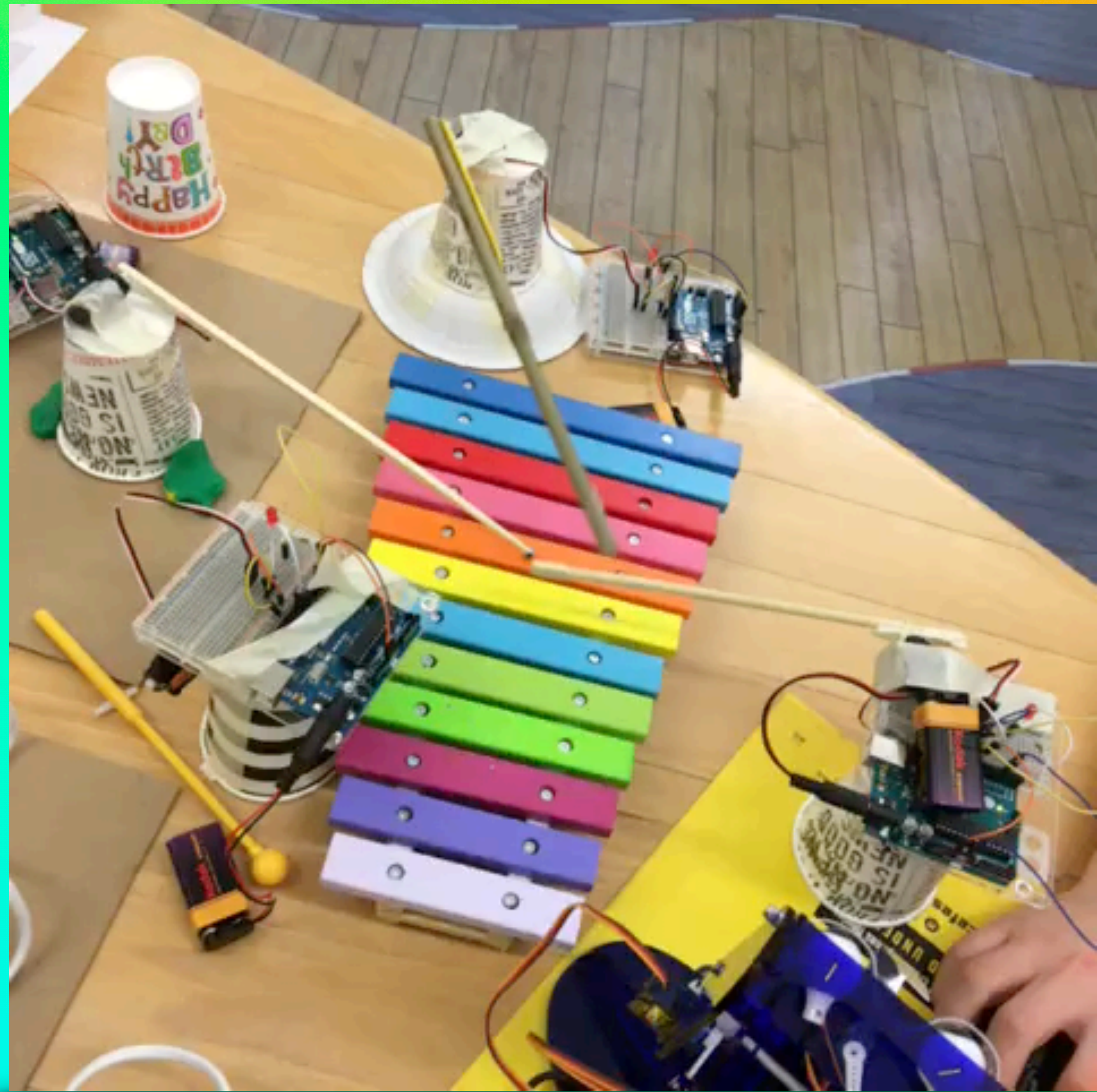
DOORLEY, 2015



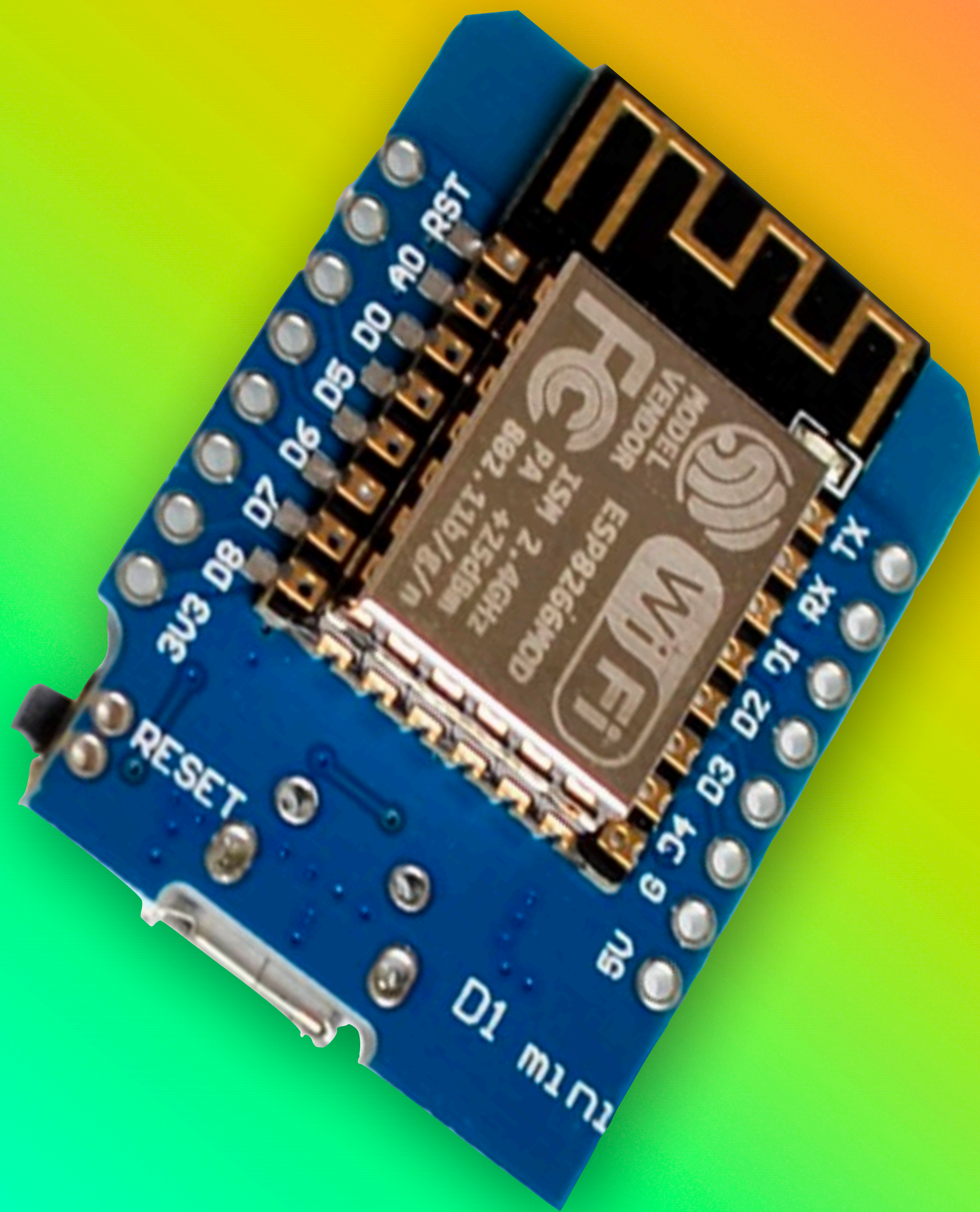
MYSTERIOUS BITS OF HARDWARE:

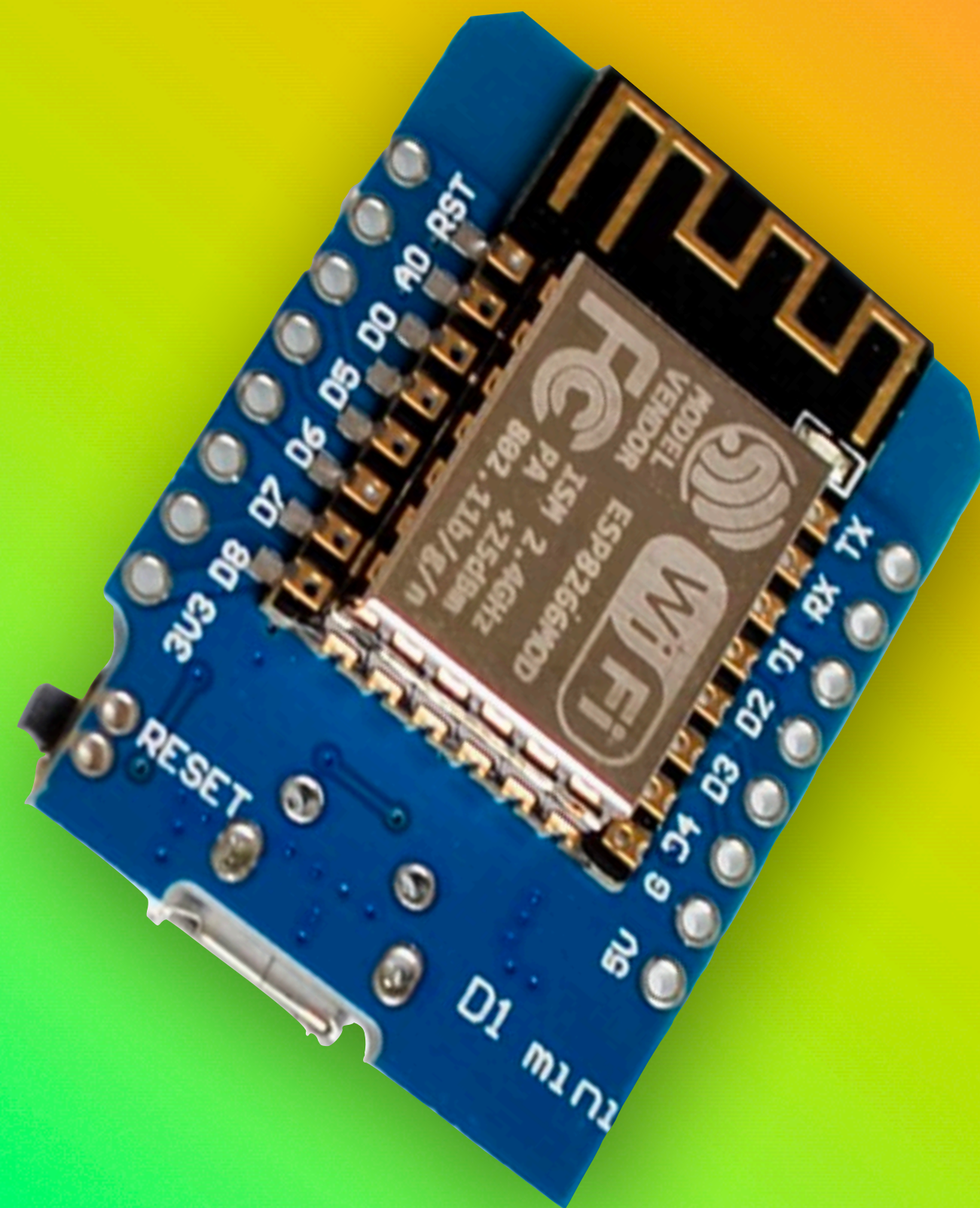
GO!

ROBOT ORCHESTRA









BUT HOW?

MY APPROACH – THINGS I AM DOING

MQTT

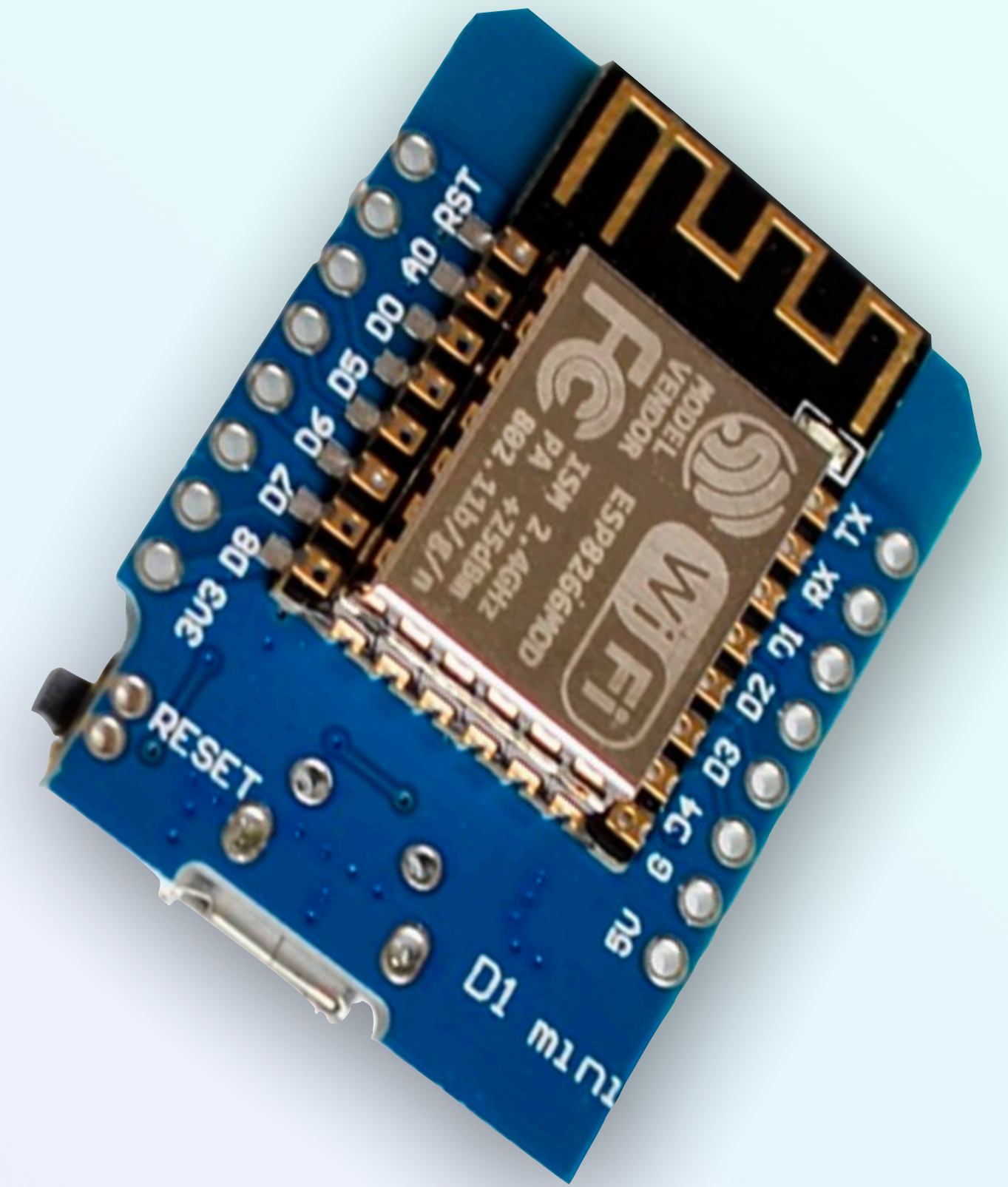
...with objectively terrible encoding

...and booleans cast to String (Arduino)

...and numpy arrays cast to strings (Python)

...and... (etc)

BUT IT WORKS!



CODE WALKTHROUGH

[HTTPS://GITHUB.COM/NUSTEM-UK/ROBOT-ORCHESTRA-3/](https://github.com/nustem-uk/robot-orchestra-3/)

ADVANTAGES: MQTT

Broadcast model... with channels

Industry-standard

Quality of Service options (not used, but interesting)

Performance at least 'good enough'

Solid libraries (plural), cross-platform

Good documentation

Andy Stanford-Clark is funny

Growth potential!

PROTOCOL

MQTT message structured as, for example:

topic: orchestra/playset

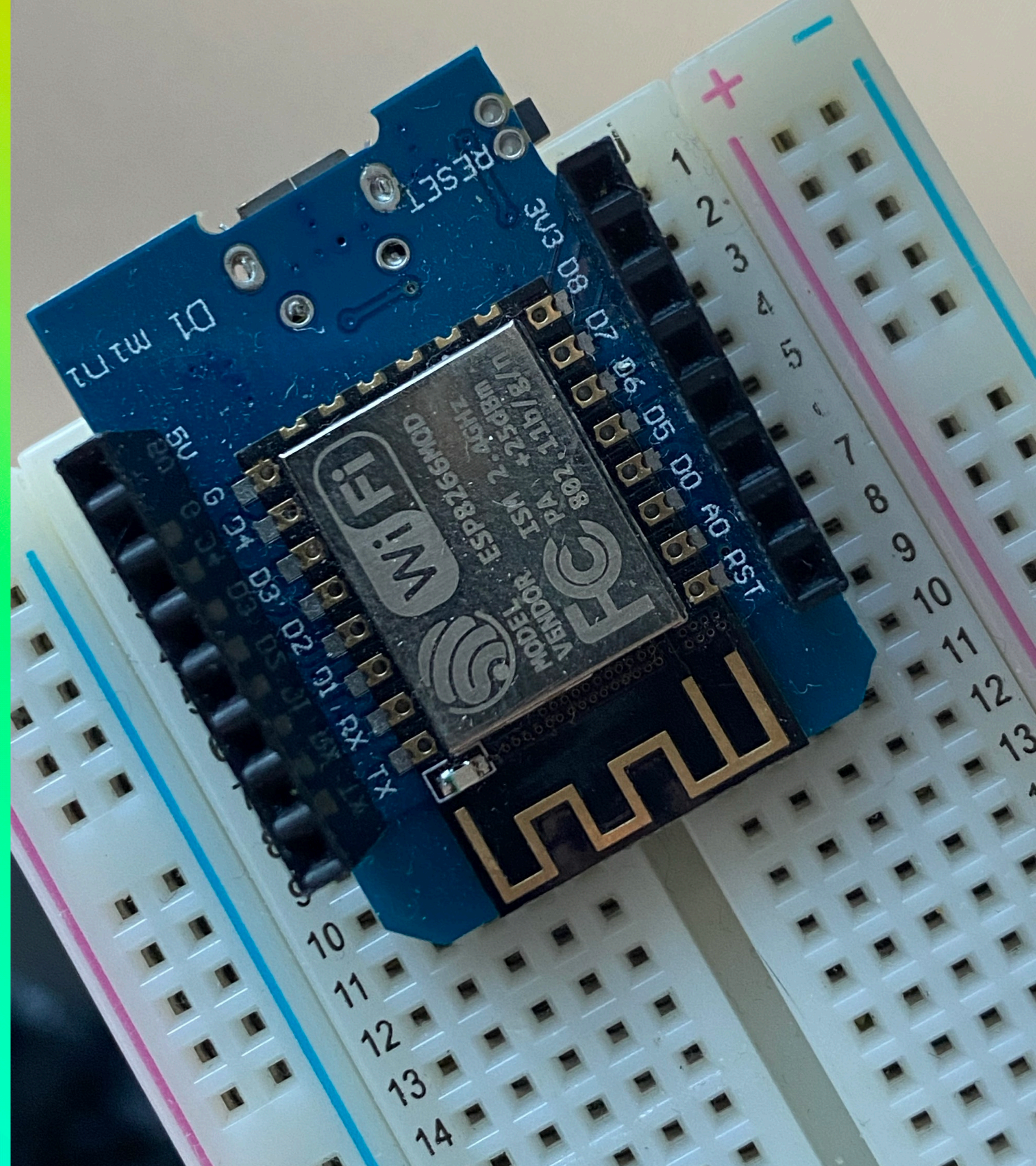
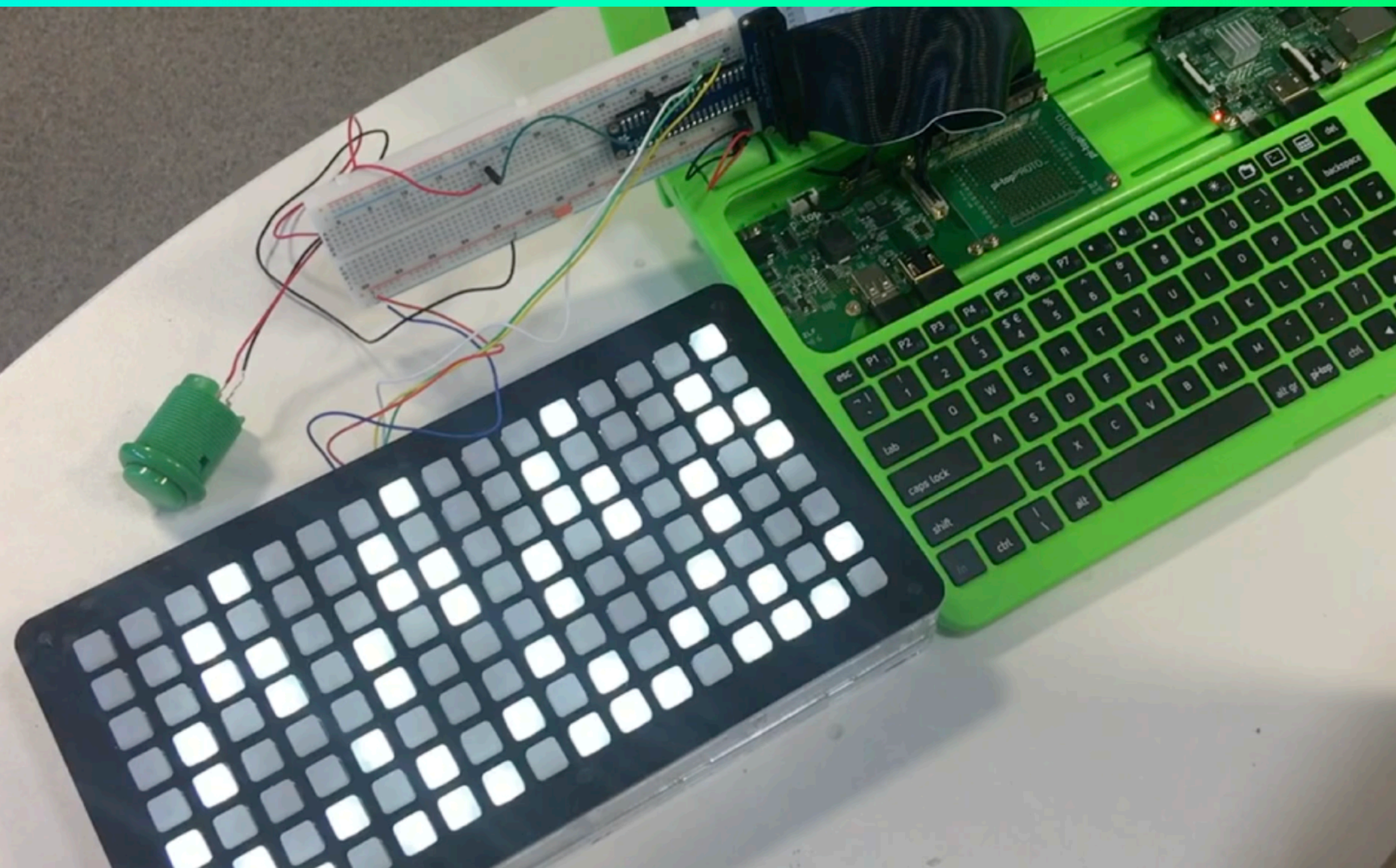
payload: 10010001

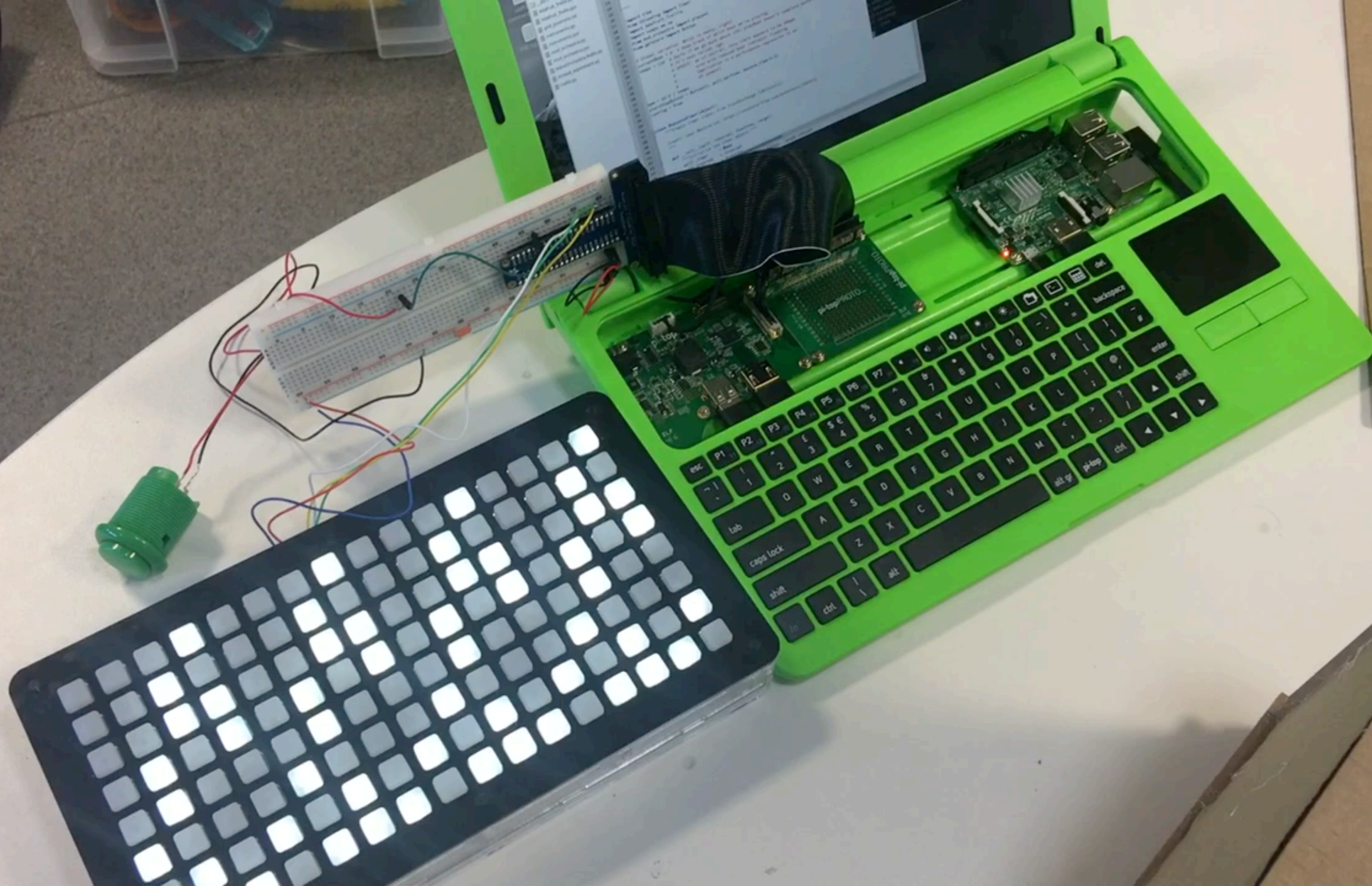
Note 8 channels

What's wrong with this encoding?



8 TRACKS





ADD GLOCKENSPIEL

**ADD RTTTL RINGTONES
+ PYTHON PARSER**

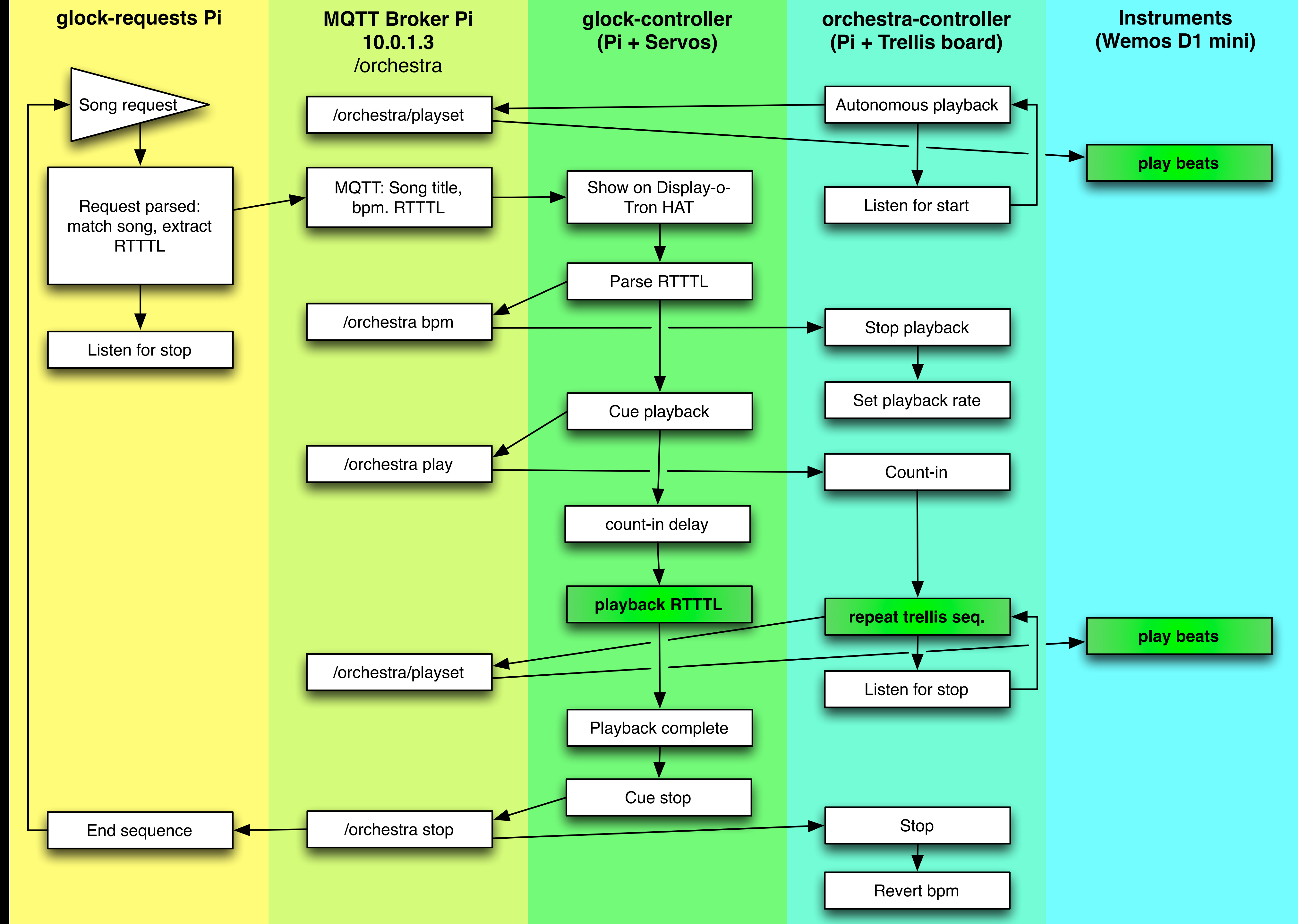
ADD TWITTER

ADD LIGHTS

ADD MOAR FESTIVE



ADD JUKEBOX



THE HEART OF MAKER FAIRE



nustem



A WORLD OF MAKERS

nustem



SYSTEM COMPONENTS

THE HEART OF MAKER FAIRE

Lights:

2,200 LEDS

6 FadeCandy Controllers

2 Raspberry Pi 3, Processing

Hub:

Pi Zero – WiFi router, MQTT, MySQL

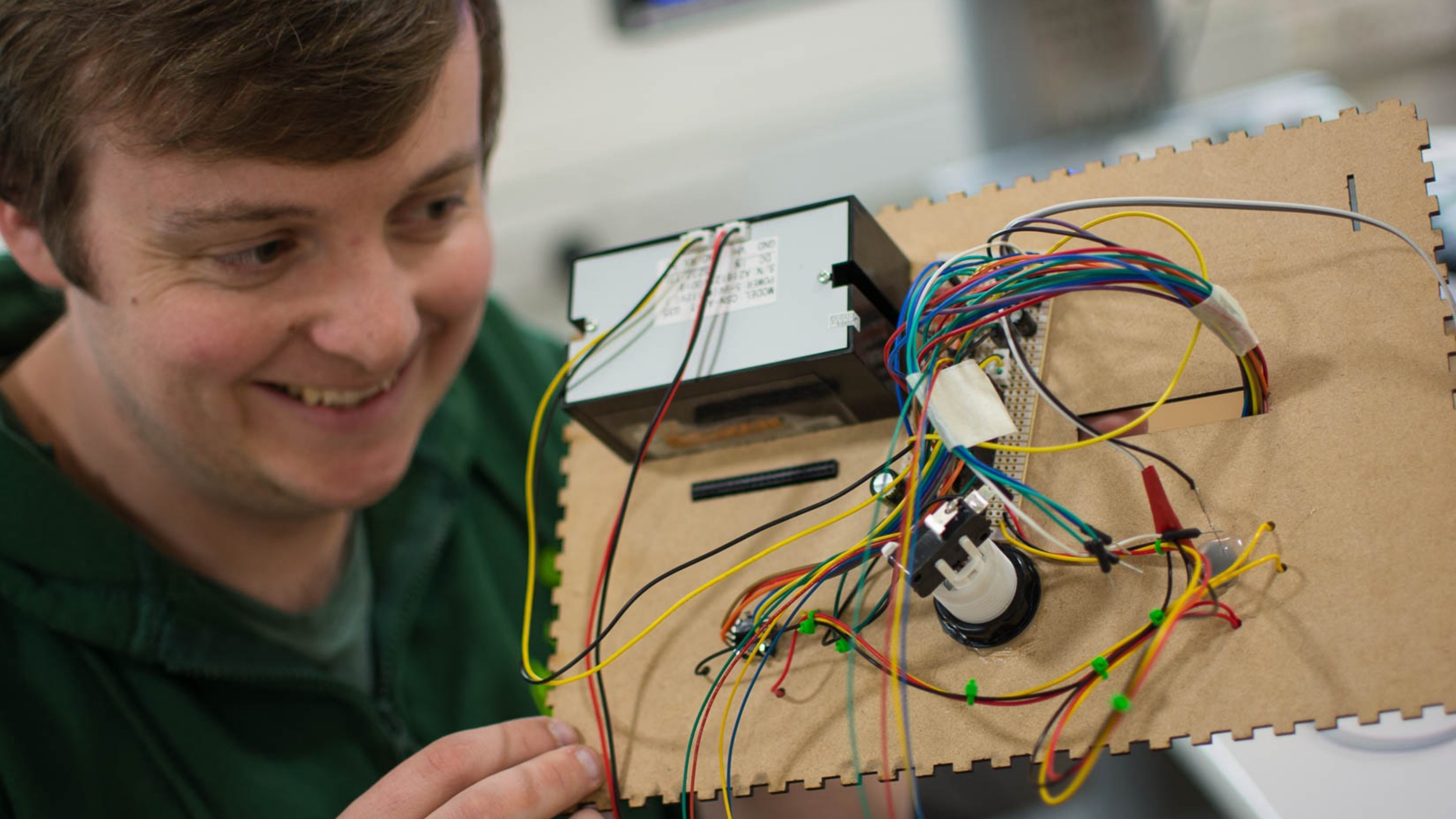
Control stations (2):

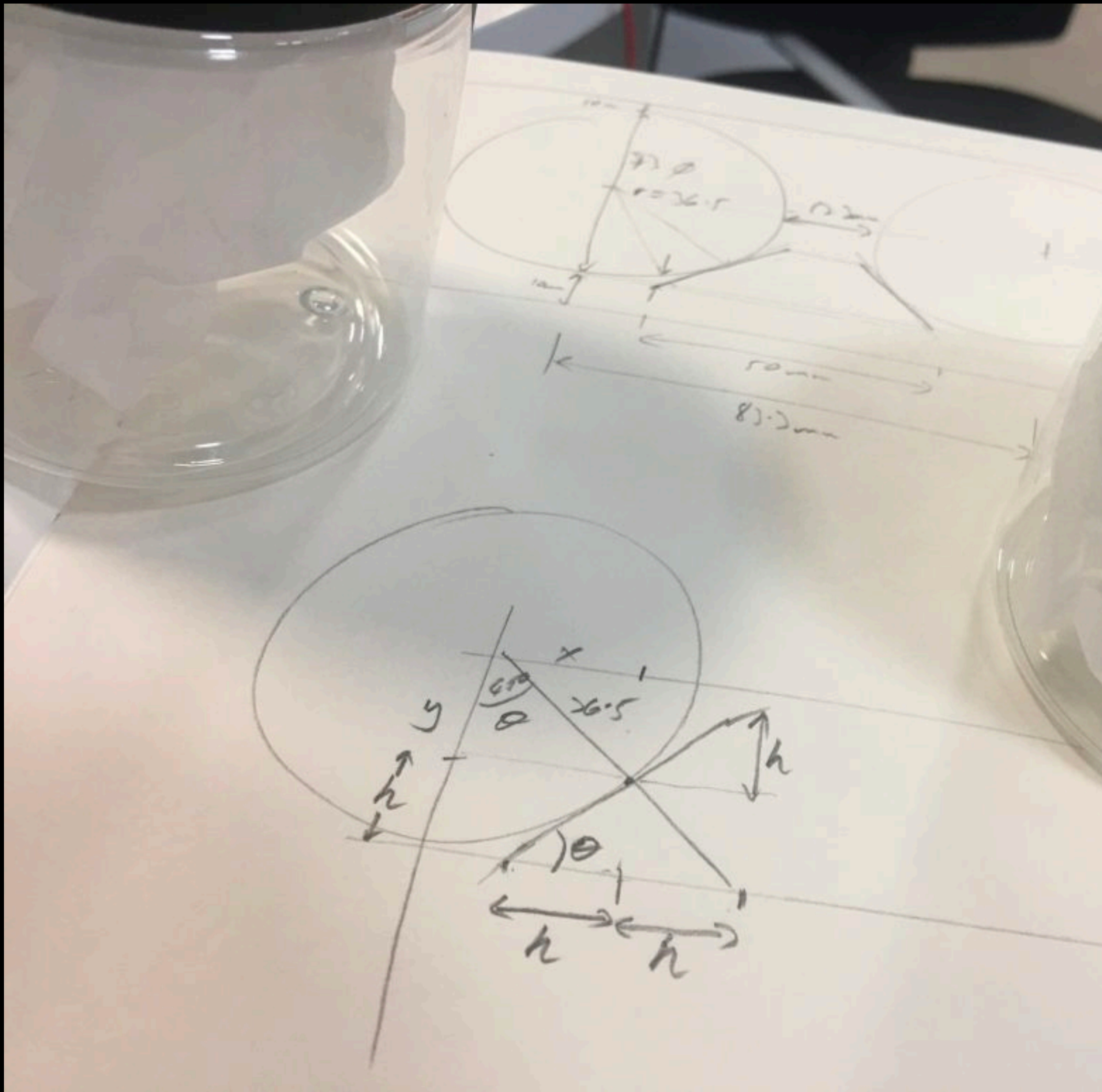
Raspberry Pi 3, Pi Camera, thermal printer, rotary encoder, display, RGB LEDs...

Control badges (4):

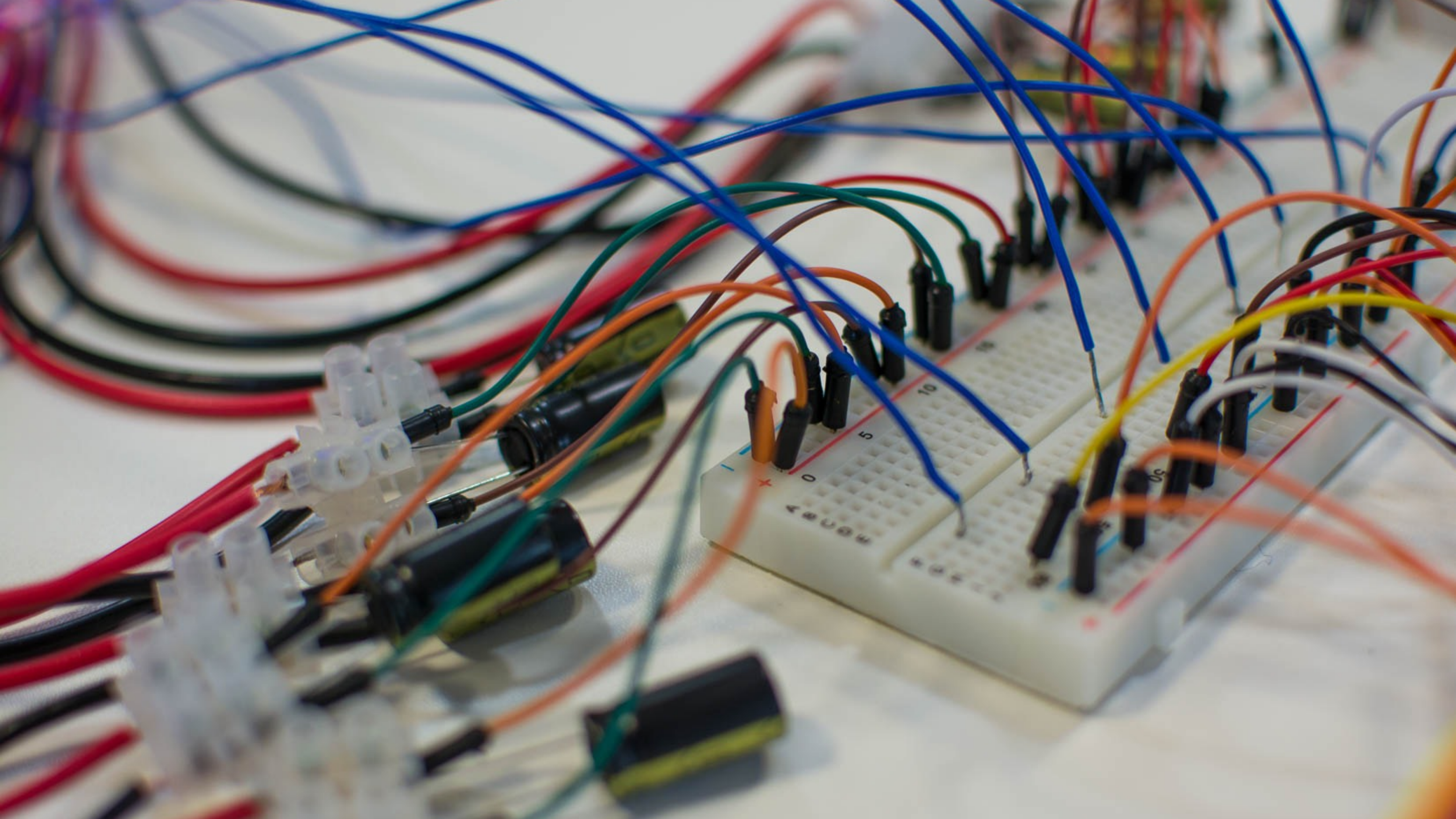
ESP8266, illuminated buttons

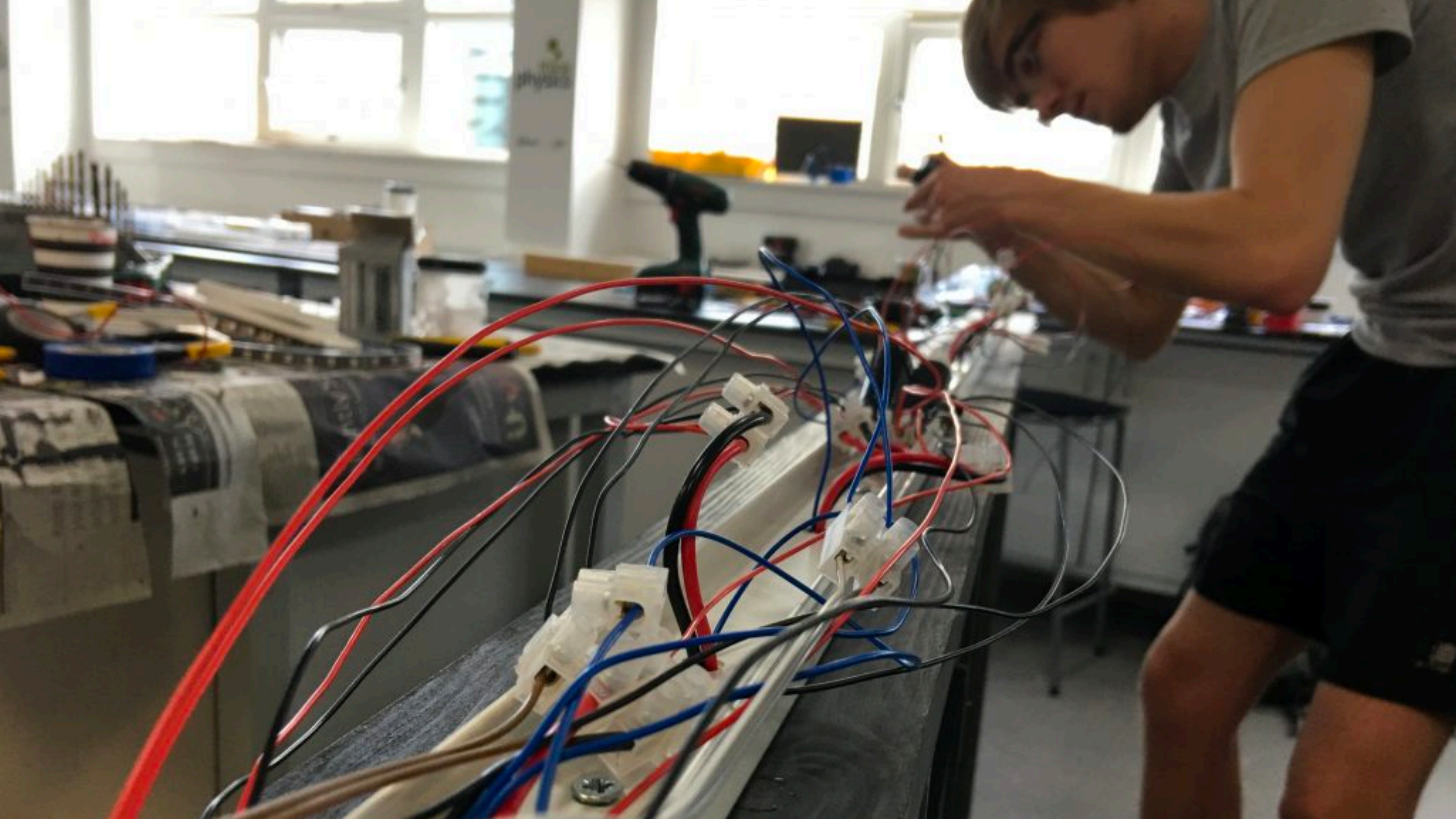


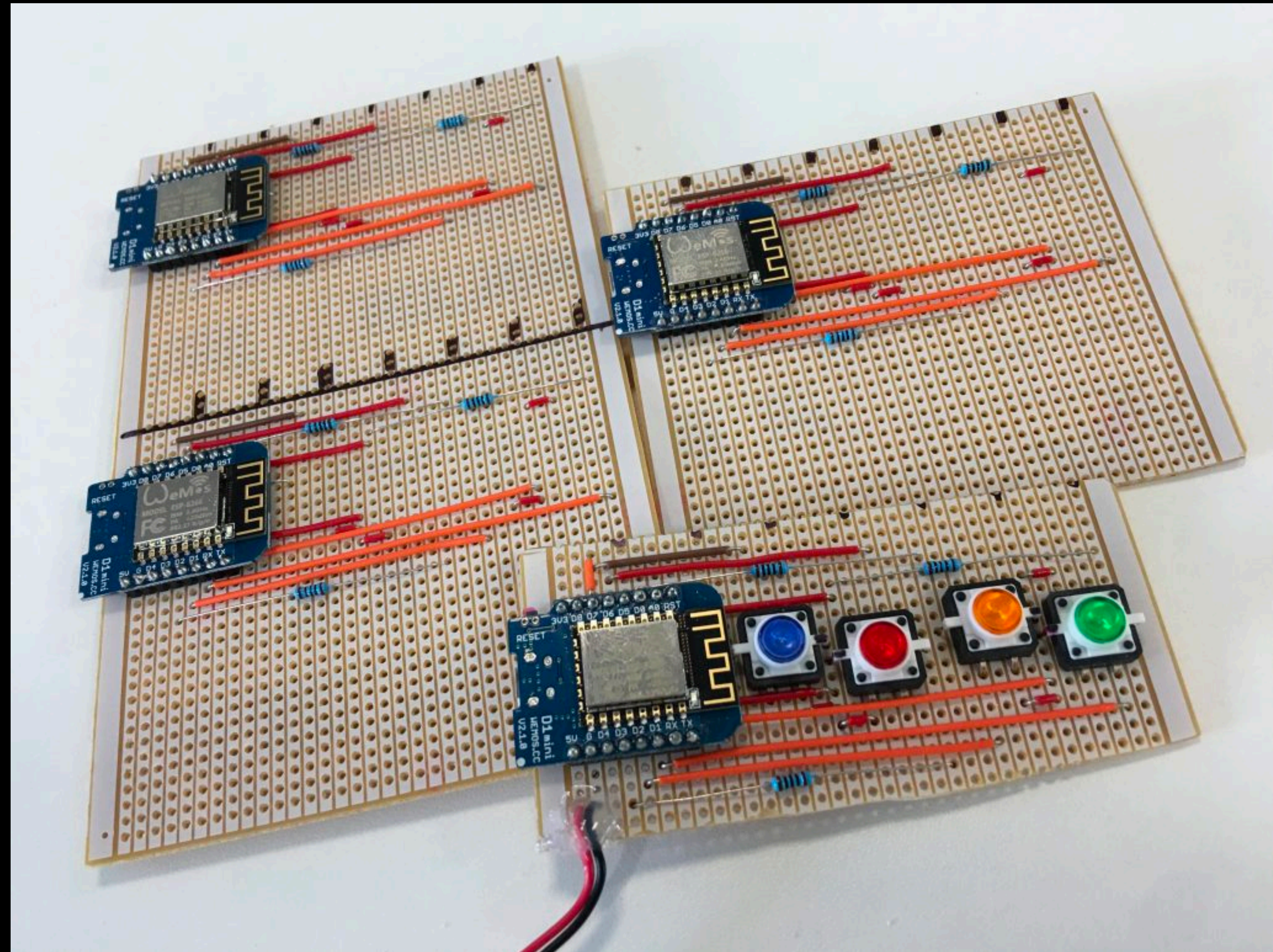
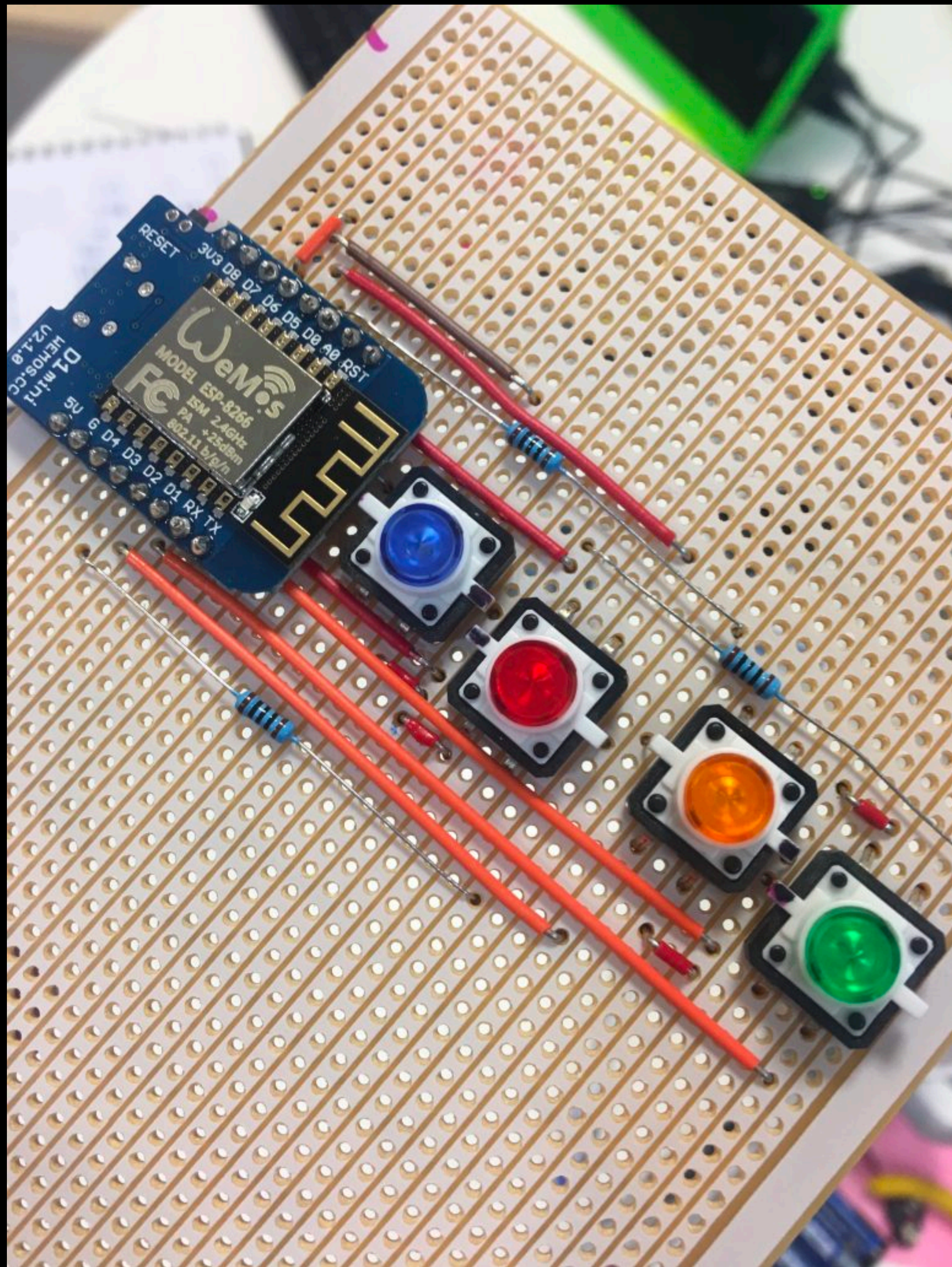


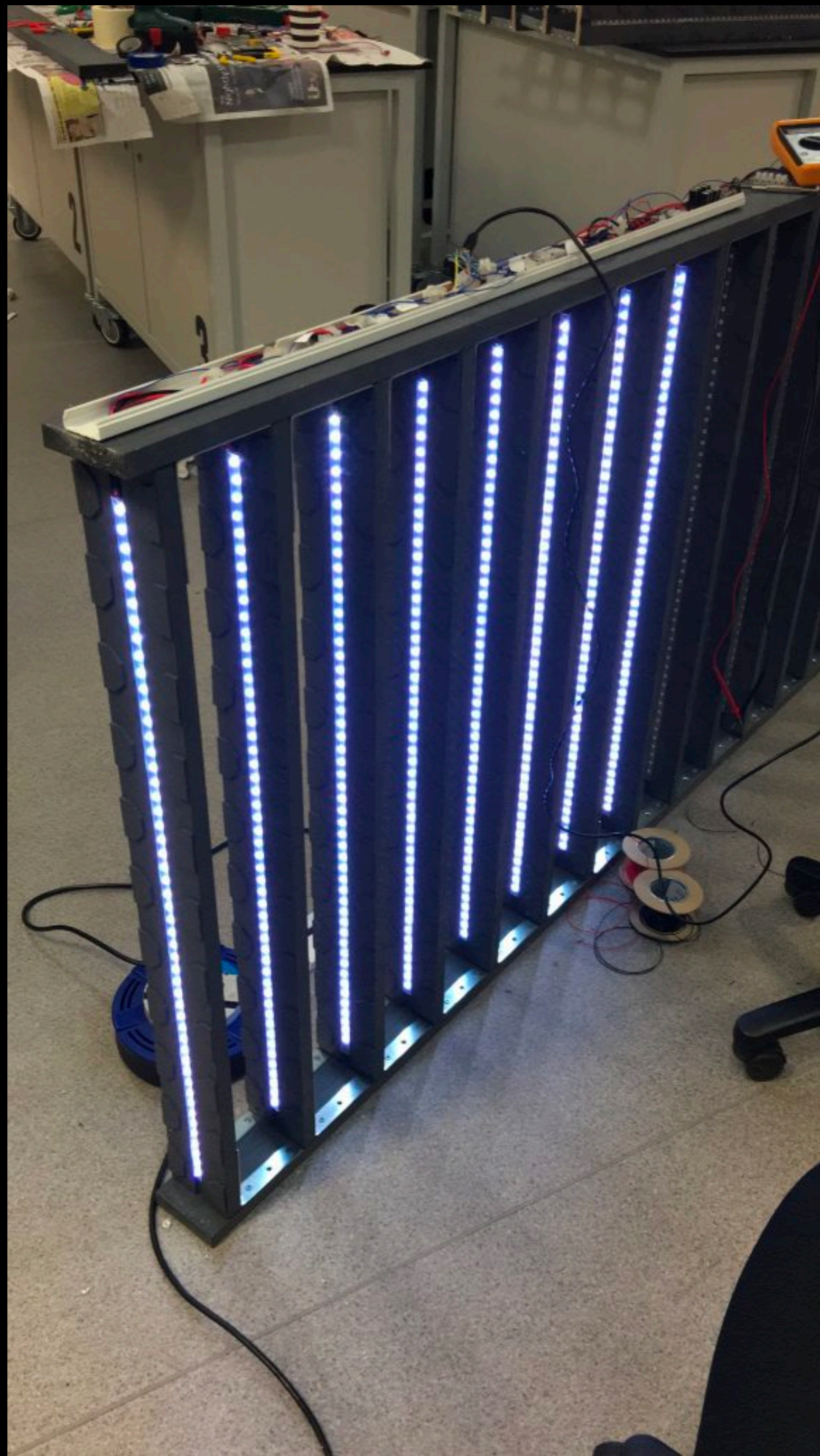
















SYSTEM COMPONENTS

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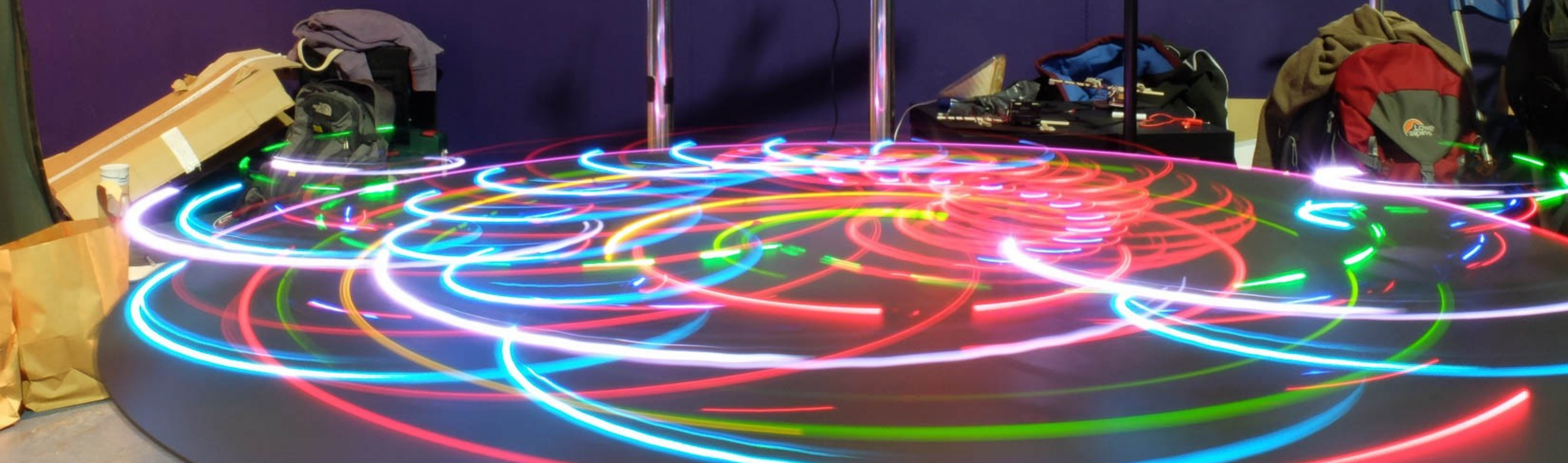
ESP8266, illuminated buttons



PIROGRAPH



Wishing Well
Think Physics
www.thinkphysics.org
MMS



PIROGRAPH

HARDWARE

Image pipeline:

Pi Camera (streaming, via Pi Zero)

Pi 3, Python (numpy)

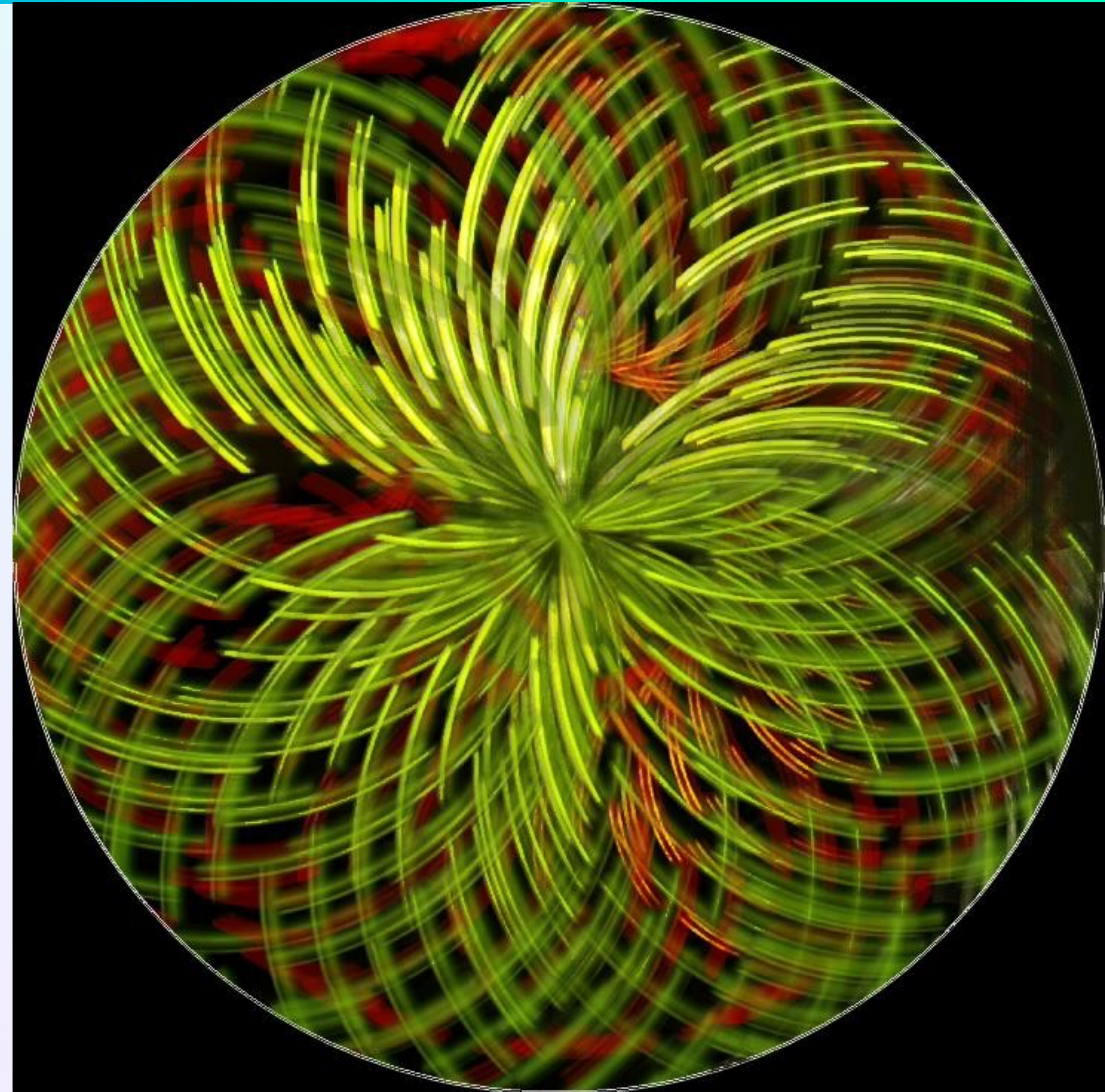
Robots:

ESP8266, continuous rotation servos

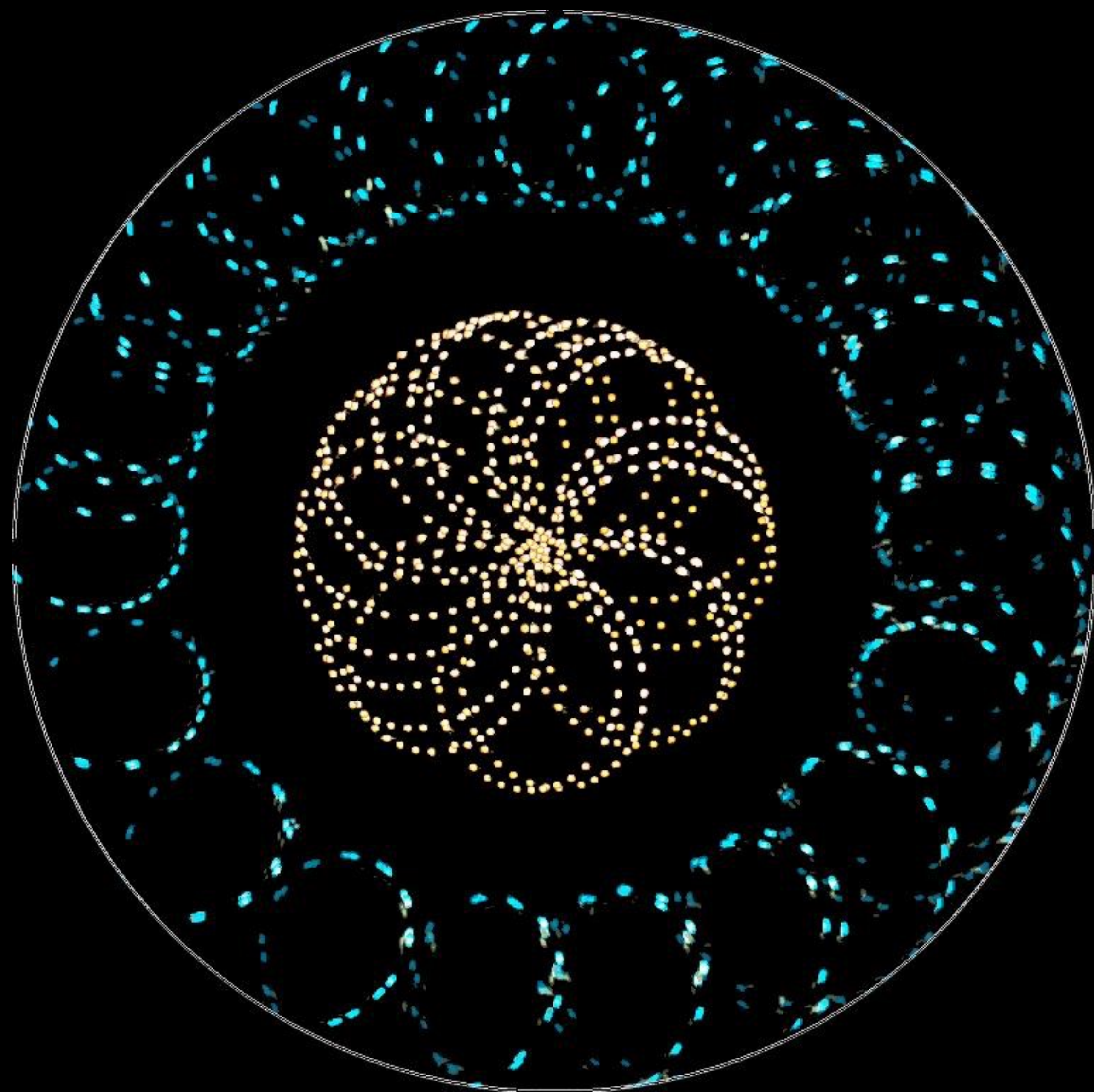
MQTT

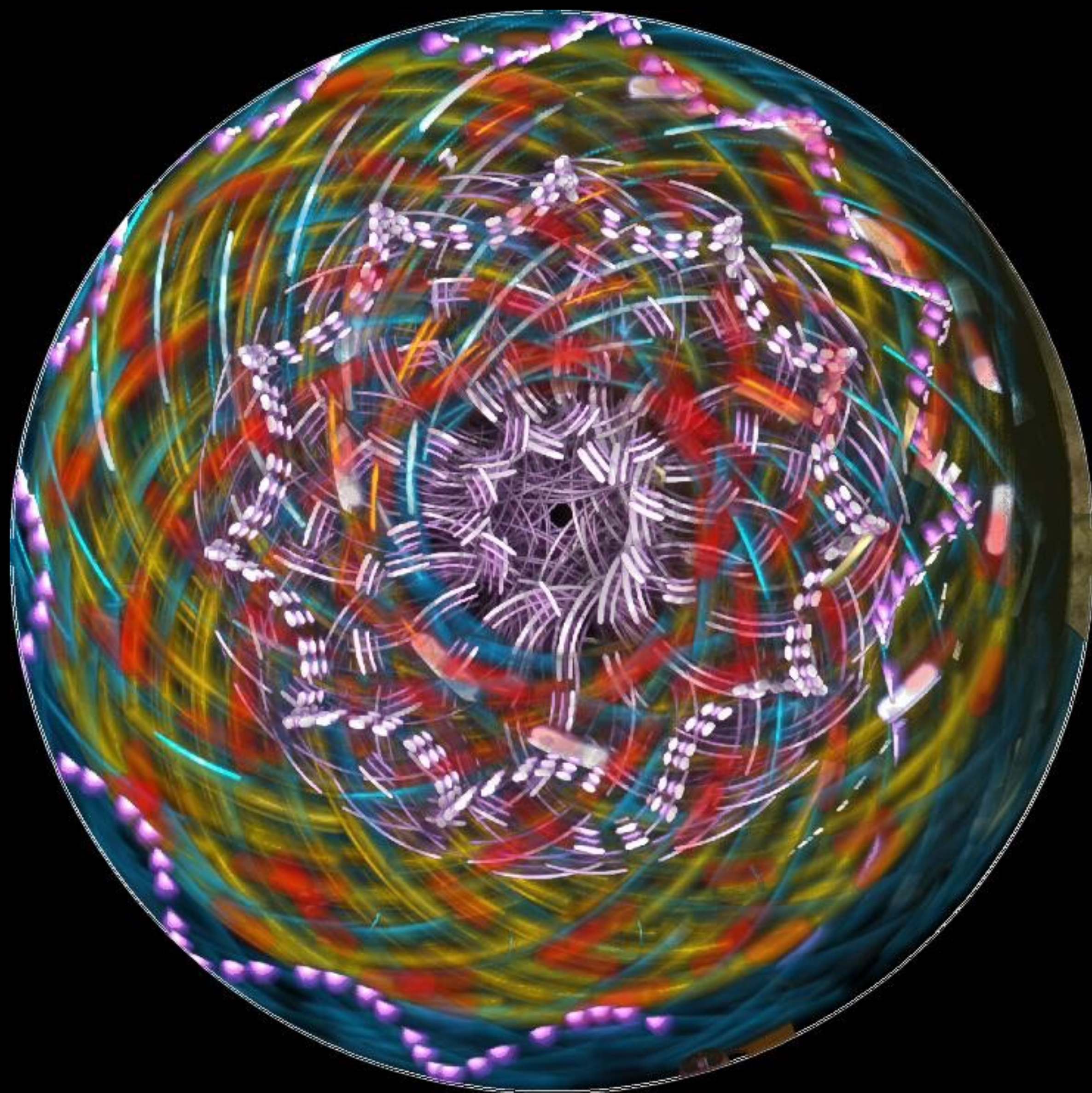
Flask app

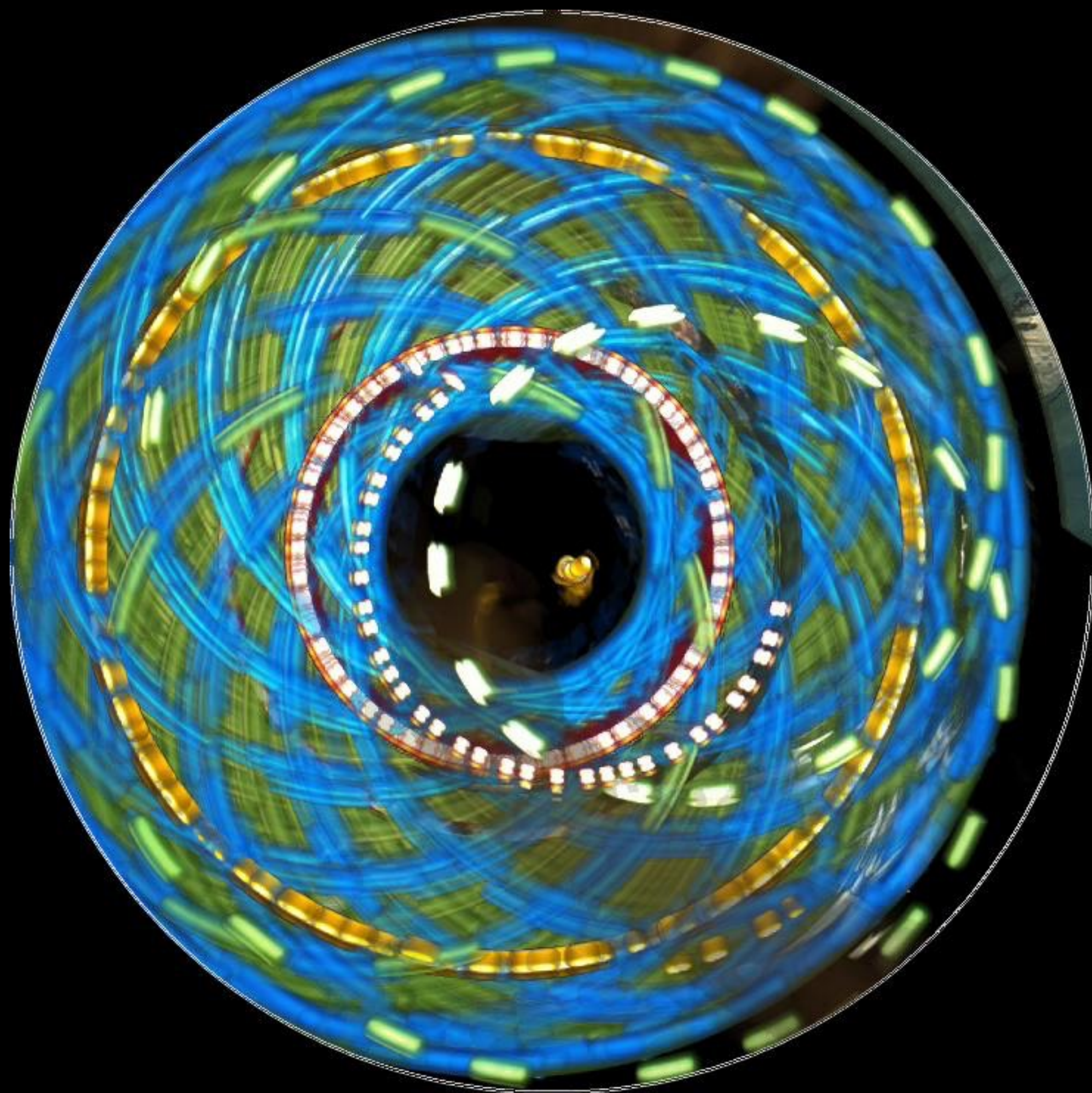
Giant turntable







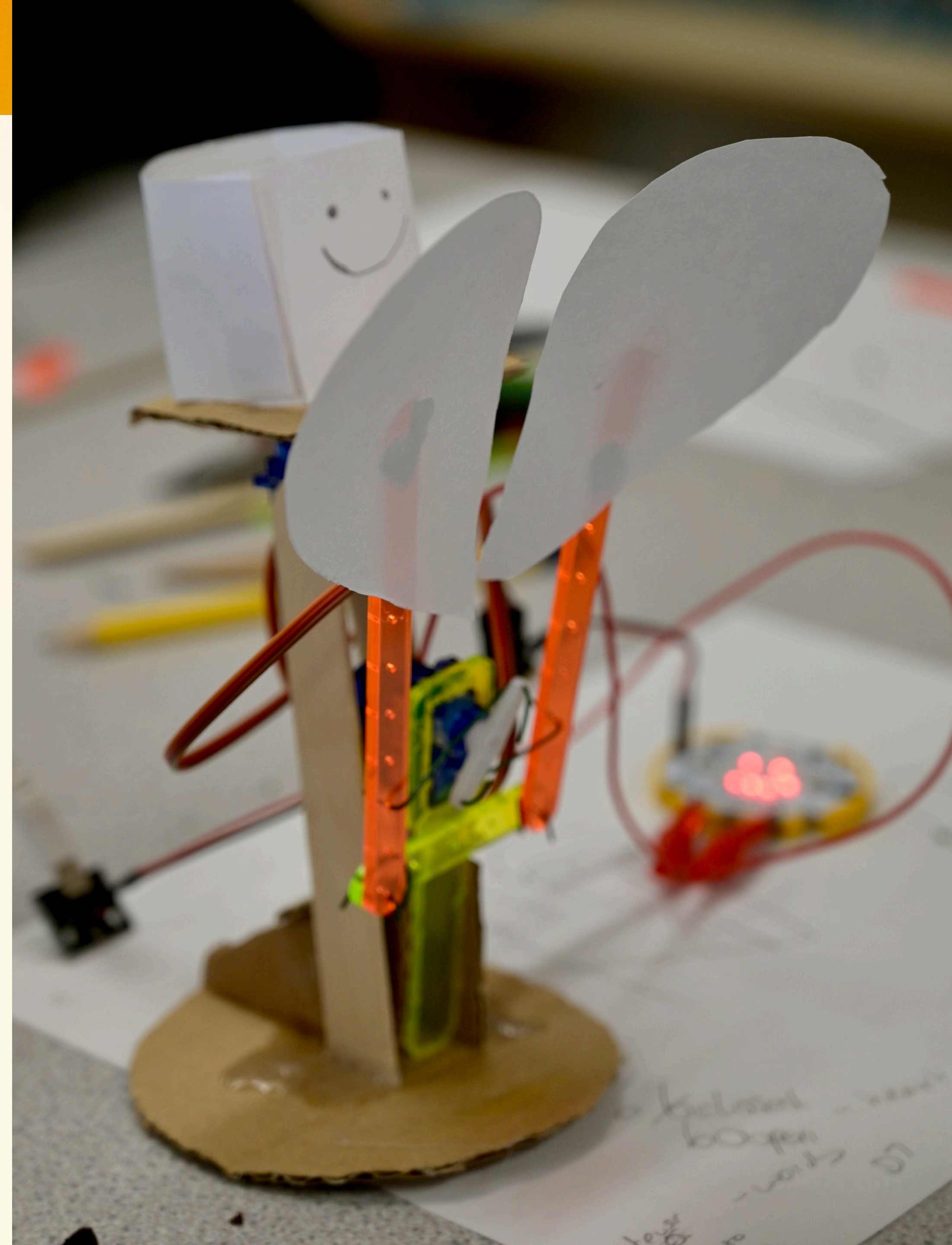




CONNECT

nustem

Life™



DEMO

CODE WALKTHROUGH

INTERMISSION

DEVELOPMENT EXERCISE



COUNTING VISITORS

Current system:

Individual staff
clipboards
sampling

New system: ?

Applications: ?

Kielder Forest



Oliver Dixon, Wikimedia Commons,
Northumberland National Park

REFLECTION

REFLECTION

LESSONS LEARNED, 'SAGE' ADVICE

Small pieces, loosely joined

Build incrementally (code... and skills)

Prototype fast: think proof-of-concept

...then iterate

Protocols, message exchange, grammar

Micropython is cool, Arduino is mature

Build on top of others' platforms

...choose by documentation, examples

...choose for growth potential

Hardware performance is not an issue

...avoid premature optimisation