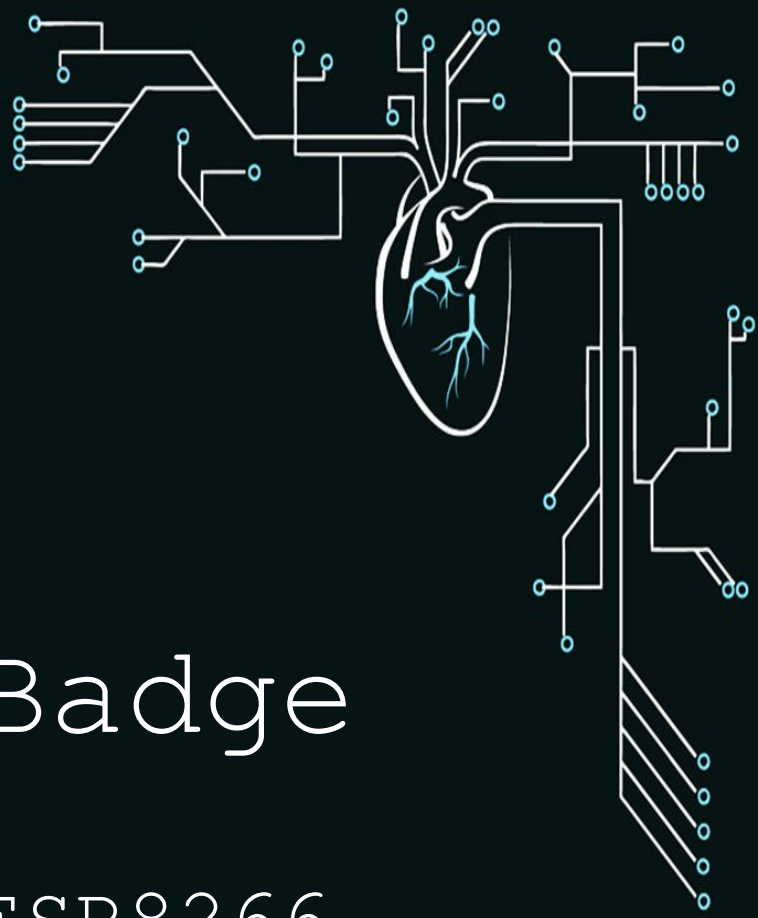

AH
AFRICAHACKON



The AH2017 Badge

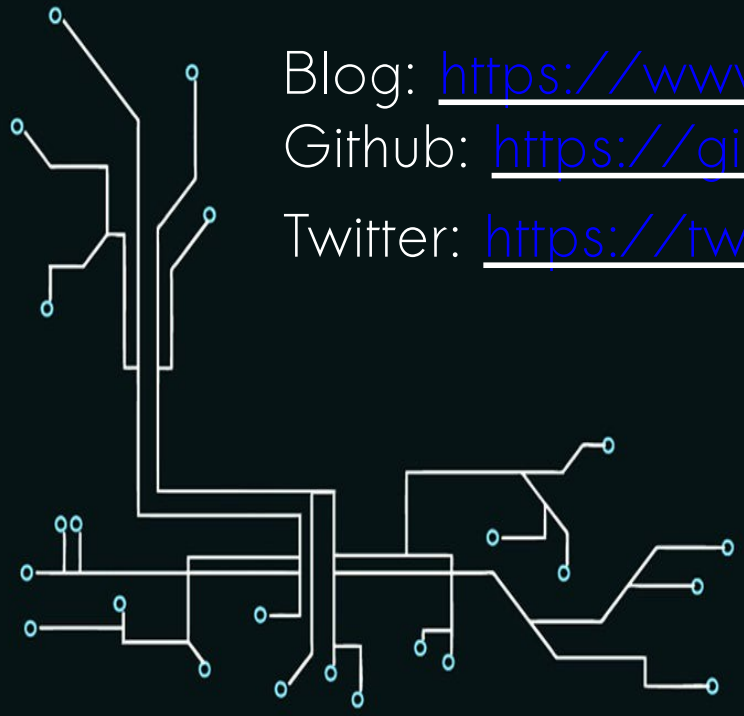
and

Hacking with the ESP8266

whoami

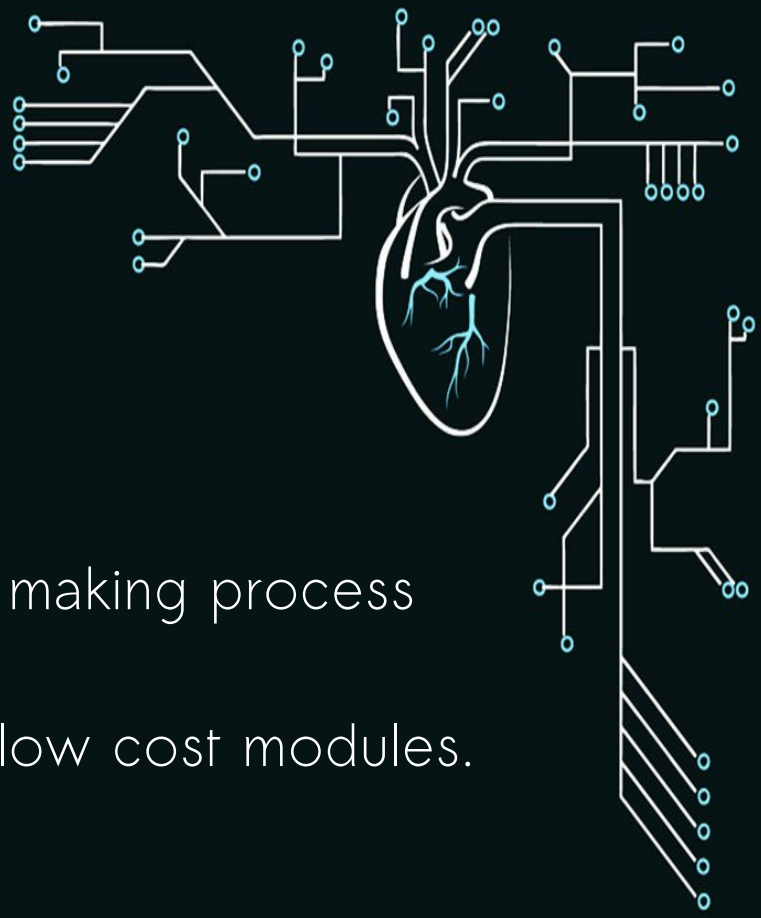
Chrispus Kamau

Electrical and Electronics Engineer by study
Information Security Constultant by practice



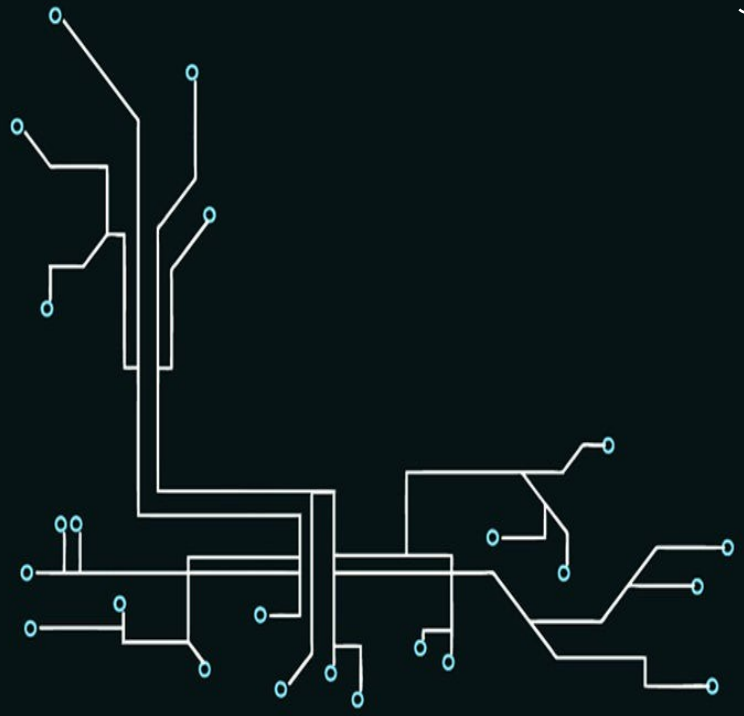
Blog: https://www.ckn.io
Github: https://github.com/iamckn
Twitter: https://twitter.com/iamckn

What's this about?

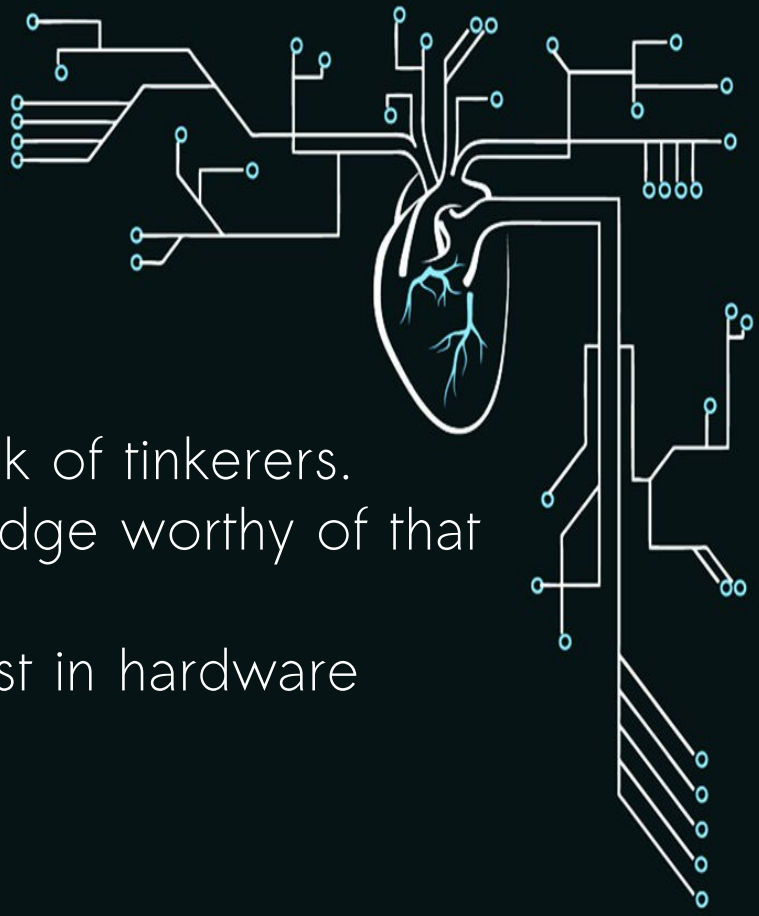


This is a two part talk:

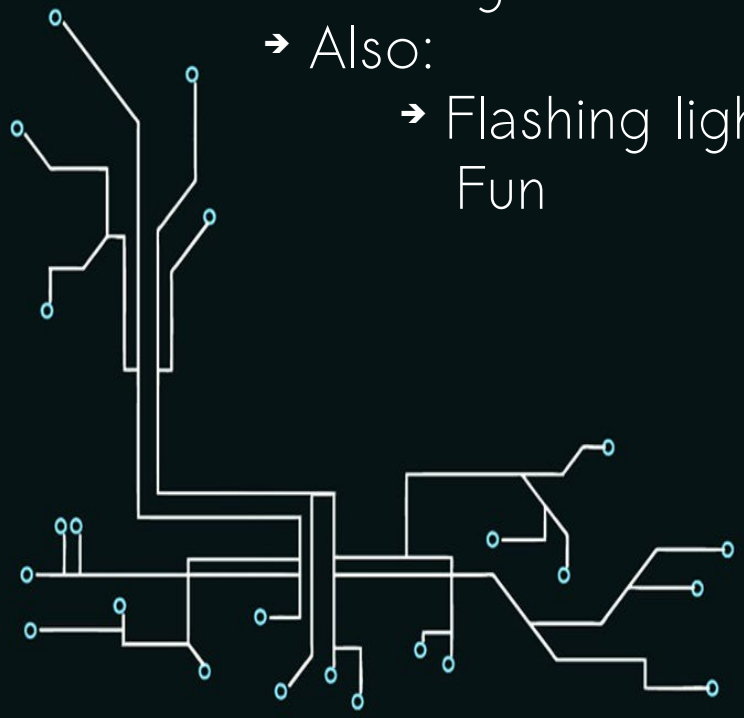
- Part one: Walkthrough on the badge making process and its operation.
- Part two: Hacking with the ESP8266 low cost modules.



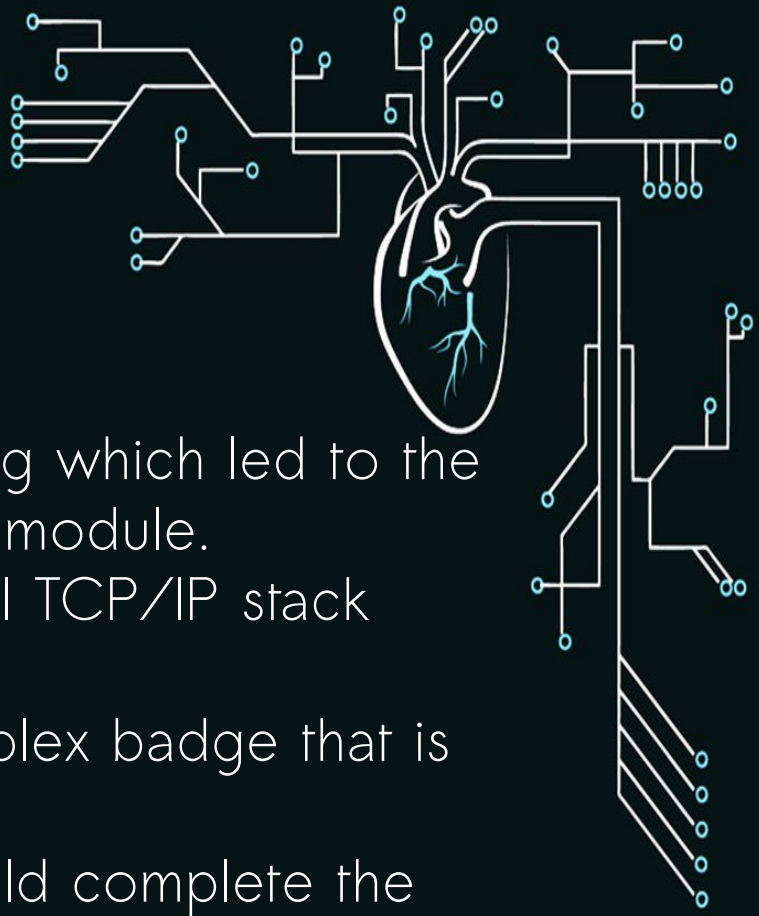
Why make the badge?



- The hacker culture is built on the back of tinkerers.
- A hacking conference deserves a badge worthy of that culture.
- The badge also hopes to spur interest in hardware hacking.
- Also:
  - Flashing lights :)
    Fun



The concept



- I have an avid interest in radio hacking which led to the discovery of the awesome ESP8266 module.
- This is a low-cost Wi-Fi chip with full TCP/IP stack and microcontroller unit.
- These are perfect for a not too complex badge that is still interesting and functional.
- A good OLED display and LEDs would complete the picture.

The concept

- To make the badges useful and fun, I decided to build them with the following capabilities:
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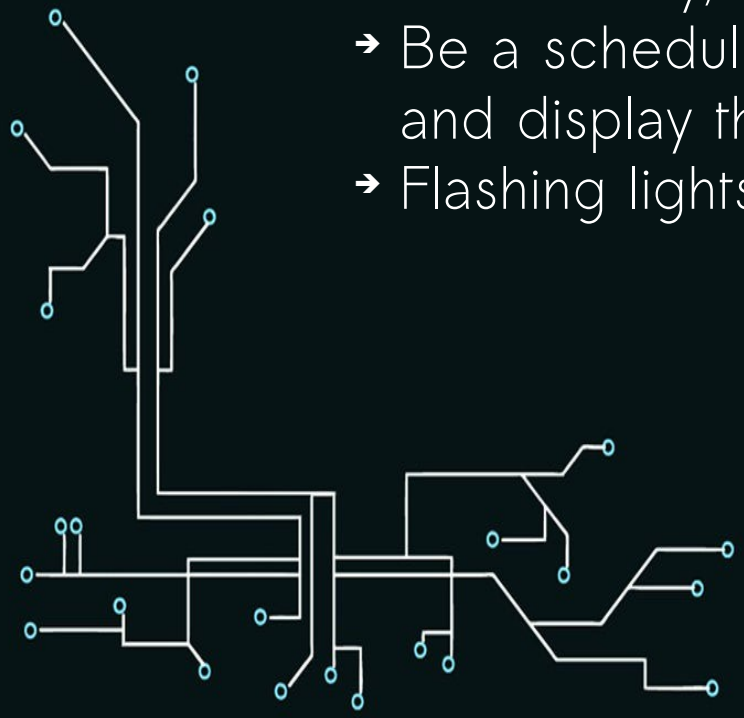
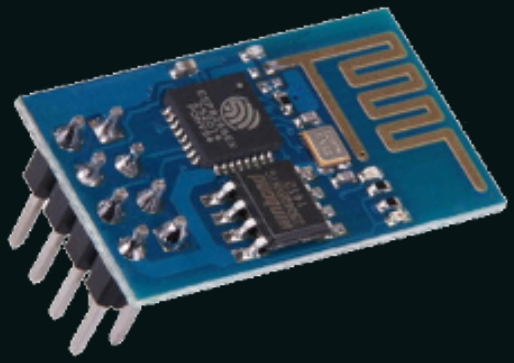
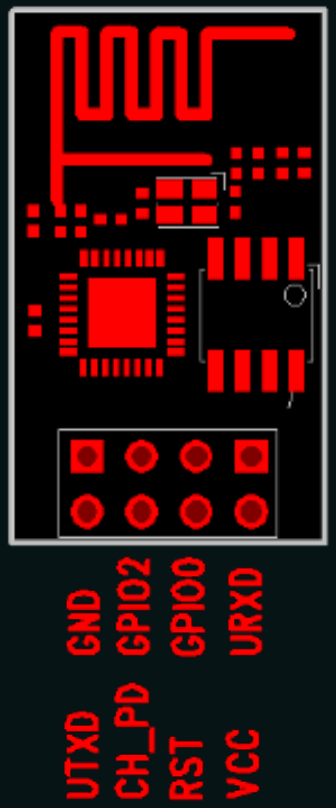
  - Ability to interact with WiFi networks (scanning and connectivity)
  - Be a schedule tracker throughout the conference and display the details of the current talk.
  - Flashing lights :)



The Hardware

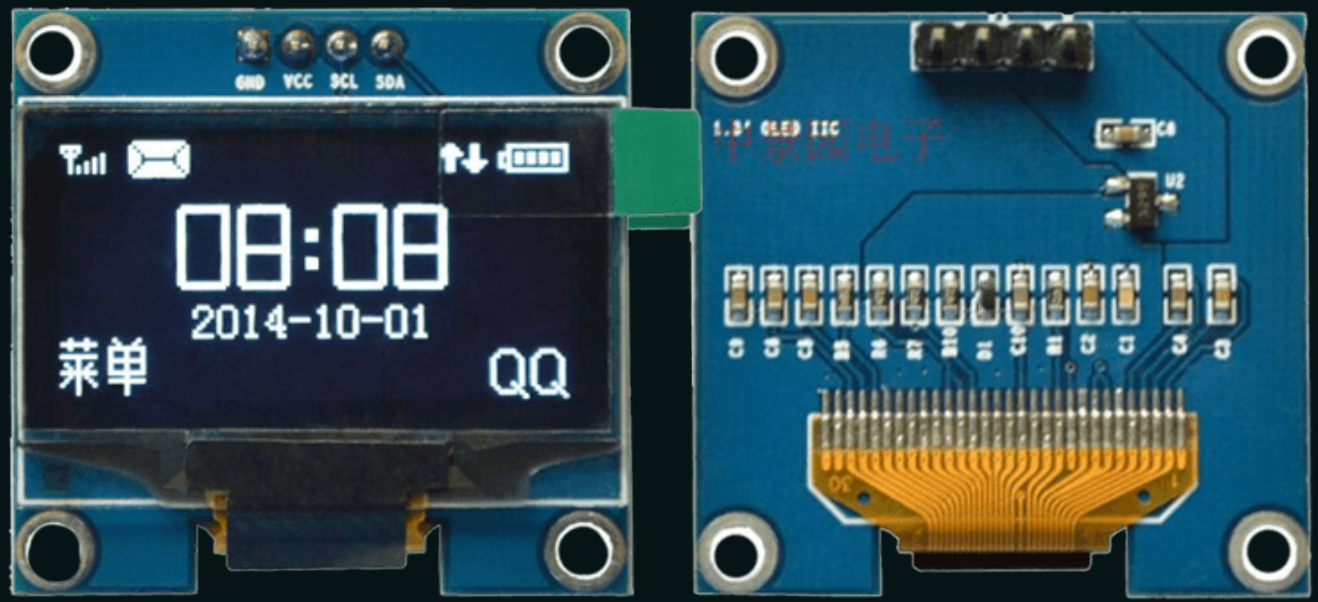
- ESP8266-01 modules ($3)





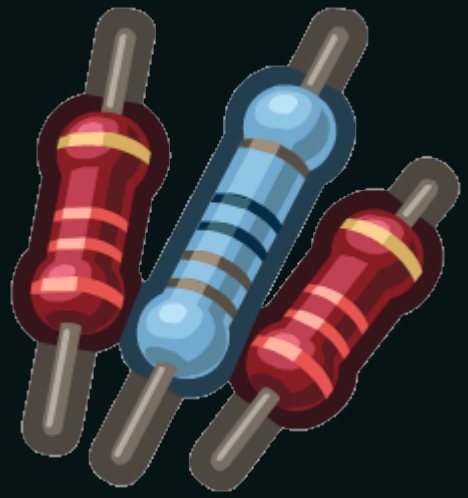
The Hardware

0.96" I2C OLED Displays 128X64 ($5)



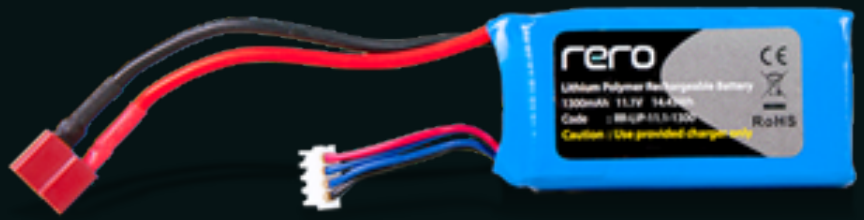
The Hardware

Assorted colour LEDs and 10k resistors

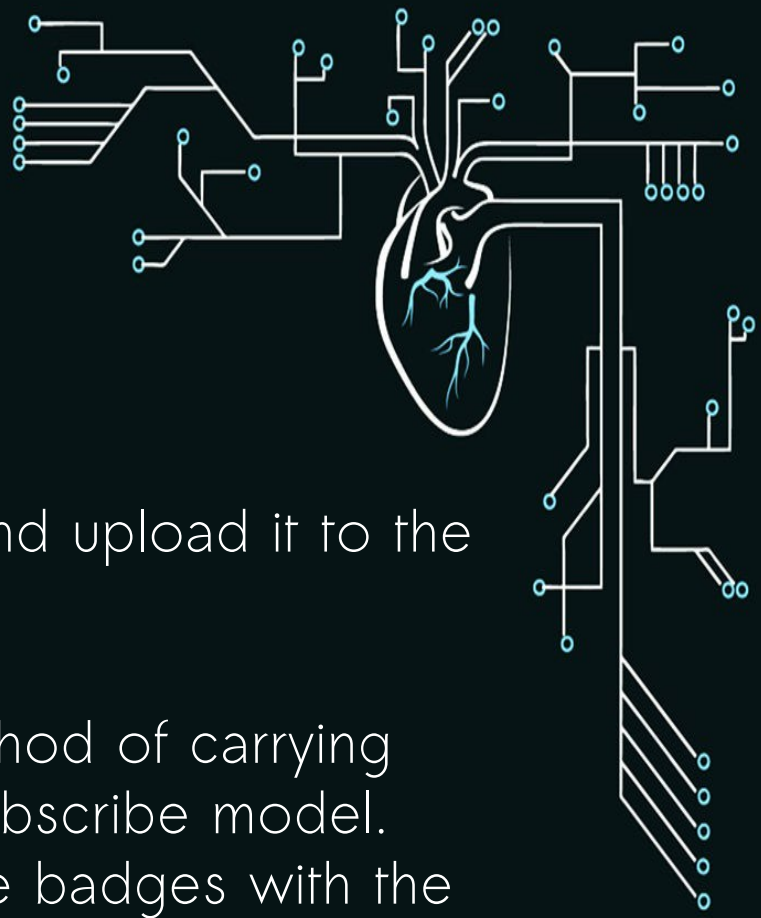


The Hardware

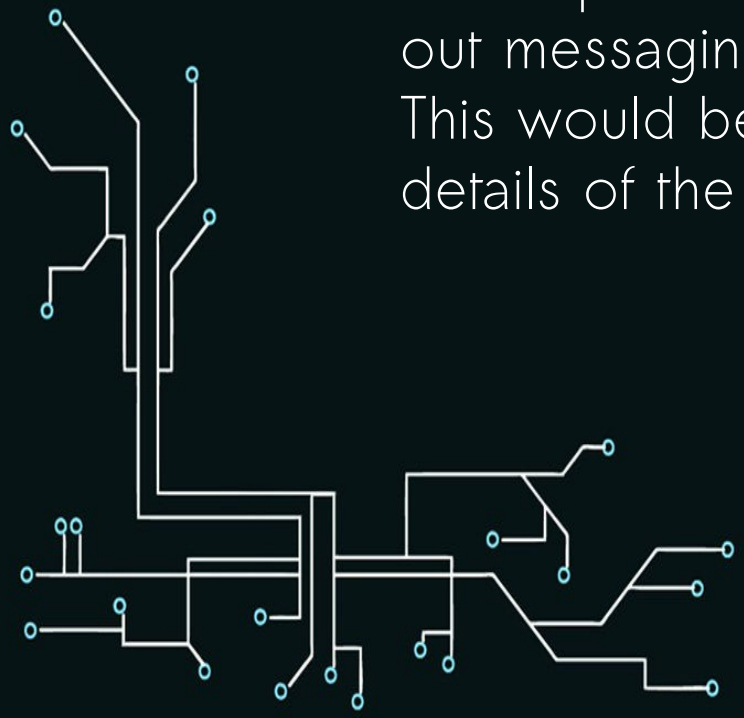
3.7v 600mAh LIPO Batteries ($5)



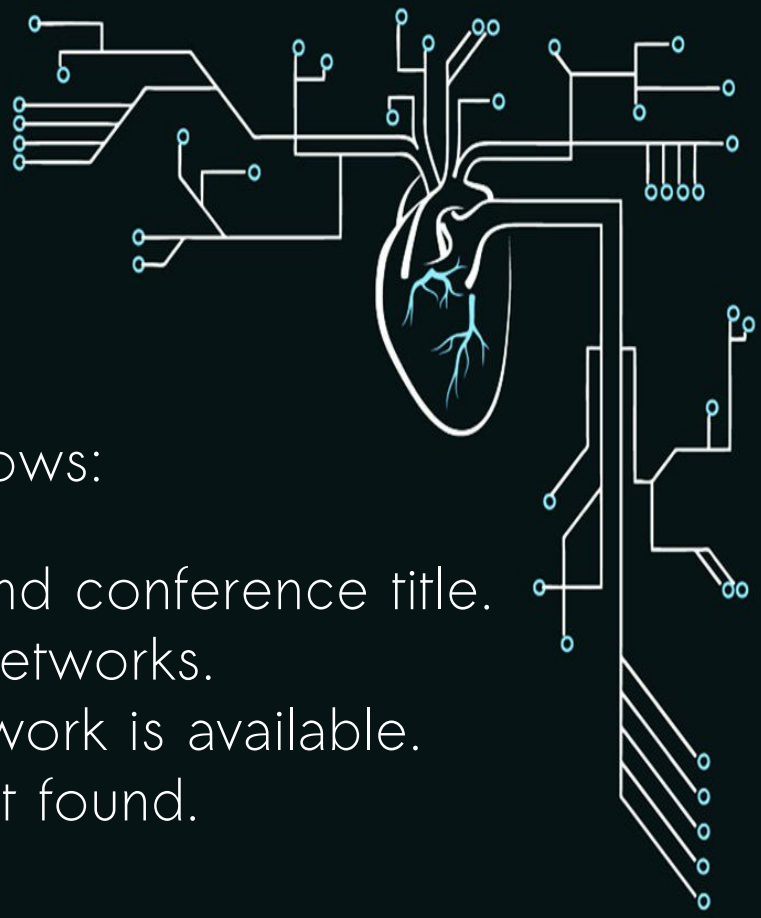
The Software



- Arduino 1.8.1 IDE
  - This was use to write the code and upload it to the ESP8266 modules.
- Mosquitto MQTT Broker
  - MQTT provides a lightweight method of carrying out messaging using a publish/subscribe model. This would be used to update the badges with the details of the current talk during the conference.

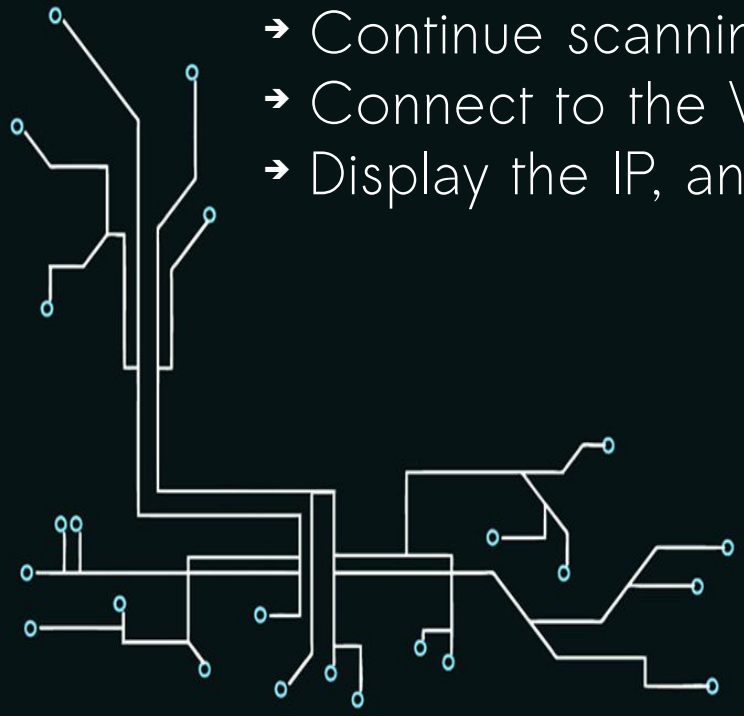


The Logic - WiFi

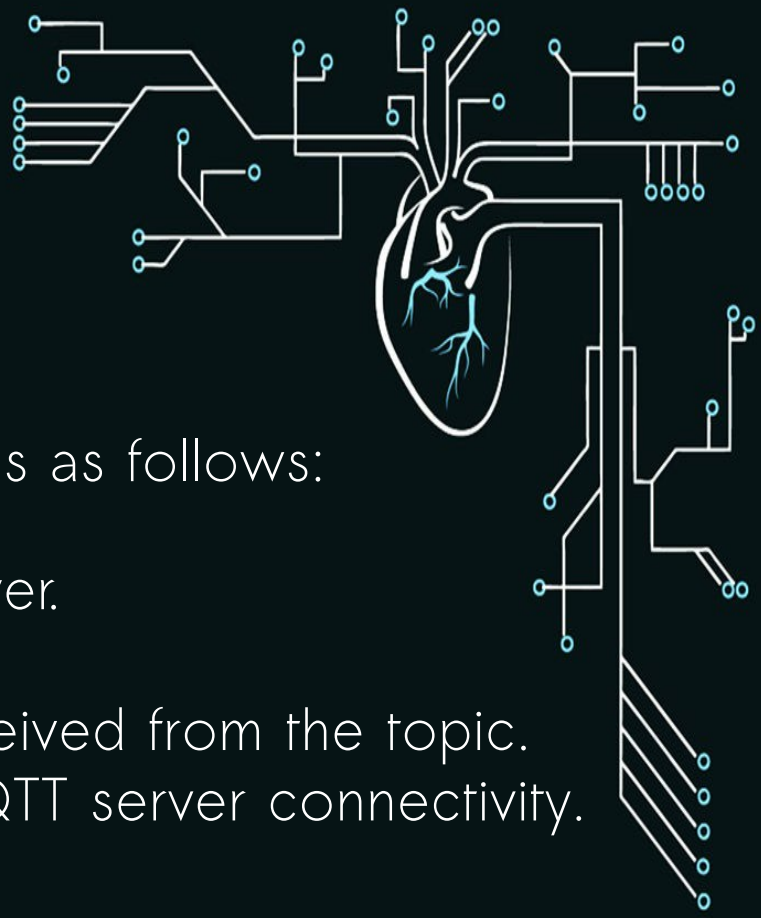


Initial operation of the badge is as follows:

- Start up and display the AH badge and conference title.
- Scan and display available wireless networks.
- Check if a preprogrammed WiFi network is available.
- Continue scanning if the network isn't found.
- Connect to the WiFi when detected.
- Display the IP, and power details of the WiFi network.

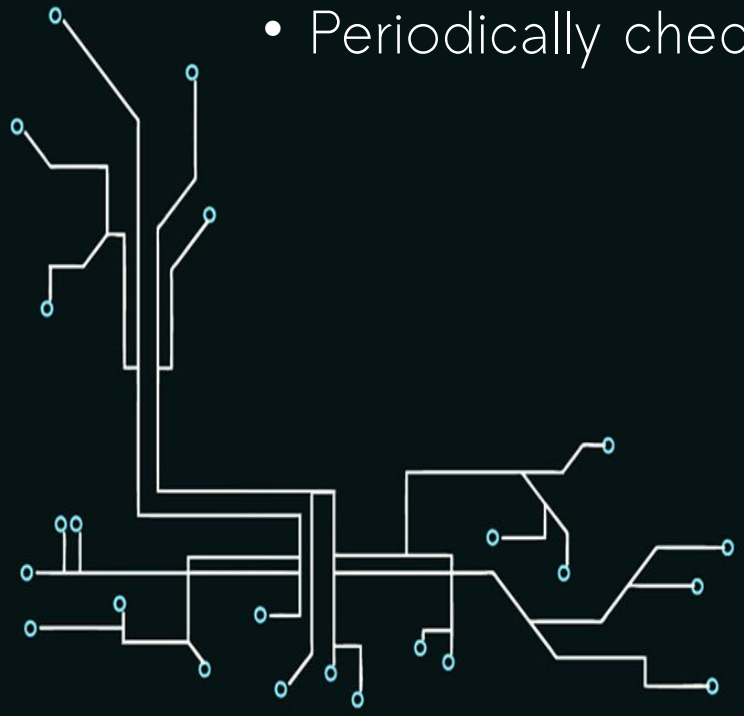


The Logic - MQTT

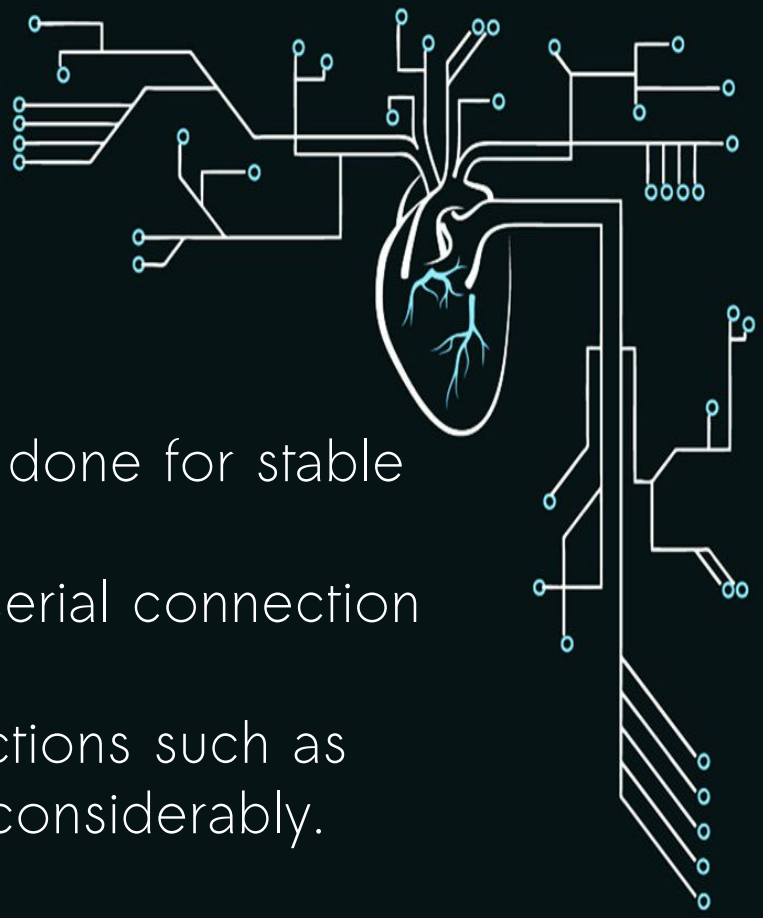


Once connected, operation progresses as follows:

- ➔ Attempt connection to an MQTT server.
- ➔ Subscribe to the event topic.
- ➔ Display the current talk details as received from the topic.
- • Periodically check both WiFi and MQTT server connectivity.



The Design - Code



- Several iterations of code had to be done for stable operation.
- Printing debug information over the serial connection helped a lot in troubleshooting.
- Availability of libraries supporting functions such as MQTT reduced the amount of work considerably.

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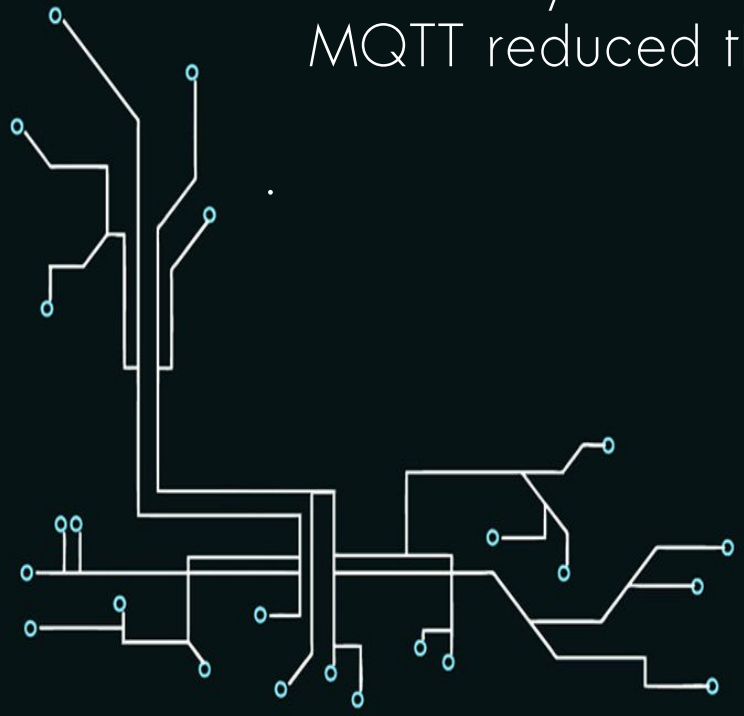
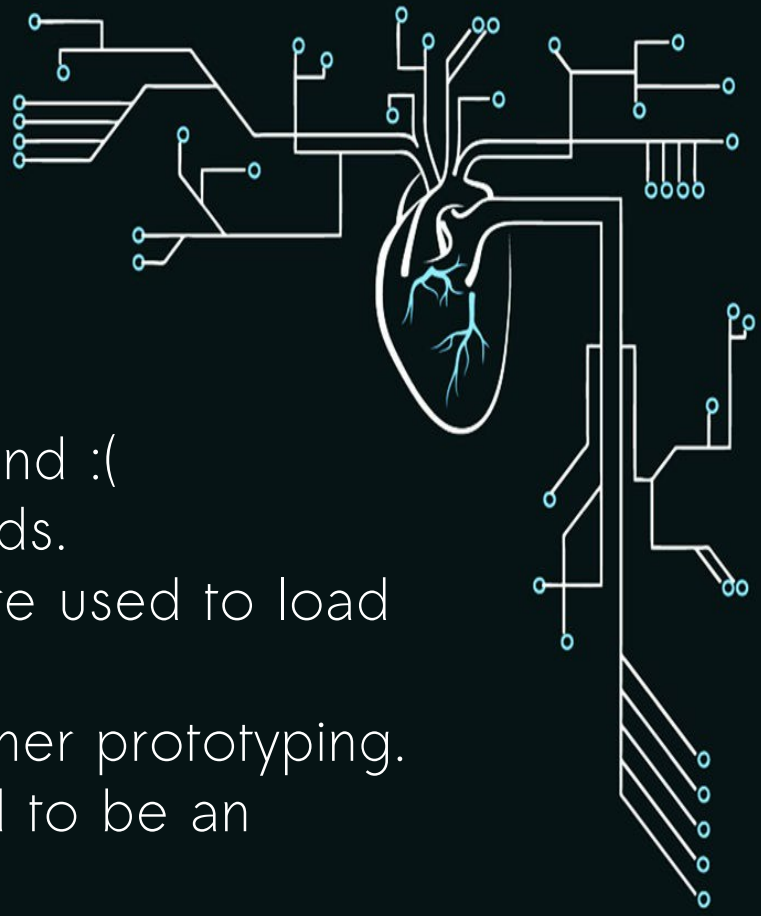


The Design - Circuitry



- Everything was done on paper by hand :(
- Prototyping was done on breadboards.
- An Arduino Uno R3 and a Shikra were used to load code onto the badge.
- Paperboard substituted PCBs for further prototyping.
- Soldering on the paperboard proved to be an adventure.

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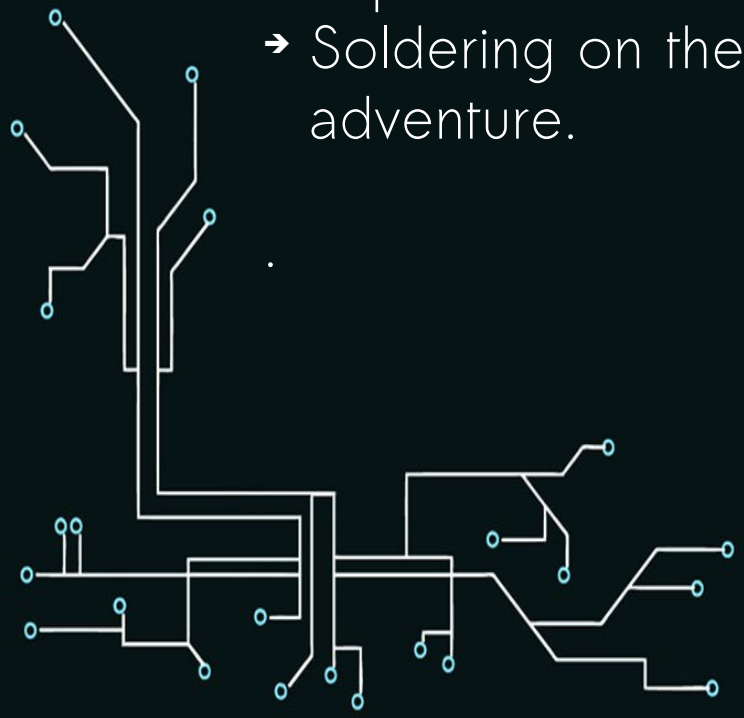
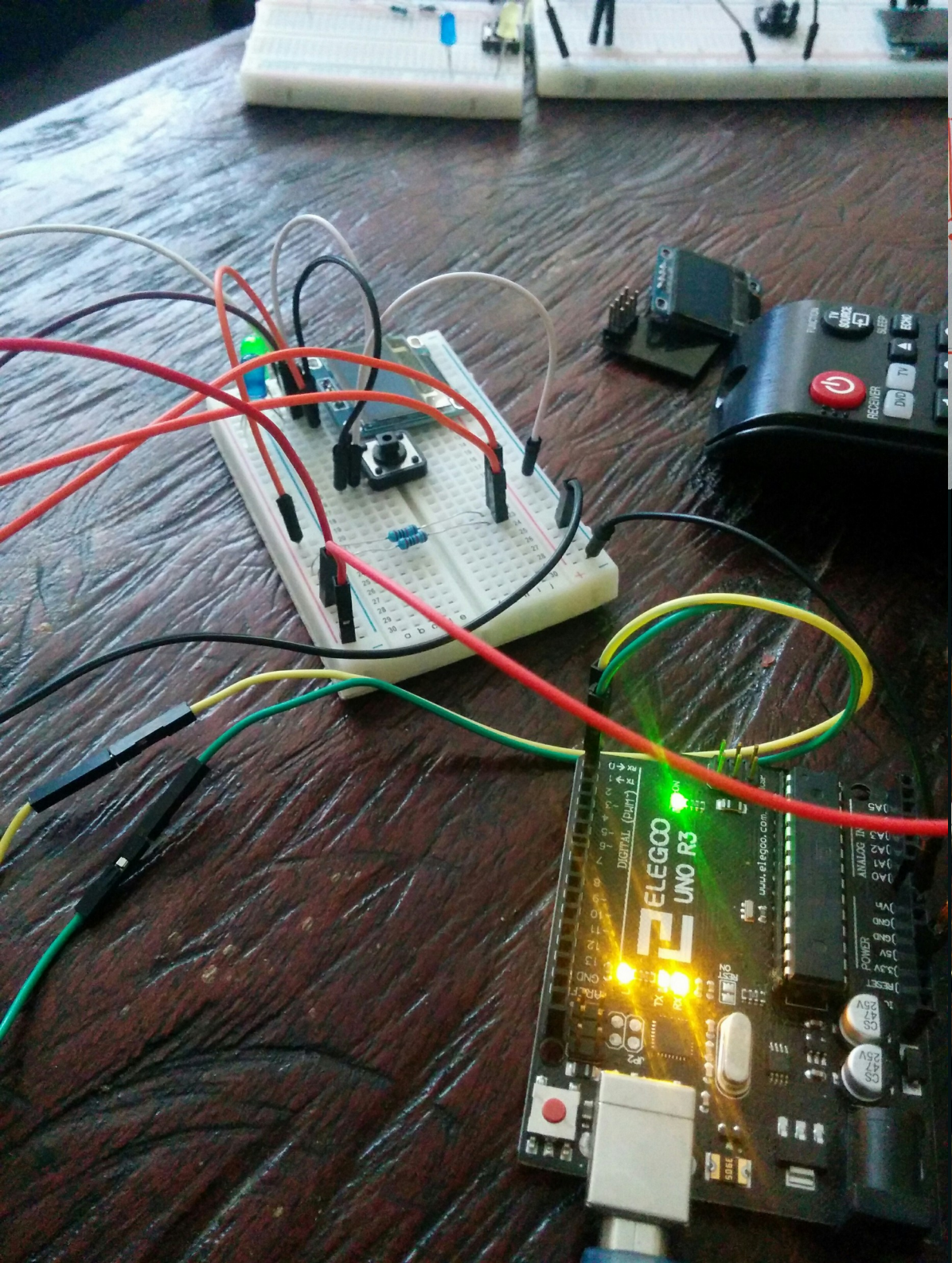
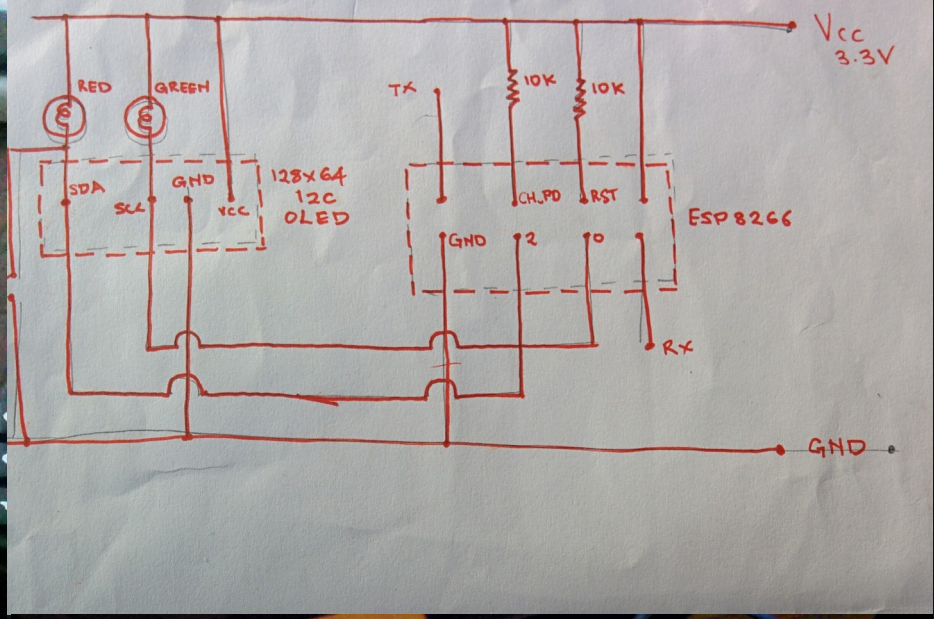
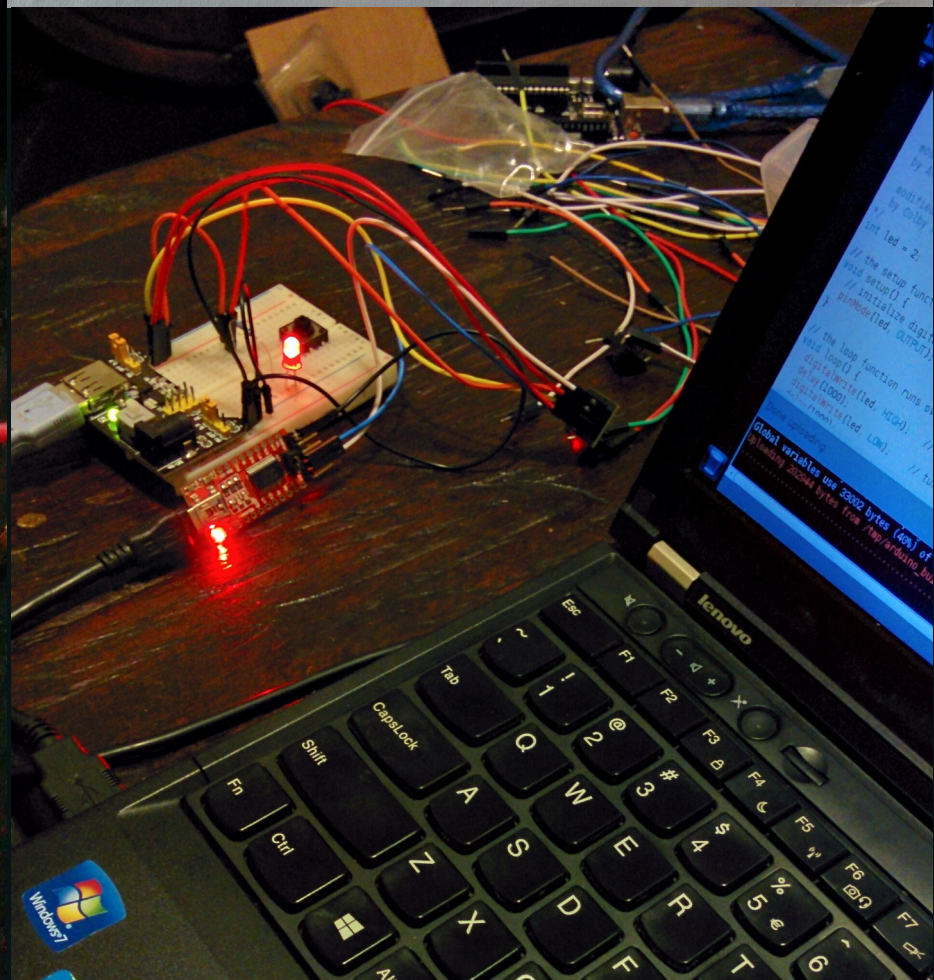
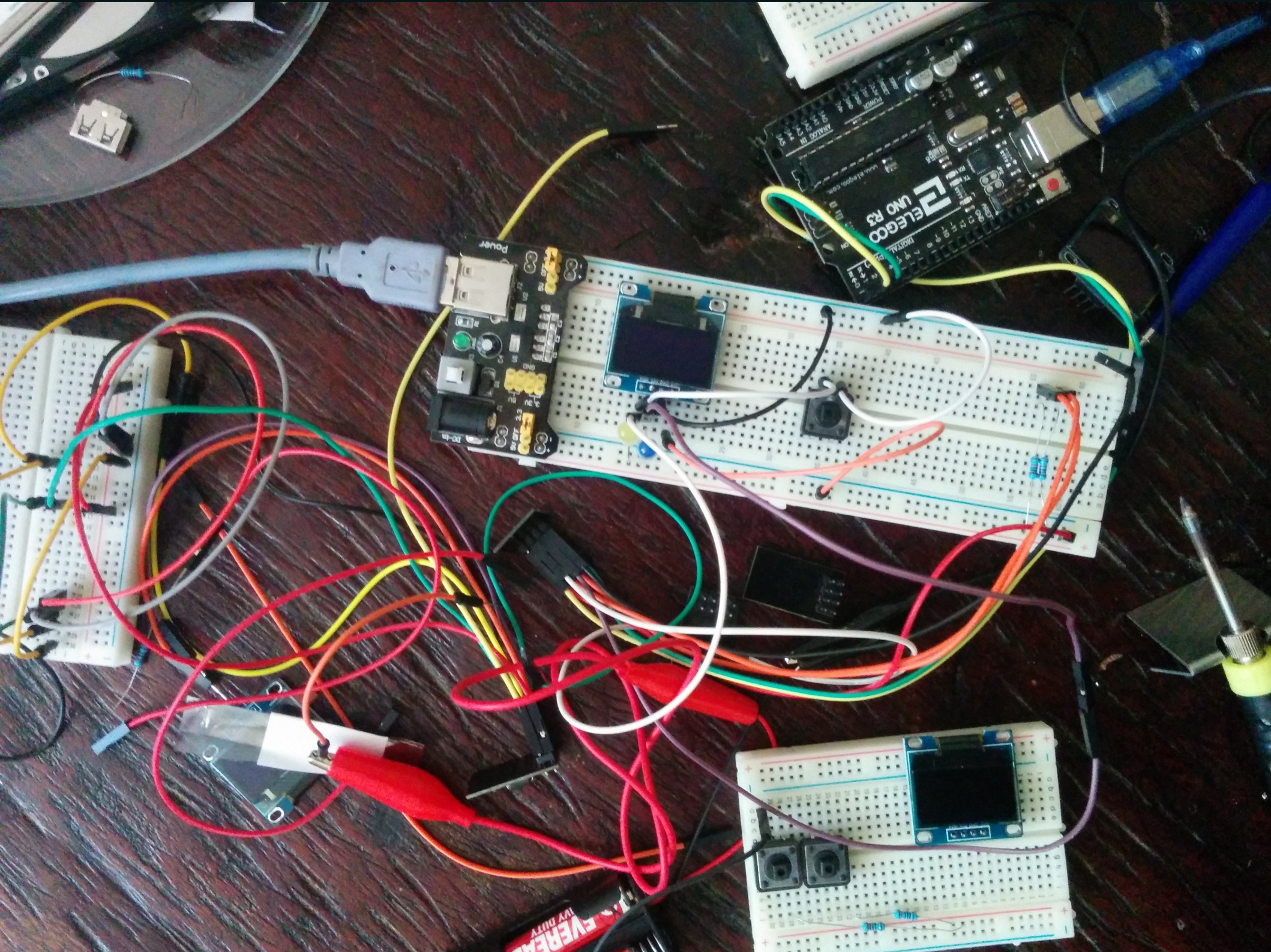
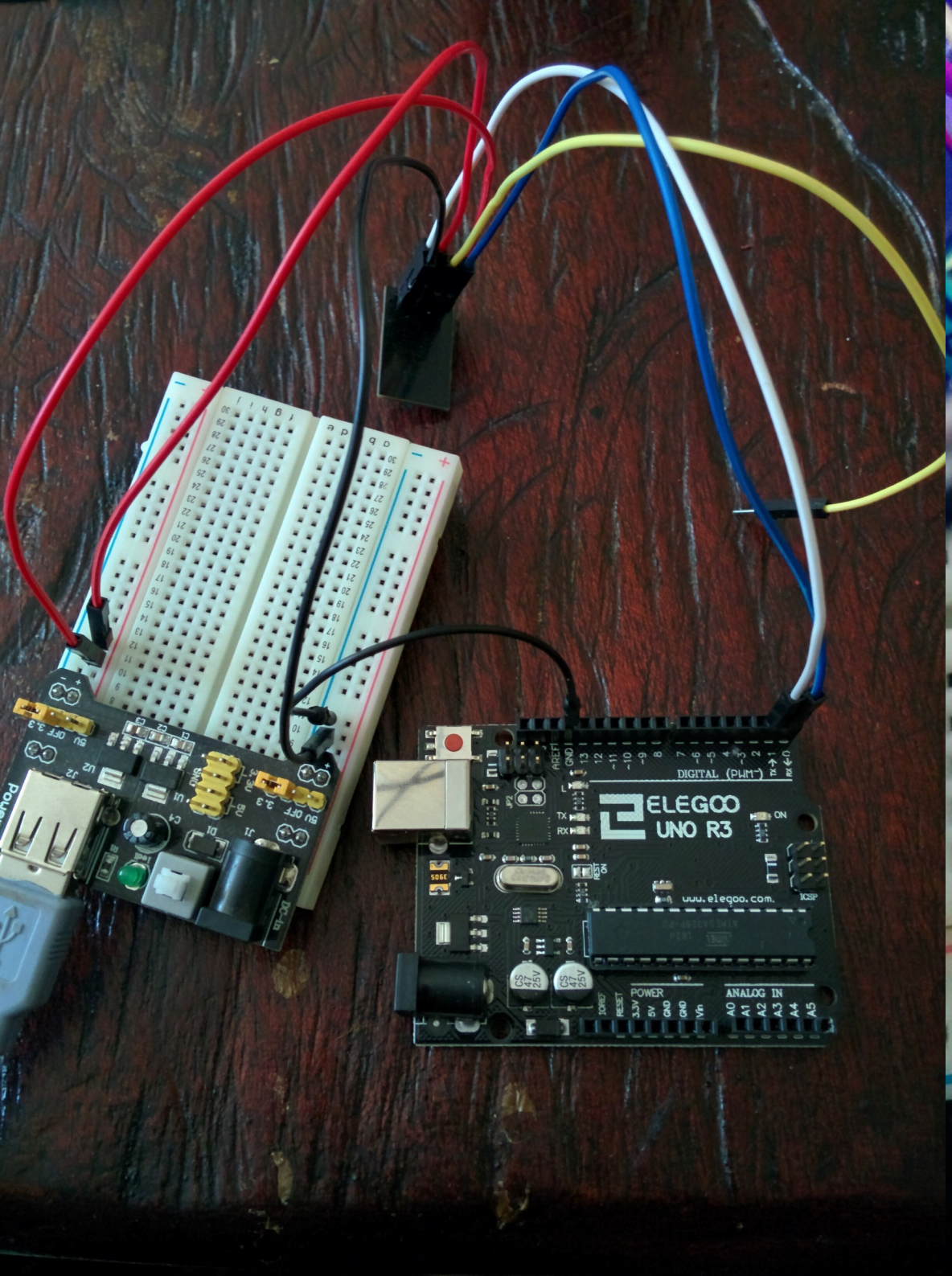


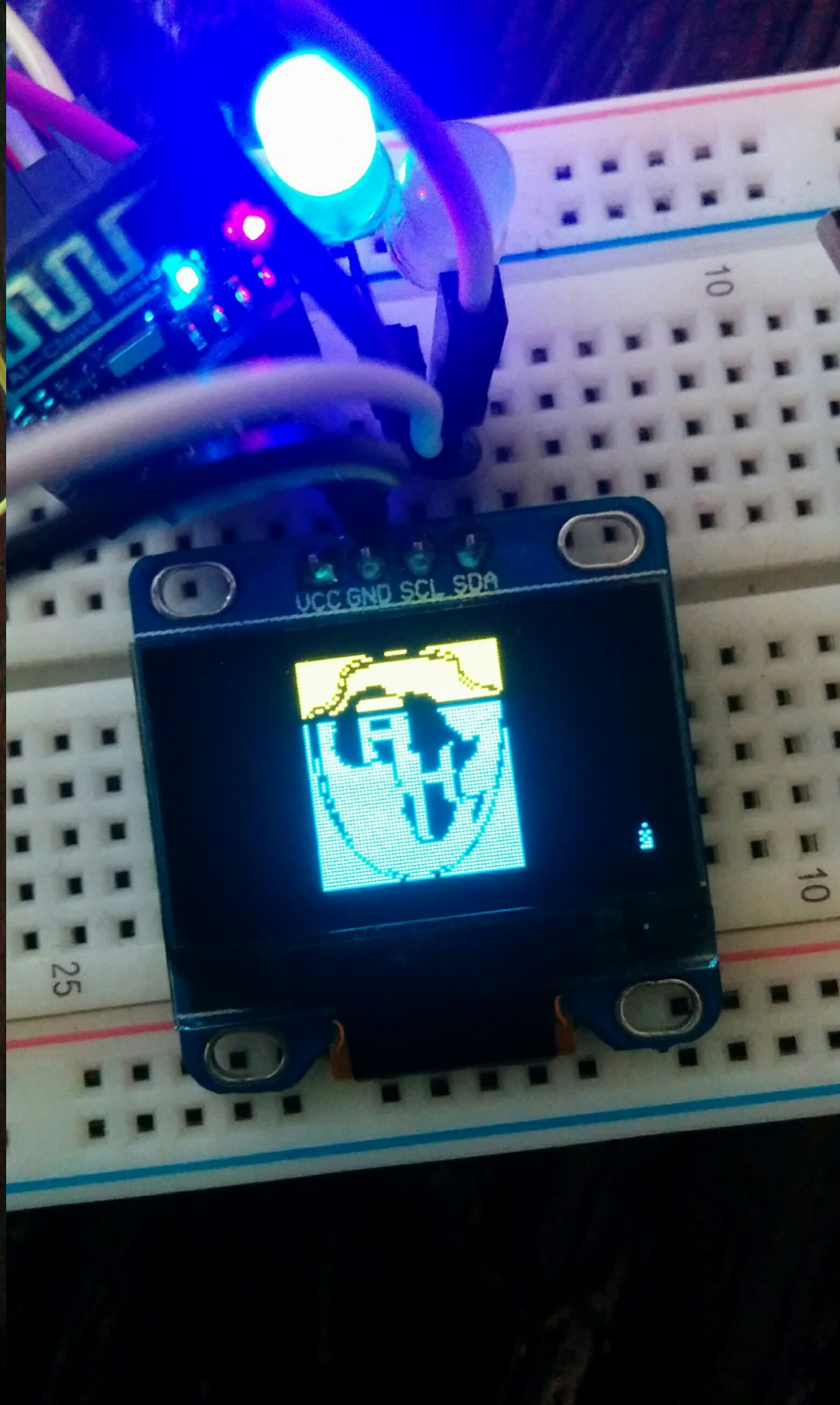

ELEGOO
UNO R3
www.elegoo.com

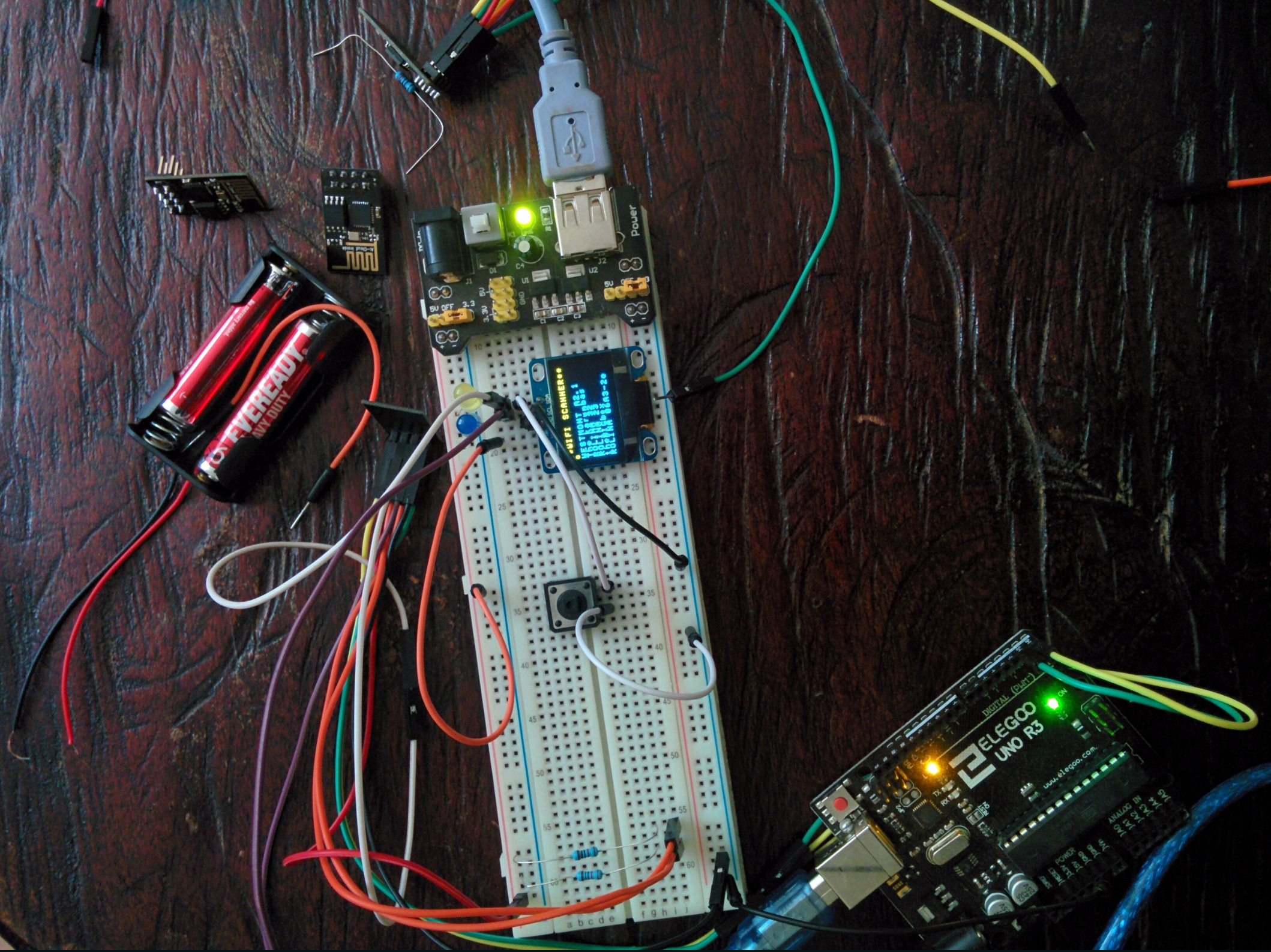

Vcc
3.3V
RED
GREEN
TX
10K
10K
SDA
SCL
GND
VCC
128x64
I2C
OLED
CH_PD
RST
ESP8266
GND
2
0
RX
GND

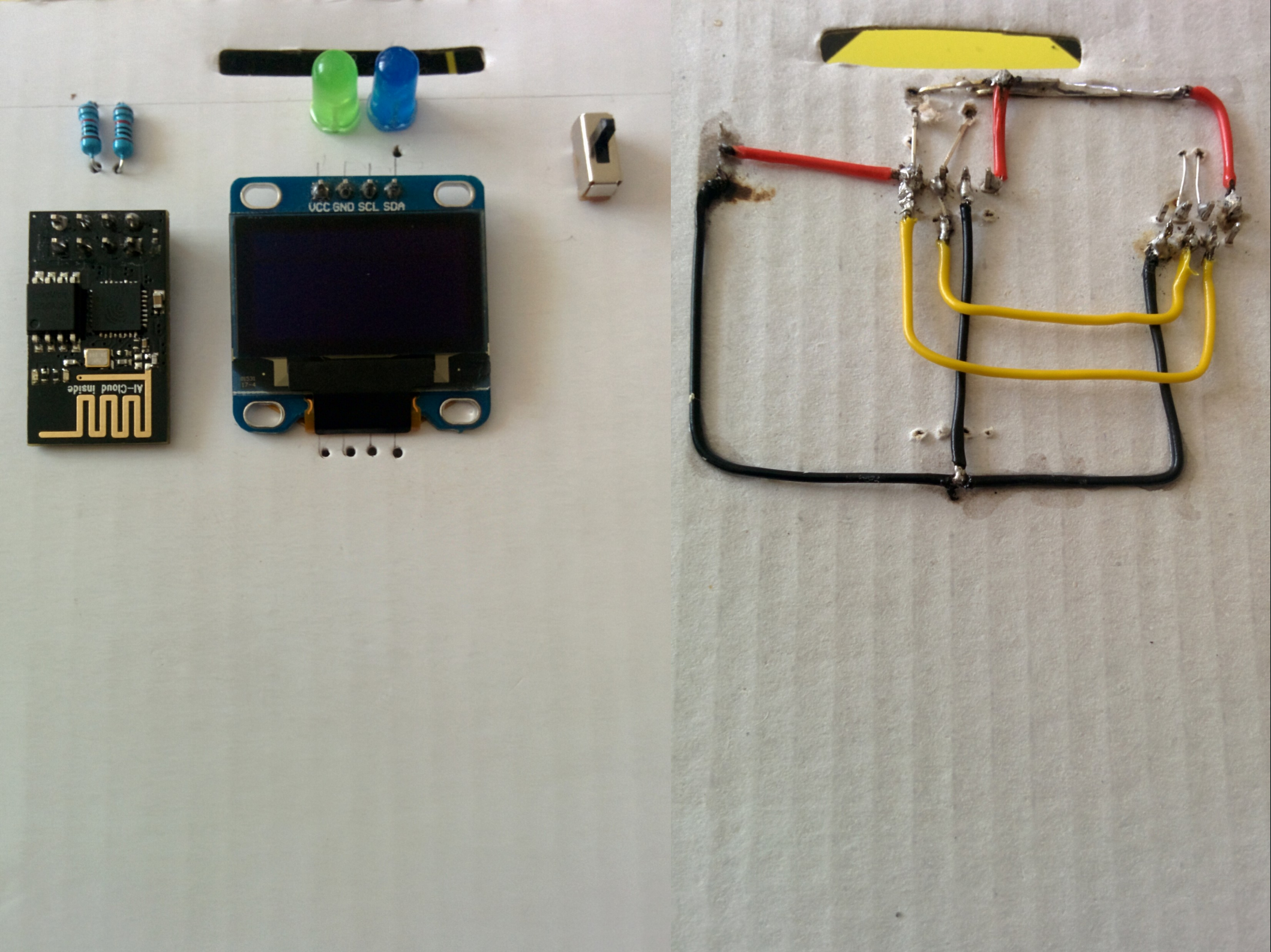

lenovo

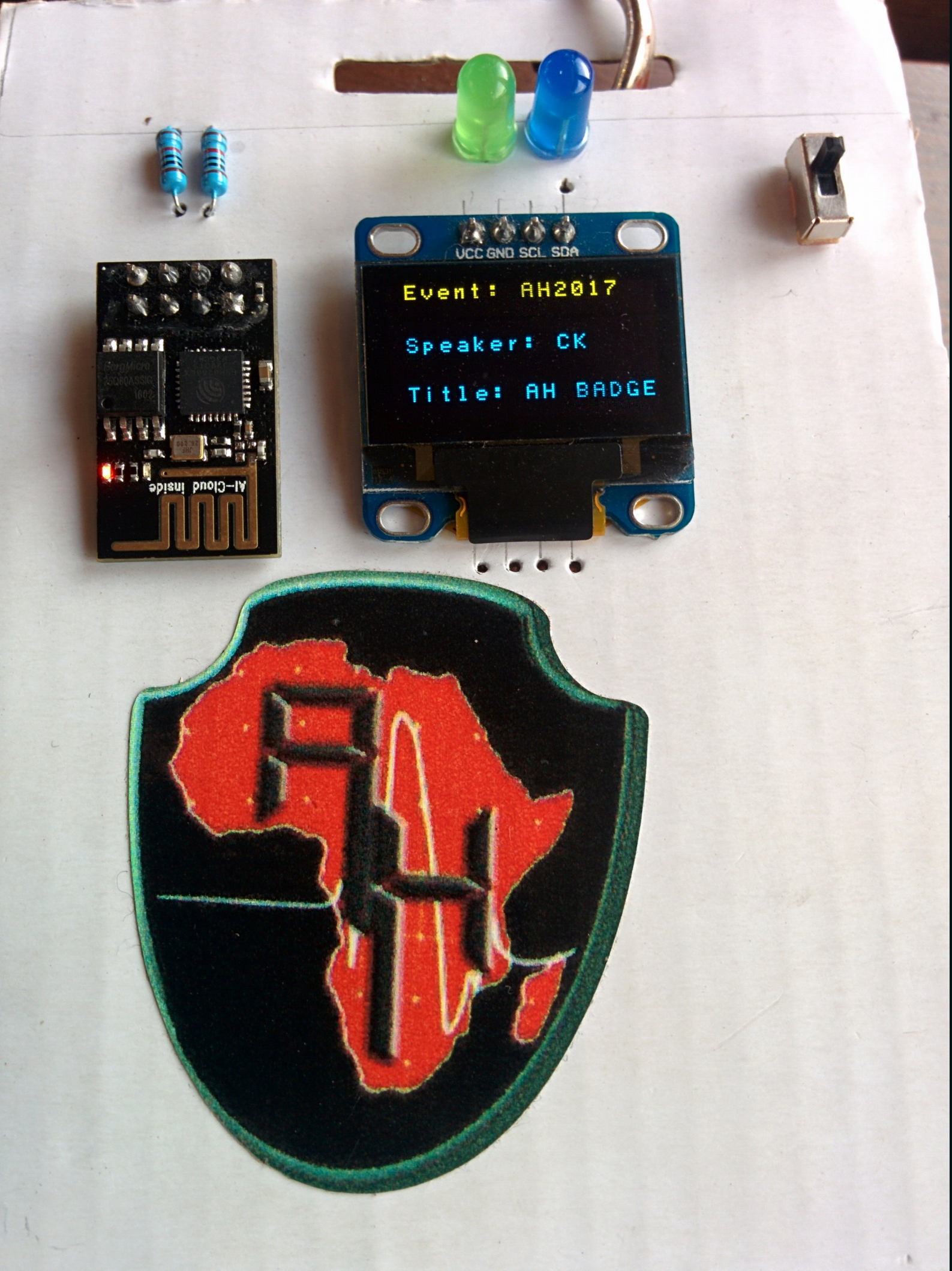

ELEGOO
UNO R3
Power

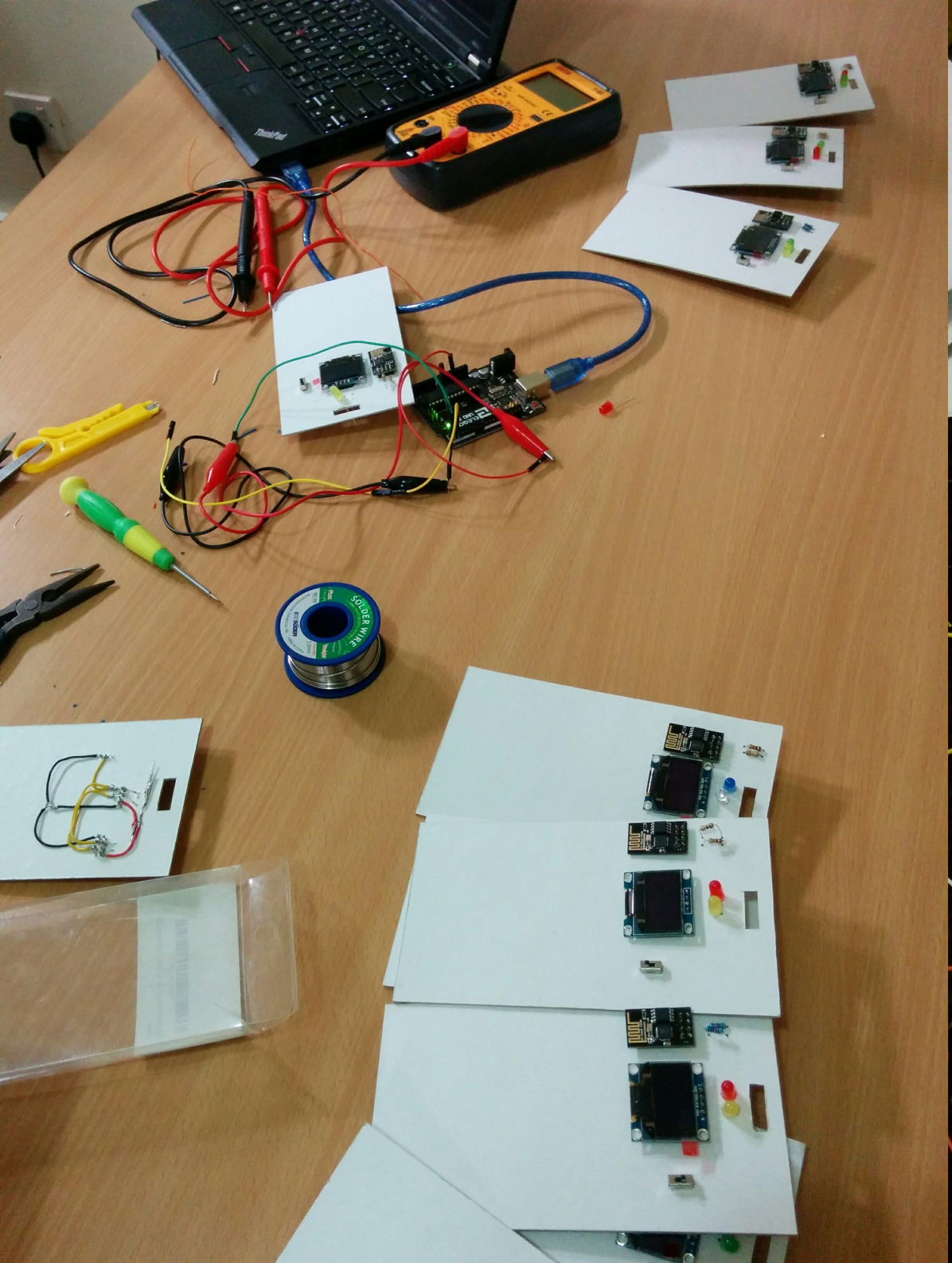

ELEGOO
UNO R3
www.elegoo.com
DIGITAL (PWM~)
POWER
ANALOG IN

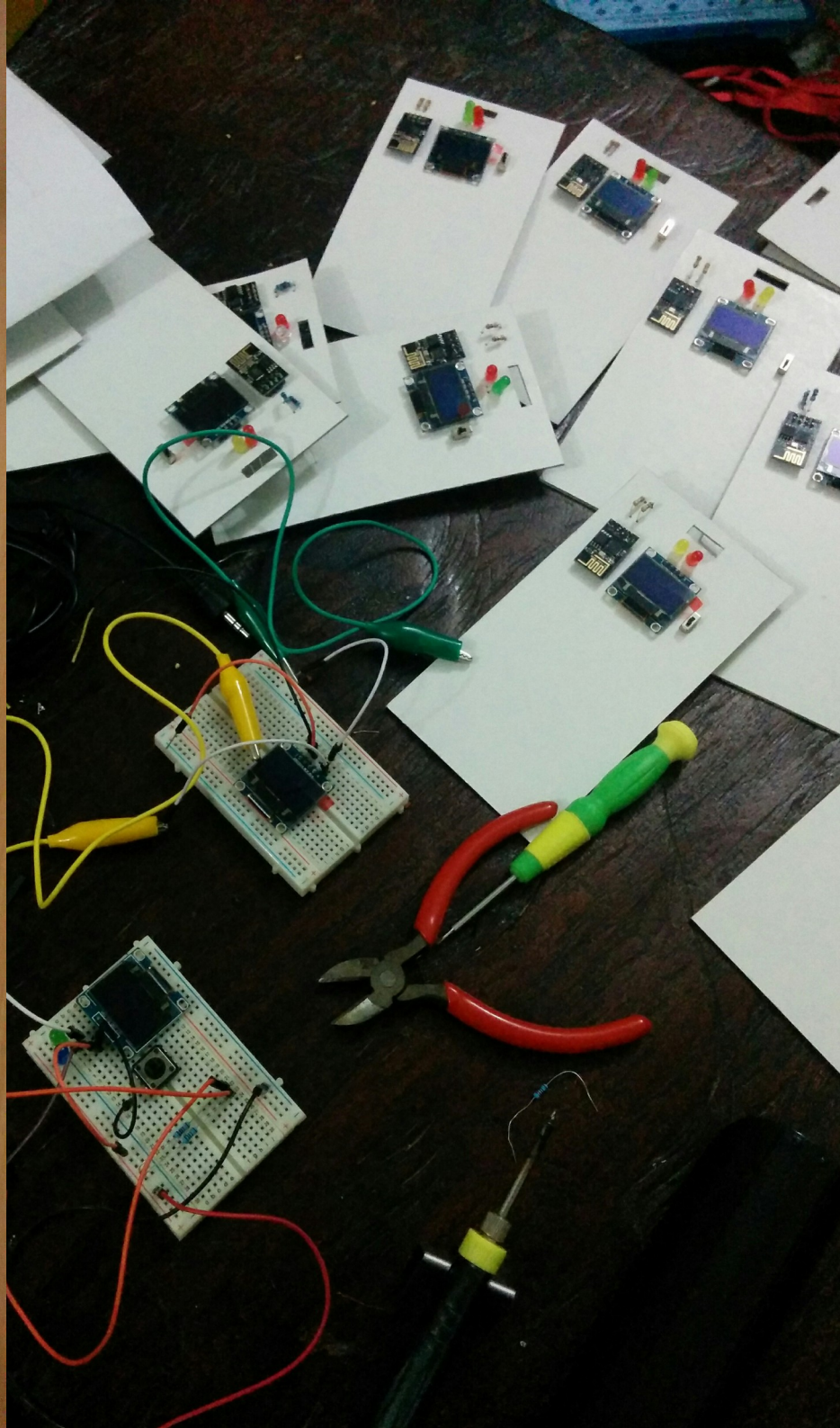

VCC GND SCL SDA


WiFi SCANNER
ELEGOO
UNO R3
www.elegoo.com
Power
EVEREADY


VCC GND SCL SDA
AI-Cloud inside


VCC GND SCL SDA
Event: AH2017
Speaker: CK
Title: AH BADGE
AI-Cloud inside

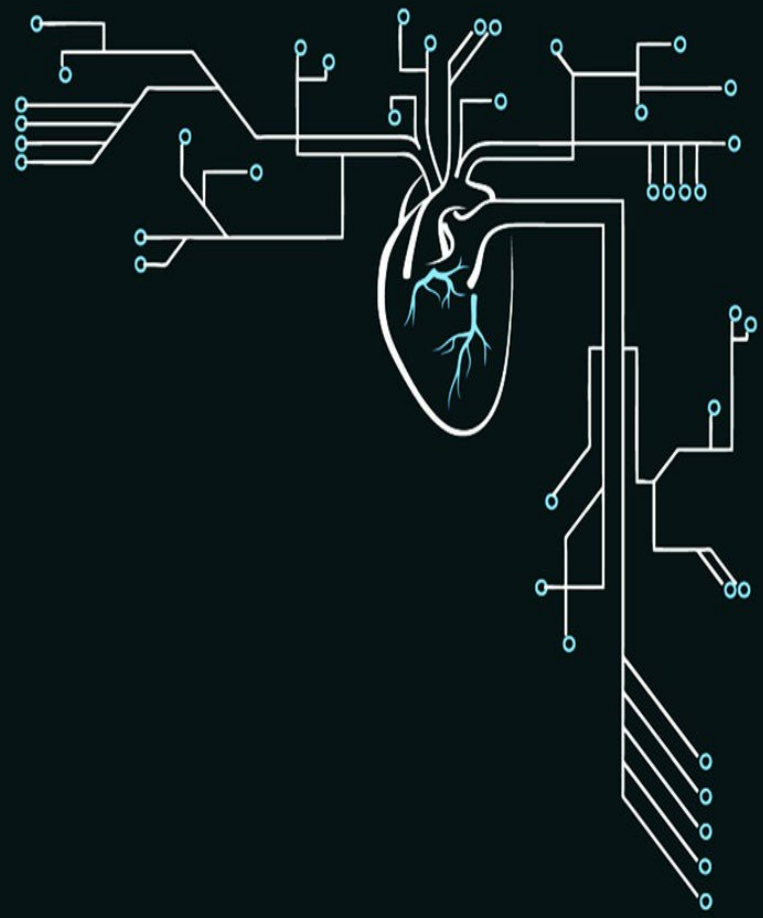

SOLDER WIRE



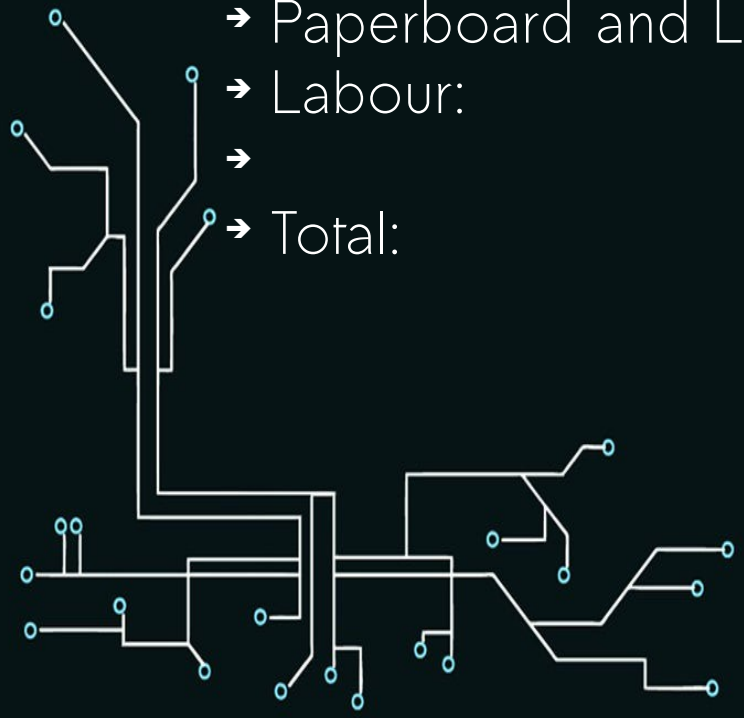

ELEGOO
UNO


Demo

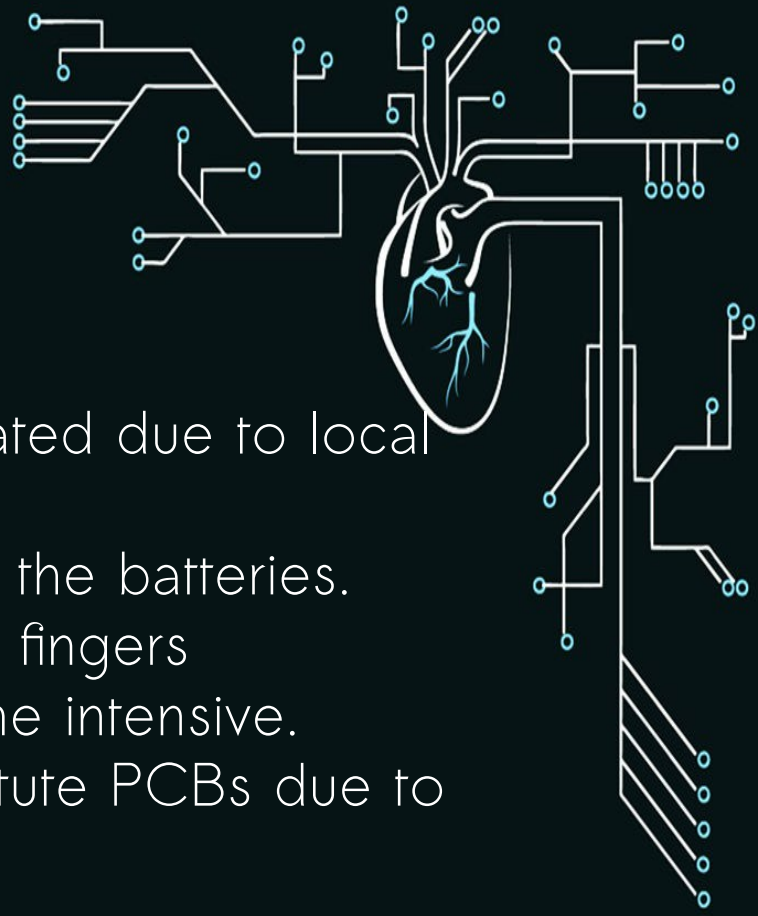
Review - Cost



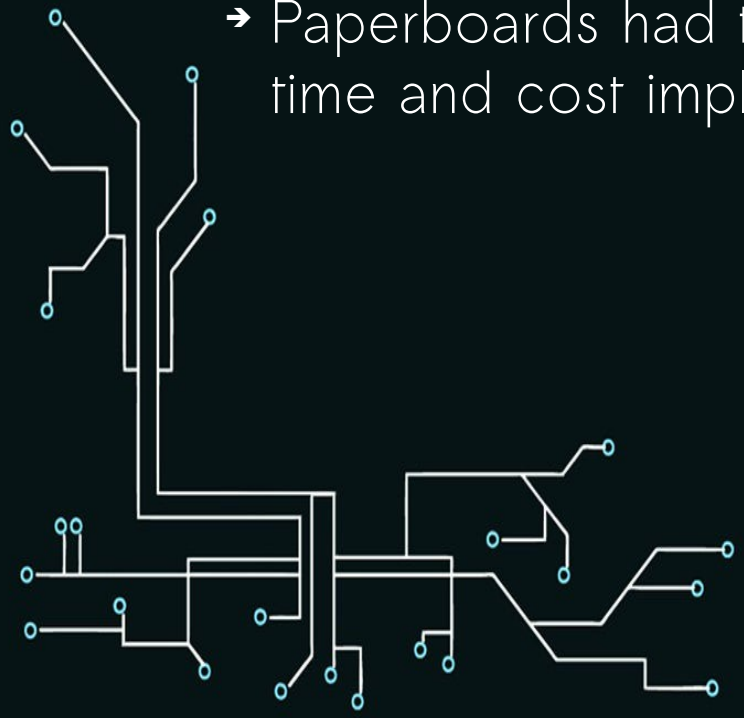
OLED Displays:	$150
Batteries	$100
ESP8266:	$60
Miscellaneous:	$50
LEDs & Resistors:	$20
Paperboard and Lanyards:	$20
Labour:	Free
Total:	$400



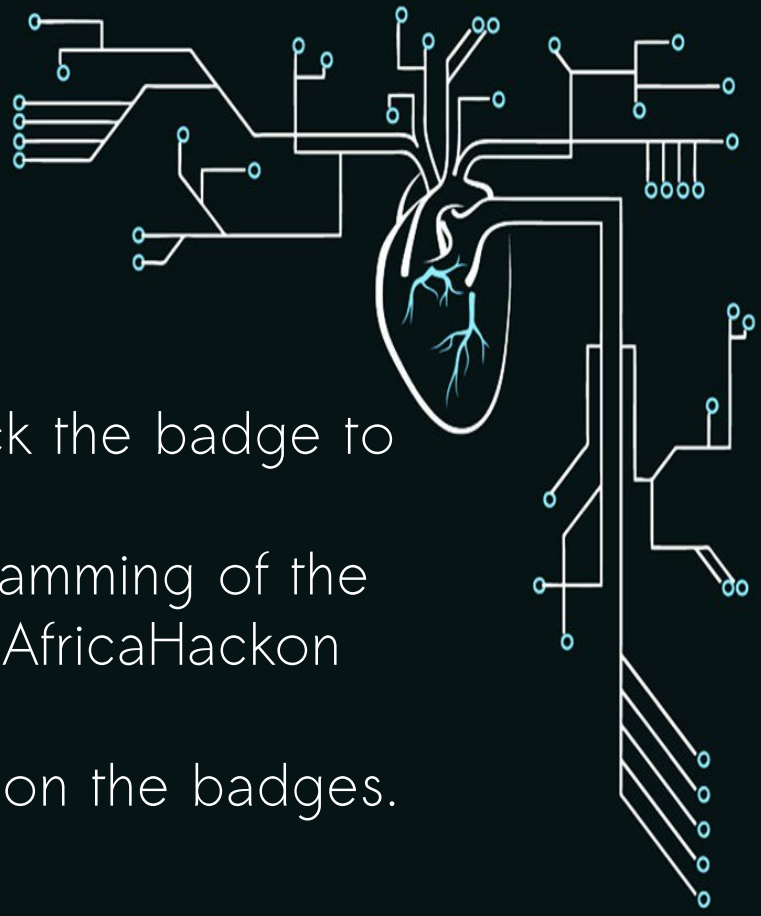
Review - Challenges



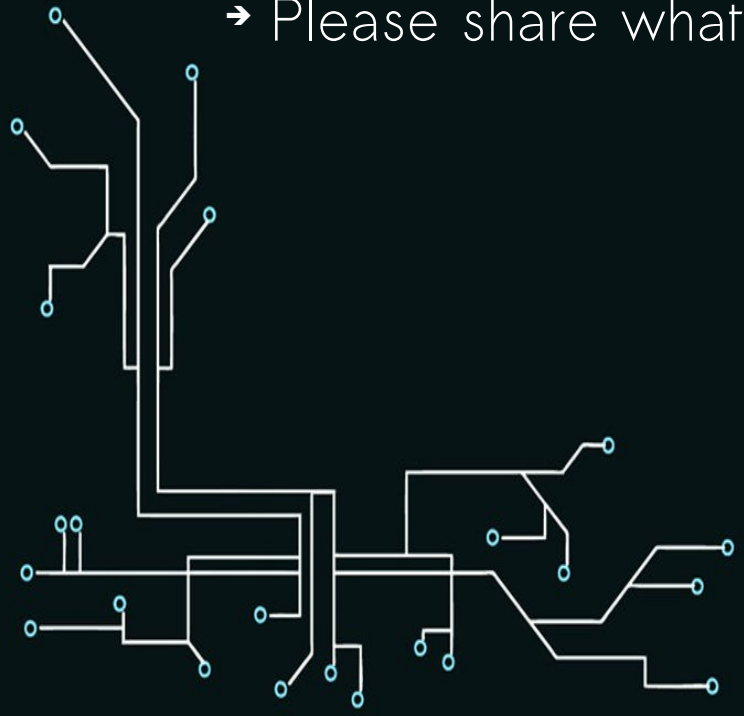
- Sourcing for some items was complicated due to local unavailability.
- Shipping delays - Had to improvise on the batteries.
- Soldering needs lot of practice - Burnt fingers
- Assembling each badge by hand is time intensive.
- Paperboards had to be used as substitute PCBs due to time and cost implications.



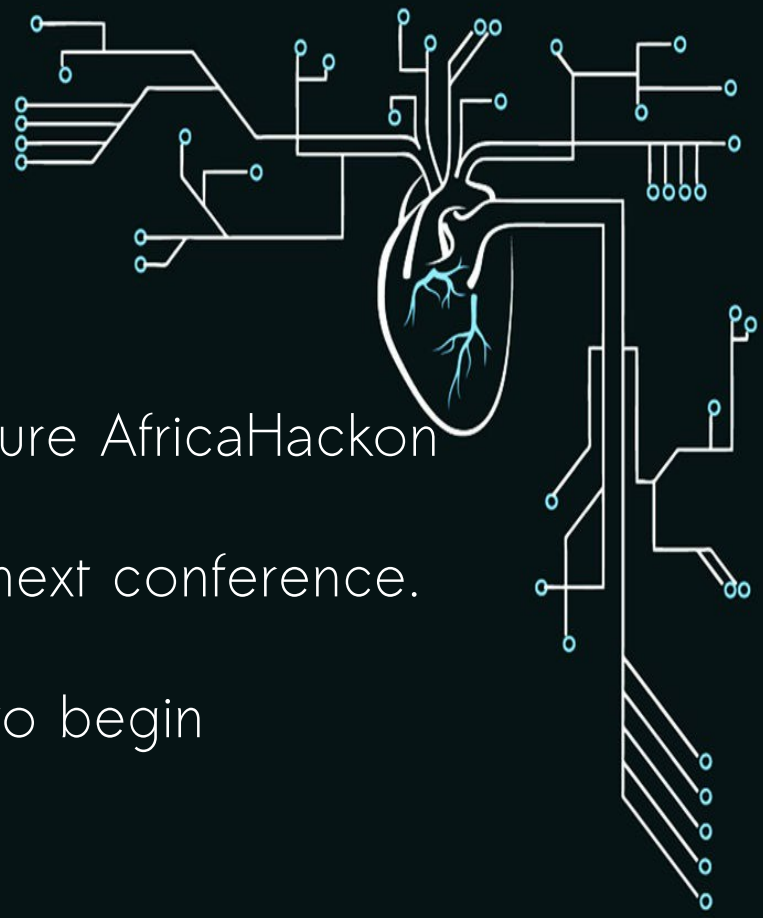
Hacking the badge



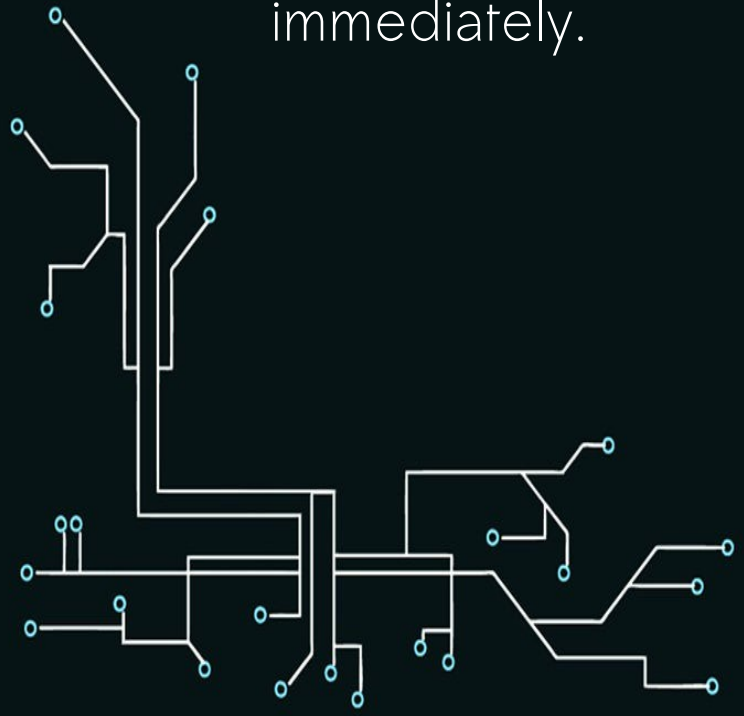
- Badge owners are encouraged to hack the badge to do more cool stuff.
- Full writeup and guidelines on reprogramming of the badges will be made available on the AfricaHackon site and on my Github.
- Please share what cool hacks you do on the badges.



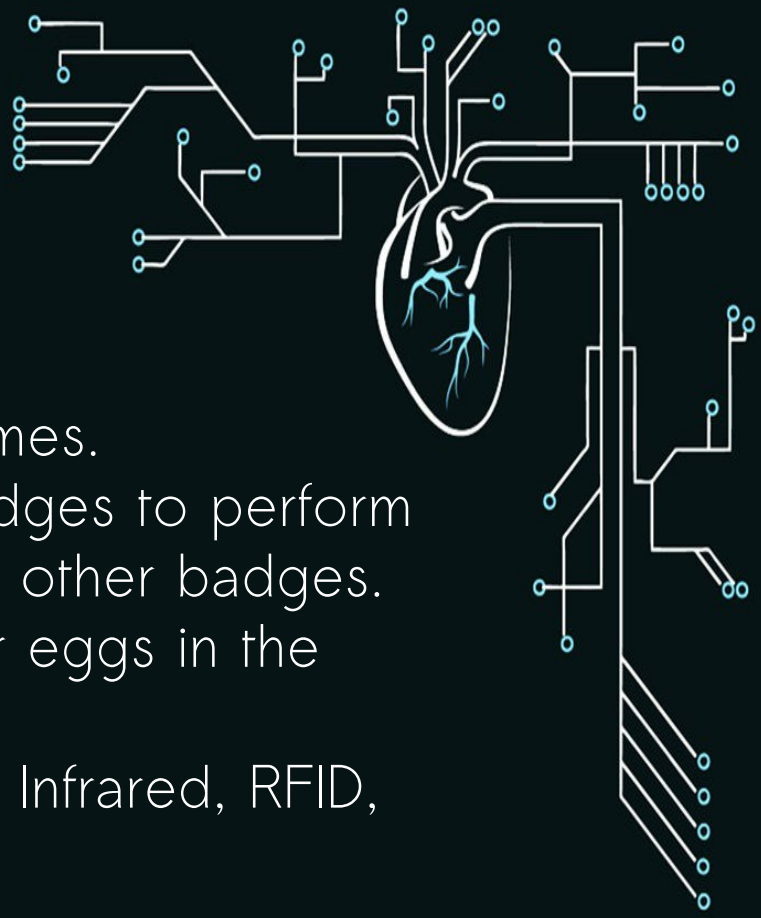
What next?



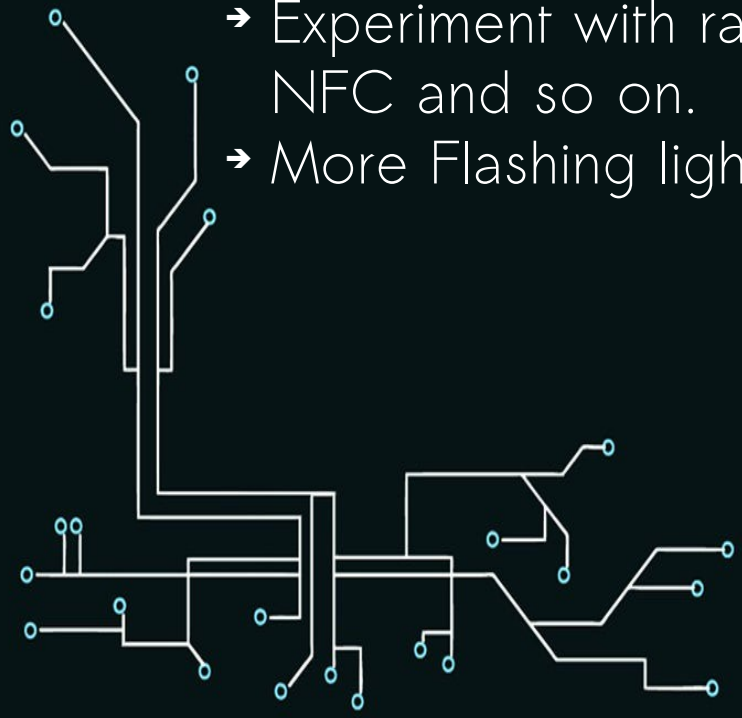
- Make badges a mainstay feature of future AfricaHackon conferences.
- Make badges for all attendees at the next conference.
- Transition to full professional PCBs.
- Design plans for the next conference to begin immediately.



The next badge ideas



- More interactivity - simple playable games.
- Communication between badges - badges to perform various actions when brought close to other badges.
- Include solvable challenges and easter eggs in the badges.
- Experiment with radio on the badges - Infrared, RFID, NFC and so on.
- More Flashing lights :)



Credits

Soldering

Anne

Board Assembly

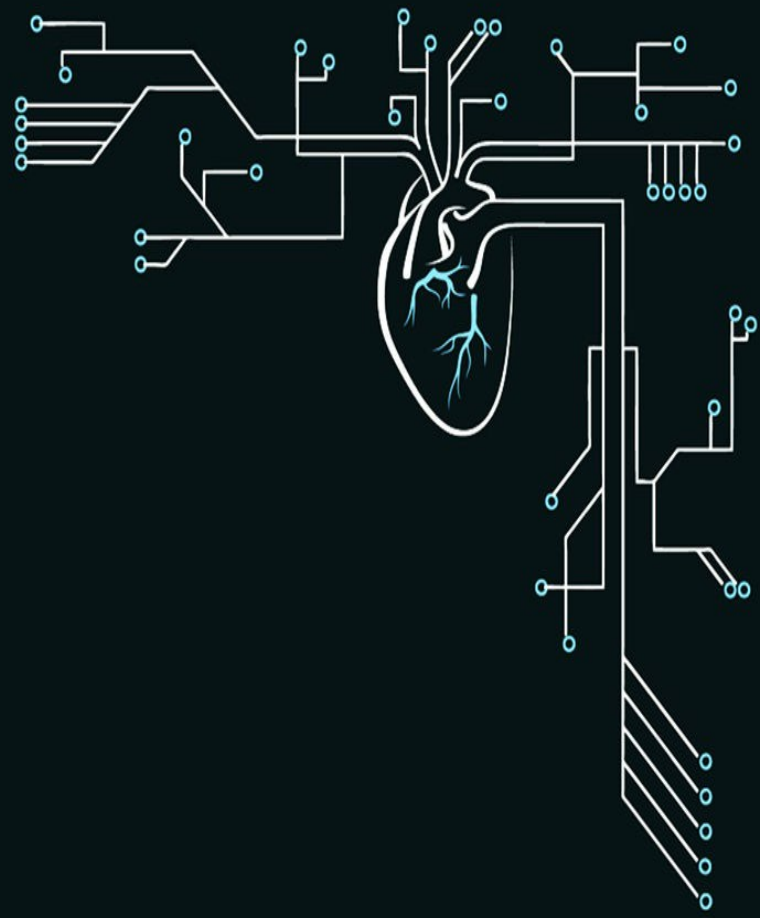
Tich

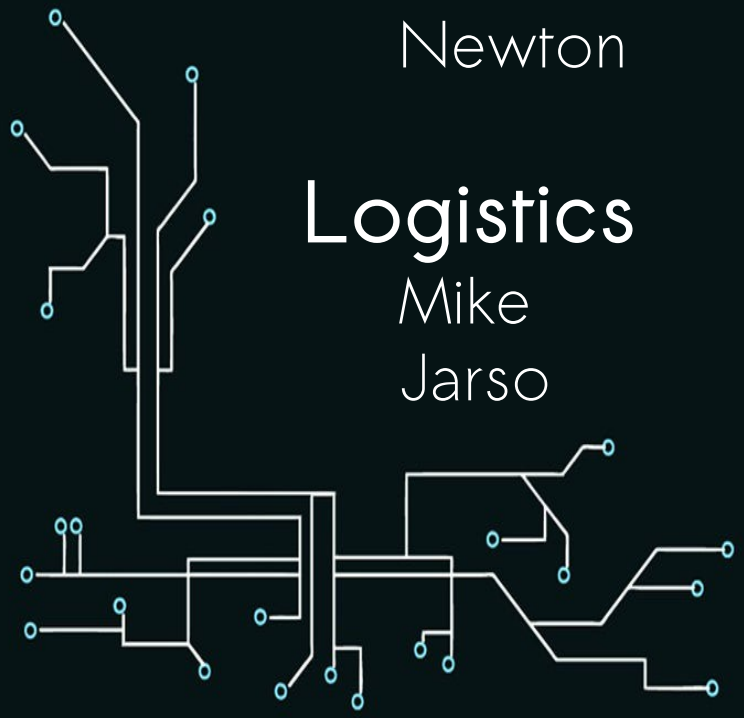
Newton

Logistics

Mike

Jarso

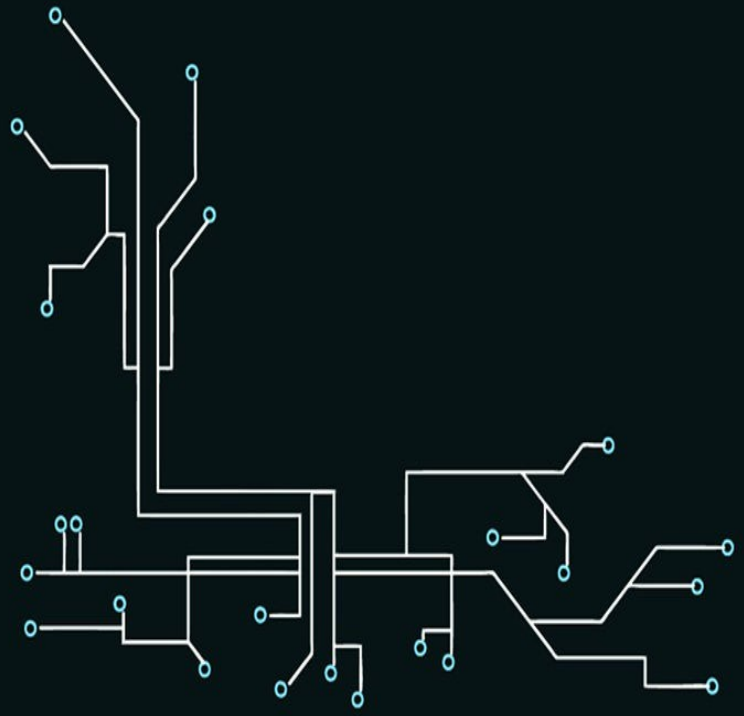




We arent done yet!

Part Two

Hacking wireless networks with the ESP8266 modules

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