

SmartPakku

WE'VE GOT YOUR BACK!

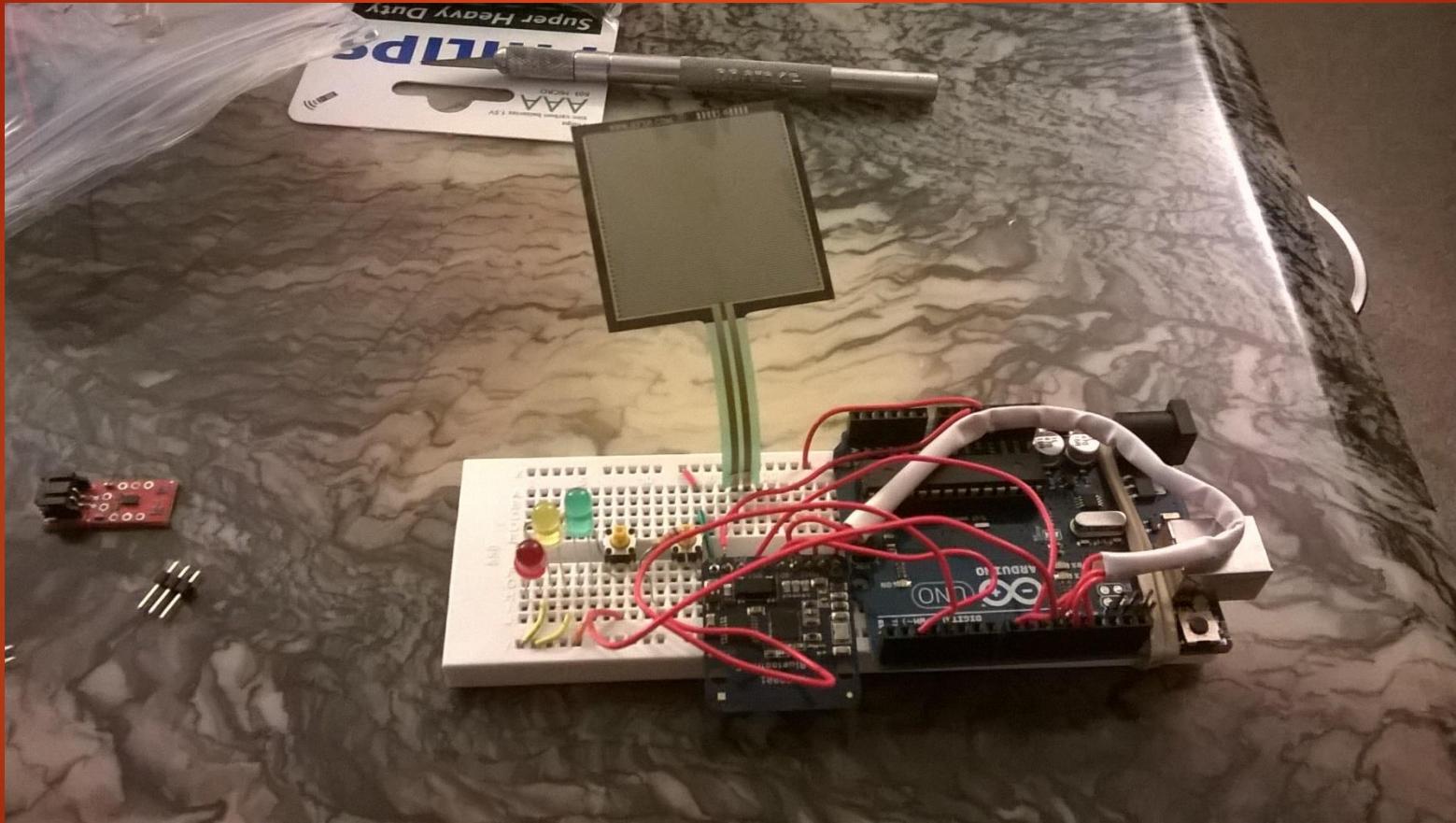
ANTHONY NGUYEN

DECEMBER 13TH, 2014

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Recap - Hardware (1)

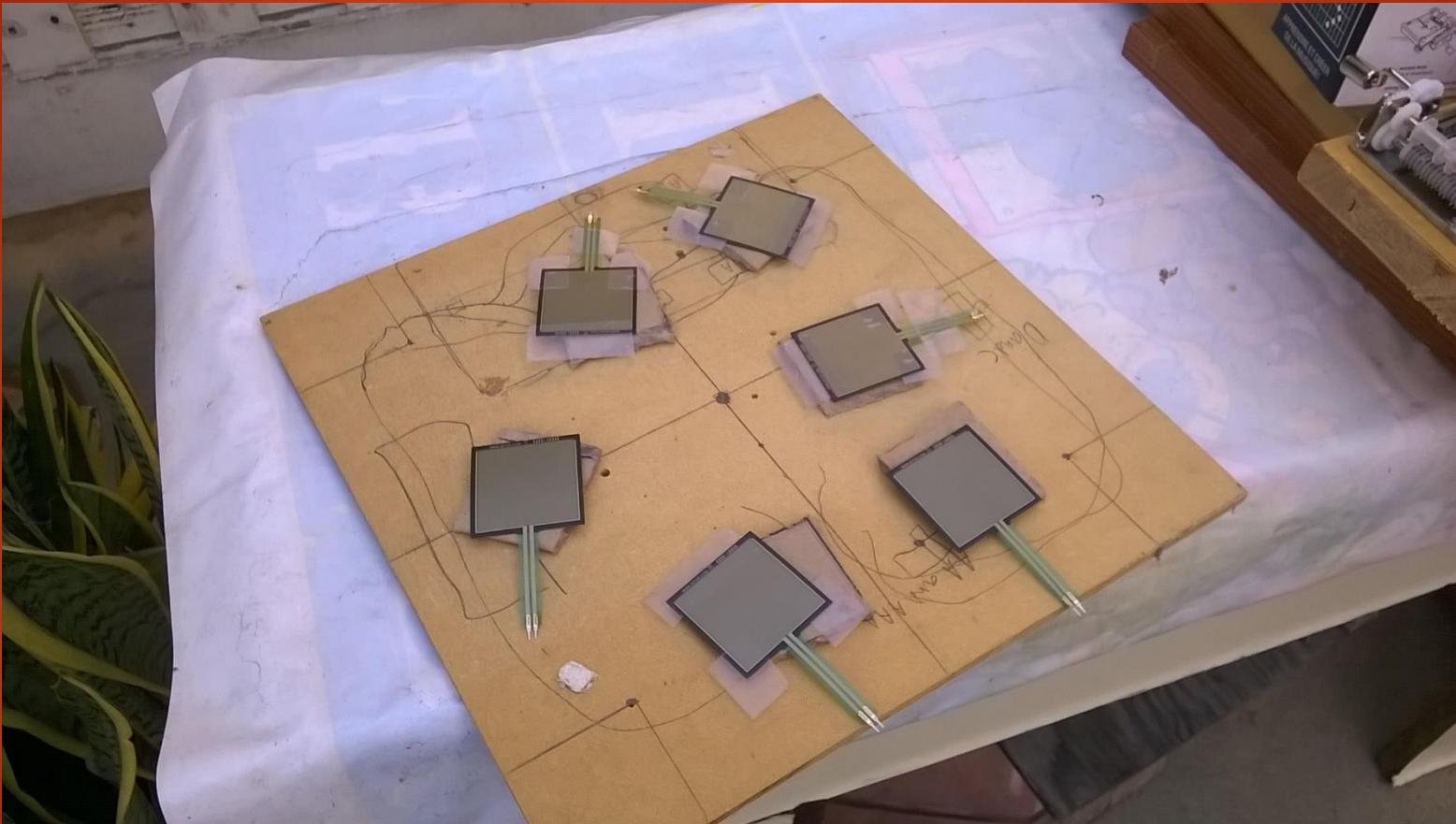


Recap - Hardware (2)

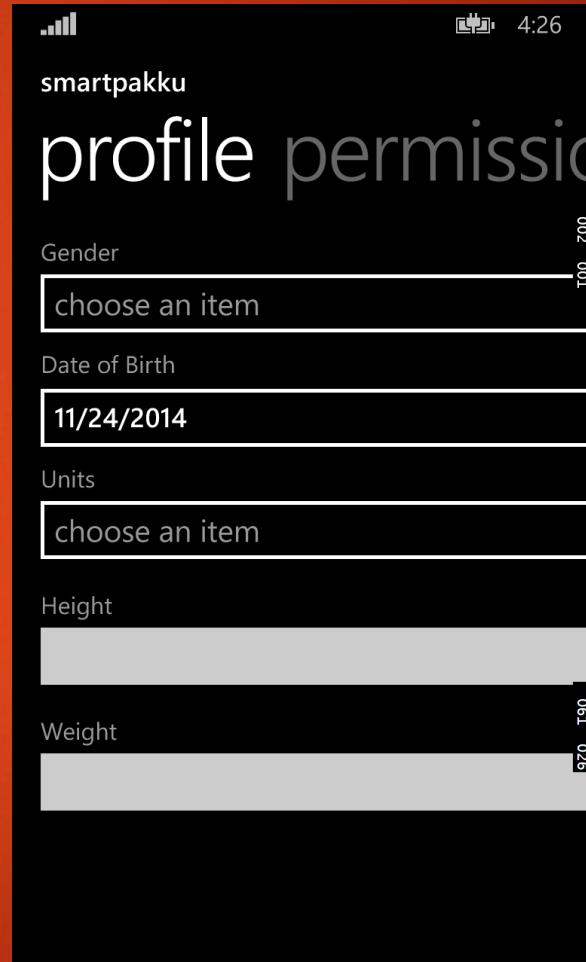


Recap - Hardware (3)

5



Recap – Smartphone App (1)



A New Vision (1)

7



A New Vision (1)

8



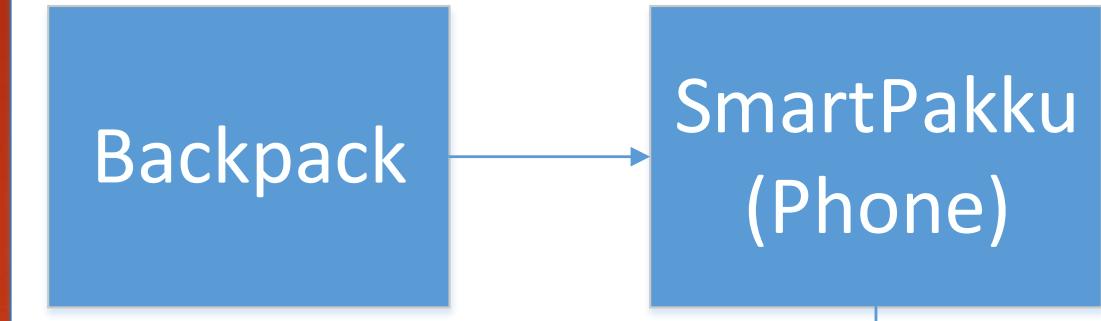
A. Heavy loads carried by more than 79 million students across the U.S. can cause low back pain that often lasts through adulthood.

B. According to the U.S. Consumer Product Safety Commission, in 2013 nearly 22,200 strains, sprains, dislocations, and fractures from backpacks were treated in hospital emergency rooms, physicians' offices, and clinics.

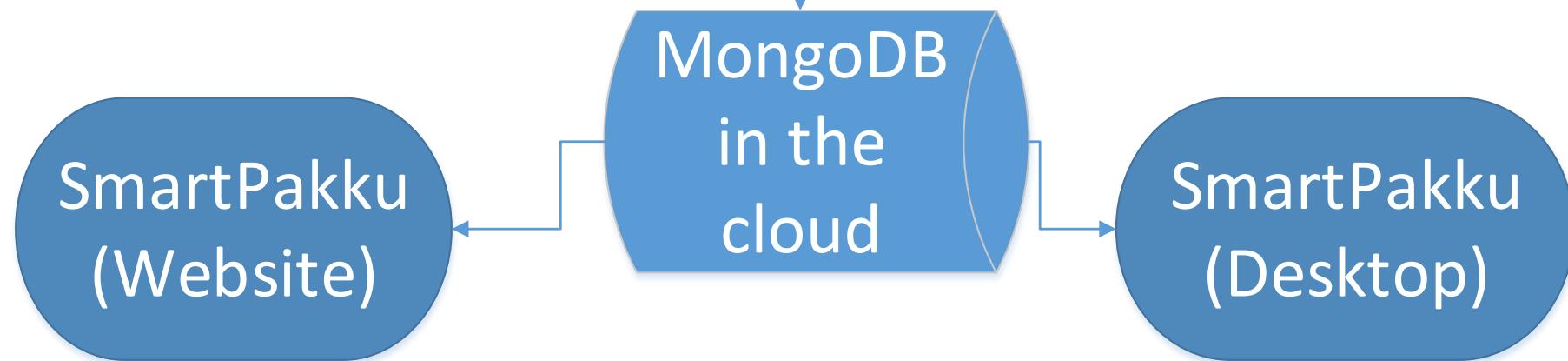
C. A backpack should weigh no more than 10% of the child's body weight.



Child

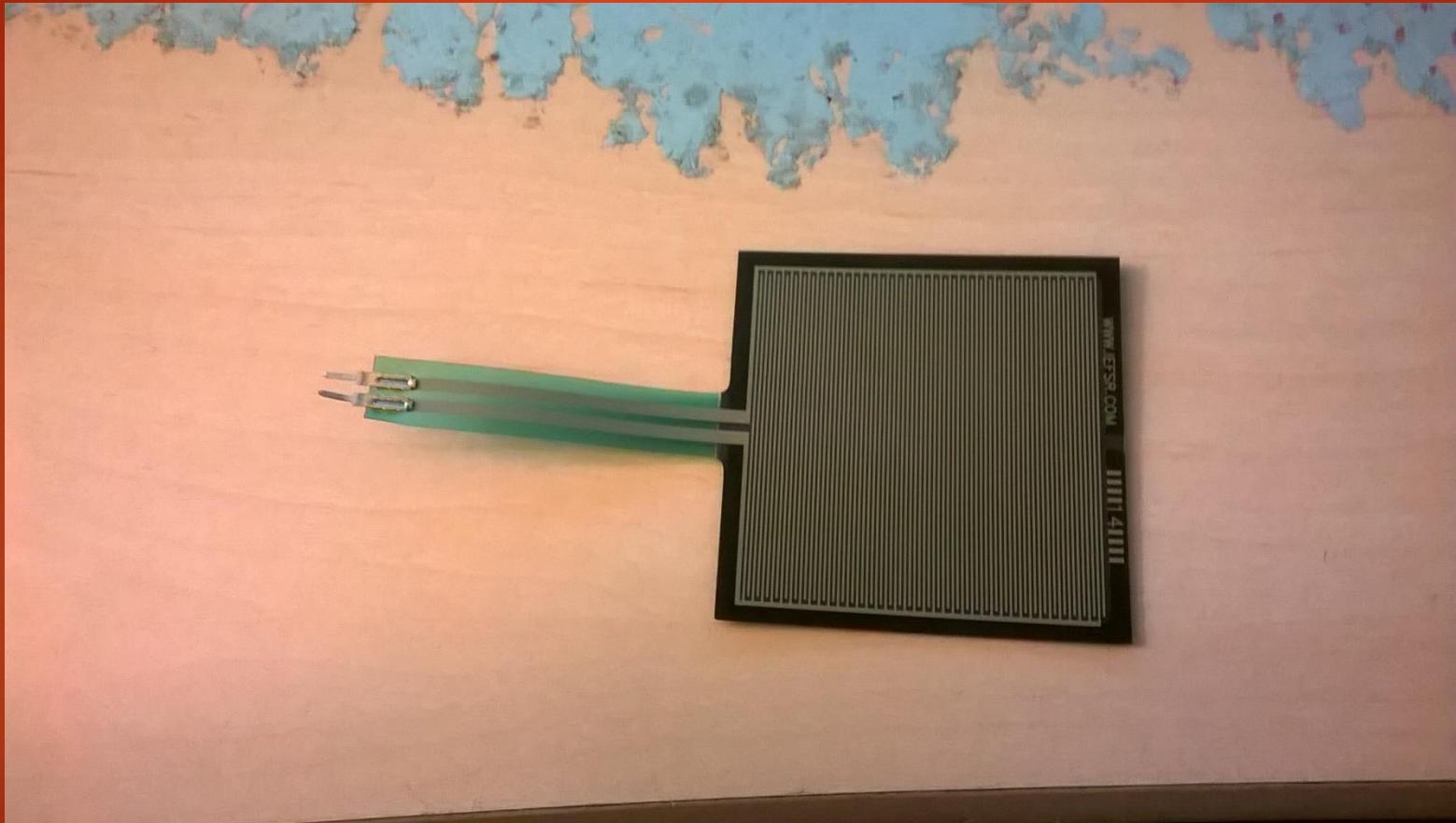


Parent



Progress! – Hardware (1)

11



Progress! – Hardware (2)

12



Progress! – Hardware (3)

13



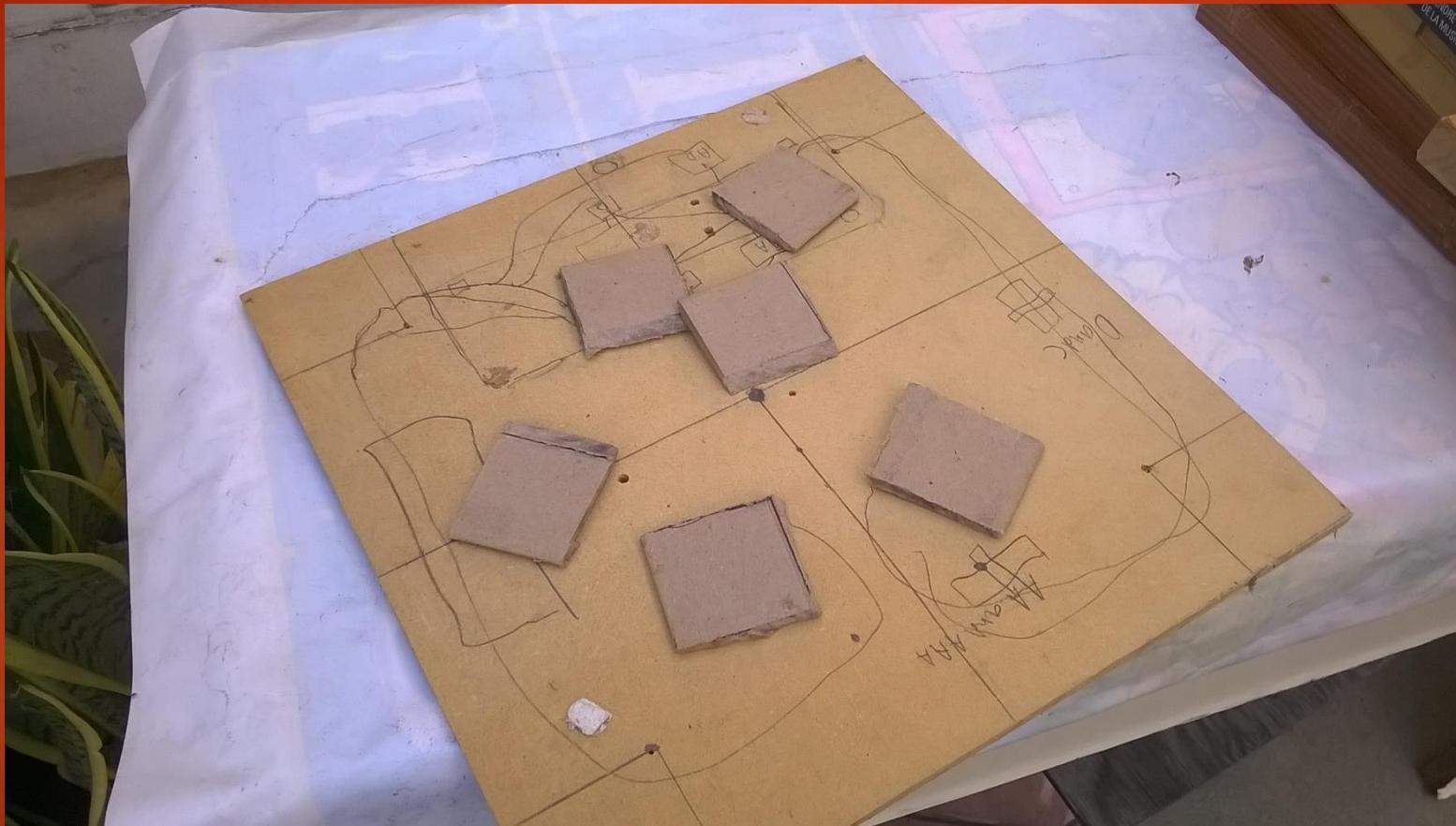
Progress! – Hardware (4)

14



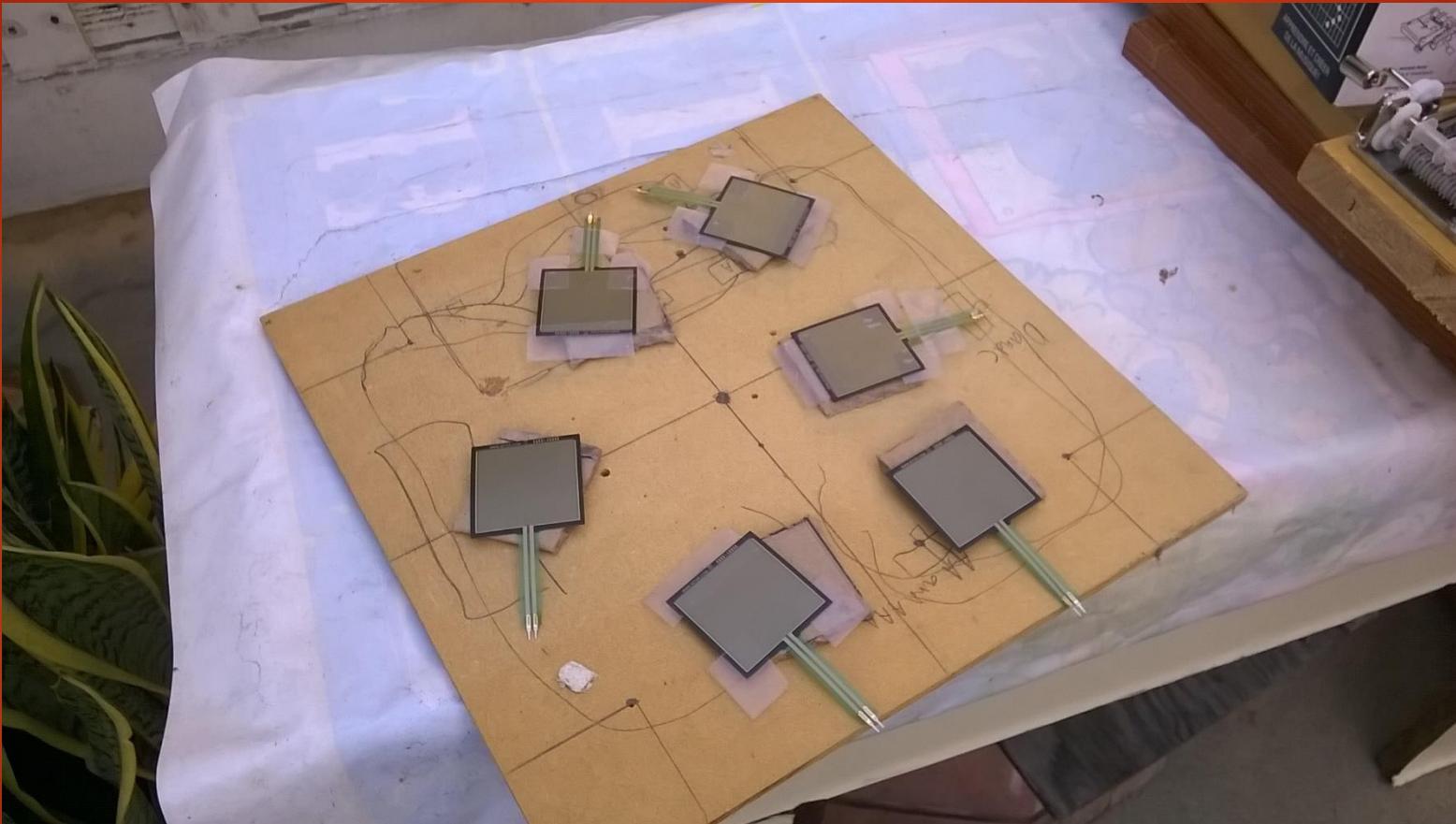
Progress! – Hardware (5)

15



Progress! – Hardware (6)

16



Progress! – Hardware (7)

17



Progress! – Hardware (8)

18



Progress! – Hardware (8)

19



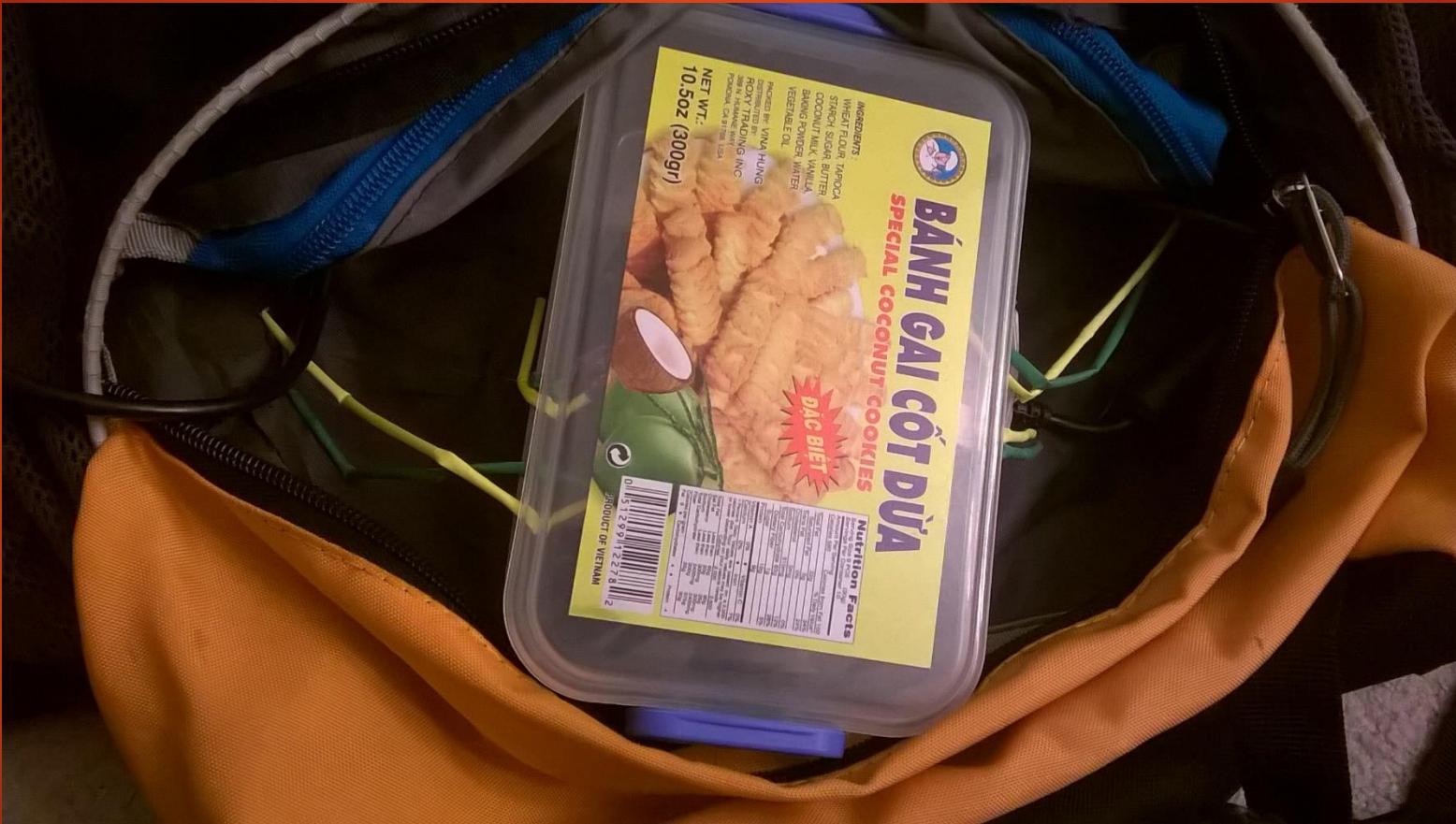
Progress! – Hardware (9)

20



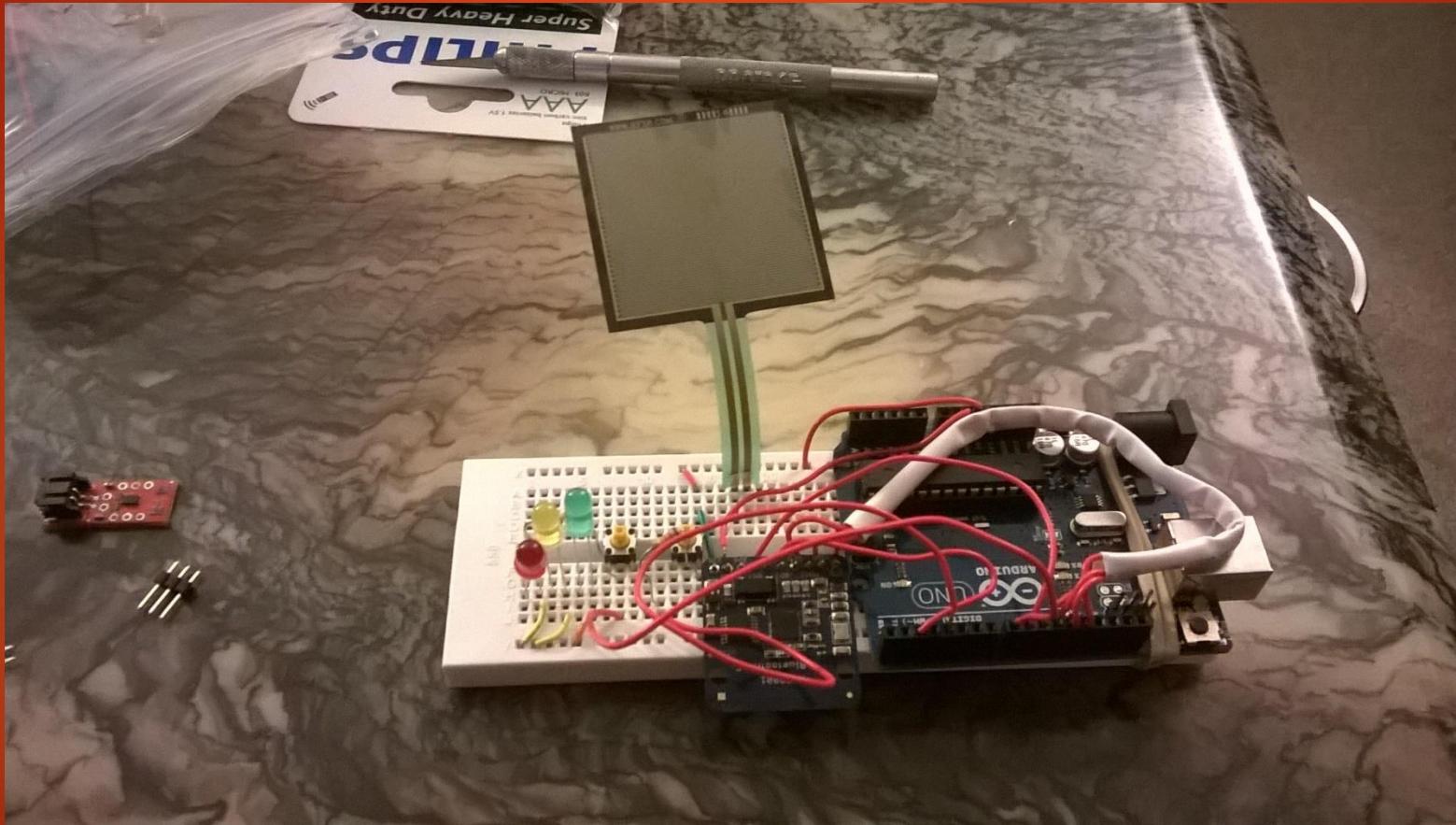
Progress! – Hardware (9)

21



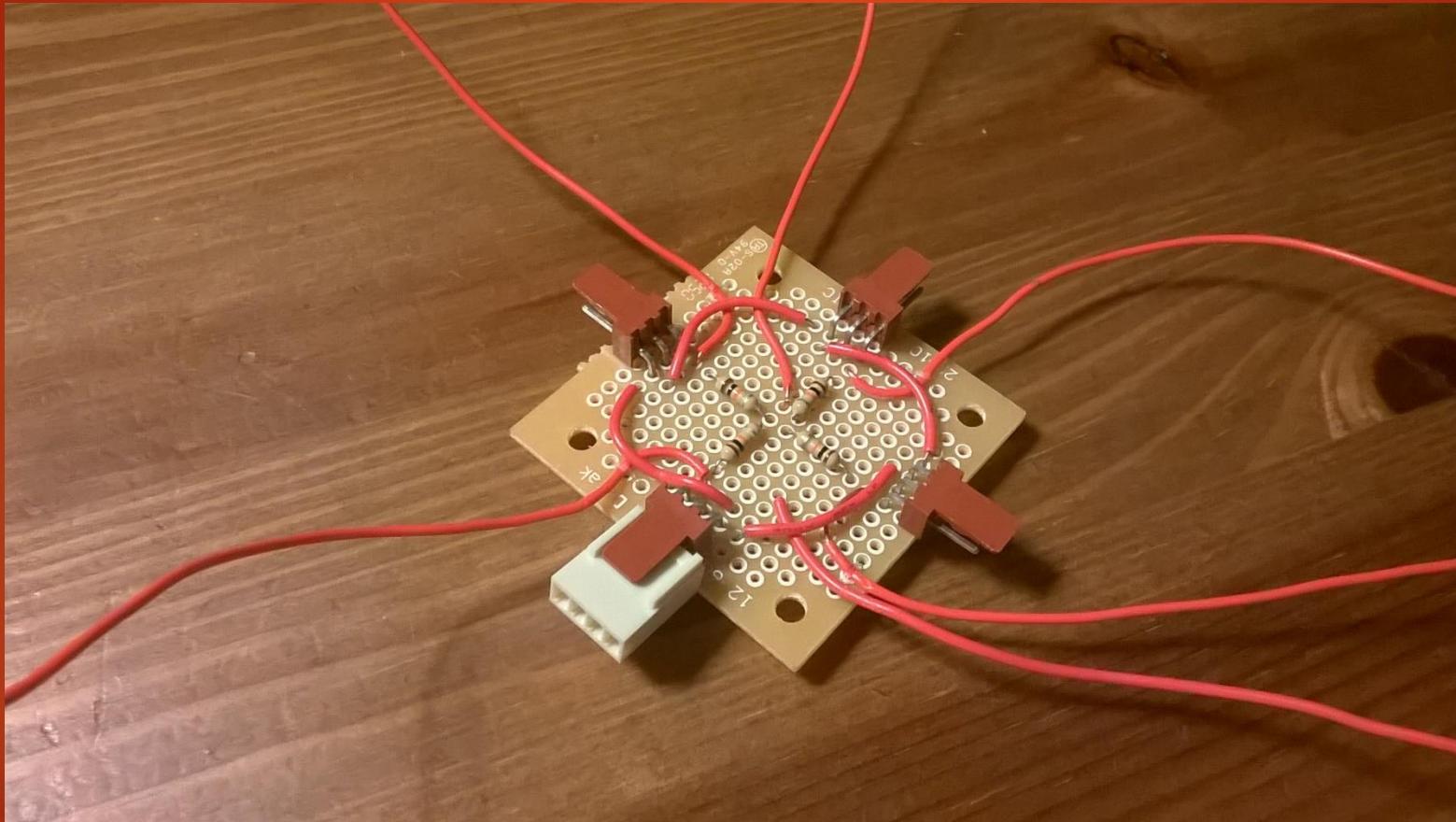
Progress! – Hardware (10)

22



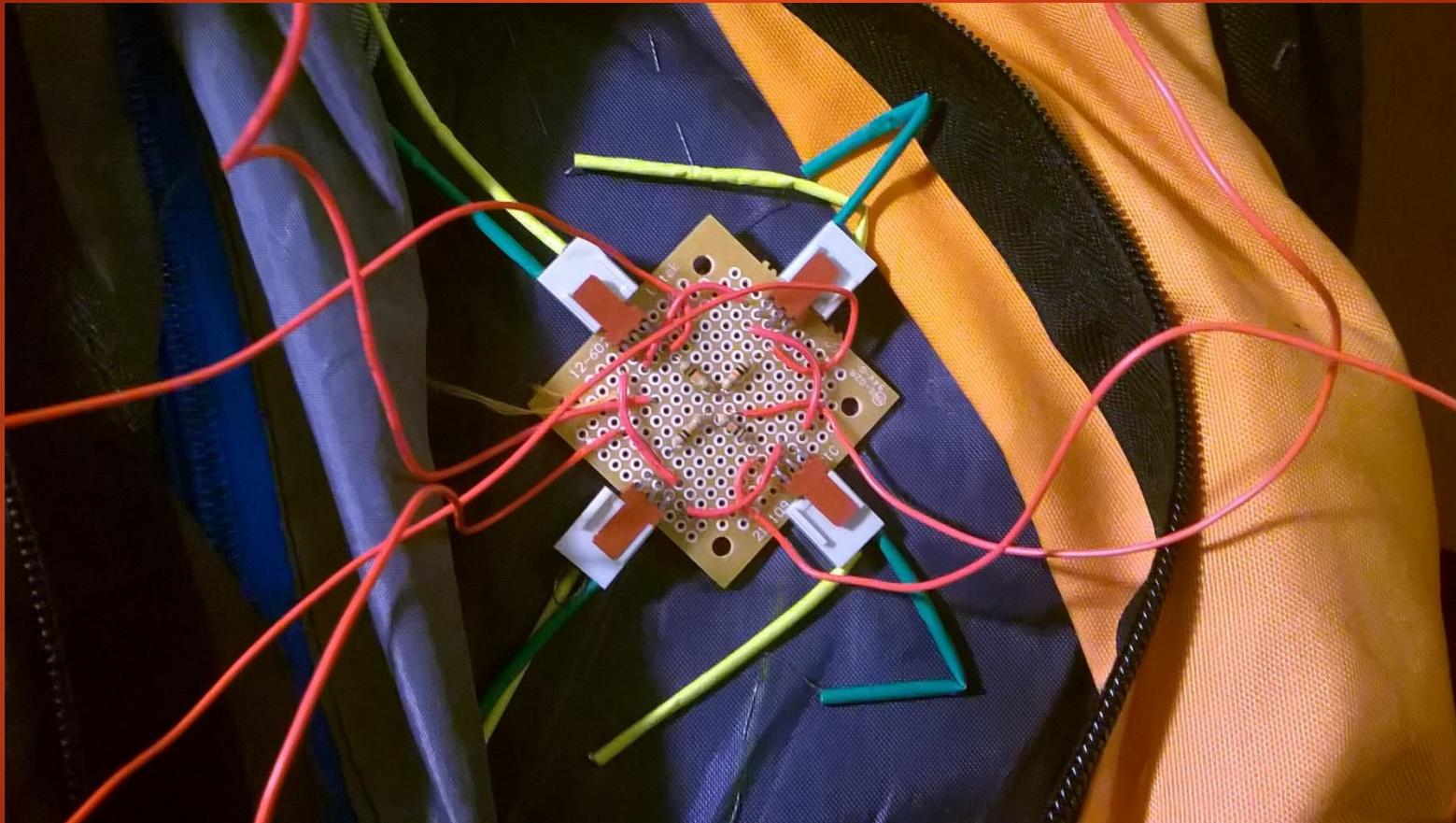
Progress! – Hardware (11)

23



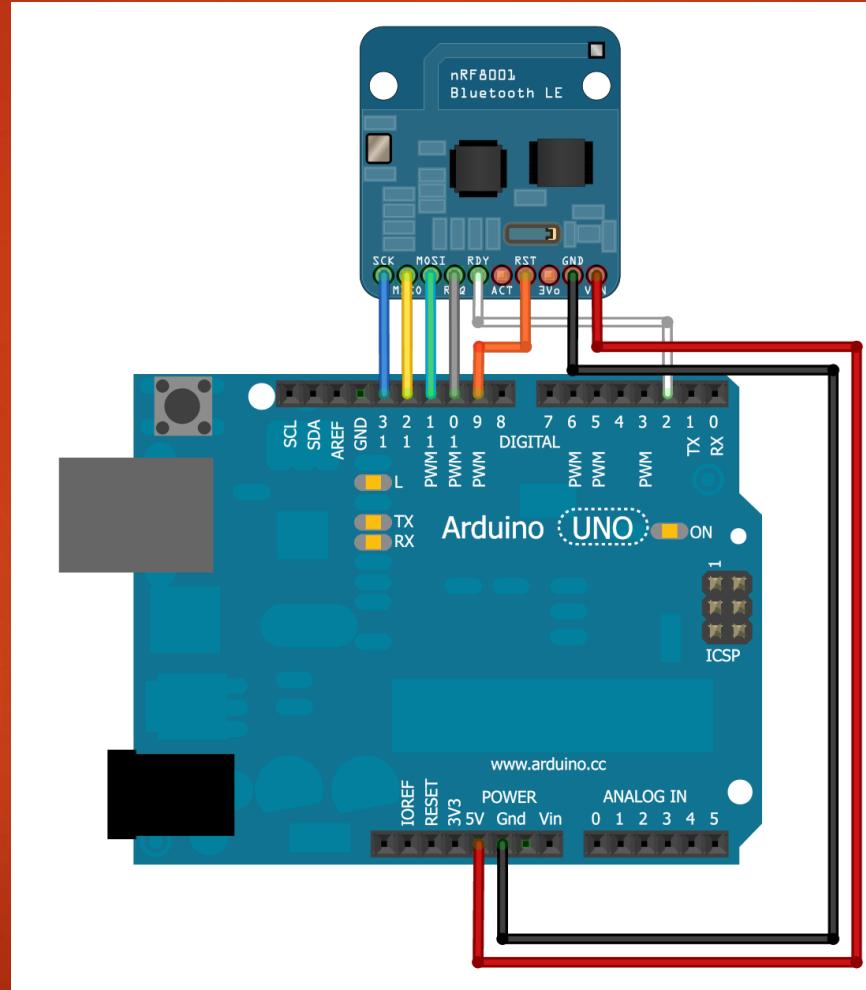
Progress! – Hardware (11)

24



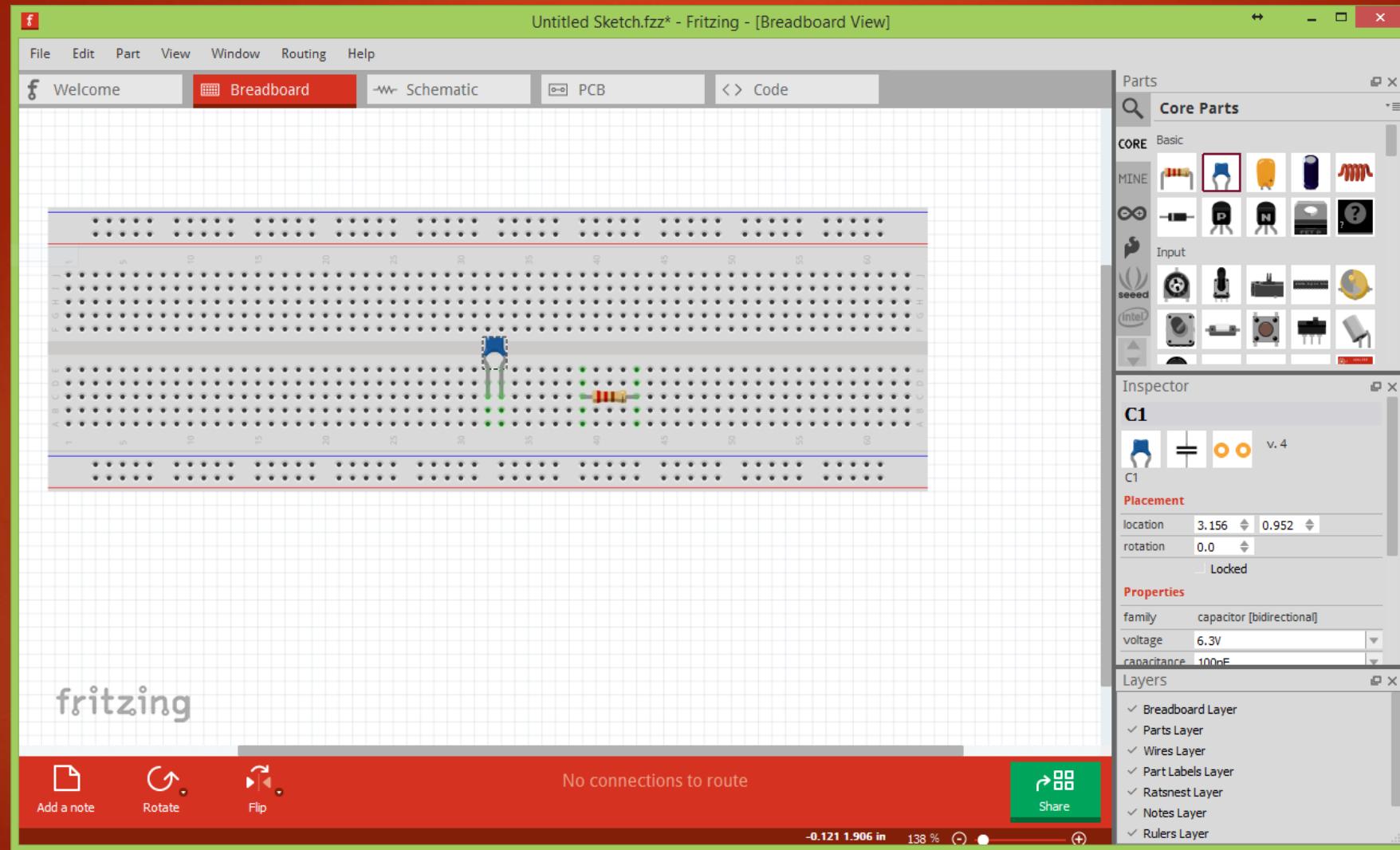
Progress! – Hardware (11)

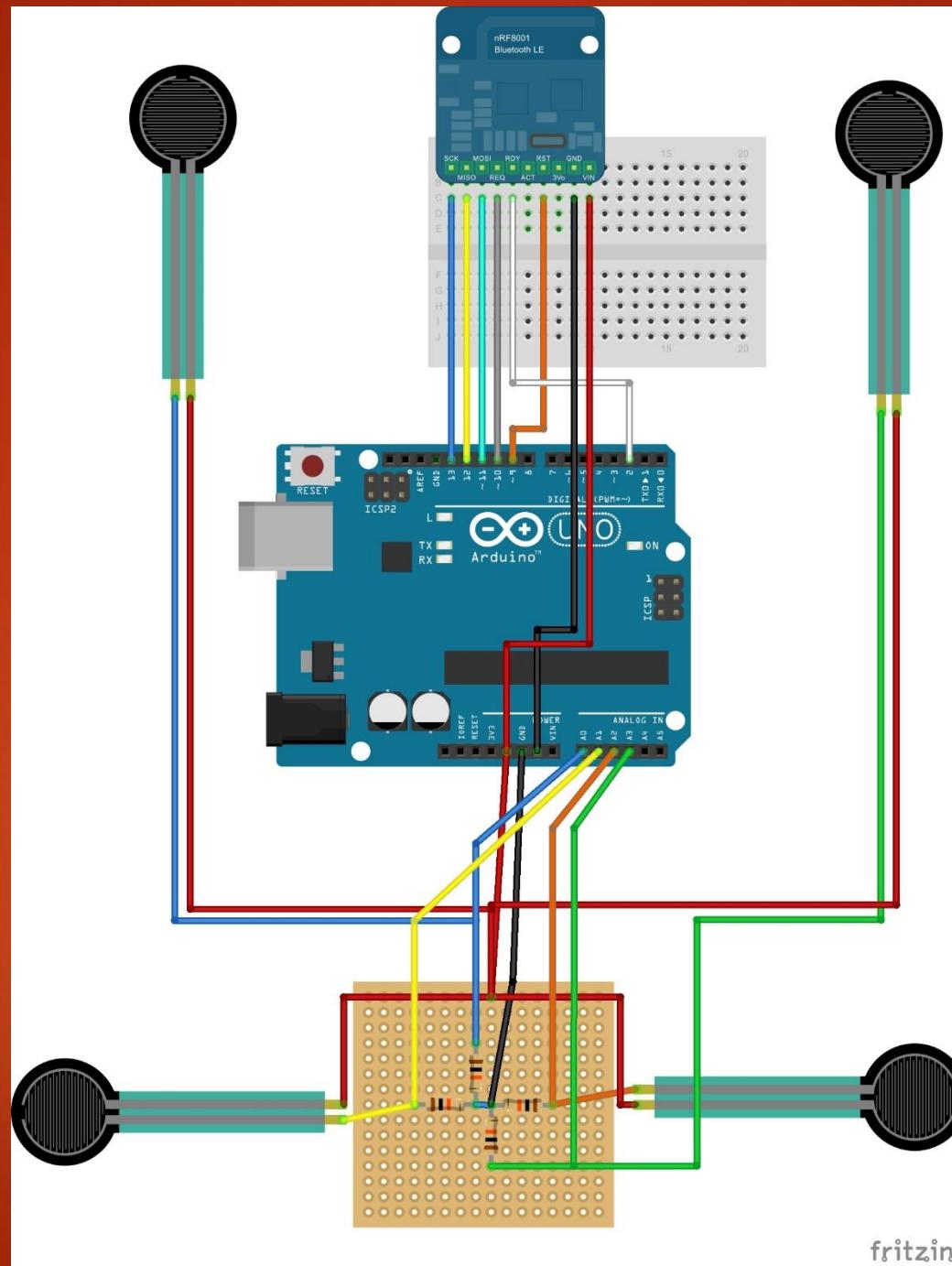
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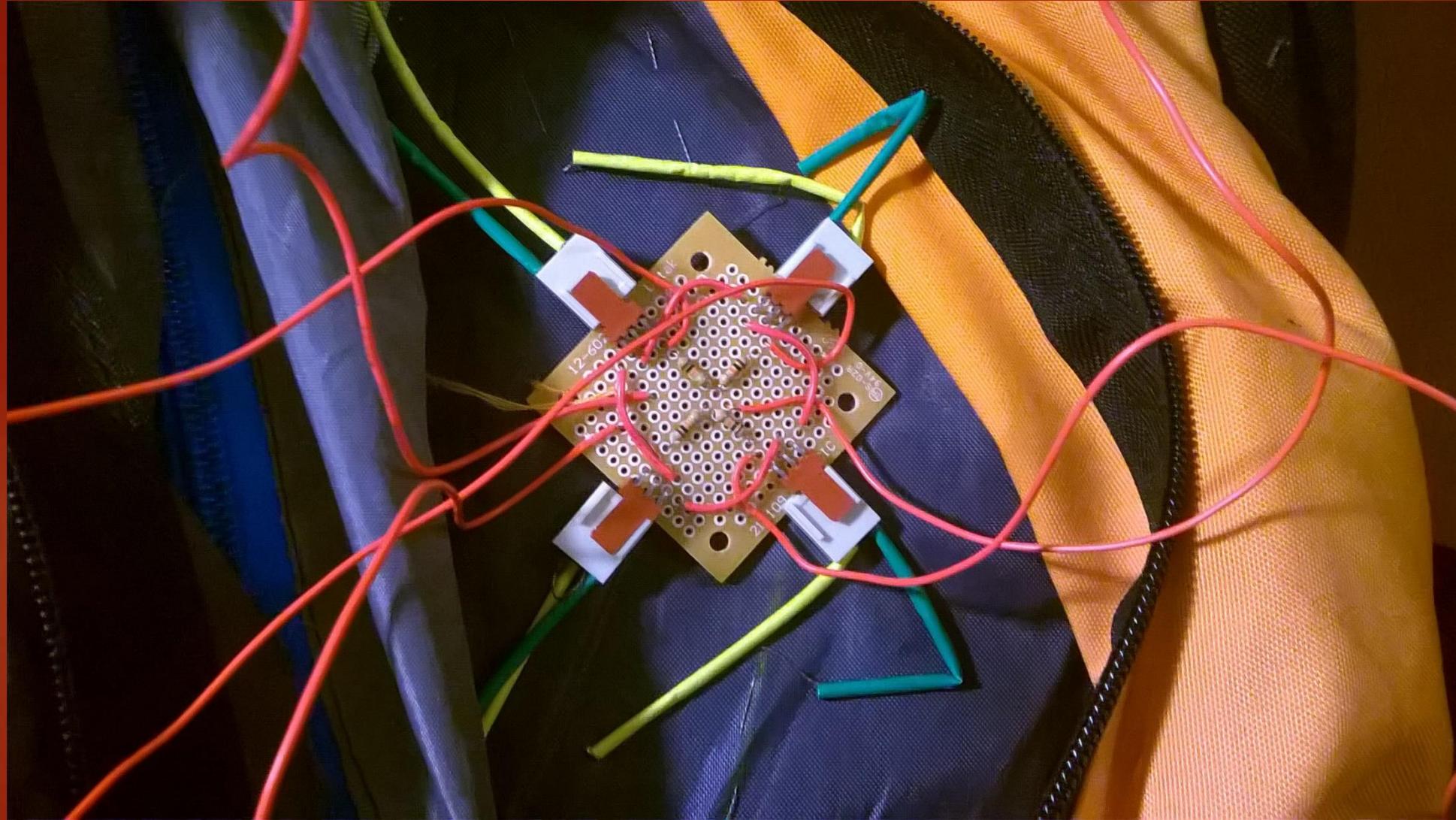


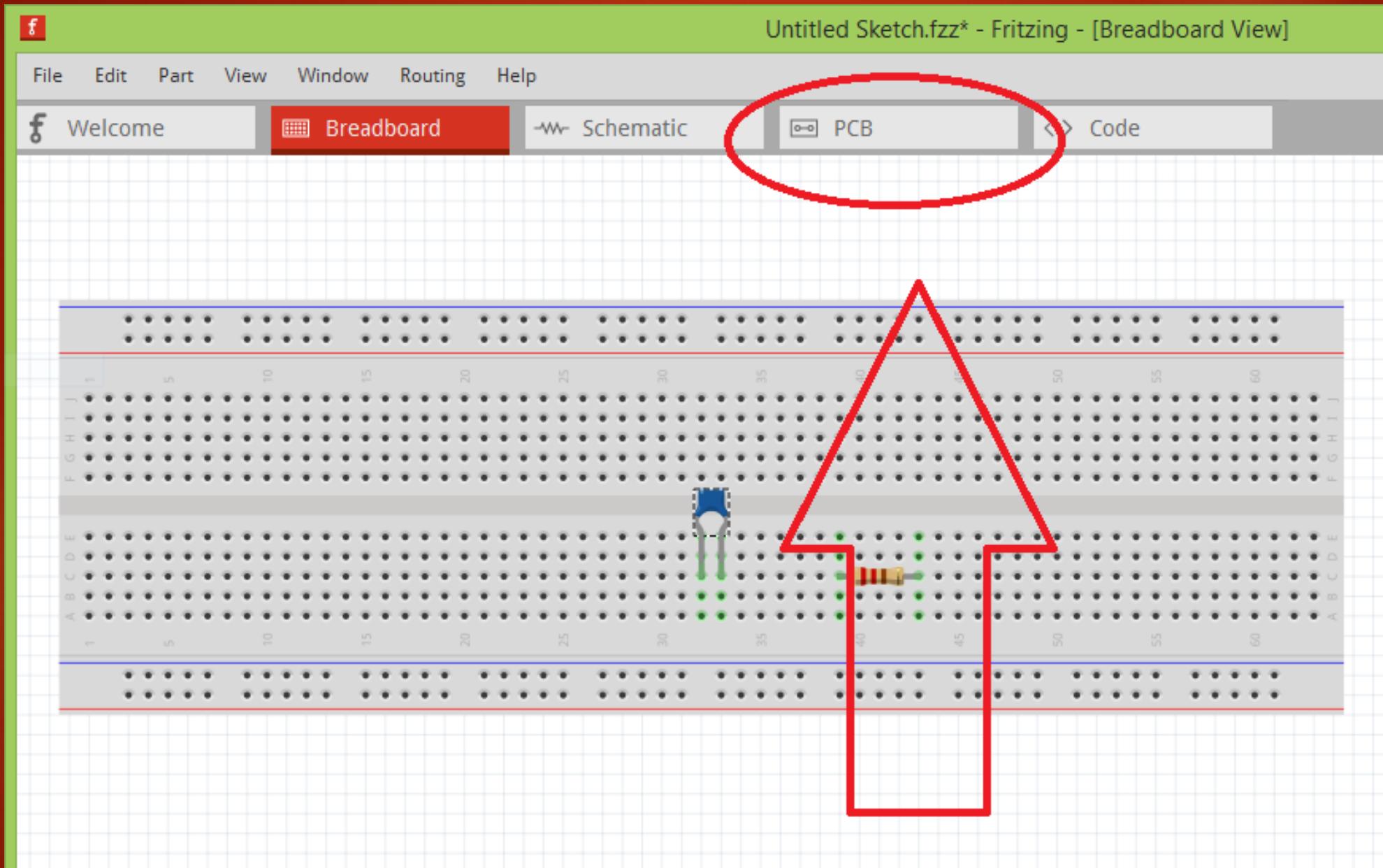
Progress! – Hardware (12)

26



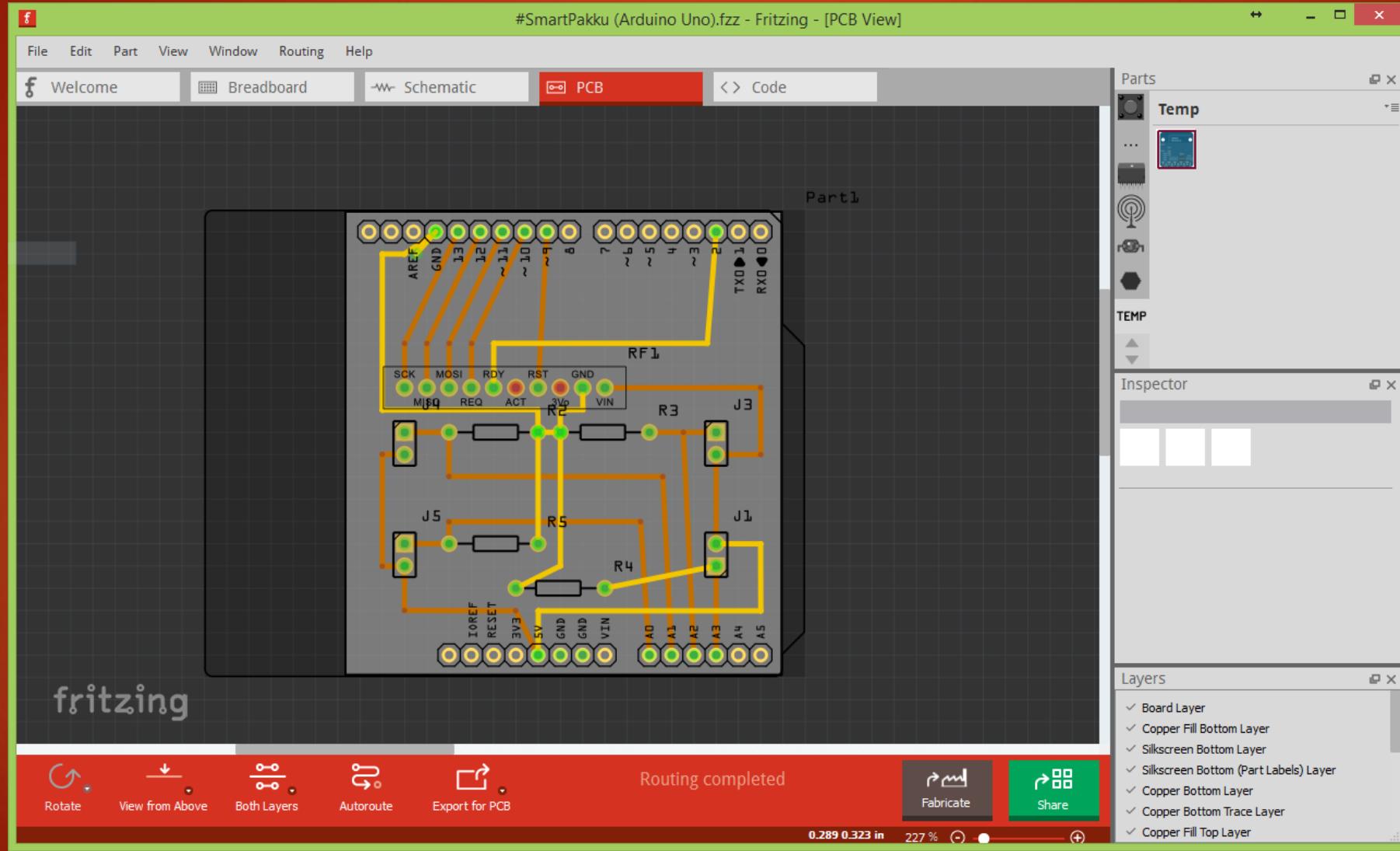






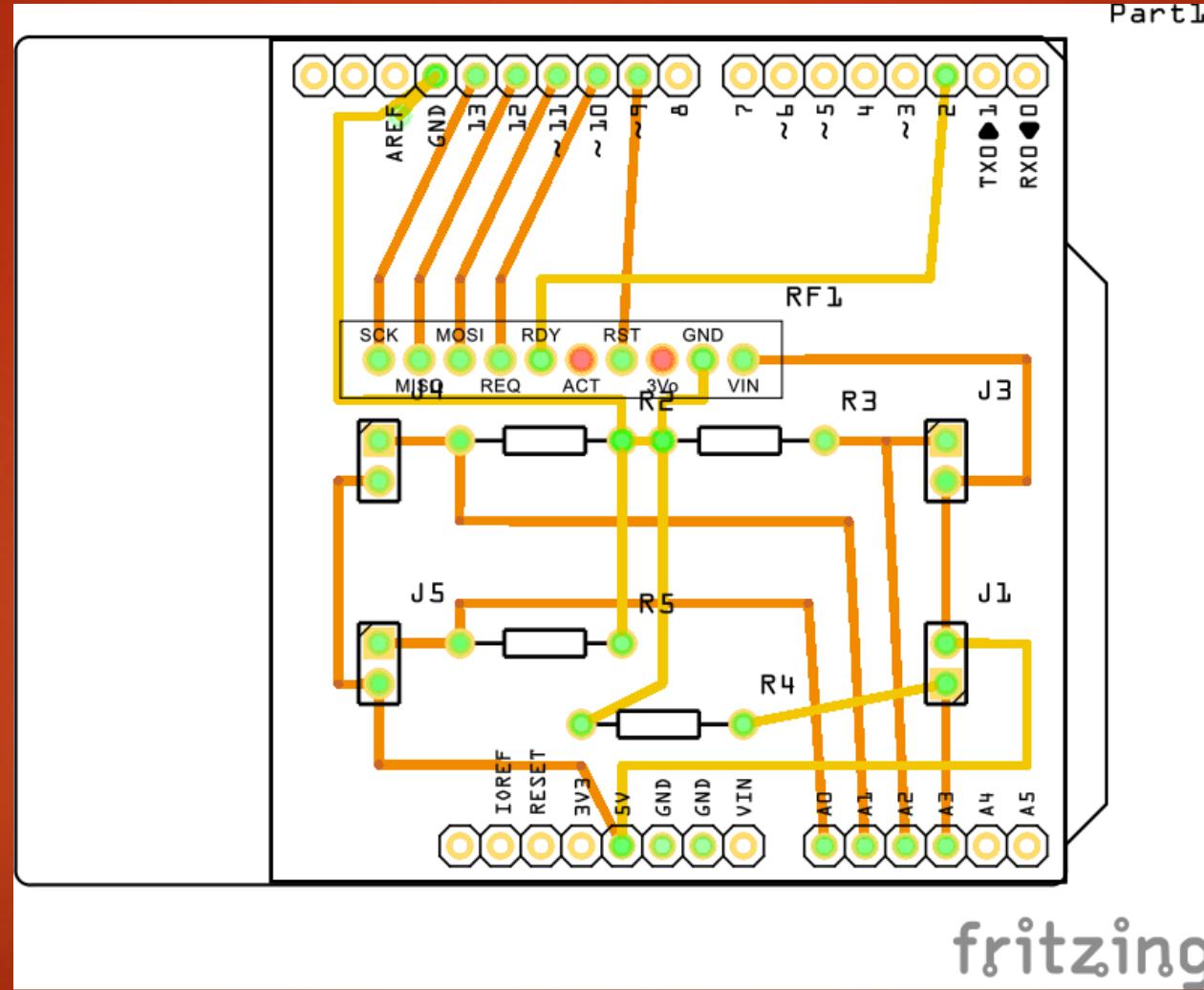
Progress! – Hardware (16)

30



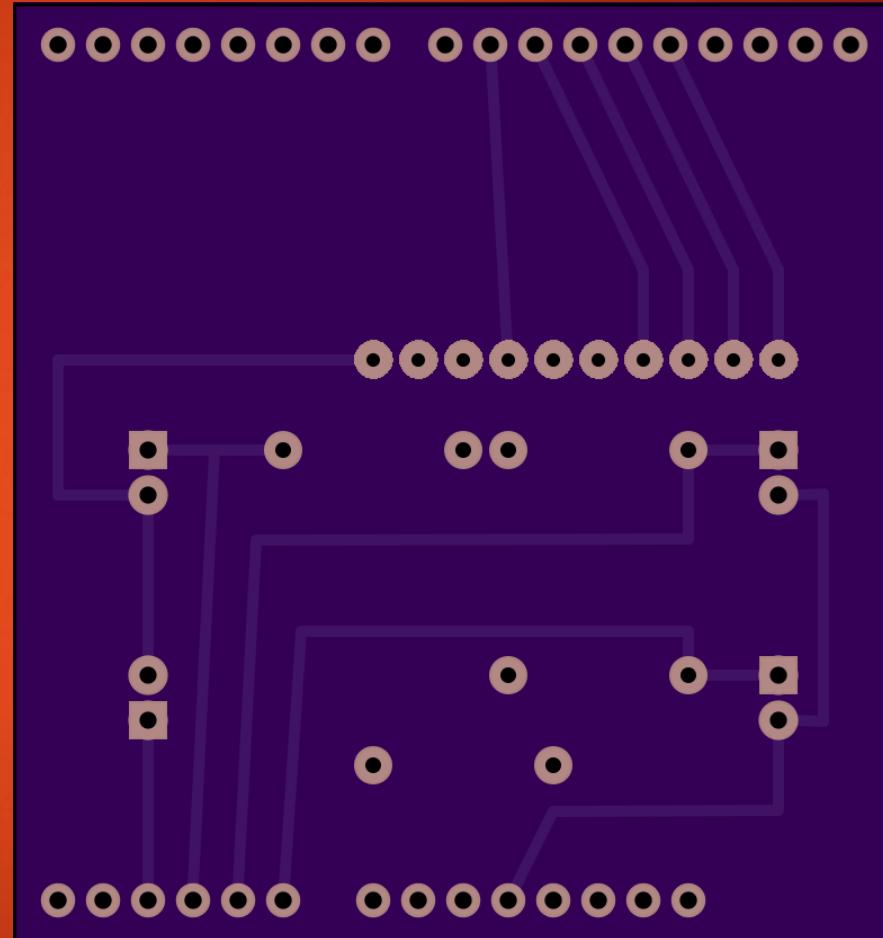
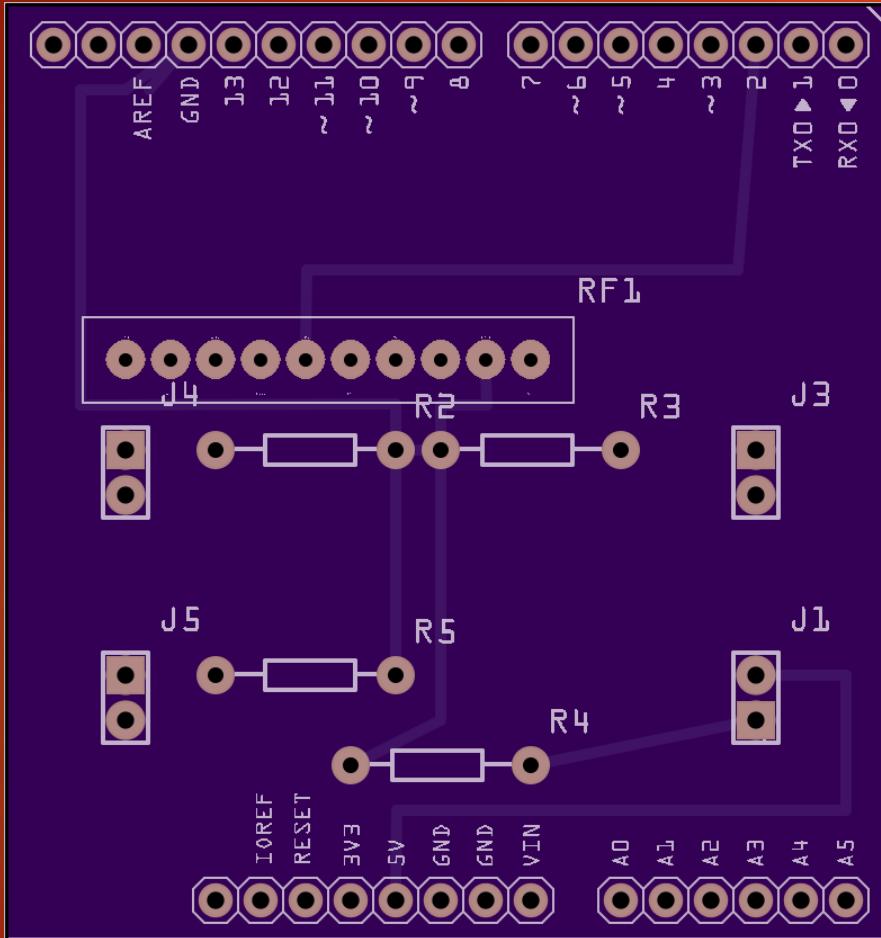
Progress! – Hardware (17)

31



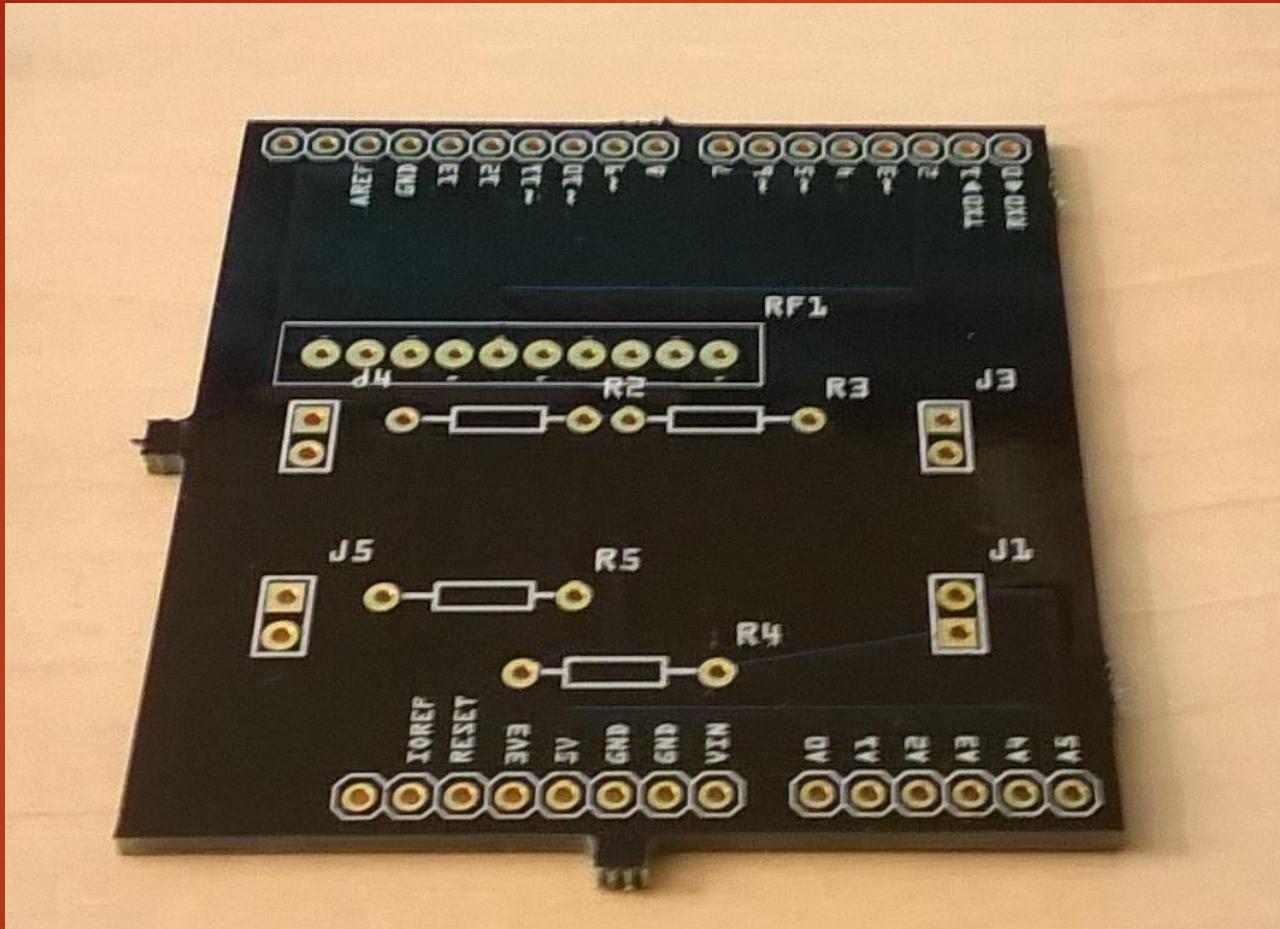
Progress! – Hardware (18)

32



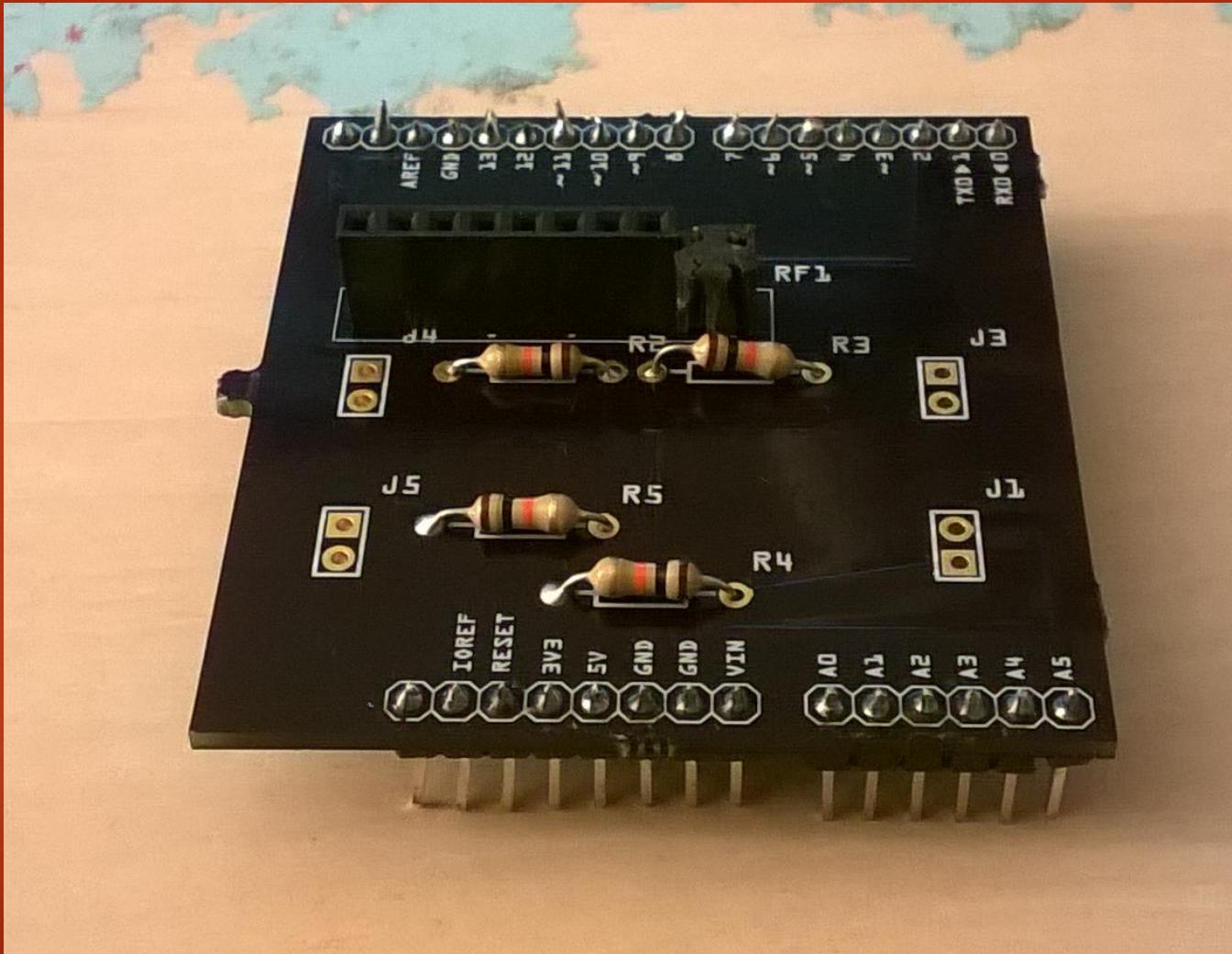
Progress! – Hardware (18)

33



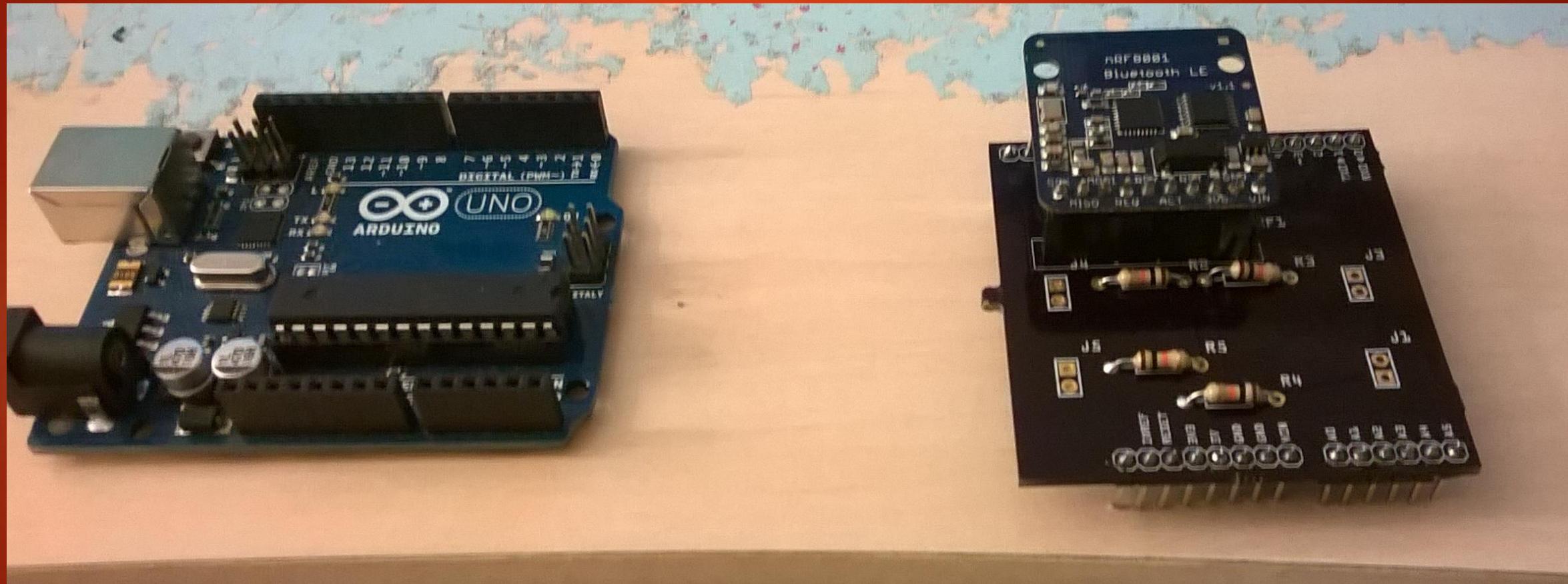
Progress! – Hardware (18)

34



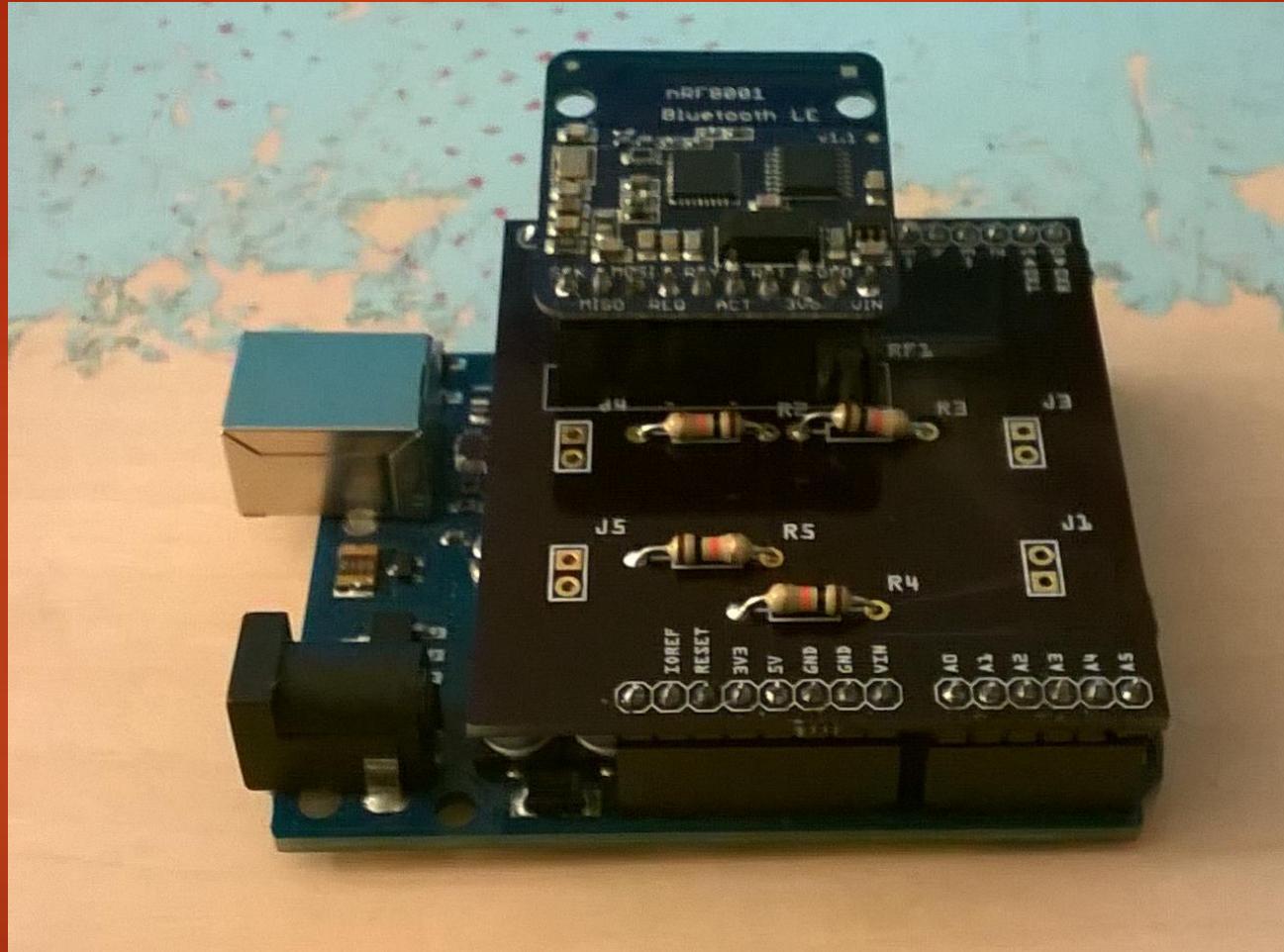
Progress! – Hardware (18)

35



Complete! – Hardware

36



Complete! – Hardware

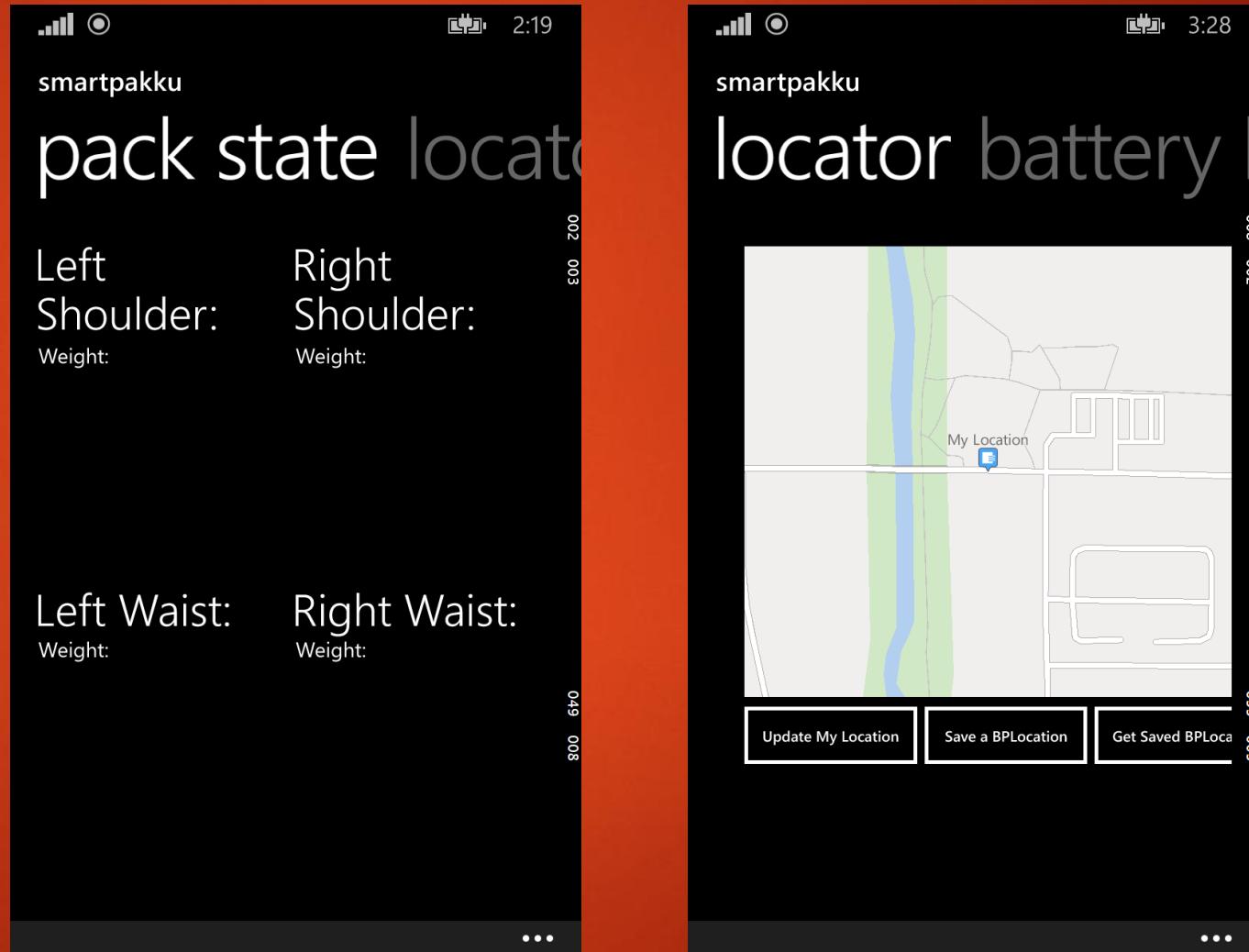
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- ▶ Arduino Uno
- ▶ Power Source
- ▶ Fully assembled SmartPakku shield
- ▶ 4 fully packaged FSR sensors
- ▶ Conductive thread

- ▶ That's it!

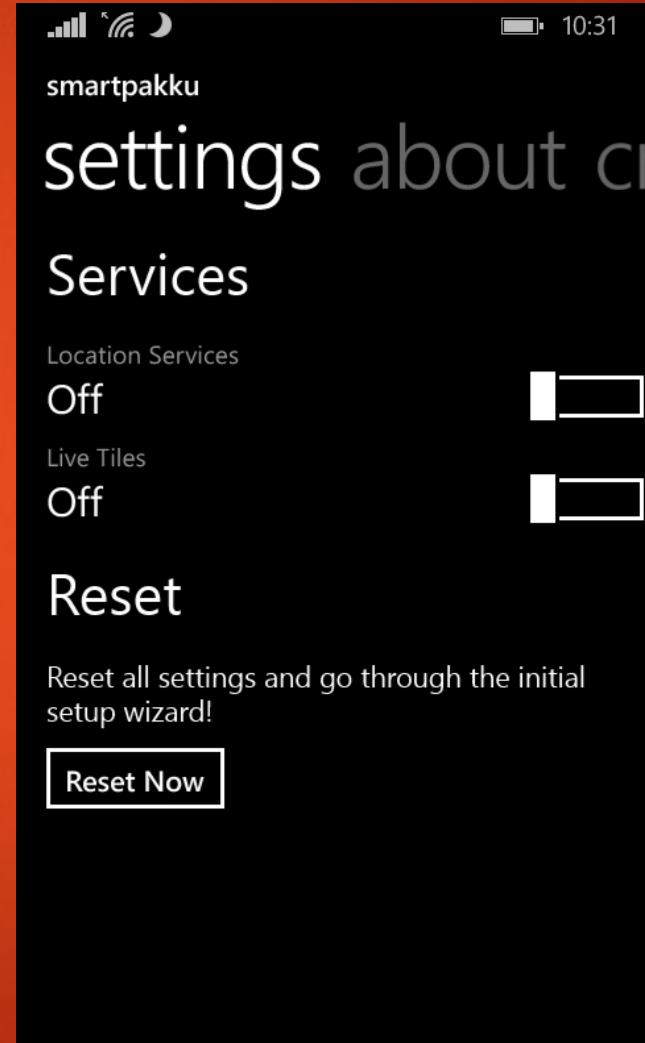
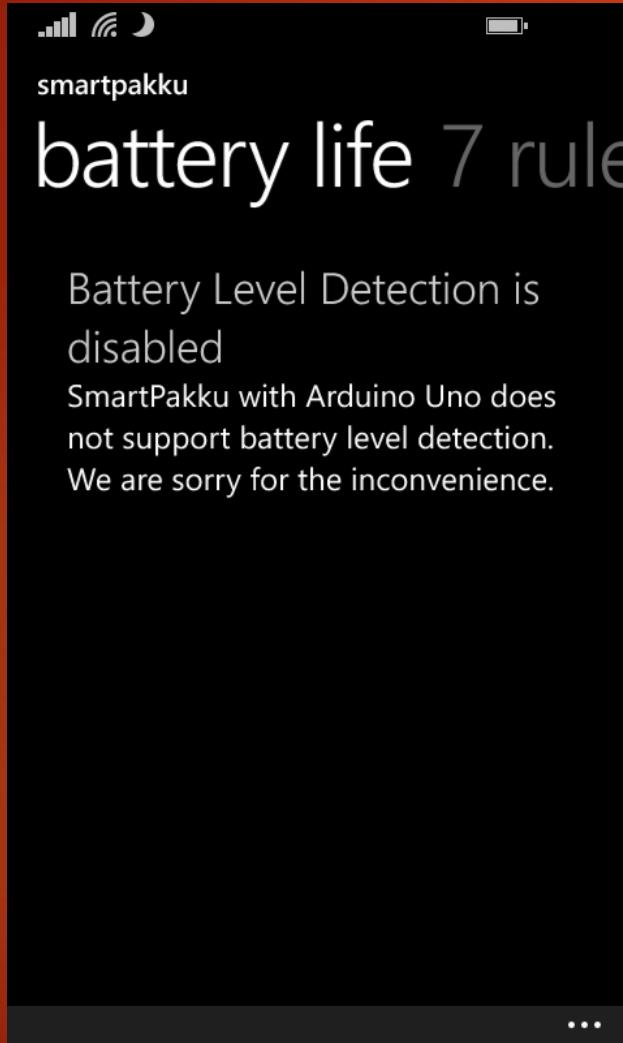
Progress! – Smartphone App (1)

38



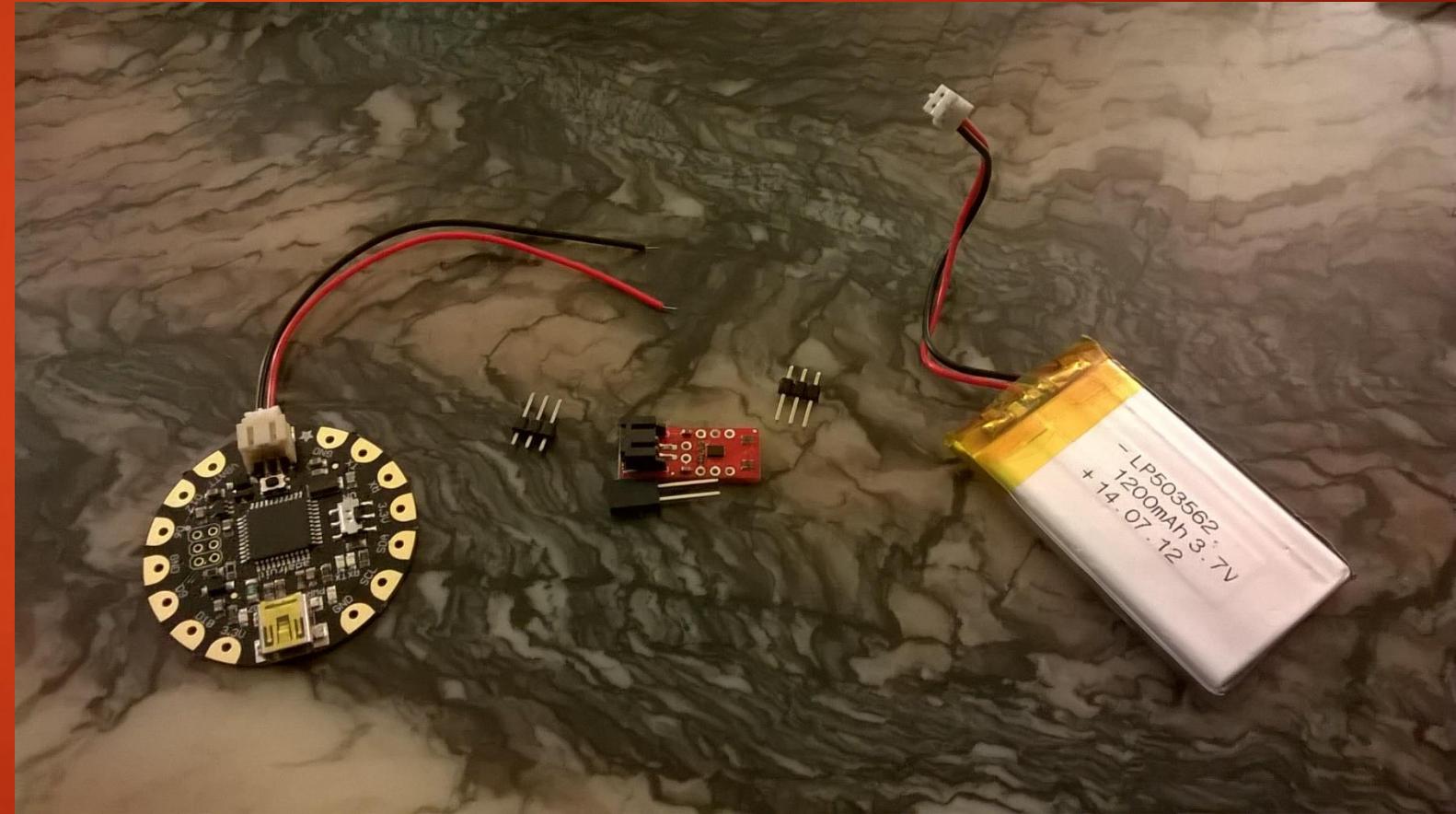
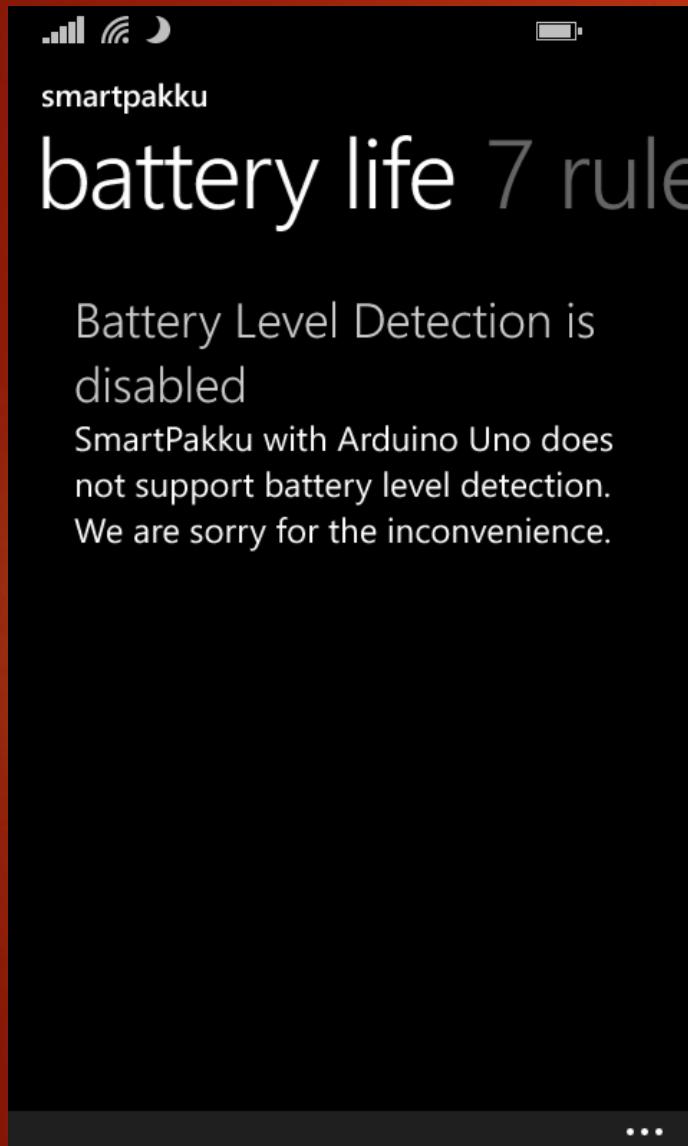
Progress! – Smartphone App (2)

39



Progress! – Smartphone App (3)

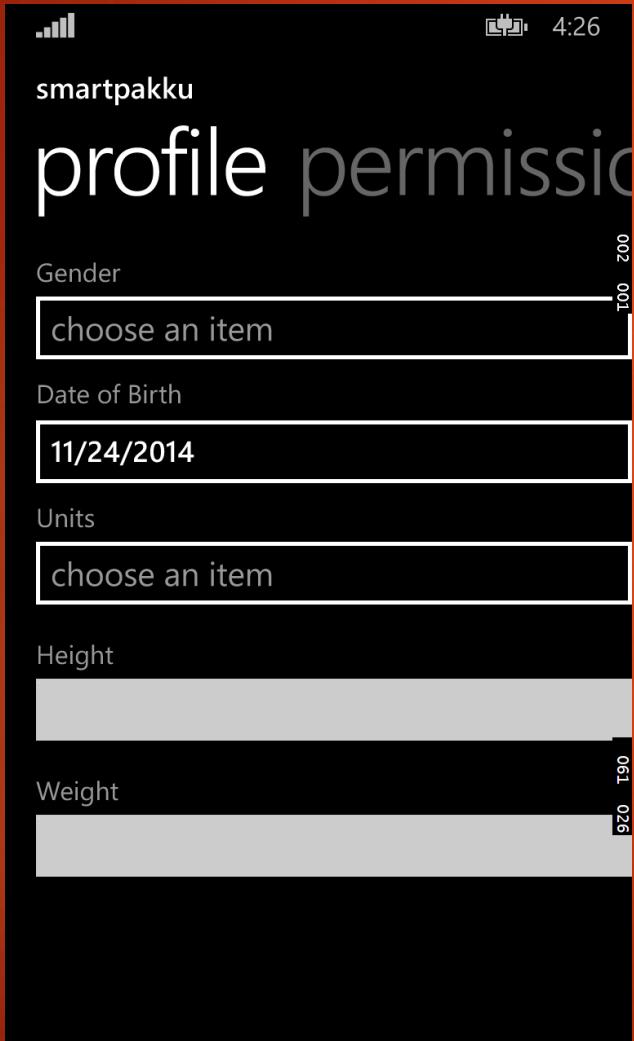
40



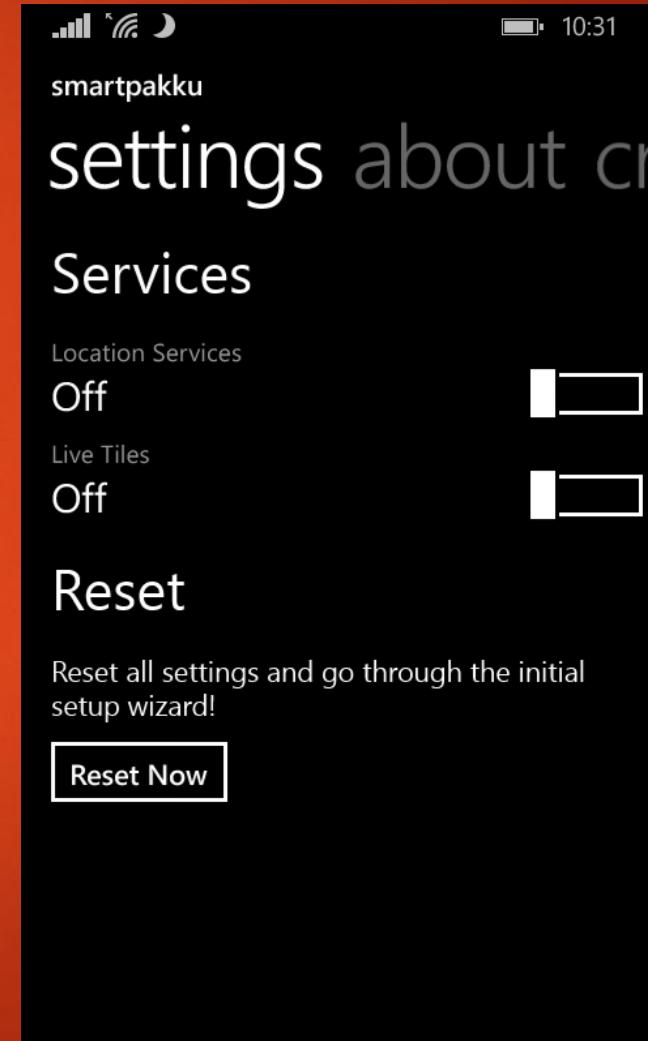
Progress! – Smartphone App (4)

41

Old
Settings

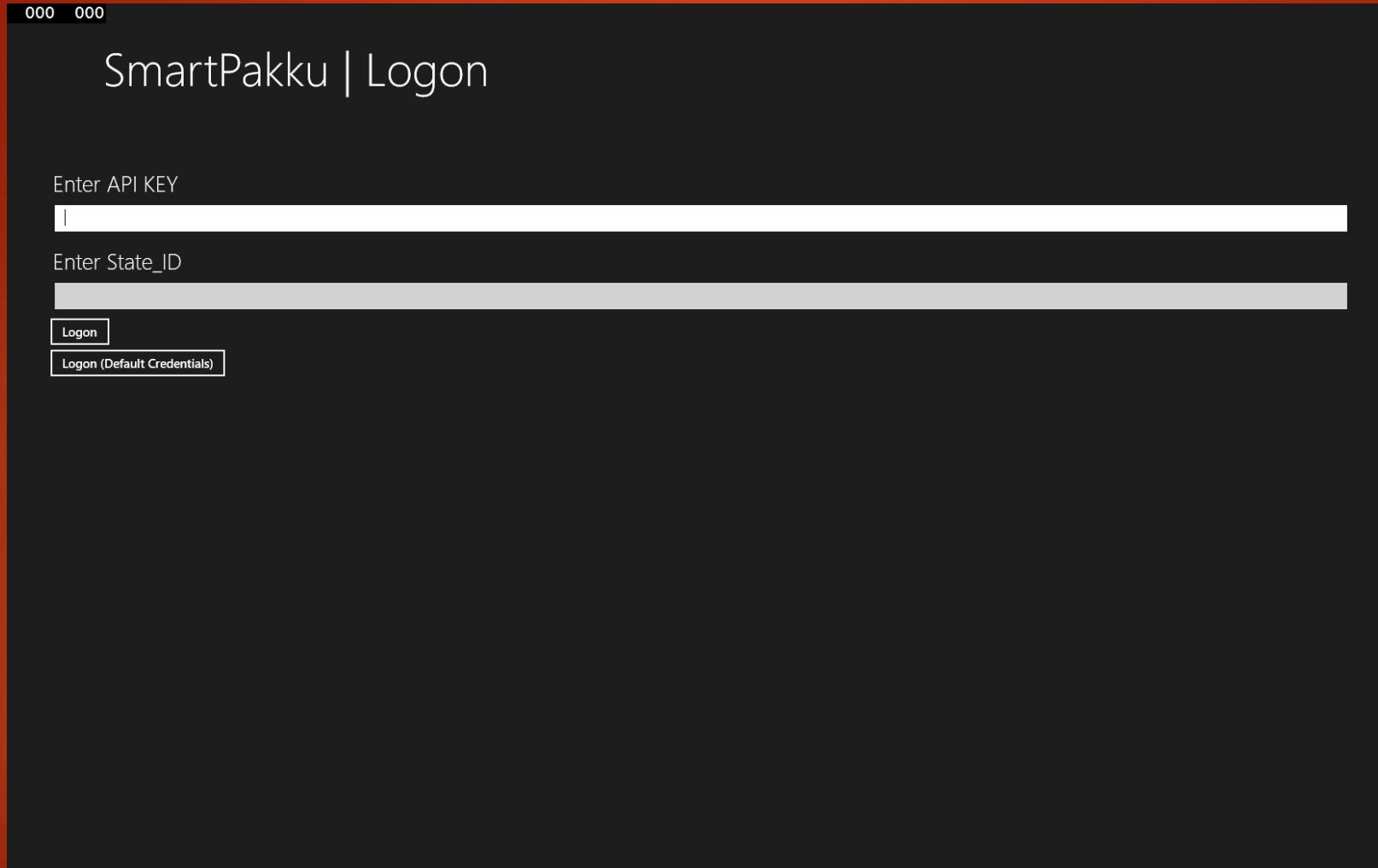


New
Settings



Progress! – App Access

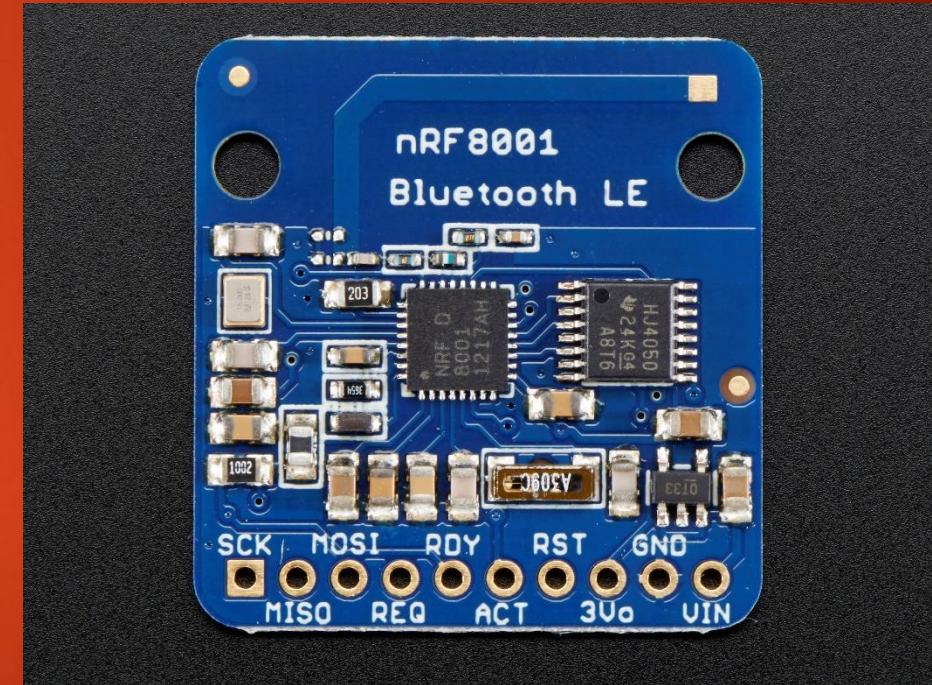
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IoT Challenges: Bluetooth LE

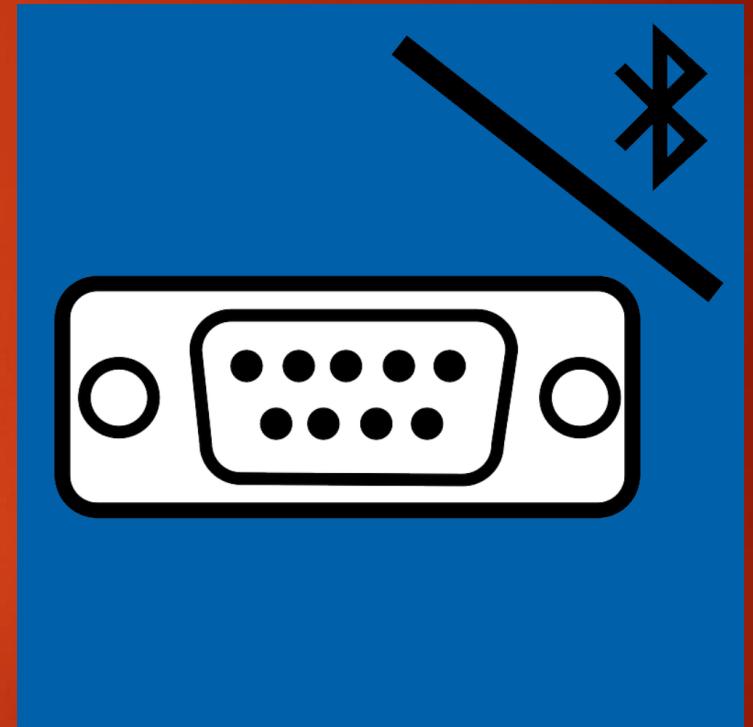
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- ▶ Bluetooth 4.0, LE stands for low energy.
Different model than regular Bluetooth, does not use lots of energy to stay connected
- ▶ Enabled by Adafruit Bluefruit LE
- ▶ No one is doing Bluetooth LE on C# with Windows, very limited sample code and need to work from unclear documentation directly



Bluetooth LE UART 8001

- ▶ Another Windows Phone 8.1 App I created during the process of developing SmartPakku
- ▶ Identical functionality to the official Android app developed by Nordic Semiconductors
- ▶ Two-way communication between a phone and a Arduino Uno with nRF 8001 BLE chip
- ▶ 237 downloads since January 28th



IoT Challenges: Security with MongoDB

- ▶ MongoDB Data Storage
- ▶ How to access the data in a secure way?
- ▶ Two types of API are provided
 - ▶ MongoLab Driver API
 - ▶ [REST API](#)

IoT Challenges: Security with MongoDB

- ▶ REST API is guarded only by an API Key
- ▶ Key grants full access to all data my account can access
- ▶ My key is b6MjZVfMLjMkaYEWGiOgkqAOYshLnzMg

- ▶ Access data through a REST call like so:
- ▶ <https://api.mongolab.com/api/1/databases?apiKey=b6MjZVfMLjMkaYEWGiOgkqAOYshLnzMg>

IoT Challenges: Systems Debugging (1)

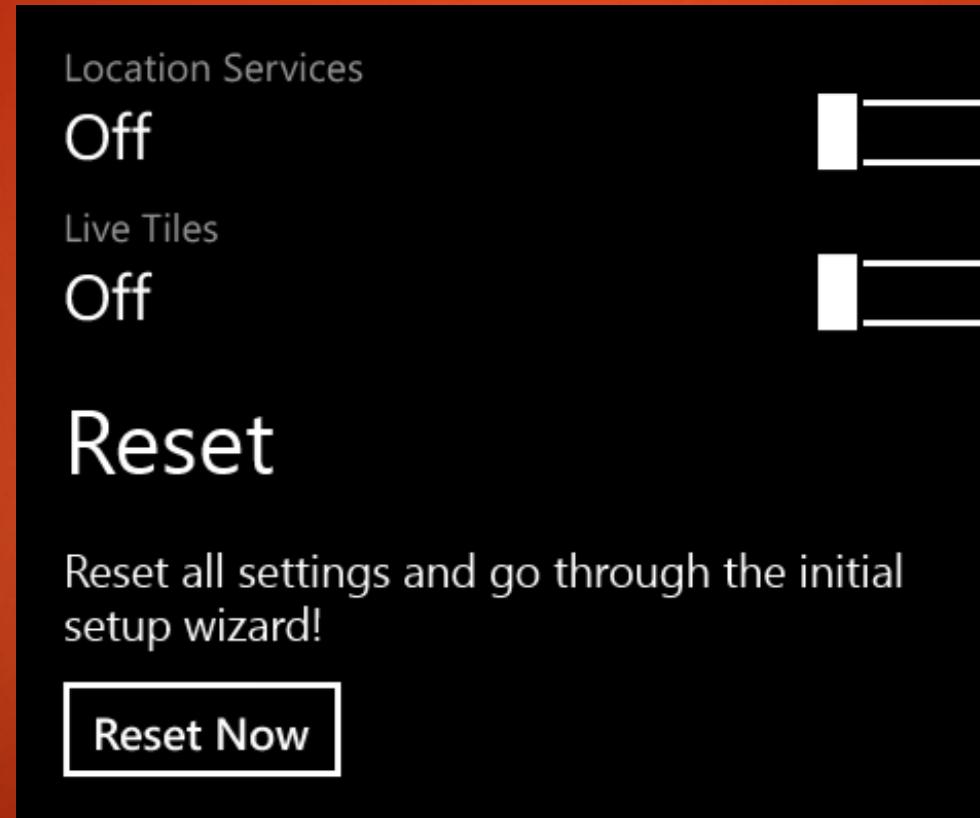
- ▶ When doing software programming on a single application, bug finding is easy
 - ▶ The search area for the bug is very small and confined
- ▶ When doing frontend/backend web programming the search area is a little bit bigger
- ▶ Now the search area for me is huge

- ▶ Recall the flowchart
- ▶ That said, the most important part of debugging is to isolate the problem into as small of an area as possible

IoT Challenges: Event Based Programming (1)

- ▶ No sequential program execution
- ▶ Asynchronous actions increase complexity

IoT Challenges: Event Based Programming (2)



Technical Challenges: Event Based Programming (3)

009 004

⟳ SmartPakku | Remote Access

Refresh Content

Left Shoulder: False
Weight: 23

Right Waist: False
Weight: 64

Left Waist: True
Weight: 23

Right Waist: True
Weight: 78

Last Updated: 1/29/2015 7:48:15 PM

Salinas Hanford Visalia Sequoia N.P. Death Valley National Park 93

Avenal Tulare Porterville Ridgecrest Baker Bullhead City Needles

Paso Robles Wasco Bakersfield Mojave Desert Mojave National Preserve

San Luis Obispo Santa Maria Carrizo Plain National Monument Lancaster Victorville Apple Valley

Lompoc Carrizo Plain National Monument Los Padres National Forest Santa Clarita Hesperia Simi Valley Ontario San Bernardino

Ventura Oxnard Simi Valley Ontario Corona Riverside Hemet Joshua Tree N.P. Indio

Channel Islands N.P. Torrance Escondido Oceanside San Diego Tecate Mexicali Tijuana Ensenada

40 miles 70 km

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Demo (Hardware)

- ▶ Left and right shoulder
- ▶ Left and right waist strap
- ▶ Turning on the SmartPack

Demo (Phone App)

- ▶ Download and install
- ▶ First run experience

Demo (PC App)

- ▶ Download and install
- ▶ Use logon information created from the phone app
- ▶ Show real-time data synchronization
- ▶ Show real-time mapping

Demo (Website)

- ▶ Access from web browser
- ▶ Use logon information created from the phone app
- ▶ Show real-time data synchronization
- ▶ Show real-time mapping

Conclusion

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- ▶ Know your target audience
- ▶ A complete, full stack solution in place that collects raw data, transmits the data, processes the data, and displays the data across the web – is hard

Next Steps

- ▶ Battery monitoring for Arduino Uno
- ▶ PCB Board Design, packaging for Adafruit Flora

- ▶ Fundamental flaw – no actual interesting suggestions for backpack adjustments

Thank You!