# Connected insole

Creating an open source connected insole with pressure sensor for podological diagnosis

Background

Project started during the **2019 SDG Summer School**

Goal : creating a **connected insole** several pressure sensors to give **dynamic feedback** of the patients' **plantar pressure**.

Results : a **DIY insole** able to **sense pressure** and to send the data through a **USB cable** to a **processing script**
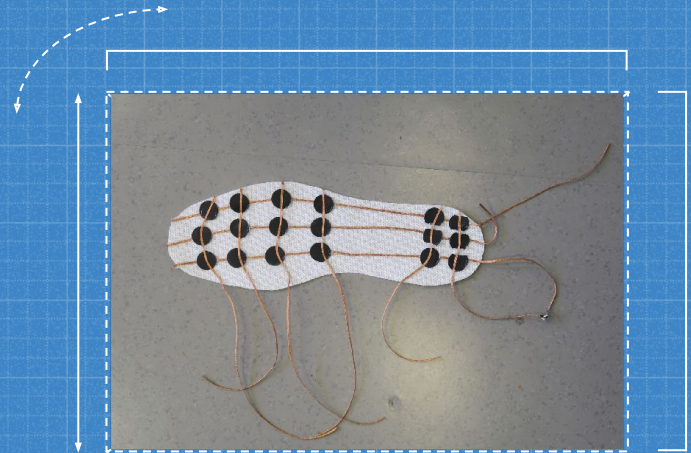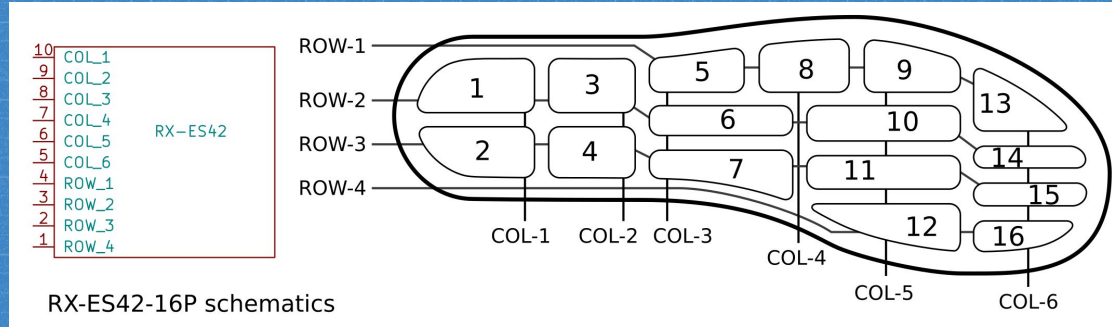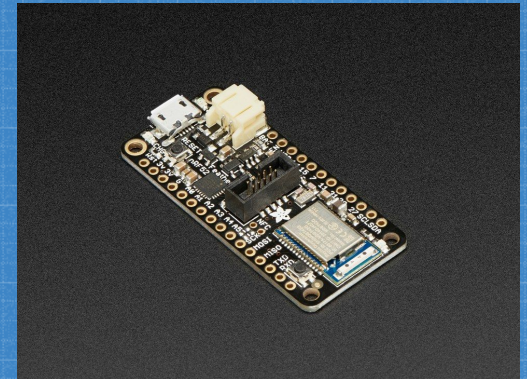
Goals

- Wireless communication

- Using commercially available insole-shaped pressure sensors matrix

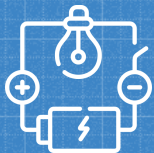- User friendlier interface able to run on any device

Hardware

Insole : a 4×6 **pressure sensor matrix**

RX-ES42-16P schematics

Microcontroller : a Feather nrf 52
(arduino compatible and support wifi
and bluetooth)

Electronics

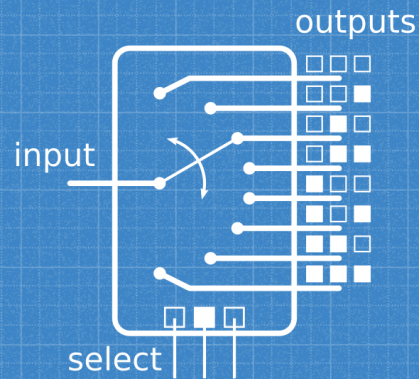### Did some tests with **multiplexers**

(electronically controlled switches that reduce the number of used pin from n analog pins to $\log_2(n)$ digital pin)
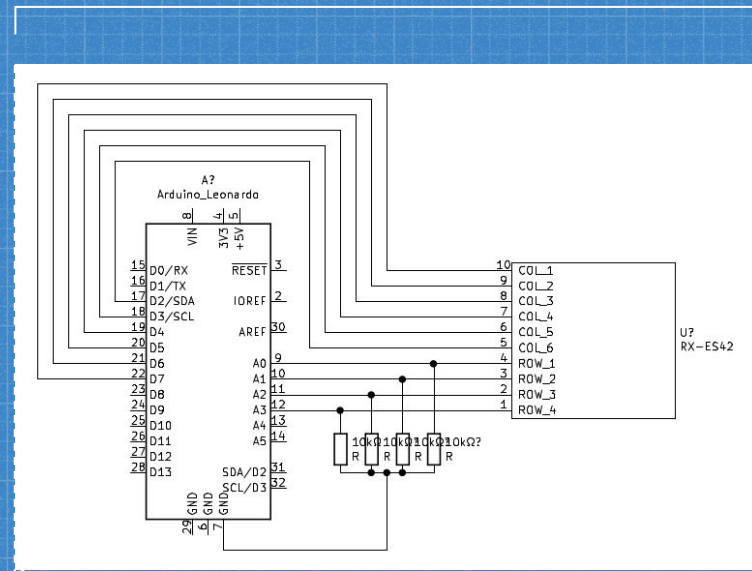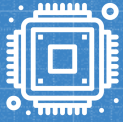
outputs

input

select

Choose to keep things **simple**

Note the 4 resistor to create a voltage divider

(I may be able to use only one resistor if I use diodes now that I think about it ...)

((not sure it's going to be worth it though…))

A?
Arduino_Leonardo

VIN 8	
3V3 4	
+5V 5	
15 D0/RX	RESET
16 D1/TX	IOREF 2
17 D2/SDA	
18 D3/SCL	
19 D4	AREF 30
20 D5	
21 D6	A0 9
22 D7	A1 10
23 D8	A2 11
24 D9	A3 12
25 D10	A4 13
26 D11	A5 14
27 D12	
28 D13	SDA/D2 31
	SCL/D3 32
29 GND	
6 GND	
7 GND	

10kΩ 10kΩ 10kΩ 10kΩ?
R   R   R   R

	U? RX-ES42
10 COL_1	
9 COL_2	
8 COL_3	
7 COL_4	
6 COL_5	
5 COL_6	
4 ROW_1	
3 ROW_2	
2 ROW_3	
1 ROW_4	

ARDUINO code

The board iterate over all sensors, send power to their column pin and not to the other pins, then read the correct row pin.

Joy of Open Source : I stole the code for Bluetooth support from a tutorial made by Sayanee Basu distributed under the MIT licence

https://github.com/hutscape/hutscape.github.io/blob/master/_tutorials/web-ble-gatt/web-ble-gatt.ino

Web App

Two possibilities :

- **Native phone app** : more portable
- **Web app** : possible thanks to the new **Web Bluetooth API**

Long story short :

I spent way **too much time** trying to do a **native phone** app before realising that doing a **web app was so much easier**

> Once again,
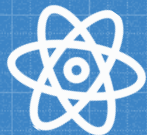> Exploration-exploitation dilemma
> are here to make life harder

Web App

Used React js as framework

Bluetooth communication : used again the code from the tutorial made by Sayanee Basu

I refactored it to be more **object-oriented**

Goal : increasing **reusability** of the code

Web App

Interface : created a react component to plot an **insole-shaped heatmap**

Just a **svg** component with controllable opacity of the fill color of the sensors

Not really easy to read

ONE DOES NOT SIMPLY

BECOME UX DESIGNER

REACT WEB BLE

Test 3

Connect with BLE device | Start | Stop

Random_Values

Improvements

- using **multiplexers** ?

- Work on **power management** for the insole

- Allow the web app to **record the data** and send it to a database or save it in a csv file.

- Create an other mode where the **insole stores the data** in a flash drive then upload everything in bulk.

- Create a **better visualization** of the sensor data

Skills

Software

- React Native Basics
- React Basics
- Improved my JavaScript (it was a bit rusty)
- A bit of asynchronous programming in JavaScript
- Bluetooth protocol basics

Hardware

- improved my electronics
- Arduino Programing
- Basic micro-controller knowledge

Others

- Autonomy
- managing long programming project (keeping a "programming lab-book" up-to-date)
- Ability to keep calm when thing are not working (things were not working a lot)

Resources used to learn those skills

- This free react native course : https://www.reactnativebasics.com/

- Arduino: A Technical Reference by J. M. Hughes (2016), O'Reilly Media, Inc.

- React and React native documentations : https://reactnative.dev/docs/getting-started

- Adafruit documentation : https://learn.adafruit.com/bluefruit-nrf52-feather-learning-guide

- not really a learning resource but this website is so cool to learn how simple computers (like micro-controllers) work : https://nandgame.com/#

Thanks!

ANY QUESTIONS?

Test the web app by yourself at
https://drblobfish.github.io/connected_insole/

Find a more detailed documentation about this project on
https://drblobfish.github.io/blog/2021/connected_insole/

Find the source code at :
https://github.com/drblobfish/connected_insole

CREDITS

Special thanks to the **makerLab team**

Thanks to Sayanee Basu from the website hutscape.github.io for providing code under the MIT licence

https://github.com/hutscape/hutscape.github.io/blob/master/_tutorials/web-ble-gatt

- Presentation template by SlidesCarnival
- Feather nrf 52 picture (slide 4) from adafruit's website