Grip on the cheap - the perspective of implementing grip force measurements with cost-effective hardware.

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Jagiellonian University in Krakow

Outline

ELSEVIER

Acta Psychologica

Volume 231, November 2022, 103791

Spatial-numerical associations without a motor response? Grip force says 'Yes'

A. Miklashevsky [a], M.H. Fischer [a], O. Lindemann [b]

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https://doi.org/10.1016/j.actpsy.2022.103791

Highlights

- Processing numbers changes grip force as the Mental Number Line hypothesis predicts.

Part of special issue

Numbers in action: The embodied nature of numerical representations

Edited by Stephanie Roesch, Korbinian Moeller, Julia Bahnmueller, Roberta Barrocas

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Recommended articles

The malleable impact of non-numeric features in visual number perception

Acta Psychologica, Volume 230, 2022, Article 103737

Denitza Dramkin, ..., Darko Odic

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Acta Psychologica, Volume 230, 2022, Article 103719

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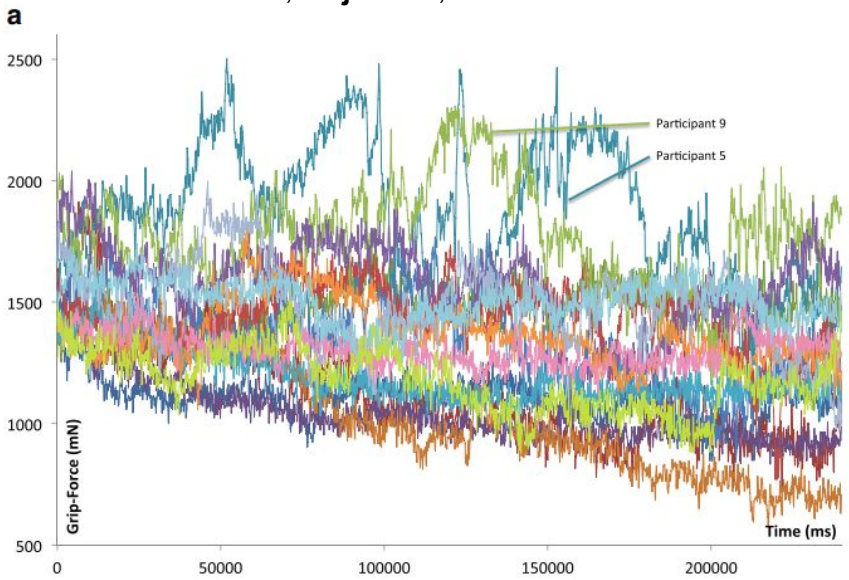
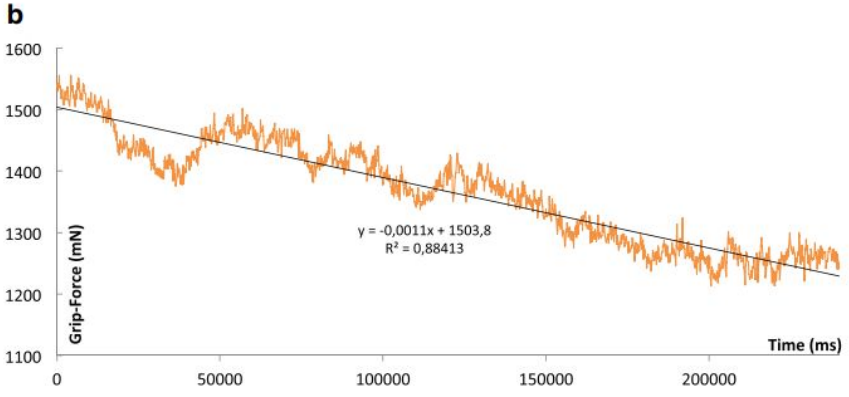
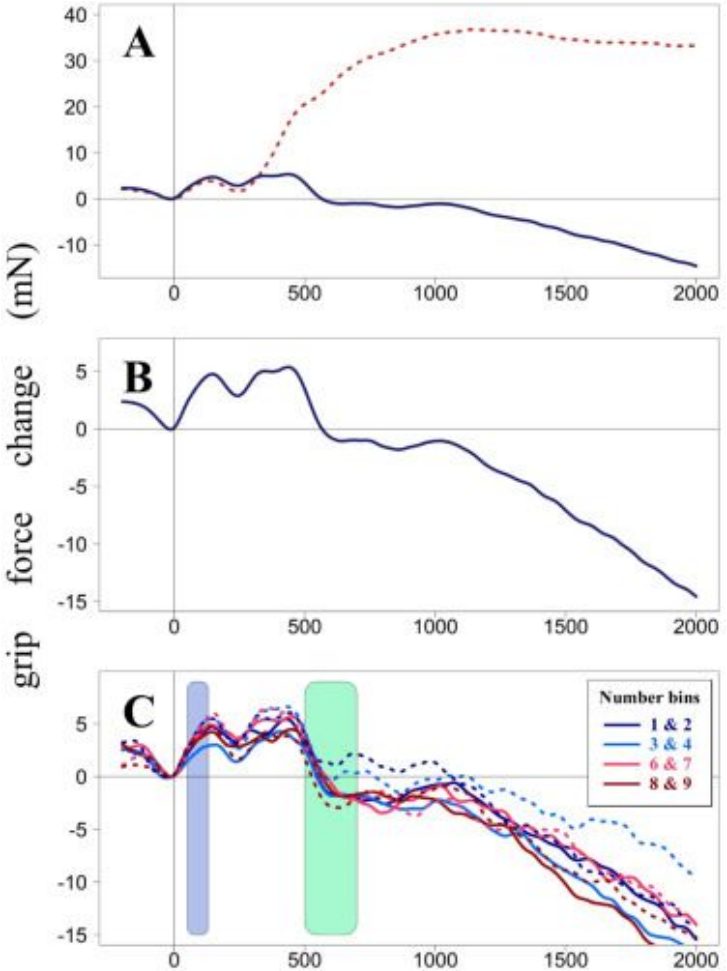
Miklashevsky, Alex, Martin H. Fischer, and Oliver Lindemann







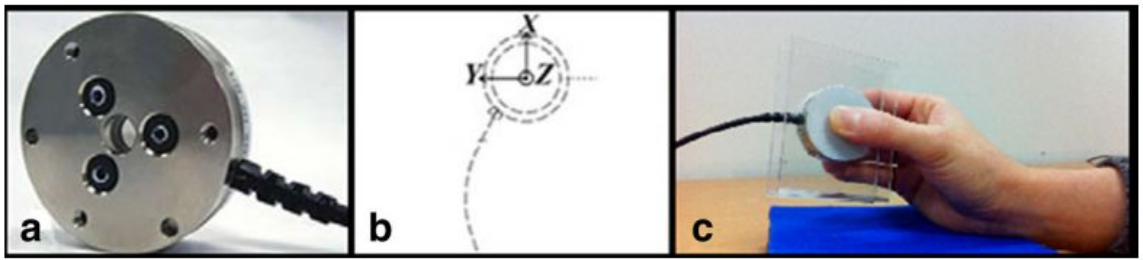


Fig. 1 Experimental material and setting. **a** A standalone six-axis load cell of 68 g was used (ATI Industrial Automation, USA). **b** The three main forces were recorded: Fx, Fy, and Fz, as the longitudinal, radial, and compression forces, respectively. **c** Participants hold the grip force sensor in a precision grip with their right hand. Participants wore headphones and were comfortably seated behind a desk on which a pad was placed. They were asked to rest their arms on the pad, holding the sensor

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Price with Selected Options: **$7,410.00**

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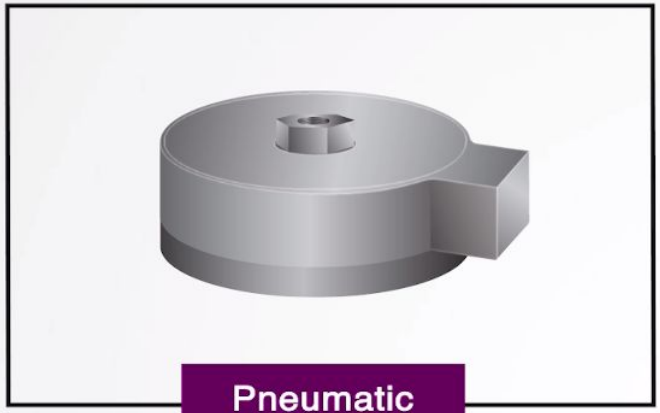
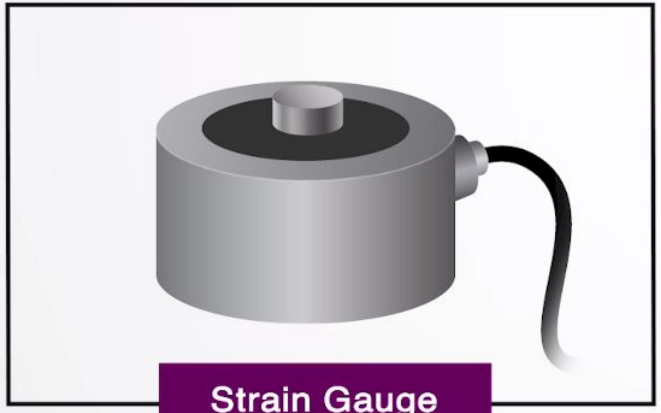
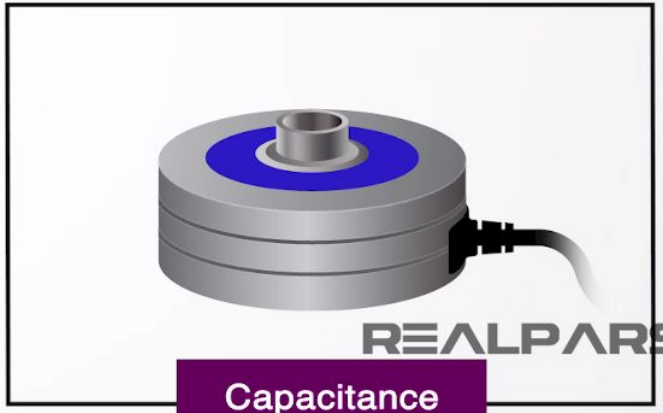


Pneumatic

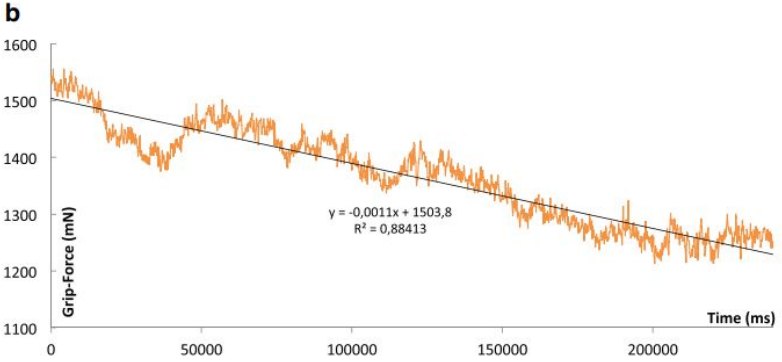
Hydraulic



Strain Gauge



Capacitance



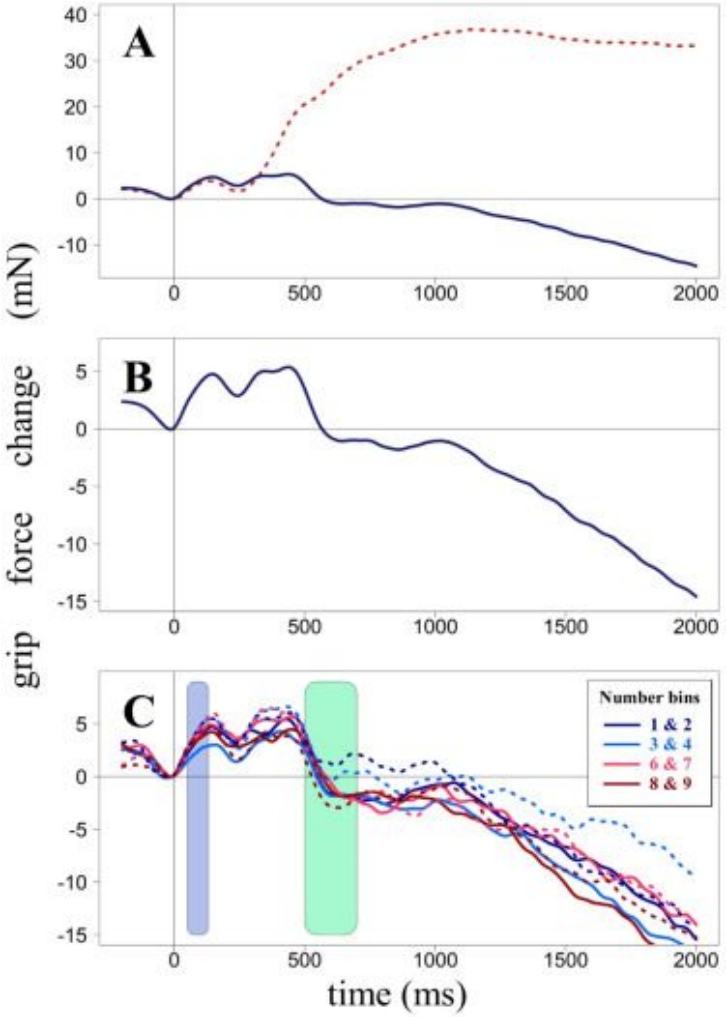
range ~0-2000mN

$$m = \frac{2\,\mathrm{N}}{9.8\,\mathrm{m/s^2}} \approx 0.204\,\mathrm{kg}$$

Convert kilograms to grams (1 kg = 1000 g):

$$0.204\,\mathrm{kg} \times 1000 = 204\,\mathrm{g}$$

So, 2000 millinewtons is approximately equal to 204 grams.



signal ~20mN
equals ~2.04g

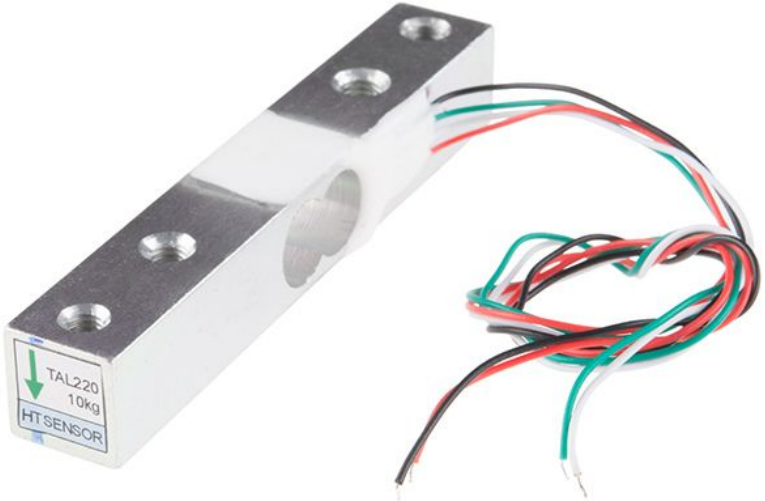
duration 10-130ms

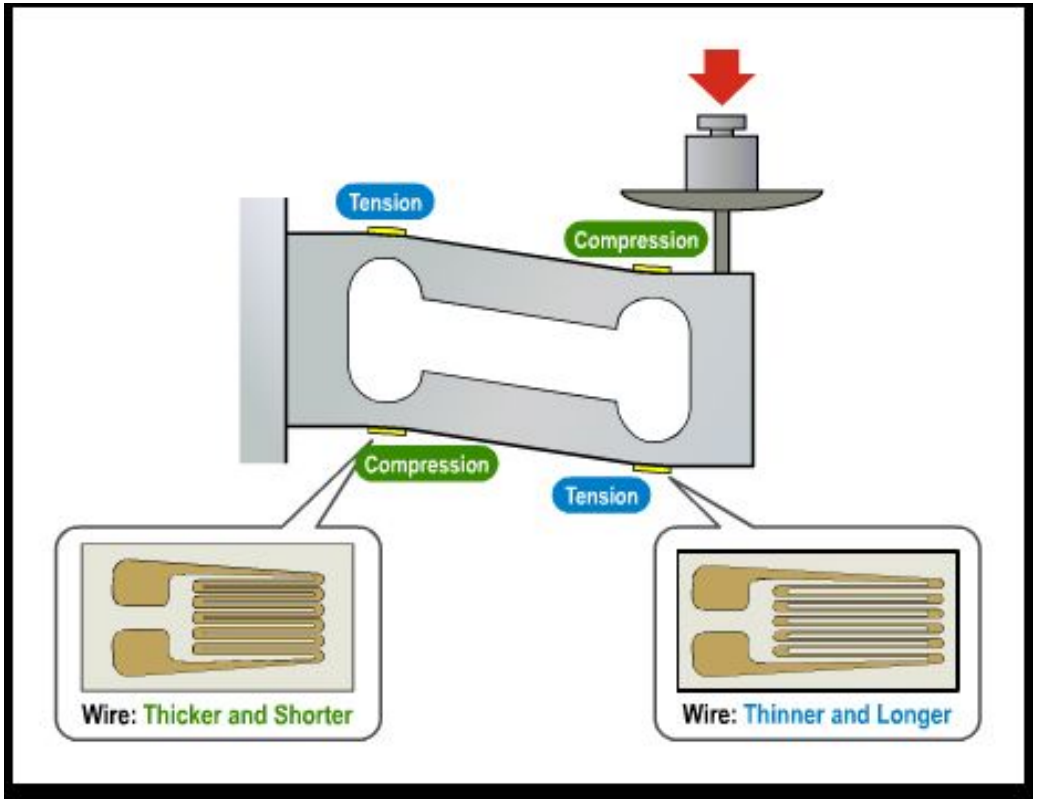
10 to 130 samples at 1kHz

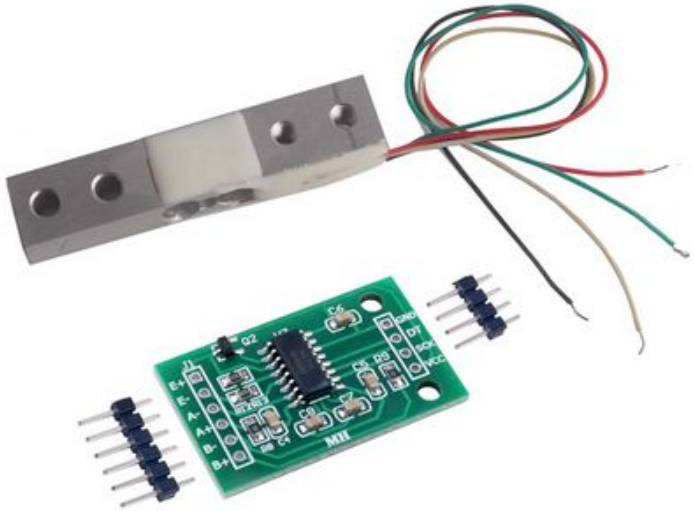
range ~0-500g
res. 0.1g


Only high-quality AAA batteries
I.Operation
Place the Scale on a horizontal flat surface.
1.Press ON/OFF key.
2.Wait until [0.0] is displayed
3.Put the object(s) on the weighing platform.
4.Using the MODE key. You can switch between the units.
II.Tare Weighing
1.Turn on the Scale as described above.
2.Place the"tare-item" on the platform.
3.Press TARE and wait until [0.0] is displayed.
4.Add the "net-weight-item".
III.Calibration
Turn on the Scale on by pressing the ON/OFF key, wait for the display to show "0.00g", then press and hold the MODE key until the display shows"500.00". And press the MODE key again. The display will flash "CAL". Place the required calibration weight on the center of the platform. The display will show"PASS". Then return to normal weighing mode. Calibration is completed.
Repeat the process if something was going wrong.
Please check the availability of weights at the store you bought your scale from.
g
3509
Pocket Scale
MODE
ON
OFF
TARE


Thank you for purchasing the digital scales. Please read all operating instructions carefully before use.
This electronic scale is a precision instrument. With normal care and proper treatment, it will provide years of reliable service.. Pls use the high quality AAA batteries only.
1.Operation
Place scale on a horizontal flat surface.
1.press ON/OFF key to turn on the scale.
2.Wait until "0.0" is displayed
3.Put the object(s) on the weighing platform
4.Using the MODE key, you can switch between the units
2. Tare Weighing
1.Turn on scale as described above
2.Place the "tare item" on the platform
3.Press TARE and wait until "0.0" is displayed
4.Add the "net-weight-item"
3. Calibration
Turn the scale on by pressing the ON/OFF key, wait for the display to show "0.0" or "0.00", then press and hold the CAL key until the display show "CAL", then release, press the CAL key again, the dispaly will flash "CAL" followed by the required calibration weight, Place the required calibration weight on the center of the platform, the display will show "PASS", then return to normal weighing mode, Calibration is complate.
Repeat this process if something was going wrong
Please check the availability of weights at the store you bought your scale from.
Capacity:100g
Graduation:0.01g
CAL
TARE
MODE
ON/OFF


TAL220
10kg
HT SENSOR


Tension
Compression
Compression
Tension
Wire: Thicker and Shorter
Wire: Thinner and Longer



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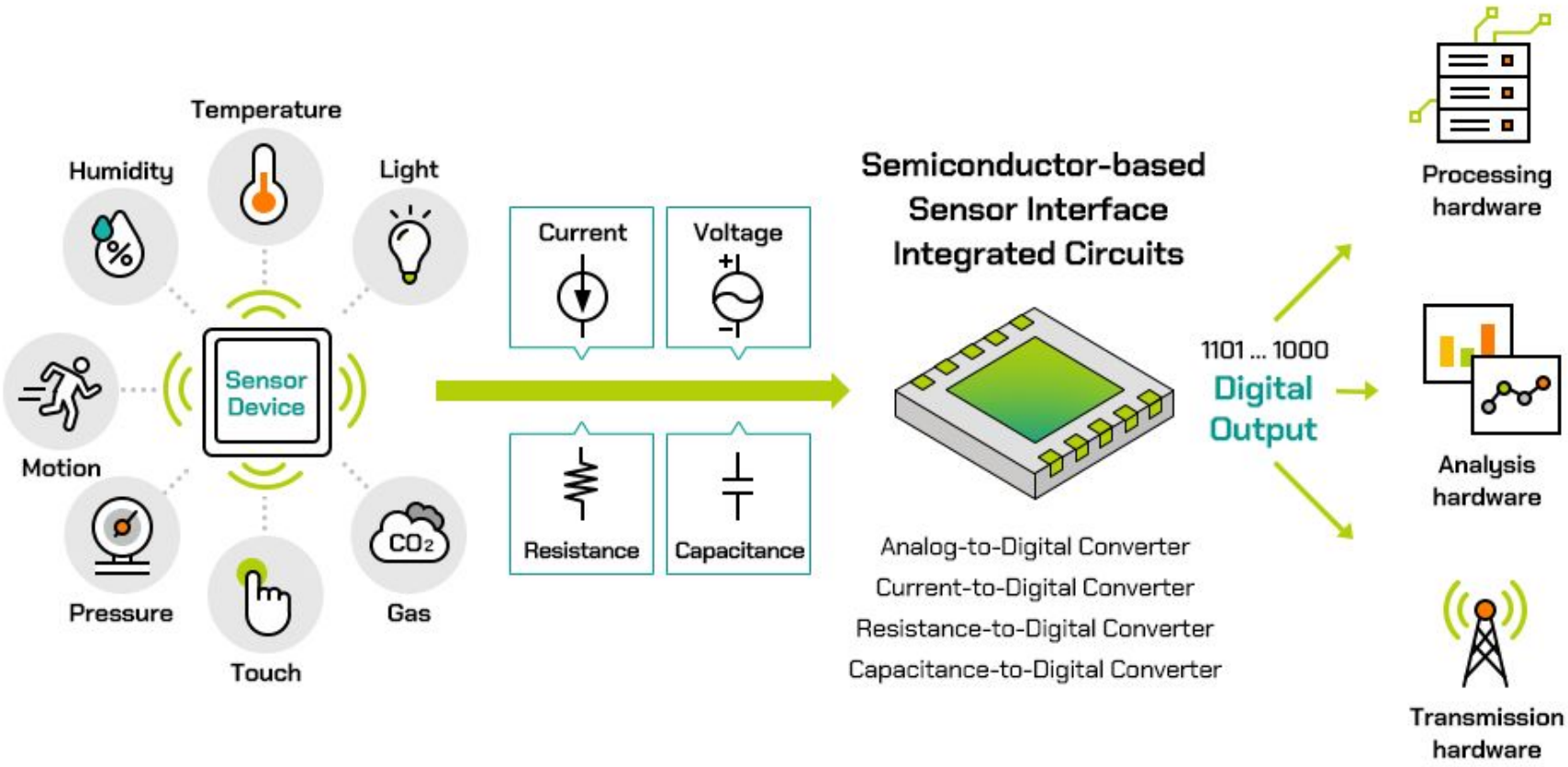
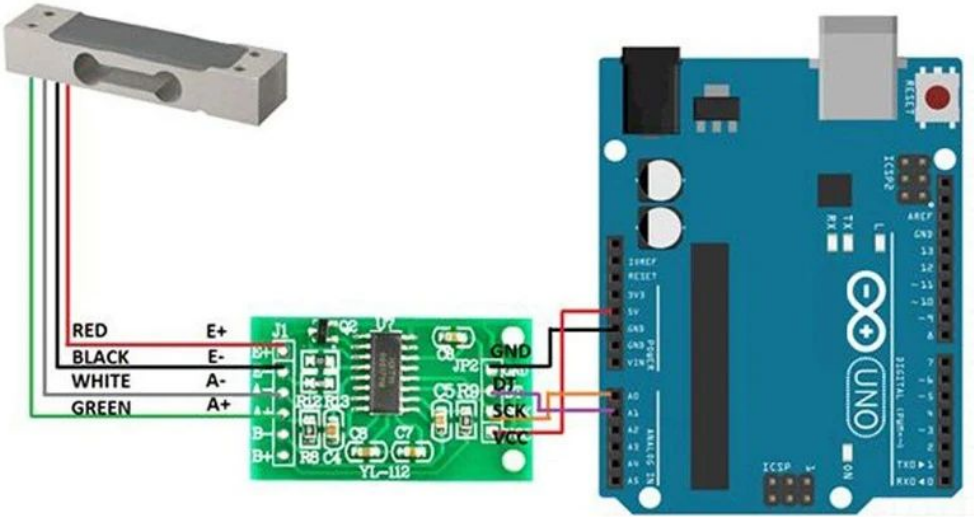
500g Scale Load Cell Weight Weighing Sensor +HX711 24bits AD Module for Arduino DIY RCmall

7 sold

vs ~$5,660.00

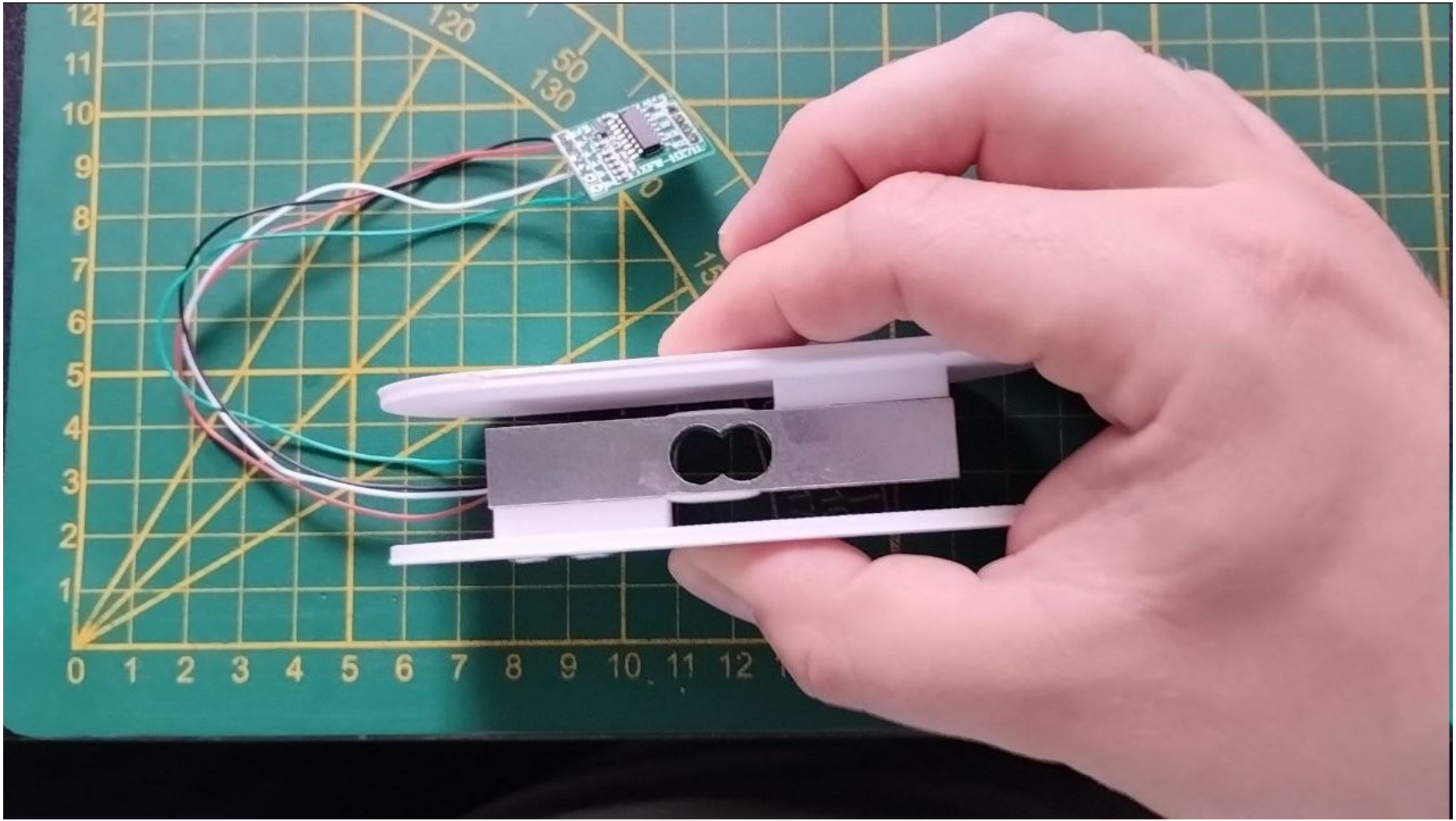

Temperature
Humidity
Light
Sensor Device
Motion
Pressure
Gas
Touch
Current
Voltage
Resistance
Capacitance
Semiconductor-based Sensor Interface Integrated Circuits
Analog-to-Digital Converter
Current-to-Digital Converter
Resistance-to-Digital Converter
Capacitance-to-Digital Converter
1101 ... 1000
Digital Output
Processing hardware
Analysis hardware
Transmission hardware


LilyPad Arduino
sparkfun.com
Arduino Pro
Arduino
Duemilanove
ATMEGA 328
www.arduino.cc
GND
V+
Arduino
MEGA



range ~0-500g
res. 0.1g

sampling 80Hz
10-130ms ~ 0.8-10.4
500ms ~ 40 [samples]



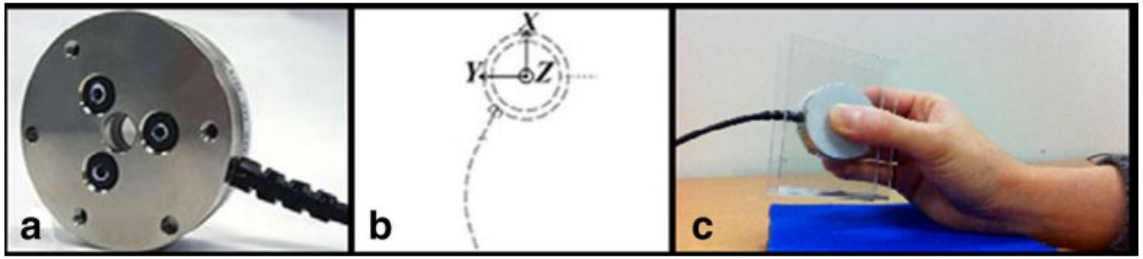
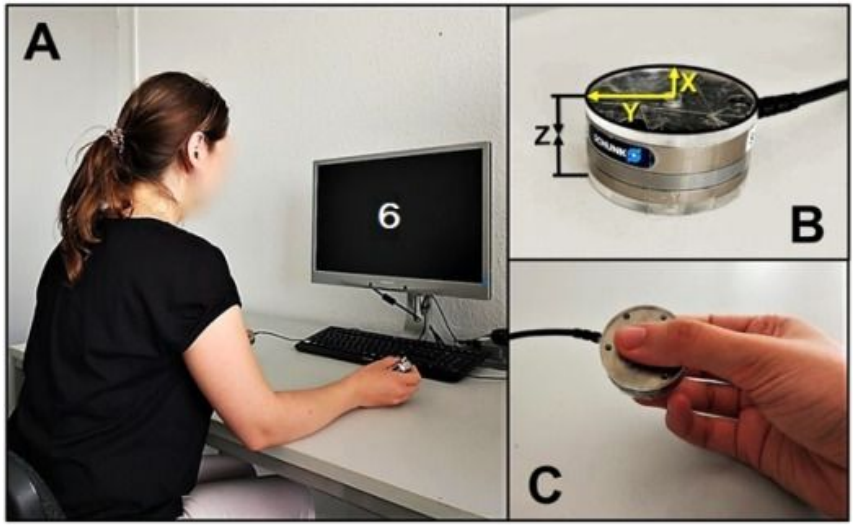
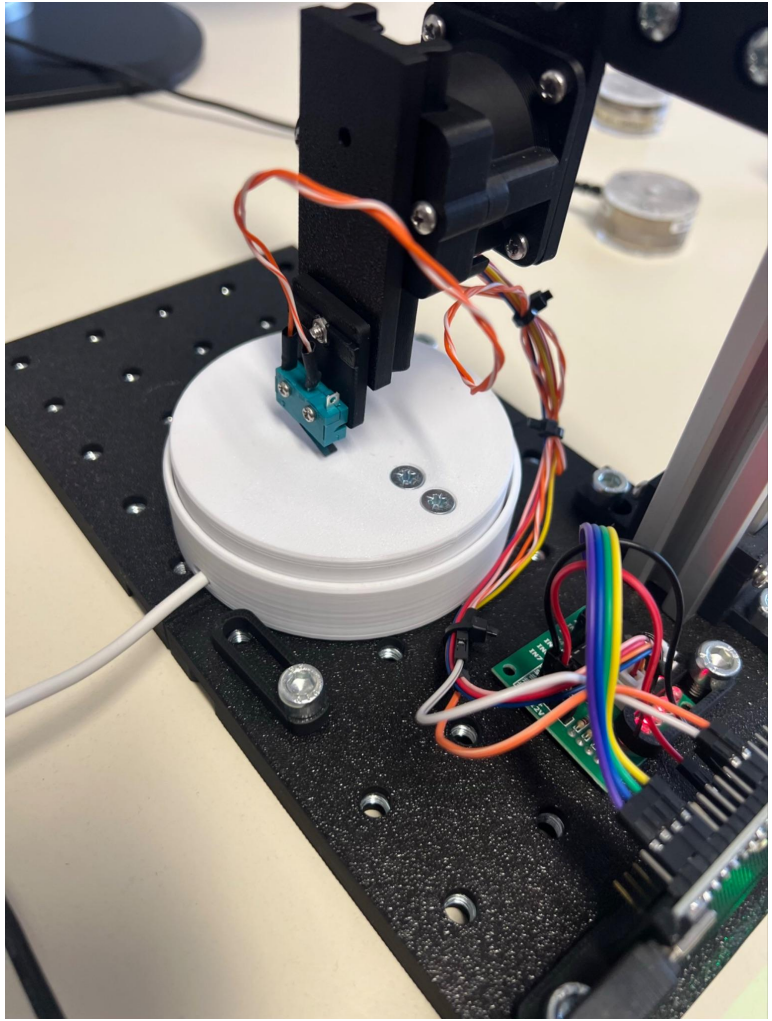


Fig. 1 Experimental material and setting. **a** A standalone six-axis load cell of 68 g was used (ATI Industrial Automation, USA). **b** The three main forces were recorded: Fx, Fy, and Fz, as the longitudinal, radial, and compression forces, respectively. **c** Participants hold the grip force sensor in a precision grip with their right hand. Participants wore headphones and were comfortably seated behind a desk on which a pad was placed. They were asked to rest their arms on the pad, holding the sensor

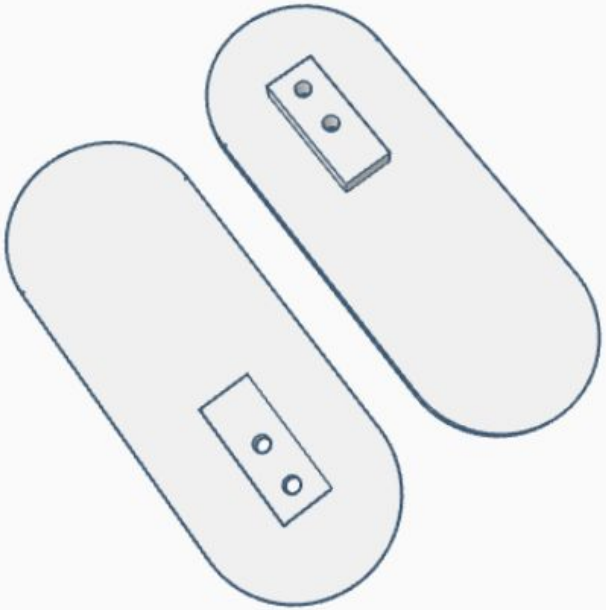


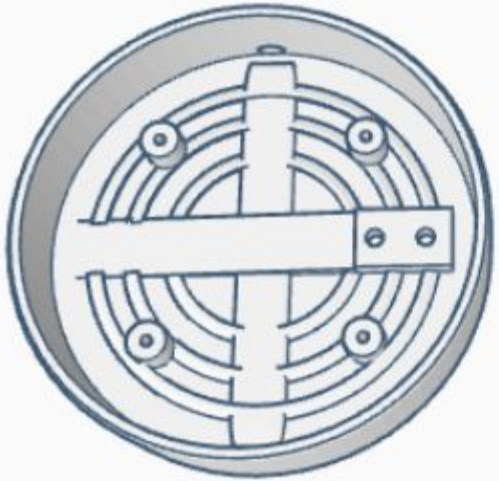
cheap one 63g

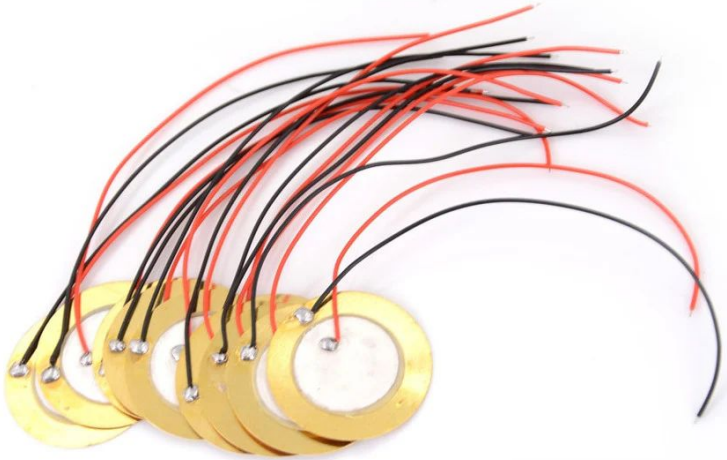

stiffness issue - the actual location of grip




UNIVERSITY







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Force (FSR)

PLUX | SK 880971202

FSR Type: (Sensing Area: Ø0.95cm)

(Sensing Area: Ø0.95cm) (Sensing Area: 3.80cm x 4.00cm)
(Sensing Area: Ø1.27cm) (Sensing Area: Ø0.50cm)

Price: €172,20 VAT inc.

Quantity: − 1 +

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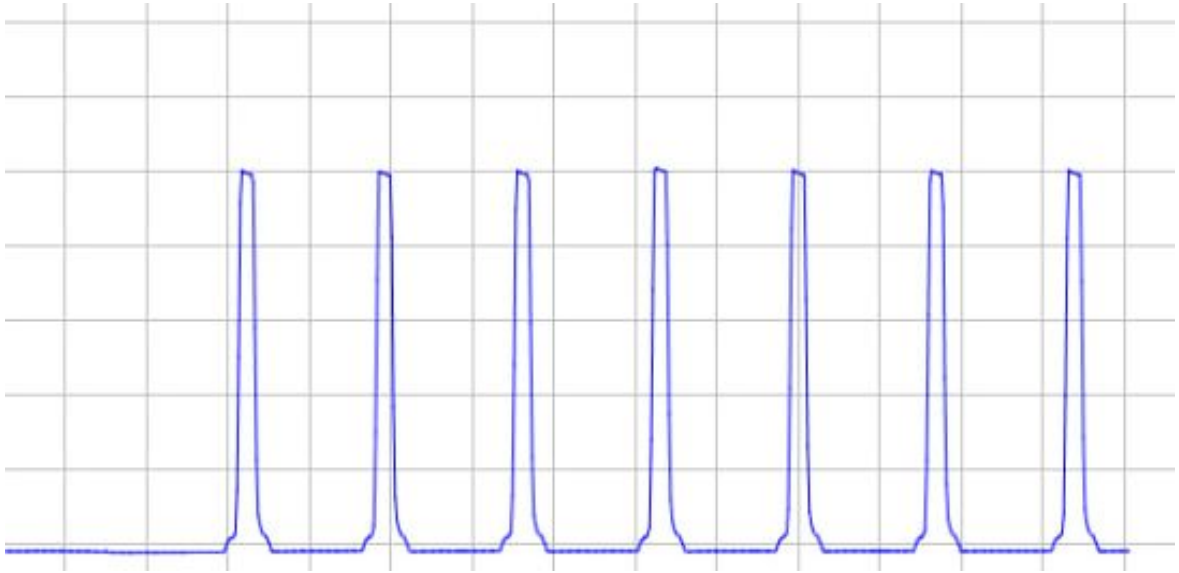
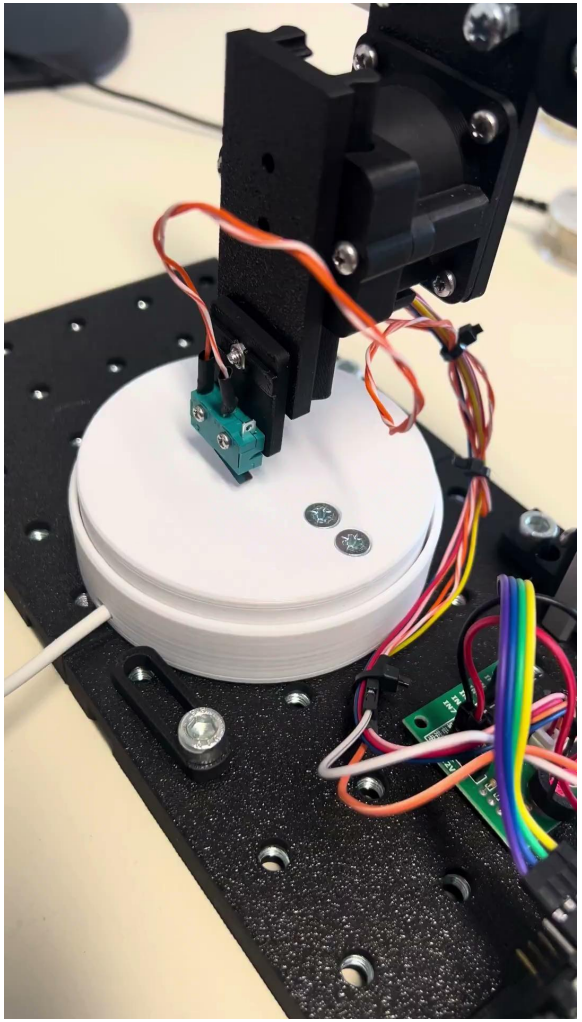
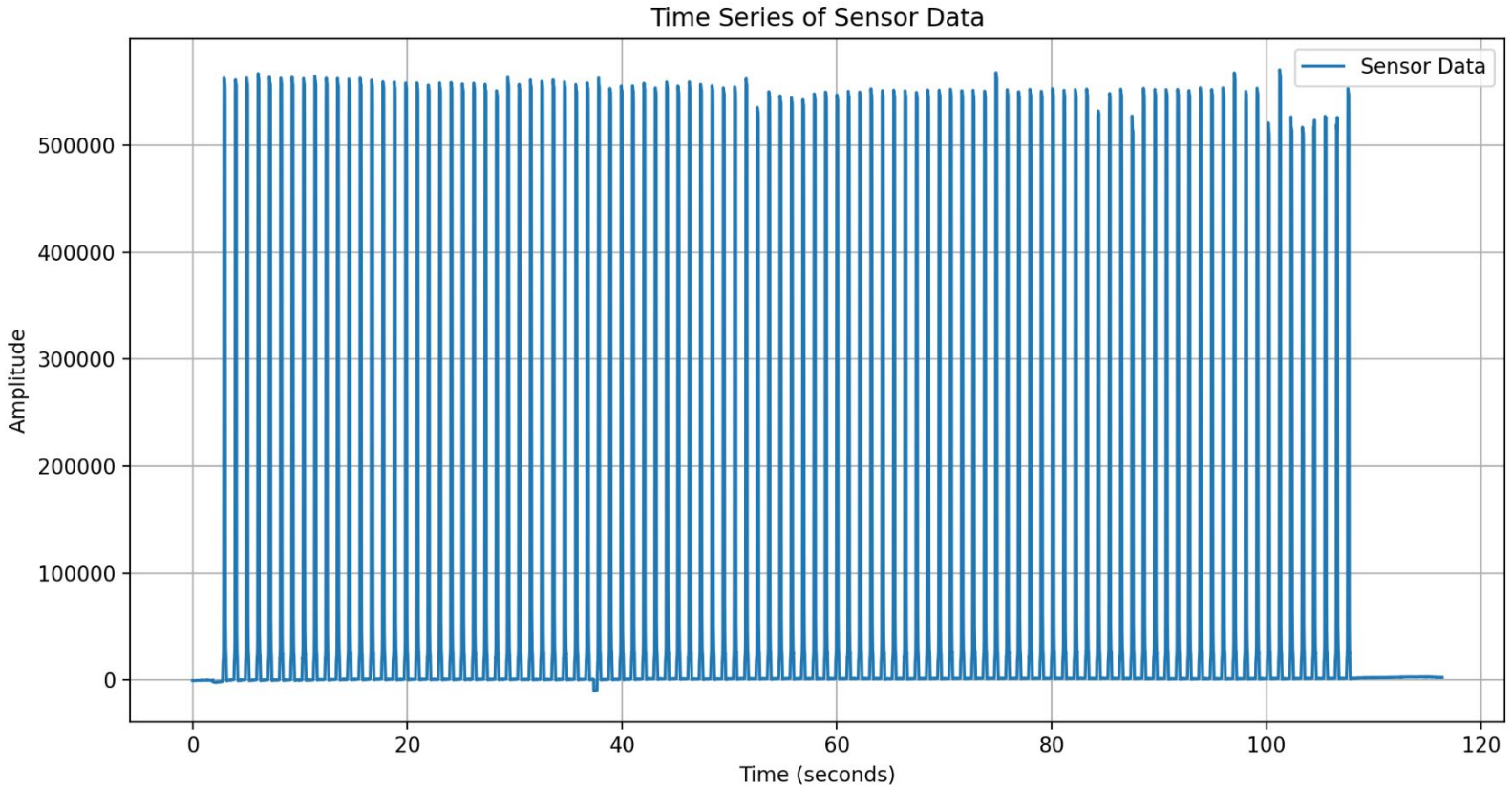
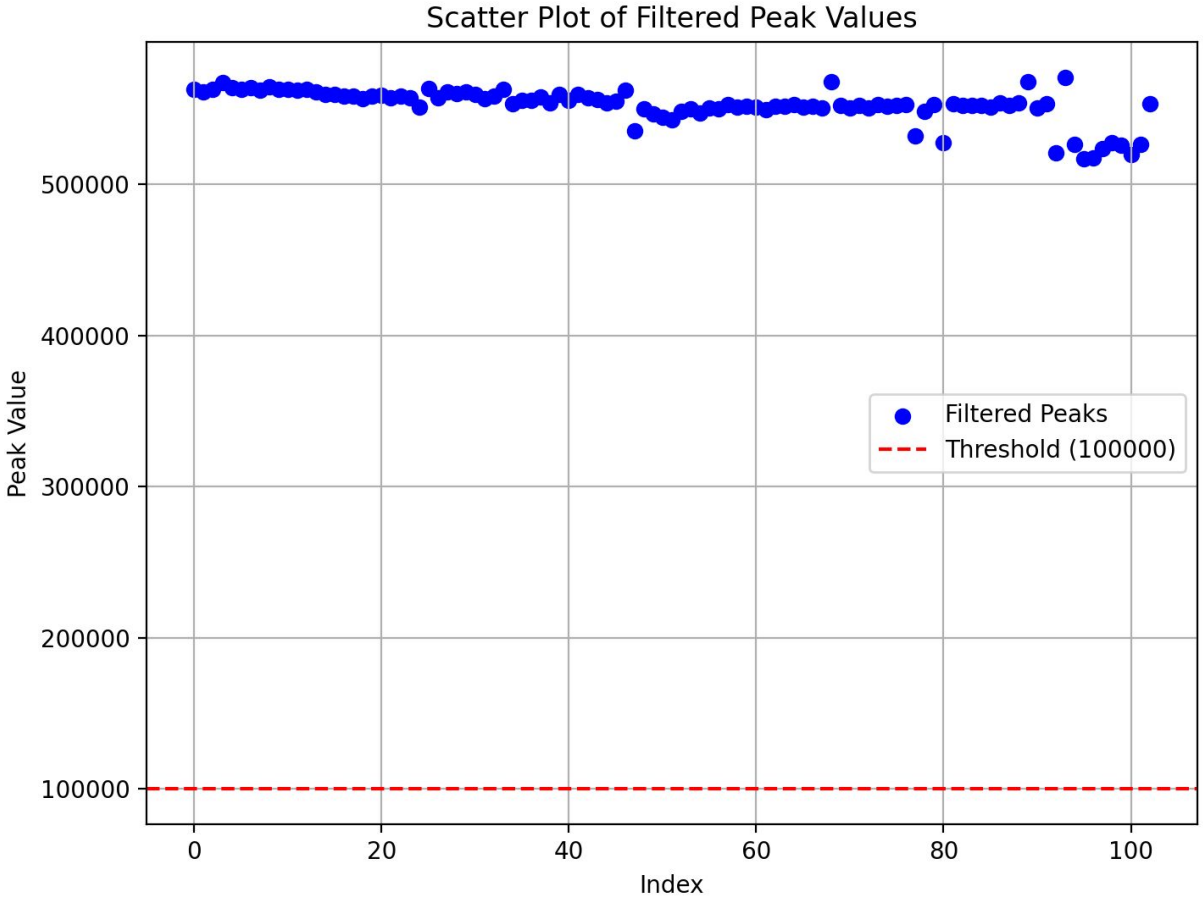
Comparison

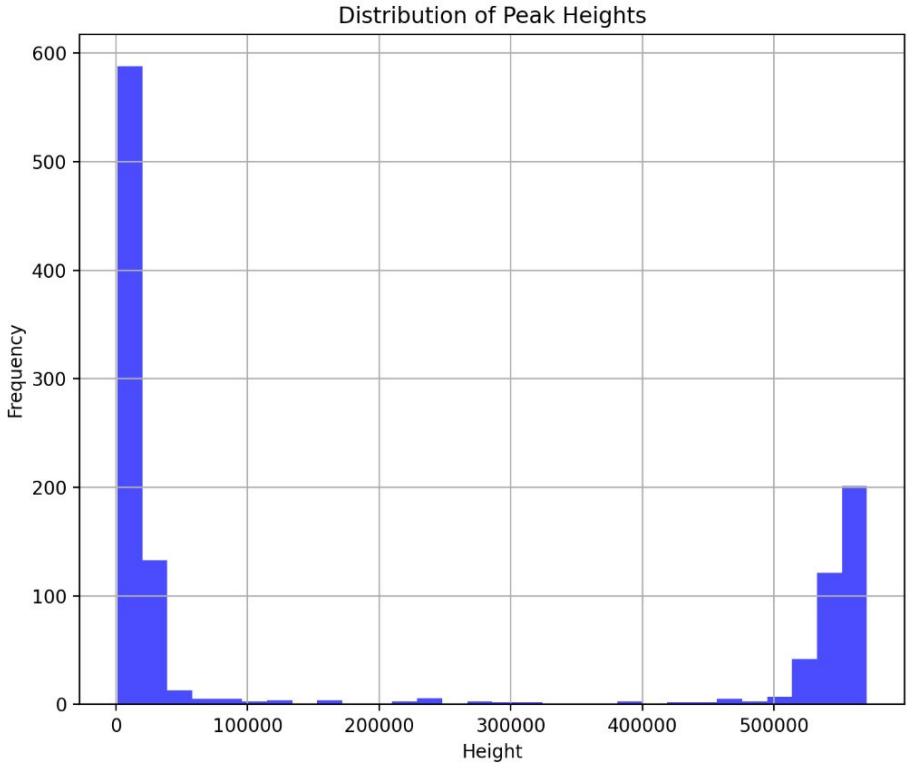
- ~~exercise numerous, consistent episodes of touch at both sensors at multiple regions while recording the signal~~
- calculating signal to noise ratio ←
- measure typical phenomena - grip tiredness, numerosity related signals etc.
- measure concordant physiological variables i.e. EMG

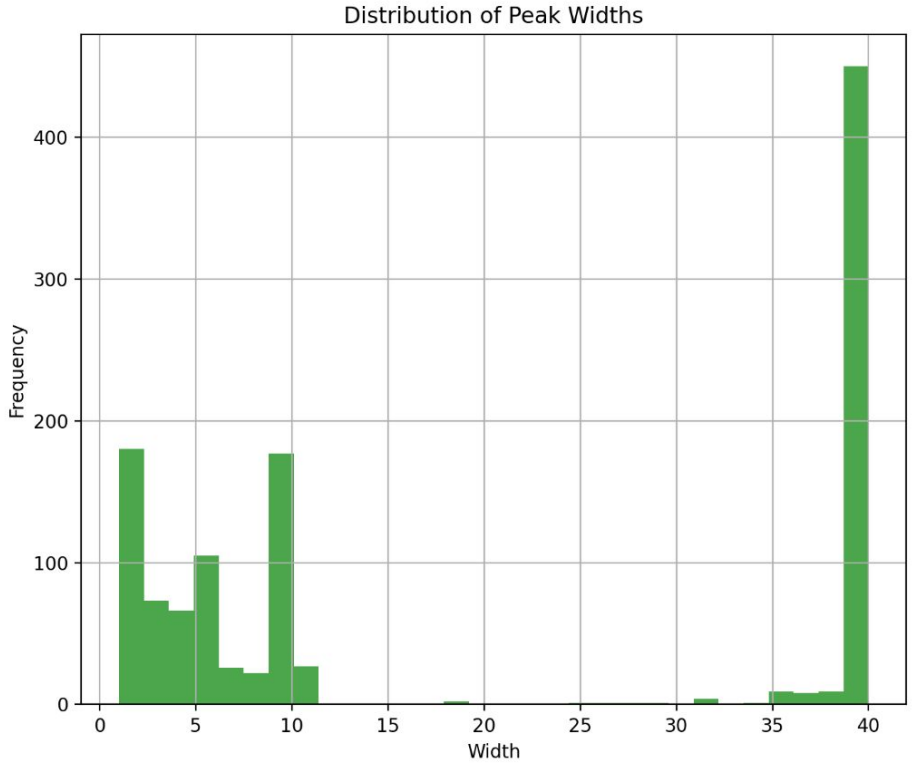





Time Series of Sensor Data
Sensor Data
Amplitude
500000
400000
300000
200000
100000
0
0
20
40
60
80
100
120
Time (seconds)

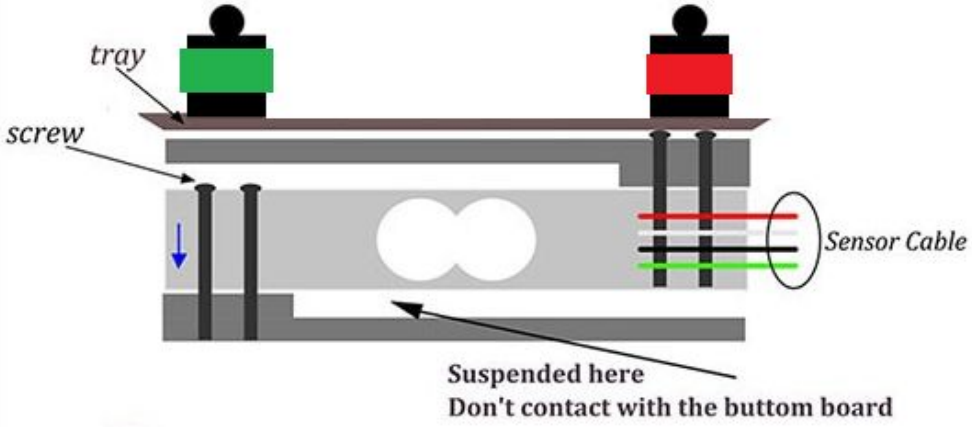

Scatter Plot of Filtered Peak Values
Peak Value
Index
Filtered Peaks
Threshold (100000)
500000
400000
300000
200000
100000
0
20
40
60
80
100


Distribution of Peak Heights
Frequency
Height
0
100000
200000
300000
400000
500000
0
100
200
300
400
500
600


Distribution of Peak Widths
Frequency
Width
0
5
10
15
20
25
30
35
40
0
100
200
300
400


230000
120000
10000
-100000
0
50
100
150
200
250
300
350
400
450
500
550
600
650


???


tray
screw
Sensor Cable
Suspended here
Don't contact with the buttom board

=<30k SPS
24bit
programmable gain <64x

Why even bother?

- cost optimisation
- wide scale availability - more throughput per lab = more data
- popularisation of the method
- field studies i.e. in schools, kindergartens etc.
- feasibility of incorporation as an auxiliary sensor for non-GF oriented experiments

Thank you for your attention!