Implementation of a Soft, Distributed 3-Axis Sensor System on a Robot Hand

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Objectives

Soft & multimodal

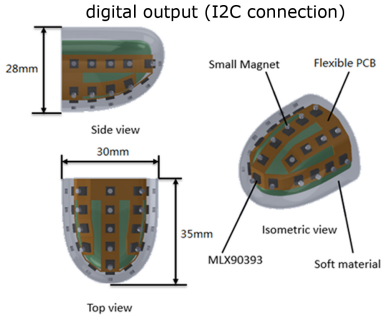
Distributed normal & shear forces measurements

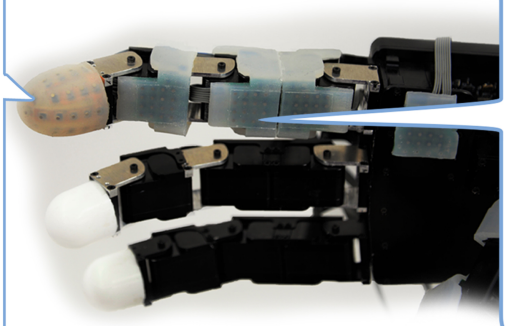
Physically small
(including amplification & digitization)

Low cost & easy to produce

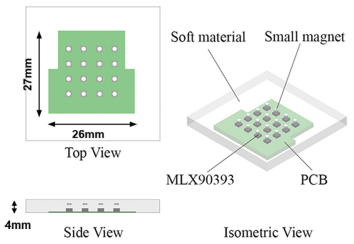
Conceptual Design

1 module: 3-axis magnetic data x 24
temperature data x 24
digital output (I2C connection)

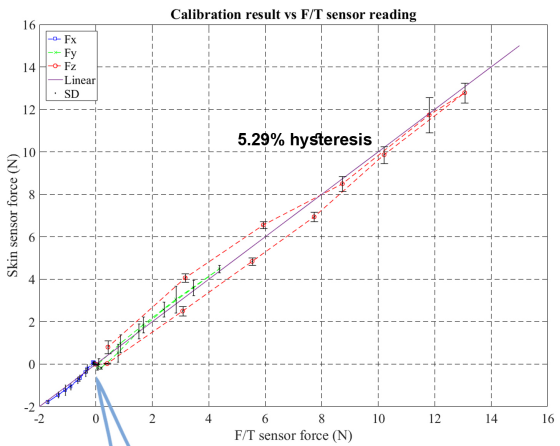


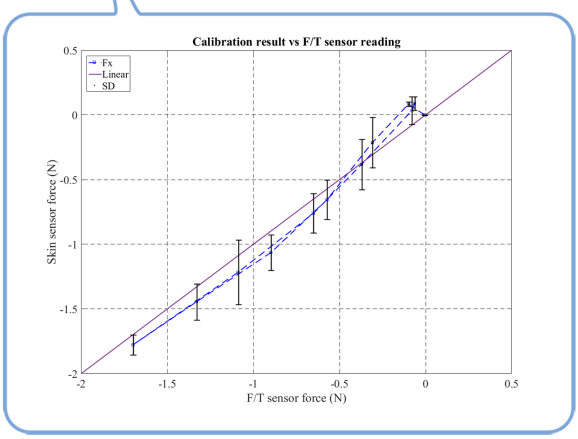


1 module: 3-axis magnetic data x 16
3 -axis accelerometer x 8
temperature data x 24
digital output (I2C connection)



Normal & Shear Forces

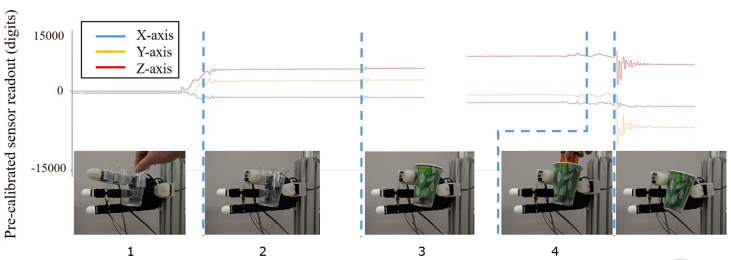




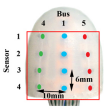
The sensor can succesfully detect normal and shear forces
Min detectable: 0.0098N Max detectable: 14.2N

Demonstration

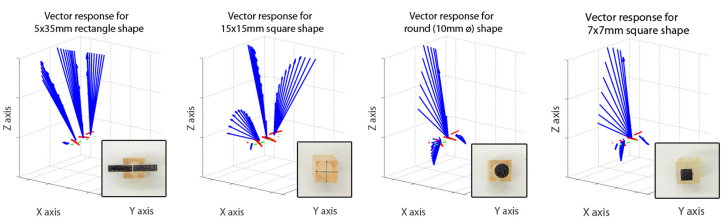
The sensor can measure force in 3-axis



1. The Alegro Hand was not grasping anything. There was no response from the skin.
2. A plastic cup was grasped. There were some changes in x,y, and z-axis reading.
3. A paper cup was placed. The skin sensor detected a small vibration.
4. A roll of wires was dropped inside the cup. A slip occured and detected by the skin.



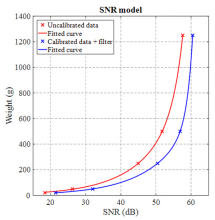
The sensor can be used to detect the distributed force vector



Signal to Noise Ratio (SNR)

Sensor response when a weight is placed on the top of it

Weight (g)	SNR (dB)		
	Unfiltered & uncalibrated	Filtered & uncalibrated	Filtered & calibrated
20	18.4229	25.3371	21.4658
50	26.2471	33.5997	32.0175
250	44.9855	51.7199	50.4757
500	51.7783	57.6239	56.8713
1250	57.6258	60.6627	60.4488



The sensor is robust from the noise