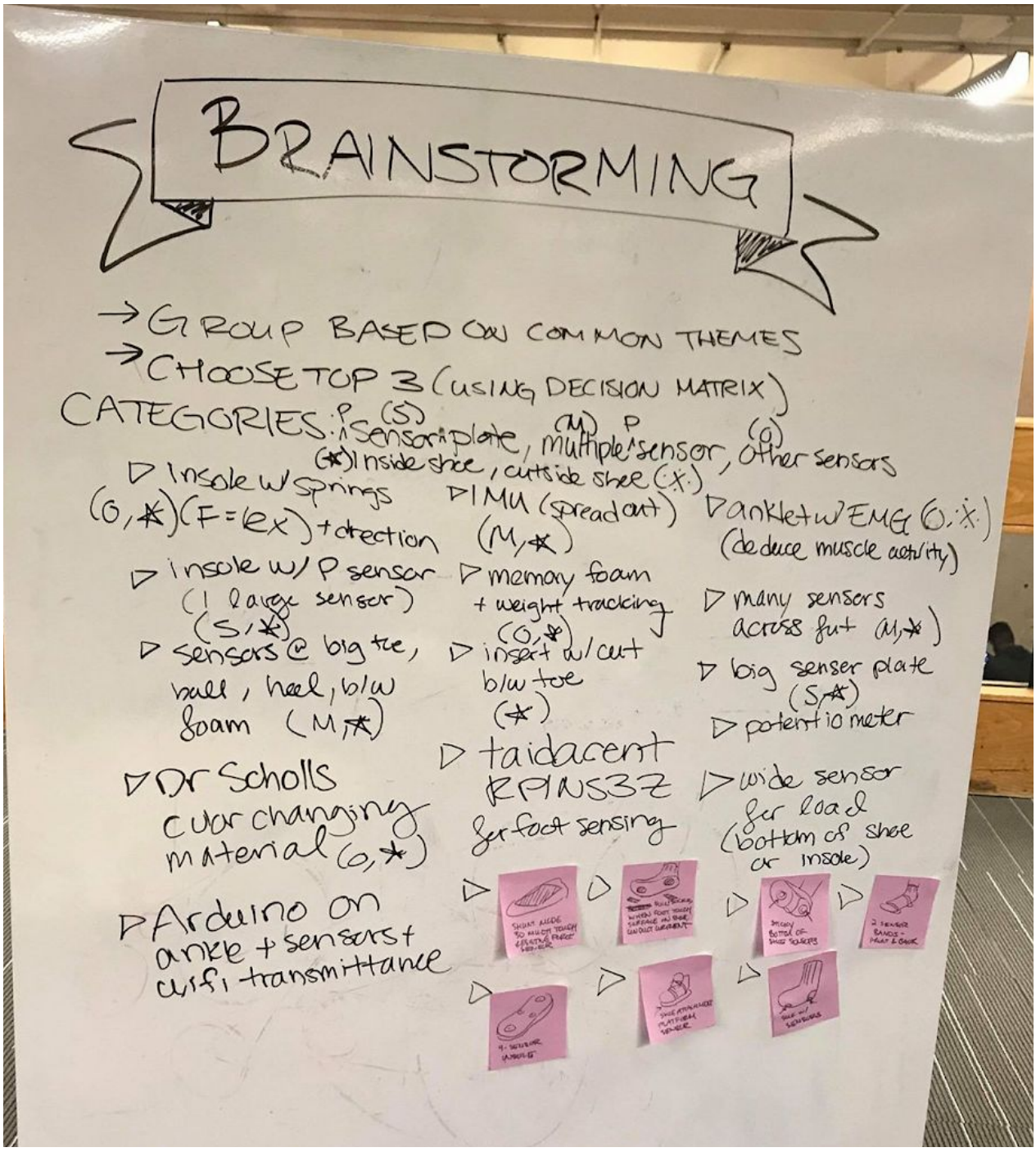
Final Project Brainstorming: Foot Load Sensing

Brainstormed Ideas:



Total: 21 Ideas

Common themes: **Sensor plate, multiple individual sensors**, **other types of sensors** (not directly force/weight/pressure sensors), **inside shoe**, and **outside shoe.**

This resulted in the following classifications:

Sensor plate, inside shoe: Insole with pressure sensor (large), big sensor plate (alone), taidescent RPINS3Z (large sensor), shunt mode 3D touch sensor

Multiple sensors, inside shoe: Spread-out IMU, many sensors across foot, sensors (at toe, ball, heel) between foam sheets, insert with cut between toe, two sensor bands around foot, 4 sensor insole, sock with sensors

Other sensors, inside shoe: Insole with springs, memory foam weight tracking, potentiometer, Dr. Scholl's color changing material, electrical conductivity socks + conductive strip on shoes

Sensor plate, outside shoe: Wide load sensor at bottom of shoe, shoe attachment platform sensor (strapped)

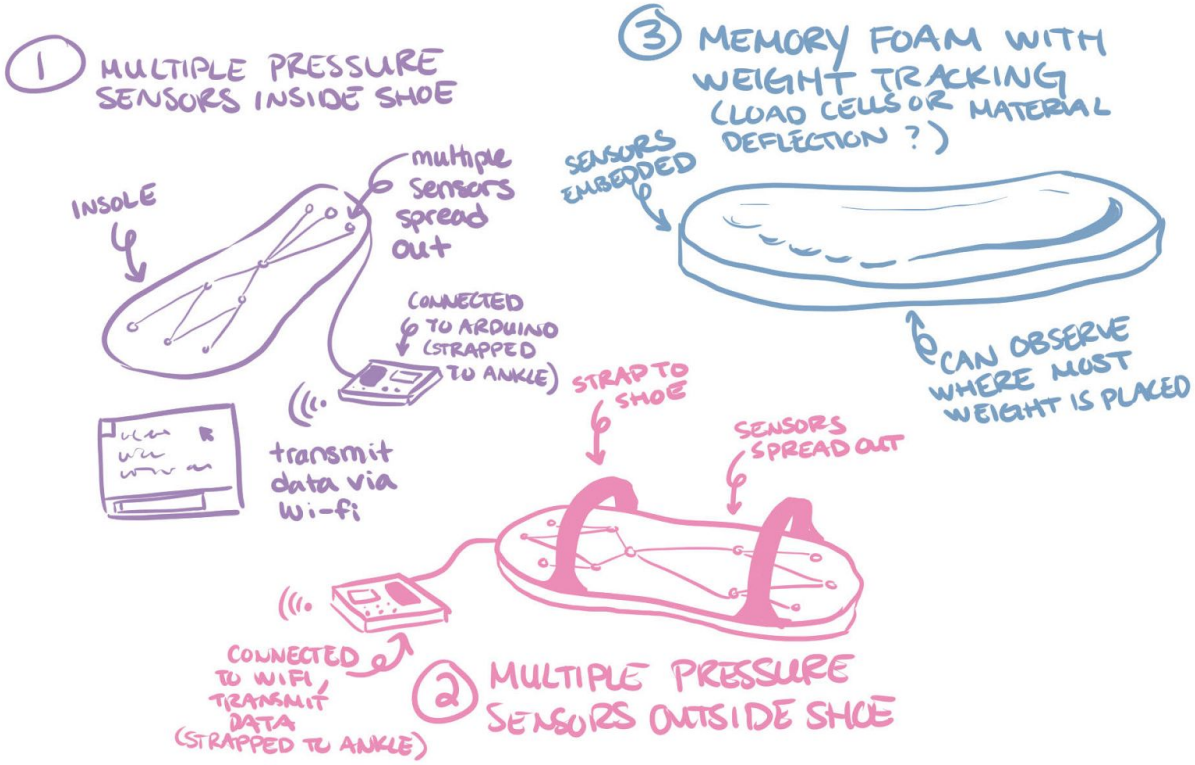
Multiple sensors, outside shoe: Arduino on ankle with sensors and wi-fi transmittance, sticky bottom of shoe sensors

Other sensors, outside shoe: Anklet bracelet with EMG to see how muscles firing lead to different motions

Decision Matrix

ME C178 / BioE C137		CONCEPT SELECTION								
Group members: Radhika, Revati, Tiana, Kristin, Keitaro										
Key Criteria	**Weight**	Sensor plate inside shoe	Sensor plate outside shoe	Mutliple pressure sensors inside shoe	Multiple pressure sensors outside shoe	Anklet with EMG	IMU	Memory foam with weight tracking software	Insole with Springs	Color changing sensing material
Modularity	0.3	2	1	5	2	4	3	4	3	4
Cost	0.05	4	4	3	3	1	1	1	4	2
Data transmission	0.1	3	3	4	4	1	3	3	2	4
Robustness/durability	0.2	3	3	4	4	2	4	2	3	2
Ease of manufacturing	0.1	4	4	3	3	2	2	1	1	1
Weight	0.05	2	2	4	4	3	3	4	2	3
User experience	0.1	1	1	4	4	1	1	4	4	3
High resolution (data)	0.1	3	3	5	4	1	3	4	3	3
Total	1	2.75	2.625	4	3.5	1.875	2.5	2.875	2.75	2.75
Weighted Total		2.6	2.3	4.25	3.25	2.3	2.8	3.05	2.8	2.95

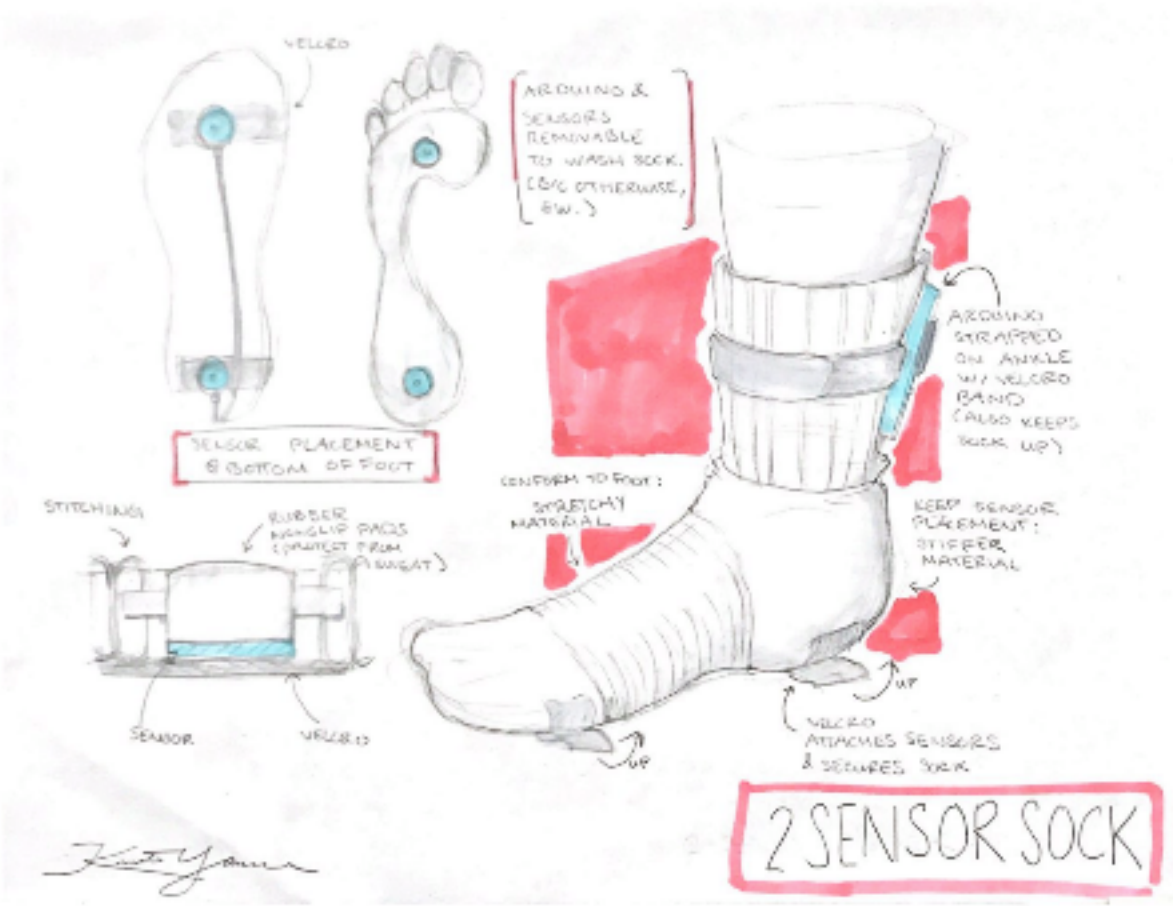
Sketches of Top 3 Ideas



Feedback from Mentor

- Insole seems like the best bet — get the most accurate readings from pressure sensors that closely interface with the foot, rather than something that has a layer of material in between
- Focus on 2 pressure sensors for now — using several sensors might result in a lot of noise in the data/difficult to wire leads to all sensors
- Consider comfort (go with the sock rather than the insole), may even be more modular for the wearer
- Data readout is a good idea, but for low fidelity prototype, focus on the sensor itself

Sketch of Reformulated Top Idea



Bill of Materials (BOM) (Theoretical)

Item No.	Qty	Item Name	Source	Cost	Comments
0001	1	Arduino	Class kit	$0	Have
0002	2	Small Force Sensors	Amazon or Adafruit	$7-30 ea.	Need to order
0003	1	Sock	Target	$2.50	Need to buy
0004	2+	Extra wires for sensor (possibly more)	Amazon/Adafruit	$?	Need to order
0005	2	Rubber pads	Amazon	$?	Need to order
0006	2	Velcro Pads	Amazon	$6	Need to order

References:

"Embedded Force Sensors." *Tekscan*, 28 Oct. 2019, https://www.tekscan.com/products-solutions/embedded-force-sensors?fbclid=IwAR2ydYFNU2X5enKvgbEj4NgVTKW7EEnM1DjTql3asS4GpEK8fdZxe_B0F0s.

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