

Urological Biofeedback System

Advisor: Dr. Amit Nimunkar

Client: Dr. Patrick McKenna

Team:

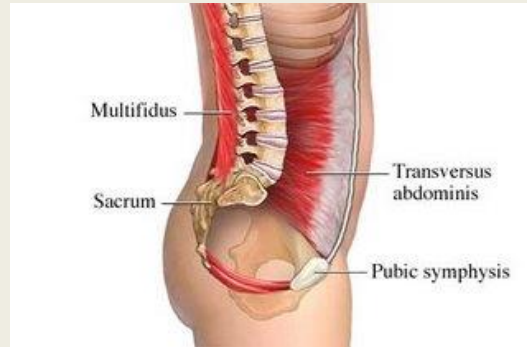
Samual Lines, Michael Simonson,
Andrew Vamos, Shawn Patel

Overview

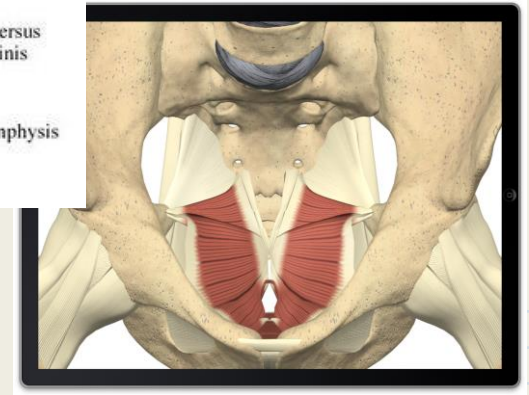
- I. Background
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Background

- ❑ Combinations of incontinence, UTI and constipation afflict around 30% of children in the United States.[1]
- ❑ Improper voiding of the bladder is the result of failing to contract Pelvic Floor (PF) while relaxing abdominal muscles.



Figs 1-2. Images of Pelvic Floor and Transverse Abdominals.



- ❑ EMG analysis and retraining has been used as effective alternative to surgery. [2]

Motivation



Fig 3. A group of physicians diagnosing pelvic floor dysfunction.

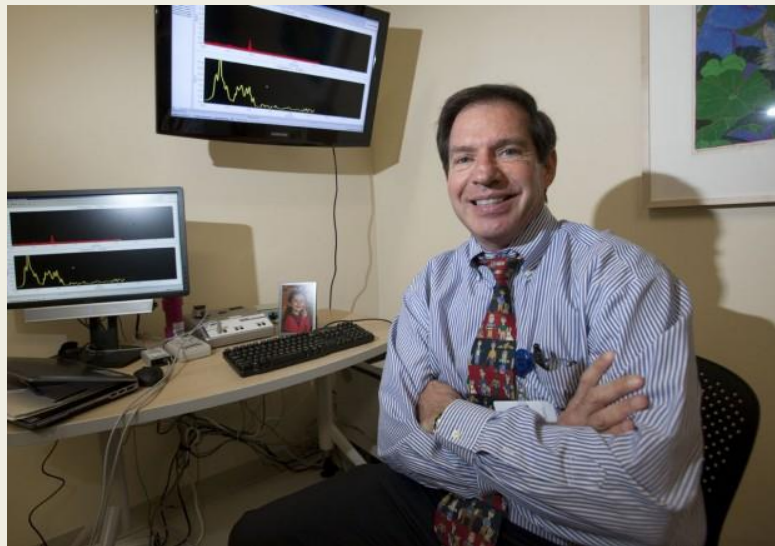
- ❑ What does background mean?
 - ❑ BIG MARKET -
 - ❑ BIG OPPORTUNITY
- ❑ Our client (Dr. McKenna) is internationally renowned Urologist
- ❑ Training appointments are currently booked until May 2015
- ❑ Our device could be in use in this and other clinics throughout the US/World.

Problem Statement

- ❑ Biofeedback training of Pelvic Floor muscle groups
- ❑ No devices currently coordinate both muscle groups w/ video game interface
- ❑ Improve our hardware to commercializable standards
- ❑ Provide supporting software for product development

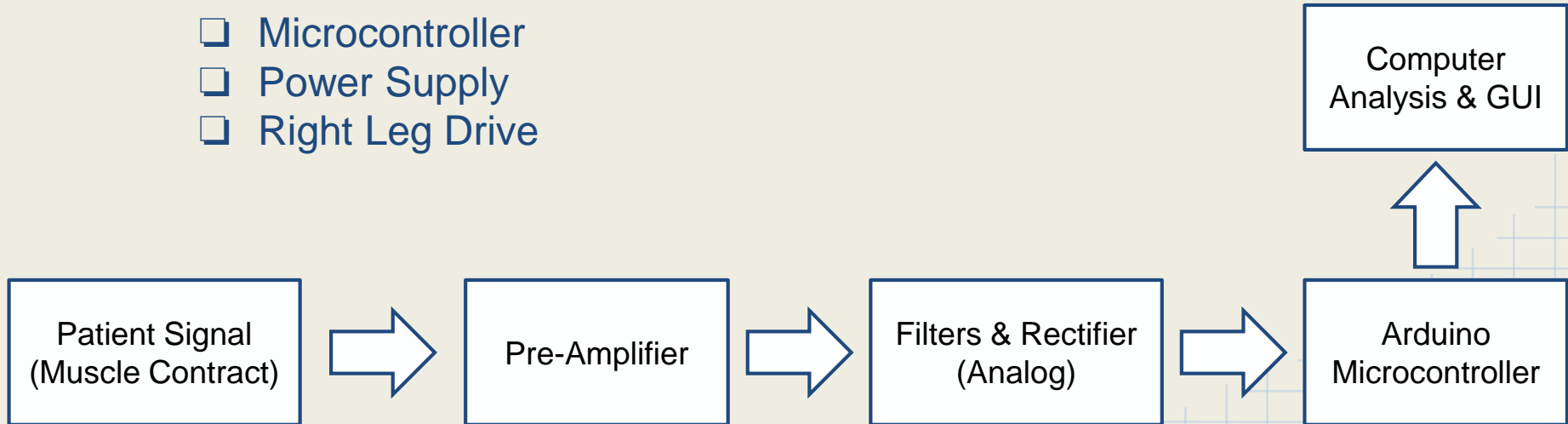
Client Requirements

- ❑ Acquire data that can accurately track/train patient exercises.
- ❑ Produce a device that can be manufactured simply and cost-effectively.
- ❑ Prepare a design for IRB & FDA approval moving forward.



Current Design Progress

- ❑ Currently have a working EMG biofeedback system
- ❑ We are looking to standardize:
 - ❑ Frequency Response
 - ❑ Gain
 - ❑ Microcontroller
 - ❑ Power Supply
 - ❑ Right Leg Drive



DM 1 = Microcontroller

Criteria	Weights	Arduino Micro	MSP430 Launch Pad (G2)	Pinguino Pic32
Developer Support	25	5 (25)	5 (25)	4 (20)
Multi-Channel	25	5 (25)	5 (25)	4 (20)
Hard/Software Reqs.	20	4 (16)	3 (12)	4 (16)
Processing & Analysis	15	3 (9)	5 (15)	4 (12)
Ease of Use	15	5 (15)	3 (9)	4 (12)
TOTAL SCORE	100	90	86	80

DM 2 = Signal Processing

Criteria	Weights	Analog	Digital
Latency	35	4 (28)	2 (14)
Processing Load	35	5 (35)	2 (14)
Signal Integrity	20	2 (8)	4 (16)
Cost	10	4 (8)	5 (10)
TOTAL SCORE	100	79	54

DM 3 = Power Supply

Criteria	Weights	Disposable Batteries	Rechargeable Batteries	Single Supply With DC/DC Converter
Safety	25	5 (25)	4 (20)	4 (20)
IRB Approval	20	5 (20)	3 (16)	4 (12)
Longevity	20	3 (12)	4 (16)	5 (20)
Ease of Use	15	2 (6)	3 (9)	5 (15)
Cost	10	3 (6)	1 (2)	5 (10)
Size	10	3 (6)	1 (2)	5 (10)
TOTAL SCORE	100	75	65	87

Future Work and Timeline

- ❑ Ensure our design stays consistent with FDA & IRB Regulations
 - ❑ Class II Medical Device
- ❑ Look to Print our Board on PCB - apply necessary revisions
- ❑ Begin Industrial-EMG comparison testing
 - ❑ Gather results, strength commercial case

[illegible]

Acknowledgements

- ❑ Dr. Amit Nimunkar
- ❑ Dr. Patrick McKenna
- ❑ Ms. Sarah Novinske
- ❑ Dr. Thomas Yen

Questions

Thank you for coming.

Any questions or comments?

References & Thanks!

[1]. “National Kidney and Urologic Diseases Information Clearinghouse.” *National Institute of Diabetes and Kidney Diseases*. Accessed 30 Nov 2013.

[<http://kidney.niddk.nih.gov/kudiseases/pubs/uichildren/>](http://kidney.niddk.nih.gov/kudiseases/pubs/uichildren/)

[2]: New Therapy for Incontinence Pioneered by madison Doctor. 30 Nov 2013.

http://host.madison.com/news/local/health_med_fit/new-therapy-for-incontinence-pioneered-by-madison-doctor/article_faf27fb2-55b0-11e2-8888-001a4bcf887a.html

Figures:

[1 & 2]: http://www.pilatesfanatic.co.za/wp-content/uploads/2011/03/iSpineCare_iPad_pelvic-floor1.png &

<http://blog.corewalking.com/wp-content/uploads/2013/10/transverse-abdominis.jpg>