

Design of Weight Distribution Monitoring System


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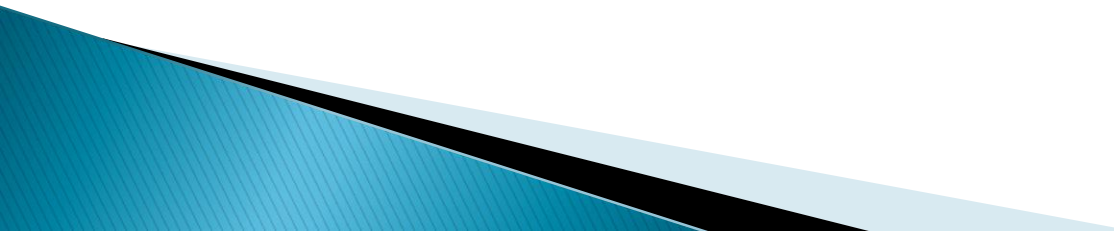
Client: Carol Rohl



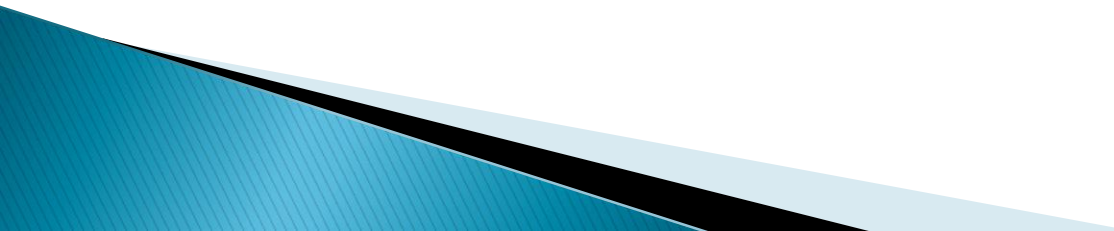
Overview

- ▶ Problem Statement and Client Information
 - ▶ Design Alternatives
 - Wii Balance Board
 - Mechanical Balance
 - Wheatstone Bridge/FSR Device
 - ▶ Future Work
 - ▶ Conclusion
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Problem Statement

- ▶ Hemiplegic patient can't feel left side of body
 - ▶ Needs help determining if she's standing straight or leaning to the side
 - ▶ Wants to practice equal weight distribution
 - ▶ Create portable device to monitor stance, provide feedback
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Client Information

- ▶ Stroke in 2004: thalamic bleed
 - ▶ Ocular migraines
 - ▶ Numbness in left side of body
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PDS

- ▶ Client Requirements
 - Portable, quick visual feedback, one-handed carrying, durable
- ▶ Operational Requirements
 - Use briefly throughout the day, functional in all environments
- ▶ Size
 - ~3 lbs., compact (area of notebook), accommodate a shoulder width stance

Design Alternatives: Wii Balance Board

- ▶ Calculate force on both sides of body
- ▶ Communicate with display via Bluetooth
- ▶ Microprocessor

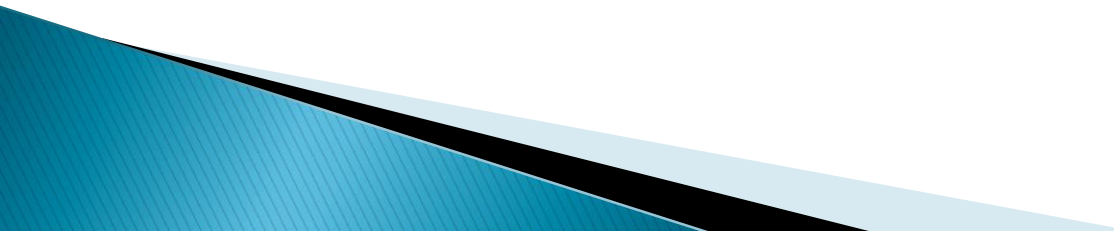


Pros/Cons: Wii Balance Board

▶ Pros

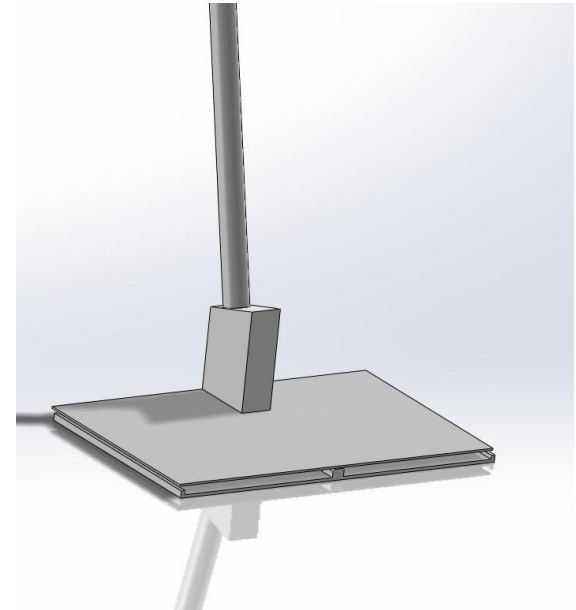
- Accuracy
- Reliability

▶ Cons

- Size and portability: board is too heavy (~ 8 lb)
 - Cost: board, microprocessor
 - Feasibility: complicated implementation
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Design Alternatives: Mechanical Balance

- ▶ Use springs to maintain balanced stance
- ▶ Telescoping pole amplifies angle
- ▶ Angle displayed with level

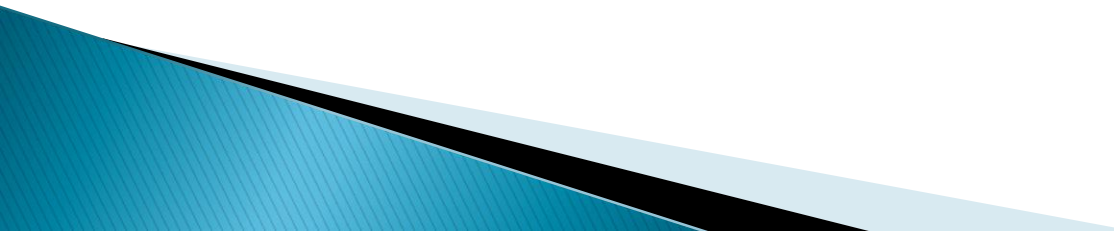


Pros/Cons: Mechanical Balance

▶ Pros:

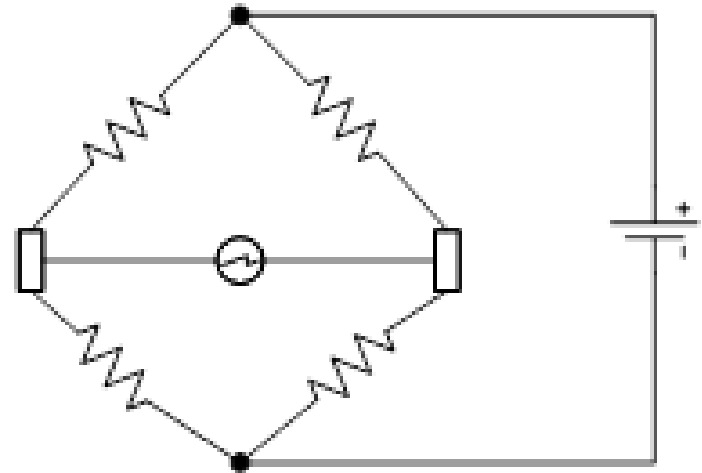
- Cost efficient
- Easy fabrication

▶ Cons:

- Very little portability
 - Safety concerns
 - Difficult to use/understand output
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Design Alternatives: Wheatstone Bridge/FSR Device

- ▶ FSRs change voltage across Wheatstone bridge
- ▶ Each foot stands on surface above FSR
- ▶ Calculate voltage differential between right and left FSRs



Pros/Cons: Wheatstone Bridge FSR Device

▶ Pros:

- Optimal size and portability
- Easy to use and understand feedback
- Safety: can use in all environments

▶ Cons:

- Accuracy and calibration
 - Lifetime from frequent use
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Decision Matrix

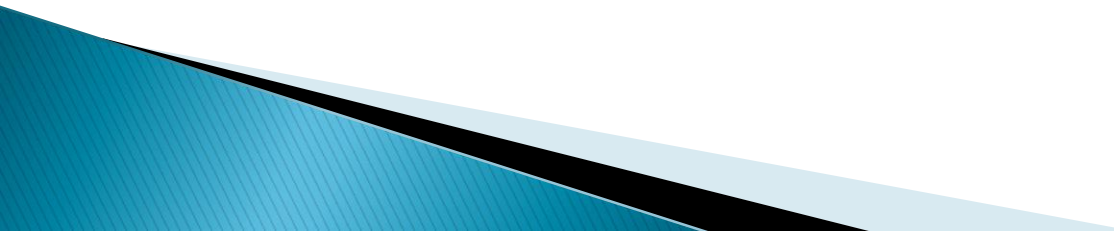
| Criteria | Wii Balance Board | Wheatstone Bridge | Mechanical Balance |
|-------------------------|--------------------------|--------------------------|---------------------------|
| Accuracy (10) | 10 | 6 | 6 |
| Aesthetics (5) | 5 | 4 | 2 |
| Cost (5) | 1 | 4 | 5 |
| Ease of Use (20) | 13 | 17 | 5 |
| Feasibility (10) | 4 | 6 | 9 |
| Portability (15) | 5 | 14 | 8 |
| Reliability (15) | 13 | 12 | 10 |
| Safety (10) | 5 | 9 | 4 |
| Size (10) | 5 | 9 | 2 |
| Total (100) | 61 | 81 | 51 |

Feedback Options

- ▶ Dial measuring voltage across bridge
- ▶ LED strip indicating degree of imbalance
- ▶ Possible auditory reinforcement

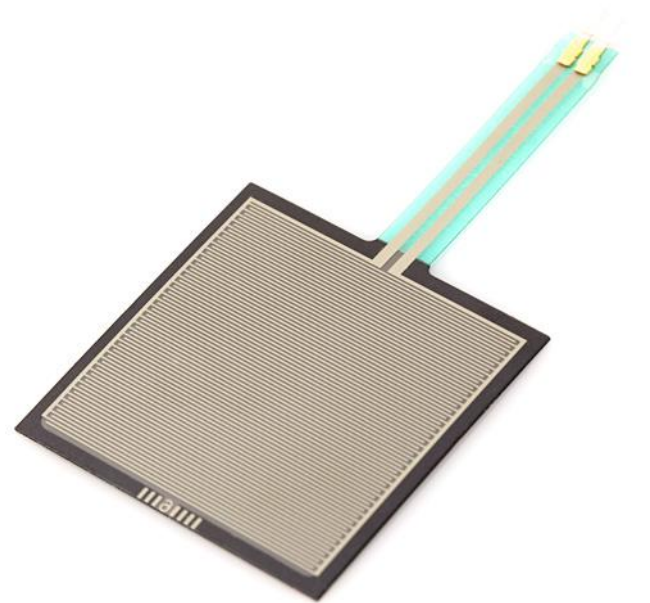


Future Work

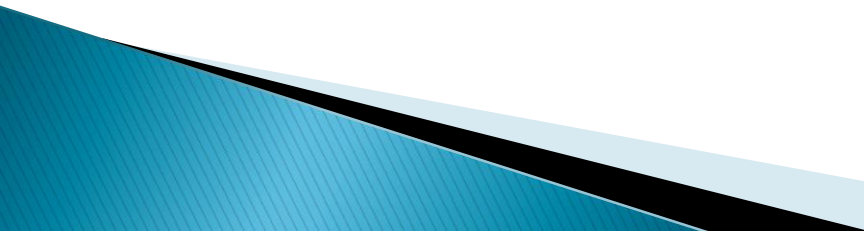
- ▶ Create Wheatstone bridge
 - Calibration
 - ▶ Analog to digital feedback
 - ▶ Test to determine degree of imbalance
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Possible Pitfalls

- ▶ Finding FSRs to support enough force
- ▶ Calibration
- ▶ Deterioration from repeated use



Conclusion

- ▶ Device to measure weight distribution for rehabilitation
 - ▶ FSR/Wheatstone bridge approach
 - ▶ Important factors: ease of use, portability, reliability
 - ▶ Must overcome calibration, deterioration
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Questions?

