Pinch Meter

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Points of Interest

- Client Information
- Background
- Problem Statement
- Competition
- Alternative Designs
- Design Matrix
- Design Criteria
- Final Design
- Conclusions
- Questions

Client Information

- Elizabeth Bourne
- Occupational Therapist-Clinician
- Department of Rehabilitation- Medical/Surgical
- UW Hospital

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Background

- Approximately 800,000 strokes every year in the United States ("Stroke" 2006)
- Strokes may impair motor function
- The goal of stroke rehabilitation is to restore fine motor control ("Post-Stroke" 2008)
- Pinch meter dynamometers are used to measure the strength of fingers
- Two different pinches are conducted
  - Two finger
  - Three finger

Problem Statement

- Measure different types of pinches

- Easy-to-view digital display

- Accurate and Precise measurements

Design Criteria

- Display forces from 0 to 5lbs (2.27kg) in 0.2lb (0.091kg) increments
- Portable
- Weight must not exceed 2lbs (0.91kg)
- Service Life: 2-5 years
- Costs less than $100

Competition

- Many companies produce hydraulic and digital pinch force dynamometers (Pinch Gauge 2008)
- Accurate devices with high force measurement ranges
- Average price of competitors $200
- Not tailored to stroke victims

http://www.rehaboutlet.com/pinch_gauges.htm

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Alternative Designs

Circuit System
- Modifying a Bathroom Scale
- Developing systems from components

Housing
- 3D printer
- PVC box
- Computer

Force Sensor
- Force Resistive Sensor
- Load Cell
- Piezoresistive Sensor

Phidgets Micro Load Cell

<http://www.phidgets.com/products.php?category=3&product_id=3134>.

Design Alternatives Continued...

Microcontrollers
- Mbed
- Arduino

http://en.wikipedia.org/wiki/Mbed_microcontroller

Circuit Design Matrix

	Weight	Modified Scale	From Components
Circuit Designs			
Reliability	1	4	4
Cost	1	2	5
Ease of Assembly	.75	3	3
Functionality	1	2	5
Availability	.5	5	5
Total		12.75	18.75

Housing Option Matrix

	Weight	3D printer	Computer	PVC Box
Reliability	1	4	5	5
Cost	1	5	5	3
Ease of Assembly	.5	5	3	2
Functionality	1	4	2	2
Availability	.5	4	1	5
Total		17.5	14	13.5

Force Sensor Matrix

	Weight	Force Resistive Sensor	Load Cell	Piezoresistive Sensor
Reliability	1	1	5	5
Cost	1	5	1	3
Ease of Use	.5	4	3	4
Accessibility	.5	5	2	5
Total		10.5	9.5	12.5

Final Design

- Piezoresistive sensor
  - needs amplification system
- Mbed microcontroller
  - Display output on LCD
- Create housing using 3D printer
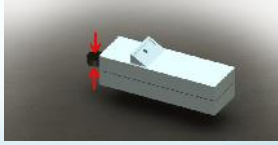
Conclusions

- Improve pinch force measurements in a low range of forces
- Allow for more accurate assessment of stroke rehabilitation progress
- Create a more cost effective design

Future Work

- Acquire appropriate materials
- Test and calibrate circuit
- Programming
- Assemble device
- Clinical Trials

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- Elizabeth Bourne
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Questions

References

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