

Head Tracker



Team Members:

Pictured left to right

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Client:

Dr. Rasmus Birn

Advisor:

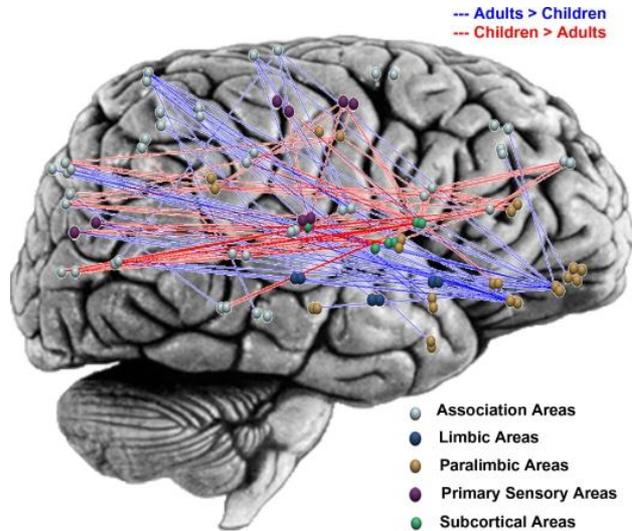
Thomas Yen

Problem Statement

- ▶ MRI scans are expensive
- ▶ Small movements can destroy data
- ▶ Train subjects to keep head still
- ▶ System to track head motion
- ▶ Reduce data loss



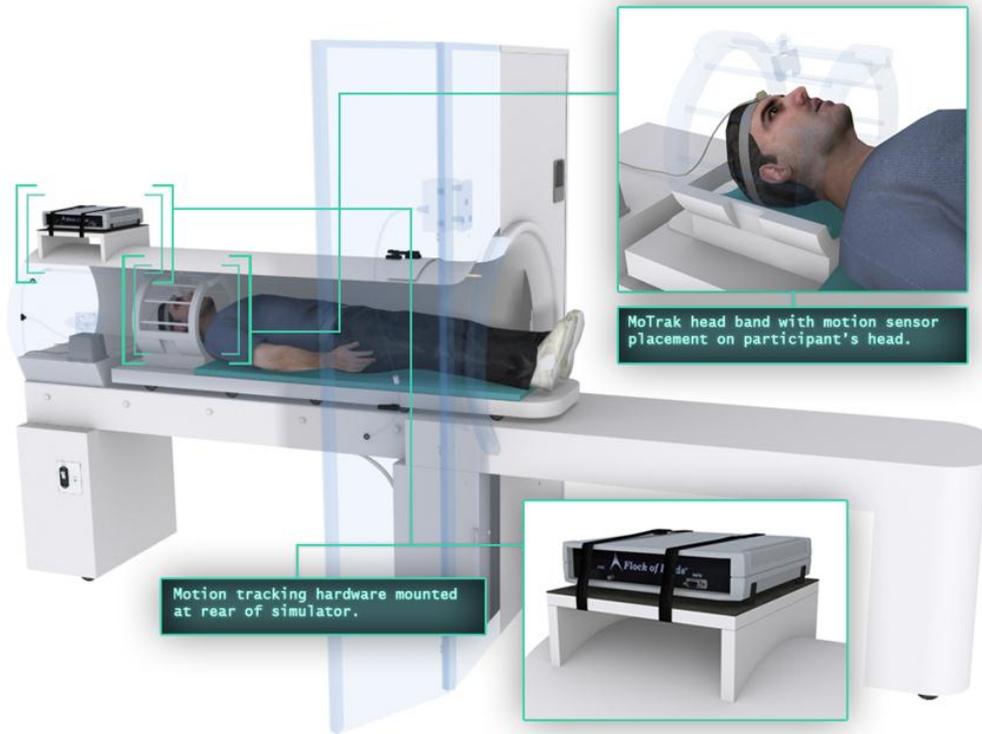
Background



- ▶ Client does research on brain organization during childhood development through MRI scanning
- ▶ 1 mm movement distorts images
- ▶ Children have difficulties remaining still during scanning
- ▶ MRI simulator is used to train patients
- ▶ Feedback needed when movement occurs



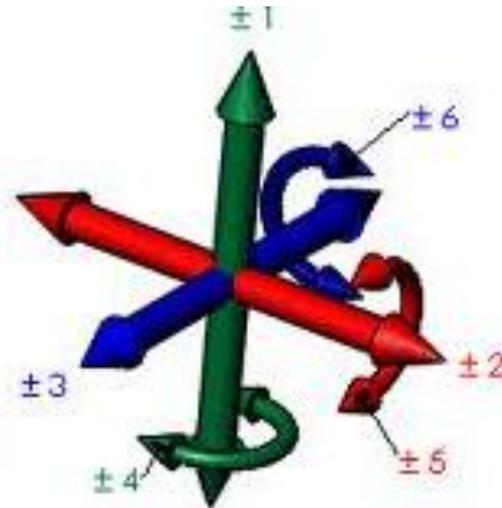
Existing Device



- ▶ Mo Trak®
 - Head tracking system for MRI simulator
 - Uses Ascension's Flock of Birds technology
 - Magnetic tracking sensors
 - Tracks 6 DOF
 - Costs **\$8,000**

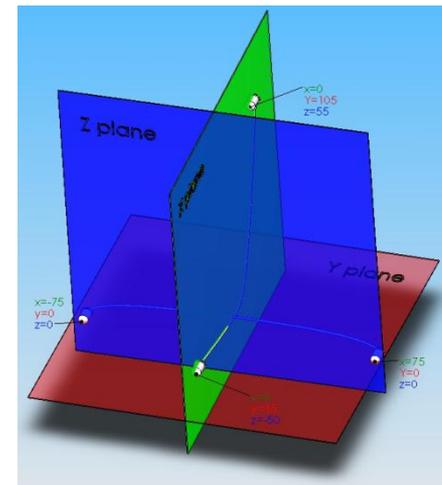
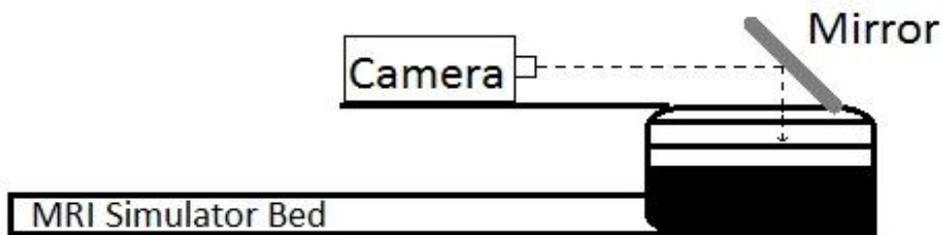
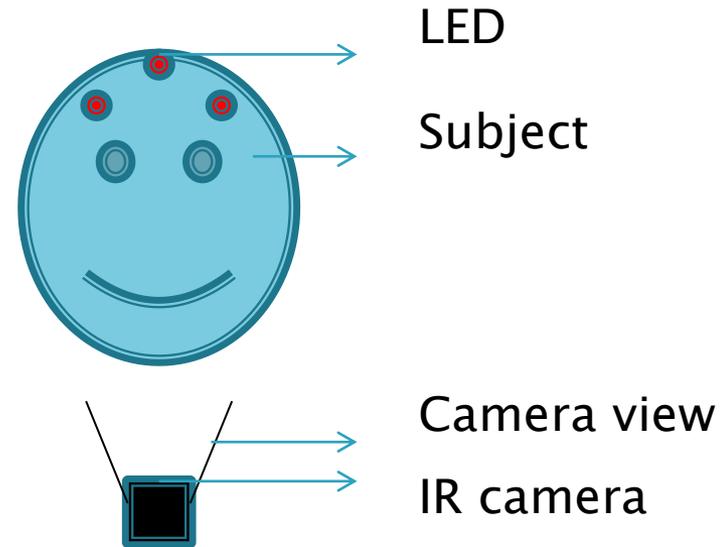
Client Requirements

- ▶ Detect movement in 6 degrees of freedom
- ▶ Fit into MRI simulator
- ▶ Accuracy of 0.1 mm for translational and 0.1 degrees for rotational movement
- ▶ Threshold for feedback set at 1mm
- ▶ Give feedback to user
- ▶ \$500 budget
- ▶ Note: we may use ferrous material

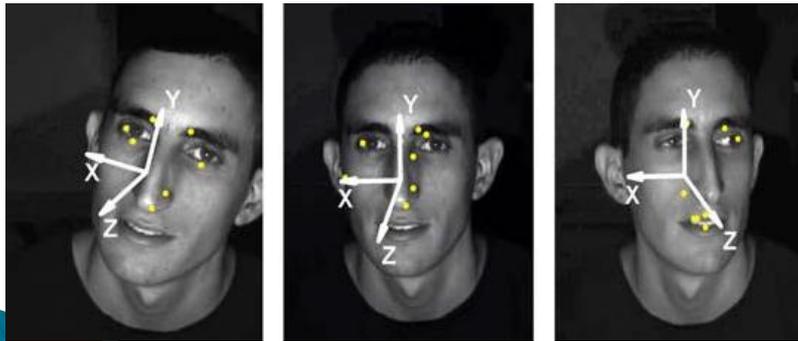


Design Alternative: Infrared System

- ▶ LEDs secured to head
- ▶ IR camera
- ▶ USB microcontroller
- ▶ Graphical user interface

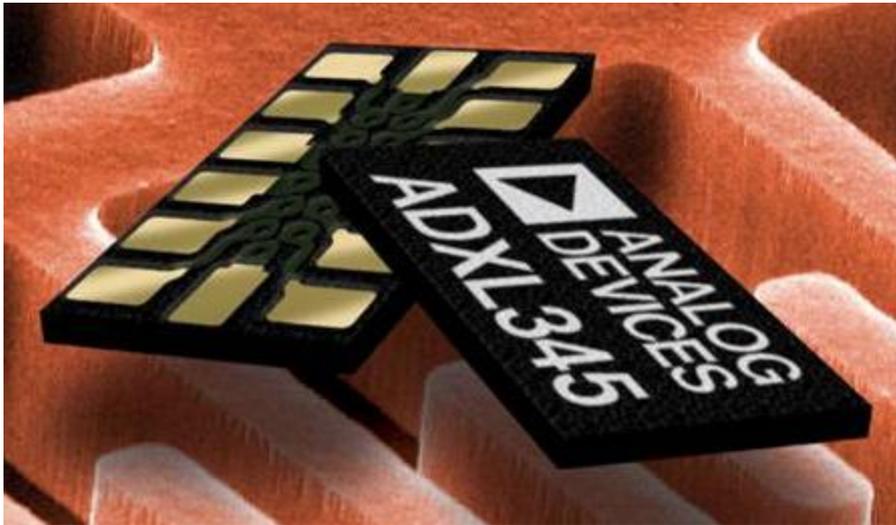


Design Alternative: Camera Tracking System



- ▶ Camera records images
- ▶ Imaging processed through computer software
 - Ex: Free Track
- ▶ Difference in images represent movement
- ▶ LED markers allows 6 DOF tracking with single camera
- ▶ Stereo Cameras creates 3D images
- ▶ Mirror allows camera to focus

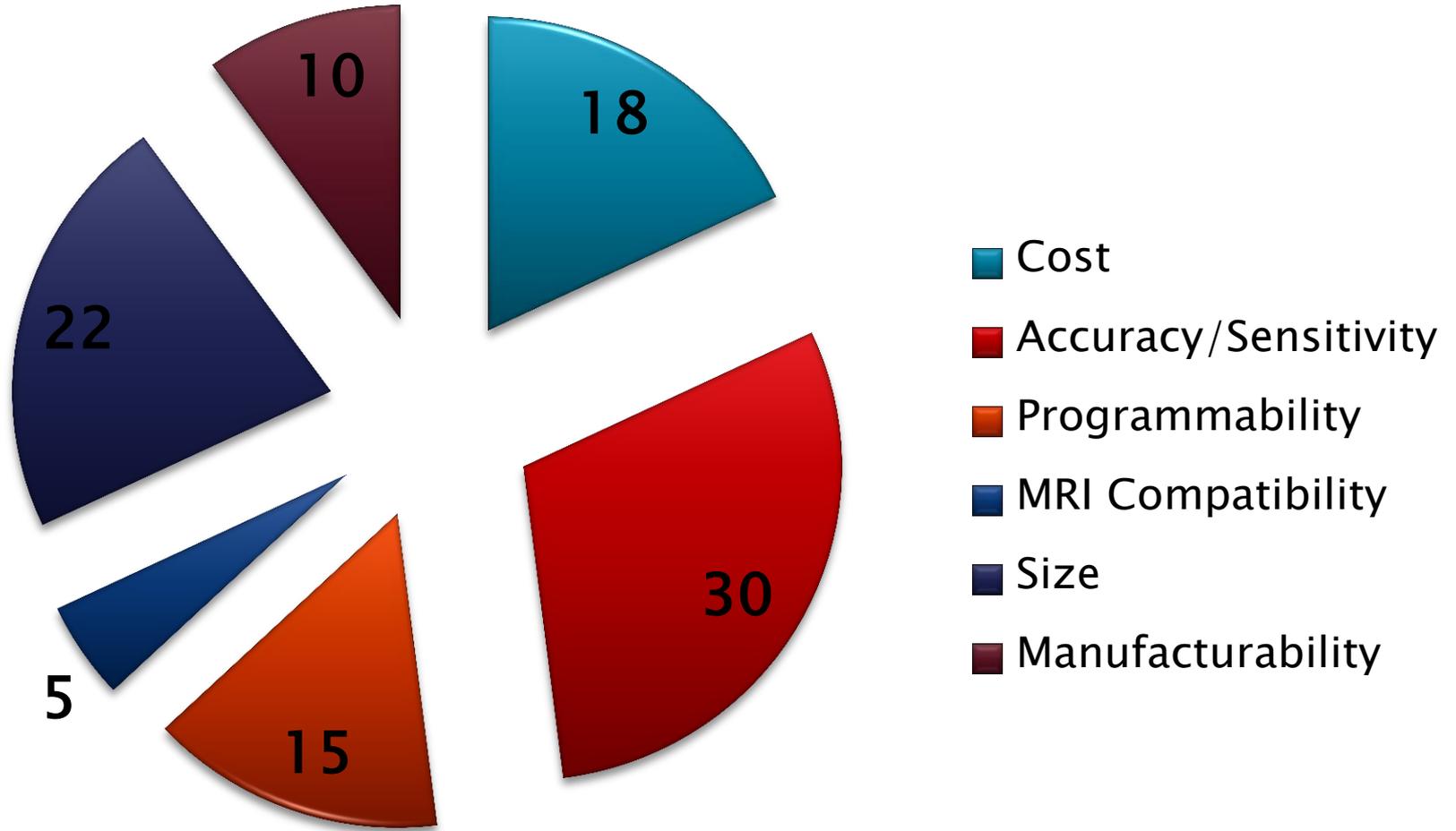
Design Alternative: Accelerometer



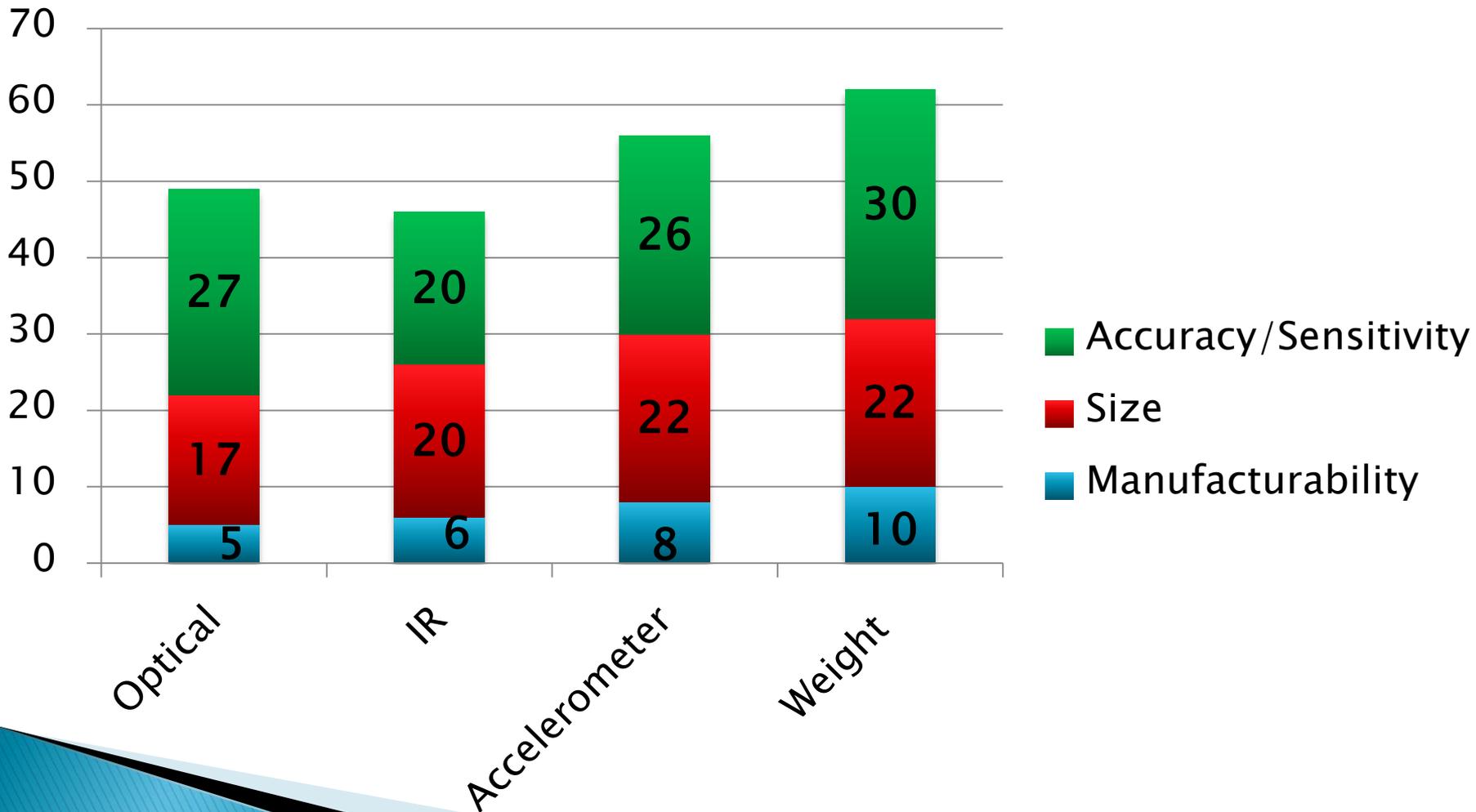
- ▶ Detects acceleration
 - Static – measure tilt
 - Dynamic – direction
- ▶ One, two, or three axes
- ▶ How it measures:
 - Piezoelectric effect
 - Capacitance changes
 - Hot air bubbles
 - Light
- ▶ Microcontroller with digital accelerometer



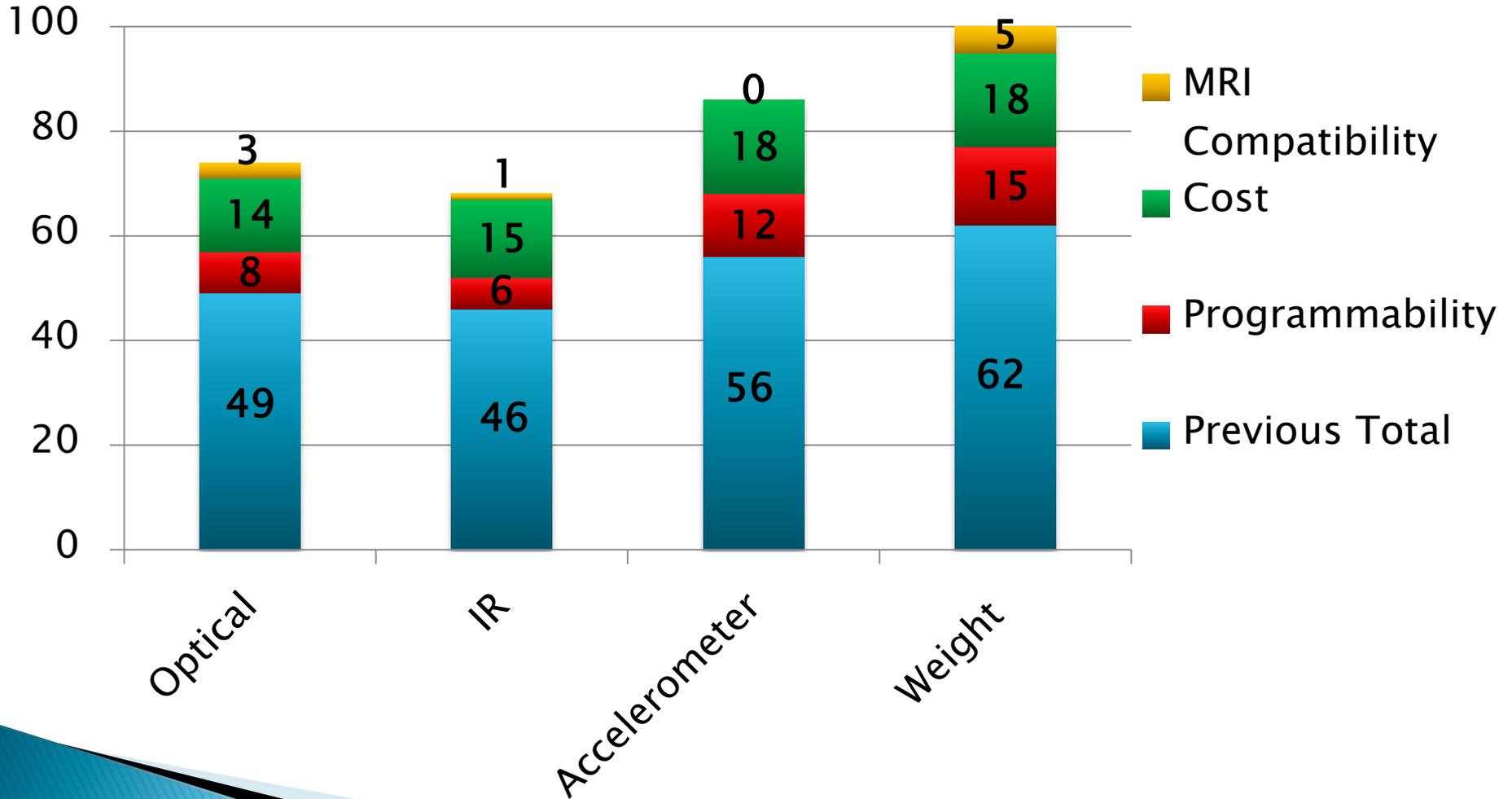
Design Matrix



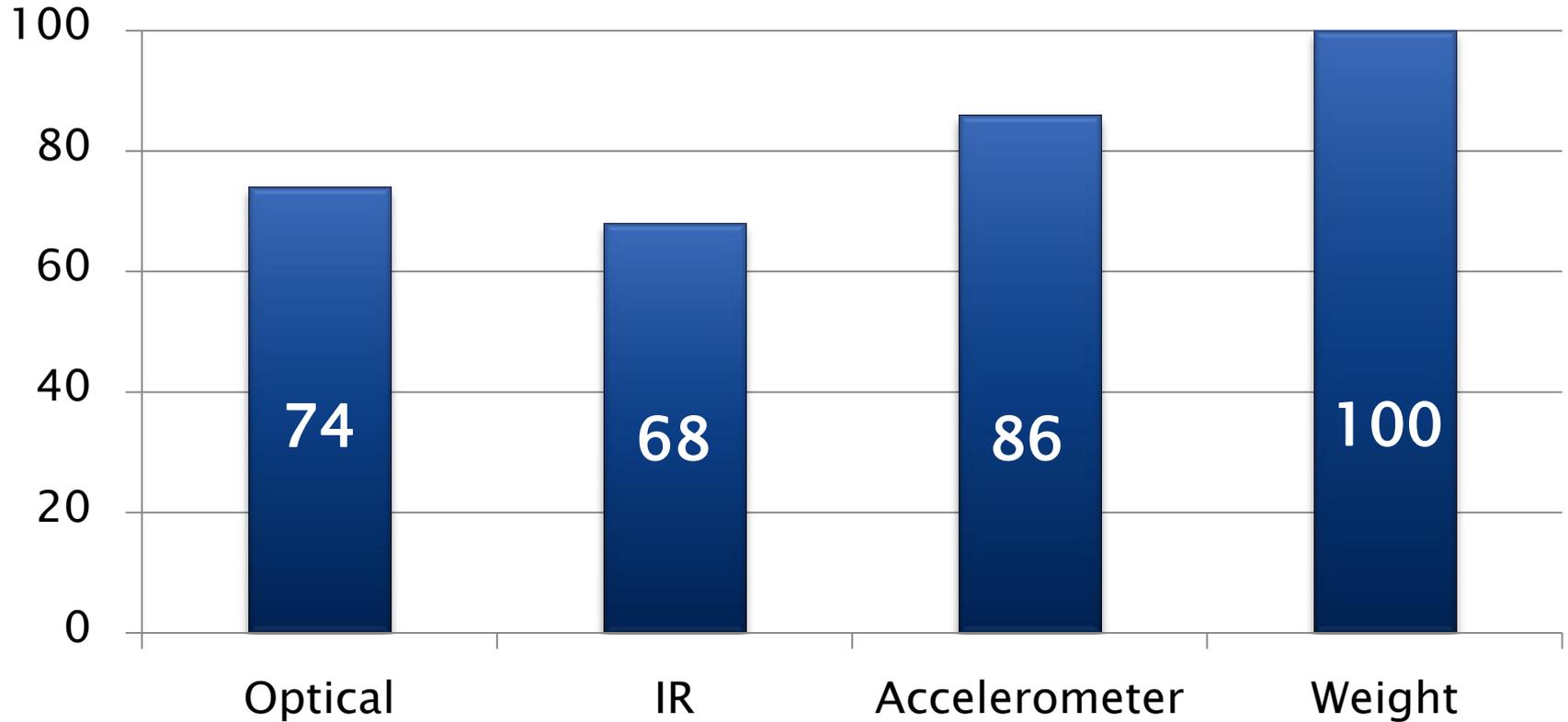
Manufacturability, Size, Accuracy/Sensitivity



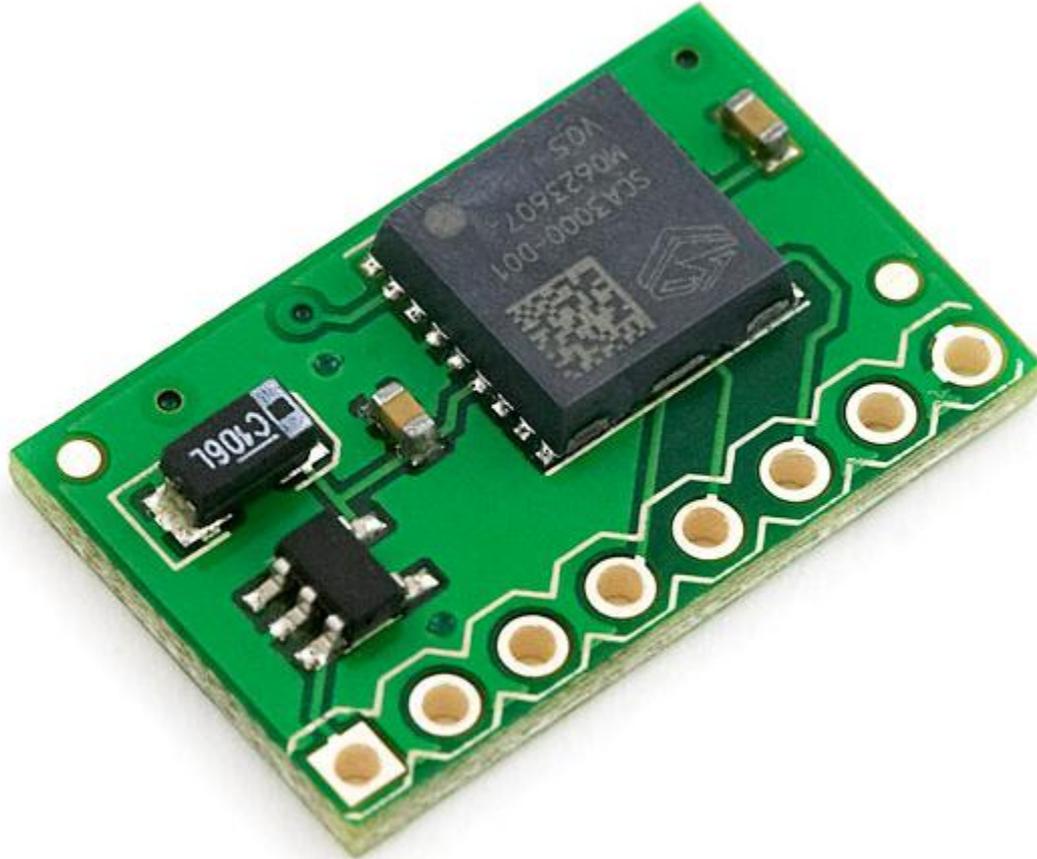
MRI Compatibility, Cost, Programmability



Design Totals



Final Design



Future Work

- ▶ Determine accelerometer type
 - Program accelerometer
 - ▶ Digital or Analog
 - ▶ Attachment method
 - ▶ Model Testing
 - Accuracy Threshold
 - ▶ Patient Feedback
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Acknowledgements

- ▶ Advisor Thomas Yen
 - ▶ Client Dr. Rasmus Birn
 - ▶ Ryan Herringa
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References

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Questions

