Designing and Building Prototypes for Assisting Blind And Visually Impaired Athletes
Problem

• Challenge
  – 10 million blind and visually impaired
  – 1.3 million legally blind

• Challenges in swimming
  – Access facilities
  – Orientation in the water
  – Location of the wall

The current method used in swim competitions uses tappers who use a stick to “tap” swimmers to turn
Organization

• Passive Team
  – In-pool tactile interface

• Active Team
  – Electronic interface to alert swimmers

• Research Team
  – Technology application in other sports
Passive Team

Team Members:
Nicholas Przybysz
McLain Hubbard
Madeih Salimi
Ryan Dudek
Kevin Ragauskis
Progression

eyeSwim Version I
eyeSwim Version IV
eyeSwim Version V
eyeSwim Version VI
eyeSwim Version VIII
Objectives

- Improve T connectors and Icicles
- Perform initial Materials Test
- Redesign Storage System
- Improve previous design using feedback from swimmers
- Create device for WCBVI (Wisconsin Center for the Blind and Visually Impaired) for 9th pool test on July 12, 2008 in Janesville, WI
Pool Tests

On campus
- 2 Tests
- 6/28: 4 students
- 7/19: 6 volunteers

WCBVI
- 29 volunteers
- Extraordinary response
Materials Test

- Children’s pool
- All device parts
- 10 days, 2x concentration
- Degrading components
Results

Icicles

- Dense rubber tubing

T/I-connector

- Single piece design
- Spring lock
Results, cont.

Materials Test
- Unstable water
- 1 degrading component

Storage
- Designs made
Recommendations

Alright, um. Did you feel that it helped keep you centered?
Active Team

Team Members:
Marta Alvar Gonzalez
Hussain Biyawerwala
Paul Cordogan
Rob Keane
Dave Malon
Jeff Lin
Short Term Active Team

- Objectives:
  1. Fix the Device to Test Following Objectives
  2. Establish a Vibration Language
  3. Determine the Best Location for Motors on Swimmer
  4. Find the Ideal Vibration Intensity
WCBVI

- Tested All Objectives
  - Vibration Language
  - Best Location for Motors
  - Ideal Vibration Intensity
Short Term Active Team

• Results:

1. Repaired Wired Device
2. Tested Several Vibration Languages
3. Understood the Best Location for Motors
4. Realized Intensity Issues
• Topics of Interest
  • Wireless Transmission
  • Sensing Equipment
  • Swimmer Interface (Language Component)
Wireless Transmission

RF (Radio Frequency)

- Amphicom’s iPod Transmitter
  - Range 80 meters (260ft)
  - Radio frequency: 40.68 MHz
  - $70 plus shipping (includes 1 snorkel)
  - FCC compliant

Sonar

- Components overall are more expensive
Transmitter: Purchased from Amphicom $50

Motion Sensor (IR): Purchased from Radio Shack $30

Snorkel Receiver Purchased from Amphicom $20
Sensing Equipment

Pool Wall Awareness System (PWAS)
- Infrared Motion Sensors (Dry)
- Physical Switches (Submerged)
- Ultrasonic Transducer (Wet Motion Sensor)

Swim Path Deviation Awareness System
- Gyrating Compass
- Audio Assistance (Outside Party) through RF signal (Proved in pool test to be preferable to physical contact warning.)
Swimmer Interface

-Bone conduction: Sound received through the bones of the skull.

-Currently the technology is used in hearing aids, military communications, and civilian/recreational applications.

-Amphicom’s snorkel $\approx$ $20 utilizes bone conduction through the teeth (FCC compliant).

-Swimp3 $\approx$ $140, utilizes bone conduction through the cheek bone.
Blind and Visually Impaired Athletes from WI Pool Test

Team Members
Joshua Cabrera
  Team Leader
  Assistive Technologies
Andrew Lichaj
  Budget
  Video Documentation
Nicole Karns
  Pool Test Manager
  Engineering Report
Fiona Daay
  Swimming Equipment
Alex Leasenby
  Sports Research
Objectives

Manage Pool Tests

Examine Assistive Technologies

Evaluate alternative Sports
Results

Pool Testing
Results

Assistive Technologies

Stand-Alone Sensors

Robotic Sensors

Fish finder/GPS Devices

Specialized Technologies
Results

Sports Research

1.) Running
2.) Cycling
3.) Tandem Cycling
4.) Soccer
5.) Bowling
6.) Judo
7.) Wrestling
8.) Beep Ball
9.) Skiing
10.) Fencing
Sports Criteria

• Calories Burned Per Hour
• Cost
• Independence
• Difficult / Safety
• Popularity
Sports Rank

Skiing: 20
Judo: 19
Running: 26
Tandem Cycling: 28
Cycling: 25
Bowling: 16
Wrestling: 14
Fencing: 6
Beep Ball: 29
Soccer: 42

Scores (subtracted from 50)
Results

Trip to Wisconsin Center for the Blind and Visually Impaired
## Budget

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Acknowledgments

Collaborative Efforts

The Chicago Lighthouse for People Who Are Blind or Visually Impaired
since 1906, “Seeing What’s Possible”®

Wisconsin Center for the Blind And Visually Impaired

UNIVERSITY OF NOTRE DAME

ROSE-HULMAN INSTITUTE OF TECHNOLOGY
Questions?

Fiona Daay: Member of Research Team