IPRO 310

I Swim, You Swim, We All Swim

IPRO It takes a team! INTERPROFESSIONAL PROJECTS PROGRAM

Designing and Building Prototypes for Assisting Blind and Visually Impaired Swimmers

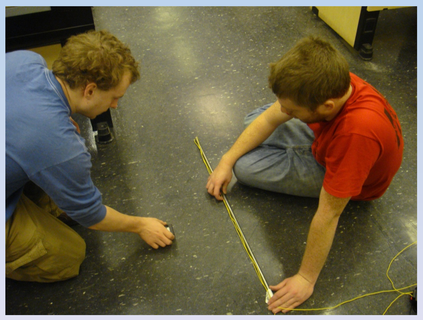
OUTREACH

BACKGROUND

- IPRO started in spring on 2006 to develop assistive technology for BVI individuals
- Rose Hulman and Notre Dame also pursued similar projects
- Fall 2008 semester modified Notre Dame's initial passive device and constructed a new lightweight storage device
- Fall 2008 also decided to pursue invisible fence & sonar technology applications
- Previous designs neglected the inclusion of the BVI community; the fall 2008 semester created and administered a user-needs survey at the Chicago Lighthouse for the Blind

OBJECTIVES

- Promote independence of BVI individuals
- Ensure device allows for a low profile during exercise
- Test the applications of sonar, invisible fence and laser technologies
- Include the BVI community in the design process using surveys, interviews, outreach group facility visits and feedback
- Identify and obtain consent from a facility for long terming of the passive device
- Develop user and staff surveys and consent forms for the passive device testing
- Develop and administer user needs survey to reference when developing assistive devices.



SURVEY RESULTS

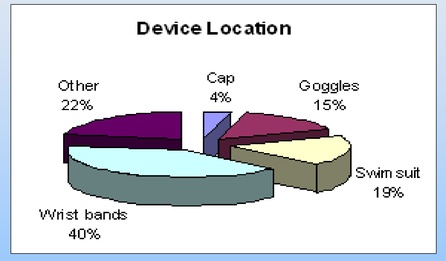


Chart 1: Surveyed BVI individuals preferred a low-profile wristband device

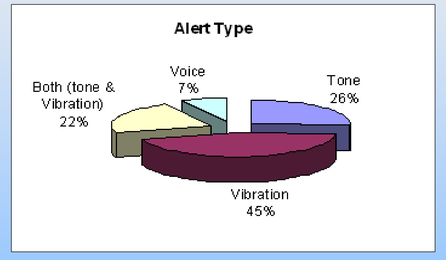


Chart 2: Nearly one half of responses indicated a preference for a vibration over audio

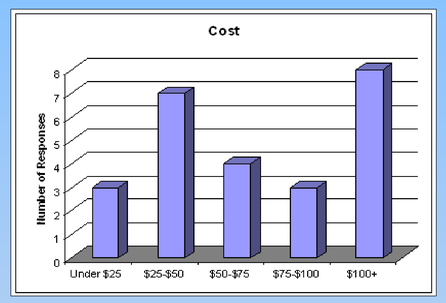


Chart 3: Popularity of the $100+ price choice may be due to the opportunity for financial assistance

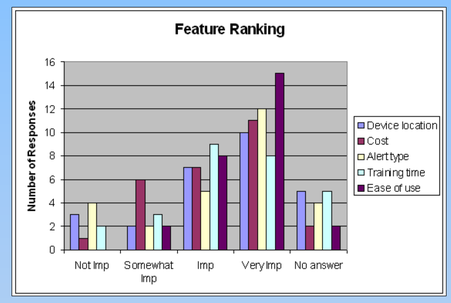
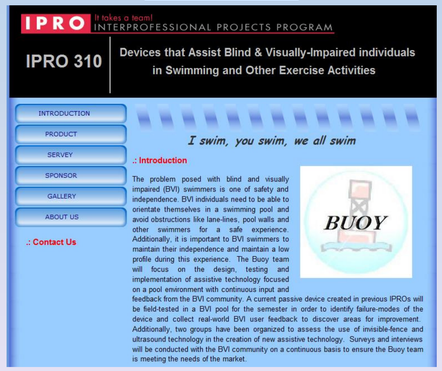


Chart 4: All device features were highly ranked, but ease of use and alert type ranked as the most important features

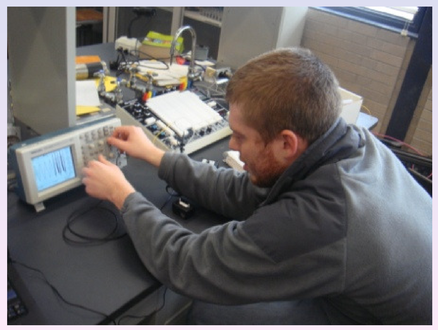
MEDIA



- Network with the BVI community; allow for the outreach and receipt of ideas and progress
- Makes the user-needs and passive device surveys more assessable to a larger community, increasing their amount of influence and feedback

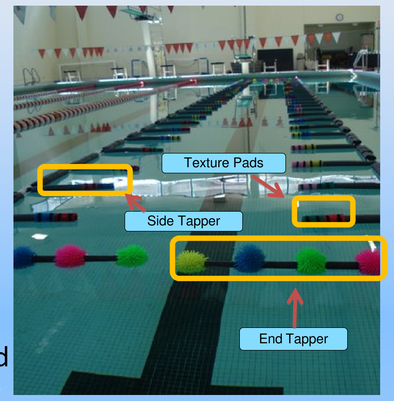
DOCUMENTATION

- Posted meeting minutes to iGroups after each group session
- Facilitated the completion of the written team deliverables
- Managed budget ensuring suitable use of team funds
- Created weekly status reports on major and minor team progress



PASSIVE DEVICE

The passive device is a mechanical apparatus that provides tactile feedback alerting the swimmer of the sides of the lane and ends of the pool.



- Long term testing of the passive device is scheduled with the Wisconsin Center For the Blind and Visually Impaired
- User surveys for the passive device for both swimmers and staff members have been written and approved by the IRB and will be administered by the Wisconsin Center during testing in the Summer 2009 term.

NEXT STEPS

- Maintain involvement with the BVI community
- Ensure website is accessible to entire BVI community
- Load both passive device surveys and user needs survey on website
- Promote documentation for future IPRO teams to ensure continuity

ACKNOWLEDGMENTS

The Chicago Lighthouse for People Who are Blind or Visually Impaired

WCBVI

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TECHNOLOGY

SONAR

Description:

Sonar includes a transmitter that emits sound waves that bounce of obstacles and a receiver that interprets the distance of the obstacles based on the time between transmission and receipt.

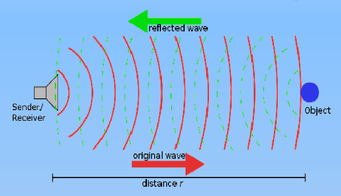


Fig.1: Standard SONAR operation

Pool Testing	Result	Conclusion
1. Obstruction Distance Test	Detection range: 4.5 ft Angle: 1 sensor: 10 degrees 4 sensors: 120 degrees	This device needs major modifications to increase the range of this device.
2. Obstruction Size test	Human, notebook, broom handle and roll of duct tape were detected	The size of the obstacles are all detectable with the sonar device above water.
3. Air to water test	The parking sensor detected the water surface as an object	This specific sonar device was intended solely for air use, and was not built for underwater.

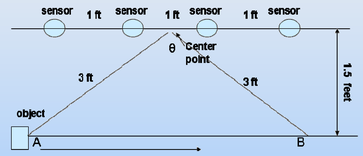


Fig.2: Detection angle results

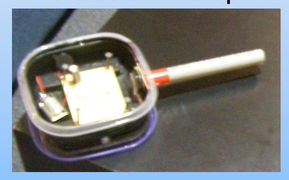
Conclusions:

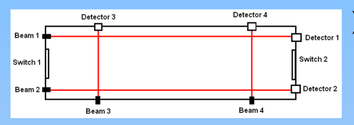
- Need a transducer made for underwater use, so that propagated waves penetrate the water.
- Question further development due to cost

LASER

Description:

Create a boundary using laser alarms to alert the user when they are out of the specified boundary.





Future Applications:

- Create a system for alerting the user when a beam is interrupted
- Design end switches to change left and right lane alert signals
- Build supports to hold the laser beams and detectors

INVISIBLE FENCE

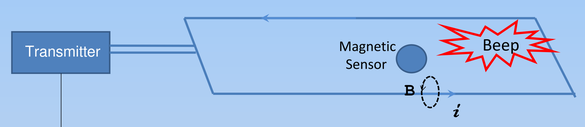


Fig.3: Standard invisible fence operation

Fig.4: Signal Transmitter

Description:

A transmitter sends a signal through a wire to create a magnetic field that can be detected by a concealed receiver.

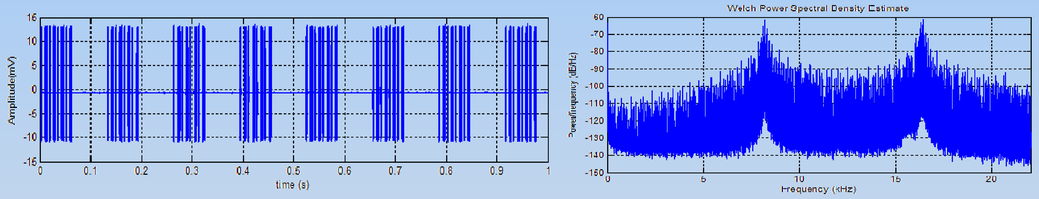


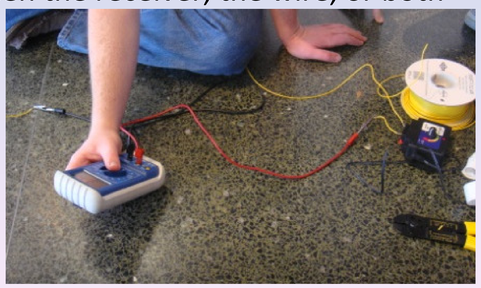
Fig.5. Time and Frequency domain of the output signal of the Transmitter (Max Width)

Testing:

- Determine the functionality of invisible fence technology in pool applications
- Examine the air to water interactions of the transmitter and receiver
- Test the technology in various potential device setups
  - Above lane lines
  - Below lane lines
  - Through flag lines
  - General perimeter

Results:

- Pool tests showed that the detection distance between the receiver did not change when the receiver, the wire, or both were underwater or in air.
- Looping the wire in the same direction with the current significantly increased detection distance.
- Looping the wire in the opposite direction with the current canceled out the signal.



NEXT STEPS

- Design a method of alerting user to the difference between left lane, right lane, and end of the pool.
- Incorporate the receiver into swim wear to maintain a low profile.
- Waterproof the receiver and the transmitter.
- Develop a working prototype
- Test cue conflict theory and it's effect on disorientation
- Involve faculty experts in the testing of communication and application

ACKNOWLEDGMENTS

ILLINOIS INSTITUTE OF TECHNOLOGY
Transforming Lives.Inventing the Future.

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