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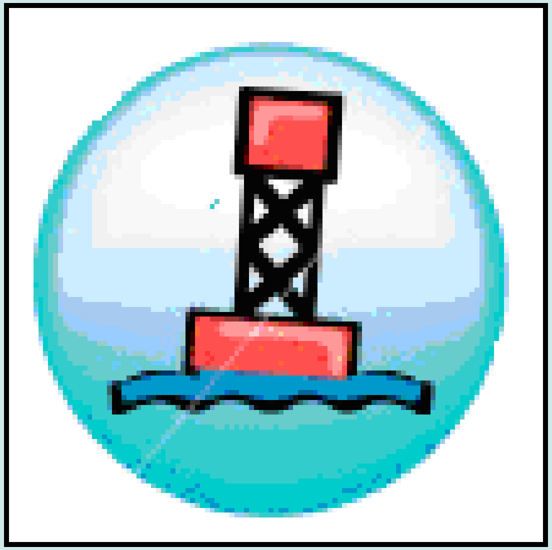


IPRO 310

Assistive Technology for Blind and Visually Impaired Swimmers

A vision for blind swimmers

Overview

- Background
- History/ Mission/ Team Organization
- Obstacles/ Solution Strategy
- Ethical Issues
- Survey/ Community Outreach
- Technologies
- Accomplishments
- Next Steps

Background

- Abandonment of assistive technology
  - Lack of community involvement in development
  - Up to 80% abandonment rate of assistive technology (Michigan Department of Education)
- National awareness of physical fitness
  - Lack of assistance leads to a sedentary lifestyle
- 7.8 million blind and visually impaired (BVI) people in the US (US Census)
  - 1.8 million completely blind people (US Census)

History

Fall 2006
- -Start of IPRO
- -Market research
- -General research
- -Notre Dame modifications

Spring 2007
- -Research
- -Passive redesign
- -Passive testing

Summer 2007
- -SONAR research
- -Passive redesign
- -Passive testing

Fall 2007
- -SONAR application
- -Passive device modifications

Spring 2008
- -Vibrator belt concept
- -Modified passive device

Summer 2008
- -Modified passive device
- -Created storage device
- -Snorkel device

Fall 2008
- -New storage device
- -Selected two active technologies
- -New management

Spring 2009
- -Discontinued SONAR
- -EMF and laser application
- -Long term passive testing

Mission

"To develop, test, and implement assistive technology with the community that promotes safety and improves independence of blind and visually impaired (BVI) swimmers."

Team Organization

1: EMF Technology
Thomas Hotz (ME): LEAD
Coleman Baar (ME)
Kim Dykeman (PSYC)
Roman Lopez (ARCH)
Smita Sarkar (BME)
Nithin Winston (BME)

2: Laser Technology
Kevin Kruse (BME): LEAD
Lisa Kwiatkowski (BME/EE)
Brendan Lane (AE)
Joanna Sowiak (BME)
Carl Stelcel (BME)
Raymond Zhou (EE)

Media
Smita Sarkar (1): LEAD
Roman Lopez (1)
Carl Stelcel (2)
Raymond Zhou (2)

Documentation
Lisa Kwiatkowski (2): LEAD
Coleman Baar (1)
Joanna Sowiak (2)
Nithin Winston (1)

Survey
Kim Dykeman (1): LEAD
Thomas Hotz (1)
Kevin Kruse (2)
Brendan Lane (2)

Faculty and Advisors
Frank Lane (Rehab Psych), Ken Schug (Chem), Phillip Troyk (BME)

Obstacles

- Lab Access
- Electronics experience
- Experience with people with disabilities
- Abbreviated semester

Solution Strategy

- Brainstorming
- Iterative prototyping
- Activities that simulate disabled lifestyle
  - Communication problems
  - Blindfold exercise
- User-centered design
  - Surveying
  - Socializing
- Research/Consultants
- Dynamic and interactive team structure

Ethical Issues

- Beneficence
- Non-malfeasance
- Autonomy
- Justice
- Fidelity

UNITED STATES POSTAL SERVICE
SIGMA PHI EPSILON

Survey

- Survey Identified the following as most important
  - Device location
  - Ease of use
- High interest in our assistive technology
- Primarily for recreation
- Vibrating wristband well received
- Other concerns included
  - Safety
  - Pool availability

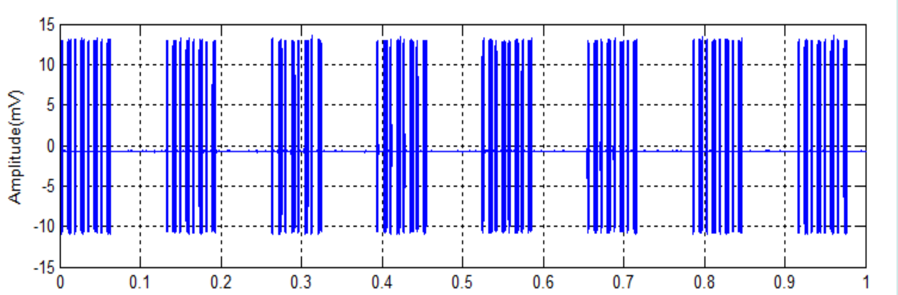
Website

(http://iit.edu/~ipro310f09)

EMF Technology

Research

- Determined frequency of stock transmitter
- Studied Electronics concepts
- Met with consultant

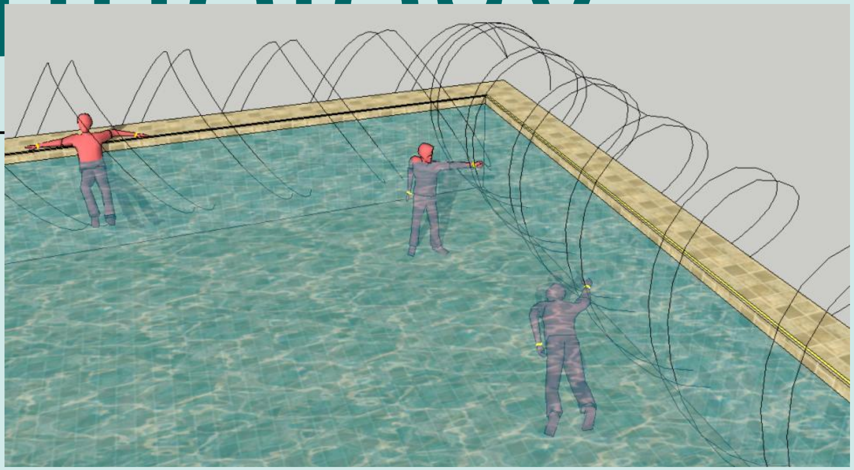


Signal of the Transmitter (**Max** Amplitude)

Tests

- Conducted quality test of EMF Prototype I
- Conducted optimum frequency test of EMF Prototype II

EMF Technology



Results/Analysis

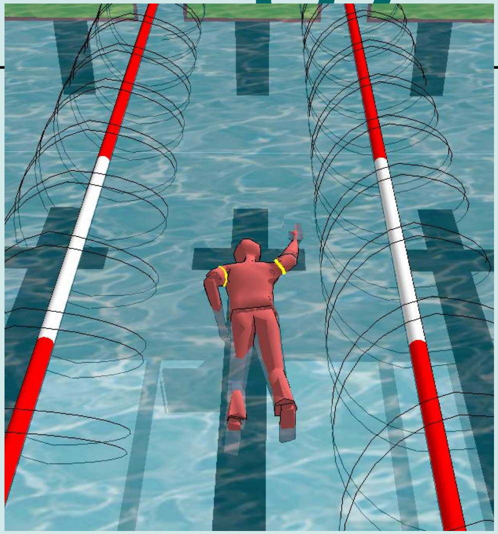
- Prototype I was able to detect EM fields, but not in a range that would be suitable for pool testing
- The signal generated by the transmitter is encrypted. A transmitted will need to be designed and developed to enhance the receiver
- The receiver's performance is partially due to the optimal frequency that it detects.
  - Using the concept of a band pass filter, the optimal frequency can be calculated and implemented

Challenges

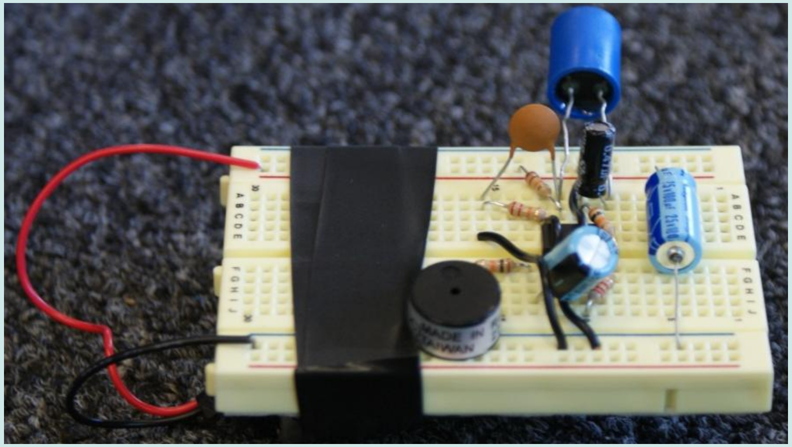
- Integrating a vibration into the receiver.
- Detecting distance
- Designing a transmitter.
- Implementing electronic circuit concepts within circuit design(s).
- Time, budget, and lack of expertise.

EMF Technology

Possible Next Steps



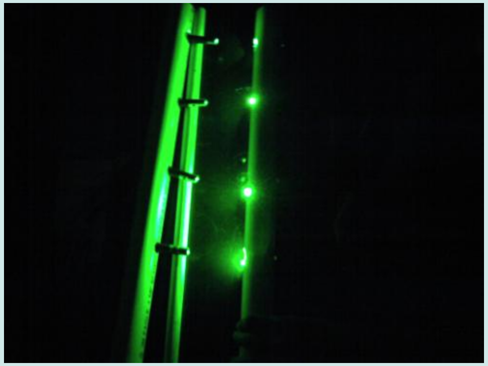
- Troubleshoot Prototype II
    - Detect within a suitable range
    - Vibrate in the presence of an EM field
- Design and develop a transmitter sending a frequency unique to the receiver
- Design and develop both a transmitter and wristband that is discrete, functional, and safe within a pool environment

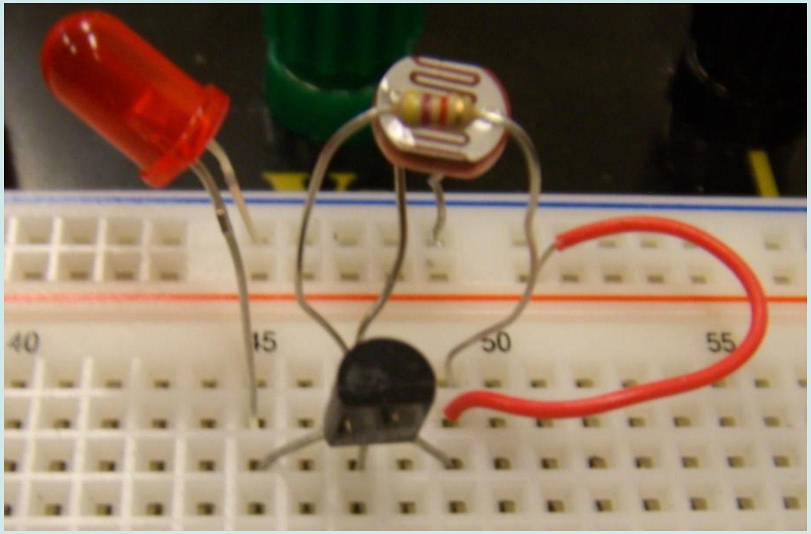


LASER Technology

Research

- Circuit design modification
- Power consumption
- Laser beam propagation in water
- Applications of lasers underwater

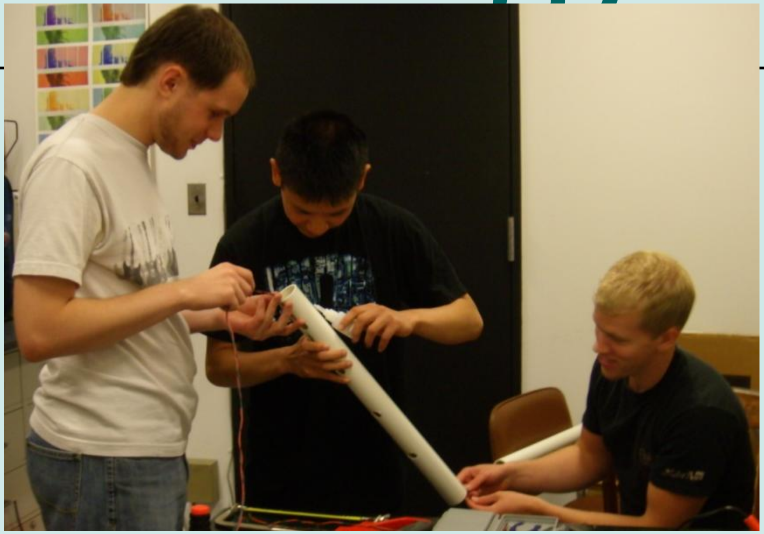




Tests

- Underwater range testing of red and green lasers
- Varied circuit tests

LASER Technology



Results/Analysis

- Properly working circuit
- Maximum 51ft underwater range of green laser
- Splashing does not interfere with laser beam

Challenges

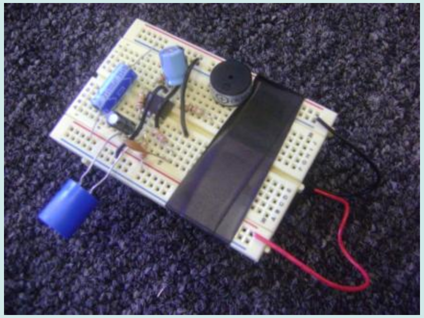
- Installation of device in pool environment
- Circuit design
- Aligning laser beam with sensor

Possible Next Steps

- Minimizing size for wristband installation
- Further testing in pool environment
- Waterproofing device for continued underwater use

Accomplishments

- Participated in disabilities exercise
- Created code of ethics
- Created team identity/ structure
- Visited Chicago Light house
  - Administered surveys/ analyzed data
  - Met with web consultant
- Developed EMF Prototype I
- Presented at RESNA conference



Accomplishments

- Developed EMF Prototype II
- Developed LASER Prototype
- Put up website
- Visited The Chicago Lighthouse
  - Interacted with the BVI community
- Checked website's compatibility with screen readers

Next Steps

- Continue community outreach
- Continue consumer based design
- Facilitate continuity of the website
- Trouble shoot current prototypes
- Develop new prototypes based off of current ones
- Consider ways to integrate EMF and LASER technologies

Questions?