

BUOY

IPRO 310

Assistive Devices for Blind and Visually Impaired Swimmers

A vision for blind swimmers

Buoy's Mission Statement

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

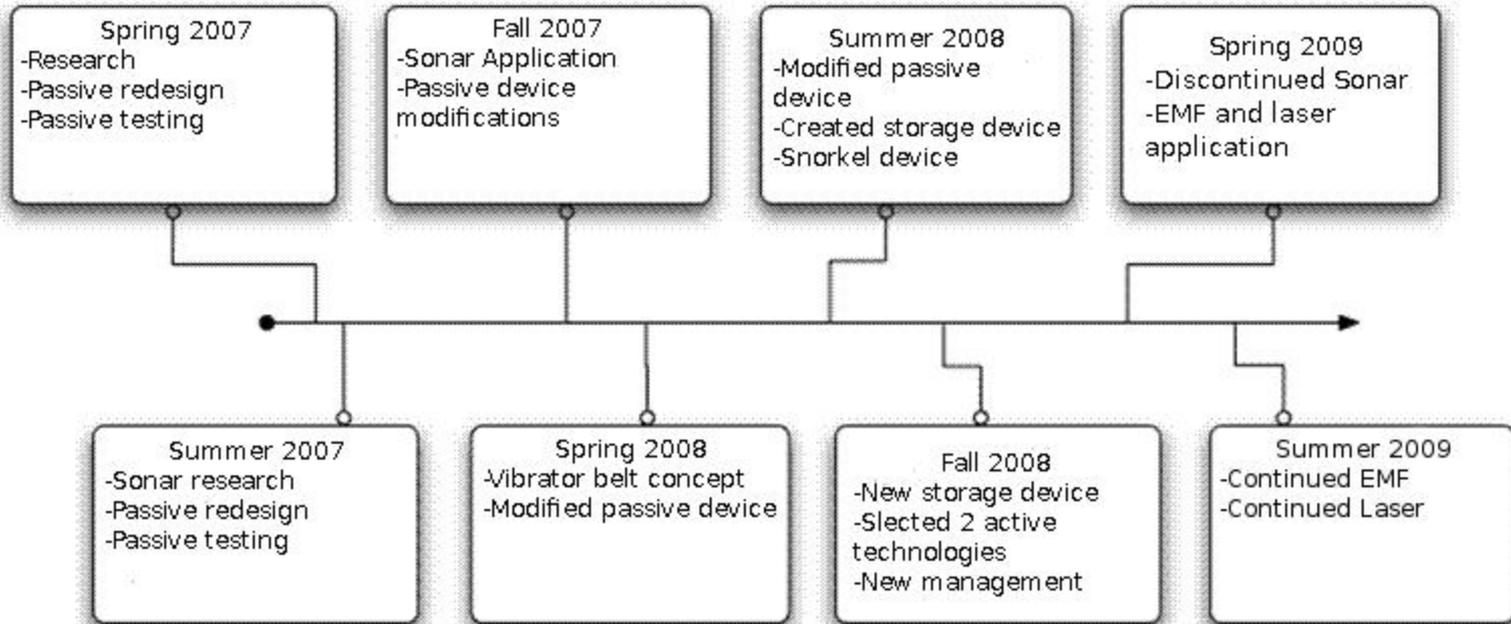
Outline

- History
- Background and Problem
- Team Organization
- Goals
- Prep. and Supp. Activities
- Progress
- Future Activities
- Alternative Applications





History



Background and Problem

Background:

- 1.8 million people with blind condition in the US (US Census)
- 7.8 million people with blind and visually impaired (BVI) condition in the US (US Census)
- Up to 80% abandonment rate of assistive technology (Michigan Dept of Education)
- Lack of user input in development of technology to increase physical activity and decrease sedentary lifestyle

Fall 2009 Problems:

- Signal produced by invisible fence is encrypted thus vibrating receiver doesn't work
- Serial problem solving approach was not efficient

Team Organization

Technology Team

Phillip Sirk (CS, CPE): LEAD
Ross Ludwig (MMAE)
Jeffrey Reilly (Phys)
Branden Toro (MMAE)

Communication Team

Jay Park (Psyc): LEAD
Kimberly Dykeman (Psyc)
Michaela Heaton (Chem)
Timothy Lipman (Psyc)
Smita Sarkar (BME)

Documentation

Michaela Heaton (Chem): LEAD
Jeffrey Reilly (Phys)
Branden Toro (MMAE)

Media

Smita Sarkar (BME): LEAD
Jay Park (Psyc)
Phillip Sirk (CS, CPE)

Survey

Kim Dykeman (Psyc): LEAD
Timothy Lipman (Psyc)
Ross Ludwig (MMAE)

Faculty and Advisors

Frank Lane (Rehab Psyc), Ken Schug (Chem), Ruthanna Gordon (Psyc)

Goals

- Re-design the invisible fence into a radio device and design a vibrating receiver to detect signal of new device
- Develop a method for the swimmer to interpret the information received from the vibrating device
- Continue BVI community involvement, Maintain website

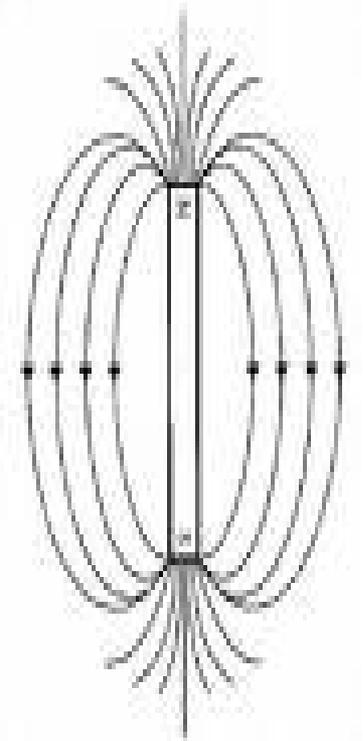
Prep. and Supp. Activities



- Team building
- Transition to conference room
- Blindfold experiment
- Strategic division of labor
 - Communication
 - Technology
- Completed project plan / midterm presentation
- Posting minutes
- Completed IRB certification
- Extensive ethics training and code of ethics
- Chicago Lighthouse tour and survey
- SME blind swimming instructor

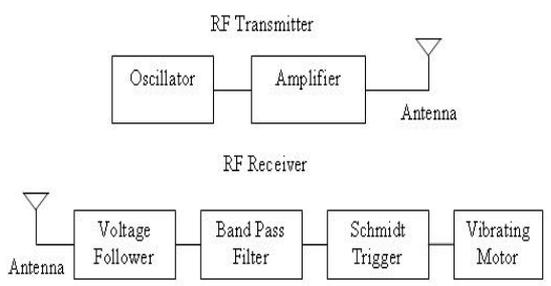
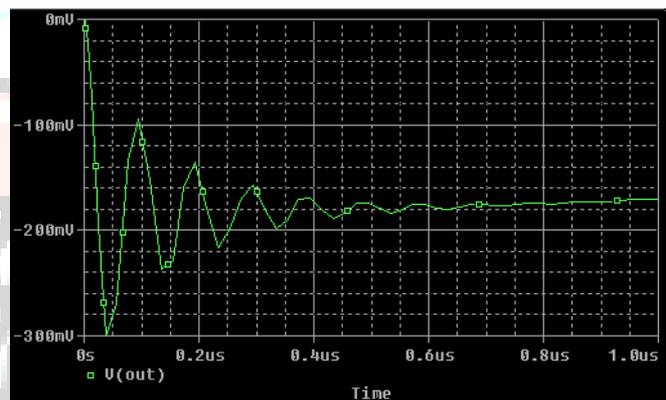
Technology Team Progress

- Ruled out simple EMF and laser system
- Researched transmitters and receivers
- Designed a new transmitter device
- Designed a new receiving device
- Circuit analysis and simulations
- Constructed both circuits
- Conducted initial testing on circuits



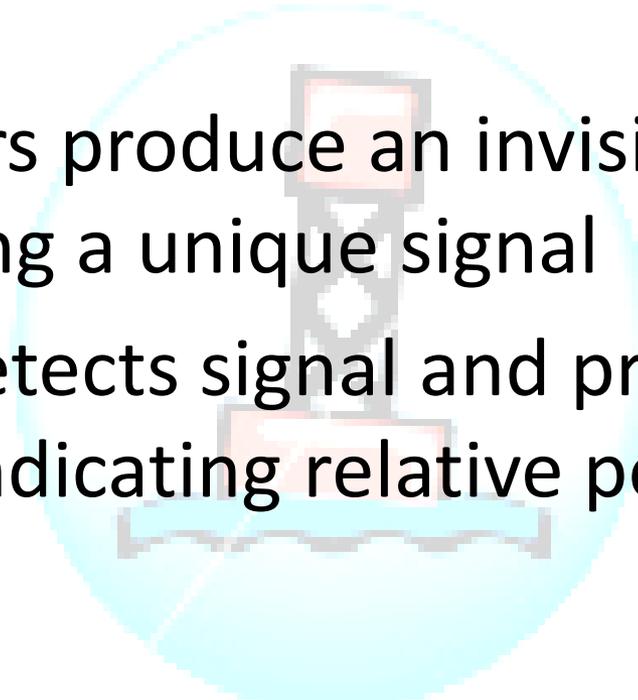
Transmitter and Receiver

- Initial testing showed that the frequency required new operation amplifiers with higher slew rates

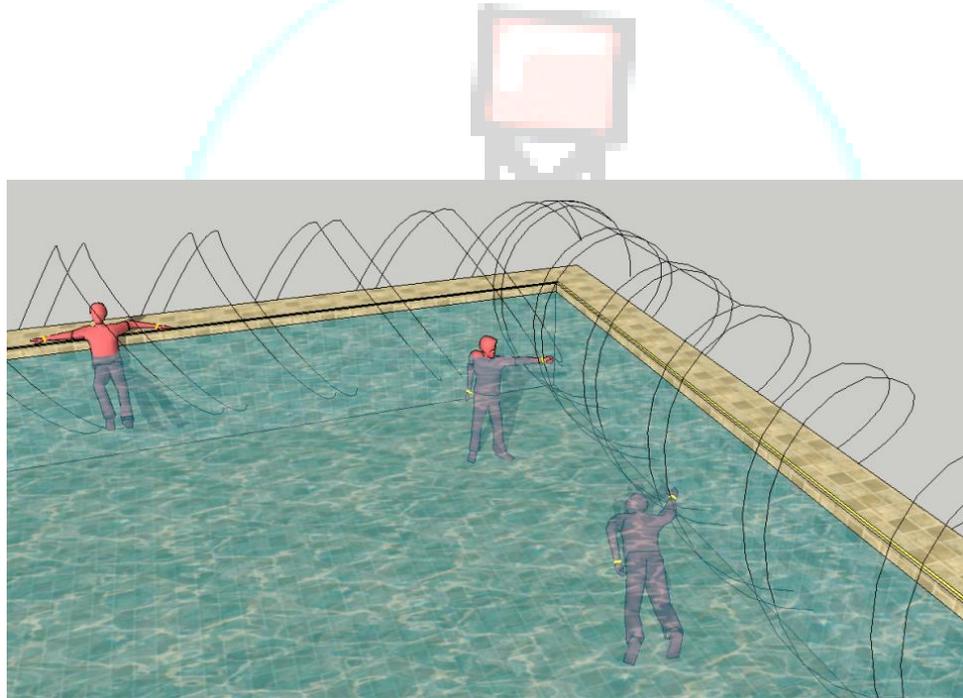


Radio

- Transmitters produce an invisible wall by broadcasting a unique signal
- Receiver detects signal and produces tactile feedback indicating relative position to perimeter

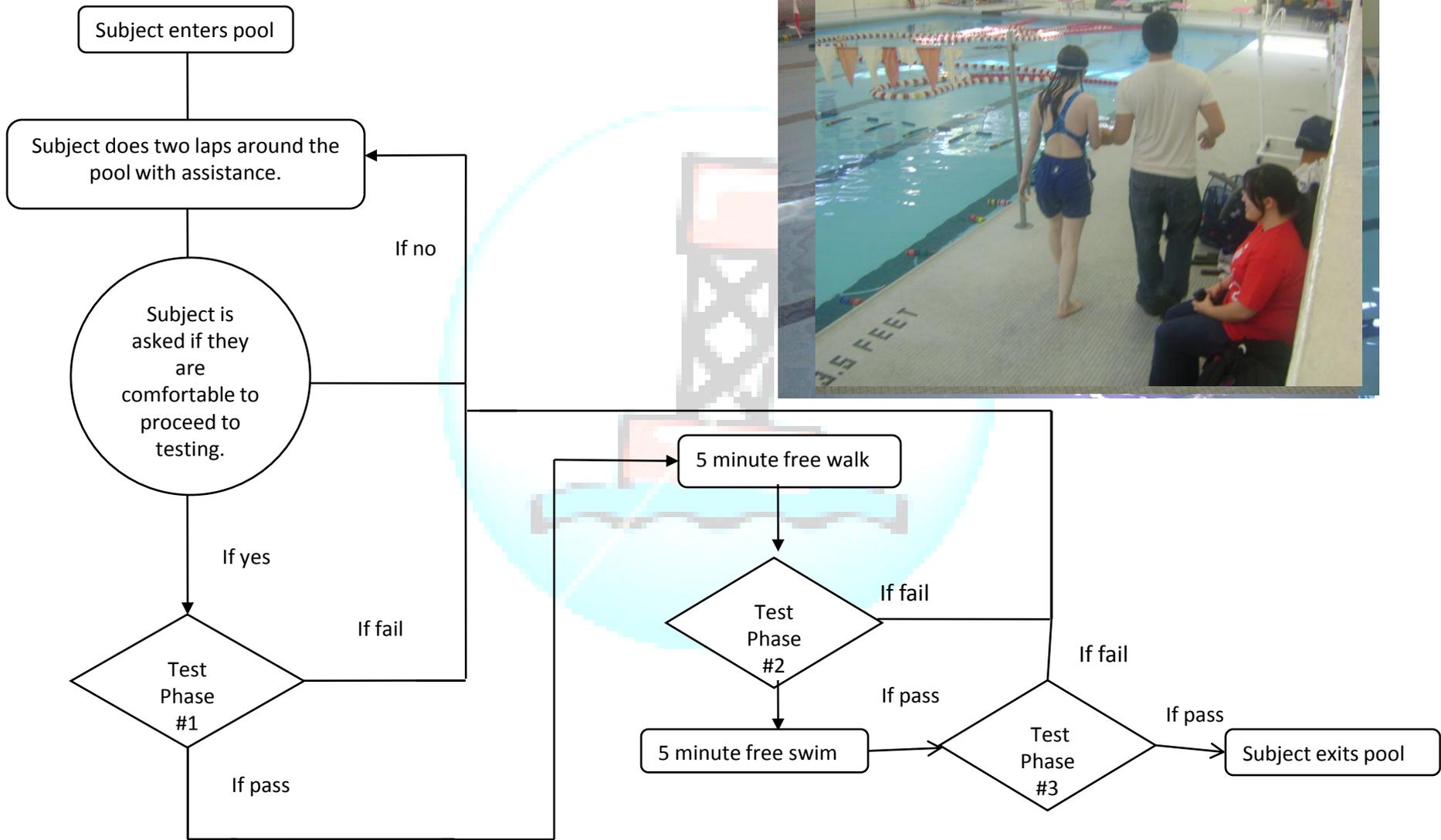


Radio



Communication Team Progress

- Review of literature and methodology for mobility training for BVI individuals
- Established pilot protocol for training
- Tested and revised protocol
- Executed further testing and gained preliminary result
- Based on preliminary result altered test methodology and continued testing



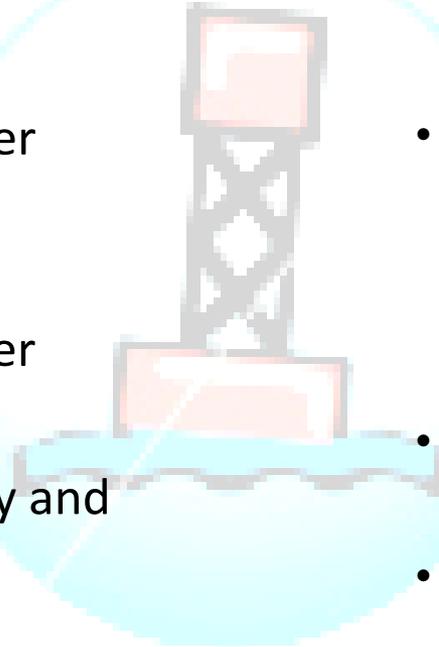
Testing and Results

- Two members of the IIT community were tested using the revised protocol.
- Data showed that comfort in the environment could be achieved without a strong mental map.
- Testing methodology was revised to find the number of laps required to achieve comfort and a strong mental map.

Future Activities

Technology

- Incorporate the receiver into a wrist band to maintain low profile
- Waterproof the receiver and the transmitter.
- Test cue conflict theory and it's effects



Communication

- Conduct significant amounts of testing in order to determine the range of laps required to form a strong spatial-cognitive map
- Incorporate the BVI community into pool testing
- Integrate updated survey onto website

Alternative Application

- **Safe play areas for children**
 - a play area or safe zone could be set up for children so that they are aware of what parts of the yard, or house they are able to play in without worrying parents/guardians.
- **Overall home boundaries**
 - Setting up a boundary system (in walls, or around furniture) would allow the person to feel more independent without their eye stick but would still have that sense of security that they would not run into any objects.
- **Safe outdoor zones**
 - Construction zones could be mapped out to prevent people from walking into objects, under objects, or possibly into a hole
- **Running boundaries**
 - A path could be created so that a blind or visually impaired runner/jogger could use their device to remain on the path, staying clear of other runners or bikers

