



Guidance System, Kayaking for the Visually Impaired



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California Polytechnic State University, San Luis Obispo, Interdisciplinary Senior Project

Project Objectives

To create a more efficient and effective guidance system for the visually impaired to navigate a flat water slalom course

Background

- 75% of all traumatic brain injury causes some sort of visual impairment
- The second most common injury to armed forces personnel is to the head
- Visual impairment, specifically, is the fourth most common injury for veterans returning from war
- Customer:** Team River Runner
 - Established as an organization to provide physical activity and camaraderie, specifically for injured veterans returning from military duty
- Sponsor:** Quality of Life Plus
 - Mission is to foster and generate innovations to aid and improve the quality of life of those injured in the line of duty

Prototyping

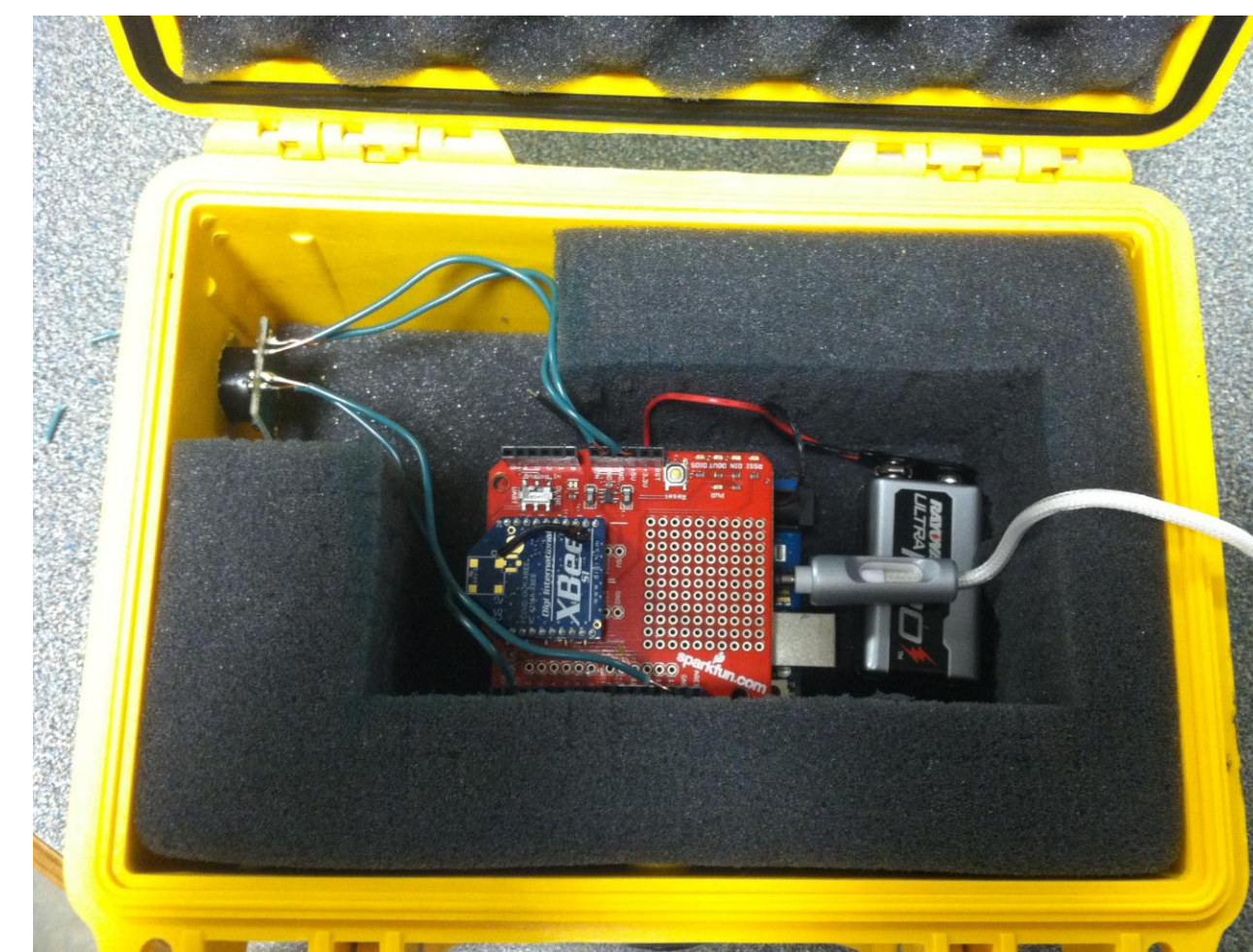


Initial prototyping lead us to design for a point sound source. This was the easiest and most effective way to guide a blindfolded individual around a series of obstacles.

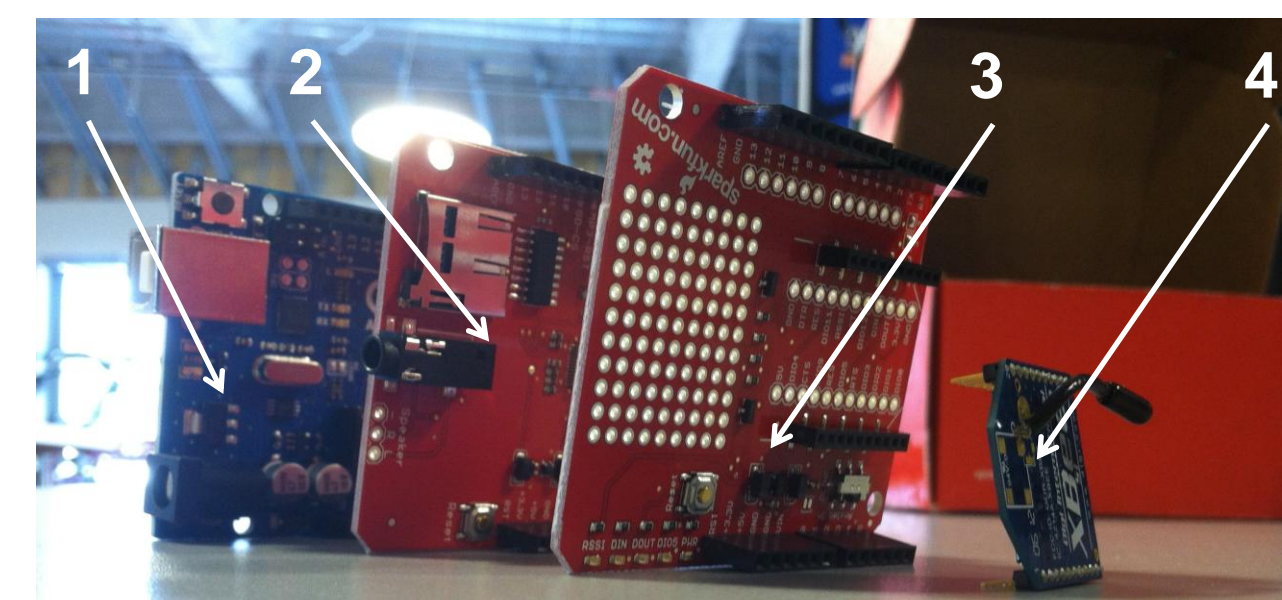


An ultrasonic range finder, similar to sonar, was selected due to its accuracy, range, and effectiveness over a passive infrared sensor or infrared proximity sensor. All sensors were compatible with Arduino hardware.

Final Design



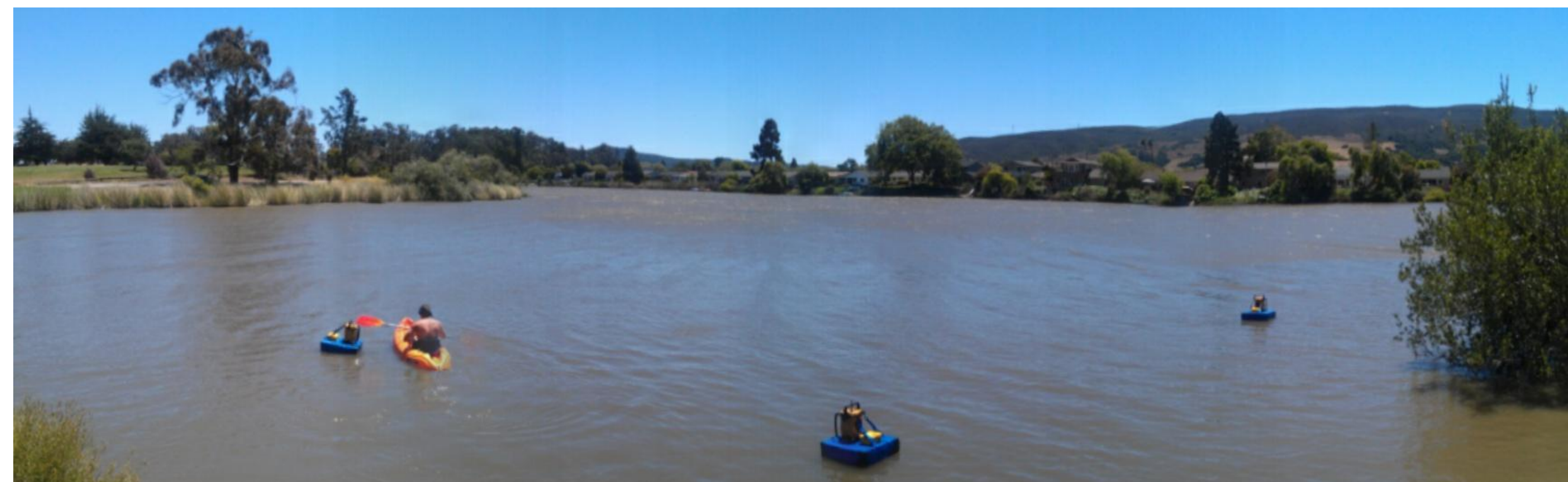
The full electronic components stack inside the Pelican box can be seen above. The ultrasonic sensor is protruding out of the left side and an auxiliary cable on the right hand side.



1. Arduino Uno - microcontroller that communicates, powers and transfers signals
2. MP3 Player Shield - accepts the signal from the Arduino the sends music to the audio output from the MicroSD card
3. XBee Shield – connects XBee to Arduino stack
4. XBee Pro – communicates wirelessly over Personal Area Network to other XBee's



Here William shows the fully assembled buoy in the Cal Poly Rec. Center Pool during testing



1. An Arduino microcontroller is turned on from shore, initiating the microcontroller at the first buoy.
2. Using the MP3 Player Shield, the Arduino turns the music on, which will stay on until a kayaker passes around the left side of that buoy.
3. When the ultrasonic range finder detects the kayaker, the music will stop playing.
4. The microcontroller will then send a signal wirelessly through the XBee Radio to the next buoy, and music will begin playing at the second buoy.
5. This process continues in a cascading fashion until the kayaker has navigated the full slalom course.

Testing & Results

	Size	Weight	Cost	Range of XBee	Water Resistance	Battery Life	Directional Sound	Stability
Target	2 ft ²	<15 lbs	\$1500	>60 ft	Pass/Fail	>3 hrs	60° cone	Pass/Fail
Result	2 ft ²	12.6 lbs	\$1230	>200 ft	Pass	>8 hrs	Pass	Pass
	Range of Sensor	Sensor Detection	Relay	Start of System	Overheating	Reset	Delay	
Target	10 ft	Pass/Fail	Pass/Fail	Pass/Fail	<180°F	Pass/Fail	<1 sec	
Result	15ft	Pass	Pass	Pass	110°F	Fail	2 sec	

Conclusions

- We successfully designed and modified a working slalom system that meets all but two of the initial desired requirements.
- This system efficiently and effectively guides a visually impaired individual through a kayaking course.
- Some obstacles along the way:
 - Range of XBee
 - Integration of sensor and MP3 Player shield code

Future Works

- Automatic reset of entire system from shore
- Fail-safe sensor: Addition of secondary sensor to increase precision
- Consider purchasing waterproof sensor or create a protective housing on current sensor
- Lower cost of individual buoy
- Portability: Shipping to different chapters around the United States
- Consider using rechargeable batteries or solar panels

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