TiresiaScope

Devon Porcher | John Bowman | Brian Young | Tim Kwong | Trevor Hecht

UC SANTA BARBARA
College of Engineering

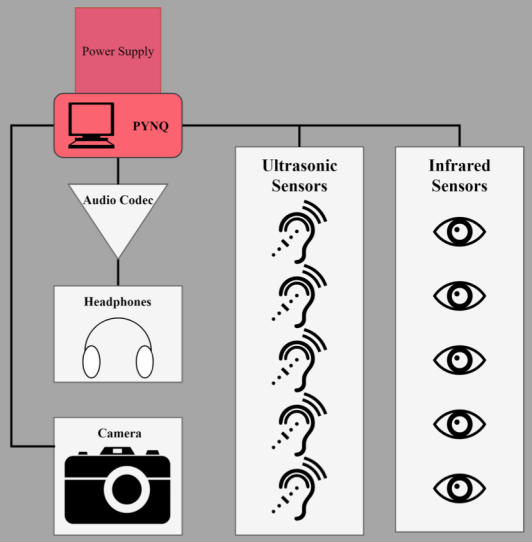
Background

As technology advances, so does society's ability to provide tools for people with physical disabilities. TiresiaScope's objective is to help the blind by creating a headset that uses sounds to assist in navigating their surroundings.

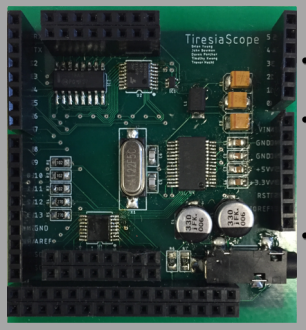
Overview

- Functions as a proximity sensor for the blind
- Detects nearby objects with ranging sensors, detects nearby faces with a camera
- Relays information to user through sound: musical tones indicate object location and distance, alert tones notify of nearby people

Block Diagram

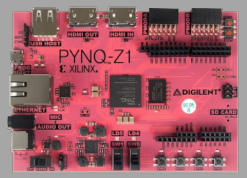


PCB



- Compatible with standard Arduino shield footprint
- Contains the audio codec and the other components required to generate audio on the stereo jack
- Includes connections for the sensors

Hardware / Key Components



PYNQ by Xilinx
- ARM processor supports Python
- Microblaze for hardware control

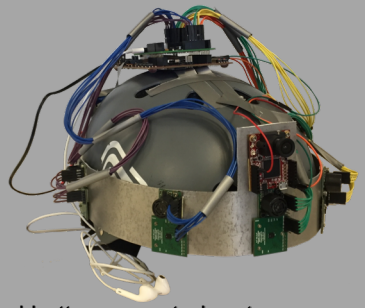
LV-MaxSonar-EZ1
- Ultrasonic ranging via UART
- Range: 160mm to 6.45m

Simblee™ IoT 3D ToF Sensor
- Optical ranging via I^2C
- Range: 100 mm to 2 meters

Audio Codec WM8731
- Stereo audio via SPI

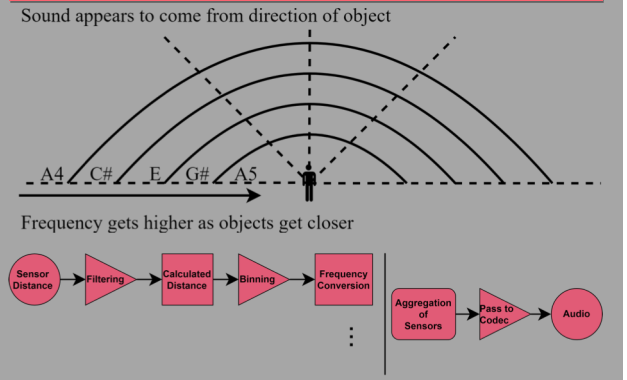
OpenMV M7 Camera
- On-board ARM processor
- 640x480 8-bit grayscale, 30 FPS
- 320x240 RGB565 at 30 FPS

The TiresiaScope



- PYNQ and battery mounted on top
- Five sensor pairs (one ultrasonic and one infrared) mounted around the forward hemisphere
- Camera mounted at front for face detection
- Stereo headphone jack for surround sound

How Sound is Generated



- Each of the five directions have five range bins
- Plays a particular note that corresponds to each direction and bin
- The ultrasonic and optical sensors work in tandem; if one of a pair fails, the other can be used instead

Acknowledgements: Thank you to professor Yogananda Isukapalli, Celeste Bean, and Caio Motta