TiresiaScope

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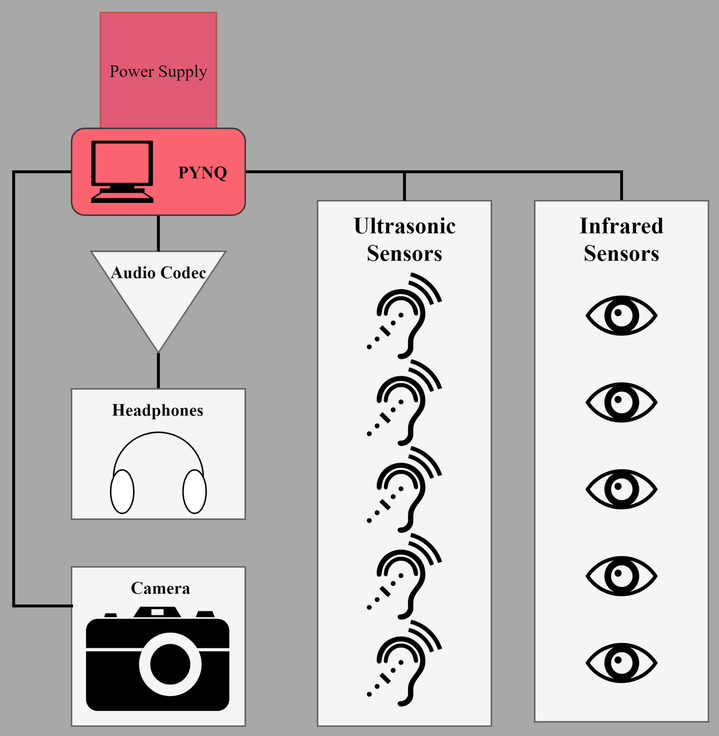
Background

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.

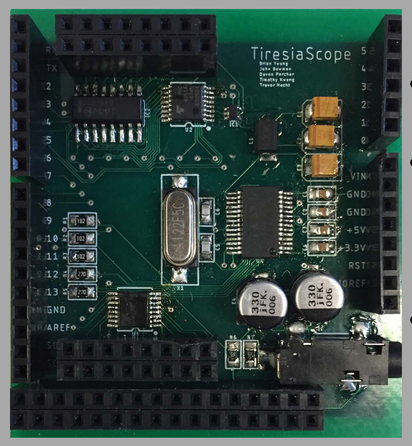
Overview

- 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

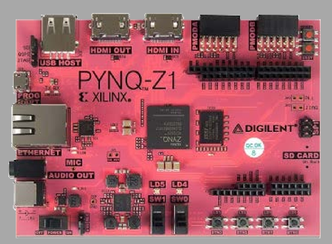


PCB

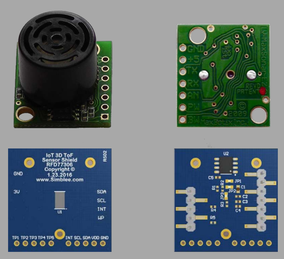


- Compatible with standard Arduino shield footprint
- Contains the audio codec and the other components required to generate audio on the stereo jack
- Includes connections for the sensors

Hardware / Key Components



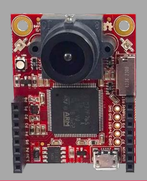
PYNQ by Xilinx
- ARM processor supports Python
- Microblaze for hardware control



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

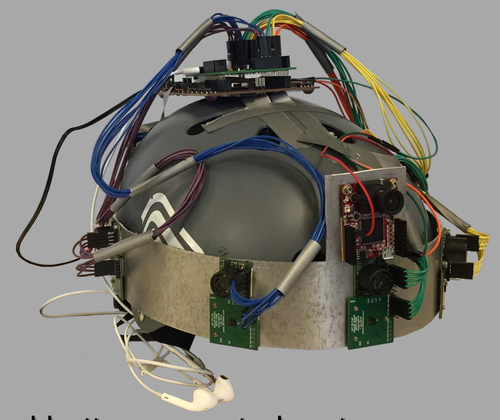
Simblee™ IoT 3D ToF Sensor
- Optical ranging via I^2C
- Range: 100 mm to 2 meters

Audio Codec WM8731
- Stereo audio via SPI



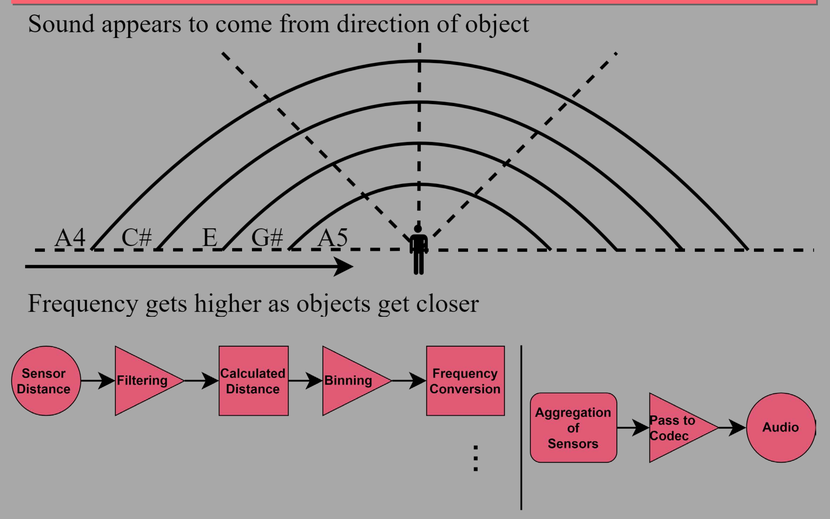
OpenMV M7 Camera
- On-board ARM processor
- 640x480 8-bit grayscale, 30 FPS
- 320x240 RGB565 at 30 FPS

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

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