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.

Background

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

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 I2C
  - 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

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

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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