TiresiaScope
Fall Quarter Design Review

DEVON PORCHER, JOHN BOWMAN, BRIAN YOUNG, TIMOTHY KWONG, TREVOR HECHT
Introduction - What is the TiresiaScope?

• A proximity-sensing device for the blind
• Detects nearby objects with ranging sensors, recognizes text on signs with camera
• Relays information to user through sound: musical tones for object location, synthesized speech for text reading
Development Team

- Devon Porcher: Team Leader, Prototyping, Software Design
- John Bowman: System Design Lead, Software Design
- Brian Young: PCB Design Lead, System Design
- Timothy Kwong: Software Design Lead
- Trevor Hecht: Apparatus Design Lead
PYNQ

- Dual-Cortex ARM Cortex A9 processor supports coding in Python
- Individual Microblaze processors on FPGA control I/O for arduino and PMOD headers
- Microblazes communicate with processor using shared memory
- HDMI, USB, Ethernet also supported
- Audio out is mono only
Camera: OpenMV M7

- On board STM32F765VI ARM Cortex M7 processor running at 216MHz with 512KB of RAM and 2MB of flash
- The OV7725 image sensor is capable of taking 640x480 8-bit grayscale images or 320x240 16-bit RGB565 images at 30 FPS
Ultrasonic Sensor:
Ultrasonic Range Finder - LV-MaxSonar-EZ1

- Detection range: 160mm to 6.45m
- 20-Hz refresh rate
- Reliable and stable range data
- Pulse-Width, Analog, Pseudo-UART Interface options
- Operates at 5V
Optical Sensor:
Simblee™ IoT 3D ToF Sensor Module

- Detection range: 100 mm to 2 meters
- 10-Hz refresh rate
- Breakout Board for mounting
- I2C interface
- Operates at 3.3V
Audio Codec:
PCM3060

- Stereo audio output (and input)
- SPI or I2C control interface
- I2S, left-justified or right-justified formats for audio interface
- Used commonly in digital TVs
Printed Circuit Board
Schematic
Printed Circuit Board
Routing
Software

Python is used for the backend processing

Sensors

• Converts sensor value inputs into noise frequency outputs of a certain tone depending on the range

• Uses multithreading in order to have each sensor read and output values independently

Camera

• Will capture images caught into words and output using text-to-speech
Wearable Apparatus

Current plan:

- Skateboard helmet, with sections removed to make space for mounting

Mounting:

- PYNQ set into top of the helmet
- Camera at front
- Sensors distributed around all sides
Critical Elements

Text Recognition with the OpenMV camera
- Has on-board facial recognition, but not text recognition

Reliability of sensors
- Detecting lower objects
- Lighting for reliable images
## Bill of Materials

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<thead>
<tr>
<th>Part Label</th>
<th>Manufacturer</th>
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Conclusion

Moving Forwards:
• Prototyping full sensor system
• Camera functionality
• Designing software to function with the sound system

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

Questions?