*Vocal*Focals

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Background

Clients: Dr Beth Todd and Dr. Dan Fonseca

For visually impaired individuals, interacting with printed text of normal-sized font is a common annoyance. For nearly 70% of visually impaired individuals, printed text of any size font is inaccessible

Problem Description

Goal: design a proof-of-concept device to empower the visually impaired by allowing them to read text in their environment

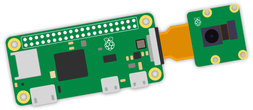
***Vocal*Focals solution:**

- Sunglasses with an embedded camera, processor, and audio output
- Identifies text in front of users and plays it back over audio

Design Requirements

Driven by user experience

- Inconspicuous
- Headpiece weight does not exceed 150 g
- Battery Life of 10 hours
- Durable
- Detect printed text with a minimum 75% accuracy
- Response time of less than 30 seconds



Design Concept Generation

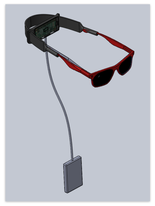


Figure 1
Initial assembly model

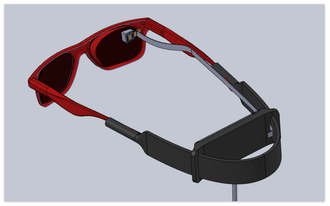


Figure 2
Initial design

Final Design

Figure 3
Croakies design

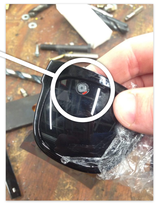


Figure 4
Integrated camera

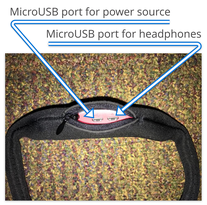


Figure 5
Raspberry Pi power and headphone ports

Testing Results

Camera

- Cable continuity
- Picture quality
- Assembly durability
- Reliability

Software

- User interface
- Reliability

Power Source

- Battery pack

Audio

- Quality
- Reliability

Glasses Assembly

- User experience
- Durability / quality

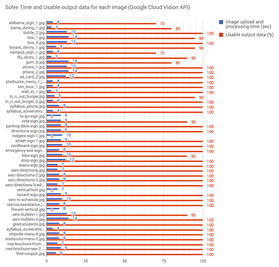
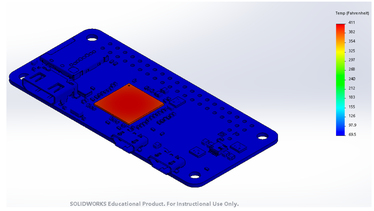


Figure 6
Google Cloud Vision API testing results

Thermal Analysis



Boundary Conditions:
Ambient room temperature: 70°F
Convection coefficient (h): 25W/m²K
Power input: 0.76 W

Figure 7
Thermal analysis of Raspberry Pi Zero W

User Experience

Device Startup

- User plugs device into power source
- User is greeted with audio welcome message
- Text detection automatically begins running

Detection

- Camera captures image
- Device plays *"scene captured, please wait"* audio message
- After a short wait, device plays back smooth audio message with any text, labels, or logos found in image
- Sequence repeats at a 30 second interval

Software

Version control and collaboration: GitHub
Open source linux platform: Raspbian OS on Raspberry Pi
Programming Language: Python
Google Cloud Platform APIs used:

- Google Cloud Vision
- Translation
- Text-to-speech

Application to run scripts when device starts up: Cron

Google Cloud Platform

Final Deliverables

Functioning Prototype

- Able to recognize printed text
- Automatic translation from other languages to English
- Object label detection
- Brand logo detection
- Average response time of 8 seconds
- Accuracy of 96 %
- Unit cost of $90.79

Codebase on Github for further development
Bill of Materials

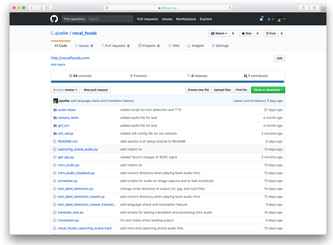


Figure 8 GitHub Codebase

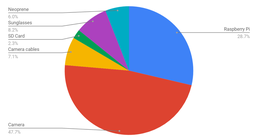


Figure 9 Budget breakdown

Other / References

Website: *vocalfocals.com*

In the process of patenting through UA OTT

Reference:

National Federation of the Blind. (2017, September). *Statistical Facts about Blindness in the United Statesction*