



# AuVi

## AUDIO TO VISUAL

### Our Team

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# Designing For The Deaf

Deaf people live in a world that is unique, one without sound

Society often assumes hearing ability when designs public amenities.

Deaf people face unique challenges that motivate unique designs

## New Study of Hearing Loss Among U.S. Adults Aged 20 to 69

Who has hearing loss?

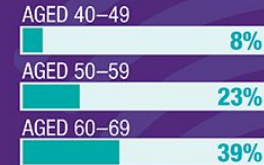


**14%** of adults aged 20 to 69 in 2011–2012

Prevalence of hearing loss has **declined slightly** from about **16%** in 1999–2004.

## Who is most at risk for hearing loss?

Older Age Groups



Men



Prevalence of hearing loss increases with age.

Men are about twice as likely as women to have hearing loss.

Hearing loss is defined as when the average threshold across four speech frequencies (0.5–1–2–4 kHz) is greater than 25 decibels hearing level. The statistics above are for hearing loss that may occur in one or both ears.  
Source: National Health and Nutrition Examination Survey, 2011–2012. Analysis reported in JAMA Otolaryngology—Head & Neck Surgery, December 2016.



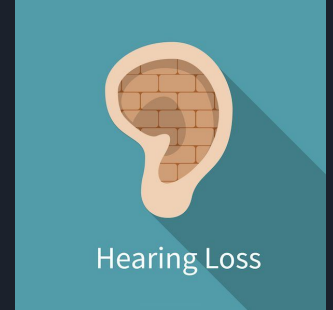
**NIH** National Institute on Deafness and Other Communication Disorders

<https://www.nidcd.nih.gov/>

<https://twitter.com/nidcd>

# Design Problem

Deaf & Hard of Hearing



Transportation



# User Research (Interviews)

Wanted find out self-reported needs

Wanted to immerse ourselves in the community

Talk directly to deaf people, find out their problems

Created survey to formalize answers

# Getting the Right Design



# Design Criteria

## Design Desires:

- Flexible
- Portable
- Nondistracting

## Supported Tasks:

- Notify when someone is trying to pass them.
- Notify when an emergency vehicle is approaching.



# Paper Prototype





# Initial Idea

Ability to sense auditory signals visually

Sensors collect and relay audio information in the users area

Auditory information is displayed into an intuitive, visual way

Like ears, information is presented stereoscopically



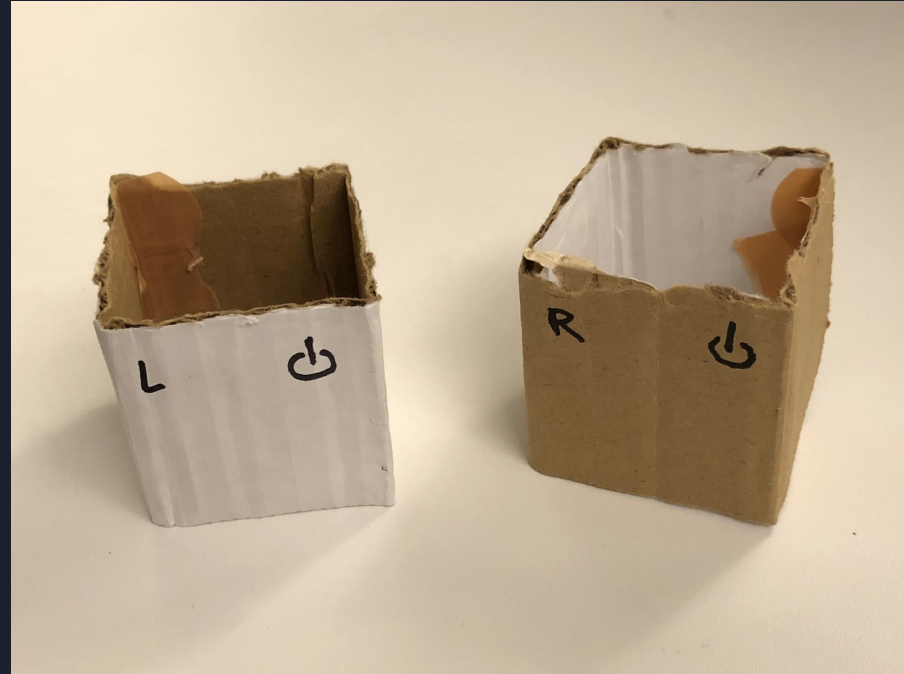
# Sensors

Come in pairs

Attachable to many different types of items

Collect and relay information

Very raw prototype

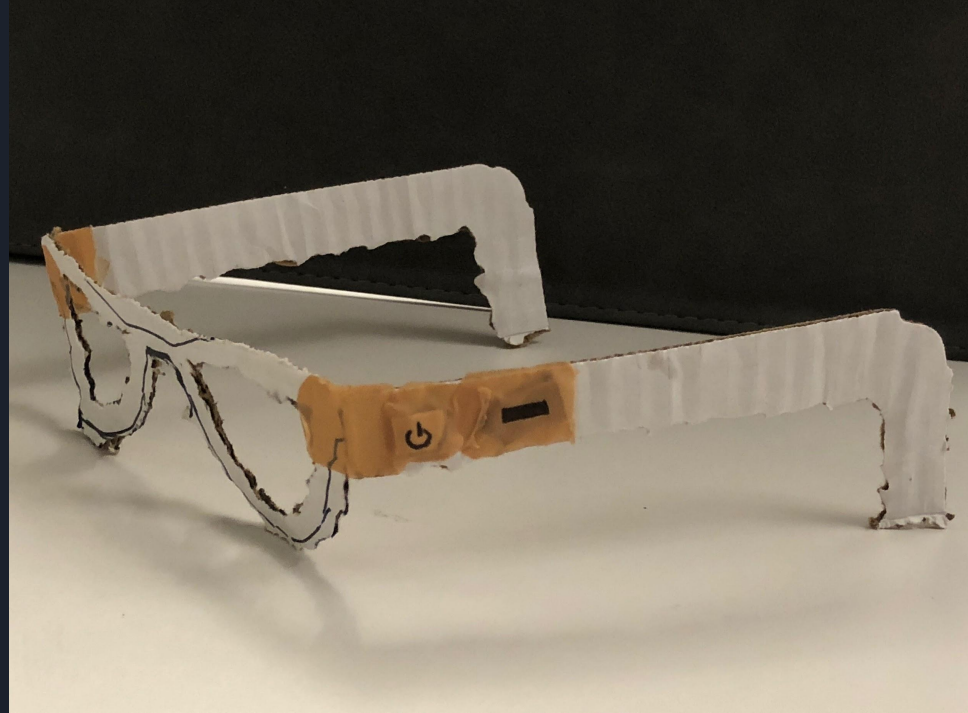


# Glasses

LED lights embedded in the rims of the glasses

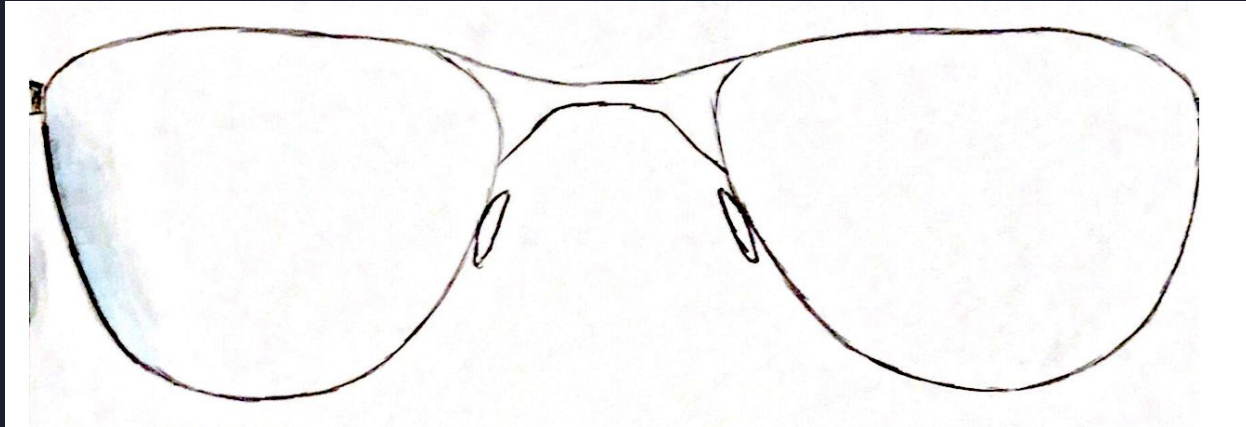
Lights up directionally

Has an on/off button and brightness adjuster on the left side



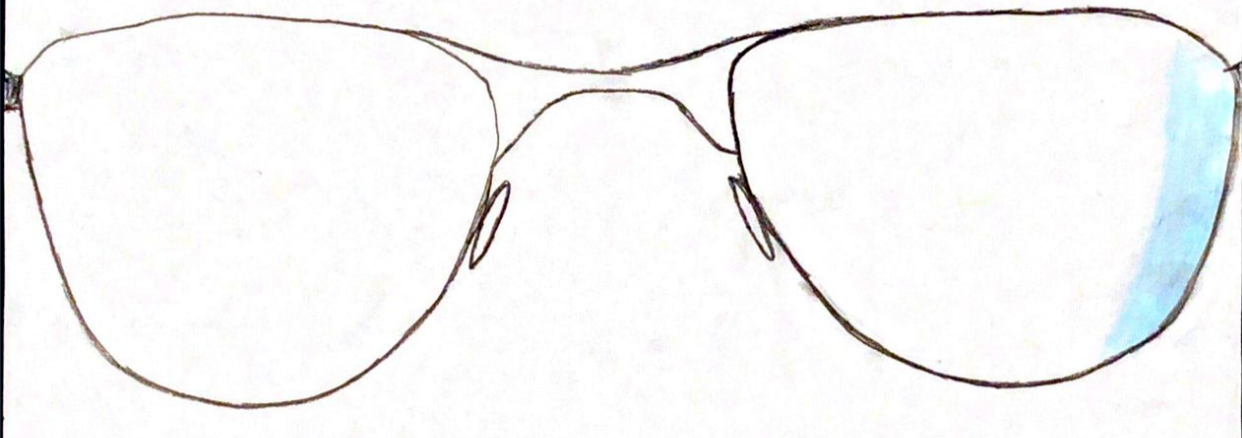


Left



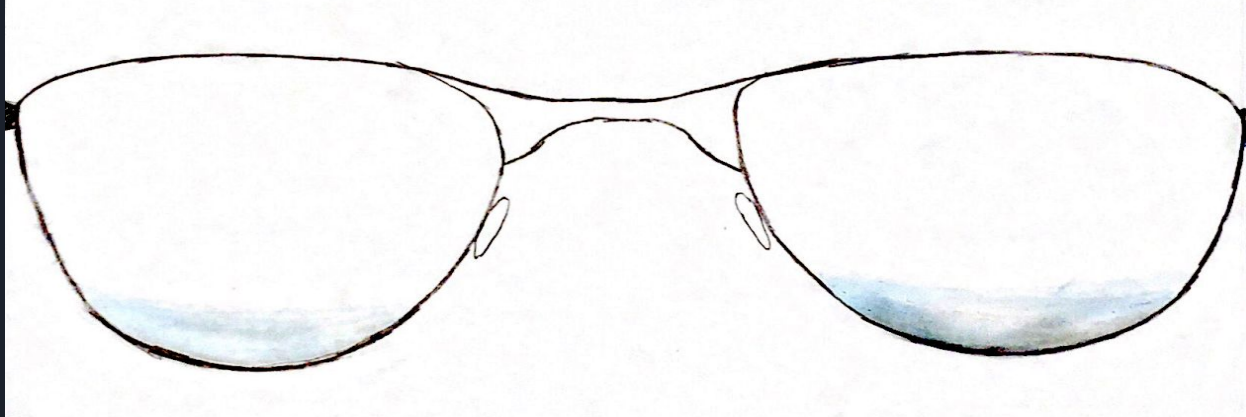


Right



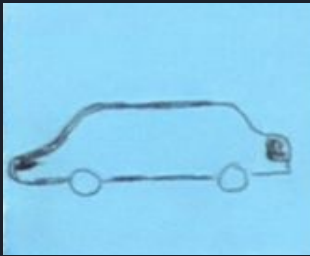


# Behind

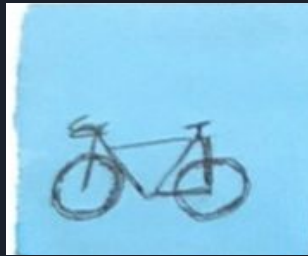


# Initial Icon Design

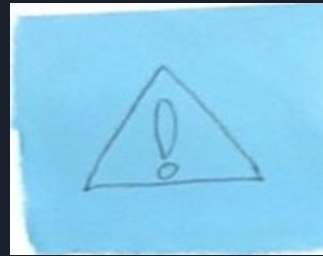
Car



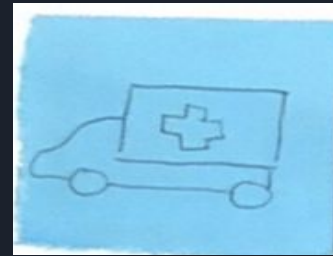
Bike



General Warning



Emergency Vehicle



# User Testing



# User Testing

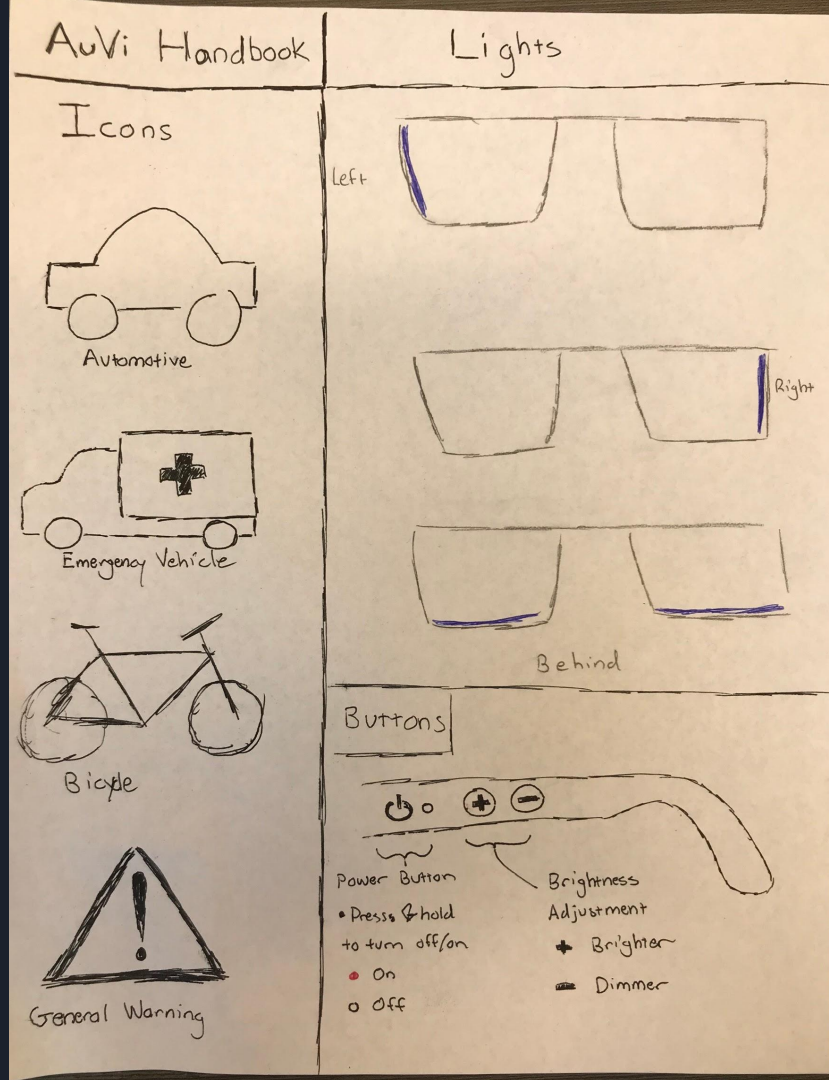
Largely informal

Users were given a manual

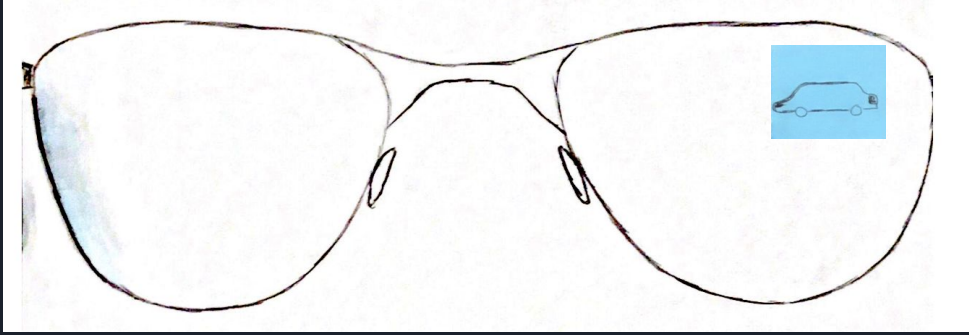
Placed paper and icons around the user while wearing the glasses

Asked to identify source type & location

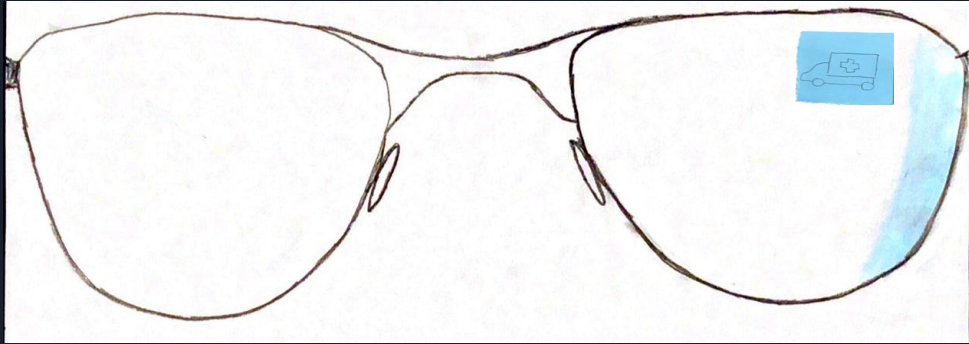
Testing for speed and accuracy







“Car honk to the left”



“Ambulance to the right”

**User Testing**

# Design Refinement

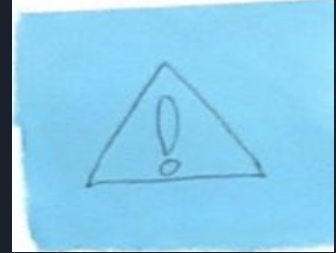
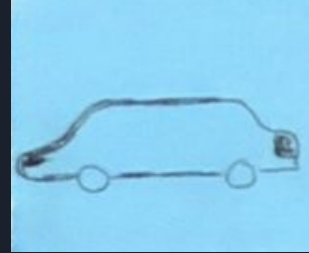


# Icons

“General warning icon doesn’t make sense, not enough icons”

“There are not enough icons, and they are way too descriptive”

“The icons are too obtrusive”



# Update

Icon color now red

Changed general warning

Added two additional icons

Only appear when user is  
looking up and right

Car



Shout



Fire  
Alarm



Bike



Emergency  
Vehicle



General



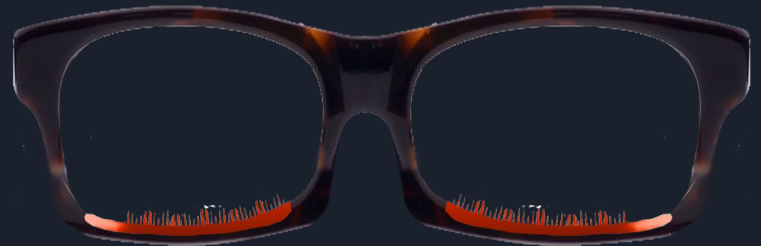
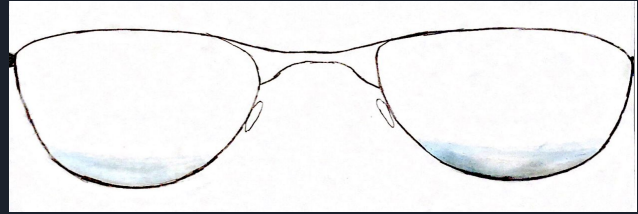
# LED Display

“The blue is difficult to see”

## Update:

Changed our icon and LED display color to red, creating a higher contrast.

Added Gradient lighting.

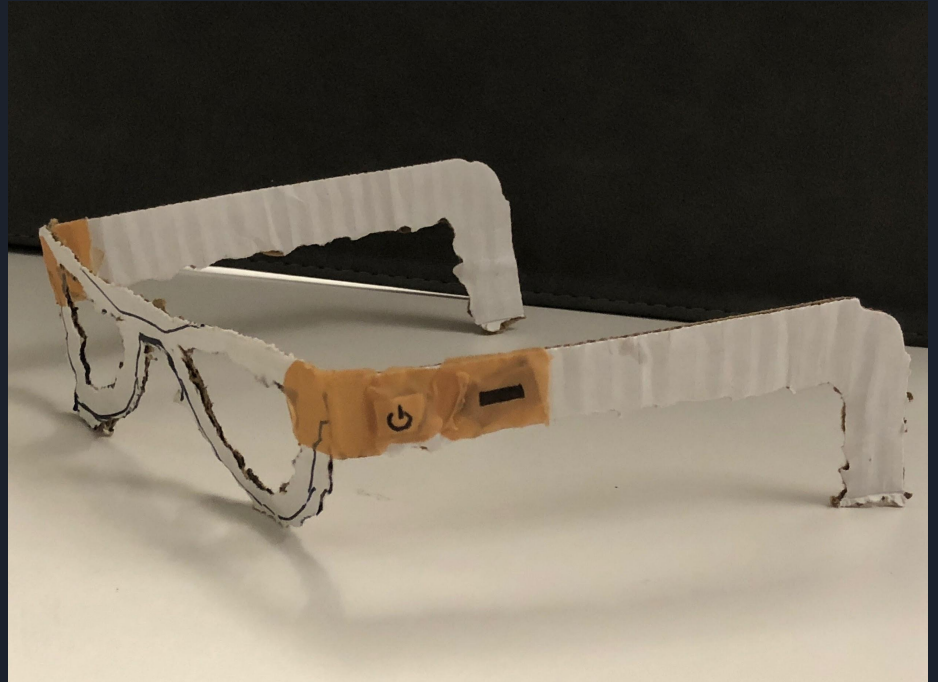


# User Controls

“How do I know when the glasses are on and off?”

“Brightness adjustment buttons not descriptive”

“I would prefer to have the controls on the right side”



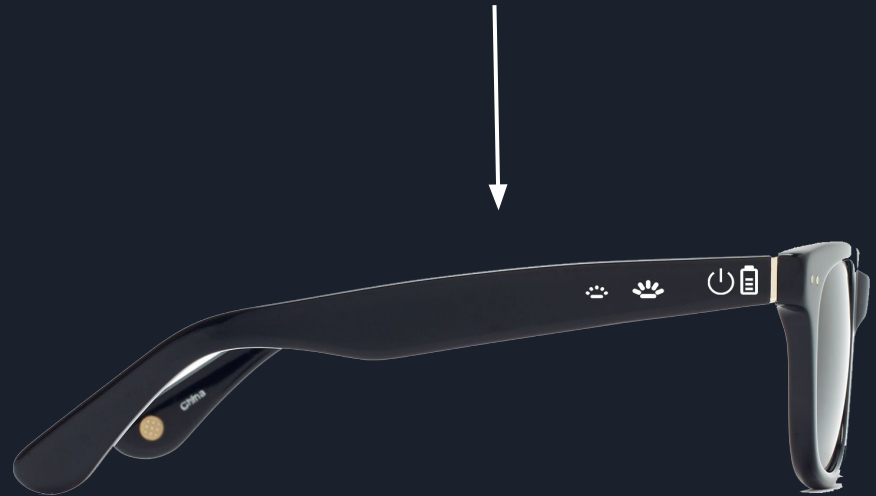
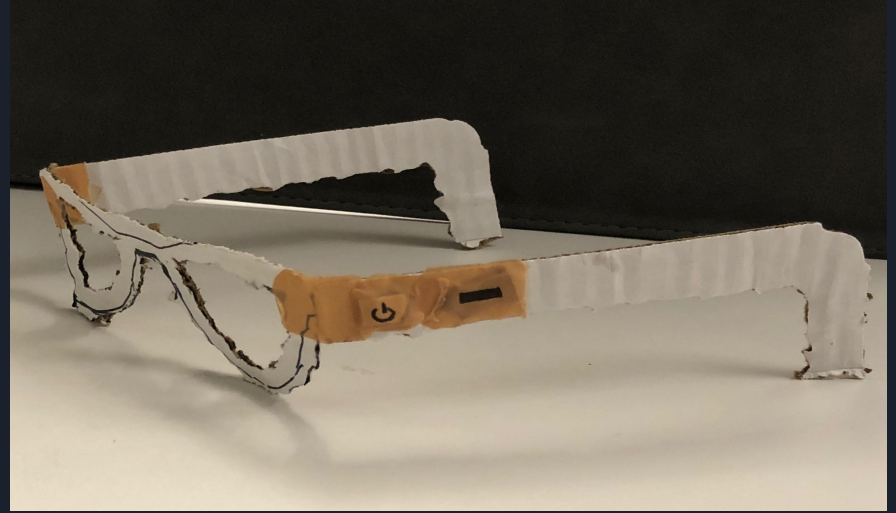
# Update

Added Power indicator

Updated brightness adjustment.

Added charging port

Moved controls to the right side



# Digital Mockup





# Sensors

Wirelessly send info to glasses

Features magnets & attachment clip

Pairing button & indicator

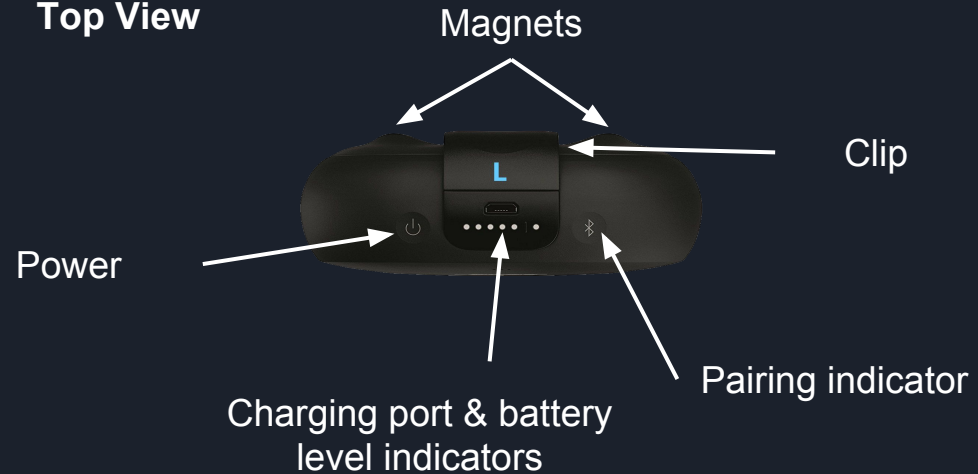
Waterproof

Come in pairs

Front View



Top View



# Attaching Sensors to Cars



# Attaching Sensors to a Bike



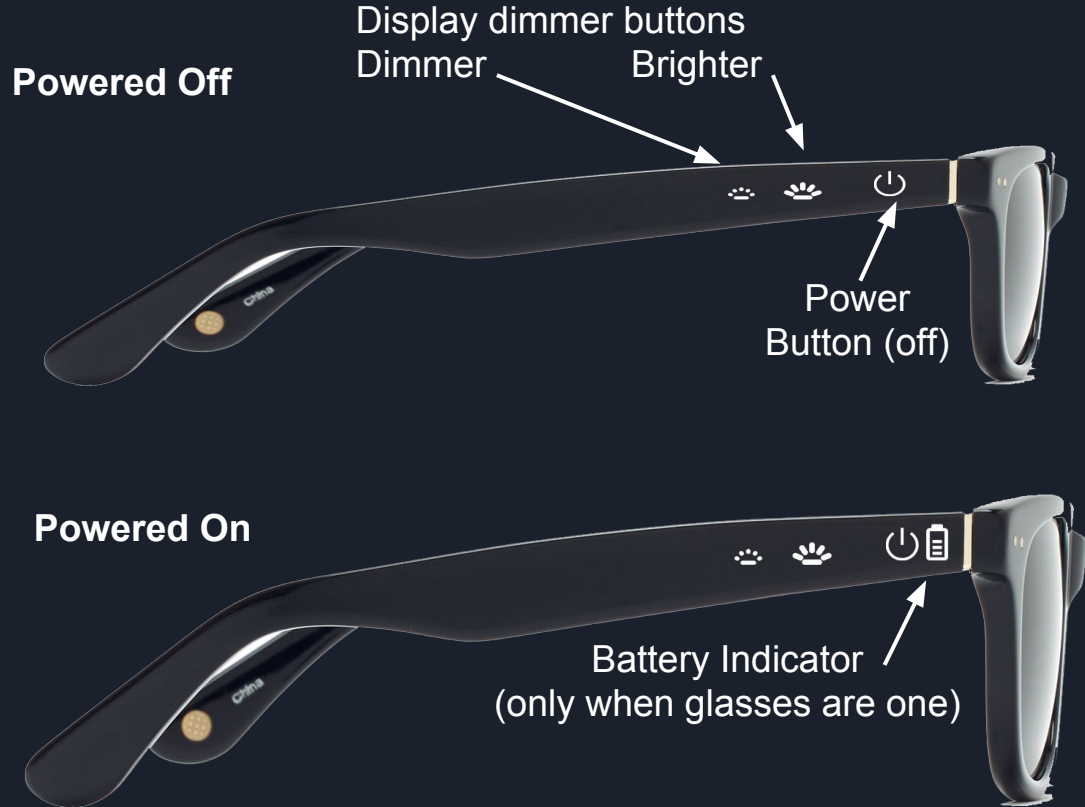
# Glasses

Takes in instructions from the sensors and display it.

An LED gradient ring around the lens lights up to indicate the location of the sound.

Display on the right lens based on Intel's Vaunt smart glasses technology

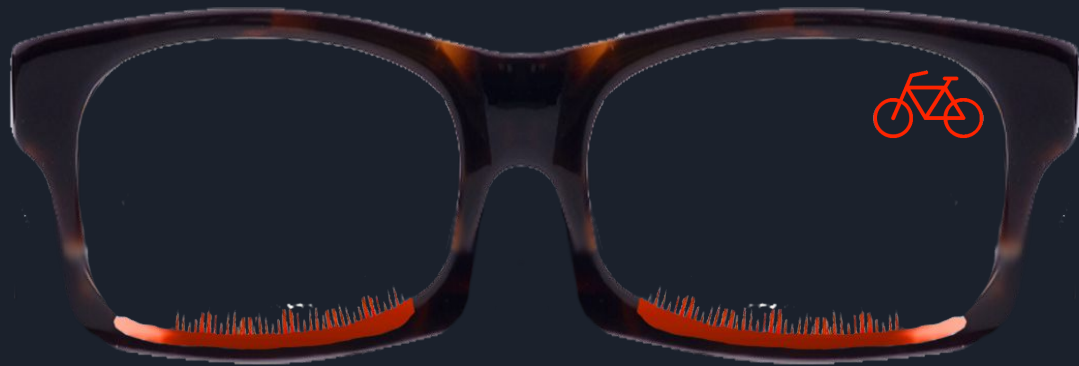
User must to look at the upper display for the icon to appear.



# Interface

## Display

- Icons are displayed in the upper right of the right lens.
- Only appear when looking



## Notifications

- A bar of lights is arranged along the inside of frame.
- Light up directionally



## Task 1

Notify commuters when  
someone is trying to pass  
them



# Situation



YOU



Biker

# Notification

Notification lights turn on when other object is detected



# Situation



YOU



Biker

# Notification

User looks to the upper right and can now see the bike icon. This informs the user that the notification lights are for a bike.



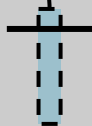


# Situation

Biker



YOU



Biker

# Notification

The other biker moves to the users left. The notification lights shift to the left also to inform user of this change in location. The icon has disappeared from view since user looked away.

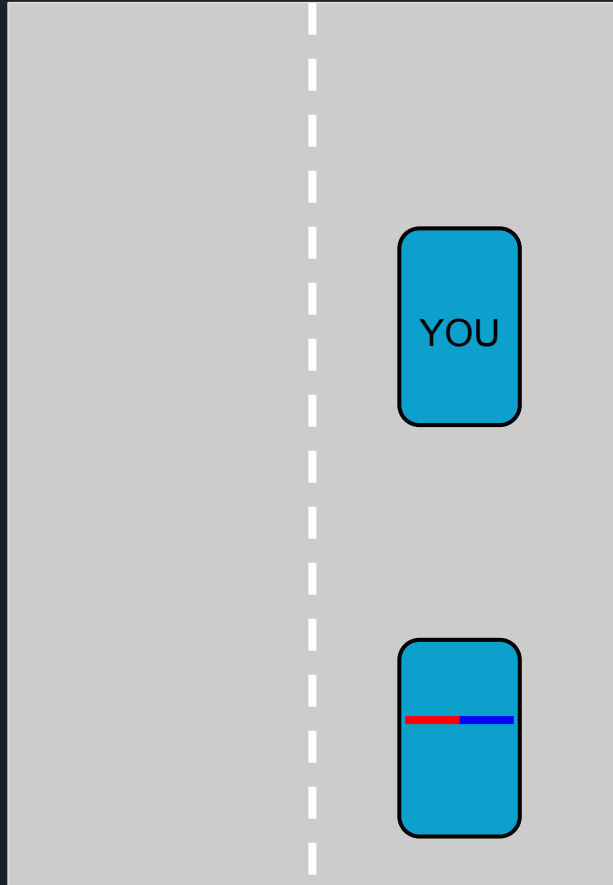


## Task 2

Notify commuters of  
emergency vehicles



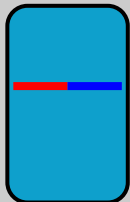
# Situation



# Notification



# Situation

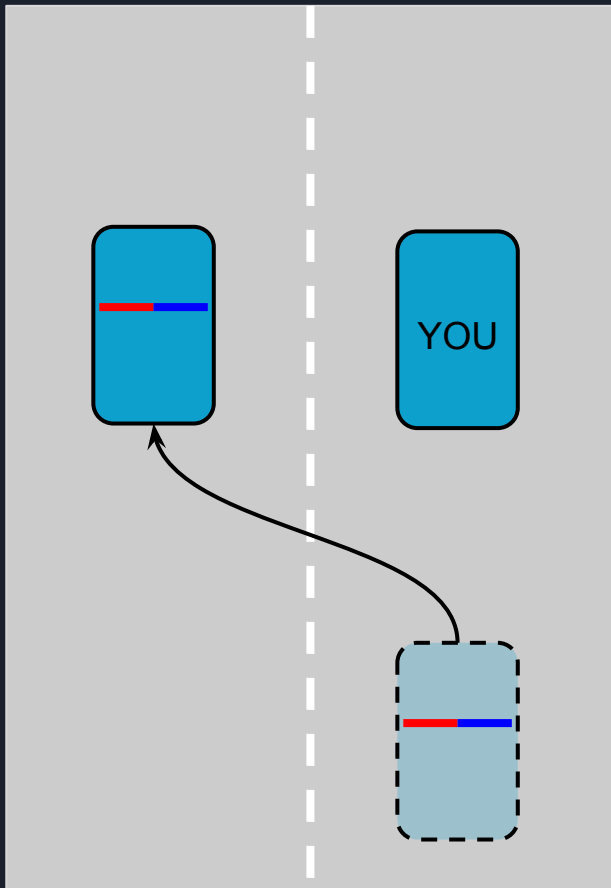


# Notification

User looks to the upper right and can now see the siren icon. This informs the user that the notification lights are for an emergency vehicle.



## Situation



## Notification

The other car moves to the users left. The notification lights shift to the left also to inform user of this change in location. The icon is still visible since the user hasn't looked away.



# Summary





# Things We Learned

Empathy is crucial to good design

You don't need a lot to design

Nothing beats than talking to users

A lot more can get done when you collaborate

**Questions?**





**Thank You!**

