CMSC 20370/30370: Inclusive Technology: Design For Underserved and Marginalized Communities GP4

High Fidelity Prototype and User Evaluation

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Project Description

We are focusing on how people who are deaf and hard of hearing navigate life on the University of Chicago campus and in the surrounding neighborhood. In our research, we considered the task of navigating around the UChicago campus and Hyde Park, especially when users are on the go, for example walking between buildings, biking to campus, or taking public transit. Our technology focuses on improving the safety of users by increasing situational awareness, especially in emergency situations. Our user population is the full spectrum of individuals who are deaf and hard of hearing in Hyde Park. This includes students, staff, and other university affiliates as well as non-university affiliated Hyde Park residents.

Requirements Summary

The task environment is strictly when the user is on the go/in motion. The environment includes ambient sounds like public conversations as well as more important sounds like sounds from other people talking to or near the user as well as cars and sirens.

A primary goal for our system is accessibility. Our system should be affordable, such that low-income users of all income levels can use it. The system must also be easy to use and add value for users of varying levels of hearing.

Another key goal for the system is that it improves safety. Particularly, since we're designing for people who are on the go, we want to ensure that our technology doesn't distract users thereby making them more unsafe.

Evaluation criteria for the technology include (a) it improves situational awareness when users are on the go (b) it improves situational awareness in emergency situations (c) it improves safety on campus/in Hyde Park (d) it is easy to use without instruction (e) it adds value beyond existing technology, whether that be through usability, affordability, customization, or the technology's affordances.

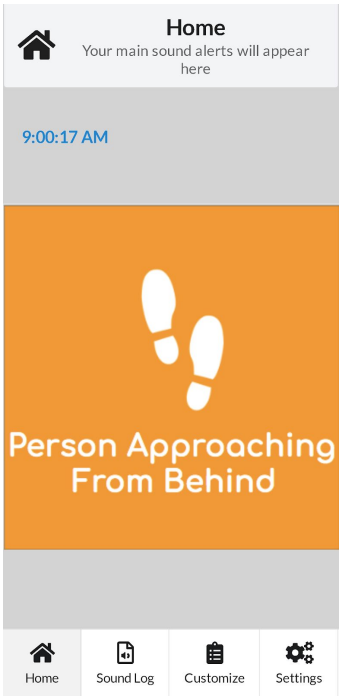
Prototype Revisions

Describe any changes you made to your prototype based on the in-class evaluation

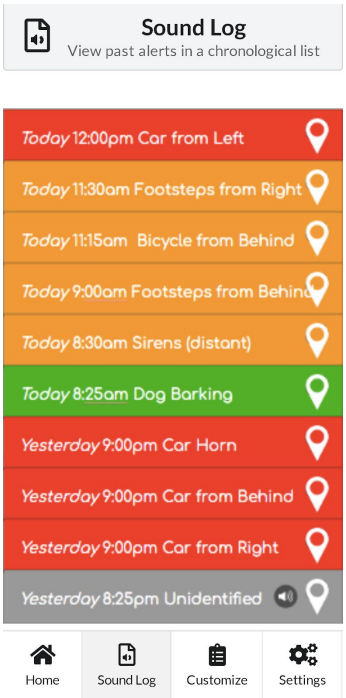
Between the low- and high- fidelity prototypes we spent a lot of time fleshing out features that weren't interactable in the low-fidelity prototype. We built out a prototype of our app using HTML and JavaScript (an upgrade from static mockflow pages) and developed 2 back-end programs, one which detects and processes sounds and their volume level and another which classifies sounds using a pre trained classifier. We also made the app mobile compatible (on Firefox, Press Ctrl+Shift+M, select Galaxy S9).

Based on in-class feedback, we added functionality to our customize page. In particular, we developed a way for users to edit presets and sounds and added in options like selecting a time or location for the preset to activate. We also allowed the user to add a sound of their own choosing through a recording. For the sound log, we put the sound log in reverse chronological order, added date information and color coded logs, and added the "play unidentifiable sound" feature. We also built out the settings page, adding options such as dark mode, font size, vibration intensity, sharing options (though these are not functional as of now). Finally, we reimplemented the speech-based alerts.

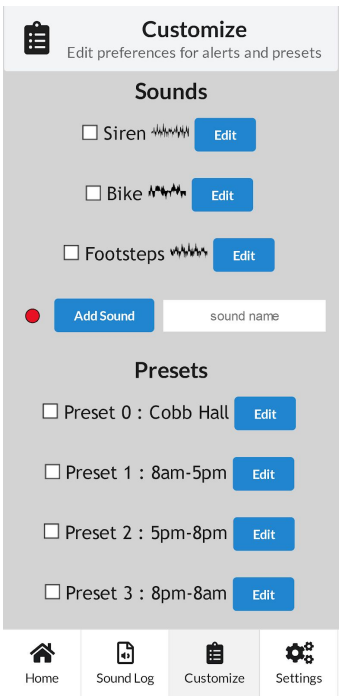
Show screenshots (with descriptions) of any changes made to your prototype based on the in-class evaluation



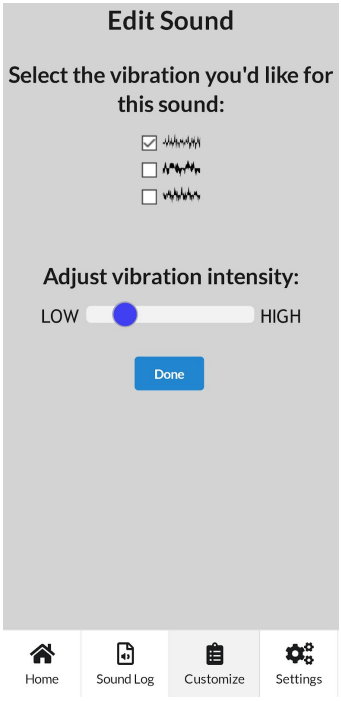
Updated Home Page



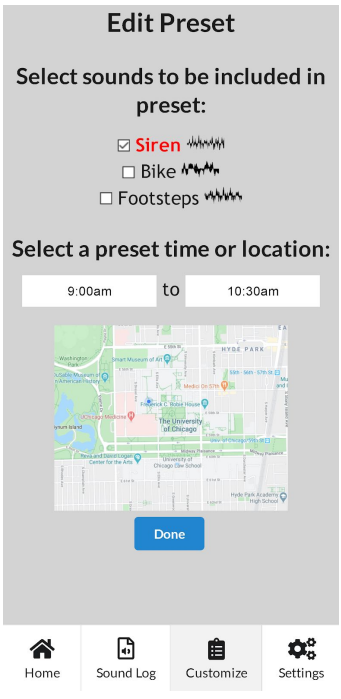
Updated Sou nd Log



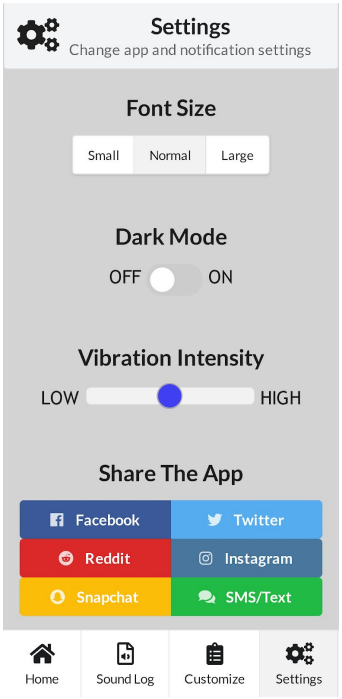
Updated Customize Page



Page to Edit Sounds



Page to Edit Presets



Updated Settings Page

Design Rationale: Describe why you choose to make these changes to the prototype

Many of the changes to our app were related to the elevation from low-fidelity to high-fidelity. These changes were important because they allowed us to get richer user feedback in the final evaluation and start to get a sense of the technical feasibility/technical bugs of our design.

Design changes were made based on user feedback. Users in class were really jarred by the intensity of the default vibration on our wearable, but they noted that if something super important were happening they might want something that intense. This demonstrated a direct need for vibration intensity customization for different sounds. We also noticed that some people had this issue and others didn't, so we complied with variation in user sensitivity to tactile feedback by adding the slider that adjusts vibration intensity across all sounds in the settings page.

Testers thought it might be cumbersome and/or hard to remember to change presets during different times of the day, so we added the time and location options to our presets. Like the vibration customization, this design change added customization capabilities without taking away from the overall design, so it was an easy choice to add these changes.

We also re-integrated the sound-alert component. We dropped this design component in our low-fidelity prototype because we thought the more accessible vibrating wearable was the better

design, but in-class users were unsure if the vibration yielded enough information, so we decided to re-integrate the sound alerts in addition to the vibrating wearable to test in our final user evaluation.

Evaluation with Users:

Discuss your initial evaluation technique(s) and procedures. Tell me why you selected those techniques.

Our evaluation strategy is as follows:

1. Describe task space: Have users inspect the wearable, then tell users to walk around with the device and walk them through the functionality they should be knowledgeable of.
2. Talk-aloud through the app
3. Semi-structured interview
    a. What do you think the device does?
    b. What was easy to use about the device?
    c. What was difficult to use about the device?
    d. Would you use this device in your day to day life? Why or why not?
    e. Would you recommend that others use this device?
4. Short explanation on device features from designers.
5. Participatory Design

We chose to have users use the device without instruction to evaluate our evaluation criteria of usability without instruction. We asked the users to use the think-aloud technique so we could get detailed feedback on/reactions to each of the features before asking for high level feedback in the interview. We decided to also add some time for participatory design so that in addition to making edits and fixes based on user critique, we could directly translate user experience into design ideas.

Discuss the results of your evaluation with your user group and the feedback that you received from participants.

We performed this evaluation with 5 users. Because of the difficulty of access of our target population, we performed evaluations with non-DHH users (we used the proxy user of students who navigate campus with earbuds in). The highlights of the data we gathered as related to our evaluation criteria are listed below.

<u>Improves situational awareness when on the go</u>

- User 3 thought the interface would be useful when walking around campus and distracted while listening to music.

<u>Improves situational awareness in emergencies</u>

- User 4 thought the uncluttered interface made it very easy to digest the information they needed to quickly, thus not making it a burden to glance to their phone.

Improves safety on campus/in Hyde Park

- User 5 commented that the different vibration patterns to classify different sounds is a good way to know when the device is novelty improving your awareness and when the device is warning you of an imminent danger.

Is easy to use without instruction

- User 1 easily understood sound log colors and images and followed preset logic, but stated “it’s a bit under explained overall " and claimed that their understanding was likely affected more by their digital literacy than the usability of the app.

Design Suggestions

- User 1 questioned how the user would add a recorded sound, especially considering hearing impairments of the user group. They suggested that one can add a sound from a database, searching through a list of sounds. As we had envisioned, user 1 claimed that the sound one might want to fully customize is the user’s name, which could be relayed through text input rather than voice/recorded input, since many DHH users might not be comfortable with speech.
- User 1 also described a lack of functionality in the sound log: “I think there’s just a lot more features that’s missing from this.” They suggested that the sound log might connect to the customize page through, for example, a button or sliding feature which says “disregard sounds like this in the future.”
- User 2 suggested including a popup / notification banner for when one is not in the app (i.e. while using Google Maps).
- User 2 questioned if the sounds could be recognized at different pitches than the original input (i.e. if someone says the user’s name in a higher pitch).
- User 2 also questioned if the device is always recording, and suggested showing the notification for the amount of time that the sound is present (i.e continually show the icon as long as footsteps are present). This lead to the suggestion of having multiple windows for the main page in order to show multiple sounds happening at the same time. (Additionally, how the vibration and text-speech handled multiple sounds happening at once came into question)
- User 3 suggested adding a Dark Mode for the settings page and having the ability to edit different vibration patterns for different sounds
- User 4 suggested including a confidence interval next to the logged sound classification so we know how much error is expected.

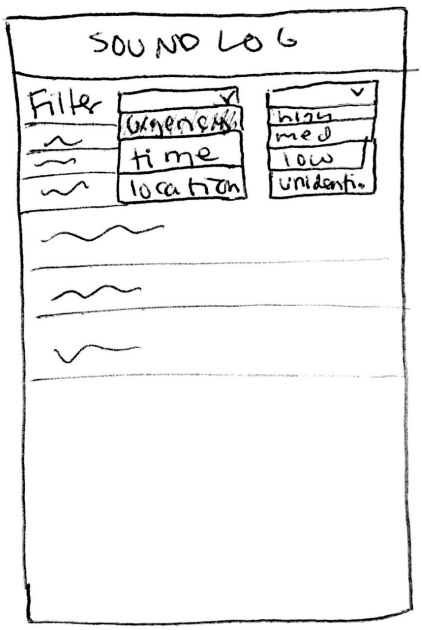
- User 4 questioned the prominence of the preset features, they felt that the ability for the user to customize this functionality would probably lead to confusion as to what setting they were on currently and what vibrations are associated with the assorted sounds
- User 5 requested a feature where one could set the bracelet to vibrate at certain times every day, so you could be reminded of when a school bell would be ringing.
- Users 2 and 5 suggested a 'help' tab or introduction screen that runs through the functionality of each widget in detail, gives a visual guide through the system, and explains how the data is recorded and processed.

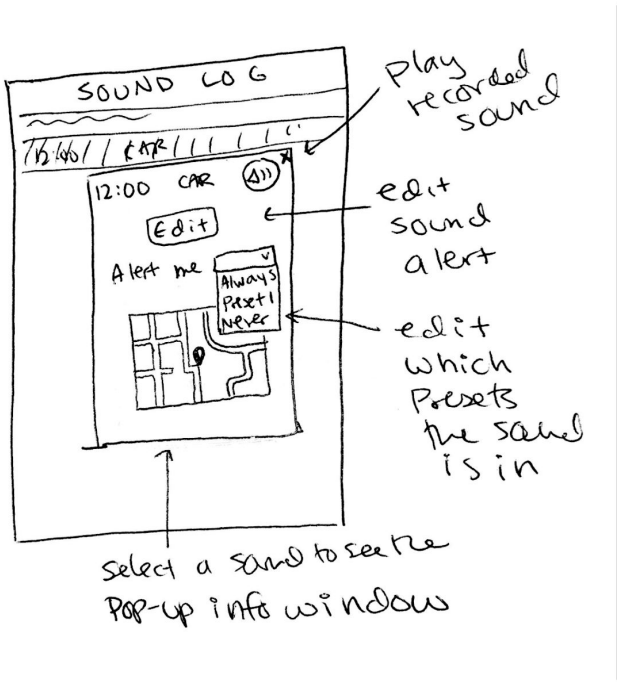
Show screenshots (with descriptions) of any final proposed changes you recommend should be made to the system in the next iteration of the design based on feedback received from your chosen user group

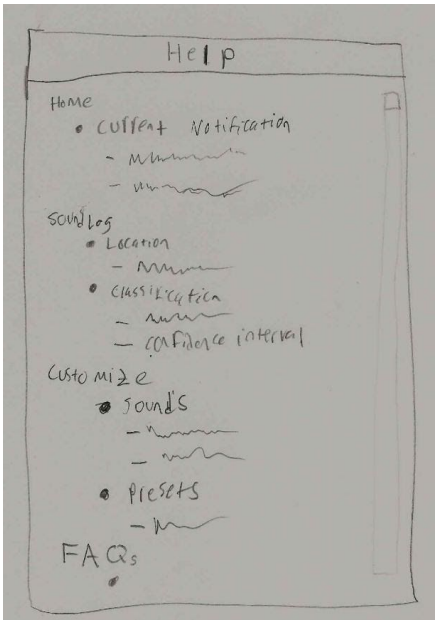
We propose a change to the sound log in which each sound has a pop up window for information about that sound. In the window, the user can directly edit the sound alert for that sound type and they can adjust which presets it is included in. We chose to move on the addition of the pop up window for sounds on the sound log because it allows us to scale up this page down the line. It also provided a platform through which we could connect this page to the customization page. This helps move the sound log from an interesting data collection point to a feature that augments the real value-add of the app, which is the customization interface.

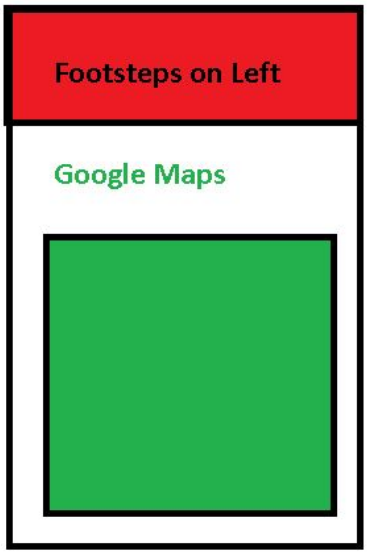
We also propose the addition of a filter on the sound log so users can look at only sounds in certain categories (e.g. most high priority, colored red, or unidentified, colored gray). The filter asks for a filter "by" variable, so far, urgency, time, location, or type (not shown). Then the user picks from a list of options for that variable, for example a list of urgency levels or a time picker option. We chose to add the filter on the sound log because users pointed out that people will probably get tons of sounds logged there every day, which would be cumbersome to sort through if looking for specific kinds of sounds.

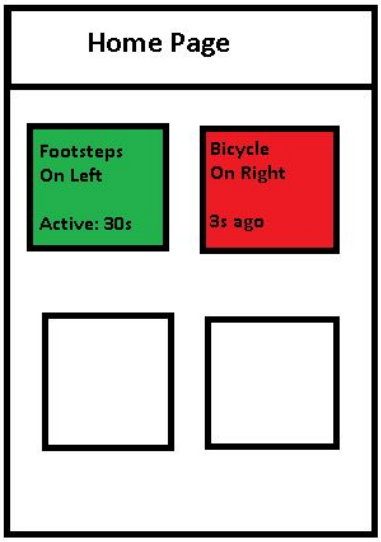
We also propose including a help page that shows users how to use the app, as well as implementing a notification banner for when users are not in the app (i.e. while using Google Maps). To give users more control and information, we would include more options / infinite options for presets (include an "Add Preset" button as we are currently limited to 4 (to avoid having to scroll when using the app) as well as having multiple windows on the home screen that activate when a sound occurs and stays activated for continuous sounds.











Discuss changes in the design and evaluation techniques you would make in the future based on your initial feedback.

If performing this evaluation again, we would have users use our for a full day so they could use it in various situations. For example, users weren't able to see how it would fit into all aspects of their life, including indoor, outdoor, home, class, work, and other environments. This made it difficult for users to understand whether or not it's a device they would fully benefit from.

Simulating tasks in a single environment also prevented us from testing out how the device might work in various environments from a technical standpoint and a usability standpoint.

We would also have liked to actually engage with our user group for these evaluations. Because we weren't able to make leverageable connections to the DHH community (for example through accessibility focused student organizations) and we weren't able to offer incentives for participation, we had a hard time getting DHH users to test our prototype. In the future we would work harder to make those community connections and try to provide incentives.

We gained a lot from the participatory design experience. In future projects, we would include this technique in our initial interviews and our first in-class user evaluation.

Writing Quality and Overall Presentation. Remember to link the project report on your group project website.