CMSC 20370/30370: Inclusive Technology: Design For Underserved and Marginalized Communities GP2

Low to Medium Fidelity Prototype and In-Class Evaluation

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Write an updated one-paragraph description of your project. Simply re-introduce the general area of application, the intended tasks your system will support, and the intended user population.

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.

Briefly state key requirements for your system. Again, the goal here is to re-introduce the requirements developed in Part 1, although it is OK if you introduce new or altered requirements here. Do not exceed one page in this 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.

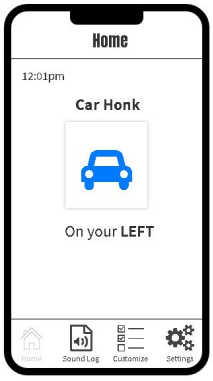
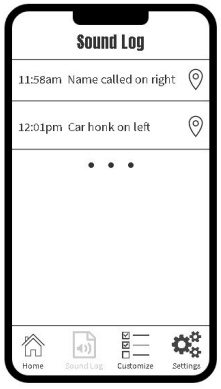
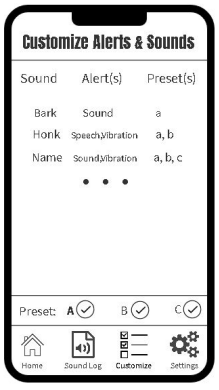
Prototype Description:

An overview of the prototype that you developed.

The prototype we developed covered two parts of our design: the customization app and the vibrating wrist-based wearable. The app was drafted using the Mockflow wireframe and had some functionality working. The wearable was built using a small electronic device which can be made to vibrate using a remote and was connected to a cloth band that could be tied around the user's wrist. We used the remote in a Wizard-of-Oz strategy to induce vibration in reaction to different sounds during our user tests. On its own, the prototype does not respond to sounds from the environment.

Describe each piece of the prototype in more detail, using screenshots or photographs to help illustrate the design in a storyboard. Your storyboard should include the most common cases of interaction. The storyboard should include a written description of the interaction at each point and either pictures/images of your prototype or scanned versions of the paper prototype

Storyboard:

			
The user is about to cross the street when the wearable on their wrist vibrates.	The user stops to see a car drive past them. They look at the app to see that the car was honking on their left. This alert also is said in their earpiece ("Car Honk on Left") if the user has a hearing aid. This is accompanied by the vibration of the wearable.	The user can go to the sound log to see if they missed any other sounds. They notice that someone called their name 3 minutes ago and can click on the location icon to see where on the map this sound occurred.	Next, the user switches to preset C before entering class so they are only alerted if someone calls their name. They can set the type of alert that occurs for each sound, as well as the preset that the sound is alerted on.

Describe at least one scenario of use from a user's perspective.

I am a student who is hard of hearing crossing the midway. One other student on the other side of the street starts to move along the crosswalk. As I begin to step into the street I feel an intense vibration on my wrist and instinctively jump back onto the sidewalk. A car speeds by right in front of me. I look up and see that my light had been red. I knew to jump back because the vibration on my wrist was intense, so I knew that something loud was happening, and since I was in a dangerous place in the street, my instinct was to jump back onto the sidewalk. I had been following the other student, who was carefully timing their walk in accordance with that car, so I didn't check if the light was red. Without my vibrating bracelet, I would not have realized the car was coming down the midway.

Design Rationale: Describe why you choose to create this prototype. What are the advantages and disadvantages of the current prototype in terms of achieving your goals

We chose this specific design (Design 1 in Group Project part 2) because we got the most positive feedback on it at the poster session. We also felt it most complied with our evaluation criteria. We chose to build a prototype based on the original design, but we envision potentially adding on (or recognizing that outside of this class, an extension to the technology could be) elements of "radar" or heat/motion detection feeding information to the user about their environment via the wearable bracelet. We also chose to focus on the "tactile" version of this design because it is accessible to users at all levels of hearing.

Details of how our prototype design fulfills (or fails to fulfill) our evaluation criteria follow:

(a) it improves situational awareness when users are on the go: The app directly relays information to the user about sounds around them, which alerts users to information about the environment that they would not otherwise have.

(b) it improves situational awareness in emergency situations: The design indicates that the user will receive more intense and/or more frequent notifications when more high-importance sounds are made. Even if the user doesn't want notifications for many sounds, they can still use the app in emergency situations, by using one of the more minimal (fewer sounds, only of the highest importance) presets.

(c) it improves safety on campus/in Hyde Park: By improving situational awareness, like in situations as described in the scenario, we will improve safety especially by keeping users alert when they are being approached by a moving vehicle and letting users know when they are being approached by another person (especially from behind). Our main concern, which needs to be tested/evaluated by potential users, is that the tech might distract people, which could result in a net negative impact on safety.

(d) it is easy to use without instruction: the bracelet and app come with default presets/settings such that the user can just put on the bracelet and go. That said, one issue might be that

(e) it adds value beyond existing technology, whether that be through usability, affordability, customization, or the technology's affordances: Unlike a lot of tech designed for this population , our design is not built into the environment and thus allows the user's situational awareness to be augmented regardless of how hostile or unsafe the environment they enter is.

Results of In Class Evaluation:

Discuss what worked successfully in class and why based on participant feedback

Participants generally liked the design and found it's flow easy to understand. Users liked that the bracelet was simple and light (although a few noted that the form factor was nice in theory but our implementation could be improved) and understood the functionality of the app interface. Participants also liked that the user does not have to engage with the visual interface, which aligns with our goal/evaluation criteria of safety.

While many testers were able to surmise use cases quickly, it was clear that many had never experienced hearing impairment, and thus hesitated to opine freely.

Discuss what did not work as well as intended and why based on participant feedback

Our app interface could be made more usable. Participants noted that the sound log should be in reverse chronological order (most recent sound first on the list) so that users can quickly see the most recent sound, especially should a lot of entries populate the log at a given time. This is also a more intuitive design, which would help the user use our tech without instruction. Another usability suggestion was that the app should have the capacity to change presets based on time of day or location, in accordance with the user's schedule. Testers thought it might be cumbersome and/or hard to remember to change presets during different times of day.

Addressing the common concern with tech for individuals who are deaf and hard of hearing, users wanted our bracelet to take extra steps to avoid information overload. Even though our design is supposed to address this issue through the customization app, testers suggested that we have a lighter standard vibration on the bracelet. This way the information will be less jarring and/or distracting to the user. Furthermore, users suggested that in addition to the different vibration patterns for different kinds of sounds as noted in the app, strength of vibration intensity should directly relate to the volume of the sound. This would ensure that the most important sounds are the ones that are being most prominently relayed to the user and further away sounds, which are usually less immediately urgent, are not relayed excessively.

Discuss the pros and cons of the prototyping tools/materials you have chosen to work with

Our prototype showed the type of information and uses that the app could have, giving participants a feeling of how the interface would be used in a real-life situation. However, it wasn't fully usable (only consisted of images and page buttons) so the participants weren't able to get the full experience of customizing their sounds/preferences or scrolling through a real-time sound log. We chose to keep our prototype low fidelity on the app-side because we wanted to make sure we didn't get too invested in our current app design and stayed open to building a completely new interface in response to user feedback. However, most of the feedback on the app simply built on the existing design, so this feature was not completely necessary.

We also felt concerned that the most difficult to use part of the prototype would likely be the bracelet, so we focused more on making sure that that was built in a way that the user could fully get the experience of interacting with. Although we want the app to be usable, the primary way the user interacts with the tech is by receiving information through the vibration of the wearable. This implementation was successful. Even with the Wizard of Oz strategy for the vibrations, testers were able to get the complete experience of feeling a vibration in response to stimuli from the environment.

Although we were able to test the usability of the bracelet through the Wizard of Oz strategy, without fully building out the bracelet we were not able to test how well we can meet our goal of creating a light piece of tech with the functionality described. Since we didn't add the mic, we couldn't debug engineering challenges and figure out to what extent our need to have a mic that can pick up and process sound from the environment will limit how light and wearable our product is. Considering that a lot of existing tech struggles to pick up different kinds of sounds in environments with multiple competing/ambient sound sources, we anticipate this engineering task to be a real challenge to our product design.

Discuss changes in the design and evaluation techniques you would make in the future based on the in-class feedback on your prototype. You will implement some of these changes for your final evaluation in part 4 of the project.

We will make the following changes to our design based on user feedback:

- Change the sound log to be in chronological order with the most recent sound at the top of the screen (as opposed to the bottom)
- Have the vibrating wearable be less intense or vary depending on the alert importance *as well as the volume of the sound*
- Allow users to include more settings for preferences such as the (time of) day that they are active
- Make a more comfortable and non-obtrusive bracelet design

Finally, during the evaluation, participants weren't using the prototype in the right context (i.e. while walking down the street). Thus, we could not see how users would react to

stimuli in real emergency (or pseudo-emergency) situations. Thus we were not able to fully test the safety criteria with the prototype in class. We will evaluate the final prototype in outside environments in order to test this criteria, which we still maintain as very important to our work.

Remember to link the report on your group project website. TODO