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CS 4590

<div align="center">Evaluation Plan</div>

Research Questions:

1. "Will the user be able to tell if the system reports an error?" This question is important as so far I've only described what successful uses of the system look like. I have not defined any protocol for if the system has an issue or some sort of malfunction. I plan to have a section dedicated for what could go wrong and how the user can fix it in a separate section.

2. "Does the user have some sort of control over what kind of sounds they can hear?" Yes, I plan to have two different types of sound (beeps and voice AI) that will help the user to perform tasks. I will explain this more in detail, and explain its relevance for the overall project.

3. "For the two sound types - beeps and voice AI - why are there two and is one better than the other?" I feel like this is a good question to ask because it can seem a bit redundant to have two entirely different systems for sound when one should be good enough. I do have an answer for this, and I will explain why both systems are ultimately necessary for the project.

4. "Will the sounds themselves of the system inhibit the user's ability to perform basic tasks?" This seems like a simple yes or no question, but I can better explain in detail how the actual loudness of the sound system can affect the user. I believe this is relevant

enough as a question since the user's ability to perform tasks is the most important

component of the project.

Participants and Recruiting:

I am primarily looking for users who have suffered some sort of nerve damage that impairs them from being able to do basic tasks. To get a bit more specific, I want a user who once could do a task, but after an accident, they are no longer able to do it (at least not able to do it at 100% efficiency). This is somewhat different than a user who has spent their whole life with inherent nerve damage, and thus might not necessarily know what performing a task at 100% efficiency feels like, as opposed to someone who DOES know what it feels like. Nevertheless, I am open to both kinds of users, and the way to recruit them is by sourcing out local hospitals and retirement homes. I feel that these two locations are the best areas to find my target user since many hospitals have impaired patients, and many retirement homes have elderly people who may not be able to do tasks like they once could.

Measures:

- Success Rate of Task

- User's Heartbeat

- User's Reaction Time

- Time Taken to Complete Task

- User's Preference for Sound Type

Protocol:

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- Preparations: Some things I need to prepare beforehand are necessary for the actual use of my project. Aside from my simulator device itself, I plan to have cups of different material types (paper, plastic, metal, ceramic), cookies, and a few miscellaneous objects (like shoes, toys, and a backpack). Each of these items will help me to test out each scenario that I outlined in previous deliverables. The coffee and cookies would also be complementary snacks for the user for participating in my project.

- Introduction: I will introduce myself to a potential user that I am a college student who is looking for someone with nerve impairments. I would like to know if they are willing to help me with my sound-based project. If they agree, I will then describe the evaluation process, and explicitly inform them of what will happen and what data will be recorded.

- Project Description: I will explain what my project is, how it works, and what I intend to do with the data that gets recorded.

    - To the user, I describe my project as "an auditory system that continuously records sound data and converts it into usable data that can help guide the user to perform basic tasks (that their nerve damage prevents them from doing)".

    - How the project works is the user has a set of devices (think of something in the shape of a pen or a small ball) and this is what will collect the data for the system. When the user performs a task, the device will collect data and then inform the user of the context of their situation and/or any challenges they might come across. For example, if the user was eating something, they can hold the device to

their cheek and the system will get the sound of their chewing and inform the user if they are chewing properly and when it is safe to swallow. All the user has to do is select what type of task they will be doing, what kind of sound type they prefer, and when they are satisfied with the data received.

- The data that gets recorded is any specific sound heard with respect to the task being performed (an eating task correlates to chewing sounds, or a walking task correlates to footstep sounds of the ground type).

- Task 1: Eating

  - The first task that I will record is eating. For this, the user will eat the cookies that I have provided them with. I have both soft, chewy cookies and hard, crunchy cookies. Both are essential for this task as they can provide different results. Both foods could be liable for choking, but hard and crunchy foods can be a bit more dangerous. With that out of the way, the user is now ready to perform the task. This time, an external microphone is used to collect the audio. It can be held in one hand while the other eats the food, or the microphone can be attached to the ear, which is close to the mouth. The data that gets collected is the sound of the chewing and it is used to help the user know if they are chewing properly or not. If they are, they receive a nice constant stream of sounds that informs them that they are on the right track. But if it sounds like the user is not chewing properly (the food is next to the teeth and not between it), then the system will inform them that they need to readjust the food in their mouth. They could use their tongue, cheeks, or even their fingers but the main point is to get the food back into place. Once the user is done eating, they can end the task on the simulator.

- Task 2: Measuring Temperature

    - The first task the user will do is to use the modified pen device to tap different materials to get a sense of temperature. I will offer various types of cups to the user. For the experiment, the user will activate the pen by tapping it near something, and based on the sound it makes, it will convert into readable data for the user that determines the temperature of the material. If they use it on a table, it should record a sound, convert it into readable data, inform the user what temperature it is and let them know if it is safe to touch. Because different materials carry different sounds, the device can determine the conductivity of the material and see if it is safe for the user to touch. During this task, I will measure how long it takes for the user to get used to the pen and what things they measure as well as the temperature of the materials received.

- Task 3: Walking Around Objects

    - The next task involves walking around objects that the user is not aware of. In more practical uses, this would work better for outside environments (hiking trails, tree paths, etc) where obstacles are not as easily seen, but for the sake of proof of concept, this experiment should work fine. I will place the miscellaneous objects around the user (the shoes, backpack, and small toys) near their feet. Some will be close to them and others will be a bit farther. The user will select the "walking" activity on the simulator, and use a modified device that looks like a small ball to listen to the audio closely. When the activity starts, the user will drop the ball near them, and in a process similar to echolocation, it will determine what sounds get absorbed by nearby objects. The device will inform them what objects

are nearby and if any are in dangerous proximity (for tripping). Within the

simulator, they can adjust the range of the ball to get what objects are nearby it

(keep in mind longer ranges may not be as accurate as smaller ranges, but this is

pretty standard as far as normal echolocation goes) I will measure how long it

takes for the user to get used to the ball, how often they might hit an obstacle,

how successful they are at overcoming the obstacles, and overall how long it takes

for them to complete the task.

Analysis:

After completing all three tasks, I should have enough data to work with to assess my simulator and adjust as needed. If I find out that the user prefers one sound type over the others (beeps over voice AI for example) that can help me to focus on that sound type instead of getting split down the two. For the tasks themselves, the success rate is what I consider to be the most important component. If the tasks have a high passing success rate right at the start, then I kno that I am definitely on the right path. However, if I am only getting satisfactory results, I still consider that good but I know I should be looking for areas of weakness. If the success rate is failing, then I feel that I should restart and come up with a different method to complete the task. Also, if the tasks are taking longer than expected to complete, then I have to go back and readjust the process so that it works more efficiently. With all these things considered, it is now just a matter of tweaking each task method until I get a success rate that I and the user are happy with.