Product Reflection Paper

Senior Design Project I

Techblazers

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Introduction

People who are visually impaired have an issue with viewing objects in their daily lives. A computer keyboard is a good example since the keys on the keyboard can be difficult to view due to their font type, size, and color. In addition, people who do not know how to touch type may experience several issues such as needing more time to complete documents, browse information, or create a presentation. It may also cause physical issues such as neck strain as someone looks down at their keyboard along with bad posture. The Keyboard Finger Position Detector and Display (KFPDD) is a potential solution to these problems as it enables the user to fixate on their display and view the keys that they have selected on screen without having to look down. During the week of November 1st, we had the opportunity to interview a few individuals about our product and collect some feedback. The team interviewed two faculty members known as Mr. Fujian Yan and Mr. Rahman Rakib, and two individuals who have worked with the visually impaired known as John Jones and Isabel Medina Keiser. The interviews were conducted based on the product's relevance, aesthetics, functionality, price-point, and suitability to solve the problems for our target audiences.

Interview 1 - John Jones

John Jones is an Executive Director of the Media Resources Center at Wichita State University. His experience with the visually impaired provided various directions for our product since most individuals that he worked with were fully blind which make up 10% of the visually impaired. He remarked that many individuals use screen readers and voice assist as a solution when typing. In addition, he believed that our product has

the potential to make an immense impact since we are aiming at the category of people that many of us will eventually be a part of as a person's vision begins to degrade in their later years. However, he was concerned that our product might be only applicable to individuals who are first learning how to type as they start to develop their skills and build up speed.

Some additional functions he recommended for the keyboard was voice feedback or a type of sound feedback for each key because knowing what's going to happen before or when pressing the key will prevent the user from making mistakes. He also mentioned that the onscreen keyboard should be transparent or translucent by default and it should not completely obscure what's beneath it when working on a specific application. 50% opacity is a good start since it will help a user determine what they need to adjust. He also mentioned that the user should have different color schemes to toggle through since anyone who is visually impaired sees differently. Some individuals use a magnifier, and it is easy for them to see with a black background with white text or vice versa. In addition, he remarked that a high contrast is recommended as you increase the translucency of the keyboard to keep it distinctive. Avoiding gray scales and non-solid discrete colors for the onscreen keyboard would be valuable for vision purposes. He also recommended that the font type of the onscreen keyboard should be sans serif which is better perceivable for the visually impaired, but there should be multiple fonts for the user to select.

Furthermore, he informed us that the price range of our product should be no less than $100. People with visual impairment pay a lot for their supportive gear which gets supplemented by different industries, and part of the problem is long tail

development since the product is directed towards an audience that is way lower than the general population. Finally, he conveyed that the severely visually impaired who are not strong typists have difficulty finding work, and they are generally unemployed since typing is a selective trait in different career fields. They tend to not have a lot of money to spend on technology that they don't need. Based on the interview, our product meets the requirements needed for our target audiences.

Interview 2 - Rakib Rahman

Rakib Rahman is the teaching assistant for Senior Design 1 at Wichita State University, and has knowledge on product design and development. According to Rakib, there do not seem to be very many existing solutions for the visually impaired on the market. Keyboards exist that use bumps on the keys such as braille, or larger-print for the lettering on the keyboards, but those are about the only options that currently exist. Voice-to-text is often used for typing and reading assist as well, but is still far from perfect.

For improvements to our product and general ideas for basic settings, Rakib did fill us in on some ideas. He recommended for potential modifying of existing keyboards use of the Logitech MX, one of the bestselling keyboards on the market, white background with black text for the on-screen display, semi-transparency for user convenience, and adjustable options in order to help the user best tailor the product to their needs. He was also interested in the idea of us adding foreign alphabet support to the keyboard. Most foreign keyboards are predominantly english with small-text

lettering for the foreign alphabet, so the onscreen keyboard feedback seems like it would be very helpful.

For pricing of the product, he stated it would really vary. Initially he suggested 50-75$, but keyboards and their prices vary wildly. Mechanical keyboards often cost over $150 dollars each, so the big takeaway he provided in that department is to justify our price compared to the alternatives. If it's more expensive than other options, be sure to make it perfectly clear why it is more expensive and why it is worth it for a consumer to pay that price.

Auditory feedback was recommended by Rakib if we could pull it off in the long run. Especially with the foreign alphabet ideas, it could be a great help. Though the concern was raised that when typing fast, the auditory feedback might cease to be helpful. Inability to keep up with the user's typing speed would result in a backlog of sound or cutting off sounds in progress, which would wind up likely being exceedingly annoying, distracting, and generally unhelpful. He suggested for this the ability to turn it off, and perhaps an auto-disable for when the typing is being done quickly. Or perhaps text-to-voice that instead of reading the characters you type, reads the entire sentence in words as you type it.

Throughout the interview, one thing Rakib made clear is that we should focus on one thing at a time if at all possible and make sure that each component works on it's own. When bringing up the audio feedback or foreign language components, for instance, he made sure to reiterate that we should ensure the product's functionality as a whole first. These components are great and would be helpful to others and

improving the product as a whole, but this comes second to having a functional product to begin with.

Interview 3 - Fujian Yan

Mr Fujian is a member of the EECS faculty at WSU. We briefly introduced our project idea to him and how we proposed on developing the idea, and asked him questions on what he felt about it and what could be done to make any changes if they were necessary.

We began by asking if he had experienced any issues with touch typing on his keyboard for which there was none and he also did not know if anyone else had any issues with that. After asking him whether he was familiar with any other current solutions to this issue on the market, he mentioned that there may have been the use of machines, like with the use of augmented reality which was able to translate code languages from one to another. When we asked whether our product solves the problem well, he mentioned that the device could help the audience interact with their computer and that It could help those who are unable to look down and back up on their screen frequently.

When asking about feedback, he mentioned that some sort of feedback received from the finger position on the keyboard could be helpful, such as autocorrect features. He suggested that we could expand the audience of this project to also focus on those who have discomfort in their necks and may not be able to monotonously look at the keyboard and back on the screen when typing. When we asked for a suitable pricing range for a project like this, he was not particularly sure, but mentioned that for this

project, focusing on an audience with educational programs and with helping disability people achieve typing goals there should be modest pricing. To continue on the focus of this project, he mentioned that it may be better to focus on the visually impaired learning to touch type and people that may need key letters on their keyboard to be translated to another language.

After asking what our project lacked and how it could be improved, he raised a concern about the speed and accuracy, explaining that for people who could type fast, this may not be an effective solution because it may be difficult to keep up with the speed of the person typing, our project however would not focus on audience who are already touch typing with high speeds. Finally, he suggested that we would need to distinguish between a person typing and a person just leaving their fingers on the keyboard when they are not trying to type anything. In addition, we could have a mechanism which gives users feedback on whether they hit the keys they meant to hit or not. (Might be an autocorrect feature)

Interview 4 - Isabel Medina Keiser

Isabel is the director of the Office of Disability Services at Wichita State University who has experience working with college students that have various disabilities. In our interview, she explained how freshman students with disabilities struggle with touch typing. She even offered to help us find visually impaired students that could test our device. While she believed our product solves the touch typing

problem well for the visually impaired, she provided some suggestions on additional requirements and features to add to our product.

There were three additions she thought we could make that are related to the physical keyboard. One was to add large print characters on the physical keyboard keys so that the visually impaired can see them if they happen to look down at the keyboard. In addition, she thought that we could expand our target market by adding braille onto the keys for the blind. Finally, she thought it would be a good idea to allow the user to type on their smartphone using a physical keyboard instead of a virtual one.

Isabel stated that we could add different tracking features to our device. One of these tracking features should assess how the user's head is positioned towards the screen to make sure it is ergonomically correct, which would likely require a camera to record the user's face. The second tracking feature she mentioned would help those with ADD or ADHD maintain their focus on the screen. This is similar to the previous suggestion in that we could use a camera to make sure the user's head is not drifting away from the screen. Another tracking feature was to detect how the user's fingers are positioned on the keyboard to verify that they are ergonomically correct. Isabel mentioned this can help individuals with carpal tunnel. The last tracking feature she brought up was to figure out which finger on the user's hand was touching a key.

The rest of the suggestions Isabel made were related to the software side of our device. One was to add a free touch typing training, which would work well if we can detect which finger is touching a key. We would be able to see if someone was using the wrong finger to press a key and give feedback to the user about this. Isabel let our

group know that she has dyslexia, which can make it difficult to read certain fonts, so she recommended that we use a font on our keyboard display with clearly defined borders. One font in particular she thought would be easy to see is Garamond. She believes that the font size on our virtual keyboard is the most important factor that will determine if the visually impaired can see the text, and said that an 18-point font will be visible to many with low vision. This feedback helped us better understand the problem the user faces since this let us know that fonts under 18-point can start to become hard to see for some of the visually impaired. Contrast is another important factor to keep in mind, and Isabel stated that black backgrounds and white fonts are ideal for those with vision issues.

When we asked Isabel about the price we should charge for our device, she did not provide a number but gave us some information on the cost of other assistive technology in addition to who we can contact to give us a better idea of how much we can charge. Towards the low end of the price range for assistive technology, there are large print keyboards that only cost $19. On the more expensive side, there are smart pens that can cost around $250. Finally, the groups that can help us determine our price point are the organizations with vocational rehabilitation services because they can give us an idea of how much they would pay for our device.

Conclusion

The feedback we received from the interviewees was across the board supportive of our product and ideas with suggestions on ways we can better cater our

product to the target markets. Most of the suggestions we received are either compatible with our planned hardware, or have a clear path to implementation with only minor adaptations as far as we can tell.

In terms of a target market and application of the product, we mainly focused on learning to touch type and helping the visually impaired with additional possible applications such as language support to aid non-native english speakers. The feedback on this was positive with everyone seeing the potential of our product design to make a difference in the target markets and solve their problems.

With the software portion of our product, the on-screen display, most of the interviewees had some input on things like text size, contrast, opacity, etc. Most of these metrics we had an idea of what might be best, but needed to do testing on early versions of the software to determine what the ideal settings would be. In addition, we planned to add customization to our software to fit the unique needs of different users. With the visually impaired in mind, we will be incorporating recommendations such as selecting larger fonts like 18pt Garamond with white text on dark background recommended by Isabel, adding multiple color schemes with high contrast options, avoiding greyscales, and adding font options including Sans Serif for easier reading recommended by John. Our team has universally agreed that we would focus on Windows development with the justification of it having the overwhelming desktop market share, with possibly adding support for MacOS in the future. This was challenged by John who thought MacOS was the preferred operating system for the visually impaired and Isabela added that accessibility support in MacOS is lacking. We will be continuing with development for Windows but with this information MacOS

support will be a higher priority to us. Auditory feedback was a common suggestion as an accessibility feature to the visually impaired who with a normal keyboard must type a character to hear what it is. This could be an improvement area with the ability to hear the character before typing. Another idea was to add some sort of autocorrect which would predict what the user meant to type. How this would utilize the capacitive functionality of our keyboard is to be determined. Having support for additional languages in our software was met with a positive response. Lastly, we had a requirement for the time it takes for a key touch to be registered on the keyboard display app, and we wanted this to be similar to the time it takes to register a key press. Fujian shared the same sentiment, thinking that how fast the capacitive sensors can detect a touch is important.

We also got some useful feedback on the hardware and functionality. A common suggestion was to have a way to distinguish between fingers on the keyboard which could enable more helpful touch typing feedback, ergonomic suggestions, and other metrics. We have contemplated whether this would be possible with only the capacitive sensors, but it may be required to add a camera to the board which does add to our hardware design. Adding standard accessibility features such as large print keycaps and braille to add additional methods and options for the visually impaired was mentioned too.

In summary, our product market and goal was well received by the interviewees. They thought the visually impaired was the preferred market, but still saw its usefulness in other areas. Distinguishing different fingers is the main addition of functionality and might require extra hardware requirements. The team’s plan moving forward is to get a

functioning prototype as soon as possible in order to test some of our requirements and make necessary changes or alterations, as well as test some of the features and feedback we received.

Those in engineering fields, designing products for consumers, need to make sure they ask the right questions to help them better understand their target market's problems. These should not be leading questions but should be designed to get honest feedback from the user so that the feedback is accurate. This information from the target market allows engineers to not design a product that no one wants or one that does not solve a certain problem well. Finally, since designs change over time, it is vital to continuously learn what your target market wants, so your new designs satisfy their needs.