Project Deliverable B: Needs, Problem Statement, Metrics, Benchmarking and Target Specifications

Submitted by

Talk Box, Team C23

Victoria Jancowski, 300203985

Abdul Alzubaidi, 300066757

Michael Hetu, 300209299

Chuanzhi Li, 300055864

January 18th, 2021

University of Ottawa

Abstract

This report details the problem definition process developed to provide a solution for a "Talk Box," proposed by clients Anthony and Roy. For persons with disabilities, the ability to speak clearly enough to communicate with others as well as with smart home hubs, such as Google Home and Alexa, is often difficult. The clients are looking for a way to simplify communication for the users by having select phrase choices organized in banks, according to requirement (ie, general living, caregiver interaction, home automation, etc.) These phrases would then be spoken out loud through an automated device, allowing for simpler and easier communication. As well as difficulties with communication, many users also experience trouble with dexterity. The clients also requested physical switches for the user to select these phrases, so that users with difficulties navigating touch screens, might have an easier way to navigate the program. As a result of the prioritized needs generated through client statements in the initial client meeting, on January 18th, a problem statement was proposed. From both the problem statement and the interpreted needs, several benchmarks were identified including: Predictable, Talk for Me, and Touch Voice, which are existing tools that fall short in addressing the needs of both the user and client.

Table of Contents

OBJ

| Table of Contents |
|---|
| List of Tables |
| 1 Introduction |
| 2 Client Meeting and Needs Identification |
| 2.1 Client Meeting Summary |
| 2.2 Customer Needs |
| 2.3 Needs Hierarchy7 |
| 2.4 Design Criteria |
| 2.5 Target Specifications |
| 2.6 Problem Statement |
| 3 Benchmarking |
| 4 Conclusions and Recommendations for Future Work |
| 5 Bibliography |
| APPENDICES |
| APPENDIX I: Importance Rating |

List of Tables

| Table 2.2.1 - Customer Statement and Interpreted Needs | 6 |
|---|------|
| Table 2.4.1-Interpreted Needs translated as Design Criteria | 8 |
| Table 2.4.2 - Design Metrics | 9 |
| Table 2.5.1 - Target Specifications | . 10 |
| Table 2.6.1 – Benchmarking | . 12 |

1 Introduction

Disabilities that impair speech such as cerebral palsy, stroke, multiple sclerosis, and others can make communication and everyday life difficult for many people around the world. These disabilities effect the lives of people on a daily basis and can range from the inability to say "thank you" to a caretaker, to closing the front door of their home. As such the quality-of-life impact is drastic. People living with these challenges require an adapted way communicate with others, that consider their needs. The advent of home automation technology can provide an easier way to communicate with their virtual assistants and offer freedom and independence in their homes. As well, the existing applications and programs on the market today, can provide persons with disabilities an easier way to communicate.

2 Client Meeting and Needs Identification

In order to establish a concrete understanding of both the needs and desires of the client, a meeting is essential. This allows for the opportunity to empathize with the client and to gain insight into their problems, frustrations, limitations and needs. The client meeting allows a chance to build a relationship and rapport with the client that will ultimately aid in problem solving during the course of the project.

2.1 Client Meeting Summary

With expensive, non-user friendly and a lack of devices that can simplify communication and interaction for persons with disabilities, there is a need for a device that allows the user freedom, independence, and the ability to talk to others. A virtual meeting was held on January 18th, 2021 to begin assessing the needs of the clients, Roy and Anthony. Both expressed challenges of persons with disabilities lacking the ability to communicate effectively with friends, families, and care givers, to having the freedom and independence that they desire, and to having the accessibility to easy and inexpensive products on the market. Taking these challenges into account, Roy and Anthony expressed the need for a cost effective, user friendly, and simple software to allow persons with disabilities the chance to communicate and have more freedom and interaction with the world around them.

2.2 Customer Needs

| | - | - | |
|---|-----------------------------------|--|------------|
| # | Client Statement | Interpreted Need | Importance |
| | | | |
| 1 | Users will have low dexterity, so | The device will need to function with | 5 |
| | lots of movement and touching | the push of one large button (or large | |
| | screens will not be optimal. | switch) intermittently. | |
| 2 | Consider broad kind of disability | The device will need to incorporate | 3 |
| | of users. (unable to see, muscle | the needs of many and take into | |
| | weakness, unable to hear, unable | account the limitations of each user. | |
| | to talk, etc.) | | |

Table 2.2.1 - Customer Statement and Interpreted Needs

| 3 | The users will not people to preform difficult tasks or navigate | Keep the user interface as simple as possible. | 4 |
|----|--|--|---|
| 4 | The users are not able to communicate freely and will need a way for the device to speak for them. | The device can speak for the user. | 5 |
| 5 | Users will take this device many places and will need the ability to use phrases for multiple situations. | The device will have a large phrase bank so that the user has the ability to use it for many interactions. | 4 |
| 6 | The user will use it for daily activities in their everyday life. | The device will be durable and easy to sustain over time. | 3 |
| 7 | The user will not have lots of money to spend on the product. | The device is inexpensive. | 3 |
| 8 | The ability to use the device offline is desired. | The device will be able to function offline. | 5 |
| 9 | The user should be able to interact with Alexa and Google Home through the talking function. | The device will be able to talk to Alexa and Google Home devices. | 5 |
| 10 | It would be beneficial is caretakers, family or friends could modify the phrases to suit their own needs. | The device will have the ability to modify, enter and delete phrases of the user's choice. | 4 |
| 11 | Sometimes users can press down on the buttons but have trouble releasing the button. | The button will reset after the user has lifted their hand from the button. | 1 |
| 12 | The device should be able to maintain a charge or be charged locally. | The device will charge through the wheelchair. | 1 |
| 13 | An option to view pictographic, speech or text cues on the screen would be beneficial. | The device will provide the user multiple ways to view disciplines. | 3 |
| 14 | The user will take the device many places. | The device mounts to a wheelchair. | 4 |

2.3 Needs Hierarchy

Based on the client meeting, the importance of the needs has been interpreted and ranked, using a scale from one to five. One is deemed as a feature that is unimportant and least important to the client and five as being necessary and critical to the design of the product. The hierarchy of needs allows for a brief overview and analysis of the importance of the features to the design and to the overall product.

2.4 Design Criteria

Based on the interpreted client's needs, a design criterion has been identified. This is shown below in Table 2.2.1. These criteria are then further translated into design metrics and classified as functional, non-functional or as a constraint. These are identified in Table 2.4.2.

| # | Interpreted Client Need | Design Criteria |
|----|--|--|
| 1 | The device will need to function with | Requires a simple switch or a button. |
| | the push of one large button (or large | |
| | switch) intermittently. | |
| 2 | The device will need to incorporate the | Adaptable User Functionality |
| | needs of many and take into account the | |
| | limitations of each user. | |
| 3 | Keep the user interface as simple as | Simple User Interface |
| | possible. | |
| 4 | The device can speak for the user. | Text-to-Speech Ability |
| 5 | The device will have a large phrase | Device possess large, diverse phrase bank. |
| | bank so that the user has the ability to | |
| | use it for many interactions. | |
| 6 | The device will be durable and easy to | Device is durable and eco-friendly |
| | sustain over time. | |
| 7 | The device is inexpensive. | Device is inexpensive. |
| 8 | The device will be able to function | Device functions offline. |
| | offline. | |
| 9 | The device will be able to talk to Alexa | Voice Interaction with Smart Devices |
| | and Google Home devices. | |
| 10 | The device will have the ability to | Software will be easily modified by users. |
| | modify, enter and delete phrases of the | |
| | user's choice. | |

Table 2.4.1-Interpreted Needs translated as Design Criteria

| 11 | The button/ switch will reset after the | Button/switch will reset when user has lifted |
|----|---|---|
| | user has lifted their hand from the | hand. |
| | button. | |
| 12 | The device will charge through the | The device will charge through wheelchair. |
| | wheelchair. | |
| 13 | The device will provide the user | Device will provide user with pictograms and |
| | multiple ways to view on screen | text on screen. |
| | disciplines. | |
| 14 | The device mounts to a wheelchair. | The device is portable through mount. |

Table 2.4.2 - Design Metrics

| # | Design Metric | Units | Importance |
|-----|--|-------|------------|
| Fun | ctional Requirements | | |
| 13 | Device will provide user with pictograms and text on screen. | Y/N | 3 |
| 11 | Button/switch will reset when user has lifted hand. | kPa | 1 |
| 10 | Software will be easily modified by users. | Y/N | 4 |
| 9 | Voice Interaction with Smart Devices | Y/N | 5 |
| 8 | Device functions offline. | Y/N | 5 |
| 4 | Text-to-Speech Ability | Y/N | 5 |
| 1 | Requires a simple switch or a button. | Y/N | 5 |
| 3 | Simple User Interface | Y/N | 4 |
| 2 | Adaptable User Functionality | Y/N | 3 |
| 5 | Device possess large, diverse phrase bank. | MB | 4 |
| Non | - Functional Requirements | I | 1 |
| 14 | The device is portable through mount. | Y/N | 4 |

| 12 | The device will charge through wheelchair. | kWh | 1 |
|-----|--|-----|---|
| 6 | Device is durable. | Y/N | 3 |
| Con | straints | | |
| 7 | Device is inexpensive. | \$ | 3 |
| 6 | Device is Eco-Friendly | Y/N | 3 |

2.5 Target Specifications

The prototype target specifications are defined after both the design criteria and metrics are defined. Table 2.5.1 details the justified, marginal, ideal and target values of the final prototype to be presented on design day. It also includes justifications of why these target specifications are important, and how each of these metrics can be verified in the future.

| Metric | Units | Marginal | Ideal | Target | Justification | Verification |
|-------------------|-------|----------|-------|--------|--------------------------|--------------|
| | | Value | Value | Value | | Method |
| Device will | Y/N | Y | Y | Y | Device will be easy to | Test |
| provide user with | | | | | use and provide user | |
| pictograms and | | | | | with visual cues. | |
| text on screen. | | | | | | |
| Button/switch | Ν | <4.5 | 3.5 | 3.5 | Important that the | Test |
| will reset when | | | | | button functions for all | |
| user has lifted | | | | | types of users with all | |
| hand. | | | | | types of dexterity. | |
| Software will be | Y/N | Y | Y | Y | Important that | Test |
| easily modified | | | | | software is easy to use | |
| by users. | | | | | for all persons. | |

Table 2.5.1 - Target Specifications

| Voice Interaction with Smart | Y/N | Y | Y | Y | Client requested that interaction with smart devices be available | Test |
|--|-----|-------|------|------|---|----------|
| Device functions offline. | Y/N | Y | Y | Y | Offline ability will allow user to operate anywhere. | Test |
| Text-to-Speech Ability | Y/N | Y | Y | Y | Prototype will have ability to provide user with simplified communication. | Test |
| Requires a simple switch or a button. | Y/N | Y | Y | Y | Allows the user to navigate the program easily. | Test |
| Simple User Interface | Y/N | Y | Y | Y | Requested by the client for function ability. | Survey |
| Adaptable User Functionality | Y/N | Y | Y | Y | Allows user to modify the program according to individual needs. | Test |
| Device possess large, diverse phrase bank. | kB | <2 | 1.5 | 1.5 | Program will allow user to use as many or as little phrases as they desire. | Survey |
| The device is portable through mount. | Y/N | Y | Y | Y | Client requested the device be portable through use of wheelchair. | Test |
| The device will charge through wheelchair. | kWh | >0.01 | .015 | .015 | Client requested the device be chargeable through use of wheelchair battery. | Test |
| Device is durable. | Y/N | Y | Y | Y | Device will be drop tested in order to ensure durability | Test |
| Device is inexpensive. | \$ | 100 | 0 | 0 | The cost for the user will be low. | Estimate |
| Device is Eco- Friendly. | Y/N | Y | Y | Y | The device will provide a neutral or negative carbon footprint. | Test |

2.6 Problem Statement

Design a technology that allows a user to communicate through a device by using a textto-speech interface, with the ability to organize and add phrases of their choosing to the phrase bank and scroll through them with a switch or a button, to use when needed. This device should also function offline, have the ability to charge through a wheelchair, be durable, and mount on the wheelchair itself.

3 Benchmarking

While a lot of the programs and apps out there offer great options for text to speech for people with dexterity, there are not many options for users with low dexterity. There are some free applications, but they all come with little or no ability to personalize them. The user interface for many of these applications and programs is also quite complicated, where the user needs a simple and user-friendly interface. It is also difficult to source out devices where all of the combined attributes and needs are addressed in one product.

Table 2.6.1 – Benchmarking

| Company | Predictable | Talk for Me | Touch Voice |
|-------------------------------|-------------|-------------|-------------|
| Item Weight | 0 | 0 | 0 |
| Cost | 159.99 | Free | 26.99 |
| Assembly Required | No | No | No |
| Simple User Interface | Yes | Yes | Yes |
| Requires Low dexterity | No | No | No |
| Speaks for the User. | Yes | Yes | Yes |
| Functions Offline | Yes | Yes | Yes |

| Interacts with Smart | Indirectly | Indirectly | Indirectly |
|-------------------------|------------|------------|------------|
| Home Devices | | | |
| Can Be Modified to Suit | Yes | Yes | Yes |
| User Needs | | | |
| Materials | None | None | None |

4 Conclusions and Recommendations for Future Work

After meeting with the client, the client's statements were analyzed, and their needs were identified and taken into consideration when formulating an effective problem statement to encompass the main goal of the product. With the client's statements in mind, and identified, a benchmarking analysis was conducted to examine where present solutions do not address all the needs of our client and in which ways our device could improve upon those short comings.

Moving forward, various conceptual designs will be formulated, and each will be analyzed and ranked depending on their suitability and their fulfillment of customer needs.

5 Bibliography

- Schectman, T. (2017, January 22). Text-to-Speech Apps Make Communication Easier. Retrieved January 18, 2021, from https://www.friendshipcircle.org/blog/2017/01/26/text-to-speechcommunication-apps/
- R. (n.d.). Caption all your phone calls instantly! Retrieved January 18, 2021, from https://rogervoice.com/en/
- Talk For Me. (n.d.). Retrieved January 18, 2021, from https://www.mobiletouchtech.com/talk-for-me/
- T. (n.d.). Touch Voice. Retrieved January 18, 2021, from https://touch-voice.com/marketing/

APPENDICES

APPENDIX I: Importance Rating

1 – Not Important

- 2 Slightly Important
- 3 Important
- 4 Fairly Important
- 5 Very Important