TalkBox: Requirements Document (version 2.0)

Project: TalkBox
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Prepared by: Kai Xu, Eli Frungorts and Yash Desai

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1. Introduction

This document contains the system requirements for TalkBox. These requirements have been derived from several sources, including Prof Melanie Baljko's presentation, the NIDCD, and the EECS2311 course website.

1.1 Purpose of This Document

This document is intended to guide development of TalkBox and give a detailed description of the requirements for this project. The document will feature a description of the expected users, and based on the description provided, the expectations and requirements of the device will be outlined. Additionally, this document aims to identify an extensive profile of the users that will most benefit from the product, and develop the application around the most likely user. The justification for why the most likely user needs to be identified is based on two reasons:
The most likely user exists in the highest numbers, meaning that **this product can help the most people** and as a consequence, yield the highest profit for the designers and manufacturers.

1.2 Scope of the Product

TalkBox is a device that helps anybody who is unable to talk, communicate.

Each TalkBox has several buttons that the user can press to play pre-recorded audio files. Some of the buttons on the TalkBox may be used to load different sets of audio files.

The Configurator device is intended to be used by either the user, or the assisting caregiver to customize the talkbox to best suit the needs of the main user. The purpose of the configurator is to act as a proof of concept device that would be able to run on any device, and directly interface with the hosting device, which will most likely be a raspberry PI.

1.3 Business Case for the Product

The purpose of this product is to provide a low-cost Speech Generating Device for individuals with communication disabilities. Our goal is to change the status of the AT product market and increase the utilization rate of the product.

2. General Description – Understanding the consumer and the product

This section will give the reader an overview of the project, including why it was conceived, what it will do when complete, and the types of people we expect will use it. We also list constraints that were faced during development and assumptions we made about how we would proceed.

2.1 Product Perspective – The customer

According to the NIDCD[1], it is said that **roughly 1 in 12 children** in America **suffer from a disability that affects speech, voice, language or swallowing.** These disabilities often prevent children from succeeding in school and can cause long term developmental issue for these children as they enter their adult life. These disorders are not always treatable, and some children will have speech and communication disabilities that will exist for the entirety of their adult life.

The TalkBox needs to act as an accessibility tool, which will be designed to enable individuals who struggle to communicate.

The objective of this product is to provide a mechanism for both the main user and an assisting caregiver, if they exist, to setup and modify the talkbox to the exact specification desired by both individuals. The level of customization will vary between individuals based on their ability to speak/communicate. The most critical aspect to remember is that **some users may struggle with their physical dexterity**, and thus, **the design must** be as simple as allowable, to **enable as many people as possible to benefit and communicate**.

2.2 Product Functions - system Requirements

The goal of this project is not to produce a brand new talkbox, but rather to design a proof of concept model that can be used to emulate the exact behaviour of a physical talkbox implement. That is why the device should aim to behave as close to a physical interface as possible. **The Talkbox does not need to be flashy but needs to consistently, and repeatedly produce the same results when the same input is generated.**

The Talkbox and configurator must be able to perform a variety of functions.
Below, the functionality of both will be listed from most critical to least:

Talkbox

1. The User must be able to register an external input, be it a capacitive switch or a touch screen, and output a corresponding sound.
2. The user must have access to different labeled sets, which will contain any possible combination of buttons and sounds.
3. The User must be able to configure the talkbox using the complimentary configurator tool to select which buttons correspond to which sounds, as well as how many buttons are available to be used per set.
4. The User must not struggle with using the Talkbox. This implies that setup time is as short as can possibly be, and that the device does not use more resources than required.

Configurator

1. The User must be able to select between various .tbc files
2. The User must have access to a default build file, incase the user loses their current config
3. The Configurator must store external image and audio files internally, incase the external file gets lost
4. The Configurator must have an intuitive interface, with as little ambiguity as possible such that the user does not struggle with modifying the talkbox
5. The User must be able to record their voice and assign the voice to buttons.

2.3 User Characteristics
The users must be divided into 2 categories:
caregivers (configurator) and Main User (Talkbox).
The requirements between users may overlap, so it is important to understand specifically what each user needs, and where the functionality of each user can be distributed.

Main User

The main user is somebody who struggles to communicate. This communication problem can have many root causes, ranging from physical disability(underdeveloped throat muscles or throat structure) to mental disorders like autism. Regardless of the disability, the Talkbox must provide the same utility. This means that **we do not make any assumptions about the users ability level.** Further, The users physical capacity will range from fully articulate to mostly

immobile. The fully articulate user will be one who simply uses the Talkbox to help their caregiver understand their emotional state of mind. For this user, the Talkbox will acts as an accessory, where they can press the buttons as an interactive mechanism with their caregiver, signaling to them that they need assistance with various tasks such as using the restroom, or answer questions when asked by the caregiver. On the other hand, a user who is fully immobilized, will need to use the Talkbox to communicate much more frequently, **stressing the importance of reliability** of the software. This user will need have access to the device all day, and power management may become an issue.

Caregiver

The caregiver is someone who is invested in the main user. This investment will be a combination of emotional, physical and financial factors. For them, the talkbox is not simply an application, but rather a tool that enables them to help the main users. The caregiver must have access to the configuration app on demand. The caregiver may not be the best with technology, so all steps must be as intuitive as possible. This means, that as few clicks should be used as possible, and during the first launch, as many processes as possible should be handled behind the scenes.

2.4 General Constraints

The talkbox will be constrained in 2 facets, the configurator and the actual box
Configurator:

1. **TalkBox**
   The Talkbox may be limited by the users: No matter how intuitive the design is, there will always be edge cases that will undermine the functionality of the device.
   The talkbox is limited by its physical interface. The fact that the box uses physical buttons, and does not necessarily have a screen, the device may not be quick to change.

2. **Configurator**
   The configurator must take up very little space on the target device. This is to ensure that the program will run on as many devices as possible, without risking older computers from not being able to execute the program. It must be easy to use, the less buttons there are, the better.
   The configurator will exist on multiple operating systems. Thus it is important to understand how the file structures work on each system, and to not use absolute structures which will vary based on the system.

2.5 Assumptions and Dependencies

One assumption that will be made is that the main user is not fully articulate with their body. This means that they might have reduced dexterity in their fingers, and as such, the device should not be hard to press, or require intense amounts of finger articulation
The next assumption will be that the caregiver or assistant will not be the most technologically adept, meaning that the device should not have bugs or issues that require expertise to solve. This means that the configurator application should not introduce new concepts beyond that of the windows operating system (or macOS).

3. Specific Requirements

This section of the document lists specific requirements for TalkBox. Requirements are divided into the following sections:

1. User requirements. These are requirements written from the point of view of end users, usually expressed in narrative form.
2. System requirements. These are detailed specifications describing the functions the system must be capable of doing.
3. Interface requirements. These are requirements about the user interface, which may be expressed as a list, as a narrative, or as images of screen mock-ups.

3.1 User Requirements

Caregiver:

The care give requires the configuration app to be intuitive, easy to use and consistent.

Main user:

The main user requires the talkbox to simply work. By this we mean that the talkbox must register an input, and quickly produce an output.

3.2 System Requirements

Along with section 2.2, the following information will help clarify what is meant in section 3.1

1. **TalkBox Simulator**
   · The Caregiver should have clear and explicit instructions that will indicate how to setup the talkbox. The product should not have any ambiguity, as that would prevent the user and the caregiver from being able to fully realize the talkboxes utility.
   · The User, upon pressing a button, should have a loud, audible sound that is produced. The box needs to exist to fulfill the functionality it is expected to have at all times. The user should not have any unexpected downtimes, and if downtime occurs, the solution should be as simple as turn it off and back on again. **No fancy Gimmicks.**

2. **TalkBox Configuration app**
   · The caregiver must be provided with a guided process to navigate the interface. We must understand that the caregiver will likely not have a comprehensive understanding of the operating system they are using, so the product should never make that assumption.
   · The user may want to record their own voice, to help the talkbox be more friendly to the main user, so this feature is paramount.

· Drag and drop must be included as a feature, since we assume the caregiver might struggle to navigate their OS file system, they must be able to drag and drop the file from where they currently are.

3.3 Interface Requirements

There will be two interfaces for this project. The first will be the configurator interface and the second will be the main device interface.

The Configurator Interface:
The configurator interface will remain the same regardless of how the main device will look. This simply means that the configurator will assign each button a value, and it is up to the main device to determine what the button looks like. For the sake of the simulator however, we will make it such that the configurator will change the simulators image icon and audio.

The Main device:
The main device, for the sake of demonstration, will be a simulator that takes on characteristics of a Raspberry Pi. This means that we will restrict the size of the screen to the resolution available on an actual raspberry pi device.

Additionally, for the sake of the user, the interface must have reasonably sized buttons. This means that each button should not be the size of a keyboard key, as then it would be simpler to give the user a keyboard. Similarly, the keys should not be too large, as then the user might have difficulties moving between separate keys. Ideally, we would like the keys of the emulator to be roughly 1x1 inch.

4. Use Cases

4.1 Support Ability to function reliably whenever needed

This use case will consist of a user who needs to signal their functions to a teacher or caregiver. This could mean that they need to use the washroom, or that they need to drink some water. This will be the most intensive use case, as the user that requires this case will likely be significantly disadvantaged in their day to day life and would need constant monitoring of their caregiver.

4.2 In School/Workplace

This use case is not as intensive at the first but will be used to help student who may have communication issues, but might not be entirely physically incapacitated. This means that the user will be still struggle to communicate, but may perform certain tasks without the need of a caregiver. One example of this would be a child who has autism, as they may be fully capable of doing things like using the washroom, but may need this device to help communicate that they are happy or sad.

4.3 Training/Learning

This is the simplest of cases, and will be used between caregivers to help familiarize themselves with the device. The training will likely be minimal, as we aim to design the interface to be as minimally complex as possible, but, nonetheless, this use case must be considered.

In order to fulfill this use case, the product needs to provide a comprehensive user manual, aswell as consider user feedback to reorganize the interface, and make it more presentable for the user.

4.4 Support Sociability

If a user is timid or anti-social, this device can enable them to communicate without feeling the risk associated with having to physically talk on their own. There are many young kids like this, who are fully capable of talking, and do so with their closest of friends and family, but struggle to repeat this behavior in new and unexplored social environments. This device will aim to enable these students, and provide them a mechanism to overcome their fears, however irrationally they may be.

4.5 Support 'Activities of Daily Living' (AODL)

This use case is the least likely to be used, but is still critically important, nonetheless. Suppose an individual suffered a debilitating injury, where they can no longer communicate, but still have social responsibilities. This device can be used by these individuals to communicate to their peers, and project their most basic feelings and desires.

5. Acceptance Test Cases

For our first release, would like the following 3 test cases to be fulfilled.

5.1 Case 1

The first test we would like to pass is the ability for the configurator to repeatedly change different images, and not have any performance hindrance. This means that our device will not have any memory leaks or processing leaks.

5.2 Case 2

The second test we would like to pass is for the device to accept a barrage of button presses, and not break. This means that we will test the device by pressing multiple buttons at faster than typical rates, ideally 5+ button presses a second, and observing the behavior. If the device is still functioning, we will deem this test case a success

5.3 Case 3

The 3rd and final test case will be the power off and power on test. We want the device to remember its 'save' state through multiple on/off cycles. This test will emulate real world circumstances, as the box will be turned on and off repeatedly, and we want the device to not break down.

References

1. https://www.nidcd.nih.gov/news/2015/about-1-12-children-has-disorder-related-voice-speech-language-or-swallowing