DEC1606

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A Voice for Autism

Design Document

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# 1 Introduction

## 1.1 Project statement

## The goal of our project is to build a device that helps those with autism communicate. Using a touchscreen, the user should be able to use the device to get things that they want/need when dealing with caretakers. The device should be customizable so people of all ages can use it, and durable enough to handle the rigors of everyday use.

## 1.2 Purpose

## This project is important because of the lack of an affordable device on the market that fills this need. Most devices currently available are either very expensive and technologically advanced, or cheap and technologically inferior. Our project has the potential to be up-to-date with technology and cheap compared to other touchscreen devices. In general, devices in the healthcare field have the potential to greatly improve the quality of life for many people.

## 1.3 Goals

# Our goal is to create an app that can be used with a smartphone that the patient already owns, and custom touchscreen device that comes loaded with our software. We hope to make the app easy to use and customizable for patients of all ages. On the hardware side, the goal is to make something that is rugged, well-designed, and has a long-lasting battery (at least one day). The key is to make something that meets all of these specifications and is still budget friendly (< $200).

# 2 Deliverables

 The product that will be delivered will include multiple different packages available. These will be targeted for various degrees of need for the user and their caretakers. The product will be any combination of the following starting with an app that can be run on the phone for those able to safely use phones. The package can then be ramped up to a device offering that will be built and setup with the application to with stand the rigors of heavy use. The last part of our product will be to provide analytics on the usage of the device to provide better service from caregivers.

# 3 Design

##  3.1 System specifications

### We have assumed that the device will be a tablet with a touchscreen interface.

### 3.1.1 Non-functional

The tablet should be designed so that is aesthetically pleasing, and something that people of all ages and both genders should feel comfortable using/carrying all day.

The app should have a response time of less than half a second maximum for any UI selection, excluding loading the data for the given view. Data loading for the app should not ever exceed ~5 seconds, maybe split large views into chunks. The app should be portable and scale on devices such as iOS phones, iOS tablets, android phones, android tablets. The screen should not take more than 3 seconds to load the word and images.

### 3.1.2 Functional

## Functionally, the device needs to be a tablet with a touchscreen that has enough battery power to last all day. Also, there must be audio output so the desired words can be heard by the caretaker(s).

The device with help will help with communication with other people. The app will need to be customizable, the text will need to be easy to read, the concept of the app will be able to be understood by many.

## 3.2 PROPOSED DESIGN/METHOD

## Our hardware team has decided to make two prototypes. The first prototype will be very basic using a Raspberry Pi and the official Raspberry Pi touchscreen. The procedure for putting everything together should be straightforward. Our plan for the second prototype is to create our own custom device. Basically, we will need to find a processor, touchscreen, and all of the necessary peripherals to complete the task. Also, the enclosure might be more difficult for this prototype since we don’t have any experience with this area.

## 3.3 DESIGN ANALYSIS

So far, we have decided on a final parts list for the first prototype. We plan on ordering the items soon and having them ready to put together sometime after spring break.

# 4 Testing/Development

## 4.1 INTERFACE specifications

The hardware and software interface will be in using the touchscreen to interface with the user and the communication application. This will involve investigating the connection and protocol of the touchscreen whether it will be I2C or Serial. This will go further were there will be a speaker and a microphone interfacing with the application in various ways on the ARM processor. The application will specifically interface in the following ways.

<Screen Sketches see appendices>

User will first enter Menu Screen and choose to launch a conversation or receive a conversation. When launch a conversation, user can choose several topic and combine them together to start a conversation. Starting a conversation will navigate user to receive conversation screen with related word choice. For example, if user chooses “Food” and “Feeling”, the word set will likely to have “tasty”, “delicious” and so on. Receive conversation is for listening other’s speech. It will judge from recognition and generate a word set to let user select. Profile will store user’s information and will infect word selection. It also allow user to erase the previous recording data of voice. Recording screen will record user’s voice feature and replace machine original voice with user’s voice when user finish the all process of recording test. Setting will change screen brightness, volume and words showing of receive conversation. Brightness and volume is essential design, since autistic people do not like too shining light and too loud sound. This is designed for their comfort to use the device.

##  4.2 Hardware/software

**Hardware**

## Raspberry Pi Starter Kit – Includes Raspberry Pi and various items to get users started

## Raspberry Pi touchscreen – 7” touchscreen built to connect to the Raspberry Pi

## Battery – 2000 mAh Lithium Ion

## Charge Circuit – converts 3.7 Volt output of battery to 5 Volts (necessary for powering RaspberryPi)

**Software**

There will be three types test we think about. First one is M-M test. We plan to have two machine has app talk to each other and see if the machine can make a conversation or not. The topic will be narrow down into few in the first stage and will eventually become large scale and complex (We probably would use Siri to test spontaneous of language use). Second is M-H test. This will let a person speak to machine and see machine can recognize voice and generate right word set or not. The third one is A-H test. We will let autistic people to try this app and see if they will be comfortable to use it or not. We will make a survey to measure the result of the test.

## 4.2 Process

Coming soon…

# 5 Results

Coming in late spring…

# 6 Conclusions

# We have started to implement an initial design where as we can get feedback on where to continue from there. We have decided and will be placing our order for hardware soon and will be having our first operating basic application running on a virtual environment.

# We have taken the approach that an approximate solution and feedback loop was going to be our best way of completing this project. This will be done by multiple iteration cycles, both in the software side and the hardware side. This is a great way to solve our project in that it allows us to fit to the need of our ideal consumer which is the main criteria for success of our product. This also allows us to flexibly meet unforeseen issues or solutions that will only serve to better the project.

# 7 References

DEC1606 Project Proposal from Micron.

# 8 Appendices

