Voice for Autism

PROJECT PLAN

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1 Introduction

1.1 PROJECT STATEMENT

Our goal is to build a device that can help those with autism communicate. We are trying to build this device so that it is customizable for users of all ages, easy to use, and durable. Our plan is to build a touchscreen device that will be running the application developed. Also, we plan to make the app compatible with any touchscreen Android device. At the most basic level, the app should allow the user to easily find what they want to say and produce audio that matches this request.

1.2 PURPOSE

Currently, there is not an AAC (Augmentative and Alternative Communication) device on the market that is both budget-friendly and up-to-date technologically. Most cheap devices do not have a touchscreen, and use primitive technology to voice the needs and wants of the user. Also, it seems that most cheap devices are developed for younger kids. The devices that are more advanced technologically are also very expensive unless bought through the individual's health insurance.

Ideally, our device would fill a gap in the AAC device marketplace. Users would be provided with a budget-friendly device that grows with them as they age and uses up-to-date technology. Such a device would also allow low-income or uninsured families the chance to use something with better technology.

1.3 GOALS

Our final goal is to build an application and a device that costs less than $200 to manufacture. There are other goals that need to be met first: programming a user interface, designing and building tablet circuitry, and creating an enclosure for the device. These are the three major goals that need to be met before we reach our final goal.

2 Deliverables

One of our deliverables is the application. The app needs to be intuitive, customizable for users of all ages and maturity levels, and practical. Also, it needs to have a data storage/analysis component so caretakers can view how the needs of the user can be met more efficiently.

On the hardware side, we need to deliver a touchscreen device that will be running our application. We need to create something that is durable enough to withstand the rigors of everyday use, and has a rechargeable battery that will last all day. Also, the device needs to have speakers with at least enough power to generate audio levels comparable to a loud speaking voice. Finally, we also must create a sleek, rugged enclosure for the device.

3 Design

3.1Previous work/literature

There has been a lot of research done on speech and how to create an effective AAC device.

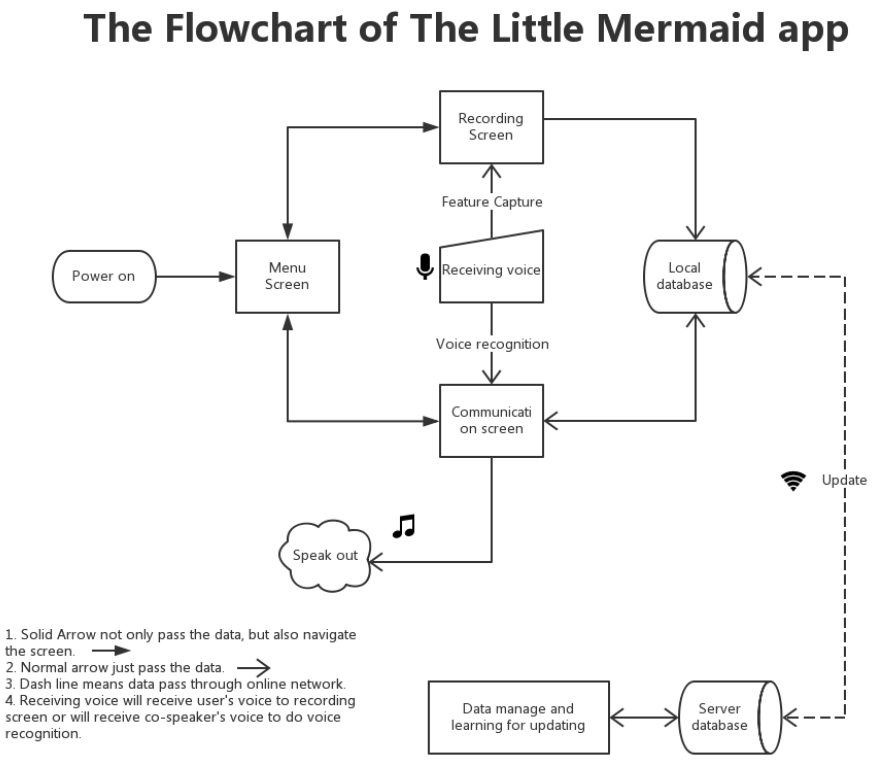
First, it is important that single words be the main output of the device. It would make the task unnecessarily complicated if we tried to create pre-loaded sentences. Also, since the majority of communication is done by a few hundred words, these core words should be emphasized and especially easy for the user to find. In order to make the search for these words as efficient as possible, the device should have as many icons on the screen as possible (as long as they are still readable). In order to lessen the number of icons, it is also recommended to use icons with abstract symbols instead of actual words.

It is also better to have computer generated voice so that the user can create any sound or phrase, and the inflection won't be unnatural (unlike when you record a voice and then paste together different recordings to form a sentence).

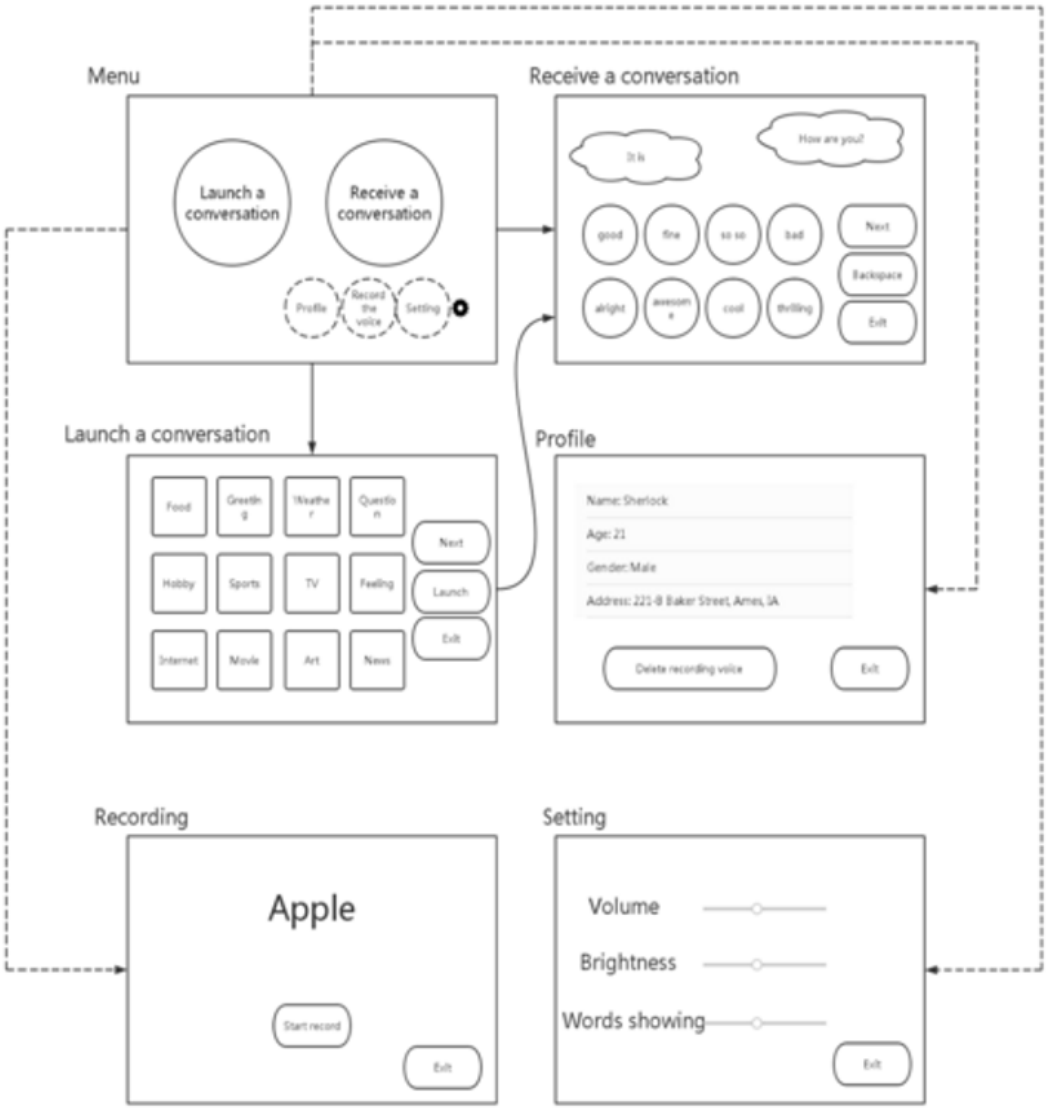
On the software side, there is project from CMU called Sphinx to make speech recognition, but it might be too over weighted. Instead, we plan to use Stanford NLP library to deal with nature language processing problem.

3.2 PROPOSED SYSTEM BLOCK DIAGRAM

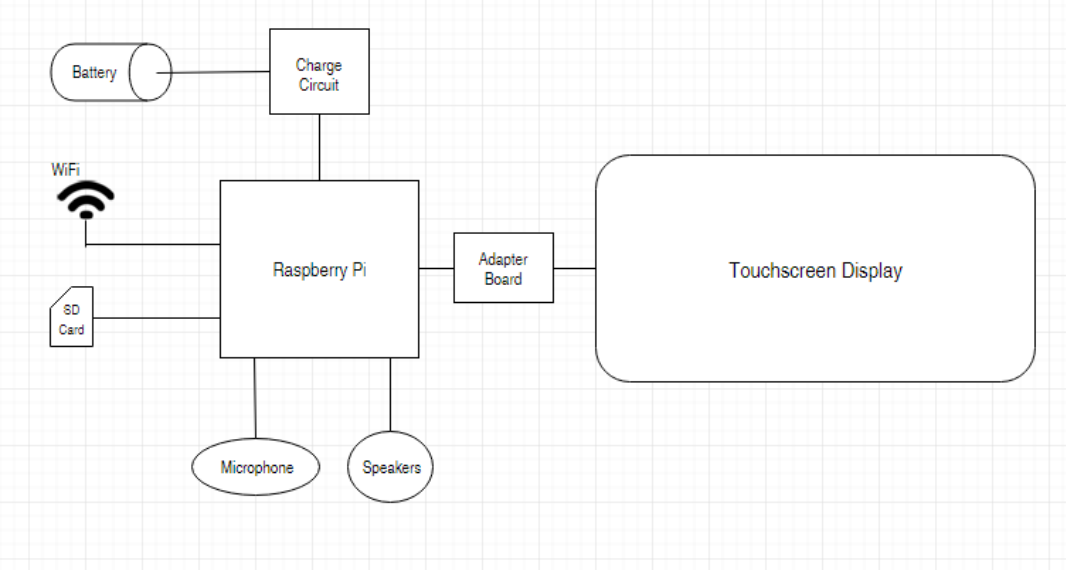
Flowchart of Application



User Interface Model



Hardware – first prototype block diagram



3.3ASSESSMENT OF PROPOSED METHODS

There are many ways to complete a project, and these can be combined in many different ways. Our path was influenced by previous senior design groups and our own past experiences with projects. Our goal is to iterate through to full prototypes multiple times over the course of the project. This is to aid our understanding and provide us with feedback at multiple points. There are other methods that involve attempting to visualize the final project with all its bells and whistles and then attempt to implement it from day 1. We all agree that if one has a choice, that blindly hoping an interpretation is right on the first try does not make sweepingly strong product. What this choice allows us to do is to have something to show that we understand the project and can demonstrate that our product will be the right choice.

3.4 VALIDATION

On the software side, it will be tough to judge how intuitive and customizable our application is. Our current plan is to find people of various ages to use it and provide feedback, and possibly collaborate with the Autism Speaks U group here on campus.

On the hardware side, we are tasked with solid and reachable criteria alongside the criteria that has been placed on our software. This criteria has is that we must meet both battery life and robustness expectations. These are both most easily validated with use testing. The use test for battery life would involve running it at multiple screen brightness levels along with different interaction levels, whether its ten interactions per hour or 60. On the robustness side of things, the best way to test the robustness is to submit the device to possibly destructive tests. This is probably best avoided with a limited budget but will be "smartly" tested in ways that will not harm the device.

4 Project Requirements/Specifications

4.1 FUNCTIONAL

Functionally, the software needs to easily guide the user to words that they are looking for and provide general assistance with communication. The main technical requirement is experience with programming in Java. Also, we may use machine learning techniques later on in the second semester as we move onto implementing more advanced features of the app. Due to the data storage component, the program also needs to be secure so that the data of users is not at risk of being stolen.

On the hardware side, the device needs to durable enough to withstand everyday use, have a battery life of at least one day, interact via touchscreen, and produce audio in/out. To complete this, it is necessary to have familiarity with microcontrollers and general knowledge of troubleshooting circuits.

4.2 NON-FUNCTIONAL

The tablet needs to be manufactured for less than $200, and be aesthetically pleasing. The application needs to be intuitive to use and able to grow with the user as he or she ages. In general, our finished products should be of high enough quality that they could be sold to the general public.

5 Challenges

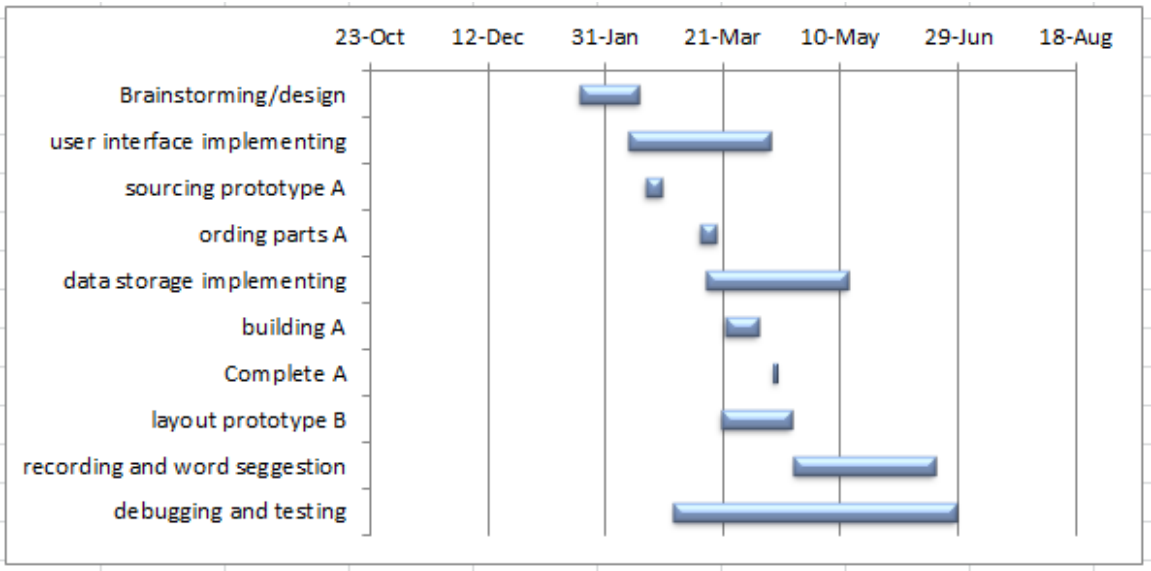
The main challenge for the software team will be creating something that is intuitive and customizable at the same time. It is difficult to tell if something that you have created is intuitive for people with no prior exposure to the product. Also, making it work for people of all ages adds another dimension to the problem. The other big challenge is the ambitious follow up to the application of creating a voice recognition and word prompt for the user. This would involve a lot investigation and trial and error.

The conglomeration of the hardware into one enclosure is another challenge that we will need to surmount. The parts and components for a computer, touchscreen, battery charging circuit, and sound circuitry all need to be pieced together to get a final product. There are also other issues in regards to specific parts as in using a stacked chip processor and going through the process of getting those designs brought to fruition.

6 Timeline

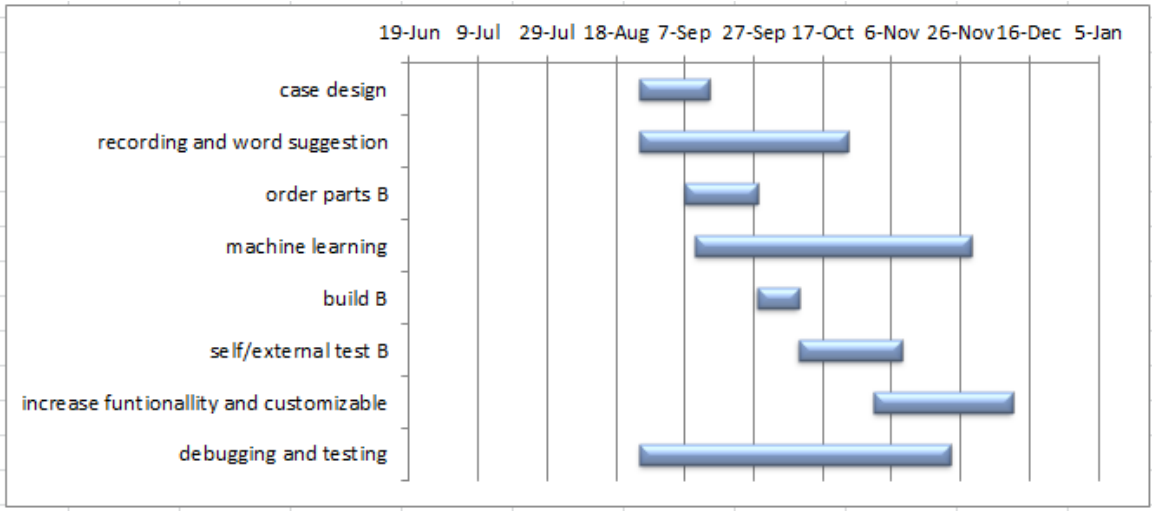
6.1 FIRST SEMESTER

The goal for the first semester is to have a working prototype of the hardware and software that complete the most basic of tasks.



6.2 SECOND SEMESTER

The goal for the second semester is to add extra features to the application and design a custom piece of hardware and an enclosure.



7 Conclusions

Our plan is to implement the basics of both the hardware and software component as much as possible in the first semester, and then build off of this next fall. Our goal is to meet all of the requirements put forth by Micron. These include creating an app that is customizable for users of all ages and a device that is budget friendly and rugged. We feel that we have a solid plan in place, outlined in this document, to accomplish everything we want to and hopefully more.

8 References

//TODO: organize references into a coherent bibliography

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