Project Title: HearMe   **Team Name : HelpMeSpeak**

Problem

People suffering from neurological speech motor disorders as a result of Multiple Sclerosis, ALS, Parkinson's disease, Stroke and Traumatic Brain Injury suffer from speech and motor impairments (Duffy, 2005). They cannot speak intelligibly and they cannot control communication artifacts with enough dexterity to communicate effectively. As a result, and coupled with the progression of their symptoms, they often find it difficult to communicate with other people. Therefore, they become isolated and their social network shrinks considerably (Beukelman et al., 2007).

Functional Requirements

Here are the three shortlisted functional requirements for our project:

1. The system should not require the use of hands as a form of input.
2. The system should visually have large and easy to see components.
3. The system should be customizable for each user.

We chose these three functional requirements based on the feedback from one speech pathologist (SLP), and two training SLPs. Most of the patients at The Boston Home (where we have been observing our target population) have visual and hand impairments therefore they would benefit most from a system catering to the above functional requirements.

Design Concept

We are proposing to develop an email system to send and receive emails. This email interface will be different from a regular email system because it will be simpler (in terms of the options it offers), visually easy to see and comprehend, and will require speech as an input to operate the interface.

We will be minimizing the options that a user sees on the screen and utilize the available real estate for larger display components the screen. The primary email control option will be voice commands and not text input via a keyboard. So when the user creates a new email, he/she will not be required to type, but instead record a voice clip which will be sent to the recipient as an attachment. Incoming email will typically be in the form of text and will be displayed in a large font to be read easily.

The system will be trained to each individual user's impaired voice and as a result of this customization we expect it will perform better than the current speech recognition software that the users are using.

This system represents a significant refinement to our previous idea, as it will be limited in terms of what it offers. The previous system was a large suite of applications such as a new Skype interface, web browser, email and word processor. These were all the tasks that our target population is trying to accomplish currently with moderate to extreme difficulty. We will only focus on one component (email) and improve performance by reducing the time it currently takes to perform the same task with current methods (Windows voice recognition and Dragon Naturally Speaking) and making it easier to perform visually and cognitively.

This system will meet the three functional requirements because it will display items is an large easy to read format, will not require users to use their hands and will be customized to the individual user's impaired voice.

The other design concepts that we were considering were:

- Mouse control using Eye Tracker
- Virtual Speech Pathologist

The mouse control system has its limitation because we have observed that some patients have a head tilt, or involuntary head tremor, which will make the gaze tracking considerably more difficult and the mouse pointer movements less fluid. Moreover, we believe that the interface on the screen will still be cognitively challenging even if it is large enough, there are too many options on the screen and within the applications (Skype, email, web browser and word processor) for our target population to easily use.

With the virtual speech pathologist, it is a rather difficult task which would require extensive computer vision and recognition of variations in voice. This system would require natural language processing to interpret user input and provide useful feedback or interactions, and language processing is already a difficult task with non-impaired speech. Also, this option would incorporate the challenge of getting the target population to accept a virtual speech pathologist on a computer as a replacement to a human.

Though both of these ideas are useful and could potentially provide a wealth of benefits to the user population, these proposed systems would take significantly more time to develop and implement, while our chosen design will allow us to rapidly provide a tool to improve their ease of interaction with email and quality of communication.

We also used the feedback from an SLP while making the choice of a design concept.

Team Contribution:
Planning (choosing functional requirements and design concept)
        Ganesh, Zhichun, Steve, Mansoor
Write up
        Mansoor, Steve
Story Board
        Steve, Ganesh
Final Proof Read:
        Steve

References:

BEUKELMAN, D., FAGER, S., Ball, L., Dietz, A., 2007, AAC for Adults with Acquired Neurological Conditions: A Review, Augmentative and Alternative Communication, September 2007 VOL. 23 (3), pp. 230–242

Duffy, J. R. (2005). Motor speech disorders: Substrates, differential diagnosis, and management. St. Louis, MO: Elsevier-Mosby.
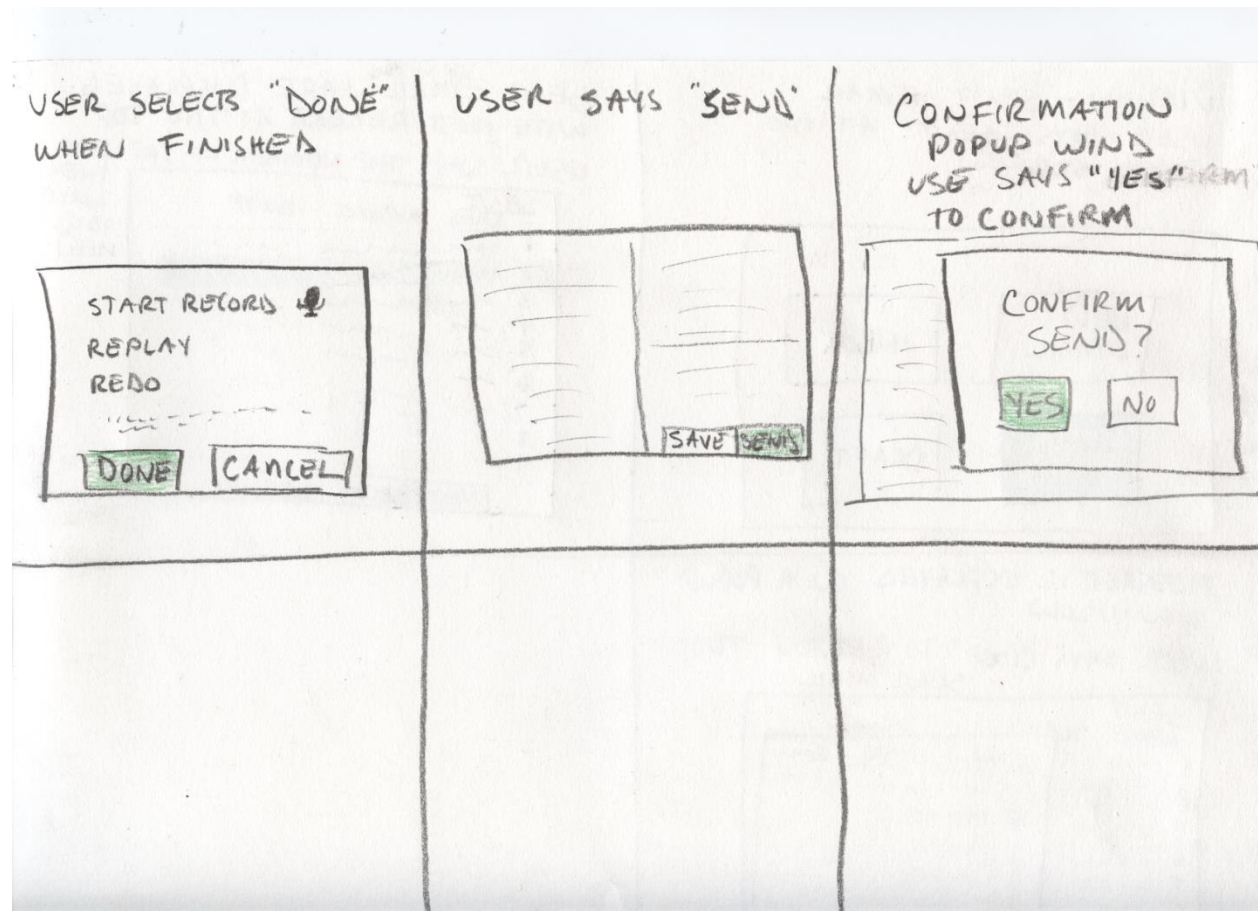
Storyboards

The storyboards below recreate the three main demonstration functions and design requirements. The system recognizes the user as they approach and loads their unique profile. Each profile contains saved voice recording of the commands for the system to match against and also the user preferences for email. These include their address book, some configuration options and default choices for email subjects. The user uses voice commands to navigate the email application, eliminating the need to use their hands.
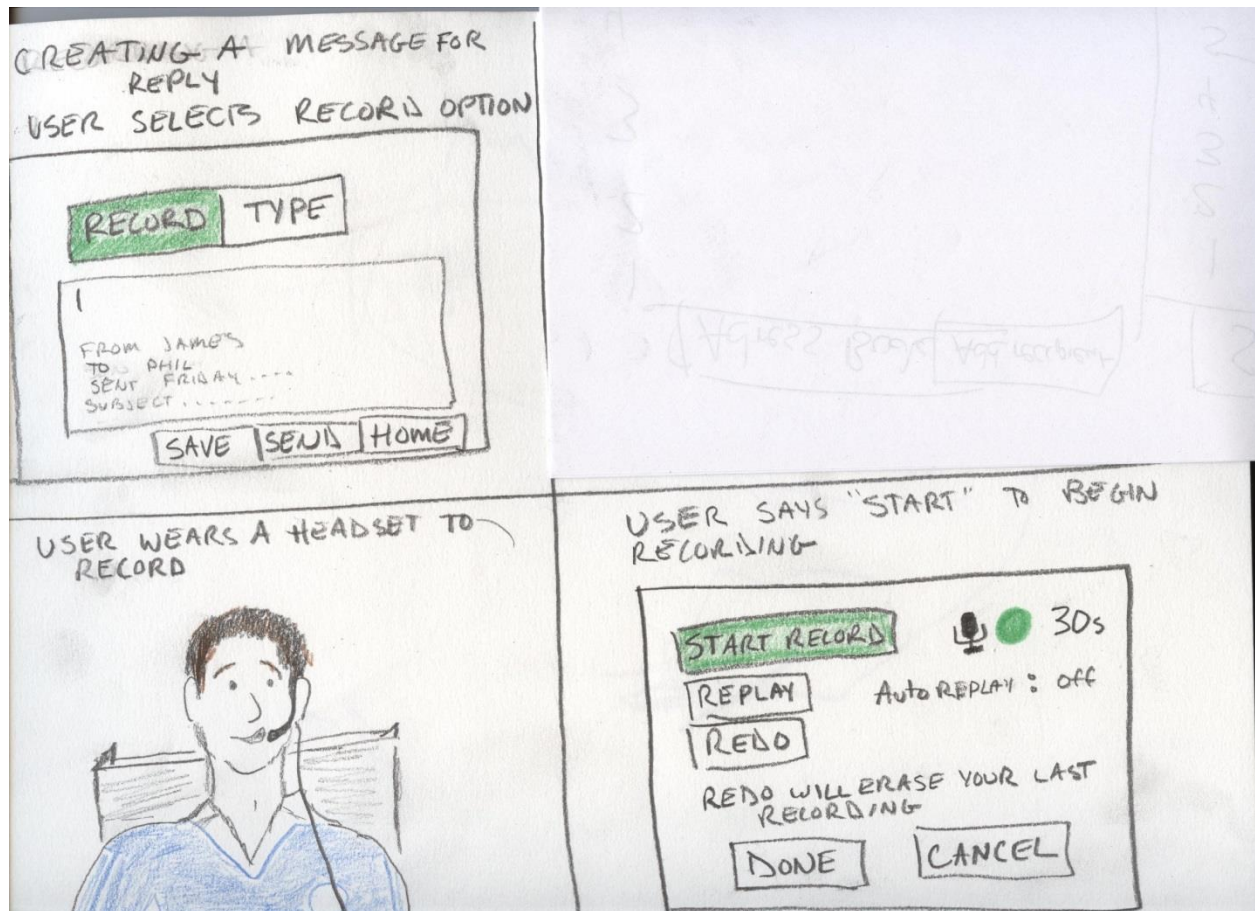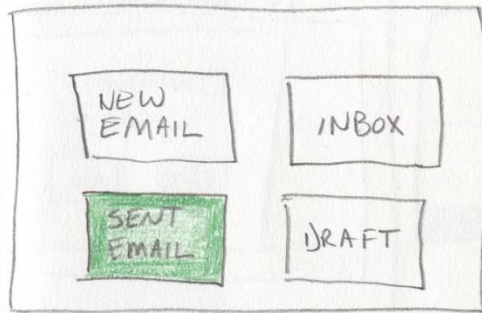
Any choices indicated by the user will be highlighted in color and the system will also give audio cues to help sight impaired users be sure they are executing their desired tasks. We have tried to minimize the number of screens to prevent users from getting lost during navigation. Multiple options are available in many places (for example, Reply and Forward can be initiated from the same place) to reduce the number of commands needed to perform actions. We also chose popups over opening full screen windows to help users retain a better sense of where they are. For example, when viewing a message in the inbox, the popup allows the user to still see the inbox in the background with the message currently open highlighted to provide a reference to where they are. Confirm popups also keep the current location in the background to help users stay grounded.

USER SELECTS "DONE" | USER SAYS "SEND" | CONFIRMATION
WHEN FINISHED | | POPUP WIND
                     | | USE SAYS "YES" FIRM
                     | | TO CONFIRM

START RECORD 🎤
REPLAY
REDO

DONE CANCEL

SAVE SEND

CONFIRM
SEND?

YES   NO

VIEWING SENT EMAIL
USER SAYS "SENT" AT THE
HOME SCREEN

NEW EMAIL   INBOX

SENT EMAIL   DRAFT

SENT EMAILS ARE DISPLAYED
WITH MOST RECENT AT THE TOP
USER SAYS THE NUMBER OF THE ITEM
                              THEY
SENT   WANT
NAME SUBJECT   DATE   TO VIEW
1
2
3
4
5
6
7
8
9
NEXT BACK HOME

MESSAGE IS DISPLAYED IN A POPUP
  WINDOW
USER SAYS "CLOSE" TO RETURN TO
         SENT MAIL

SENT
NAME SUBJECT   DATE
1
2
3   NAME   DATE   REPLY
4   SUBJECT   FWD
5
6
7
8   UP DOWN CLOSE
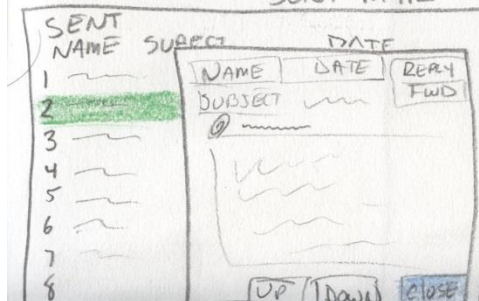
TO CREATE AND SEND A
NEW EMAIL, THE USER SAYS "NEW EMAIL"
AT THE HOME SCREEN

| NEW EMAIL | INBOX (4) |
| SENT MAIL | DRAFT |

THE USER CHOOSES AN ADDRESS
BY SAYING THE NUMBER OF THE
RECIPIENT, Add can be used to add more
than one.

Address | Add   SUBJECT | CHANGE
1   1
2   2
3   3
4   4
5   RECORD | TYPE
6
7
8
NEXT | BACK   SAVE | SEND | HOME

USER THEN SELECTS A SUBJECT FROM
THE SAVED OPTIONS. 1 IS THE DEFAULT
OPTION: THE USER CAN SAY "CHANGE" TO
SELECT ANOTHER OPTION

SUBJECT | CHANGE
1. MSG FROM TOM
2. MSG FROM GRAMPA
3. . . . . . .
4. . . . . . .
5. . . . . . .
RECORD | TYPE

USER SELECTS "RECORD" OR "TYPE"
TO CREATE MESSAGE. "TYPE" PLACES
THE CURSOR IN THE TEXT BOX, WHEN
FINISHED THE USER CAN "SEND" OR "SAVE"
4
5

RECORD | TYPE

SAVE | SEND | HOME