T1: Find a Team & Identify a Project Topic

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Project Proposal

Problem:

People with speech impairments have a hard time communicating with the general public. North American demographic studies have indicated that there are approximately two million Americans have severe communication impairments. This prevalence is even higher according to the U.S Census Bureau's report in 1996, which reported that 2,521,000 Americans older than 15 years old are unable to meet their daily communication needs. This represents 1.3% of the total population. The situation is also severe in Canada, 0.9% of the population are experiencing the difficulty having their speech understood.

There are many reasons that can lead to the communication difficulty, cerebral palsy, developmental dyspraxia, traumatic brain injury, Parkinson's disease, multiple sclerosis, etc. Among them, dysarthria is the most common disorder resulting from these diseases. Dysarthria is a class of neurological speech motor disorder, in the beginning patients are able to communicate with people because they can understand them (though with difficulty). However, as the impairment progresses the communication becomes labored and eventually the patients reduce the communication attempts. As a result, the network of the patients shrinks considerably. So much so, that only the

caregivers of the patients are able to understand them for a very limited set of utterances. This reduces the self-reliance and autonomy of these patients.

Why is Health Information Technology Important?

Effective use of communication and technology by health care and public health professionals can bring about an age of patient and public-centered health information and services. Current solution is Augmentative and Alternative Communication(AAC). AAC can be either unaided or aided. Unaided AAC is the form of communication where an external device is not used for communication purposes. It is restricted to facial expressions, vocalizations, gesture and sign languages. The various examples of these options are Amer-Ind code, Signing Exact English and American Sign Language. Aided form of AAC can be further categorized into low-tech and high-tech. The low-tech options comprise very simple communication board, books and flashcards, whereas the high tech AAC devices are devices that are electronic devices which generate speech on basis of the input from the user with a speech impediment. The benefit of using high-tech AAC devices is the ease of user for the people who are communicating with the speech-impaired user and the relatively less time it takes for the user to construct a sentence.

Challenges with AAC devices and individuals with speech impairment:

The AAC devices in the industry require tapping a sequence of images and symbols to generate a sentence. This process is very slow for a normal healthy person with perfect motor function of the hands. However, this problem becomes exacerbated for subjects with motor impairments. Parkinson's disease, ALS, MS and brain injury patients, not only suffer from speech impairment but also motor control impairments. This makes the whole communication process really slow. The user gets frustrated and they just don't want to use the AAC device any more. The users also have visual impairments which makes it hard to read the symbols and text off the AAC devices.

Commercial efforts and Current research:

Commercial examples of such devices are from Dynavox, Auditory Sciences and Tobii. These devices have touch screen which symbols and the user can tap a sequence of symbols to create a sentence. That sentence is then generated by the device. The touch screen interface can either be static or dynamic. For the static interfaces the pictures are fixed and the user learns to make do with the symbols and options that are available. However, with a dynamic interface the user gets the option to update the pictures and the message behind them.

Current research efforts are geared towards not using a mxm grid for the icons/ symbols, because many users with speech impairments also have motor impairments and cannot access all areas of the screen with a uniform dexterity. Therefore, some areas of current research are focusing on developing an asymmetric grid for the icons/ symbols, which is more accessible for the users. Moreover, there is also research to use brain computer interfaces to choose these icons and then generate the sentences.

Target Users:

Our target population is people with mild dysarthric speech disorders who currently use an Augmentative and Alternative Communication (AAC) device to assist them in their communication with others. Age, gender, race and other demographics are not expected to be critical factors, other than restricting the target to adults (aged 18 or over) in a sample population primarily to reduce recruitment complexity. AAC devices allow the user to generate words and phrases from a special computer, typically the size of a laptop. People in our target population can still speak, but have some difficulty with producing speech that can be understood beyond their immediate care circle. The quality of their speech is beginning to deteriorate or has deteriorated due to their health condition, and their speech can be unintelligible for people who are not familiar with the person (those who interact with the dysarthric person on a regular basis, such as family or caregivers, learn to decipher the altered speech patterns of the impaired individual). The impaired person must rely on the AAC when interacting with people outside of their normal peer group and these devices can introduce delays in conversations or interactions as the user creates words and phrases with the device. Our proposal is to create a system that allows a user to record common phrases by speaking themselves, which are then converted into computer generated intelligible speech. these phrases can be stored and retrieved more quickly than recreating them with the AAC. The system would require the user to be able to speak at a minimum level of intelligibility dictated by the speech recognition software. The user must also possess either the motor skills to interact with a computer via keyboard or touchscreen, or have a caregiver that can provide this facility.

Team Contribution:

- Ganesh worked on gathering information on AAC population and device and wrote the section on the need for technology for this population.
- Mansoor wrote the section on challenges with AAC devices and previous work in this area.
- Zhichun created the team website and wrote the problem section.
- Stephen worked on the target population and reviewed the final document.