**Abstract**

Today, deafness and hearing loss affects many people in the world. There are about 70,000,000 fully deaf people worldwide. Telecommunication Device for the Deaf (TDD) was a one way communication device from the deaf person to a well-hearing person who is receiving the message. A more modern version was created to allow a two-way communication with the help of a TDD, called the TTY, or Telephone Typewriter. The TTY used only capital letters for the communication. Our dream for our technology is that in 20 years there will be a device developed that scans deaf people’s hands of signs and translates the intended message on the screen to be read aloud. Then we had the idea of a device that can be spoken into and have the words and signs appeared instantaneously. This technology has the ability to help bridge the gap between the deaf community and the non-deaf community.

**Anacusis Linguist**

**Present Technology**

Today, deafness and hearing loss affects many people in the world. Being deaf must fit the criteria of having no hearing in both ears. There are about 70,000,000 fully deaf people worldwide. Roughly 4,000 new cases of deafness occur each year in the United States. Also, there are 36,000,000 adults with hearing loss in America. As age increases, the percentage of adults with hearing loss increases. There are different kinds of hearing loss. One kind is Tinnitus. Tinnitus is when people hear clicking, ringing, or buzzing sounds throughout their ear. There are about 16% of people in the United States with tinnitus, which equals out to about 25,000,000 people who suffer. Another kind of hearing loss is Ménière's disease. Ménière's disease causes congestion, dizziness, hearing loss, and tinnitus. Nearly 615,000 people have been diagnosed with this disease. Another 45,500 are diagnosed every year. A different kind of hearing loss is vestibular schwannoma, or commonly known as acoustic neurinoma. It includes a slow-growing tumor that is caused from the overproduction of schwannoma cells. This only occurs in one ear which produces many problems. This disease can even cause paralysis, which is the damage of facial nerves, to a rare extent. One out of 100,000 people develops acoustic neurinoma a year. Finally, one more extent of hearing loss is Usher syndrome. This is a disease that doesn’t only affect someone’s hearing, but also their vision. They mainly lose their night vision and peripheral vision. Practically 3% to 6% of all deaf children have Usher syndrome and 4 out of every 100,000 babies are born with Usher syndrome. The majority of babies that are born deaf are born to perfectly hearing parents.

There are very few things that are invented to help deaf people communicate with other people without using a translator. One of them is a website called<http://icommunicator.com/>. It has speech to sign language, speech to computer generated voice, and speech to video translations. That helps but not sufficiently enough. This only works if you have internet connection, and the website is not free. There are many other websites just for learning how to perform sign language and sign language dictionaries. There aren’t many easy portable things invented yet.

Another type of technology that has been invented to help deaf people communicate is called Video Relay Service, or video interpreting services. This service helps deaf people communicate through video calls with another hearing person who knows sign language as well. This would be problematic for people who want to communicate with a deaf person, but can’t because they don’t know sign language.

There are also various apps that help make the daily life of people with hearing disabilities a little bit easier. For example, an app called ClearCaptions. This app offers free captions during phone calls, so a deaf person could read and understand what the other person is saying. With our technology, we will help with easier communication, in person or over the phone.

**History**

In the 1500’s Geronimo Cardano taught his deaf son how to communicate using symbols. Pedro Ponce taught speech to people who have been deaf since birth. Between 1760 and 1788,Charles Michel De L’Eppe developed a system of signs and finger spelling in France. Then he published a dictionary of French signs.

In 1817, Thomas Hopkins Gallaudet established the First American School for the deaf in Hartford, Connecticut. In 1870, Alexander Graham Bell promoted deaf education by teaching deaf students how to read peoples lips to understand what they are saying. In 1892, the electrical hearing aid was invented to give hearing impaired people a chance to hear normally.

In 1950, the first pager was invented. It was used to help doctors communicate about patients. Later wireless pagers were invented to allow a deaf person to send emails, pages and calls to TTY or video relay services. Also in need of help, Able Access Accommodations   
(AAA) can be communicated with through the pagers.

In 1960, American Sign Language (ASL) was proposed as an official language. In 1964 a deaf phone was invented. Also in 1964, the Telecommunication Device for the Deaf was invented by deaf physicist Robert Weitbrecht, such as the Telephone Typewriter (TTY). It was a one way communication from the deaf person to a well-hearing person who is receiving the message. In 1965, an ASL dictionary was published.

In 1973, a more modern version was created to allow a two-way communication with the help of a TDD. The TDD looks like a small computer. It has a screen, a regular keyboard, and even a printer. Words would be spoken as the deaf person typed them. A company called “Applied Communications” partnered with MIRCon and together helped make communication for the deaf which made everyday life easier. The TTY or telephone typewriter, previously known as the TDD, used only capital letters for the communication. In 1979, a few televisions came with closed captioning, which are subtitles on the bottom of the television screen that shows in words what the people on the screen is saying.

In 1982, Cochlear Implants is a device that gets put into the cochlea to help with hearing. It is useful to those with hearing loss and receives no help with regular hearing aids. The Assistive Listening Device (ALD) is used by people with hearing loss and who use cochlear implants. They lower background noise to try to focus directly on the voice of the person talking. The person has to wear a microphone and FM waves get transmitted to the ALD or cochlear implant.

Since 1993, all televisions come with closed captioning. In 1994, the V18 was invented, which was a modernized version of the TDD. Now cell phones, text messaging, and instant messaging helped make the deaf community interrelate with fully- hearing people.

A technology that has been invented in 2013 to improve the lives of deaf people is called VibroHear bracelet, which vibrates and flashes green or red L.E.D. lights, the intensity and color depending on how close or far away the sound is and how loud it is. This bracelet is supposed to help let deaf people know when there are potential dangers nearby, for example a fire alarm or smoke detector going off, and a car honking.

There is a certain kind of alarm clock for those who are deaf where flashing lights appear to wake up the person. The flashing lights are also used to alarm someone when there is a buzzing or ringing or any other noises in the home. Also, there is a vibrating bed that vibrates when it is time to wake up. It also does the job of the flashing lights to alarm the person of any noises.

**Future Technology**

The goal for our technology is that in 20 years there will be a device developed that scans deaf people’s hands of signs and translates the intended message on the screen to be read aloud. Also, the deaf person would have the option to type in what they want to have read aloud, or they can choose pictures of signs with words beneath it. The hearing person that the deaf person is communicating with would be able to speak into the device and the words would show up on the screen. This device would be called the Anacusis Linguist, because anacusis is the difficulty of hearing and linguist is a translator, and it would be installed in every store and business for easy communication between the hearing and non-hearing. Also in 20 years, hopefully there will be a law passed that would require this device in every store and business so deaf people would not be deprived of communication and they could communicate easily just as easy as any normal hearing person would. Hopefully this technology will become the go-to device for communication between the hearing and deaf rather than the TTY. This technology would not be very hard to develop considering that many of the variables for this device already exist, like voice recognition and typing in words, but the scanner may be difficult. The scanner may be difficult because it might be hard for the device to detect what signs the deaf person is making. It would have to be able to translate relatively fast considering that many deaf people fluent in sign language sign fast, almost as fast as how a person speaks words. This would be helpful for communication processes because it would quicken the conversation, and it would be easy as if they were talking to another person who knows sign language.

**Breakthroughs**

There are many breakthroughs in technology that must occur to have the Anacusis Linguist be possible. First, there must be a technology that can immediately transfer words to pictures of signs and words beneath it. This is important because our invention would not be useful if it was time consuming. Another reason is that there must be a technology that can scan peoples hand and understand the sign. It would be helpful because now the deaf person can put in their share of the conversation. Also, there must be individual pictures of the signs with words under it so the deaf person can tap instead of scanning their hands and it is also helpful for the non-deaf to be able to understand what the deaf person is saying if the non-deaf person cannot understand sign language. The reason this technology does not exist today is because there was already existing technology for the deaf, such as the TTY, and possibly no one ever thought that there could be improvements for this simple technology. In our research, we haven’t found any needed improvements of the telephone typewriter, but there is always a need for new inventions. Also, this technology may not exist today because our idea is that the device would be in all stores and businesses for easy communication between deaf and hearing people, and the TTY may be costly considering all of its components. This device would be like an iPad, as it will be similar or congruent to and be able to be a touch screen that has pictures of the symbols with closed- captioning under it, but can also double as a scanner and immediately understand what is being signed. It is important that this works. There are different kinds of applications that are similar to a scanner, so that breakthrough won’t be necessary. We would create an experiment to calculate the accuracy of the scanner’s readings to be confident that this invention will be able to work. We have to make sure the scanner can pick up the signer’s words, because they may sign quickly. To test the accuracy, we will need many people fluent in American Sign Language (ASL), many people learning it who will perform slower, and the Anacusis Linguist. The independent variable would be the speed and the people signing. We would manipulate the speed of the person signing, to make it very fast or slow. This would make a difference because it may not be understood if some people go too fast. We would need a scanner that can decipher signs from fluent signers who sign very quickly. The control group would be the people who sign the same signs done at the same speed and fluency. The experimental group would be the people who fluctuate the speed and have different messages, because everyone signs differently for their speeds. We would hope to see more than 99% correct of the signs.

**Design Process**

There were a few stepping stones that led us choosing the idea for creating an easier communicating device for the deaf. Our original idea was the do something to help the blind. We thought of just a sensor in the cane. We eventually found out that there were many types of canes with sensors. We thought of an idea of a sensor and GPS included as a chip in the blind cane to help them know where to go. We didn’t see it listed on the internet separately, so we thought it was acceptable. Unfortunately, that exact idea was invented, so we had to change it. Then we were thinking of more ideas for blind people because one team member recently saw a blind person struggle. Then we realized there may be hard things to invent things to help blind people because there were already many technological advances already invented. The blind person that the team member saw has many brothers and sisters, but one sister in particular is deaf. Then we had a thought in mind for deaf people.

We then had the idea of a straight out translator where one person would type the phrase into the translator but that was too generic and already invented. One team member was talking to their parent and their parent said they have a deaf patient and it is hard to communicate with them over the phone. They have to use the TTY, but that can be difficult and time-consuming. That is when we had the idea for deaf communication. Also, it is difficult for one person who has many years of experience to one who doesn’t even know one sign. We didn't know what was invented yet, so we researched a lot so we can see what we have to work off of. We found out that there were many communicators for those between two experts at American Sign Language (ASL). That isn’t so resourceful in the matter that the deaf communication is usually between a deaf person and non- deaf person, intercepted by a translator. Using a translator can be tiresome and bothersome. Many of the communicators are online which can be very annoying in the case that there is no wifi or the website is shut down.

That is when we thought of a device that does not require the internet help. Also, there are many ASL dictionaries. That can also be a struggle due to the fact that the conversation would be extremely long and tedious for the receiving deaf person. Then we had the idea of a device that can be spoken into and have the words and signs appeared instantaneously. Also, not only would there be closed captions, there would be pictures of the signs. These would be in every store and business. The deaf person can type what they want to say in or tap the signs with words under it to make a complete and coherent sentence that the device would read out loud for the hearing person or they can scan their hand and have the sentence appear and read aloud. The hearing person trying to communicate with the deaf person can speak into the device, and the words would show up on the screen for the deaf person to read. We chose this because it seemed the most realistic and normal conversation wise. Our future technology is better than the rejected technology because it is new, original, and inventive. We will be helping many more people than we would with our technology.

**Consequences**

With our technology, there will be many positive and negative consequences. One positive consequence that will come from this technology is the ability to help bridge the gap between the deaf community and the non-deaf community which will help eliminate social barriers. Another consequence would be the ability of a person who does not know sign to be able to learn sign by using the pictures given. The pictures are there to help any person using it create a sentence instead of speaking, typing it, or scanning their hands. One negative consequence that will arise from this technology is that it may be costly for everyday people who need it. New technologies cost a lot of money that some people may not be able to afford, not allowing them to use the device. Another negative consequence of this technology is that it could have glitches or freeze every once in a while would be inconvenient. No technology is perfect, but ours will try to achieve as much perfection as it can.

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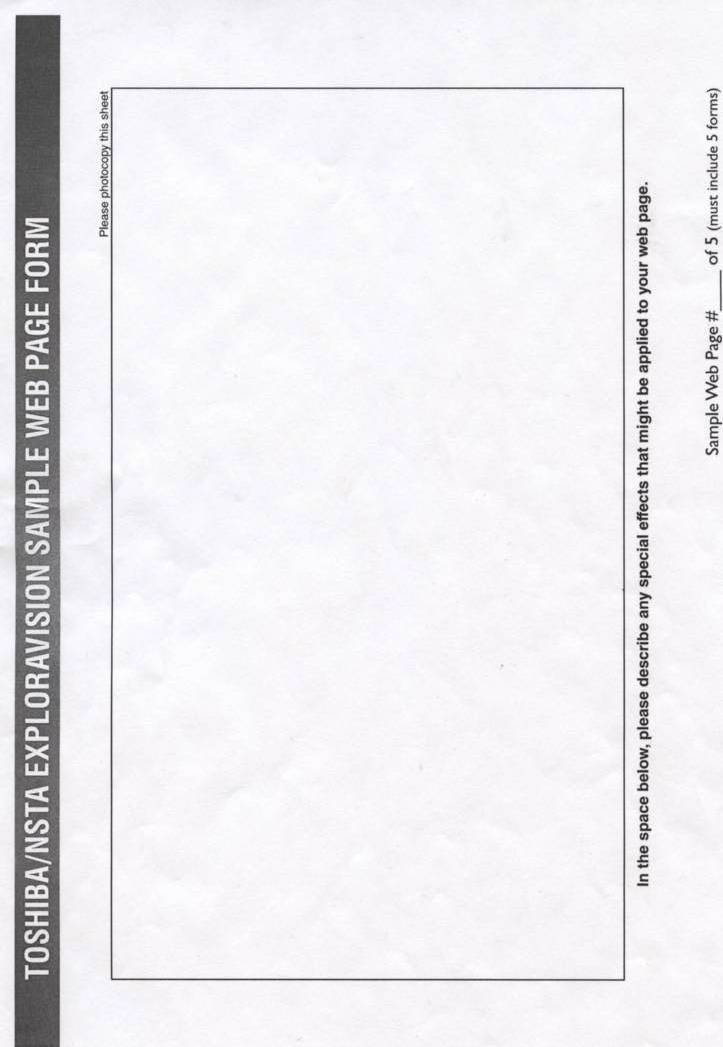
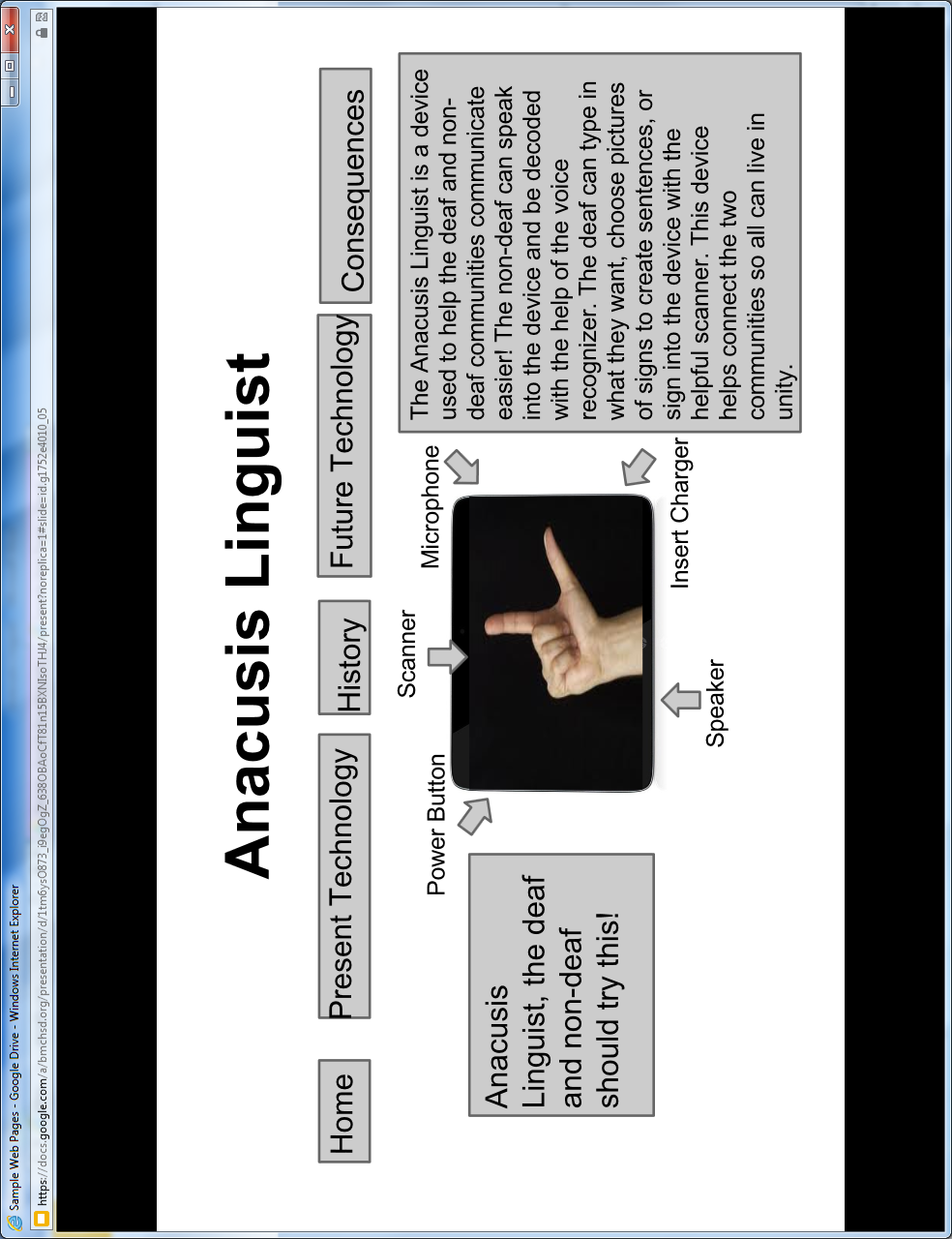
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