

Final Portfolio

Element A: Choosing a Topic

Project Title: Speakey Speakey
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Problem Statement:

There is a communication barrier between people who use American Sign Language (ASL) all over the United States and those who do not. A bridge needs to be developed to close the gap in effective communication. We propose developing a device that takes the motions of ASL and translates them in to the Latin alphabet, initially exclusively written and later spoken. Our Speakey Speakey will be made using a Makey Makey and its Arduino companion.

Personal Justification

Article 1: Breaking Down Barriers: For the deaf, a doctor who can communicate.

This article is about a women who by working with deaf people learned of their hardship of communication. She was surprised at how frequently her colleagues spoke about their difficulties communicating with doctors. This article also states that 10 percent of the population is either deaf or hard of hearing. Both of these statements prove the need for a barrier to be diminished.

Calabro, T. (2013, November 25). *Breaking down barriers: For the deaf, a doctor who can communicate*. Retrieved from <http://www.post-gazette.com/news/health/2013/11/25/For-the-deaf-a-doctor-who-can-communicate.html>

Article 2: American Sign Language

This article talks about the history of sign language and how people learn to use it. It also states the fact that a deaf person's most useful and valuable sense when it comes to communication is sight since they have a loss of hearing. This is important because it proves that the people who do not know sign language can see and use that sense to communicate with people who use ASL.

Article 3: The Effects of Bad Communication in Business

This article states the problems that come with bad commication in the work place. It states that bad communication can decrease productivity, lower morale, and increase mistakes in the work place. This is significant to our problem because everyone needs to be able to communicate effectively.

Forneris, J. (n.d.). The effects of bad communication in business. Retrieved from <http://smallbusiness.chron.com/effects-bad-communication-business-2880.html>

Element B: Documentation of Prior Solution Attempts

Existing Similar Products

Acceleglove



This product is a gesture recognition glove that detects the individual motions of the finger, hand, wrist, and it uses direct glove output to recognize static gestures from either a pre-trained library or a user-trained library. This means that you will have to download software to your computer. This product is not made specifically for sign language translation. It can be used for many different tasks such as controlling a robot. It is expensive and is made custom for each individual customer. Our product will be better in that it will be less expensive and the glove will not need to be custom made for each customer. Our product will not require the user to download any software and it will be made specifically for sign language translation.

Kinect

This translator is made by using a Kinect camera that recognizes signing gestures, then gives a spoken and written



translation. This system can also take a hearing person's spoken words and translate them into accurate signs carried out by an on-screen avatar. This product requires a Kinect camera and requires the researchers to gather

real world data on how each sign is made and how it is read through the connect. This product is also being improved and software is being developed that can artificially replicate a person's voice. Our product will be better in that it will be transportable and the word will be spoken and also spelled out on an LCD screen. This product works through the XBOX Kinect which is also very expensive. Our product will be cheaper and more practical for everyday use.

Evaluating the Competition

- Who/What are your major competitors?
Anthrotronix, Microsoft
- On what basis do you compete?
We are both solving the same problem. Our solution will be different in that we are using a different method.
- How do you compare?
Our product will be cheaper and more practical for everyday use. Our product will not have to be custom made for one person, multiple people will be able to use the same glove.
- Who are potential future competitors?
Microsoft
- What are the barriers to entry for new competitors?
Microsoft has yet to release their translator to the public because they are working on fine tuning the translator's algorithms and gathering real world data.

Pros and Cons of Existing Products:

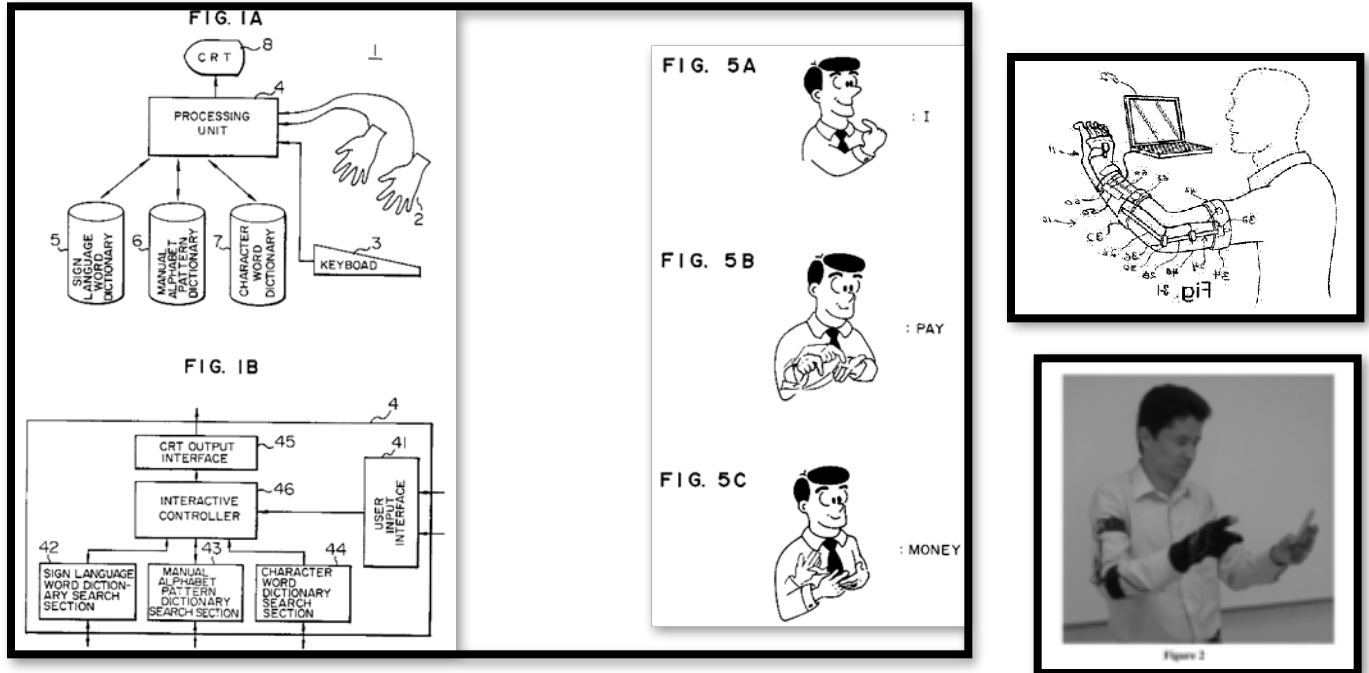
Name of Product	Advantages, Disadvantages, Cost
Acceleglove	<p>Pros: can translate sign language and also can be used for other purposes</p> <p>Cons: expensive, has to be custom made so therefore not readily available</p> <p>\$500</p>
XBOX Kinect	<p>Pros: Not only translates sign language to spoken and written language but also translates spoken and written language into sign language that is carried out by an avatar on the screen</p> <p>Cons: Expensive. The buyer has to buy an XBOX and Kinect in order to have the ability. This translator is not transportable.</p> <p>\$600</p>

Patent Search

1. Sign language/word translation system

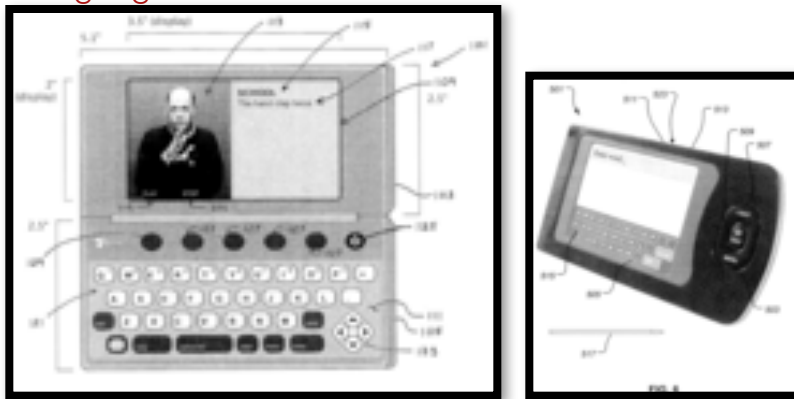
This patent is for a word translation system. It is for a sign language word dictionary in which words are recorded in correspondence with hand operations. The system will use a glove-like data input unit, a keyboard, a processing unit, a sign language word dictionary, a manual alphabet pattern dictionary, and a character word dictionary.

2. ASL Glove with 3-axis Accelerometer



This patent is for a sign language recognition apparatus and method provided for translating hand gestures into speech or written text. The system uses 3-axis accelerometers on fingers and back of the palm to measure dynamic and static gestures, an analog multiplexer and a programmable micro controller to detect hand postures of American Sign Language and send them to a host via serial communication. The sensors are then connected to a microprocessor to search a library of gestures and generate output signals that can then be used to produce a synthesized voice or written text.

3. Sign Language Translator



This patent is for a digital sign language translator. It has a touch screen display located on a face of the case, a microprocessor for selectively translating words, letters, and numbers into video clips of an actual person performing a sign language translation.

Identifying Users and Buyers

Our products potential buyers are anyone who uses sign language to communicate. There are an estimated 360 million people worldwide who are deaf or hard of hearing that could use our product to communicate. Beside

these 360 million people, people with the ability to hear but not able to communicate with people who can't could also be a potential buyer.

The Market

The target market for our product will be American Sign Language users so mostly people who reside in geographical locations that use the American language. This should be our target because our product will not be all that helpful to people who use a different language

Element C: Design Specifications

1. Customer Needs- the customer want a device that will translate ASL into written and spoken language.
2. Performance-the product must be able to translate hand motions into words.
3. Target Cost- Our product will cost less than our competitors. We estimate our product will cost \$50 taking into consideration that the Makey Makey device cost \$50 dollars and the cost of an Arduino.
4. Size and Weight- Our product will need to be light weight for a user to be able to wear on their hand for long periods of time. Our device will also need to be portable.
5. Aesthetics- the product will come in a variety of different colors. The gloves will be latex with spots of material that will be used to connect the circuit. The spots will connect to a bracelet that can also come in a variety of different colors.
6. Materials- The materials will need to be cost effective and durable. The gloves will be made out of latex and once used can be thrown away.
7. Safety and Legal Issues-wires may get tangled and wrapped around the hands
8. Ergonomics
9. Operating Environment- will need be able to access a computer in order for the apparatus to operate. The product needs to be used in a dry environment at reasonable temperatures.
10. Global Environment- at the end of its life it will need to be disposed of in an electronics disposal bin.
11. Service Life-Our product can last a life time and the parts can be replaced for a longer life.
12. Product Life- our product can last a life time and the parts of it can be replaced for a longer life.
13. Durability and Maintenance- our product will need to be durable with easy maintenance because the product will be used daily.
14. Additional Criteria

Element D: Selecting a Solution Path

Problem Statement

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Product Description

The Speakey Speakey is a latex glove with paint tracks connecting the main touch points used in ASL to the bottom of the glove. At the bottom of the glove will be a bracelet- type apparatus that will host the alligator clips that will be connected to the Makey Makey. The Makey Makey will be attached to the Arduino board. The Arduino board will also host the screen that will display the letters that are motioned.

Operation

The product will take each movement, track which touch points are activated, and "type" the letters and display them on the screen making anyone who does not use ASL able to instantly understand someone who does.

Justification

The Speakey Speakey solves the problem because it makes effective communication possible between ASL users and nonusers by translating what an ASL user says directly into the Latin alphabet. We chose the Speakey Speakey glove with painted tracks and a bracelet because it would be the most comfortable, durable, and versatile. The Speakey Speakey will also be the least expensive, least bulky and most the most appropriate mode of translation.our product will definitely be less expensive than the Acceloglove which is priced at around \$500 a glove. Our product will be \$50 but will include the bracelet and 50 disposable gloves. Our product will also allow the user to be able to use the device on any computer; no downloads of software are necessary.

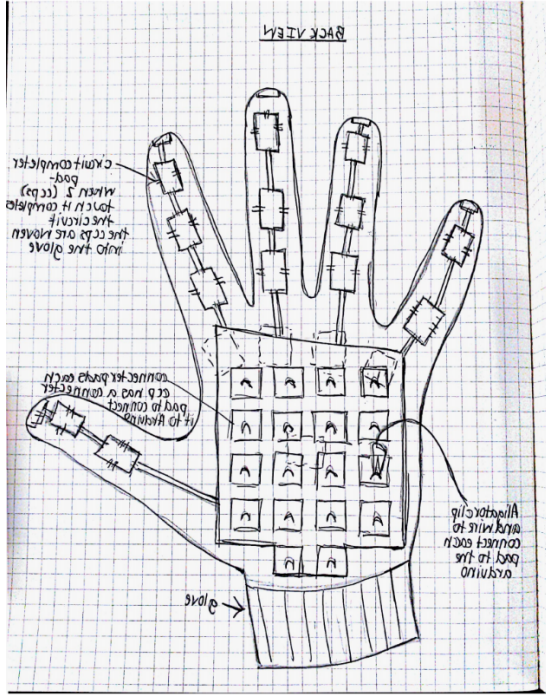
Appendices

Brainstorming Ideas

1. Glove- the wires will be integrated into the glove, could make it stylish, but the glove would have to fit tight on the hand.
2. Exposed Elements- the user would be able to see the pads they are connecting, easier to make, hard to attach to hand, can break easily.
3. Latex glove- paint pads on the glove, makes hand sweaty- uncomfortable, can be used then disposed of, product can therefore be cheaper.
4. Temporary tattoos and bracelet- the tattoos would go on the hand and connect to the bracelet, tattoo can be skin colored so people won't be able to see/ know you have it on.

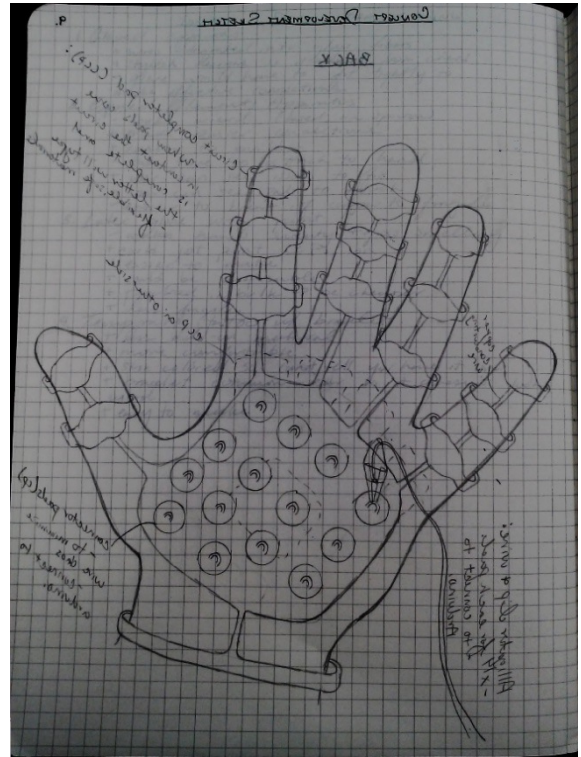
Product Concepts

1. Glove



Generated by Cms2csmr from intsig.com

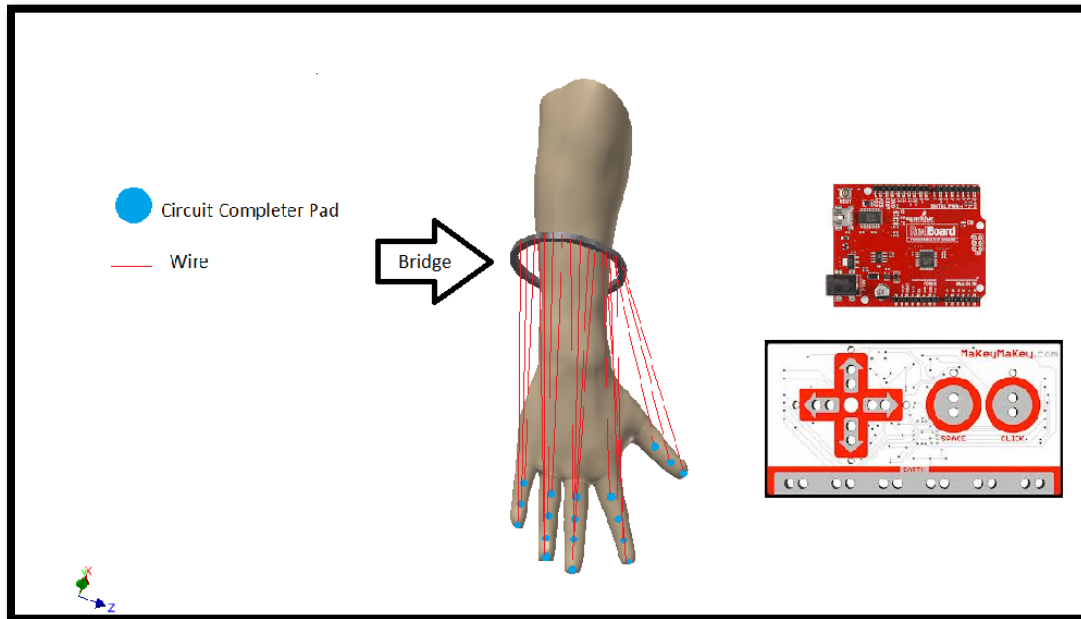
2. Exposed Elements



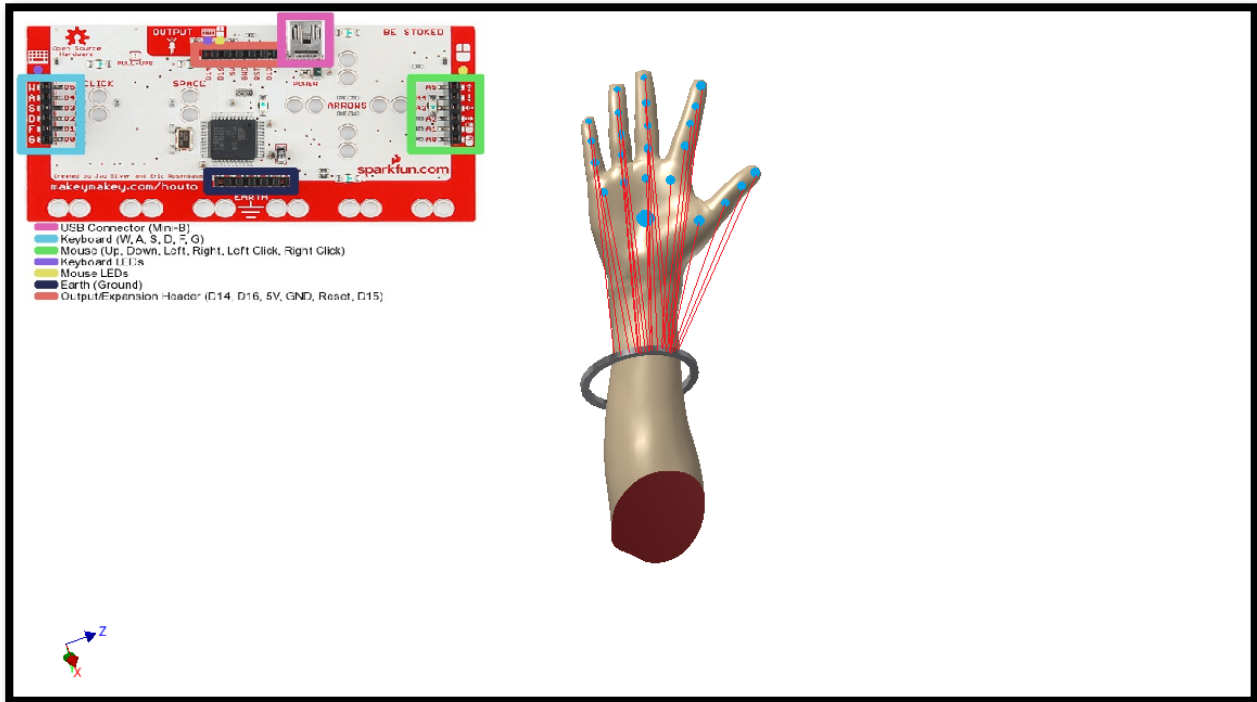
Working

Drawings

Top of hand:



Bottom of Hand:



Decision Matrix

Specifications	Design Matrix		Baseline Design-Nothing		Design 1-Glove w-paint		Design 2-Exposed Elements	
	Weight	Rank	Weighted	Rank	Weighted	Rank	Weighted	
Feasibility	0.2925	3	0.8775	4	1.17	3	0.8775	
Customer Needs	0.175	3	0.525	5	0.875	5	0.875	
Safety	0.15	3	0.45	5	0.75	2	0.3	
Ergonomics	0.125	3	0.375	2	0.25	2	0.25	
Aesthetics	0.1	3	0.3	5	0.5	4	0.4	
Target Cost	0.075	3	0.225	5	0.375	1	0.075	
Size and Weight	0.05	3	0.15	1	0.05	1	0.05	
Materials	0.025	3	0.075	1	0.025	1	0.025	
Product Life	0.005	3	0.015	5	0.025	2	0.01	
Durability and Maintenance	0.0025	3	0.0075	5	0.0125	2	0.005	
Total:		1	30	38	4.0325	23	2.8675	

Scale:

- 1 Way Worse Than Base line
- 2 Worse Than Base line
- 3 Same as Base line
- 4 Better Than Baseline
- 5 Optimal

Cost and Time Analysis of Prototype

Makey Makey \$50

Red Board Arduino \$25

Estimated Cost when made in Bulk \$50

Time to Build Prototype 5 weeks

Element F: Viability of the Proposed Solution

Technical Expertise and Knowledge Required to Design Product

1. Loads- Our product will not interact with any loads.

2. **Materials-** The Speakey Speakey will be made using latex gloves that will be disposable. The mechanical properties of a latex glove should provide sufficient strength to stay functional with the Bridge. Our gloves will be disposable and the Bridge will be made of a rubber bracelet that will be flexible and durable unless improperly handled. It will be able to withstand reasonable temperatures. Extreme temperatures will damage the electrical components.
3. **Mechanical Engineering-**The Speakey Speakey will not require any input of heat or mechanical power as there are no moving parts in our design.
4. **Energy-**The Speakey Speakey requires electrical input that it will obtain from a computer via USB in its initial stages. In the future with mass production, the Speakey Speakey will require a wireless portable battery.
5. **Chemical/Bio Energy-**Our product does not require the conversion of raw material into another form during manufacturing or use. There are no chemical or biological transformations involved.
6. **Electrical Energy-** The Speakey Speakey will require electricity to power the Arduino and Makey Makey which it will get from a computer.

Ethical Justification

The Speakey Speakey will break the communication barrier between ASL users and non-users. This will allow ASL users to communicate more effectively and avoid stress.

Possible Failures

- It could misread what the person is signing and display the wrong letters.
- It could be too obstructive to be wear.
- The programming could limit what can be said.

Element G: Building

Resource Planning

Bill of Materials

Item	Cost	Vendor	Includes	Quantity	Description	Notes
Makey Makey Kit	\$49.95	Sparkfun	Hid Board	1	Platform to input signs into PC	
			USB Cable	1	Connects HID Board to PC	
			Alligator Clips	7	Connects Makey Makey to Glove	
			Connector Wires	6	Initially connect CCP to Bridge	Later will be substituted for conductive paint or thread.
RedBoard programmed with Arduino	\$24.95	Sparkfun	RedBoard	1	Allows for programming of the LCD screen	
LCD Screen	\$14.95	Sparkfun	Screen	1	Displays the letters that are signed	
Latex Gloves	\$3.39	Great Value	Gloves	100	Provides base to apply CCP.	Later may be substituted for a leather glove if thread approach is chosen.
Copper Tape	\$2.95	Sparkfun	Tape	1 Roll-50 ft	CCP	

Tools and Equipment

Item	Exists in Lab	Source if not in Lab	Outside Source Notes
Scissors	Yes		
Computer	No	Madison's PC	Laptop
Wire Strippers	Yes		
Arduino Environment	No	Online Freeware	

Needed Knowledge

Item	Need Outside Assistance	Source	Outside Source Notes
C++ Programmer	Yes	Knowledgeable adult	Possibly from Walmart, UofA, or Mrs. Carrol
Program to use all Latin letter keys	Yes	Sparkfun	Download program

Build Procedure

Makey Makey

1. Install Arduino Add-on
2. Open the Makey Makey program found online.
3. Reassign the keys to the appropriate letters
4. Upload the Program
5. Attach wires to the appropriate holes on the Makey Makey

The Glove

1. Obtain a model glove for planning purposes
2. Wearing the model glove, sign each letter and designate where each CCP should be.
3. Draw lines from the CCP to the wrist to ensure there is enough room for all the wires so that they don't overlap.
4. Obtain the actual glove to be used.
5. Obtain conductive thread.
6. Stitch each CCP and the trail leading to the bridge
7. Cut off the thumb

LCD Screen

1. Obtain a bread board, Arduino Uno, LCD screen, and Potentiometer.
2. Wire the LCD Screen:
 - LCD RS pin to digital pin 12
 - LCD Enable pin to digital pin 11
 - LCD D4 pin to digital pin 5
 - LCD D5 pin to digital pin 4
 - LCD D6 pin to digital pin 3
 - LCD D7 pin to digital pin 2
 - LCD R/W pin to ground
 - wiper to LCD VO pin (pin 3)
3. Open up the Serial Monitor Example found in the IDE.

Ground Band

1. Obtain Conductive tape.
2. Shape into a bracelet

Element K: Design Reflection

1. Did you solve the problem?

Our solution did solve the problem.

2. Impact

Our solution will be helpful for ASL users to communicate more effectively with non-users. Our solution would lead to more optimal devices that may be wireless, fashionable, and compact. Future devices may also provide audio instead of a screen in order to speed up the process. Also, translations may be done in real time.

3. Re-do

We would've tested the materials for conductivity beforehand in order to not have to re-map later. We would've also tested the compatibility of different materials as we now have supplies that remain unused. The project resulted the same but the process would've been faster.

Element L: Designer Recommendations

Modifications

- A professionally sewn glove would've made the glove look better.
- A glove insulated on the inside would remove the need for a latex glove under our glove.
- The purchase of a Makey Makey add-on would allow us to use the entire alphabet. The Speakey Speakey would've been more ready for the market.

Reasoning

We will not pursue this further because of time restraint. The building period is almost over and the modifications would require 2 weeks max to allow for shipping of products and developing a method to insulate a glove on the inside only.