EECE401 Senior Design I Electrical and Computer Engineering Howard University
Dr. Charles Kim -- Instructor
WWW.MWFTR.COM/SD1415.html

Sign Language to English



Team SLatE8

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Background

Customer:

- Hearing Impaired community in the U.S. (28 million)
- Parents of hearing impaired children
- business
- office
- retail
- ect.

Background

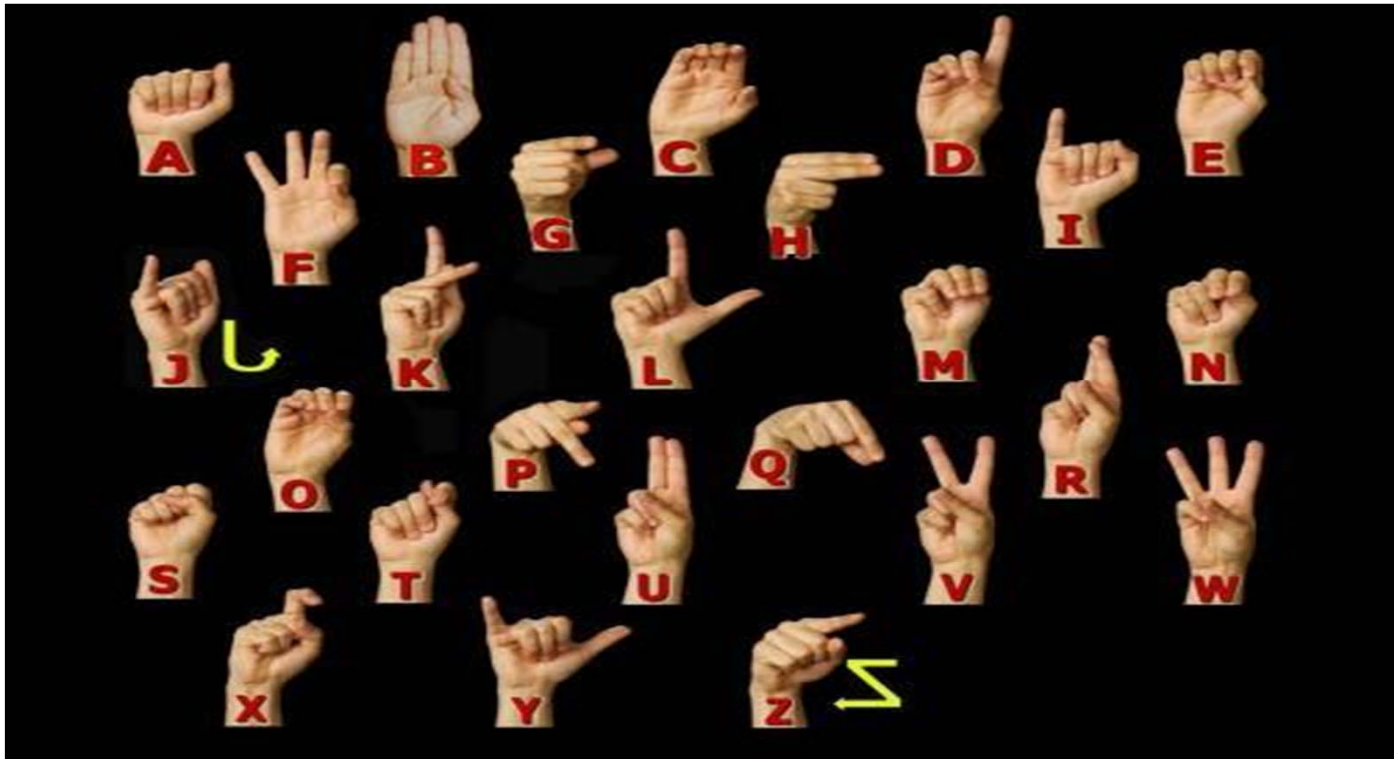
Needs and Demand:

- portable device
- easy to use
- fast response time and accuracy
- long battery life
- helpful
- fastest communication
- ect.

Problem Statement

The core principle of our team project is to build a device that will help to integrate the deaf/mute community more into society by developing a device able to understand, translate, and communicate with a person not knowledgeable with ASL by interpreting ASL into English.

Problem Statement Count'd



Design Requirements

- Internal features: **Intel Galileo Board**
  - ➢Physical Characteristics
  - ➢Communication
  - ➢Processor Features
  - ➢Storage Option
- Constraints:
  - ➢Resources
  - ➢Time
  - ➢System Developments

Design Requirements

- **Weight & Size:** less than 15 oz, 10x5x2 in.

- **Camera:** 640x480 bit resolution

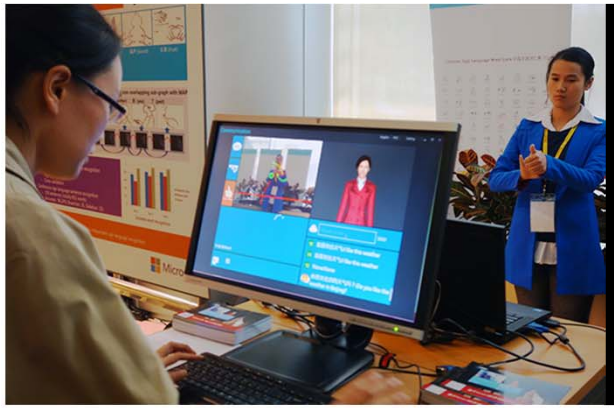
- **Sound system:** 3.5 mm TRRS, with frequency response range from 20Hz to 20kHz.
- **Display screen:** touch screen about 3.5in diagonal of a resolution of 640x480 at 326 ppi (0.61megapixels) with a typical 800:1 contrast ratio.
- **Response time:** no more than 30 seconds after the camera captures the picture of sign.
- **Accuracy:** are greater than 90% and error are below 5%.

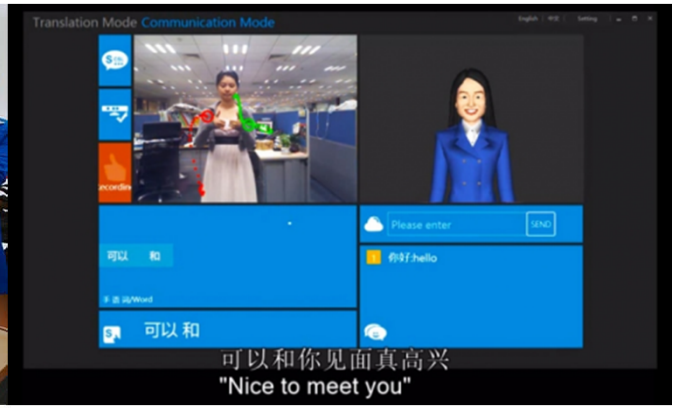
Current Status of Art

- MyVoice (University of Houston students of engineering technology and industrial design programs)

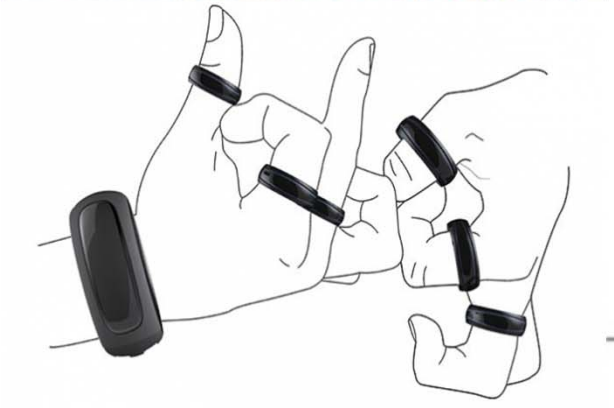
- EnableTalk gloves translate sign language into speech in real time (Ukraine's quadSquad winners at Microsoft Imagine Cup

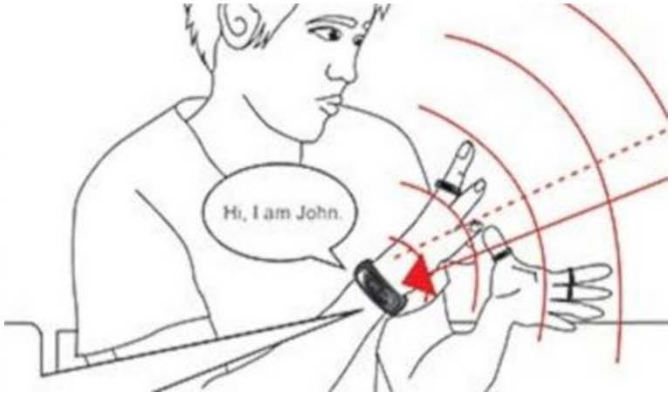
Current Status of Art





- Kinect Sign Language Translator (Microsoft Asia)





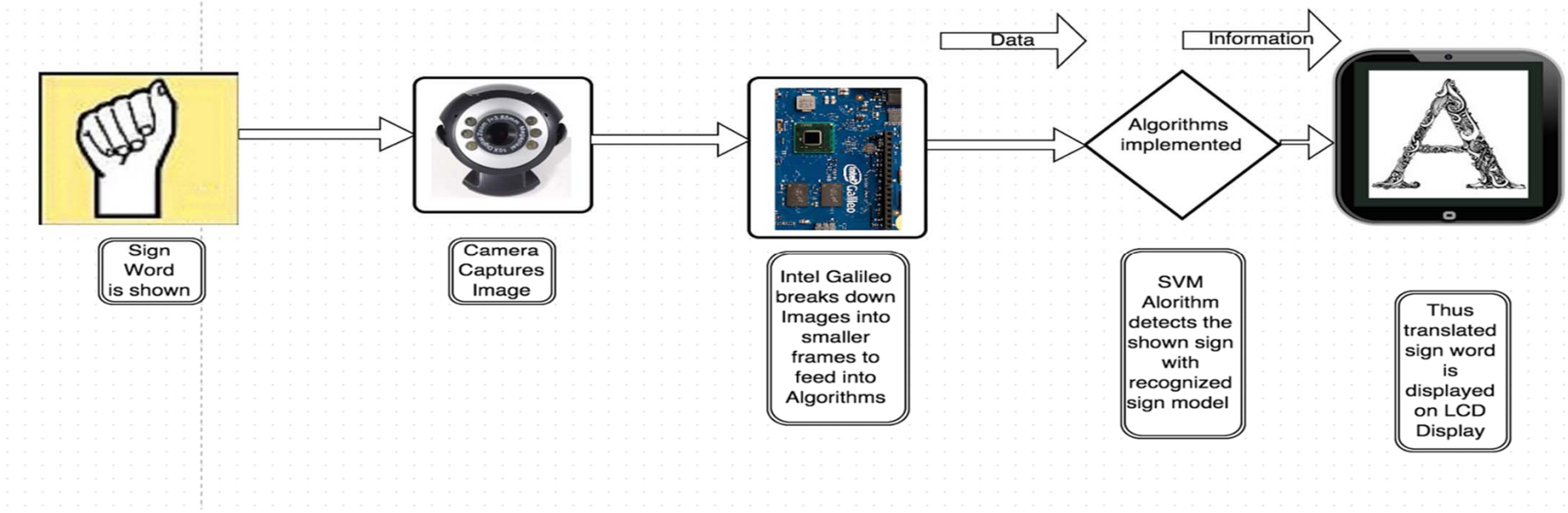
- The Sign Language Ring (winner of the 2013 RedDot Design Award)

Solution Approach

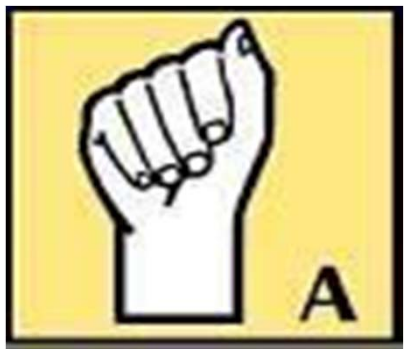
Design a working prototype which is

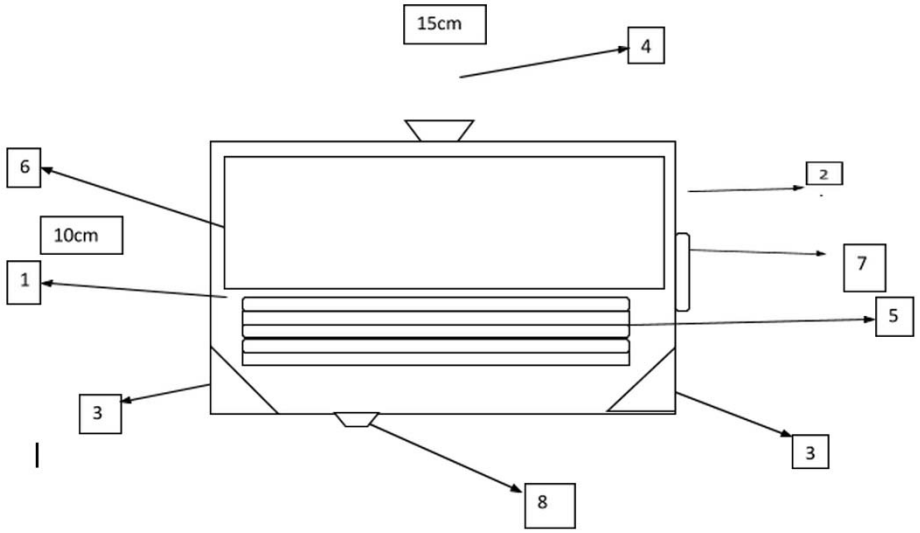
- Handheld and Portable
- Efficient and inexpensive means to bridge communication gap
- A fast and efficient method of communication

Solution Approach



Conceptual Design I

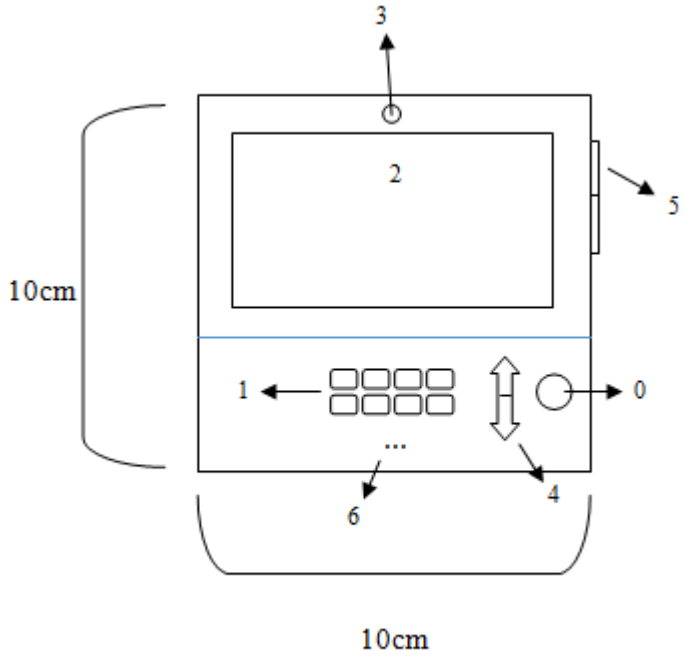




Conceptual Design I

Button	Function	Description
1 – Power Button	ON/OFF	Turn the device off
2 - Speakers	To provide the output	Allows Customers to hear
3 - Camera	Captures images of Sign	Camera captures the video of users gesture and then convert into text
4 - Distance from the Object to the Camera	To read the object capture	To Test the accuracy of the device at different distance that an object is capture
5 - Keyboard	To control the volume	Customer can type in word to know the sign for the word
6 - Screen	Display	Allows Customers to see what sign will look like
7- Volume	To control the volume	To increase or decrease the volume to understand the speaker perfectly.

Conceptual Design II



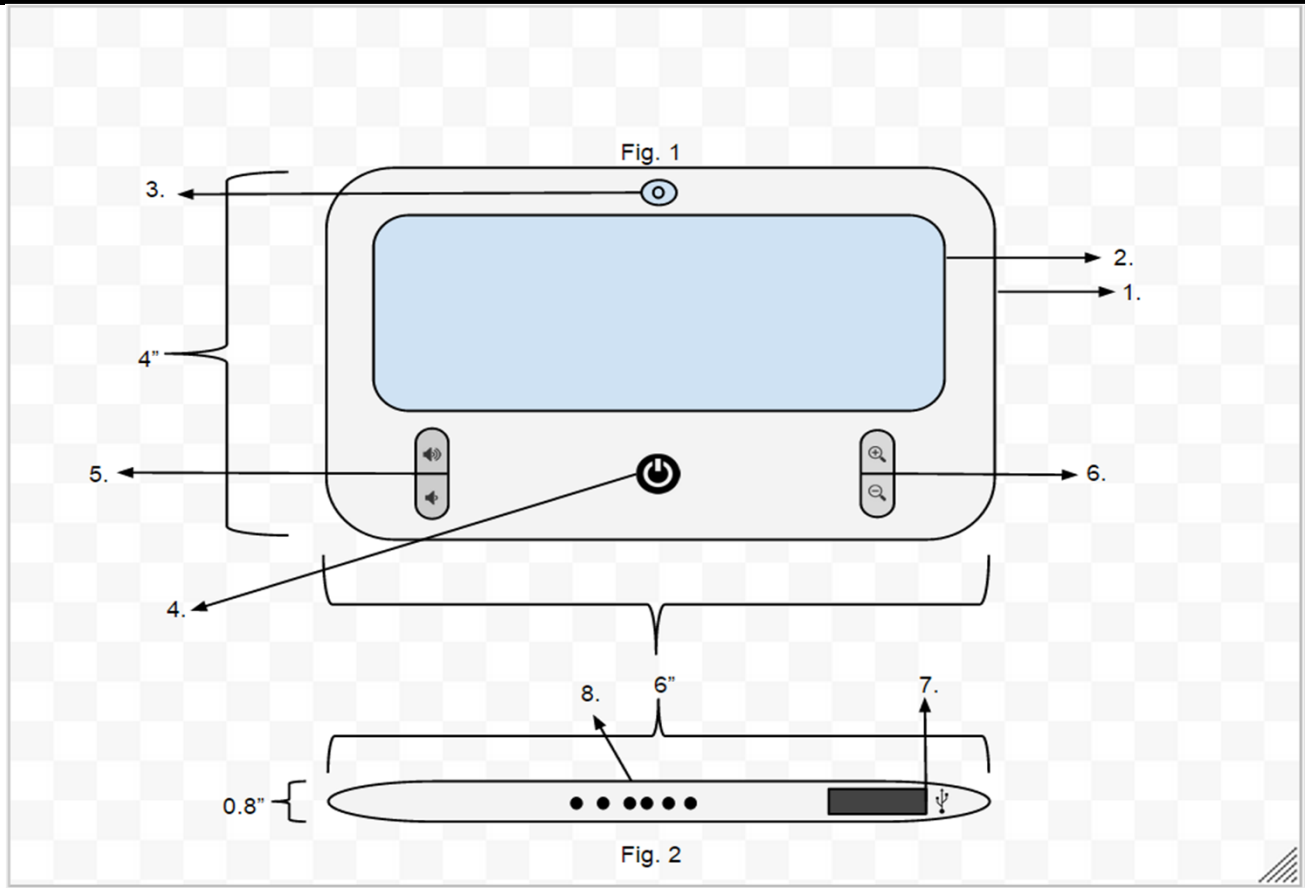
Conceptual Design II

Button	Function	Description
0 - Power	ON/OFF	Turn the device off
1 - Keyboard	To input text into a computer	To help the user to enter data
2 - LCD Screen	To display image on the screen	Produces the visible image on the screen to help the user to read/identify the correct output
3 - Camera	Motion Controller	Camera captures the video of users gesture and then convert into text
4 - Distance from the Object to the Camera	To read the object capture	To Test the accuracy of the device at different distance that an object is capture
5 - Volume	To control the volume	To increase or decrease the volume to understand the speaker perfectly.
6 - Speakers	To provide the output	Responsible to present the output for the translation by sound.

Top Design Selection

Attributes	Conceptual Design I	Weight	Score	Agg. Score	Conceptual Design II	Score	Agg. Score	Analysis Method
Speed	100 Mhz/sec	5	4	20	120 Mhz/sec	5	25	**Speed of Operation**
Responce Time	12 sec	4	4	16	10 sec	5	20	**Time in sec**
Weight	15 Oz	3	5	15	17 OZ	3	9	**weignt in lbs**
Power	AC conveter and USB cable	2	2	4	AC converter and DC Power Connector - 2.5mm I.D. - 5.5mm O.D	1.5	3	**Method of charging**
Life	6 Hour usage, 12 Hour Standby	2	5	10	4 Hour Usage, 10 Hour Standby	4	8	**Battery Life in time**
Screen Size	3.5in diagonally	4	3	12	9.7 in diagnolally	4	16	**Size in inches**
Screen Type	960x640 at 326 ppi	4	3.5	14	960x640 at 326 ppi	3.5	14	**Resolution of screen**
Camera	5-megapixel camera embedded in device	5	5	25	4megapixels camera connected Outside	4	20	**Capacity in pixels**
Video Capture	720p	5	5	25	.6megapixel	4	20	**Capture capability in pixel**
Volume Button	2 Buttons for Volume Up and Down	2	2	4	Rotating volume control	1.5	3	**Convenience**
Dimension	10 X 10 X 2	5	4	20	15 X 10 X 2	5	25	**Portable/easier to carry**
Display Screen	6 X 4	5	4	20	12 X 5	5	25	**Size and quality of display**
Power Switch	On the the front face of the device	2	2	4	One the right edge of the device	2	4	**Convenience**
Total		**48**	**48.5**	**189**		**47.5**	**192**	

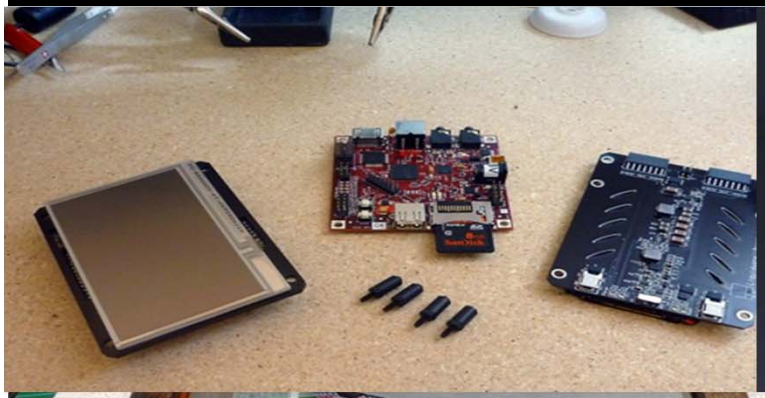
Final Design



Final Design

Attributes	Details
Weight	15 ounces (425.5 gm)
Height	4 inch (10.16 cms)
Width	6 inch (15.24 cms)
Depth	0.8 inch (2.03 cms)
Display	2” X 4.75”X 5.15 Screen(Diagonal), 960 X 640 at 326 ppi
Camera	5.1 megapixels
Video	720p Video recording (30-60fps)
Power	AC converter and USB
Battery	Built in rechargeable lithium-ion battery
Speakers	On the bottom middle of the device
Buttons	1-Turn ON/OFF 2- Volume UP/DOWN 2- Zoom IN/OUT (to focus)

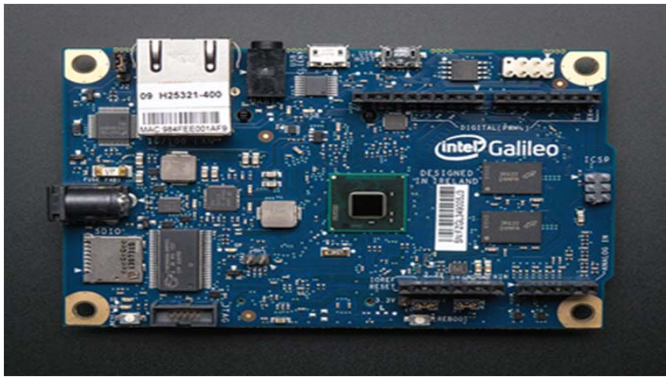
Cost & Resources- 1st prototype

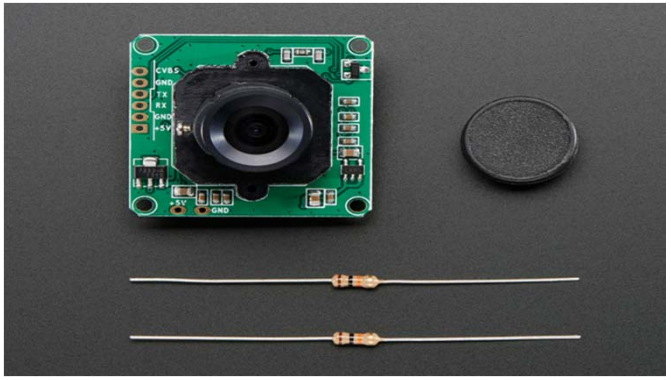


Tablet kit with a 4.4” OLED touchscreen that mounts directly on the Board

$295

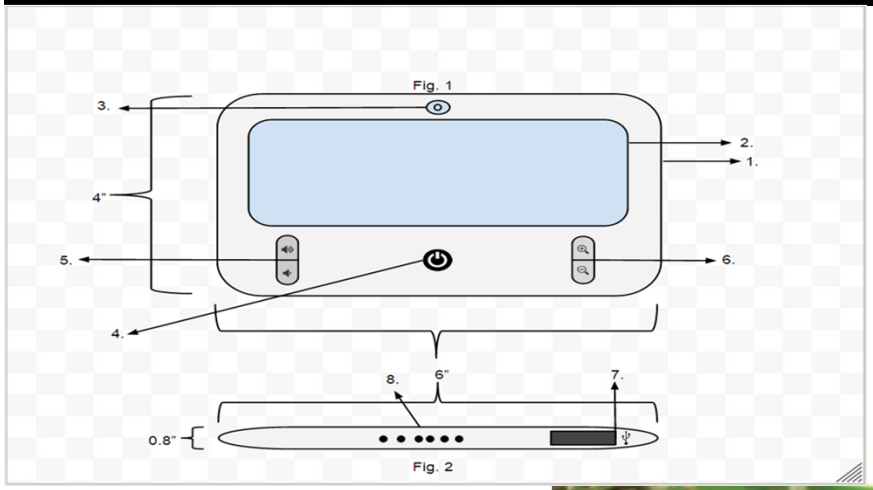
Cost & Resources- 1st prototype

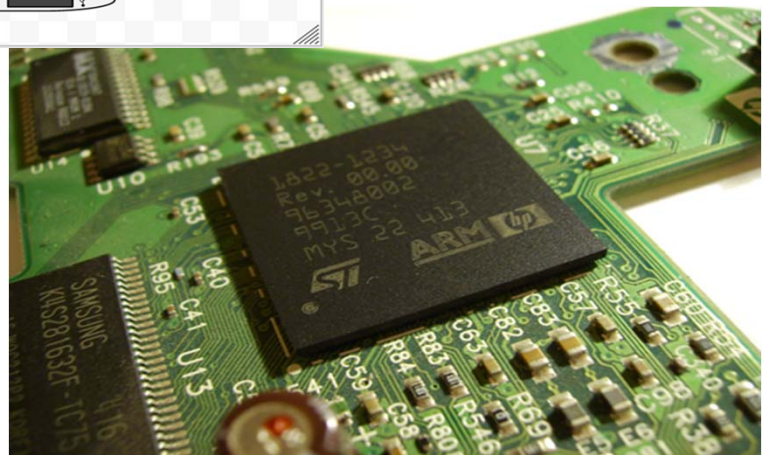




- Intel Galileo **$60**
- TTL Serial JPEG Camera with NTSC Video **$40**
- 7"inch fpc3-tp70001av2 Black Glass Panel Touch Screen Digitizer **$24**
- Anker® 2nd Gen Astro E4 13000mAh External Battery **$30**

Cost & Resources- final prototype





Goal: Final product for customer should not cost more than ***$100***.

To fit design parameters some changes maybe required such as ARM Microcontrollers **$45**

Fabrication cost $??

Implementation and Verification Plan

Stage 1- Still Image Analysis

Image Processing Timeline

→

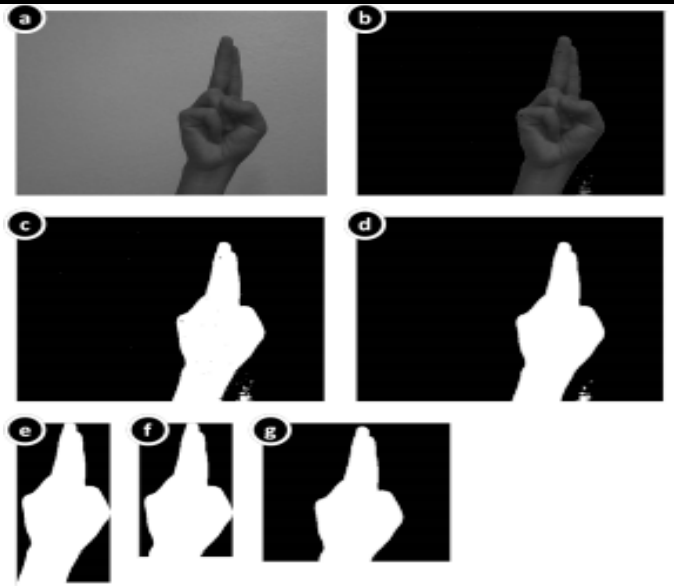


Table 1: Pixel Feature Classification Results

Classifier	C.V. accuracy		Test accuracy	
	12 signs	25 signs	12 signs	25 signs
Linear kernel	97.2%	90.8%	98.6%	92.4%
Gaussian kernel	98.3%	92.4%	98.6%	93.5%
k-nearest-neighbor	N/A	N/A	93.0%	84.8%

20x20px images

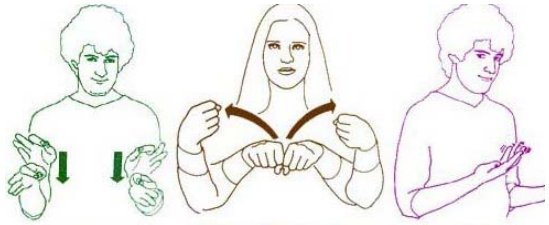
*problem with j & z

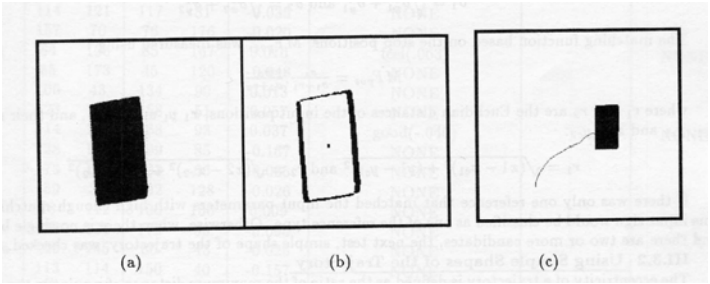
Classify using linear and Gaussian kernel SVM

Run cross-validations to determine optimal SVM parameters C and ϭ

1. Knight
2. Shariff
3. Marx
4. *Markov

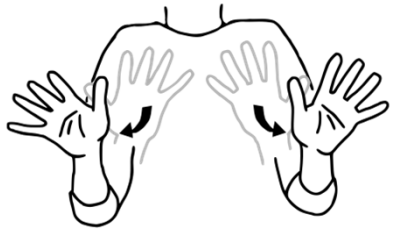
Stage 2- Image Motion Analysis





$$D(n,x,y) = 1 \; if \; abs[I(n,x,y) - I(n-1,x,y)] > threshold$$
$$= 0 \; otherwise$$

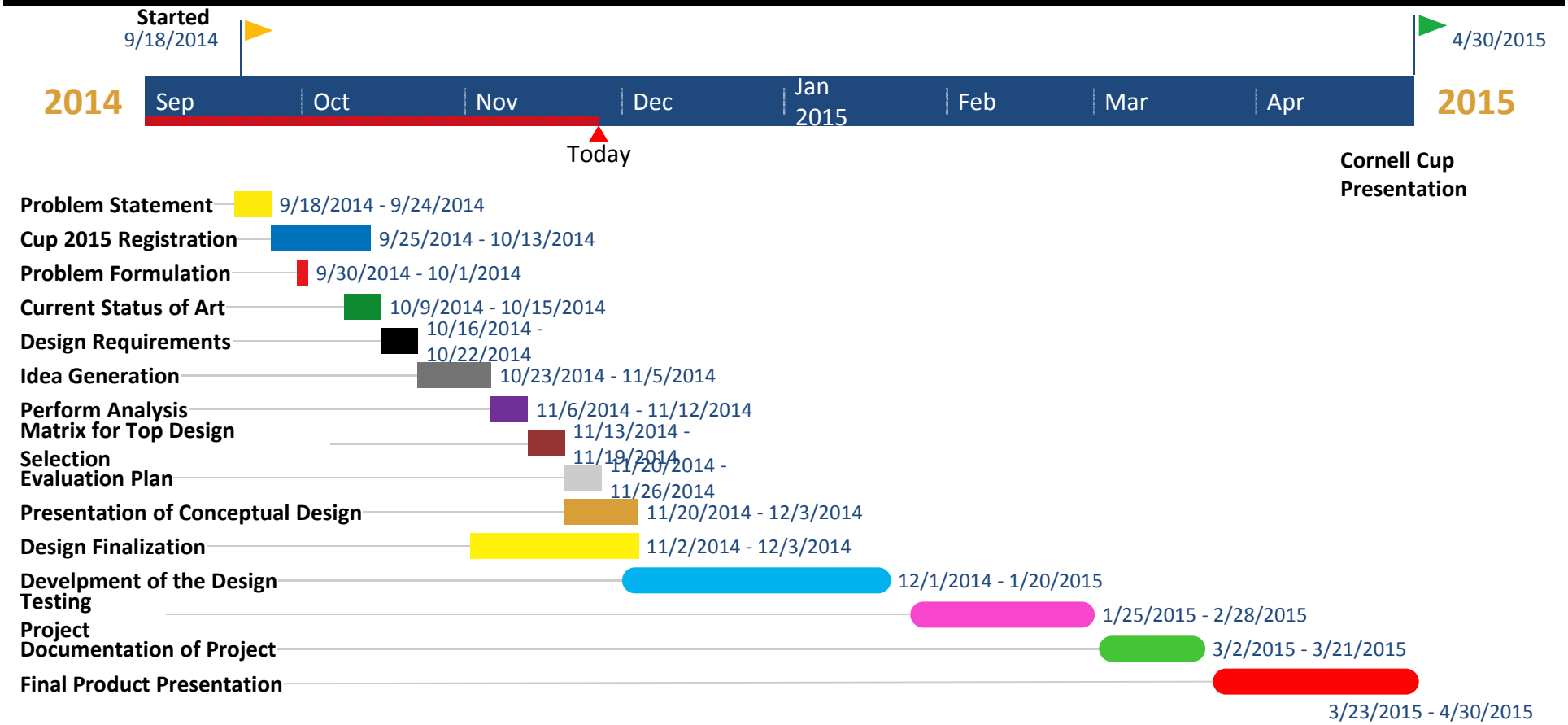
finished



I (n,x,y) → Intensity of image frame at position x,y

D(n,x,y) → Difference image frame (n)

Timelines and milestones



Conclusion

- SLATE 8 will use all resources available to reach the goal of providing a *portable* and *cost efficient* device that can help the hearing impaired community communicate easier by translating sing language into text/voice.

Questions