

# Analysis on Current Therapy and Hand Gesture Device for Aphasia

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**ABSTRACT-** Language is the roots in communication and it is very important when interacting with people. For people with a speech disability, sign language is very crucial. Gesture based communication is often used to help the recovery of speech deficiency for the aphasia patients. The lack of number of people that understand the sign language arise a few communication problems. With the conversion of sign language into audio the problems that surfaced will be reduce. Also, the repetition of pronunciation will help the post-stroke aphasic to recover from the speech disability. A glove with the flex sensors along all five fingers, will gestured a specific sign language and change it into audio so it will help the aphasic people to communicate in the daily life. Aphasia people also can utilize the glove to perform the repetition of pronunciation as the therapy for the speech disorder.

**Keywords** -Sign language, Aphasia, Stroke, Gesture.

## I. INTRODUCTION

Aphasia is language impairment. It can affect many aspects of communication including speech, writing, reading, gesture and understanding. The common cause of aphasia is stroke but there are few other causes such as head injury and tumors[1]. Aphasia can be classified into few types which are global aphasia, isolation aphasia, transcortical motor aphasia, Wernicke's aphasia, transcortical sensory aphasia, conduction aphasia and anomic aphasia[2].

Deficits that occurred after stroke are classically attributed to focal damage[3]. Language impairments represent an interesting counterpoint to both sensorimotor and cognitive deficits[3]. When left intrahemispheric connectivity of the brain was damage, this will lead to the language deficits. Language disorders can arise not only from pure disruption of language processing, but also from disruption of bilaterally distributed support processes including auditory processing, visual attention as in reading, and motor planning for speech[3]. Damage to any of these structures can affect the communication and function of the language system.

## II. LITERITURE REVIEW

There are many people that loss the ability to speak and hear especially deaf and mute people. But there other language impairment called aphasia which occurred due to stroke and also head injury.

### a) Current Treatment for Aphasia

For individuals with aphasia, gestures have been examined as a modality to promote recovery of communication skills[3]. Individuals with left hemisphere brain damage often develop limb apraxia [4], an impairment of limb movements, which can undermine the ability to use gestures effectively to communicate. Thus, gestures are often the target of treatment in clinical interactions with individuals with aphasia, both to improve the quality of gestures as a compensatory communication modality and to facilitate recovery of language skills, in particular word retrieval[3].

Stimulation response or direct retraining of deficit is still used nowadays. But a newer technique has been introduced called MIT (Melodic Intonation Therapy) which is a neurobehaviorally based. MIT consists of intoning normal language with exaggerated rhythm, stress and melody.

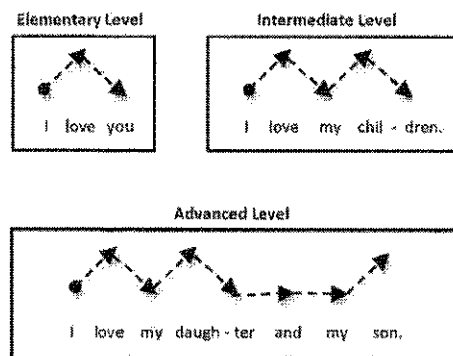


Figure 1: Melodic Intonation Therapy (MIT)

Other than that, Computerized Visual Communication (C-VIC) was designed as an alternative communication system for patient with severe aphasia. Pictures and icons are used to represented meaningful concepts or things and this

system is used as an alternative way to communicate for aphasic.



Figure 2: Computerized Visual Communication system (C-VIC)

**b) Current Treatment for Stroke (Finger)**

Stroke is a common health problem globally and a leading cause of impairment. Unfortunately, majority of the stroke patient has an incomplete recovery of motor deficits despite intensive rehabilitation[9]. Stroke related motor deficits affect independence doing activities of daily life.

Constraint-Induced Movement Therapy[10]. The concept of CIMT is Stretching, orthotics and positioning[11]. Numerous form of intervention are available that are thought to influence tone and reduce spasticity. These include stretching, mobilization, casting, splinting, orthotic, posture management and ethectra. These form of treatment need to be complemented with active treatment whenever possible, in order to improve motor control and enhance more long-term and functional carry-over. One of the exercise used squishy ball. Patient used the ball to exercise their fingers. These exercise includes stretching and posture management.

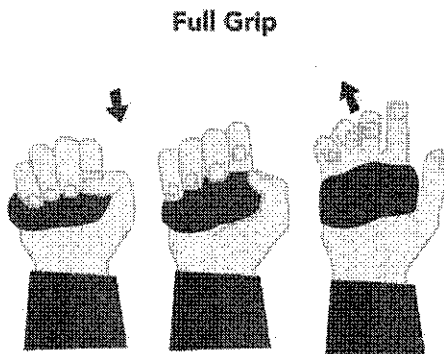


Figure 3: Hand Stroke Exercise using Squishy Ball

**III. METHODOLOGY**

The project consists of idea of the device, design consideration of hardware, software implementation and the block diagram for methodology. Communication is a challenge for people with aphasia. As per the convenience for the user, the communication is achieved by using Arduino Nano as the processor and LED as an indicator of the success rate of the exercise.

**Hardware and Software**

This device will be using a flex sensor as this component's features are suitable to recognize the hand gesture because it is physically bendable. Other than that, Arduino Nano also will be used in this device as this microcontroller board contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get started.

This device is visualized to be look like a glove. Each finger of the glove will be fitted with a flex sensor so the data input will be receiving resistance of the particular movement. The data then will be encoded into the Arduino and check over the comparison of each letters to get into the array needs stick it. The encoded data will recheck with database which of storage of alphabets has encoded for the particular resistance. After that, it will be extracted the results through audio.

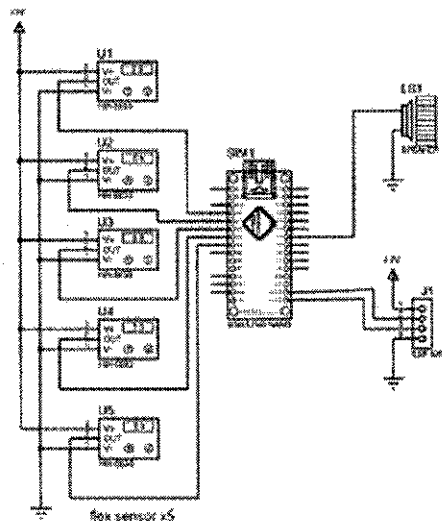


Figure 4: Circuit simulation using Proteus software.

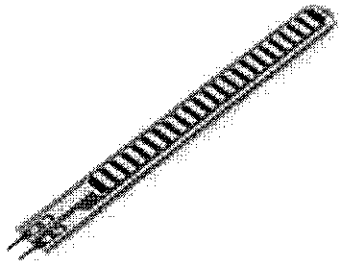


Figure 5: Flex sensor 2.2 inches.

#### IV. RESULT AND EVALUATION

Result for this project is obtained by bending the flex sensors to the desired position. This product used flex sensors that were attached along the five fingers to measure the resistance produced when the user gesture a sign language. The flex sensors which connected to the processor, Arduino Nano had been programmed. Each gesture of the sign language has their own threshold. This threshold is used to reduce and limit the amount of deflection of each syllable in sign language. Therefore, the redundant signal will be reduced.



A

B

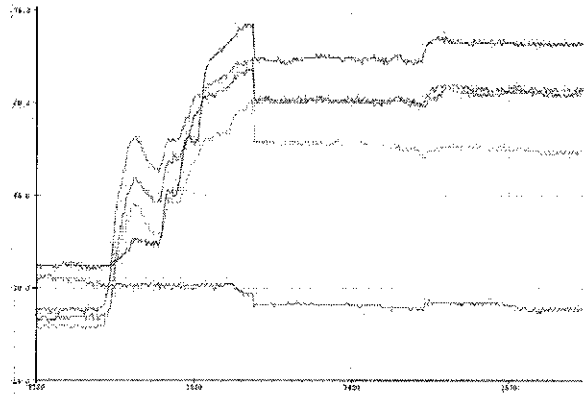
C

Figure 6: Sign Language for ABC



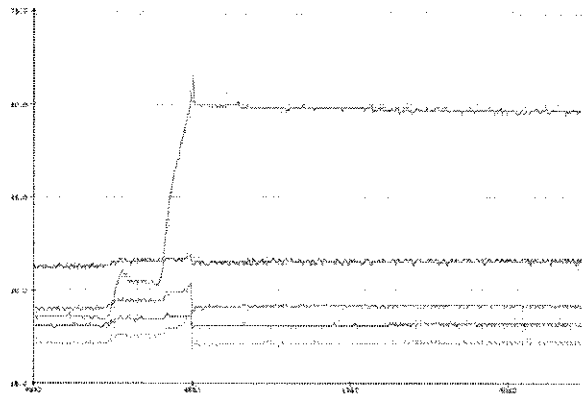
Figure 6: End Product

For 'A', the threshold for the flex attached to the thumb was set  $<50$  and the rest is set  $>60$ .



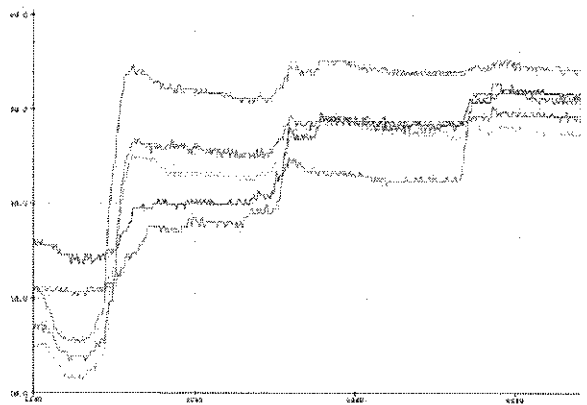
Graph 1: Graph for A

For 'B', the threshold for the flex attached to the thumb was set  $>60$  and the rest is set  $<50$ .



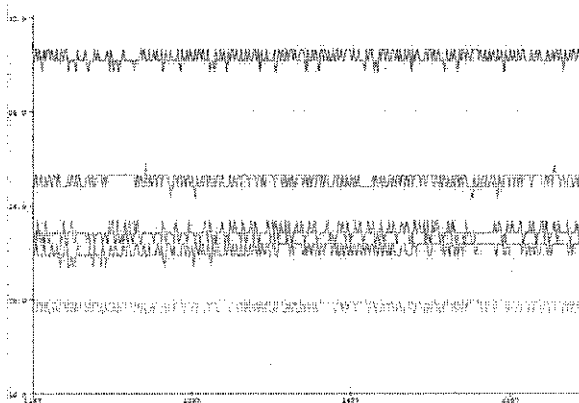
Graph 2: Graph for B

For 'C', the threshold for the flex attached to all fingers are set to  $>60$ .



Graph 3: Graph for C

Relax state. Every fingers  $<40$ .



Graph 4: Graph for Relax State

## V. DISCUSSION

The results of the hand gesture device proved the flex sensor is a very sensitive sensor. So when handling the device, a proper care must be taken to ensure that the result is correct.

## VI. CONCLUSION

The previous study shows a variety of approaches that have been done by the neurologists and the researchers to treat the patients with the aphasia disease due to post-stroke. From the traditional technique which the repetitive drill to the computerized technique has been used as the therapeutic tools for the aphasic so that patient can return to normal. As we know, aphasia is not an untreated or a permanent disease. It can be cure if the patient is willing to undergo the therapy. Also, we know that there many therapy nowadays to provide a fully functional motor movement of the fingers. Thus, this product was designed to help aphasic due to post stroke to undergo a speech treatment along with their physical treatment.

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