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Design Issue and Proposed Implementation of Communication Aid for Deaf & Dumb People

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Abstract— Deaf and dumb people communicate among themselves using sign languages, but they find it difficult to communicate with the outside world. This paper proposes a full proof system to aid communication of deaf and dumb people communicationg using Indian sign language (ISL) with normal people where hand gestures will be converted into appropriate text message. The hand gestures corresponding to ISL English alphabets, numbers and words will be captured through a webcam. Main objective is to design an algorithm to convert dynamic gesture to text at real time. Finally after testing is done the system will be implemented on android platform and will be available as an application for smart phone and tablet pc.

Keywords- *Deaf, dumb, gesture recognition, ISL.*

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I. INTRODUCTION

For the deaf and dumb people the method of communication is sign language, which comprises of hand gestures and face expression for each alphabet, numbers and words. Figure 1 show some gesture used in Indian Sign Language (ISL). Learning sign language is like learning any other language. The sign used for different gesture may appear similar to each other and it can be differentiated by looking at the angle, space between finger, number of fingers opened, number of closed or semi closed, etc. Every deaf and dumb person is aware of these signs but the normal person does not bother to learn their language. The major challenge these people are facing is communication with the external world.

As per the census report of 2011, 6 million people in India are deaf and dumb [1], it is a big number which cannot be ignored. Today these physically challenged people stands at par with the normal people and they have a lot of knowledge, skills and talent to contribute to the society, finding a viable solution to their problem is need of the day. To overcome this communication barrier we propose a smart module which will convert the signs in hand gesture and face expression into text, readable by normal people. The two different approaches are used one using sensor and other using image processing. We will use image processing technique in our work. A complete solution for conversion of ISL to text will be implemented and an algorithm will be designed and implemented to convert ISL to text at real time.

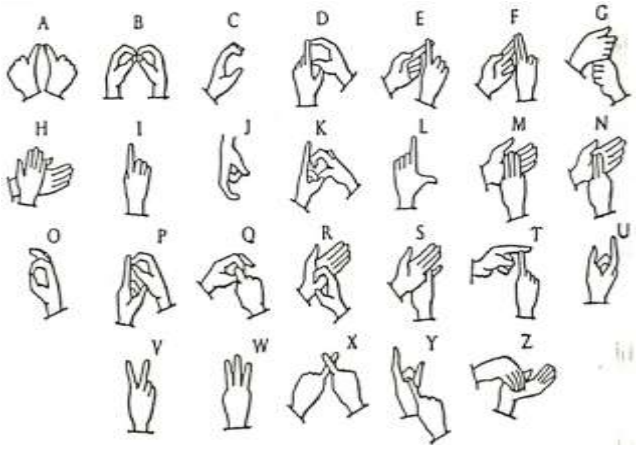

Figure 1. Alphabets in ISL

Major work is extraction of gestures. Gestures are static and dynamic. In static, gesture does not change for particular piece of information for instance gesture of alphabets are static. In dynamic, gestures comprises of multiple frames of different gesture when combined in a particular sequence gives one piece of information. Gesture recognition implies extraction of static gestures and gesture spotting refers to recognition of dynamic gesture.

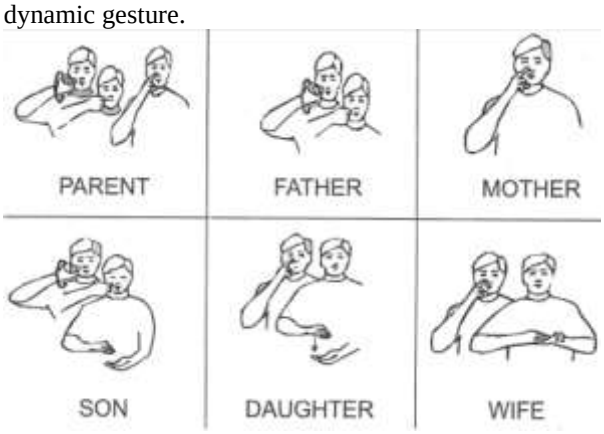

Figure 2. Static Gestures

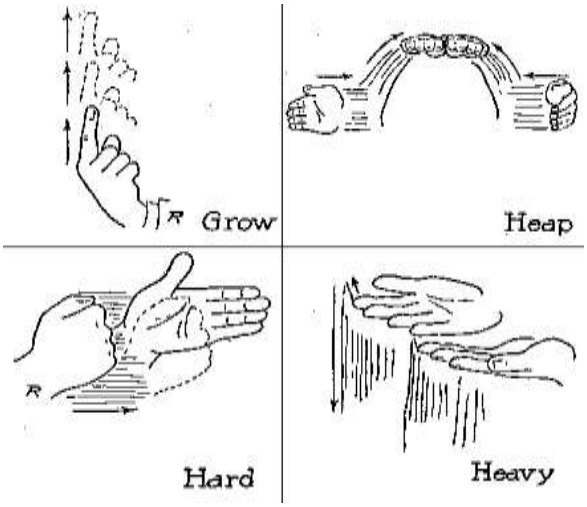

Figure 3. Dynamic Gestures

II. LITERATURE REVIEW

This application has not been explored much. The work proposed so far can be categorized in namely two types one using sensors and other using image processing.

Using a portable accelerometer (ACC) and surface electromyographic (sEMG) sensors a framework for automatic Chinese sign language recognition is implemented, data segmentation is performed to divide a continuous sign language sentence into subword segments, three basic components of sign sub words, namely the hand shape, orientation, and movement, are further modeled and the corresponding component classifiers are learned [2]. [3] uses low cost packaging material, velostat for making piezoresistive sensors that detects a bend in fingers and the data generated is map to a character set by implementing a Minimum Mean Square Error machine learning algorithm. M. Delliraj and S.Vijayga Kumar propose a system with a flex sensor and IMU (Inertial Measurement Unit) to recognize sign symbol, speech synthesis chip for voice output and speech recognizing module for converting voice to sign symbol, interfaced with microcontroller [4]. [2-4] presents the sensor based technique. [5-12] Propose image processing based technique. A novel method for designing threshold models in a conditional random field (CRF) model is proposed which performs an adaptive threshold for distinguishing between signs in a vocabulary and nonsign patterns; a short-sign detector, a hand appearance-based sign verification method, and a subsign reasoning method are included to further improve sign language spotting accuracy. It has 87.0% spotting rate and 93.5% recognition rate [11]. A Conditional Random Field (CRF) based ISL recognition for complex background using a novel set of features is proposed [8]. [9] Propose Transition movement models (TMMs) to handle transition parts between two adjacent signs in large-vocabulary continuous sign language recognition, experiments over a large vocabulary of 5113 Chinese signs was conducted with average accuracy of 91.9%.

Models using Microsoft kinect system are proposed in [6, 7, 10] which uses the hand tracking feature of the device to perform hand gesture spotting.

Computer vision based technique for gesture recognition of alphabets for Bangladeshi and Indian sign language are proposed in [5, 12] respectively.

III. PROPOSED WORK

To accomplish the desired system behavior the work has be divided in the following phases

- Understanding ISL and categorizing various symbols as
  - alphabets, words & sentence
  - static & dynamic
- Feature extraction implementation.
- Pre-possessing reference video of ISL.
- Making compressed reference library.
- Gesture recognition and spotting.
- Developing an algorithm to convert static and dynamic gesture to text at real time.

Tools Proposed:

- Designing and testing using MATLAB.
- Implementation on ANDROID platform for smart phones and tablet PCs.

IV. CONCLUSIONS

Smart Module will be designed and implemented to bridge the communication gap between deaf & dumb and normal people. Image processing technique is used as sensor based module requires additional hardware. Face gesture recognition is difficult using sensor based module. The algorithm that we will design to implement the designed module can be used for other sign language as well. The gesture spotting module that will be implemented can be used to capture and analyze emotions of the people in area where high security is desired. The analysis can then be used to track criminal activities.

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