

## Speech to Sign Language Translation

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***Abstract:** Communication plays a critical role for people and is regarded as a skill in life. Having this important aspect of life and surroundings in mind, we present our project article, which focuses primarily on supporting patients with pain or silent speech. Our research work leads to improved contact with the deaf and the mute. Each sign language uses sign patterns visually conveyed to express the true meaning. The combination of hand gestures and/or motions of arm and body is called Sign Language and the Dictionary. It is the combination of hands and facial expressions. Our program project is able to understand signals in sign language. These symbols may be used to interact with hearing aids. Our article suggests a program that allows common people to interact effectively with others that are hard to understand. In this case, we are implementing the Indian Sign Language (ISL) method by using a microphone and a camera. Translation of the voice into Indian sign language system by the ISL translation system is possible. The ISL translation framework uses a microphone to get pictures (from ordinary people) or continuous video clips, which the application interprets.*

***Keywords:** Indian Sign Language, facial expressions, video clips*

### I. INTRODUCTION

It is said that Sign language is the mother language of deaf people. This includes the combination of hand movements, arms or body and facial expressions. There are 135 types of

sign languages all over the world. Some of them are American Sign Language (ASL), Indian Sign Language (ISL), British Sign Language (BSL) and many more. We are using Sign Language in this project. This system allows the deaf community to

enjoy all sorts of things that normal people do from daily interaction to accessing the information. Sign language is communication language used by the deaf people using face, hands or eyes while using the vocal tract. Sign language recognizer tool is used for recognizing sign language of deaf and dumb people. Gesture recognition is an important topic due to the fact that segmenting a foreground object from a cluttered background is a challenging problem. There is a difference when a human looks at an image and a computer look at an image. For humans it is easier to find out what is in an image but not for a computer. It is because of this; computer vision problems remain a challenge. Sign language is a language that consists of signs made with hands and other movements, facial expressions and postures of the body, which is primarily used by people who are deaf or hard hearing people that can easily express their thoughts or can easily communicate with other people[1]. Sign language is very important as far as the deaf people are concerned for their emotional, social and linguistic growth. First language for the deaf people is sign language which get proceeded bilingually with the education of national sign language as well as national written or spoken language. There are different communities of deaf people

all around the world therefore the sign language for these communities will be different. According to the 2011 census of India, there are 63 million people which sums up to 6.3% of the total population, who are suffering from hearing problems. Out of these people, 76-89% of the Indian hearing challenged people have no knowledge of language either signed, spoken or written. The reason behind this low literacy rate is either the lack of sign language interpreters, unavailability of Sign Language tools or lack of researches on Sign language. Sign language is a natural way of communication for challenged people with speaking and hearing disabilities.

There have been various mediums available to translate or to recognize sign language and convert them to text, but text to sign language conversion systems have been rarely developed, this is due to the scarcity of any sign language corpus. This is done by eliminating stop words from the reordered sentence. Stemming is applied to convert the words to their root form as Indian sign language does not Stemming is applied to convert the words to their root form as Indian sign language does not support for inflections of the word[2].

All words of the sentence are then checked against the words in the dictionary containing videos representing each of the words. If the words are not found in the

dictionary, its corresponding synonym is used to replace it. The proposed system is innovative as the existing systems are limited to direct conversion of words into Sign languages whereas our system is capable of doing the translation.

## II. LITERATURE SURVEY

As per Amit Kumar Shinde on his study of sign language to text and vice versa in Marathi Sign language recognition is one of the most important research projects and it is the most natural and common way of communication for the people with hearing problems. A hand gesture recognition system can help deaf persons to communicate with normal people in the absence of an interpreter. The system works both in offline mode and through a web camera. Neha Poddar, Shrushti Rao, Shruti Sawant, Vrushali Somavanshi, Prof. Sumita Chandak in their paper discussed that the prevalence of deafness in India is fairly significant as it is the second most common cause of disability. A portable interpreting device which converts higher mathematics sign language into corresponding text and voice can be very useful for the deaf people and solve many difficulties. The glove based deaf-mute communication interpreter introduced by Anbarasi Rajamohan, Hemavathy R. Dhanalakshmi is great research. The glove comprises five flex sensors, tactile sensors and accelerometer. The controller matches

the gesture with pre-stored outputs. The evaluation of interpreter was carried out for ten letters A, B, C, D, F, I, L, O, M, N, T, S, W. As per the Neha V. Tavari A. V. Deorankar Dr. P. N. Chatur in his report discusses that many physically impaired people rely on sign language translators to express their thoughts and to be in touch with the rest of the world. The project introduces the image of the hand which is captured using a web camera. The image acquired is processed and features are extracted. Features are used as input to a classification algorithm for recognition. The recognized gesture is used to generate speech or text. In this system, flex sensors give unstable analog output and also it requires many circuits and is thus very expensive.

Purushottam Kar et al. [3] in their 2007 paper developed INGIT, a system for translating Hindi strings to Sign Language. It was developed specifically for the Railway Inquiry domain. FCG was used to implement the grammar for Hindi. The developed module converts the user input into a thin semantic structure. Unnecessary words are removed by feeding this input to ellipsis resolution. The SL generator module then generated a suitable SL-tag structure depending on the type of sentence. A graphical simulation was then generated by a HamNoSys converter. The

system was successful for about 60% of cases in generating the semantic structures. Ali et al. [4] developed a domain-specific system in which the input fed had to be English text. The text was converted into SL text which was further translated into SL symbols.

Vij et al. [5] developed a 2-phase system of Sign Language Generation. The first phase dealt

with preprocessing 2 Sentences and converting it into SL grammar. The phase used a

combination of Dependency Parser and WordNet for this purpose. Dependency graphs in the

Dependency Parser represent words and their relationships between head words and words

which modify those heads. In the second phase, HamNoSys was used for converting this

grammar into different corresponding Sign Language symbols. The generated symbols are

converted into XML tags form using SIGML. The XML tags form is then readable by a 3D

rendering software. MS Anand et al. [6] developed a two-way SL translation system. In the

speech- to-sign module, the input speech was first put through the noise removal submodule.

The output was then used as an input for the speech recognizer for decoding the spoken speech into a textual word sequence. A natural language converts the word sequence into a sequence of signs by a rule-based technique. Finally, a sign animation module with text annotation was used for displaying the signs. In the system generated by Dasgupta et al. [7]. English text was taken as input and it was then converted into the corresponding SL structure that adhered to the rules of the grammar. Their system consisted of the following key modules: a) Analysing text coupled with parsing Syntax b) Representation using LFG f-structure c) Transferring grammar rules and finally d) Generating proper SL sentences . Minipar Parser was used to parse the input sentence and the parse tree was used to construct a dependency structure. An f-structure is generated which encoded the grammatical relation of the input sentence. When we say Grammatical relation of the input sentence, we essentially refer to the subject, object and tense of the sentence. We represented this This information as a set of attribute-value pairs. Each attribute corresponded to the actual grammatical symbol name. On applying proper grammar transfer rules, the English f-structure generated was converted to Indian Sign Language f-structure. It needs to be mentioned that evaluating this

system is extremely difficult due to the unavailability of a proper, official SL written orthography [8].

### III. PROPOSED WORK

Few works have been done to generate a system that is based on the above concepts listed in

the existing approaches section and cater to Indian sign language. Thus, we propose to develop one for Indian sign language based on transfer-based translation. The success of this translation system will depend on the conversion of English text to Indian sign language bearing its lexical and syntactic knowledge. Our objective is to help people suffering from the problem of hearing. There have been many projects done on sign languages that convert sign language as input to text or audio as output. But audio to sign language conversion systems have been rarely developed. It is useful to both normal and deaf people. In this project we introduce new technology that is audio to sign language translator using python. In this it takes audio as input, displays the text on screen and finally it gives sign code/language of given input. All the words in the sentence are then checked against the words in the dataset containing videos and GIFs representing the words. If the words are not found, it splits the words into an individual letter and shows the corresponding videos/clips which are predefined in the system. In this

section we will discuss our project. Our system consists of four main steps: input audio or text, tokenizing the input, searching the words/letter form dataset and display videos/clips.

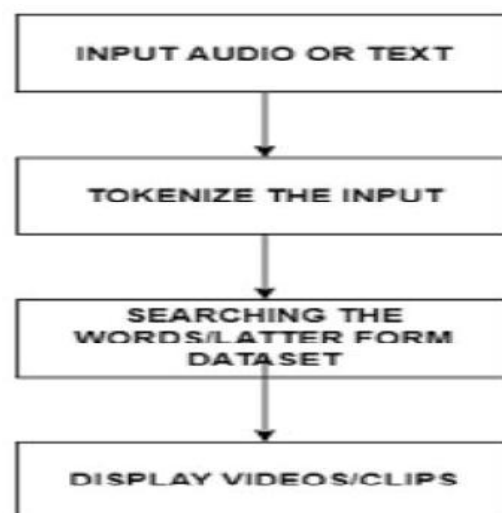


Fig.1 Proposed work

### IV. IMPLEMENTATION

World's normal people have been in a difficult situation in society because of their inability to communicate vocally with hard hearing people in connection with the indifference of others to learn their language, the sign language. With the arrival of multimedia, animation and other computer technologies, it is now becoming possible to bridge the communication gap between the normal and hearing-impaired person. Sign language is a visual/gestural language that serves as the primary means of communication for hard hearing individuals, just as spoken languages are used among the hearing. Hard hearing individuals encounter the difficulty that most hearing

**individuals communicate with spoken language.**

1. First, we use the webkit Speech Recognition to capture audio as input.
2. We then use the Chrome/Google Speech API to transform the audio to text.
3. Currently, we use NLP (natural language processing) to break down the material into smaller, more easily comprehensible chunks.
4. We have a reliance parser that analyzes the sentence's grammatical structure and builds up the word connections.
5. Finally, we converted audio into Sign language and user will get videos/clips as sign language for given input

**SPEECH RECOGNITION**

The live speech is received as input from the microphone of our system. This is done using the Python package PyAudio. PyAudio is a Python package that is used to record audio on a variety of platforms. The audio thus received is converted into text using Google Speech Recognizer API. It is an API that helps to convert audio to text by incorporating neural network models.

In the input format of giving the audio file, the received audio is translated into text by using this Google Speech Recognizer. For lengthier audio files, the audio is divided into smaller chunks based on the occurrence of silence. The chunks are then

passed into the Google Speech Recognizer to efficiently convert into text.

**PRE-PROCESSING OF TEXT**

The filler words which are used to fill the gap in the sentence are apparently lesser-meaning words. They provide less context to the sentence. There are around 30+ filler words in the English Language which hardly make sense in the sentence. So, the system removes the filler words from the sentence and makes it more meaningful. By removing these words, the system will save time.

**Porter Stemming Algorithm**

Porter Stemming algorithm provides a basic approach to conflation that may work well in practice. Natural Language Processing (NLP) helps the computer to understand the human natural language. Porter Stemming is one of the Natural Language Processing techniques. It is the famous stemming algorithm proposed in 1980. The Porter Stemmer algorithm is known for its speed and ease. It is mainly used for data mining and to retrieve information. It produces better results than any other stemming algorithms. It has less error rate. The system removes the morphological and inflexional endings of the English words. The system uses Porter stemming Algorithm to remove the commonly used suffixes and prefixes of the words and find the root word or original word. For example, the Porter

stemming algorithm reduces the words “agrees”, “agreeable”, “agreement” to the root word “agree”. Because of this stemming, we can reduce the time taken for searching the sign language for the given word.

### **Text to Sign Language**

The system iterates through every word in the processed text sentence which is received from

the previous step and searches the corresponding sign language video sequences in the local system. If the word is found, the system shows the output as a video sequence. If the word is not found in the local system, then it splits the word into letters, and according to the letter the sign video clips are played

## **V. RESULTS**

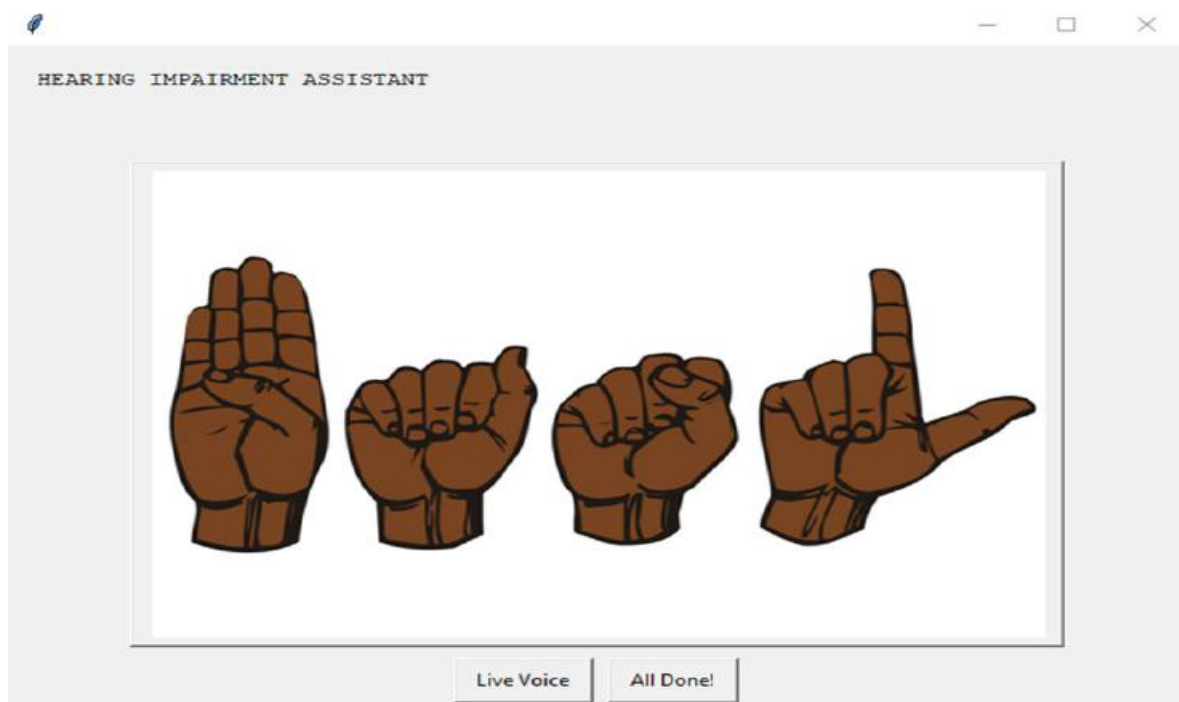
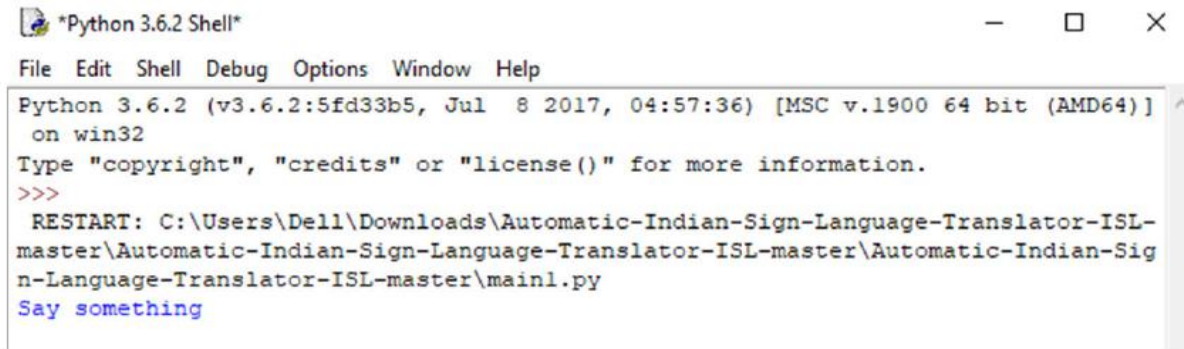


Fig.2 Hearing Impairment Assistant Window



```
*Python 3.6.2 Shell*
File Edit Shell Debug Options Window Help
Python 3.6.2 (v3.6.2:5fd33b5, Jul 8 2017, 04:57:36) [MSC v.1900 64 bit (AMD64)]
on win32
Type "copyright", "credits" or "license()" for more information.
>>>
RESTART: C:\Users\Dell\Downloads\Automatic-Indian-Sign-Language-Translator-ISL-
master\Automatic-Indian-Sign-Language-Translator-ISL-master\Automatic-Indian-Sig
n-Language-Translator-ISL-master\main1.py
Say something
```

Fig.3 Taking input voice message



```
*Python 3.6.2 Shell*
File Edit Shell Debug Options Window Help
Python 3.6.2 (v3.6.2:5fd33b5, Jul 8 2017, 04:57:36) [MSC v.1900 64 bit (AMD64)]
on win32
Type "copyright", "credits" or "license()" for more information.
>>>
RESTART: C:\Users\Dell\Downloads\Automatic-Indian-Sign-Language-Translator-ISL-
master\Automatic-Indian-Sign-Language-Translator-ISL-master\Automatic-Indian-Sig
n-Language-Translator-ISL-master\main1.py
Say something
you said what is your mobile number
```

Fig.4 Displaying input voice message

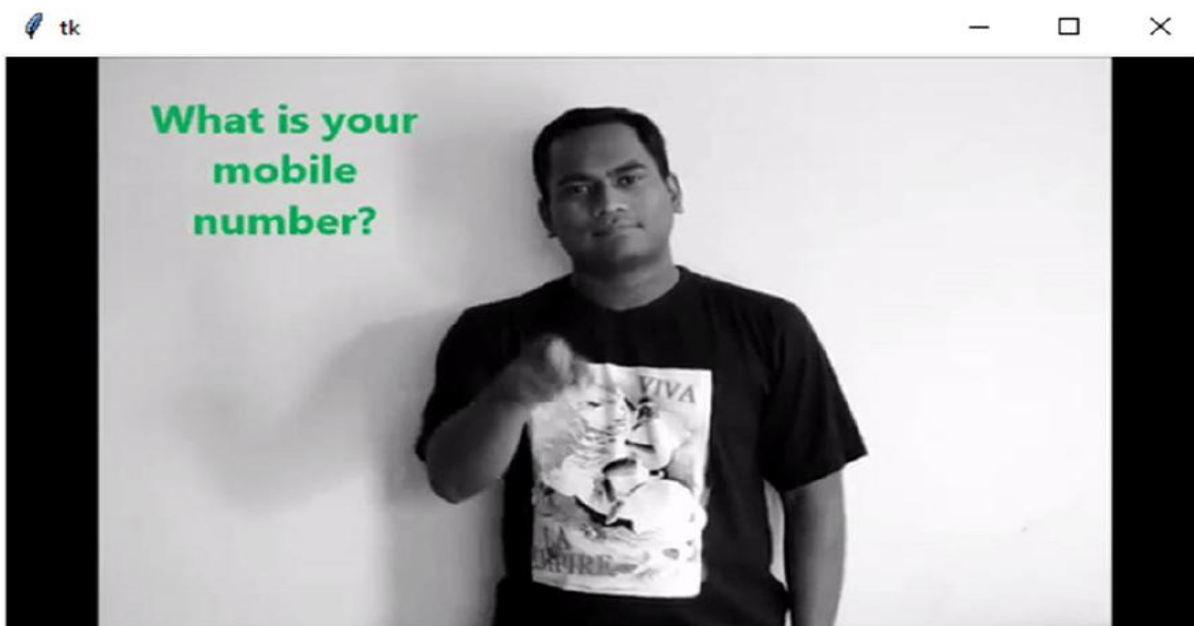


Fig.5 Displaying sign language output



## VI. CONCLUSION

A significant section of the society suffers from hearing and speech impairment. This population uses Sign Language as their primary mode of communication. Due to the difficulty in learning and understanding the meaning and context of written texts, sign language is preferred. Sign language involves the usage of hands, lip movements and expressions in order to communicate words, emotions and sounds. The proposed system provides an efficient method to aid communication between an individual with hearing and speech impairment. It is a field that has had little development over the years particularly in successful implementation in Python programming language. The system would improve access to information for the hearing-impaired population of the country like India. Moreover, the system can also act like an educational tool to learn SL. Here, we have attempted to create a model that will allow people with disabilities to express themselves distinctly, which will help them blend with the rest of the world without any difficulty. Our proposed model will successfully convert the given input audio into an animation. Many improvements along this route can be made as and when the SL Dictionary grows. The words in the SL are small, so many improvements can be made by adding new words to their dictionary to

increase their breadth. In addition, text-and-speech integration can be done on a project to enable Monaural / Speech to Sign Language Translator better communication techniques that will allow users to convert Text into Sign Language by hand-input text.

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