

## Speech To Sign Language Translator For Hearing Impaired

Ezhumalai P <sup>1</sup>, Raj Kumar M<sup>2</sup>, Rahul A S <sup>3</sup>, Vimalanathan V <sup>4</sup>, Yuvaraj A <sup>5</sup>

<sup>1</sup>Professor, Department of CSE, R.M.D. Engineering College.

<sup>2</sup>Associate Professor, Department of CSE, R.M.D. Engineering College.

<sup>3</sup>Intern, Infosys Limited.

<sup>4</sup>Intern, Kaar Technologies.

<sup>5</sup>Intern, Cognizant Technology Solutions.

<sup>1</sup>hodcse@rmd.ac.in, <sup>2</sup>mrk.cse@rmd.ac.in, <sup>3</sup>rahulas.1505@gmail.com, <sup>4</sup>vimalanathan.v2000@gmail.com,

<sup>5</sup>ayuvajarasu@gmail.com

**Article History** Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 28 April 2021

**Abstract** –The growth of the Internet has increased multi-folds in recent years. The Internet has become the medium of communication since the Covid-19 pandemic had started. The usage of communication via online means that the audio and visual content has also increased rapidly. Though it has been a boon for the major section of the people, differently-abled like the hearing-impaired people have limited resources to make use of. This project is aimed to design an application that converts the speech and text input into a sequence of sign language visuals. Speech recognition is used to convert the input audio to text and it is further translated into sign language. Natural Language Processing algorithms are used for word segmentation and extraction of root words. The translation happens to the Indian Sign Language in an effort to make this project more regional to the people of India.

**keywords** – Speech to Sign Language Translation, Speech Recognition, Indian Sign Language, Natural Language Processing

### 1. Introduction

Normal people will find it difficult to communicate with hearing-impaired people. To break the barrier of communication between normal and hearing-impaired people, the Speech to Sign Language translator is used. This translator makes the interaction simpler and faster for normal people to convey their ideas to hearing-impaired people. The translator converts speech or text to Sign Language using Natural Language Processing algorithms. Thus, the system is used to overcome the hurdles faced by normal people to share their thoughts with hearing-impaired people and it will be an ear for the hearing-impaired.

#### A. Existing System:

The existing systems focus on the translation by each letter in a word and translation to American Sign Language (ASL). It is difficult for the Indian deaf people to understand other countries Sign Language like American Sign Language(ASL), British Sign Language (BSL), New Zealand Sign Language, and many more.

#### B. Proposed System:

Our proposed system is designed to overcome the troubles faced by the Indian deaf people. This system is designed to translate eachword that is received as input into sign language. This project translates the words based on Indian Sign Language.

- Natural Language Processing – Thefiller words such as ‘is’, ‘are’, ‘was’, ‘were’ etc., are words that hardly contribute to the context insign language conversion. Therefore, the system removes those filler words from the speech or sentence.
- Root Words – The words may be in gerund form, plural form, or adjective form. The proposed system will remove these forms of the words and find the root word from that words. These root words will be helpful in the effective conversion into sign language.
- Dataset – The system has a large dataset of Indian sign language words to map according to the text or text recognized from the speech. So, it will be helpful to all deaf people in India. It makes the people understand most of the speech or text.

### 2. Methodology

#### A. Forms of Input

Our project is intended to get inputs in multiple formats. The inputs can be of forms:

- Text input

- Live speech input
- Recorded audio file input



Fig. 2: Front End of the System

Fig. 2 shows the front end of the system designed using Tkinter

**B. 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 on the basis of the occurrence of silence. The chunks are then passed into the Google Speech Recognizer to efficiently convert into text.

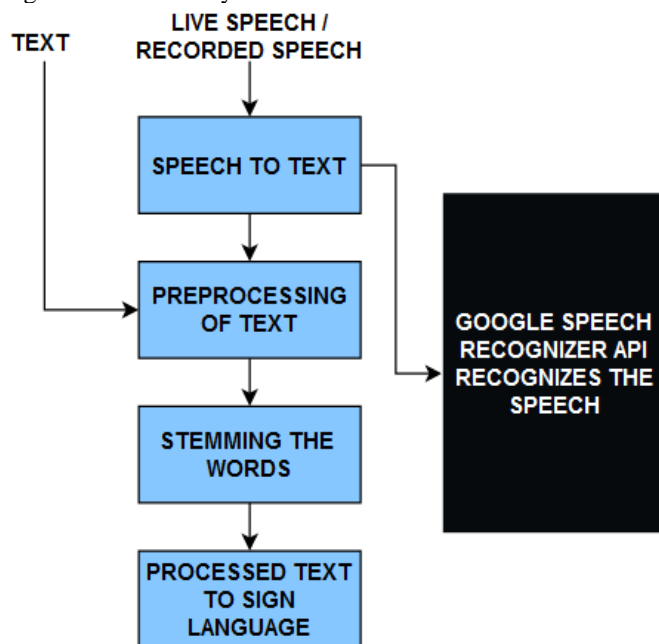
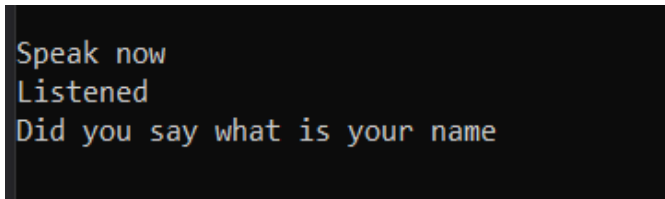


Fig. 1(a): Block diagram of Speech to Text Conversion

Fig. 1(a) depicts the process to convert the speech to text using the Google Speech Recognizer API.



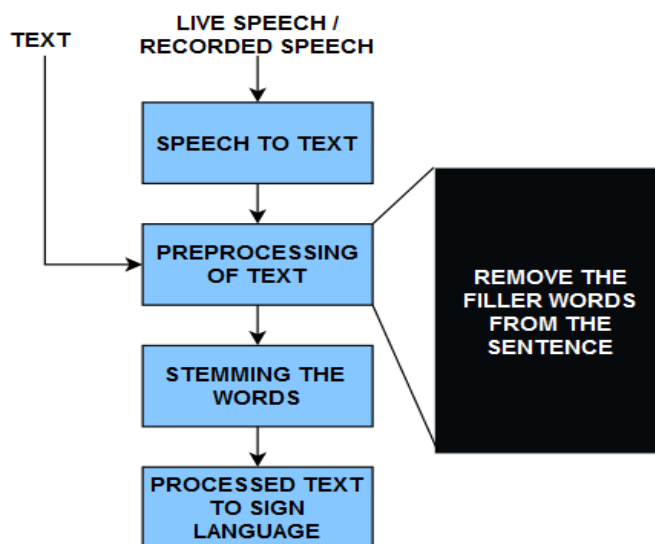
**Fig. 3: Speech Input**

Fig. 3 shows the speech recognized by the Google Speech Recognition API.

### C. 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 makes 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.

The system also removes any punctuations present in the sentence and makes the sentence only contain alphabets and numbers.



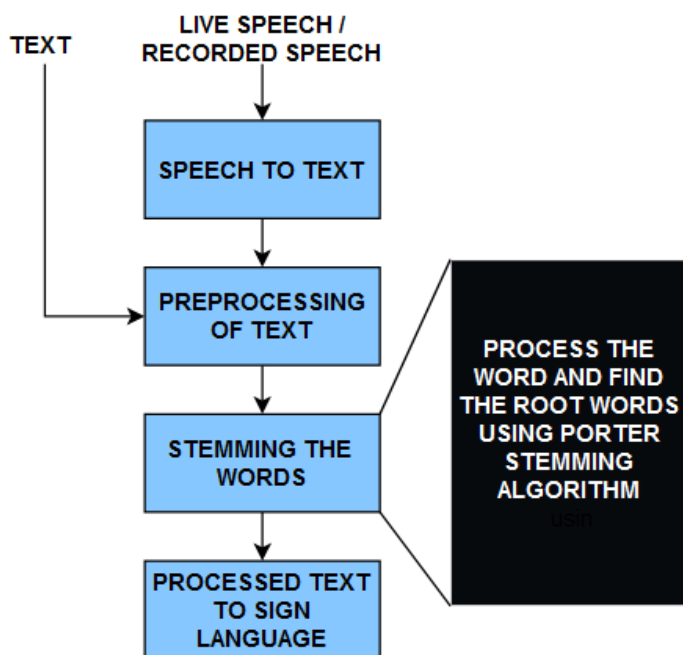
**Fig. 1(b): Block diagram for pre-processing of text**

Fig. 1(b) shows the process done in the pre-processing of the text.

### D. 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. 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.



**Fig. 1(c): Block diagram of Stemming of words**

Fig. 1(c) shows the process done by the Porter Stemming Algorithm to find the root word.

#### **E. 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 using the OpenCV module in Python.

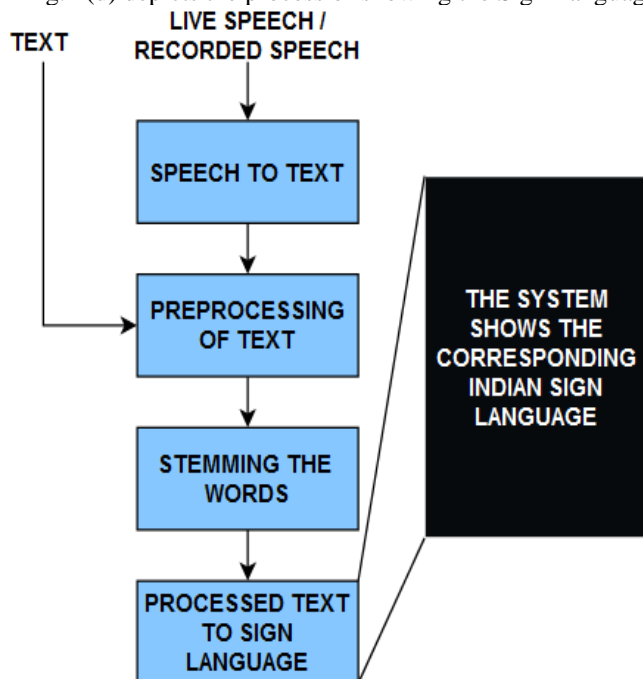
OpenCV is an open-source library mainly used for image processing, video analysis, and many more functionalities related to computer vision. The System passes the path of the video sequence to the OpenCV module to play the video. It shows the video sequence frame by frame.

If the word is not found in the local system, the system will search for the word in a sign language repository named "Indian Sign Language Portal". The system looks for the video link in the Indian Sign Language Portal by webscraping. And plays the corresponding sign language video sequence.

Webscraping is the process of extracting the content from the website. WebScraping is achieved using the BeautifulSoup module. BeautifulSoup module in Python helps to get or search or navigate or modify the data from the Html files by using parsers.

**Fig. 1(d) – Block Diagram for showing the sign language**

Fig. 1(d) depicts the process of showing the Sign Language for the processed text sentence.

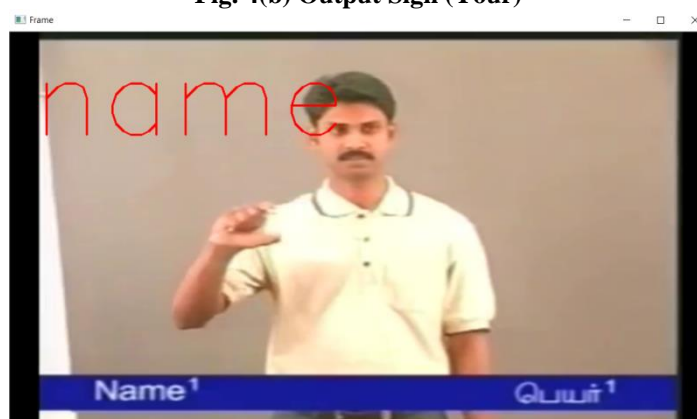


When you speak the sentence “What is your name” as input through the microphone, the text is processed and converted to “What your name” to give faster conversion by removing the filling words. The following output pops up each video in the sequence as –

Fig. 4(a), Fig. 4(b), Fig. 4(c) shows the output sign languages for the given sentence “What is your name”.



**Fig. 4(a) Output sign (What)**

**Fig. 4(b) Output Sign (Your)****Fig. 4(c) Output Sign (Name)**

### 3. System requirements

#### Software Requirements

##### A. Python

Python is a high-level, object-oriented, interactive, and interpreted programming language. It is easy to write, learn and read. It is a free and open-source language. It has a large set of libraries. Python is used in almost all the domains in the computer industry.

##### B. OpenCV

OpenCV (Open Source Computer Vision Library) is an open-source library present in Python. It is used has many machine learning algorithms which are used for image processing, video analysis, and real-time vision applications.

##### C. PyAudio

PyAudio is a Python module to interface with audio drivers present in the device. It helps to play and record audio on various platforms.

##### D. Tkinter

Tkinter is a standard Graphical User Interface (GUI) package for Python. It is available in most operating systems. It provides an easy and faster way to construct many widgets with basic functionality. It creates widgets like button, frame, checkbox, text field, etc.,

##### E. BeautifulSoup

BeautifulSoup is a Python library that provides an easy way to extract information from web pages. It isolates each tag, division, and section to make the searching faster and easier.

#### 4. Result

Most of the time is taken for playing the video sequence in the Sign Language translator. We have noted the time taken for the translator to translate from speech to sign language from the command line. Speech recognizer takes time depending on the length of the sentence we speak. The text analysis takes a minimal amount of time in converting the text sentence.

- Time taken to convert the speech containing the word “nice” to sign language is 10.37 seconds (from the start of audio recording to translation).
- It takes 28.94 seconds to convert the speech “What is your name?” to sign language (from the start of audio recording to translation).

#### 5. Conclusion and future works

Speech to sign language translation is a necessity in the modern era of online communication for hearing-impaired people. It will bridge the communication gap between normal and hearing-impaired people.

The future work is to develop a chat application incorporated with this sign language translation system. This can be used in team meeting applications, where a live translator feature can be added to the application. Also, a sign language to text translating option can be added to this application.

#### References

1. Ankita Harkude, Sarika Namade, Shefali Patil, Anita Morey “Audio to Sign Language Translation for Deaf People” ISSN: 2277-3754, International Journal of Engineering and Innovative Technology (IJEIT) Volume 9, Issue 10, April 2020.
2. Farahanaaz Shaikh, Shreya Darunde, Nikita Wahie, Swapnil Mali “Sign Language Translation System for Railway Station Announcements”, Institute of Electrical and Electronics Engineers (IEEE), IEEE Bombay Section Signature Conference (IBSSC), 2019
3. Vajjarapu Lavanya, Akulapraavin, And M.S., Madhan Mohan “HandGesture Recognition And Voice Conversion System Using Sign Language Transcription System” ISSN:2230-7109 (Online) | ISSN:2230-9543 (Print) IJECT Vol. 5, Oct-Dec 2014.
4. Amit Kumar Shinde and Ramesh Khagalkar “sign language to text and vice versa recognition using computer vision in Marathi” International journal of computer Application (0975-8887) National conference on advanced on computing (NCAC 2015).
5. Dr. Sami M. Halawani. Arabic sign language translationsystem on mobile devices. 2008.
6. V. Lpez-Ludea, C. Gonzlez-Morcillo, J.C. Lpez, E. Ferreiro, J. Ferreiros, and R. San-Segundo. Methodology fordeveloping an advanced communications system for the deaf in a new domain. Knowledge-Based Systems, 56:240 – 252, 2014.