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REVIEW ON SPEECH TO INDIAN SIGN LANGUAGE TRANSLATOR

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***Abstract*—Based on the local language, each country has its own sign language. Even those of us with adequate hearing talents have a tendency to ignore or refrain from communicating with those. Those who cannot hear will find it considerably harder if they do not hear. In addition to bridging the communication gap, being able to communicate with persons who are deaf or hard of hearing can facilitate a rich interchange of ideas and fresh perspectives that may inspire them to advance technology. Every thought has the potential to transform the impossibly unattainable into the known. Using a language known as sign, hearing-impaired people can comprehend our thoughts. Our project's main focus is on Indian Sign Language, which is primarily utilised by groups in India that are deaf or hard of hearing. We suggest an audio to Indian Sign Language translation system in the project to close the communication gap between the deaf community and the rest of society. The major goal of this project is to provide an interface that can transform audio and text into the appropriate sign language for those who are deaf or hard of hearing. The project's goal is to use natural language processing to transform audio and text into Indian Sign Language in order to improve hearing-impaired people's communication ability and display the sign using an animated character.**

***Index Terms*—Indian Sign Language, Natural language pro- cessing, Tokenization, Lemmatization, Parsing**

I. INTRODUCTION

A serious hearing disability affects 63 million Indians, or 6.3% of the nation's total population, according to the 2011 census. Between 63 million people, these 63 million people, at least 76-89% are not to know Indian Sign Language. The following are thought to be the causes of this very low literacyrate:

1) Insufficient ISL interpreters
2) Lack of ISL tool availability
3) Insufficient study of ISL

Due to their limitations, people who are deaf or hard of hearing sometimes have trouble communicating. For the growth and development of impaired persons, this presents a significant challenge. The employment of sign language for communica- tion is the most often used solution to this issue. The majority of hard of hearing people utilise sign languages like ISL, a visual language based on gestures and action, as their primary form of communication, whereas the hearing population uses the typical spoken languages to express thoughts and ideas.

A. Background

A sign language (SL) is a natural visual-spatial language that combines face emotions, hand shapes, arm orientation, and movement with the movement of the upper body and upper body parts to produce verbal utterances in three dimensions rather than just one. The people in India who are hard of hearing, deaf, and dumb gave rise to the language. There are numerous communities of deaf and dumb people throughout the world, and as a result, their languages may vary. There are numerous spoken languages throughout the world, including Urdu, French, and English. Similarly, hearing-impaired people utilise a variety of sign languages and phrases throughout the world. In order to express ideas and communicate with one another, people utilise American Sign Language (ASL), British Sign Language (BSL), and Indian Sign Language (ISL) in the United States, UK, and India, respectively. For many sign languages, such as ASLand BSL, interactive systems have already been built.

Due to their inability, communication for the deaf community in common places like railway, bank, and hospitals is difficult. To help them communicate better with the rest of the world, a system is needed which will enable the conversion of text to Indian Sign Language and vice versa. These systems will increase the quality of living of this community. Sign languages have not been studied as extensively as spoken languages, and there is still much left to be learned about themis the concept of people, individually or as a group, appearing at a location for a previously scheduled event Audio to sign language translator is a web-based application

developed for deaf or hard to hearing people. It translates English audio into Indian Sign Language. The system takes simple English sentences as input and generates ISL which may then be converted into the Hamburg Notation System (HamNoSys). The HamNoSys representation will provide signing instructions to the sign synthesis module, to generate an animated representation of ISL to the user.

B.Indian Sign Language

Indian Sign Language can help people build an inclusive society where those with disabilities have equal opportunities for growth and development so they can live fulfilling lives in safety and dignity. Indian Sign Language (ISL) is widely used by the country's hard-of-hearing population. Hard-of- hearing kids are not, however, taught in deaf schools using ISL. ISL usage in the classroom is not something that teacher education programmes prepare teachers for. Nothing in the teaching materials mentions sign language. The importance of sign language in bridging communication gaps is frequently unknown to the parents of hard-of-hearing children. In institu- tions and other places where people who are hard of hearing or hearing communicate, ISL interpreters are in high demand, yet India only has about 300 licenced interpreters. ISL wantsto be successful in the following areas:

- To educate the public about Indian Sign Language (ISL), especially bilingualism, and to conduct research on the language.
- To promote the use of Indian Sign Language as a teachingtool for deaf students in primary, intermediate, and highereducation.
- To introduce and instruct various groups in the usage of Indian Sign Language, including government represen- tatives, educators, professionals, community leaders, and the general public.
- To promote and spread Indian Sign Language in conjunc- tion with organisations that assist the hard-of-hearing and other institutions that deal with disabilities.

II. Overview of Existing Audio to Indian Sign language system

The goal of the literature review is to present a summary of the most recent developments in speech to sign language systems. The various sign language techniques will be covered. computer vision, machine learning, and deep learning are all examples of recognition. A summary of the most recent state- of-the-art systems, their capabilities, and their shortcomings will also be included in the assessment. It will also draw attention to the system's difficulties, including the variety of sign languages, signer-specific variations, and the scarcity of data.

A project article that primarily focuses on supporting pa- tients with pain or silent speech is presented by Kajal Jadhav et al.[1] in their 2021 publication. Improved communication with the deaf and the mute results from the scientific work. The Indian Sign Language (ISL) approach is being used in this instance, and a microphone and camera are being used. The voice can be translated into Indian sign language using the ISL translation technology. A microphone is used by the ISL translation framework to capture still images or looping video clips, which the app then interprets. Python's PyAudio module is used for audio input. After being recorded with Pyaudio, the audio is transformed using a speech recognising library, or you can use the Google Speech API (application programme interface).By establishing relationships between words and the words that alter those words, dependency parsers assist in identifying the grammar or understanding the grammatical structure of a given phrase. Text divider then splits the text using natural language processing to clear up any ambiguityor produce Python machine representation language.

A reliable system that can automatically translate spoken word into text and written word into animated sign language was proposed by Prof. Abhishek Mehta et al in 2021 [2]. Systems for sign language translation could greatly enhance the lives of the deaf, particularly in terms of communication, information exchange, and the use of machines to translate discussions across different languages.It seems vital to explore voice recognition in light of these considerations. Three main issues are typically addressed by voice recognition algorithms. The first problem is separating speech features from other sound sources, the second is when there is a little sound gallery available for detection, and the third challenge is to improve speaker dependent to speaker independent voice recognition.A crucial phase of our technology is feature extraction from speech. There are numerous methods for extracting features from speech. MelFrequency Cepstral Coefficients are one of the most often employed in voice recognition systems (MFCCs). Signal conditioning and preprocessing are the first steps of the method. The next step is to extract features from speech using Cepstral coefficients. The segmentation part receives the process's output after that. Lastly, the recog- nition component identifies the phrases before translating them into animated face expressions. The research is still in development, and the latest report describes a few new, intriguing techniques.The system will carry out the recognition process by comparing the parameters of the input speech with the templates that have been previously stored before finally displaying the sign language in the video caption on the computer/mobile device/etc. screen. So, with the online YouTube video, Deaf and Dumb people or students can easilylearn the subject.

The main goal of Harshita Mishra et al's study from 2022[3] is to close the communication gap between hearing and deaf people, which will help people who use sign language as a simple and efficient means of communication. The deaf com- munity communicates using sign language, a visual language. It makes use of facial expressions, hand motions, and body language. Indian Sign Language is one of the most important and widely used forms of communication for people who have trouble speaking or hearing. For people who are hard of hearing or have trouble speaking, this web application makes communication easier. These innovative web applica- tions' main areas of interest are NLP and Translation is the translation of sign language from spoken or written language. Users of this web application can record their voice using a microphone or enter text using speech recognition based on NLP. The corresponding video is shown if the word is spit out and the video is absent from the database. This method has made it easy and practical to communicate with deaf people. The Sign Language Recognition system, which uses Python to recognise hand motions, is presented by Onkar Bidkar et al. in 2021[4]. This framework was inspired by the unique group of people who have problems with linguistic structure. It is designed to be easy to use for those who have hearing loss or hard of hearing.The goal of this project is to create a system prototype that automatically assists in recognisingthe speaker's audio languages and converting them into sign language.

The system being developed by Ashmi Katariya et al in 2022[5] comprises of a module that first converts spoken input into English text,

parses the phrase, and then applies grammar rules to Indian sign language. This is accomplished by removing stop words from the rearranged sentence. The word's inflections are lost in Indian Sign Language (ISL). Hence, stemming is used to categorise words according to their root or stem class. The labels in the dictionary that contain videos of each word are then compared to each word in the phrase. The proposed system is novel since it seeks to rework these sentences into ISL, whereas the current methods are restricted to merely straight translation of words into ISL.

An audio to Indian Sign Language translation system was the topic of Purushottam Sharma et al 2022[6] .'s study in an effort to close the communication gap between the two languages. Society and those with hearing impairment. The system accepts input in the form of text and audio and com- pares it to the videos stored in the authors' database. If they are matched, it outputs appropriate sign motions based on Indian Sign Language grammar rules; if they are not, tokenization and lemmatization methods are used instead. Tokenization, parsing, lemmatization, and part-of-speech tagging are all features of the system's core technology, known as natural language processing.

According to Vishwas S et al 2018[7], not everyone is able to understand sign language when speaking with a deaf or stupid individual. There is always a demand for sign lan- guage communication. Without an interpreter, communication is challenging. A sturdy and adaptable product is required to address this. The product must translate sign language so that it is accessible to the general public and enables barrier-free communication. The major goal of the initiative is to break down the barriers that separate the dumb and deaf from therest of society.

A system was suggested by M. Jerin Jose et al. in 2013[8] to make it easier for normal people to converse with hard of hear- ing persons.Instead, this approach of Indian Sign Language (ISL) uses a camera and microphone as a tool. Indian Sign Language is translated into through the ISL translation system. The ISL translation system employs a microphone or USB camera to collect photos or a continuous video feed from reg- ular people that the programme can then translate.Translation, scale, and rotation invariance are regarded as properties of acquired voices. The phases of translation in this method are image capture, binarization, classification, edge detection for hand shapes, and feature extraction. Following feature extraction from the vectors, pattern matching is carried out by comparing the database. The message is being displayed and sent to the recipient by the GUI programme. With the aid of this technique, deaf/dumb persons can readily communicate with regular people.This programme aids those who have difficulty hearing and speaking during video chats or calls.

In order to enable a very practical, real-time form of communication between the disabled community and the general population, Pankaj Sonawane et al. 2021[9] proposed an end-to-end human interface framework that is capable of recognising and interpreting spoken language and then acting out the corresponding ISL gestures. To collect motion data for all the various ISL motions, they employed the depth sensing and motion capture capabilities of the Microsoft Xbox Kinect 360. They then used Unity3D to create up all the animations, and eventually combined everything into an Android application. The creation of this system will aid in bridging the communication gap between the community of hearing and speech impaired people and the community of able-bodied people.

Ritika Bharti et al. 2019[10] concentrated on creating an automated software system to translate speech to sign language so that a deaf/dumb person might understand what a normal person is saying. This automated system first detects speech, then transforms it to text, matches tokenized text with a visual sign word library (sign language movies), concatenates all the matched videos in accordance with the text detected, and then displays the combined video to the deaf/dumb person.

Indian Sign Language is one of the project articles that Hemang Monga et al.[11] provide in their 2021 paper.The most significant and popular modes of communication for those who have speech and hearing difficulties.The primary goal of this project is to create a translating system made up of numerous modules that accept English audio input and convert it to English text. This text is then parsed to create a structure grammar representation, on which Indian Sign Language grammar rules are applied. The rearranged sentence is free of stop words. The provided word will be stemmed and lemmatized into its root or original word because the Indian Sign Language does not permit word conjugation.Then, each individual word is examined in a lexicon that contains movies for every single word. The best synonym is used to replace terms when the system is unable to locate them in the dictionary. The method we've presented is innovative because, unlike existing systems, which can only translate words directly into Indian Sign Language, it can also display grammar in Indian Sign Language sentences to the user.

Ankita Harkude et al.[12] argue in the 2020 paper that Deaf people always miss out on the enjoyment that hearing people have, whether it is in conversation, playing video games, attending seminars, or participating in virtual conferences, for example,The biggest problem they have is communicating with regular people, and most regular people do not know sign language. The goal of our project is to create a deaf-friendly communication system. It translates the spoken message into sign language. This system accepts audio as input, transforms the audio recording message into text, and then displays the appropriate GIFs or graphics in Indian Sign Language that have been predefined. This system makes it simpler for hearingindividuals to communicate with deaf people.

In the 2020 work, Renjitha.R et al. [13] give a project article arguing that the ordinary person has the capacity to notice and react to their surroundings. There are numerous unfortunate people who do not possess this essential blessing. It can be difficult for Deaf and Dumb persons to converse with regular people. Deaf and hard of hearing persons use sign language to communicate with the rest of society. With the aid of an Arduino Uno, a technology known as sign language recognition is employed to recognise human motions. An audible text output results from gesture recognition based on the associated gesture sign. The hand motions are recognised using the flex sensor. The Arduino Uno receives the recognised gesture, and an output is produced. We can build an effective audio text output for those with physical disabilities utilising these methods. This device consists of a glove that dumb people will wear to interact with seeing people. The proposed prototype might also act as a bridge between hearing-impaired and regular people in settings like banks and post offices. The output generates a voice signal and will be displayed on an LCD.

For those who are deaf or hard of hearing, Minh Le et al. 2021 [14] provides a design for a speech to sign language converter.The gadget is inexpensive, uses little power, and can function totally without an internet connection. Using the Pocketsphinx library, an opensource API, speech recognition is created.In this study, we suggested a context-oriented language model that gauges output based on how closely recognised speech resembles prescribed speech. The database's recom- mended speech, which is the best match to the identified speech, is used to determine the output speech. The rate of voice recognition can be increased by 21 using the suggested context-oriented language

model, which operates fully offline. The output sign language is determined by a decision module that compares the similarity of the two texts using the Lev- enshtein distance. The output sign language is created as a series of sequential visuals that corresponds to the recognised speech. The speech to sign language translator is installed on a Raspberry Pi Zero board for inexpensive assistive technology for the deaf.

Dr.L.Priya et al. 2020 [15] offered the idea since sign language translation will effectively assist those in need. This can translate in real time between several Indian languages and English and sign language, greatly assisting in closing the communication gap. It can also function without an internet connection. The majority of the population is illiterate and unable to communicate effectively with the deaf. Because of this, it might be difficult for the deaf to communicate with people on a daily basis. However, this problem can easily be resolved with a smartphone application. Deaf and dumb people can simply learn other languages by using their preferred language. The application allows users to study in both online and offline modes, encourages user interaction, and offers a greater level of comfort, enhanced higher understanding, and a relaxed environment. The humanoid studio installation is required for the applying development, which is value- free. Mobile applications are widely used and may effectively address the majority of issues faced by people with speechand hearing impairment.

The concept that people with hearing and speech impair- ments utilise sign language to express their thoughts and feelings is presented in the Dhivyasri S et al 2021 [16] study. Yet, because they do not comprehend the meaning of the sign language movements, most individuals have trouble understanding the hand gestures used by people with special needs. When a person with speech or hearing impairment wants to interact with a regular person, a translator is typically required. A method that converts Indian Sign Language (ISL) hand gestures of numerals (1–9), English alphabets (A–Z), and a few English words to comprehensible text and vice versa has been proposed in order to help the specially challenged personscommunicate with the people around them successfully.

English Speech to Indian Sign Language (ES2ISL) anima- tions are converted using a model and preliminary imple- mentation proposed by Bhavinkumar Devendrabhai Patel et al. in 2020 [17]. A hearing-impaired person's quality of life could be significantly improved by such a system, particularly when it comes to communication and information sharing. The system's main objective is to eliminate communication barriers between hearing-impaired people in India and others. It utilises and combines the semantics of Natural Language Processing (NLP), the Google cloud speech recognizer API, and a pre- existing database of sign language. The experimental findings demonstrate that the suggested system performs better than the benchmark models, with an average accuracy of 77%. As a result, it outperforms the current systems in terms of processing time, taking roughly 0.85s.

An application to help the Indian deaf people integrate into mainstream culture is presented by Ruviansh J. Raghavan et al. in 2013 [18]. This is accomplished by feeding animated gesture sequences into an English text feed that correspond to the content of the text. The three primary components of this programme are a user-entry interface, a mechanism for translating English text into ISL, and a virtual character who serves as an interpreter for the user at the interface. We developed a novel technique to map the kinematic data for the related word, and it is used to dynamically animate these motions. After being translated into ISL, the word will be searched for in the database to see how it should be written out. With the help of these parameters, the system will be able to recognise features like hand position (L), hand orientation

(O) in 3D space, hand trajectory movement (T), hand shapes (S), and non-manual elements like face expression. The series of notations that are queued in order of appearance are therefore used to create the animation of a sentence fed. In addition, we are inserting the movement-epenthesis, which is the inter sign transition gesture, in order to prevent jitters in gesturing. In India, Indian Sign Language (ISL) is the primary form of communication for more than a million deaf adults and over 500,000 deaf children. To advance sign language communication in the banking industry, however, this system would act as a catalyst. In the working area, there is little audio reliance, which helps the cause.

According to Prof. Prashant G. Ahire et al. (2015) [19], the ability to express oneself by responding to happenings in one's environment is the most priceless gift that nature has given to humans. Every normal person observes, listens, and then responds to the circumstances by speaking out. Nevertheless, some poor people are denied access to this priceless gift. This widens the divide between privileged people and average people. They can speak with each other more easily thanks to this software. The system primarily consists of two mod- ules, the first of which extracts Indian Sign Language (ISL) movements from live video and maps them to speech that is understandable by humans. As a result, the second module will translate animated movements in Indian Sign Language into natural English using as its input. Frame construction from videos, region of interest (ROI) detection, and picture mapping with linguistic knowledge bases will all be part of the processing from video to speech process. Relevant audio will then be generated using the Google Text-to-Speech (TTS) API. By using Google Speech-to-Text (STT) API to convert speech to text, natural language is mapped with similar Indian Sign Language movements. The text is then further mappedto pertinent animated gestures from the database.

Jerome M. Allen et al. 2015 [20] go over a method for turning English into its Signed English visual equivalent. This involves the development of a programme that can take spoken or written words and turn it into an animated gesture sequence that encapsulates its meaning. Three basic components make up this application: a method for entering English language into the system, an algorithm that analyses the input and generates kinematic data that correlates with an animation process, and a virtual avatar that serves as an interpreter and conveys the information.

III. Conclusion

Hearing and speech impairments affect a sizable portion of Indian culture. As their main form of communication, this group employs Indian Sign Language. It is preferred to use sign language because written materials might be challenging to learn and interpret in terms of context and meaning. In order to transmit words, emotions, and noises using sign language, hands, lip movements, and expressions are used. The suggested system offers a useful means of assisting hearing- and speech-impaired people in communicating with one another. Here, we've taken steps to provide a framework that will enable those with impairments to express themselves clearly, allowing them to easily integrate into society. The audio provided as input will successfully be converted into an animation using our suggested model. Moreover, text- and-speech integration can be implemented on a project to provide Monaural / Speech to Indian Sign

Language Translatorimproved communication strategies that will enable users to manually input text into Indian Sign Language.

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