Indian Sign Language Interpreter

Sagar Socrates S, HKBK College of Engineering Bangalore & India, sagarsocrates22@gmail.com

Krithika Ravindran, HKBK College of Engineering Bangalore & India, krithikaravindran022@gmail.com

Abstract - Sign language is a visual language used by both speech-impaired and hearing-impaired people as their mother tongue. People suffering from hearing and speaking disabilities use sign language as a simple mode of communication amongst each other and also with others but sadly not everyone can understand sign language hence it results in a lack of communication and isolation. As far as both speech-impaired and hearing-impaired people are concerned, having access to a sign language is very essential for their social, emotional, linguistic and cultural growth. Our project aims to bridge the gap between these both speech impaired and hearing-impaired people and with the rest of the world with the help of new technologies. We have developed an application which will convert voice of the user to Indian sign language with the help of Google speech recognition, natural language processing semantics and other technologies.

Keywords — Google Speech Recognition, Indian Sign Language, Natural Language Processing.

I. INTRODUCTION

Sign language is a natural visual-spatial language used by the deaf people in which body language is used in contrast with the regular sound to communicate with another person, it is done by integrating handshapes, orientation and motion of the hands, arms, upper body and facial expressions all at once. Deaf, dumb and hard of hearing people in India were the reasons behind the invention of the Indian Sign Language. Globally there are numerous fraternities of deaf and dumb people and hence the languages of their own communities will not be the same. There are different sign languages that are practiced across the globe like, America uses the American Sign Language (ASL), and Britain uses the British Sign Language (BSL) and India uses the Indian Sign Language (ISL) etc.

The number of people with hearing impairment in India alone crosses 1.1 million and about 98% of them are illiterate. There are attempts being made to make their lives better and easier like introducing hearing aids etc., but the success rate was very low. A study that was made in 1986 showed that only 2% of the deaf children actually went to school. The main reasons behind the low literacy rate are due to many reasons like scarcity of the interpreters, and lack of study on ISL.

There have been different ways available to recognize or to translate sign language and convert them to text, but audio to video sign language conversion systems have been rarely developed, this is due to the lack of any sign language corpus. The main purpose of this project is to build an application which accepts Audio/Voice as input and converts them to corresponding Sign Language for both speech-impaired and hearing-impaired people. The interface works in two phases, first converting Audio to Text using speech to text API (python modules or Google API) and secondly, applying the semantics of Natural Language Processing (NLTK) and then produce the ISL video output.

II. EXISTING SYSTEM

A good deal of study has been done on the topic of Indian Sign Language, to help create systems that can help in the betterment of lives of people with speech and hearing impairment. There are multiple projects and systems that have been developed and are being developed to recognize the Indian Sign Language, they make use of different kinds of technologies that will help in achieving it. They have made use of different machine learning techniques, in [1] they classify single and double handed ISL using algorithms of machine learning, and in [2] they have used k-nearest neighbor classification, in [3] and [4] ANN based and Convolution Neural Networks based ISL recognition techniques have been used.

There are a very few systems that have been developed that converts audio to Indian Sign Language, for example in [5] a system has developed that converts audio to ISL gloss using wordnet. And there are many systems that have been developed that convert text to Indian Sign Language. In [6] and [7] English text is converted to ISL, in [8] Hindi text is mapped to its corresponding ISL similarly there are other *language texts that are converted to ISL. But not many* systems are created that converts voice/speech/audio to Indian Sign Language

 DOI : 10.35291/2454-9150.2022.0416

I. METHODOLOGY

i) Proposed System - Sign language helps people with partial or full speech and hearing impairment. It makes use of manual communication methods like hand gestures, facial expressions and bodily movements to convey the message. This paper takes in audio/speech as the input and it converts it to its corresponding Indian Sign Language video. The system architecture is shown in figure 1 below.

ii) Implementation-

It works in 3 phases:

a) Audio to text

Processing the recognized text

c) Produce the video output

a) Audio to text - The voice input provided by the user is recognized in this phase and then converted to English Text. In this paper, pyaudio is used to record the voice/speech of the user; Google Speech Recognition API is used to convert the audio to its corresponding text.

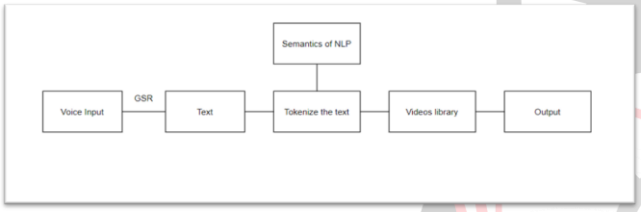

Figure 1: System Architecture

b) Processing the recognized text- once the audio is correctly recognized and converted to text, the next step is to process this text in order to easily convert it to Indian sign language.

The first step in this is word tokenization which is the process to split the text into a list of words. According to the rules of Indian Sign Language we never make use of articles like a/an/the or the linking verbs. These are called stop words. The next step is to remove the stop words from this list of words. The next step is to bring the words to its root or to its common base form.

For example,

Am, are, is ==be

Question's, question, questions ==question

The reason behind this step is that in ISL we never make use of suffixes or words that ends with gerunds. For processing the recognized text, the main tool that is used in this paper is the python nltk toolkit and its libraries.

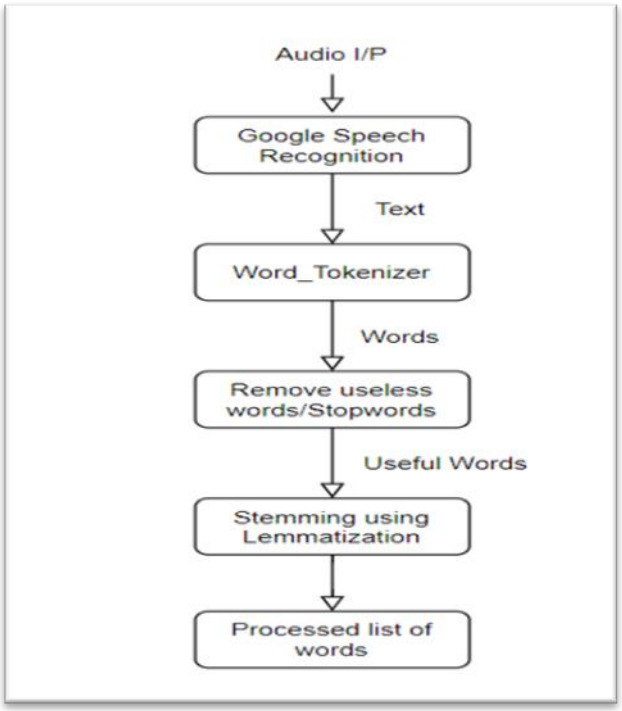

Figure 2: Audio to processed text dataflow

c) Video output- The final stage is to map the words to the video files that are stored in the library and then play them to convey the message. The library contains numerous video files of ISL words that was created and added manually. Since there are a very few words in ISL the number of words present in this library is also not very large. It works in two ways, first it will check the library for the word and if the word is found then it can be queued, otherwise if the word is not found in the library, then the word is spelt and its corresponding letter video is queued. Once all the mapping is done, the queued videos are played in a sequence and shown as one full video of ISL and serving the purpose of filling the gap of communication between the speech or hearing-impaired community and the rest. Figure 3 illustrates how the path of the video files have been written in a text file and then served as a command in command line to play the concatenated video. And we can see the entire process of converting Audio to Indian Sign Language in figure 4

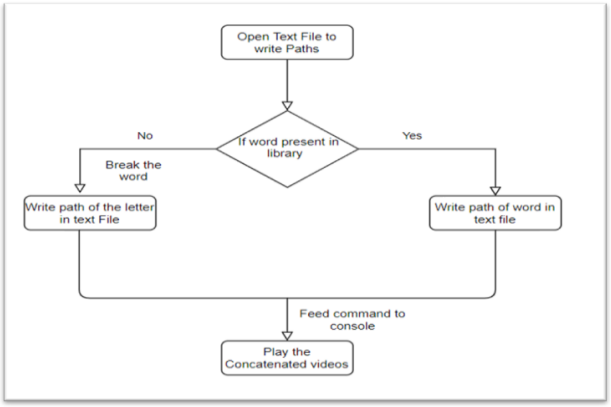

Figure 3: Writing Path of Video Files

 DOI : 10.35291/2454-9150.2022.0416

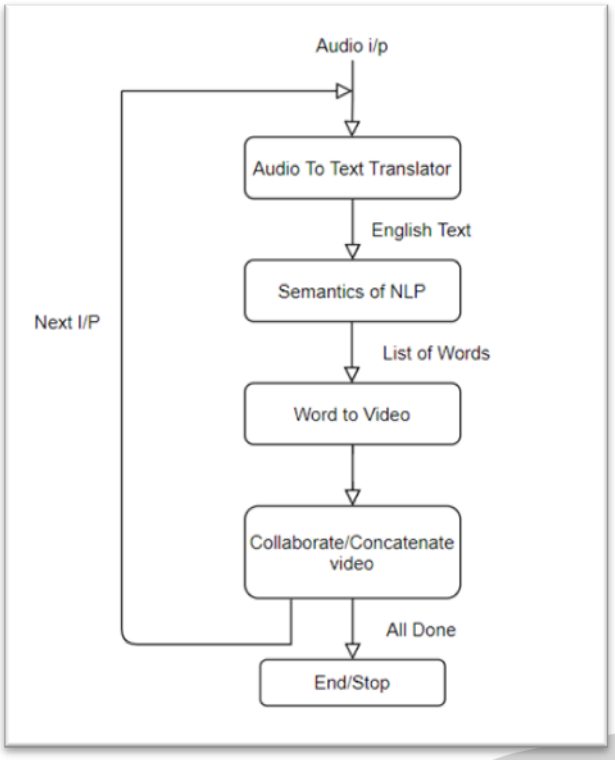

Figure 4: Audio to Indian Sign Language

II. RESULTS AND DISCUSSION

Several tests were conducted to check the integrity of the system, it proved that the system works as expected and it serves the purpose of bridging the communication gap between the speech and/or hearing impaired and the rest of the world. These tests included different unit tests and integration tests. In order to check the audio to text conversion module we ran a unit test on it and the result is shown in figure 5.

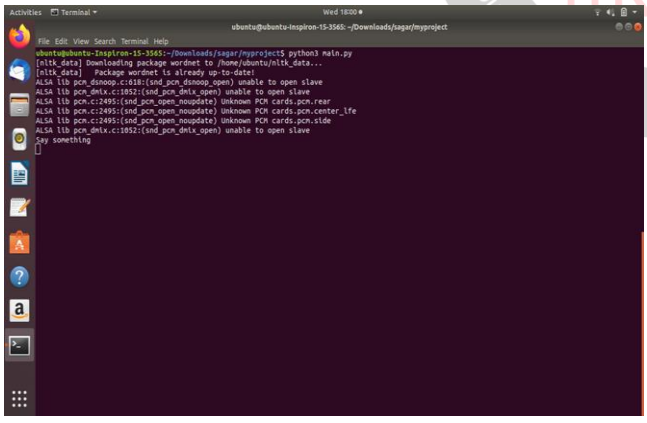

Figure 5: **Audio to text unit testing**

Whenever a word that is not present in the dataset has to be processed, the output will be spelled. Also, the words will be concatenated and played continuously. Also, in this paper an additional feature of recorded voice is discussed, where the user can select any recorded speech/audio file and convert the entire file into its corresponding Indian Sign Language videos. The process of selecting any audio file is shown in figure 6.

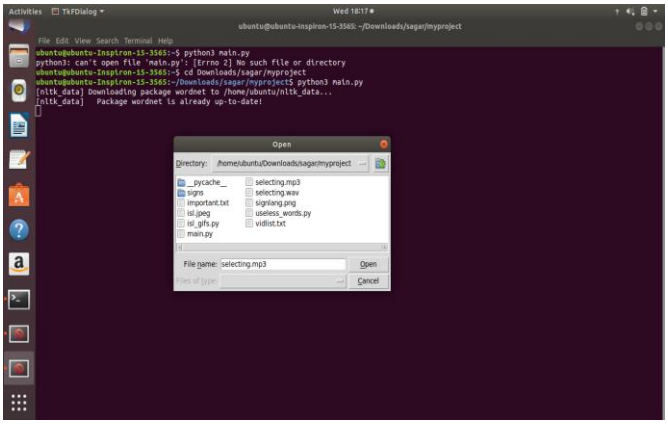

Figure 6: Selecting a recorded audio

And finally, text to Indian Sign Language Conversion is shown in figures 7, 8 and 9. All the tests that were conducted during various phases of development were successful and ISL videos are being added continuously to expand the library to make the translation easier and efficient.

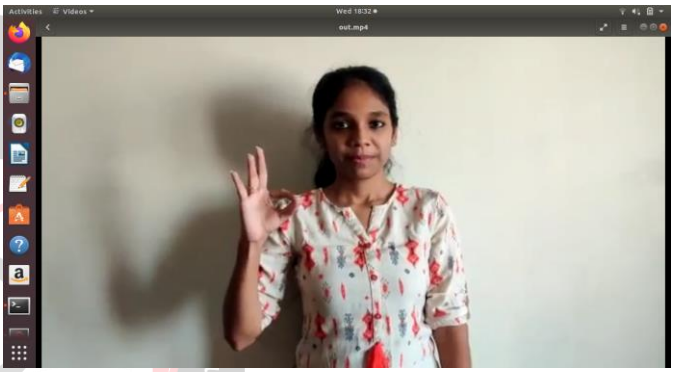

Figure 7: ISL Output 1

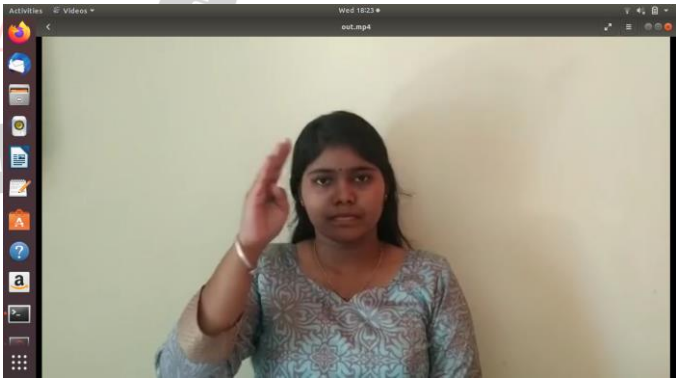

Figure 8: ISL Output 2

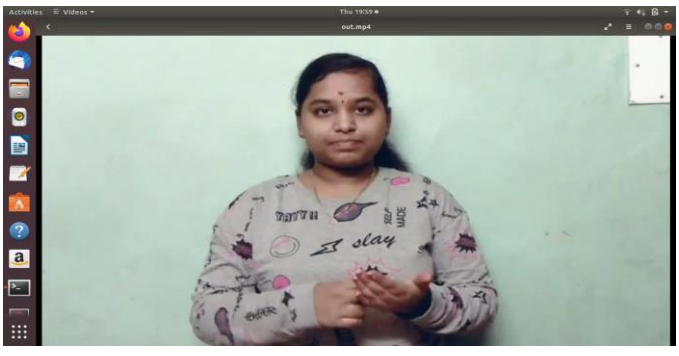

Figure 9: ISL Output 3

 DOI : 10.35291/2454-9150.2022.0416

III. CONCLUSION

The main aim of this paper was to fill the communication gap between speech and/or hearing-impaired community and the rest of the world. The Sign Language Interpreter has been successfully implemented. After a successful user testing phase, it was discovered that the new system, particularly for ISL, has mostly solved the drawbacks of the previous ones. Since the ISL is still in its infancy and little progress has been made in this area, many new videos for various terms can be added to the dictionary to expand its range and improve communication using this language. The entire system has a variety of uses that include the educational sector, which includes schools, colleges, and other offices, as well as different types of agencies, airports, train stations, and many other locations.

IV. FUTURE WORK

The current system operates on a basic set of words and in order to extend the system, many new words can be included in the dictionary in future and specialized terms from different fields can be incorporated too. This project can be made as a mobile application, so that user can install the application into their mobile phones or laptops and can access it easily

REFERENCES

[1] K. K. Dutta and S. A. S. Bellary, "Machine Learning Techniques for Indian Sign Language Recognition," 2017 International Conference on Current Trends in Computer, Electrical, Electronics and Communication (CTCEEC), Mysore, 2017, pp. 333-336, doi: 10.1109/CTCEEC.2017.8454988.

[2] B. Gupta, P. Shukla and A. Mittal, "K-nearest correlated neighbor classification for Indian sign language gesture recognition using feature fusion," 2016 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, 2016, pp. 1-5, doi: 10.1109/ICCCI.2016.7479951.

[3] D. Naglot and M. Kulkarni, "ANN based Indian Sign Language numerals recognition using the leap motion controller," 2016 International Conference on Inventive Computation Technologies (ICICT), Coimbatore, 2016, pp. 1-6, doi: 10.1109/INVENTIVE.2016.7824830.

[4] N. Intwala, A. Banerjee, Meenakshi and N. Gala, "Indian Sign Language converter using Convolutional Neural Networks," 2019 IEEE 5th International Conference for Convergence in Technology (I2CT), Bombay, India, 2019, pp. 1-5, doi: 10.1109/I2CT45611.2019.9033667.

[5] K. Saija, S. Sangeetha and V. Shah, "WordNet Based Sign Language Machine Translation: from English Voice to ISL Gloss," 2019 IEEE 16th India Council International Conference (INDICON), Rajkot, India, 2019, pp. 1-4, doi: 10.1109/INDICON47234.2019.9029074.

[6] Goyal, Lalit, and Vishal Goyal. "Automatic translation of English text to Indian sign language synthetic animations." Proceedings of the 13th International Conference on Natural Language Processing. 2016.

[7] K. Anuja, S. Suryapriya and S. M. Idicula, "Design and development of a frame-based MT system for English-to ISL," 2009 World Congress on Nature & Biologically Inspired Computing (NaBIC), Coimbatore, 2009, pp. 1382-138.

[8] Vij, Paras, and Parteek Kumar. "Mapping Hindi Text to Indian sign language with Extension Using Wordnet." Proceedings of the International Conference on Advances in Information Communication Technology & Computing. 2016.

[9] R. Shahriar, A. G. M. Zaman, T. Ahmed, S. M. Khan and H. M. Maruf, "A communication platform between bangla and sign language," 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Dhaka, 2017, pp. 1-4.

[10] T. DasGupta, S. Dandpat, A. Basu. Prototype Machine Translation System from Text-To-Indian Sign Language, 2008.

[11] Almasoud, Ameera M., and Hend S. Al-Khalifa. "A proposed semantic machine translation system for translating Arabic text to Arabic sign language." Proceedings of the Second Kuwait Conference on e-Services and e-Systems. 2011.

[12] San-Segundo, Rubén, et al. "A spanish speech to sign language translation system for assisting deaf-mute people." Ninth International Conference on Spoken Language Processing. 2006.

[13] M. S. Nair, A. P. Nimitha and S. M. Idicula, "Conversion of Malayalam text to Indian sign language using synthetic animation," 2016 International Conference on Next Generation Intelligent Systems (ICNGIS), Kottayam, 2016, pp. 1-4, doi: 10.1109/ICNGIS.2016.7854002.

[14] T. Vichyaloetsiri and P. Wuttidittachotti, "Web Service framework to translate text into sign language," 2017 International Conference on Computer, Information and Telecommunication Systems (CITS), Dalian, 2017, pp. 180-184, doi: 10.1109/CITS.2017.8035336.

[15] S. Fatima, A. Agarwal and P. Gupta, "Different approaches to convert speech into sign language," 2016 3rd International Conference on Computing for Sustainable Global Development (INDIACom), New Delhi, 2016, pp. 180-183

 DOI : 10.35291/2454-9150.2022.0416