MAULANA AZAD
NATIONAL INSTITUTE OF TECHNOLOGY
BHOPAL INDIA, 462003

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Voice to Sign Language Converter & vice versa

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ABSTRACT

The **aim** of this project is to design a convenient system that is helpful for the people who have hearing difficulties and in general who use very simple and effective method; sign language.
Sign language is a visual language that is used by deaf people as their mother tongue. Unlike acoustically conveyed sound patterns, sign language uses body language and manual communication to fluidly convey the thoughts of a person. It is achieved by simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions.
It can be used by a person who has difficulties in:

- ➢ speaking,
- ➢ hearing but could not speak,
- ➢ communicating with hearing disabled people.

A motion capture system is used for sign language conversion and a voice recognition system for voice conversion. It will capture the signs and dictates on the screen as writing. It also captures the voice and displays the sign language meaning on the screen as motioned image or video.

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1. Introduction

i) Project Idea

The aim of this project is to improve the communication with the people who have hearing difficulties and using any sign language to express themselves.
Our group is planning to implement for our minor project is a **voice to sign language converter and vice versa.**
The use of this project is to decrease the communication gap faced by the mute and deaf and the people by making a program that can take in speech and convert it into **Indian Sign Language** and also to take in sign language and convert it to speech.

This project is based on converting the audio signals received to text using speech to **text API** (***Python modules*** and ***google API***) and then using the semantics of **Natural Language Processing** to breakdown the text into smaller understandable pieces which requires **Machine Learning** as a part. Data sets of predefined sign language are used as the input so that the software can use artificial Intelligence to display the converted audio into the sign language.

Goals

1. To provide information access and services to deaf people in Indian Sign Language.
2. To develop a scalable project which can be extended to capture whole vocabulary of ISL through manual and non manual signs.

ii) Applications of this Project

a) Increasing the ease of communication between differently abled people and people who do not understand sign language
b) Can be used as a tool to teach and learn sign language to a normal person as there are not many schools that teach this language
c) Aims to reduce discrimination against this group of differenly abled population.

2. Literature Review and Survey

This section contains the description about the survey done to identify the problems faced by hearing and speech impaired persons. Further, the study about various proposed and available solutions are discussed along with their drawbacks.

A few philanthropic developers have attempted to solve the problem faced by deaf and mute persons by developing text to audio converters, sign language interpreters and standard signs guides to name a few. However, our study of the existing solutions revealed that none of them provided a complete solution to the problem. While one application takes input as text and produces audio as output, another simply shows the corresponding sign for the entered text. There is no integration of all the features required for a conversation in one single application. Moreover, all the existing solutions use American Standard Sign Language which is not followed in Indian deaf schools, as per our survey.

Sr. No.	Application Name	Pros	Cons
1.	Virtual Voice	-Simple interface -Uses device's native language	-Needs external software support - Requires internet connection
2.	Note Speak Listen for Deaf	-Synthesized speech feature	-Slow -Only serves literate - Does not support full communication
3.	Sign Language Interpreter	-Converts Text to Sign -Audio output	-Uses ASL only
4.	Sign Short Message Service	-On screen sign language keypad	-No support for ISL

3. Gaps Identified

a) Hearing and speech impaired persons rely on sign language to communicate among their peers but this is not convenient to communicate with normal persons as the latter do not understand sign language.

b) To comprehend the words spoken by a person, a deaf candidate relies on lip reading, which is an age-old but highly erratic and unreliable technique.

c) There is a huge communication gap between hearing and speech impaired persons and normal persons which creates social divide and leads to dearth of equal opportunity for disabled people.

d) The applications available on Google Play Store are not of any significant use to Indian disabled people as they are based in English, which only the literate are blessed to know and use American Standard Sign Language which is not followed in India.

e) There is no single application or solution that integrates all the facets of communication and enables a disabled person to have an almost normal conversation with a normal person.

f) The proposed methodologies are not adequate as they are not useful on-the-go. Most are desktop based solutions, which have restricted use.

4. Proposed work and methodology

i) Proposed work

We have decided to divide the project into 3 phases:

1st Phase : Build Program for converting speech into ISL
2nd Phase : Build Program for converting ISL into Text/Speech
3rd Phase : Build a User Interface That facilitates the above to Programs

ii) Methodology

Phase 1

1. Audio input on a electronic device using the python PyAudio module.
2. Conversion of audio to text using Google Speech API.
3. Dependency parser for analysing grammatical structure of the sentence and establishing relationship between words.
4. ISL Generator: ISL of input sentence using ISL grammar rules.
5. Generation of Sign language with signing Avatar or with Images

Phase 2

We would make the architectures of various self-developed and pre-trained deep neural networks, machine learning algorithms and their corresponding performances for the task of hand gesture to audio.
We will try to train the model to classify these hand gestures which correspond to a letter in the indian sign language and so forming words and sentences with these letters

Dataset

The dataset used for this work was based on ISL. According to the best of the knowledge of the authors, there does not exist an authentic and complete dataset for all the 26 alphabets of English language for ISL. Our dataset was manually prepared by clicking various images of each finger-spelled alphabet and applying different forms of data augmentation techniques. At the end, the dataset contained over 1,50,000 images of all 26 categories. There were approximately 5,500 images of each alphabet. To keep the data consistent, the same background was used for most of the images. Also, the images were clicked in different lighting conditions to train a robust model resistant of any such changes in the surroundings. The images in this dataset were clicked by a Redmi Note 5 Pro, 20 megapixel camera. All the RGB images were resized to 144×144 pixels per image so as to remove the possibility of varying sizes.

Phase 3

Development of a User interface with the following technologies:

- HTML
- CSS
- JavaScript

5. Tools and Technology to be used

The tools and technology needed to implement this project are

1. Python
2. Google speech to text API
3. HTML
4. CSS
5. JavaScript
6. Google text to speech API

6. Conclusion

Sign language should be recognized as the first language of mute and deaf people and their education can be proceeded bilingually in the national sign language as well as national written or spoken language.
Indian Sign Language is used by deaf and hard of hearing people for communication by showing signs using different parts of body. All around the world there are different communities of deaf people and thus the language of these communities will be different. The Sign Language used in USA is American Sign Language (ASL); British Sign Language (BSL) is used in Britain; and Indian Sign Language (ISL) is used in India for expressing thoughts and communicating with each other. The “Indian Sign Language (ISL)” uses manual communication and body language (non-manual communication) to convey thoughts, ideas or feelings. ISL signs can be generally classified into three classes: One handed, two handed, and non-manual signs. One handed signs and two handed signs are also called manual signs where the signer uses his/her hands to make the signs for conveying the information. Non Manual signs are generated by changing the body posture and facial expressions. This system is to help hearing impaired people in India interact with others as it translates English text to Sign language.

There may be an abundance of similar software that converts speech to ASL or BSL but there are only a handful of software that does the same for the Indian Sign Language.

The goal of our project is not just to demonstrate our expertise in Machine learning and implementation of code but also to help a large section of people (around 5.1 Million people) to have at least a good software that they can rely upon currently but also to provide a starting point/base to other developers to improve our code for better performance and for newer features in the future.

7. References

We have taken the reference of 2 research papers and numerous websites to get our Project idea and to get the necessary information to see the problems faced by mute and deaf people.We have also gone through the implementations of similar projects for other sign language converters in order to get an idea on how to implement our solution.

I. https://www.geeksforgeeks.org/project-idea-audio-sign-language-translator/
II. https://core.ac.uk/download/pdf/25725245.pdf
III. https://github.com/mjk188/ASL-Translator
IV. https://github.com/Tachionstrahl/SignLanguageRecognition
V. https://www.researchgate.net/publication/282839736_Sign_Language_Converter