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Speech to Sign Language Converter & Vice Versa Using Machine Learning

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Abstract: *Taking into account the complications faced by pupils of speech and hearing impaired, we would like to present a tool that connects the gap in communication and facilitate better interaction. In situations where a spoken person is untrained with sign language, the need is unavoidable for a sign language interpreter in order to setup an interchange of expounding. We propose a system that allows two-way conversation between deaf people and people with other voices. In this paper, we present an efficient prototype in two stages. In the early stages, sign language gestures are fed into the system in real time using the device's computer vision capabilities. These gestures are then recognized using our Deep Neural Network while the fine-tuned hand detection with edge detection algorithm interprets it as text as well as audio. The second stage is to convert the audio to text and optionally display the relevant hand gestures for the same The system can recognize more than 300 sign words in Indian Sign Language.*
.Key Word: *Concurrent Neural Networks, Natural Language Processing, Machine Learning, Sign Language Converter, Computer Vision*

I.INTRODUCTION

Sign language is the primary mode of communication for speech impaired people. It empowers them communicate with gestures that convey your thoughts join the conversation. Many researchers possibility of major language challenges suggested the aforementioned community of people lack of access to information communication lead gaps to the uncompromising situation of such people in society to put the numbers in context the 2011 census india has 134 million people with disabilities employable age group 15-59 years old 99 years old 739 millions were non-workers or part-time workers this is thats just 261 of the working-age population in the country adopted people with hearing impairments face many challenges trouble at work 31 of people feel treated differently because of hearing loss or hearing loss tinnitus while 33 of deaf people avoid social contact the situation because they find it difficult to communicate 68 percentage of people with hearing loss who feel isolated at work as a result unable to communicate.

Sign language is used all over the world to fill communication gaps for deaf and speech impaired people who mainly rely on sign language for their daily communication. There is no efficient model to convert to Lack of adequate and effective audiovisual support for oral communication. Although considerable progress has already been made in computer recognition of sign languages from other countries, very limited work has been done on the computerization of the ISL. Previous research in this area has focused on American Sign Language (ASL) or British Sign Language, but few systems have been developed for Indian Sign Language.

The sign language used in America is American Sign Language (ASL); British Sign Language (BSL) is used in the UK. Indian Sign Language (ISL) is used in India to express thoughts and communicate with each other Indian Sign Language (ISL) uses manual communication and body language (non-manual communication) to convey thoughts, ideas, or feelings. Communication is the biggest problem as we don't know what disabled person is saying to us and vice versa. And if you know Sign language but maybe other people don't know. While Travelling, they can't hear voices of vehicles, announcements etc. so sometime they might help you for the help but you can't because you know how to communicate with them. For developing this program requires the use of NLTK, OpenCV, PIL libraries in python. Different algorithms used to propose this program are Image Processing Algorithm and Speech Recognition Algorithm for creating different phase of this program.

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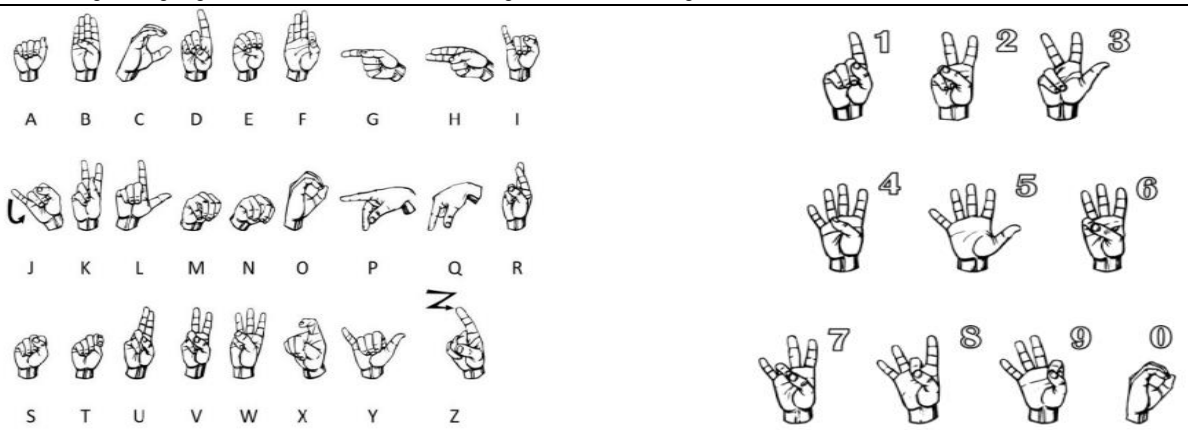


Fig 1: The Gesture Symbols for Sign Language Alphabets & Numbers that will be in the training data

II.RELATED WORK

The paper [1] "Audio to Sign Language Translation for Deaf People" takes speech as input, converts it into text and then displays the Indian Sign Language images. The front end of the system is designed using EasyGui. Speech which is taken as input through microphone uses PyAudio package. The speech is recognized using Google Speech API. The text is then pre-processed using NLP(Natural Language Processing). Finally, Dictionary based machine translation is done.

The paper [2] "Software Based Sign Language Converter" uses LabVIEW,which is a graphical designing platform that uses blocks instead of codes hence interfacing of smartphone or in that matter any hardware to build real-time application becomes much easier.

The paper [3] "Conversation of Sign Language to Speech with Human Gestures" uses Microsoft Kinect a motion capture device from Microsoft to convert the human sign language to Voice with human gesture understanding and motion capture. The use of Microsoft Kinect in the system is to track the human joints and gestures; the stream of input data to the Kinect will be the live action of human's gestures. Once the human skeleton is identified the system keeps track on the gestures and matches with the user defined gestures. Once if both the gestures suits the word is played.

The paper [4]"American Sign Language Translator Using Machine Learning" uses NLTK, OpenCV, PIL libraries in python.They have used speech engine of Google for Speech/Text to Sign Language in the replacement of PyAudio because PyAudio is not generating the correct output as desired and also it is consuming more time.For Sign Language to Speech/Text they have used simple rule classifier for the hand gesture classification after recognition of the fingers.

The paper [5] "Sign Language Communication with Dumb and Deaf People" uses image processing with artificial neural network based. It is real time, less time and highly efficient technique which convert sign language of dumb people translates into voice or text and voice of dumb deaf people convert into text. In this paper we used web camera to take images of various hand shapes and send to raspberry pi for further processing, Raspberry pi 3 controller is used for interfacing purpose and image processing purpose. Raspberry pi is mini computer has own CPU and operating system. Voice recognition module is used for converting the voice of normal people to text or with the help of models of neural network convert that text into various sign gestures. In this way complete communication takes place from the both side.

III.OBJECTIVES

The primary goal of this project is :

- To convert sign language into text and voice.The framework makes it easier for those who have trouble speaking to communicate with others through sign language.
- It results in the removal of the intermediary, who typically serves as a translator.
- It would have a user-friendly interface by producing speech or text in response to a sign gesture input.
- To offer deaf individuals services and information in Indian sign language.
- To create a project that is expandable and can record the entire ISL vocabulary using both manual and non-manual signs.

IV.PROPOSED SYSTEM

There are many algorithms and programs for the speech recognition and gesture recognition. But they work differently in this we have joined the different approaches to make all the multiple events occur at same place and also this will offer a single package for the communication of both the disable and normal person, where both of them will have a medium to interact with each other. This has two phases of working-

• Speech to Sign Language
• Sign Language to Text

A] Speech to Sign Language

There are many algorithms which convert your speech to text and also there are speech engines of Google and Microsoft which also do the same. We have taken help of the existing speech engines and made some advancement in the existing speech engines where with the use of this speech engine we have recognized the sentence of the user who is speaking and then used every word of the sentence to map them with the images associated with them. We have used file handling for fetching of all the images required because database connectivity can result in the delay of the process and can also increase the time complexity of the program. We have also used the existing media player in the system to eliminate the problem of installing any other specific media player as different platforms have different media player this will also create the flexibility to implement this on any of the system in respective to operating system and system configuration. We have used speech engine of Google in the replacement of PyAudio because PyAudio is not generating the correct output as desired and also it is consuming more time. The steps of working of this phase are-

- Speech Recognition.
- Extraction of the sentence.
- Splitting the sentence to get all the words spoken.
- Storing all the text in the array for further processing.
- Linking all the text with their associated images in the data set.
- Fetching all the images.
- After fetching all the images then the images will be processed using OpenCV (python library).
- In the image processing all the images will be converted into a common frame which will be calculated by taking the average of the dimensions of the all images.
- After image processing all the images will be stitched to for a video.
- A video will be generated. Now generated video can be played in any of the existing media player.

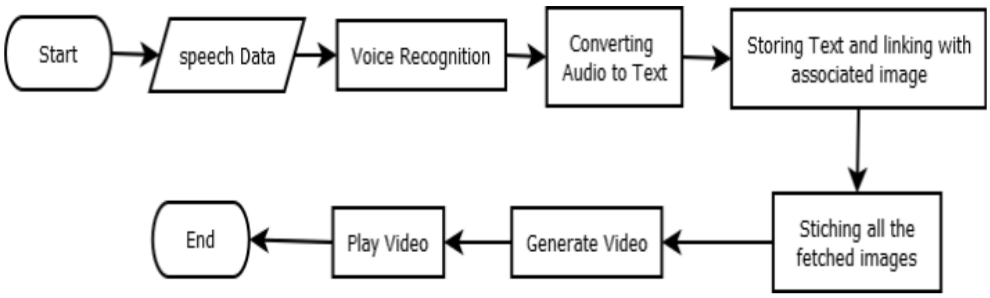


Fig 2: Diagram of Speech to Gesture Video

B] Sign Language to text

For the conversion of the sign language we have considered that the user will be using only hands for the communication and eliminated the facial gestures. For the hand gesture recognition, we have used “Palm and Finger Segmentation”. Now on the basis of segmentation all the fingers on the hand image are discovered and recognized. Simple Rule Classifier is used to accomplish the hand gestures. Performance of this method depends on the data set of hand images. Most data sets for automatic sign language is created by us for training the model. Then we will use simple rule classifier for the hand gesture classification after recognition of the fingers.Here we have used Opencv,mediapipe,scikit-learn. Steps for the hand gesture recognition-

- Hand Detection
- Segmentation of finger and palm.
- Finger recognition.
- Calculation of multiple finger point and angles.
- Recognition of hand gesture.
- Displaying text of that action.

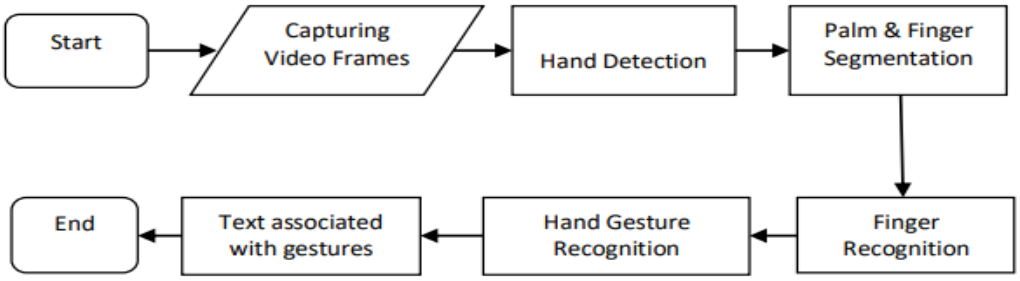


Fig. 3: Flow Diagram of Gesture to Audio

V.EXPERIMENTAL RESULT

Proposed technique is implemented and verified on our local system. In our experiment we have created a python program for all the working. This python program is running as expected. We took a small Data Set of gesture images for the testing of speech to gesture part and we have tested lots of sentences and the video is generating as expected also the video is understandable for all the sentence.

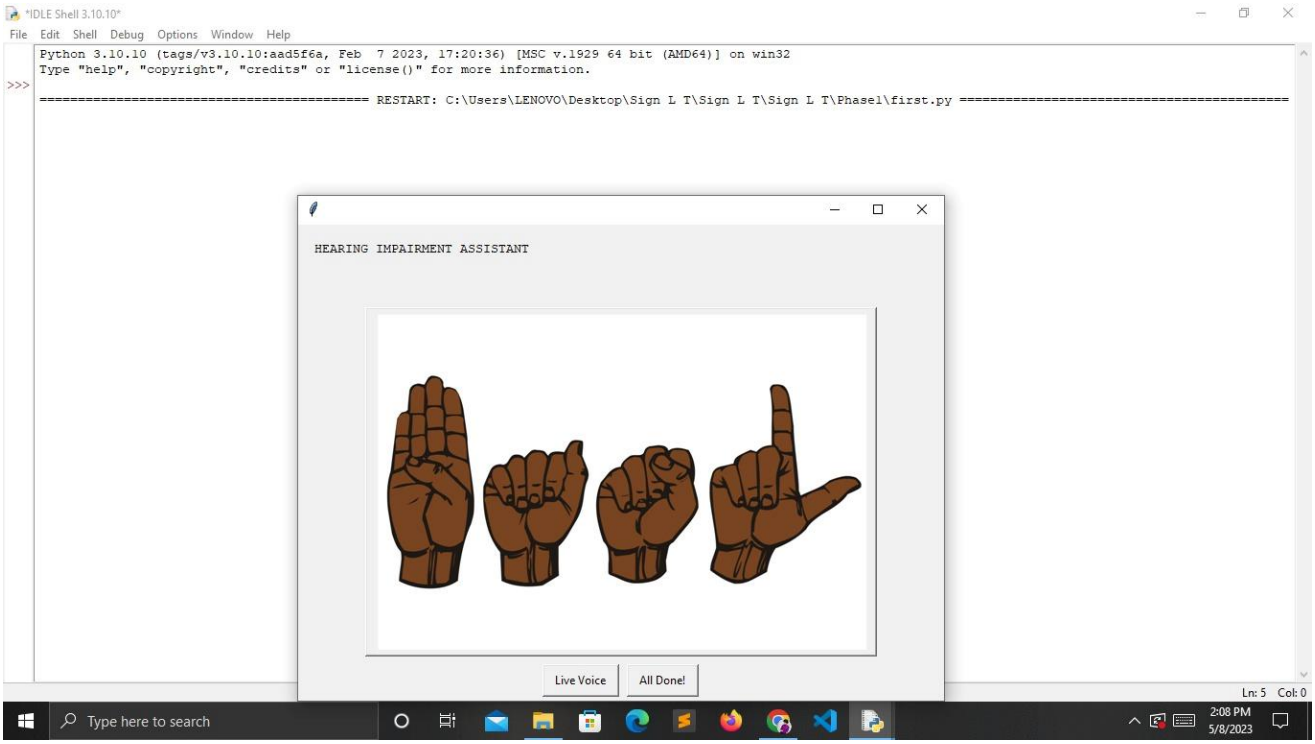


Fig 4: Inteface of Speech to Gesture

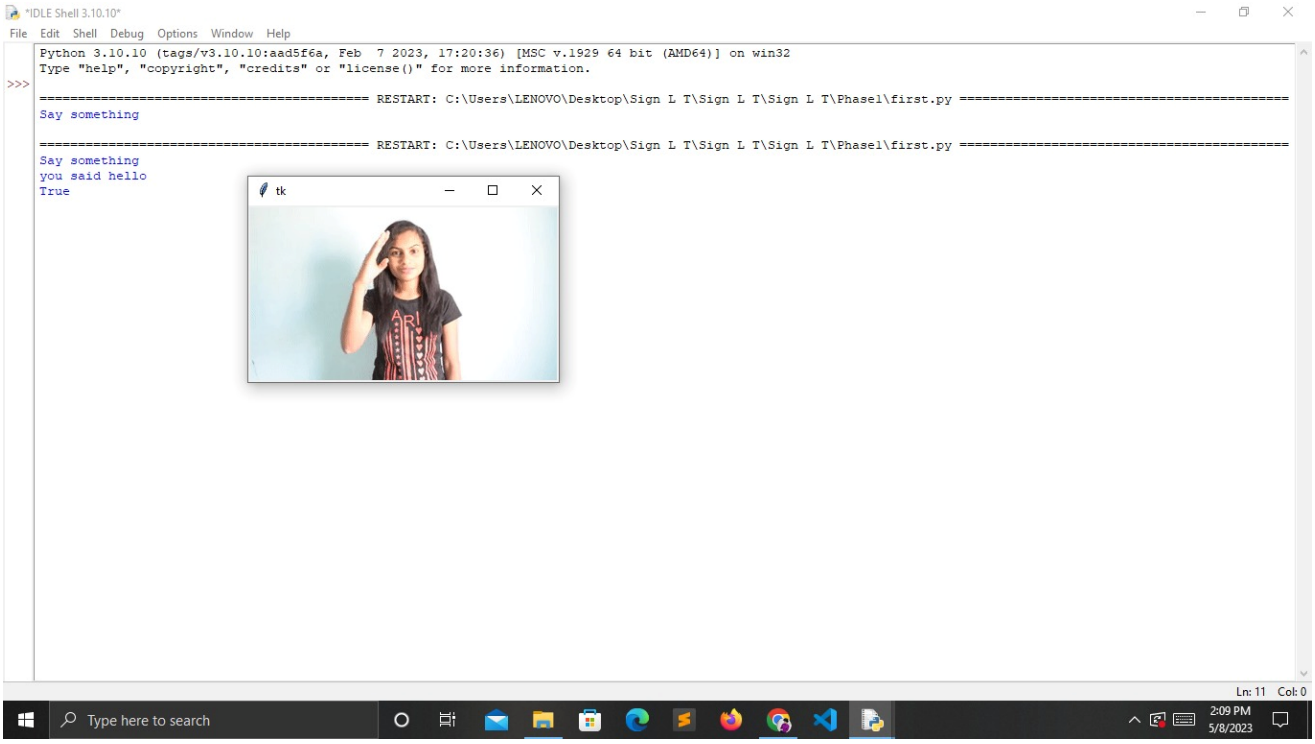
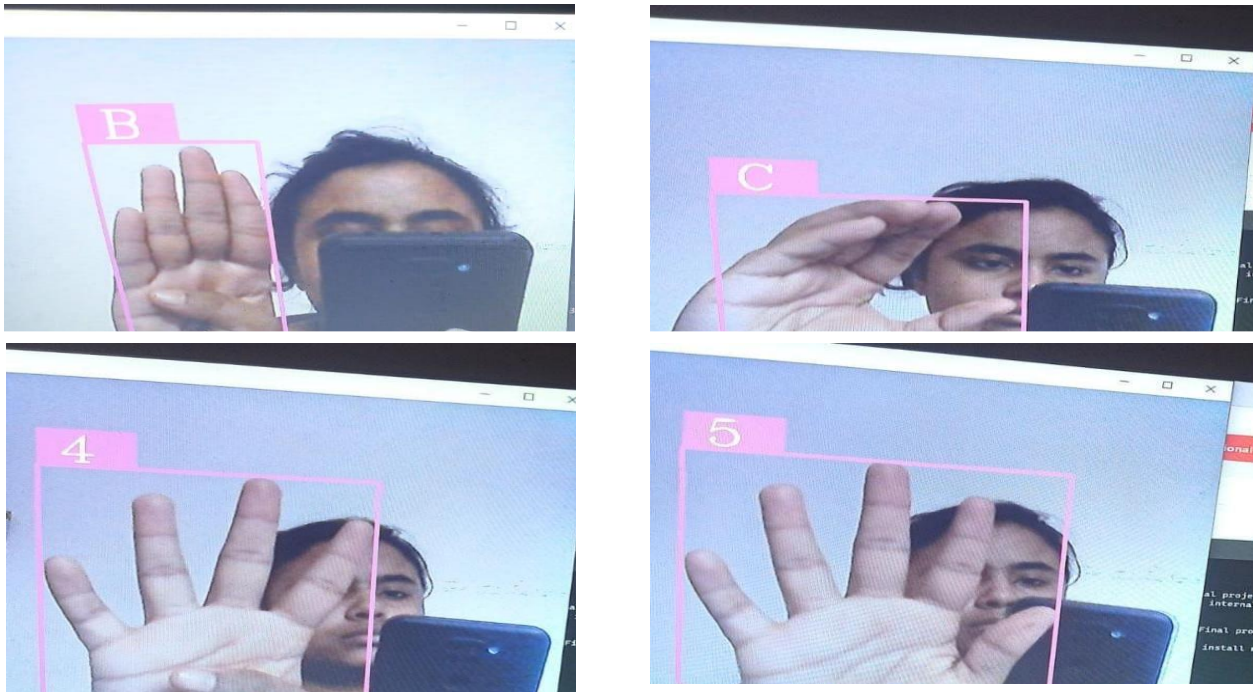


Fig 5: Testing Speech to Gesture

For the gesture to text part, we have created a python program which registers your hand gesture inputs and converts your gestures

into text. In this phase we have tested only small gestures like numbers and hello/hi, because this requires to calculate all the angles and defects of the figures so we have calculated only for such small gestures. After implementation this part is also working as expected to the given real time text output of hand gesture. Both the parts Text to Speech and Speech to text is working as proposed in this paper.



6: Testing Gesture to Text

VI.CONCLUSION AND FUTURE SCOPE

This project was intended to tackle the language challenge about a significant number of India's population communication. The prototype is specially designed for voice impairment and succeeded in showing a solution to bridge the communication gap. The prototype is recognizable to convert 320 words into hand gestures with 100% accuracy. It can also split sentences and display appropriate hand gestures for a set of keywords in the text. In this paper, we have proposed a new method of creating an interface for the communication between a disable person and a normal person. This can eliminate the language barrier between the disable and normal person. This approach is applied considering the real time output in the less time. This approach relies on the network for using the speech engines so internet connectivity is required in this approach, offline speech engines of the python has less accuracy and takes more time for pro-cessing, these engines can be used for the devices which have no connectivity options.

This proposed method can be implemented in multiple devices irrespective of operating system and system configuration some examples are smart watches, phones and kiosk. According to the experimental results it is clear that by implementing this approach the users will not have any problem for using this program. 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. We look forward to expand the project by also including facial expressions into the system.

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