Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 2, No. 1, February : 2023

EFFICIENT AND REAL TIME COMMUNICATION BETWEEN DISABLED AND NORMAL PEOPLE

Sachin Sase, Department of Electronics and Telecommunication, Vidyalankar Institute of Technology, Wadala, Mumbai
Beena Ballal, Department of Electronics and Telecommunication, Vidyalankar Institute of Technology, Wadala, Mumbai

***Abstract*—** Deaf, hard of hearing, and other people with hearing loss utilize sign language, a nonverbal language, to communicate with hearing people. Few people have a working knowledge of sign language. People who are deaf or dumb use sign language as their first language. It is necessary to convert sign language into text or audio and vice versa to provide effective communication between hearing- and speech-impaired individuals and able-bodied individuals. There are several different language translators that have been developed to bridge the gap between them. The suggested system's goal is to translate sign language into audio and audio into sign language for reducing the communication gap between impaired and able-bodied persons and enabling them to communicate effectively with one another. It is a complete two way communication system in which first stage uses CNN to convert an ASL hand gesture into audio, and the second stage uses speech recognition to convert the audio from any language into sign language.

***Keywords*—** *Convolution Neural Network(CNN), American Sign Language(ASL), Indian Sign Language(ISL), Google Text to Speech(gTTS)*

I . INTRODUCTION

We are aware that sign language is the native tongue of the deaf and the dumb. People with disabilities communicate with one another using sign language. It entails the fusion of facial expressions, arm or body motions, and hand motions. People who are deaf or dumb frequently use sign language to communicate, although most people are not familiar with it. This research primarily aims to close this gap and prepare them to function alongside regular people. The major goal is to assist those who have a hearing impairment and are unable to talk. The development of audio to sign language conversion has been far less common than that of sign language to text conversion. This project includes of audio and sign language translation. This project combines a Python-based language translator with sign language to audio and audio to sign language conversion. It identifies sign language gestures when converting sign language to audio. To create the data set, the hand gestures are captured using webcam and pre-processed. Convolution neural network is used to train and test the model, which then makes predictions based on the data set[1]. The identified hand gesture is translated into the appropriate text and audio output.

II. LITERATURE SURVEY

In the paper “Sign Language to Text and Speech Translation in Real Time Using Convolutional Neural Network” by P. Ayush, A. Ojha[1], have built an application for desktop computer which captures a hand gesture in American sign language and convert those signs into text as well as speech.

In the paper “Audio to Sign Language Translation for Deaf People” by H. Ankita, N. Sarika[2], have created system for the deaf people through which they communicate. This system is used for audio to sign language conversion. This system receives input audio and translates into text and then shows appropriate ISL images.

In the paper “Sign Language Translation” by Harini R, Venkatasubramanian[3], have developed computer vision based system which take users sign and instantly translate it into text. This is done

in real time. Using the OpenCV library in python, sign gestures are recorded and processed. To achieve high accuracy prediction, the captured motion is scaled, turned to a greyscale image, and the noise is filtered. Convolution neural networks are used for classification and prediction.

In the paper "Sign Language to Text and Vice Versa Recognition using Computer Vision in Marathi" by S. Amitkumar and K. Ramesh[4], have suggested approach to identify discrete words from the common Marathi sign language that are captured using a camera and they have utilised a vast collection of samples. Taking into account all the alphabets and words used in sign language, the database has 1000 unique gesture images. The suggested approach aims to translate several very fundamental sign language components from sign to text and vice versa.

In the paper "Study of Sign Language Translation using Gesture Recognition" by P. Neha, R. Shrushti, S. Shruti and S. Vrushali[5], hand gesture is captured using webcam and recognized using contour recognition method. The recognized hand gesture is converted into audio output.

In the paper "Indian Sign Language Translator Using Gesture Recognition Algorithm" by B. Purva and K. Vaishali [6], A technique for translating motions made in ISL into English is suggested. Data capture is the first step in the algorithm, followed by pre-processing to track hand movement using a combinational algorithm and recognition using template matching.

In the paper "Sign Language to Speech Translation" by S. Aishwarya, P. Dr. Siba and V. Prof. Saurav[7], suggests combining the usage of Text-to-Speech translator with the use of convolutional neural networks (CNN). The proposed application can recognise the gestures and translate them from text to speech by employing the CNN algorithm.

In the paper "Real Time Sign Language Interpreter" by N. Geethu and S. Arun[8], Utilizing the convex hull method and the template matching algorithm, the system for sign language recognition for deaf and dumb persons is implemented in the ARM CORTEX A8 processor board. The image was captured using a webcam. To achieve communication between hearing and deaf people as well as normal people, this hand sign has been turned to text.

In the paper "Research of a Sign Language Translation System Based on Deep Learning" by H. Siming[9], On the basis of a neural network, common sign language recognition and hand location are examined. According to experimental findings, this method outperforms other well-known ones in terms of recognition rate in a data set which is up to 99%.

In the paper "IoT based Assistive device for deaf, dumb and blind people" by A. Karmel, S. Anushka, P. Muktak and G. Diksha [10], A simple, quick, accurate, and cost-efficient single device solution is developed. The major goal of the technology is to provide persons with disabilities a sense of independence and confidence by seeing, hearing, and speaking for them. Through this study, a new prototype for helping the blind, deaf, and hard of hearing has been developed.

In the paper "Audio to Sign Language Translator Using Python" by J.Sathya Priya, E.Ghanishka, V.Kamal Raj, Mohana Priya, Mrs.B.Sivaranjani[11], Using the speech-to-text API, audio signals are converted to text. Small, medium, and large vocabulary conversions are all included in speech to text conversion. These systems handle or take voice input, which is then converted to the appropriate text.

In the paper " Sign Language Translation Systems for Hearing/Speech Impaired People: A Review" by G. Yuvraj, A. Riya, S. Deepak and G. Prashant[12], has talked about a number of sign language interpreters and recognition methods to overcome the communication gap between able-bodied and impaired individuals.

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 2, No. 1, February : 2023

III. METHODOLOGY

A. Communication between dumb person and normal person

The hand gestures made by dumb individuals in sign language are translated into audio for effective communication with the normal people.

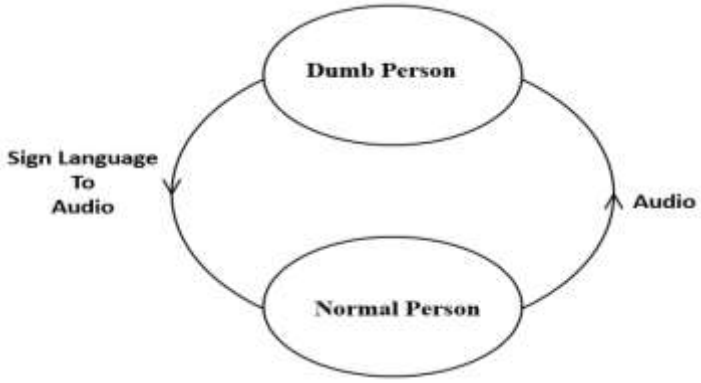


Fig. 1. Communication between dumb person and normal person

B. Communication between deaf person and normal person

The audio from normal people is translated into corresponding hand gesture.

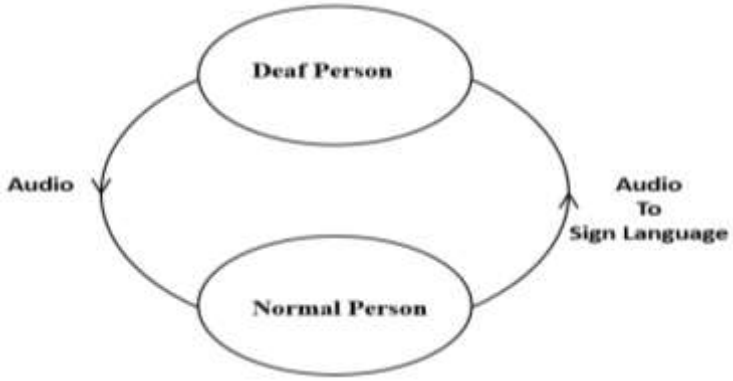
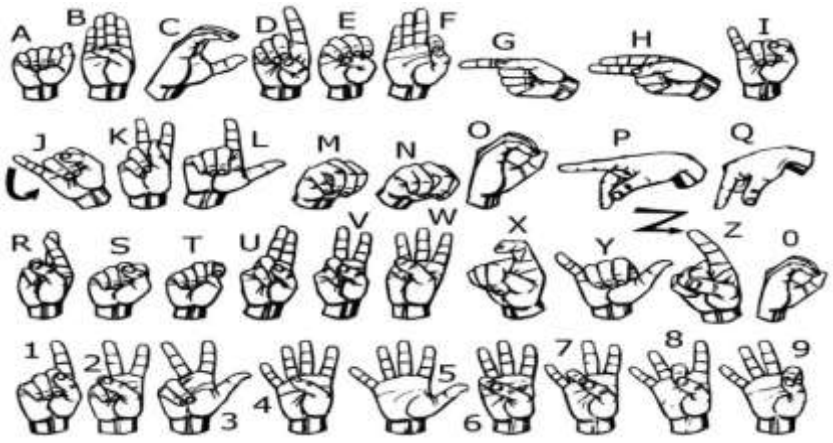


Fig. 2. Communication between deaf person and normal person

IV. SYSTEM DESIGN

A. Sign Language to Audio Conversion

There are 135 styles of sign languages across the globe. A few of them are American sign language, Indian , British, Australian etc[2]. ASL may be a complete linguistic communication that has the identical linguistic properties as spoken languages, with grammar that differs from English. ASL includes movement of the hands and face. In this project American sign language is employed.



Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 2, No. 1, February : 2023

Fig. 3. American Sign Language

1) Work flow for Sign Language to Audio Conversion

Different steps involved in sign language to audio conversion are shown below.

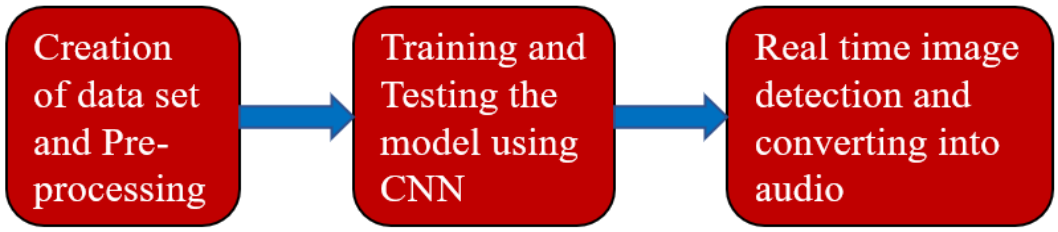


Fig. 4. Steps for Sign Language to Audio Conversion

a) Creation of data set and Pre-processing

Available data set consists of 1200 images for each alphabet and digit each of 50x50 pixels. Each image is converted into grayscale and flipped. To create own dataset thousands of images of each category need to be capture. Captured images are converted into desirable size and pre-processed by applying different filters.

Fig. 5. Image pre-processing

b) Training and Testing the model using CNN

The pre-processed image dataset is created and to get feature map from image , Convolution Neural Network is used. It is also used for image recognition and processing. It is used as image classifier where image is passed through different layers to predict the output.

i. Convolution layer:

This performs convolution operation on image in order to extract some important features. This layer takes the input and apply some filters in order to extract features. Convolution layer performs multiplication of image matrix and filter matrix also called as kernel matrix. The output produced after convolution is dot product of image matrix and kernel matrix.

ii. Pooling layer:

An image which is generated after convolution is not in proper size. It needs to be converted into suitable size without compromising with its features. There are three types of pooling. The maximum value from the specific region is chosen for the Max pooling layer, and the minimum value from the specific region is chosen for the Min pooling layer. Average value is used in average pooling.

iii. Flattening layer:

To feed the classifier, this layer converts a multidimensional matrix into a 1-dimensional array[3].

iv. Activation Function:

It gives a model nonlinearity. Any negative values present in the feature map created after the convolution layer are replaced with zero. There are various activation mechanisms, including sigmoid, tanh, ReLu, and others. The ReLu function is used in this project. It is the activation function that is most frequently utilised. Any negative input is treated as 0, otherwise it is treated as 1. ReLu's

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 2, No. 1, February : 2023

precision is great as a result, and computation is simple[3].

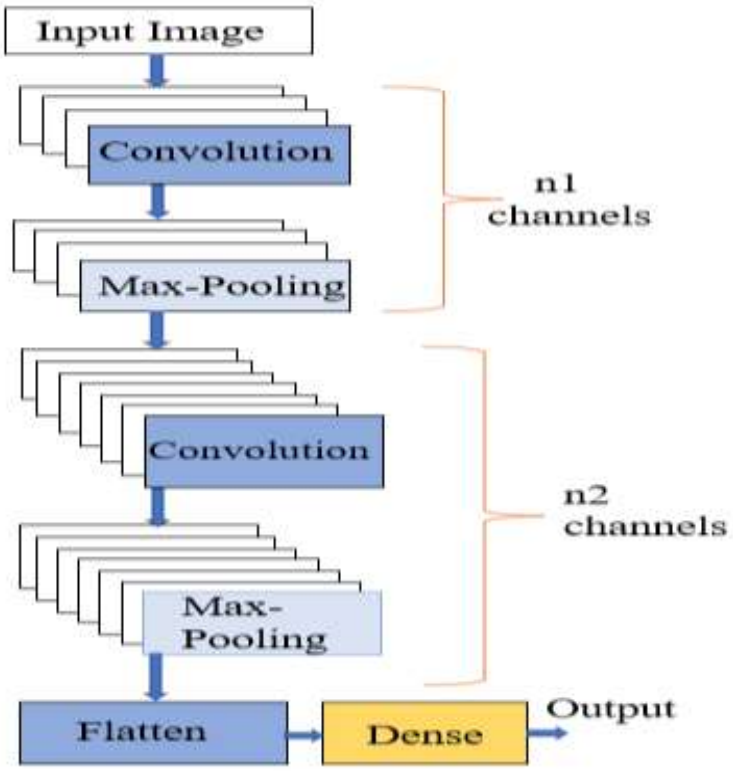


Fig. 6. Convolutional neural network

B. Audio to Sign Language Conversion

In this method audio message is converted into sign language. It takes speech from user and converts into text . This text is then converted into respective American sign language images which are predefined[2].

1) Work flow for Audio to Sign Language Conversion

Speech recognition is a python package used to identify spoken words and coverts them into text. Speech recognition package offers easy audio processing and microphone accessibility. It takes speech as input from microphone, converts it into text and then displays the American Sign Language images.

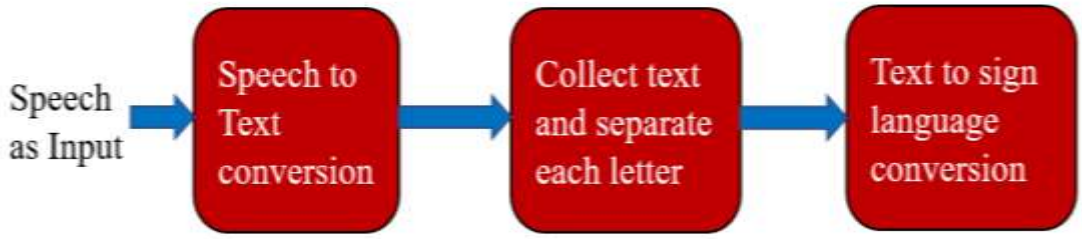


Fig. 7. Steps for Audio to Sign Language Conversion

a) Audio to Text Conversion

It uses the microphone as source for input. A speech is taken as an input from microphone. Then wait for a second to let the recognizer adjust the energy threshold based on the surrounding noise level. Listen method is used to listen for the users input. It employs google recognize method to recognize audio and convert into text which is same as spoken language. Using google translator any language text can be converted into English for further processing.

b) Text to Sign Language

It collects text and separate each letter. The separated letter is checked with predefined database which

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 2, No. 1, February : 2023

consists of images of all the alphabets. Then based on dictionary, corresponding to each letter sign language image will be displayed.

V. RESULTS

In Sign language to audio conversion, Shown hand gesture is recognized and converted into respective text and audio.

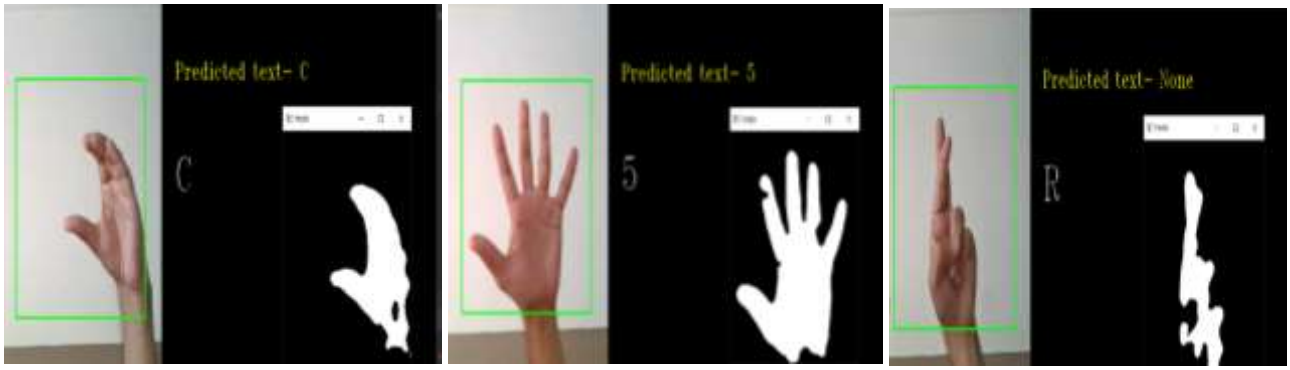


Fig. 8. Sign language to audio conversion results

In Audio to sign language conversion, Audio input is converted into text and with respect to each letter, respective hand gesture is generated.

Fig. 9. Audio to sign language conversion results

VI. CONCLUSION

The disabled people can communicate with normal people using sign language. The proposed system is complete two-way American sign language system which translates hand gesture to audio using CNN and audio to sign language using speech recognition. The system provides an interface that can easily communicate with deaf and dumb people in real time. This system helps all the hearing/speech impaired people in general. This system can translate sign language into audio and vice versa. It provides efficient and real time communication between disabled and normal people using CNN with transfer learning. This project would help them to convey their thoughts in a better and efficient

manner.

VII. REFERENCES

[1] P. Ayush, A. Ojha, Shubham and A. Thakur, "Sign Language to Text and Speech Translation in Real Time Using Convolution Neural Network" in *International Journal of Engineering Research & Technology*, 2020.

[2] H. Ankita, N. Sarika, P. Shefali and A. M, "Audio to Sign Language Translation for Deaf People" *International Journal of Engineering and Innovative Technology (IJEIT)*, vol. 9, no. 10, 2020.

[3] R. Harini, R. Janani, S. Keerthana, S. Madhubala and S. Venkatasubramanian, "Sign Language Translation" in *6th International Conference on Advanced Computing & Communication System(ICACCS)*, 2020.

[4] S. Amitkumar and K. Ramesh, "Sign language to text and vice versa recognition using computer vision in Marathi" in *International Journal of Computer Applications (0975 – 8887) National Conference on Advances in Computing (NCAC 2015)*, 2015.

[5] P. Neha, R. Shrushti, S. Shruti and S. Vrushali, "Study of sign language translation using gesture recognition" *International Journal of Advanced Research in Computer and Communication Engineering* , vol. 4, no. 2, 2015.

[6] B. Purva and K. Vaishali, "Indian Sign Language Translator using Gesture recognition algorithm" in *2015 IEEE International Conference on Computer Graphics, Vision and Information Security (CGVIS)* , 2015.

[7] S. Aishwarya, P. Dr. Siba and V. Prof. Saurav, "Sign Language to Speech Translation" in *11th ICCCNT*, Kharagpur, 2020.

[8] N. Geethu and S. Arun, "Real Time Sign Language Interpreter," in 2017 International Conference on Electrical, Instrumentation and Communication Engineering (ICEICE2017) , 2017.

[9] H. Siming, "Research of a Sign Language Translation System Based on Deep Learning," in *International Conference on Artificial Intelligence and Advanced Manufacturing (AIAM)* , 2019.

[10] A. Karmel, S. Anushka, P. Muktak and G. Diksha, "IoT based Assistive device for deaf,dumb and blind people," in *INTERNATIONAL CONFERENCE ON RECENT TRENDS IN ADVANCED COMPUTING, ICRTAC* , 2019.

[11] J.Sathya Priya, E.Ghanishka, V.Kamal Raj, Mohana Priya, Mrs.B.Sivaranjani “Audio to Sign Language Translator Using Python” International Journal of Scientific Engineering and Applied Science (IJSEAS) – Volume-6, Issue-6, June 2020 ISSN: 2395-3470.

[12] G. Yuvraj, A. Riya, S. Deepak and G. Prashant, "Sign Language Translation Systems for Hearing/Speech Impaired People," in *International conference on innovative practices in technology and management(ICIPTM*, 2021.