IJETIR

ISSN (Online) 2583-0554

International Journal of Emerging Technologies and Innovative Research (IJETIR)

Volume 4, Issue 6, June 2024

Impact Factor: 5.731

Sign Tone: A Deep Learning-Based Deaf Companion System for Two Way Communication Between Deaf and Non-Deaf Individuals

Harish Dr[1] and Dr. C. Meenakshi[2]

MCA Student, Department of Computer Applications[1]

Associate Professor, Department of Computer Applications[2]

Vels Institute of Science, Technology & Advanced Studies (VISTAS), Chennai, Tamil Nadu, India

22304215@vistas.ac.in and poonguzhali.research@gmail.com

Abstract: *Communication is essential to express and receive information, knowledge, ideas, and views among people, but it has been quite a while to be an obstruction for people with hearing and mute disabilities. Sign language is one method of communicating with deaf people. Though there is sign language to communicate with non-sign people it is difficult for everyone to interpret and understand. The performance of existing sign language recognition approaches is typically limited. Developing an assistive device that will translate the sign language to a readable format will help the deaf-mutes to communicate with ease to the common people. Recent advancements in the development of deep learning, deep neural networks, especially Temporal convolutional networks (TCNs) have provided solutions to the communication of deaf and mute individuals. In this project, the main objective is to design Deaf Companion System for that to develop SignNet Model to provide two-way communication of deaf individuals and to implement an automatic speaking system for deaf and mute people. It provides two-way communication for all classes of people (deaf-and-mute, hard of hearing, visually impaired, and non-signers) and can be scaled commercially. The proposed system, consists of three modules; the sign recognition module (SRM) that recognizes the signs of a deaf individual using TCN, the speech recognition using Hidden Marko Model and synthesis module (SRSM) that processes the speech of a non-deaf individual and converts it to text, and an Avatar module (AM) to generate and perform the corresponding sign of the non-deaf speech, which were integrated into the sign translation companion system called deaf companion system to facilitate the communication from the deaf to the hearing and vice versa. The proposed model is trained on Indian Sign Language. Then developed a web-based user interface to deploy SignNet Model for ease of use. Experimental results on MNIST sign language recognition datasets validate the superiority of the proposed framework. The TCN model gives an accuracy of 98.5%..*

Keywords: Temporal convolutional networks (TCNs), The sign recognition module (SRM), Avatar module (AM), SignNet Model

I. INTRODUCTION

Sign language is manual communication commonly used by people who are deaf. Sign language is not universal; people who are deaf from different countries speak different sign languages. The gestures or symbols in sign language are organized in a linguistic way. Each individual gesture is called a sign. Each sign has three distinct parts: the handshape, the position of the hands, and the movement of the hands. American Sign Language (ASL) is the most commonly used sign language in the India. A sign language (also signed language) is a language which uses manual communication, body language, and lip patterns instead of sound to convey meaning—simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to fluidly express a speaker's thoughts. Signs often represent complete ideas, not only words. However, in addition to accepted gestures,

IJETIR
ISSN (Online) 2583-0554
International Journal of Emerging Technologies and Innovative Research (IJETIR)
Volume 4, Issue 6, June 2024
Impact Factor: 5.731

mime, •and hand signs, sign language often includes finger spelling, which involves the use of hand positions to represent the letters of the alphabet.

II. LITERATURE SURVEY

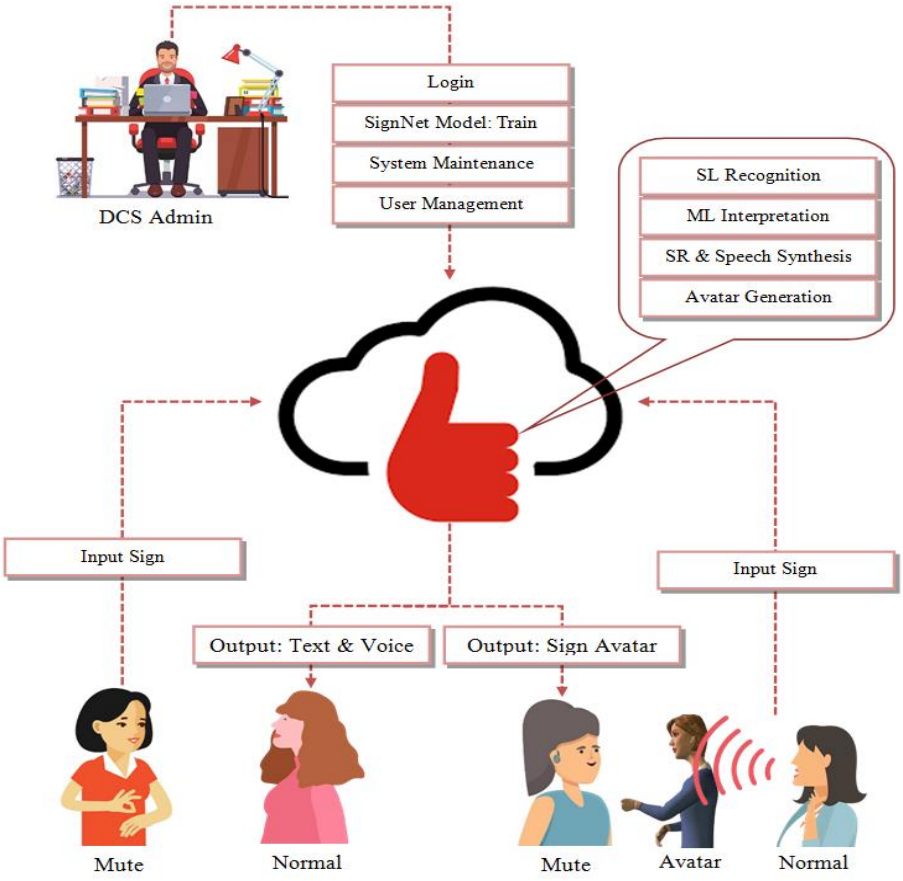
• The literature survey for "Sign Tone: A Deep Learning-Based Deaf Companion System for Two-Way Communication between Deaf and Non-Deaf Individuals" delves into a multifaceted exploration of existing research and advancements in several key domains.

• It encompasses an examination of cutting-edge developments in deep learning algorithms, particularly those pertinent to natural language processing (NLP) and computer vision, which are foundational for understanding spoken language and interpreting sign language gestures.

• Additionally, the survey scrutinizes previous studies on sign language recognition systems, encompassing hand gesture recognition, facial expression analysis, and body movement tracking, alongside investigations into speech recognition methodologies and speech synthesis techniques.

• Moreover, the survey extends to encompass research in human-computer interaction (HCI), focusing on accessibility and inclusivity for individuals with disabilities, as well as user studies and evaluations of existing communication aids for the deaf, aimed at identifying common challenges and limitations. Ethical considerations surrounding the development and deployment of such technologies are also explored, alongside discussions on future directions and challenges, outlining a comprehensive roadmap for advancing communication accessibility for the deaf community.

III. SYSTEM ARCHITECTURE



IJETIR
ISSN (Online) 2583-0554
International Journal of Emerging Technologies and Innovative Research (IJETIR)
Volume 4, Issue 6, June 2024
Impact Factor: 5.731

3.1 OBJECTIVES

The objectives of the literature survey for "Sign Tone: A Deep Learning-Based Deaf Companion System for Two-Way Communication between Deaf and Non-Deaf Individuals" are multifaceted and comprehensive. Firstly, it aims to meticulously review the latest advancements in deep learning, computer vision, and natural language processing to identify cutting-edge technologies applicable to the development of the Sign Tone system. Secondly, the survey seeks to conduct a thorough examination of existing research literature on sign language recognition, speech recognition, and human-computer interaction, with the goal of understanding methodologies, challenges, and user preferences pertinent to the system's design. Furthermore, it endeavors to assess the ethical implications and social ramifications concerning the autonomy and inclusivity of the deaf community.

- **Dataset:** This module facilitates the acquisition and loading of the dataset required for training the SignNet Model. The dataset typically consists of images or videos containing sign language gestures. Here's a brief.
- **Data Validation:** Conducts validation checks to ensure the integrity and quality of the dataset. This involves verifying the correctness of data formats, labels, and metadata associated with each sample.
- **Data Loading:** Implements mechanisms to load the collected dataset into the system. This may involve parsing image, extracting relevant information, and organizing the data in a suitable format. Description of the functionalities of the Import Dataset Module
- **Data Visualization:** This module is responsible for visualizing the dataset to gain insights into its structure, characteristics, and distribution. Displays a sample of images from the dataset to provide an overview of the sign language gestures. This allows users to visually inspect the quality and content of the images.
- **Preprocessing:** The Preprocessing Module is tasked with preparing the dataset for subsequent stages of training and model development by applying various preprocessing techniques. Below is a detailed description of the module's functionalities along with relevant formulas where applicable

IV. EXPERIMENTAL RESULTS

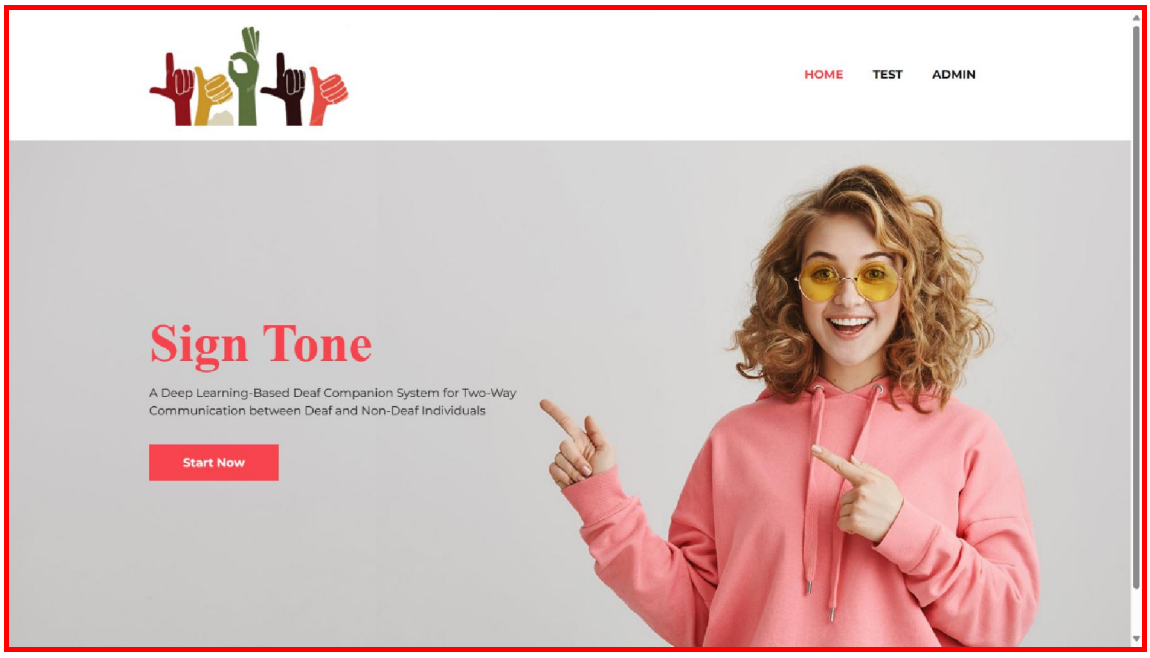


Fig.1 Home page

IJETIR

ISSN (Online) 2583-0554

International Journal of Emerging Technologies and Innovative Research (IJETIR)

Volume 4, Issue 6, June 2024

Impact Factor: 5.731

Fig.2 Admin login

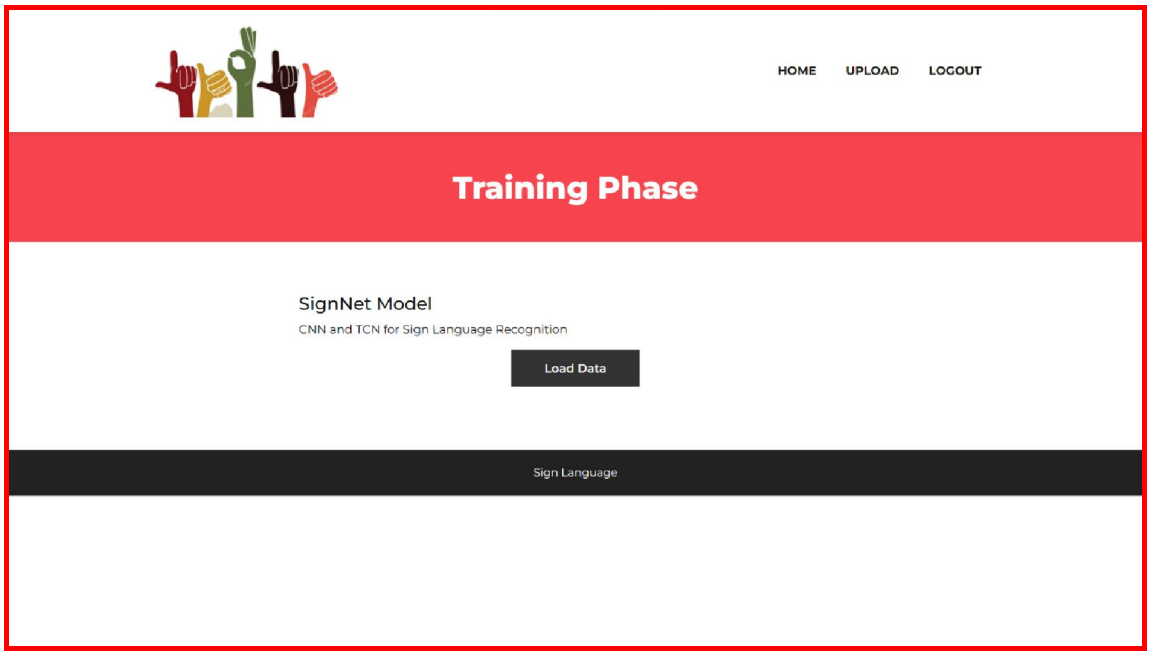


Fig.3 Training phase

IJETIR
ISSN (Online) 2583-0554
International Journal of Emerging Technologies and Innovative Research (IJETIR)
Volume 4, Issue 6, June 2024
Impact Factor: 5.731

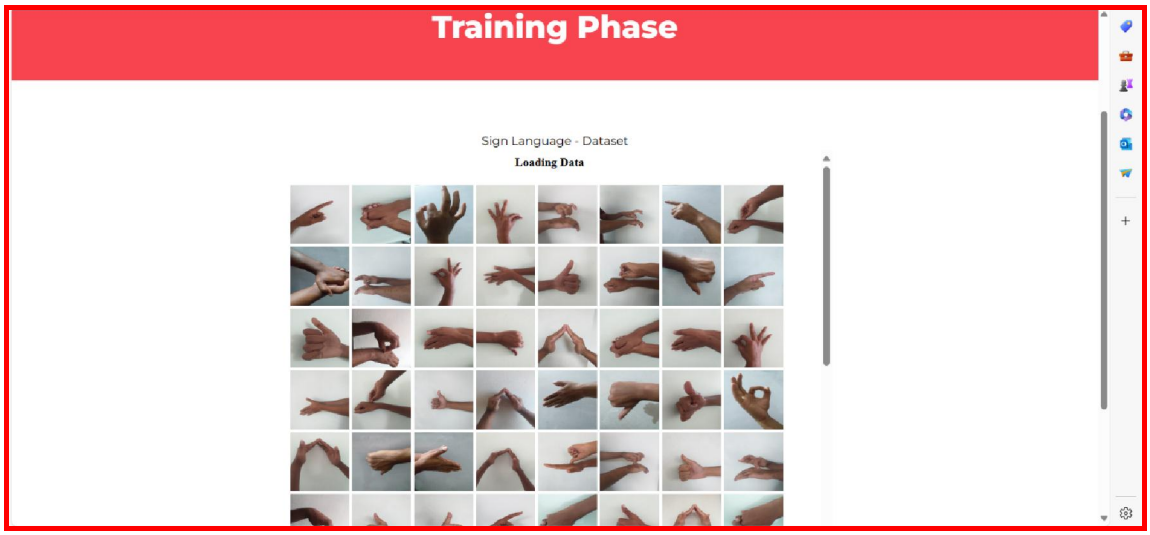


Fig.3.1 Training phase

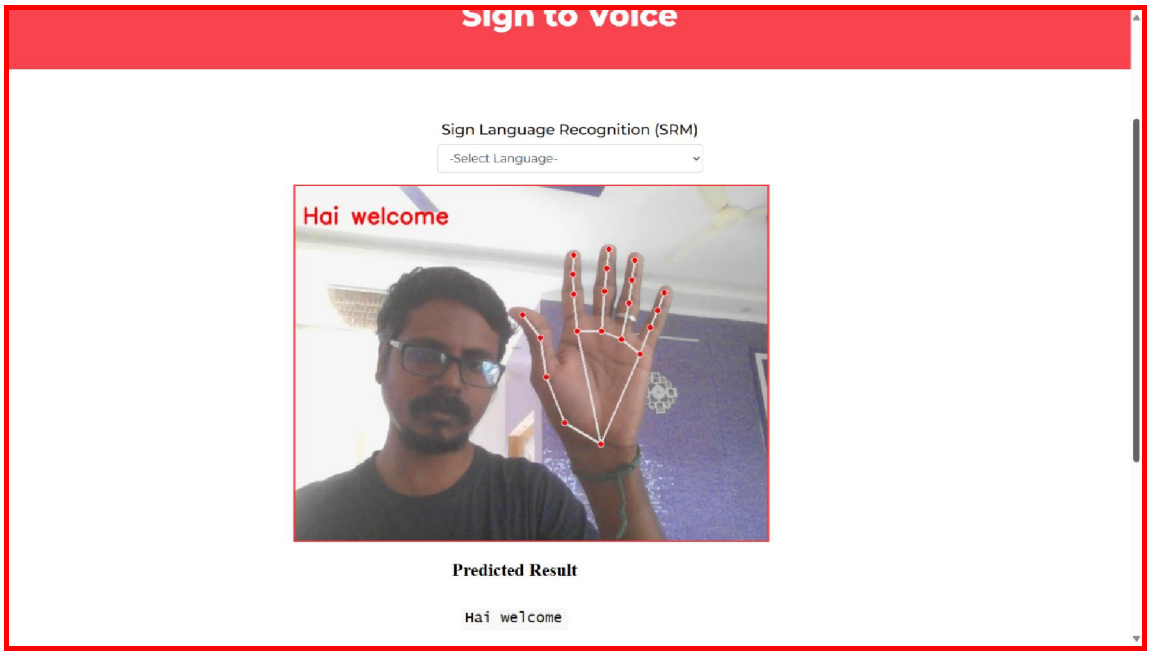


Fig.4 Sign to voice

V. PROPOSED SYSTEM

The proposed system for the project, titled "Deaf Companion System," is designed to revolutionize communication for individuals with hearing and mute disabilities. Key components and features of the system include:

Deaf Companion System

Introduction of an innovative system addressing communication challenges faced by individuals with hearing and mute disabilities.

IJETIR
ISSN (Online) 2583-0554
International Journal of Emerging Technologies and Innovative Research (IJETIR)
Volume 4, Issue 6, June 2024
Impact Factor: 5.731

SignNet Model Architecture
Development of the SignNet Model, combining Convolutional Neural Networks (CNN) and Temporal Convolutional Networks (TCN) for robust sign language recognition.

Two-Way Communication
Implementation of a comprehensive two-way communication system, fostering seamless interaction between deaf individuals and the broader community.

Sign Language Recognition Module (SRM)
Integration of the SRM, utilizing the SignNet Model to accurately interpret sign language gestures in real-time, ensuring contextual understanding.

Speech Recognition and Synthesis Module (SRSM)
Incorporation of an SRSM employing Hidden Markov Models to convert non-deaf speech into text, facilitating comprehensive communication.

Avatar Module (AM)
Creation of an AM to generate realistic sign language avatars synchronized with non-deaf speech, enhancing visual communication.

Cultural Sensitivity and Inclusivity
Emphasis on cultural sensitivity by training the system on the Indian Sign Language, ensuring inclusivity for diverse communication needs.

VI. CONCLUSION

In conclusion, the Deaf Companion System represents a significant milestone in the realm of assistive technology, providing a comprehensive solution to facilitate communication for individuals with hearing and mute disabilities. Through the integration of advanced technologies such as Temporal Convolutional Networks (TCNs), Hidden Markov Models (HMMs), and Convolutional Neural Networks (CNNs), the system enables real-time interpretation of sign language gestures and conversion of spoken language into text, fostering seamless communication between deaf and non-deaf individuals. The project's success lies in its robust performance, user-centric design, and adaptability to diverse linguistic preferences. By offering multilingual interpretation and customizable avatar generation, the system caters to the diverse needs of its users, promoting inclusivity and accessibility in communication. Looking ahead, the project opens avenues for further research and development in the field of assistive technology. Future enhancements could focus on expanding language support, improving accuracy and efficiency, and integrating additional features to enhance user experience. Overall, the Deaf Companion System stands as a testament to the transformative potential of technology in empowering individuals with disabilities, bridging communication barriers, and fostering a more inclusive society.

REFERENCES

[1]. T. Reddy Gadekallu, G. Srivastava, and M. Liyanage, “Hand gesture recognition based on a Harris hawks optimized convolution neural network,” Computers & Electrical Engineering, vol. 100, Article ID 107836, 2022.

[2]. G. T. R. ChiranjiLalChowdhary and B. D. Parameshachari, Computer Vision and Recognition Systems: Research Innovations and Trends, CRC Press, 2022.

[3]. M.M. Riaz and Z. Zhang, "Surface EMG Real-Time Chinese Language Recognition Using Artificial Neural Networks" in Intelligent Life System Modelling Image Processing and Analysis Communications in Computer and Information Science, Springer, vol. 1467, 2021.

[4]. G. Halvardsson, J. Peterson, C. Soto-Valero and B. Baudry, "Interpretation of Swedish sign language using convolutional neural networks and transfer learning", SN Computer Science, vol. 2, no. 3, pp. 1-15, 2021.

[5]. P. Likhar, N. K. Bhagat and R. G N, "Deep Learning Methods for Indian Sign Language Recognition", 2020 IEEE 10th International Conference on Consumer Electronics (ICCE-Berlin), pp. 1-6, 2020.

[6]. F. Li, K. Shirahama, M. A. Nisar, X. Huang and M. Grzegorzek, "Deep Transfer Learning for Time Series Data Based on Sensor Modality Classification", Sensors, vol. 31, no. 20(15), pp. 4271, Jul 2020.

[7]. J. J. Bird, A. Ekárt and D. R. Faria, "British sign language recognition via late fusion of computer vision and leap motion with transfer learning to american sign language", Sensors, vol. 20, no. 18, pp. 5151, 2020.

[8]. S. Sharma, R. Gupta and A. Kumar, "Trbaggboost: an ensemble-based transfer learning method applied to Indian Sign Language recognition", J Ambient Intell Human Comput Online First, 2020, [online] Available: https://doi.org/10.1007/s12652-020-01979-z.

[9]. M. Oudah, A. Al-Naji and J. Chahl, "Hand Gesture Recognition Based on Computer Vision: A Review of Techniques", J. Imaging, vol. 6, no. 73, 2020.

[10]. Z. M. Shakeel, S. So, P. Lingga and J. P. Jeong, "MAST: Myo Armband Sign-Language Translator for Human Hand Activity Classification", IEEE International Conference on Information and Communication Technology Convergence, pp. 494-499, 2020.