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Signcall: Bridging Communication Gaps In Virtual Meetins With Sign Language Recognition

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Abstract It is important to communicate effectively if you want to exchange information, ideas and emotions. Even so, platforms like Zoom, Microsoft Teams and Google Meet are rarely accessible to those who are hard of hearing or have speech problems, keeping them from fully participating. Sign language provides a way for deaf persons to talk, but non-signers find it hard to interpret. Today's sign language recognition systems are not accurate enough and are still difficult to access, so they cannot be easily integrated into virtual platforms. The project introduces a system that uses AI to improve how deaf and hearing participants communicate during virtual meetings. This system uses techniques from TCNs, an advanced form of deep learning which allows it to send and receive messages without delay as part of the conversation. Three main modules are part of the research: a Sign Recognition Module that interprets signs using TCN, a Speech Recognition and Synthesis Module powered by Hidden Markov Models for text-to-speech conversion and finally, an Avatar Module for turning spoken words into signs. With Avatar Module, non-signers can learn to sign conversationally and interact easily with people who communicate with sign language. Because the system uses Indian Sign Language, it empowers people who are deaf, mute, hard of hearing, visually impaired and even others who do not use signs to communicate. Because it is part of web-based virtual platforms, it is easier for people to participate. It brings us much closer to ensuring that everyone can join and contribute in online meetings.

Keywords: Sign Language Recognition, Virtual Meetings, Accessibility ,Real-time Translation, Human-Computer Interaction ,Assistive Technology, Gesture Recognition, Machine Learning, Deaf Communication, Inclusive Technology, Natural Language Processing, Video Conferencing Accessibility, Sign Language Interpretation, Multimodal Communication, Speech-to-Sign Translation.

INTRODUCTION

A lot of people who are deaf often use sign language to communicate. There are many sign languages since people who are deaf all across the globe use their own languages. Sign language gestures are handled and organized just like any other language. All movements of the hands, gestures or facial expressions are called signs. In every sign, there's the handshape, the way the hands are placed and how the hands move. American Sign Language (ASL) is the language most often used in India. A sign can mean a whole idea, even if it is not just a single word. As well as accepted gestures, mime and hand signs, sign language includes the use of hand positions to spell out letters from the alphabet. Groups of people with unintelligible spoken languages have formed sign languages when they found a way to

communicate through sign. People who are deaf or hard of hearing, their friends and families and interpreters usually come together to form deaf communities, where sign languages can emerge.

PROPOSED SYSTEM

The new system uses artificial intelligence to help people with hearing or speech problems better connect through sign language. With deep learning and natural language processing, the system supports conversations between sign language users and those who speak. Consequently, virtual meetings, classes and workplaces are open to every participant.

1.Sign Recognition Module

The SRM uses TCNs to recognize sign language gestures seen on live videos. The module uses information about movements, facial expressions and body position to make sure signs are recognized properly. Thanks to TCNs, the system becomes highly reliable and responsive, creating effective virtual communications for people who sign.

SRSM stands for Speech Recognition and Synthesis Module.

The SRSM enables users to speak and have their words written or to read the text and have spoken audio generated. In this module, Hidden Markov Models (HMMs) allow speech signals to be processed, turned into text and synthesized out loud when required. With this, speech-based users can interact with sign language users who cannot hear or speak.

2.**The Avatar Module is abbreviated as AM**

The Avatar Module helps people who are hard of hearing by converting spoken language into sign language in real time, using an animated figure. This module allows deaf users to receive content in sign language through an easily understood interface. Because the avatar shows human sign language, anyone can follow and talk with you in translation.

2.1Working together with Virtual Platforms

The system was developed to easily connect with well-known online meeting services such as Zoom, Microsoft Teams and Google Meet. Thanks to this integration, interaction and participation of deaf people in all gatherings is free from speech concerns. As soon as you speak, the system interprets your message and allows sign language users to participate in any setting.

EXISTING SYSTEM

Zoom, Microsoft Teams and Google Meet, as well as many other virtual meeting tools, lack effective real-time sign language interpretation. This, however, makes it hard for those with hearing impairment to engage fully in online meetings, talks and conferences. Without documented sign language support from companies, AI solutions are needed.

1.Equipment Made for Daily Living

Many people who have hearing loss benefit from hearing aids and cochlear implants, basic types of assistive device created for improving hearing. Unfortunately, these devices do not help with the communication problems people who use sign language face, so they remain incomplete for true inclusivity.

1.Tools That Work Manually

Most people with hearing and speech impairments use pen and paper to communicate. The method is useful for straightforward chats, but it does not work well or quickly for action-filled situations in digital or work environments.

1.1Sign Language Interpreting

All over the world, human sign language interpreters connect deaf and hearing people wherever they must communicate. Yet, being able to find an interpreter can be hard, they may cost a lot and they have to be arranged ahead of time, so they do not always work well for everyday situations.

SVMs are one way to recognize sign language.

- People have used SVMs a lot because of their effectiveness in classification in sign language recognition. They efficiently manage feature vectors that come from images of sign language gestures. Even so, their efficiency is reduced when facing huge datasets and streams of continuous signals.
- By utilizing Ensemble methods, we can expect more accurate results.
- Using Random Forests or Gradient Boosting as ensemble methods, we can improve the performance and dependability of sign language recognition models. These techniques help you produce better results but they need a lot of computer power to work well.
- Gesture Recognition using Examples of Pose (GRBP)
- GRBP is a method that finds the spatial organization of body joint positions required for recognizing sign language. The approach improves how accurately it recognizes dynamic gestures by using pose features from skeletal data. Using skeletal data is a major obstacle for its use in conventional video sign language recognition systems.

MODULES

1. Sign Meet Web App

The Sign Meet Web App is built to give a new way for deaf or mute individuals to take part in video conferences and webinars. The module for secure access is User Authentication and the Dashboard acts as the main area for smooth navigation. Users can use gestures on the Sign Language Recognition panel for instant interpretation which can be supported by the Speech-to-Text interface for detailed communication. You can match the game to your tastes with Avatar Customization and changes in language, culture and accessibility support better adjustment With the Admin Dashboard, you have tools for teaching the model, keeping an eye on the system and managing it. As a result, people with hearing and mute problems find it easy to use the website.

2. End User Interface

The End User Module specifies the different roles in the Sign Meet Web App to make sure all users have appropriate functions for their jobs. The platform depends on the actions of Admin, Deaf Users and Non-Deaf Users.

3. Sign Net Model: Build and Train

The Sign Meet Web App is built around the Sign Net Model, the main AI sign language recognition system. The model can recognize hand gestures on the spot, process incoming video, highlight significant details and categorize hand motions using sign language classes. The accuracy of interpreting sign language comes from training the system with innovative deep learning methods. The model is built by completing preprocessing, extracting features, classifying sounds and deploying them, to ensure deaf and non-deaf users can interact normally.

4. Sign Language Recognition

The Web App's Sign Language Recognition is important because it makes talking easy between deaf and hearing people. The goal of this module is to take live video, spot sign language moves and instantly show the text or say the meaning over a microphone. Sign language recognition is made very accurate using the combination of TCN and the trained Sign Net Model. Making sure gestures are detected, dealt with and sorted out, the system allows everyone to interact easily and smoothly in virtual meetings.

5. Multilanguage Interpretation

With this module, sign language can be I interpreted live into different spoken and written languages, allowing both users and non-users to talk clearly with one another. Thanks to NLP and deep learning, it is able to turn texts recognized from signs into both text and audio content in several languages. The system makes it possible to turn spoken words into sign language using MFCC and HMM speech techniques that, in turn, create text which is then used to translate into sign language and presented by an AI avatar. With context-aware translation, the module guarantees correct and clear interpretations whether languages or sign language are used. It responds to each region's needs and grows better each time users interact with it. In Jitsi Virtual Meet, this module lets users change the language and have text or sign language appear with the meeting. As a result, more people can communicate well and freely online.

6. Speech Recognition

Thanks to this module, interactions between non-deaf and deaf users are helped by converting what is said into text and sign language. As a result, non-deaf users can see questions and answers in a way that is easy for all to view. Also, the speech recognition begins with filtering sound noise out by using the Wavelet Transform. After that, MFCCs are applied to describe important body characteristics of the speech, enhancing the effectiveness of recognition. HMMs are used in the system to turn speech into text, making certain that what is said is interpreted accurately.

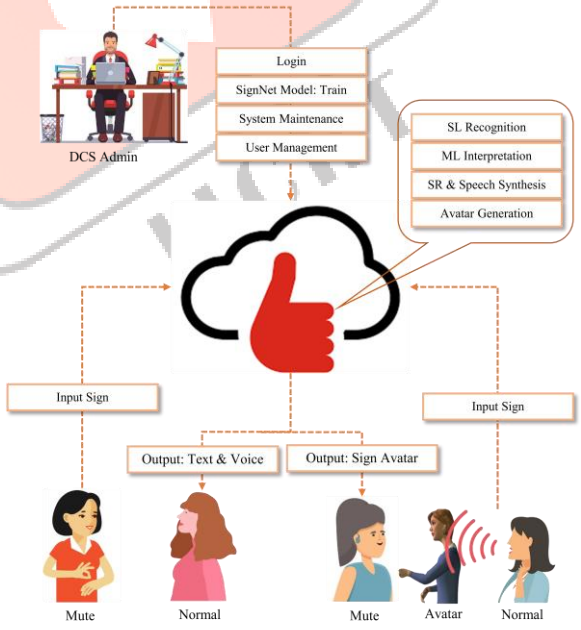
7. Avatar Generation

The Avatar Generation module links deaf and non-deaf users by presenting an animated, real-time interpretation of spoken language. This module helps students interpret what they hear or read by making the audio or text into sign language gestures using an AI-assisted avatar, keeping communication accessible to everyone. Motion synthesis algorithms are used to make each avatar move and speak in real time. Speech recognition models are used by the system to first turn the non-deaf user's speech into text. The gestures used in sign language are then assigned, according to specific language models. An accurate and expressive sign language version is displayed by a 3D animated avatr.

8. Visual Communication

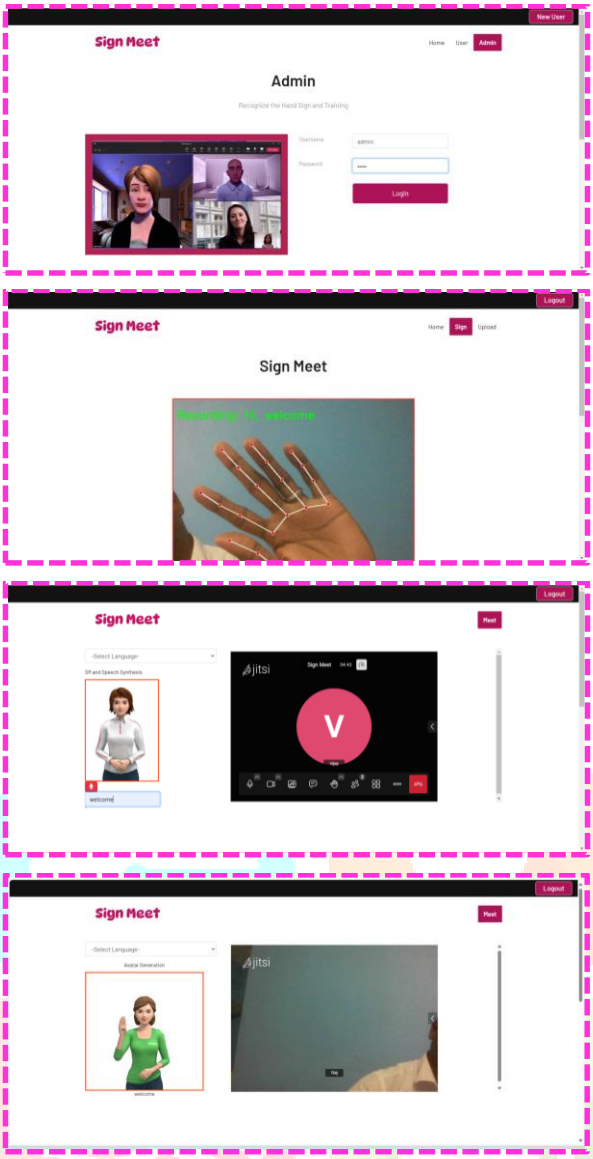
The AI avatar changes the person's words to sign language so that deaf users can follow along with the conversation without delay. Thanks to this model, everyone can participate more easily in virtual events and meetings. Text messages from deaf users can be made to sound like speech which supports easy discussion. Thanks to virtual platform Jitsi, this feature offers a simple and open way for users to communicate.

SYSTEM ARCHITECTURE



RESULT

Several aspects of performance and usability were tested to figure out how well Sign Call helps solve communication issues when people meet online.



CONCLUSION

In short, this work brings deaf and non-deaf users together efficiently using modern Sign Language Recognition, Speech Recognition and Avatar-Based Visual Communication within virtual meetings. The module identifies sign language gestures with TCNs and HMMs and turns regular speech into sign language actions using an animated figure. The module provides effective real-time communication in meetings by using Jitsi virtual platforms. In addition, the capability to show texts and speak them in many languages and individually adapted notifications allow a wider user group to benefit from the platform. The module gives deaf people a scalable and inclusive way to interact virtually. It helps create a platform that encourages everyone to participate and offers improved ways for virtual connections to be made within the deaf community. To improve accessibility, access VIEW sign language software may include new languages, upgrade the way signs are recognized and increase compatibility with different conferencing programs.

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