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AUDIO TO SIGN LANGUAGE CONVERSION USING NATURAL LANGUAGE PROCESSING

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ABSTRACT

Whether it's having a discussion, playing a game, attending a lecture, or taking part in a virtual conference, deaf people will never have the same opportunities that hearing people have. For the most part, average people don't understand sign language or how it works, so making connections is the hardest part of connecting with them. The goal of our initiative is to assist those with hearing loss in creating a means of communication. Signals are generated from the spoken word. It translates spoken language into sign language. This technology takes vocal commands, translates them into text, and then uses symbols that are important in the Indian language—long before GIFs or graphics—to represent them. When those with normal hearing and those with hearing loss utilise this technology, it becomes much simpler for them to communicate. The integration of your limbs, physique, and overall look is considered here. The number of distinct hand signals is really 135 all throughout the cosmos. American Sign Language (ASL), Indian Sign Language (ISL), British Sign Language (BSL), Australian Sign Language (Auslan), and many other sign languages exist. As part of this endeavour, ISL is being used. With the use of modern technology, the deaf community may participate in all the same social and informational pursuits as the hearing population. Natural Language Processing (NLP) is used for text pre-processing. Natural Language Processing (NLP) is used to publish the text, which enables hearing-impaired individuals to take part in a variety of activities, including socialising and gaining access to information. This software can take voice commands, translate them into text, and show Indian sign language. With a validation accuracy of 96% and a planned project work accuracy of 99%, you can't go wrong.

I. INTRODUCTION

For those who are deaf or hard of hearing, sign language is an essential means of communication because it allows them to communicate themselves using non-verbal cues such as hand gestures, facial expressions, and body language. Nevertheless, as sign language is not generally understood, users of sign language have the significant obstacle of interacting seamlessly with others who do not utilise sign language. Because of this language barrier, deaf people have a harder time integrating into society and gaining access to necessary services. Machine learning and

Natural Language Processing (NLP) advancements in the last few years have created new opportunities to close this gap. Audio to Sign Language Conversion is one such application that uses a mix of audio recognition, natural language processing, and gesture modelling to attempt to translate spoken language into sign language. One of the main purposes of audio-to-sign language conversion devices is to let the deaf and the hearing communicate with each other in real-time. By using technologies such as Automatic Speech Recognition (ASR), Natural Language Processing (NLP) for comprehending the context and meaning, and gesture recognition systems for representing signs via video or animation, the system is able to transform spoken language (audio) into a sequence of related signs and gestures. As a result of this integration, the deaf people may have much better access to communication, which would increase their social inclusion and decrease the stigma connected with hearing loss.

II. LITERATURE SURVEY

Using a mix of voice processing, natural language understanding, and computer vision technologies, many experiments have been carried out on systems that can recognise sign languages and translate audio into sign languages. The majority of earlier approaches to sign language identification relied on image-based technologies, such as RGB sensors or camera systems, to detect and record hand gestures and motions. Earlier methods, such Hidden Markov Models (HMMs) for finger-spelling recognition, attempted to decipher sign language by identifying fixed hand positions and then converting them into the appropriate letters or words [1].

To interpret audio-based inputs, more recent systems have included Automatic Speech Recognition (ASR), made possible by developments in deep learning and machine learning. The researchers in [2] used automatic speech recognition (ASR) methods to transcribe spoken words into text, and then they applied Natural Language Processing (NLP) to decipher the language's grammar. A more accurate and contextualised translation was produced by mapping the processed text to suitable movements. The system's gesture recognition component has also been the subject of a substantial amount of research. Successful applications of Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) for the modelling of hand movements and postures have been shown [3]. As an example, convolutional neural network (CNN) models may be used to categorise certain signals by extracting characteristics from video frames that record sign language motions. Some research has looked at the possibility of using multi-modal systems, which combine audio signals with gesture recognition systems, to increase the system's responsiveness, adaptability, and accuracy [4]. The authors of [5] suggested a system that would combine speech-to-text and text-to-gesture translation. To translate text into hand signals, the text-to-gesture translation step employs rule-based algorithms in addition to machine learning models. Additional research, such as that in [6], has shown the possibility of using sensor-based devices to identify hand gestures and motions for sign language translation, which might further improve the experience of involvement in real-time communication. The development of systems that can properly translate voice

characteristics, such as intonation, pauses, and context, as well as systems that can adapt to diverse dialects and languages, continue to be significant problems in the field of audio to sign language conversion. Furthermore, the cultural variety of sign languages and the great unpredictability of spoken language make accurate real-time translation a challenging undertaking.

III.EXISTING SYSTEM

Currently, most systems that can convert audio to sign language rely on gesture detection and Automatic Speech detection (ASR). It is common practice for these systems to transcribe spoken word into text and then assign appropriate sign language motions to that text. Speech-to-text APIs from Google and other ASR systems, as well as open-source models like CMU Sphinx, are used for this purpose. Following the transcription of spoken words, the system is trained to grasp the intended meaning by using Natural Language Processing (NLP) methods to the language's context and structure.

With these technologies, converting text into sign language is the next step. One way this is accomplished is by making use of gesture databases, which include recordings or animations of sign language gestures that correlate to words or phrases. Systems that monitor hand placement, motion, and posture may also be used for gesture recognition. Two popular methods are vision-based models and Convolutional Neural Networks (CNNs), which use video inputs of hands in motion and compare them to a database of known sign language motions.

Some of the current systems use hybrid models that integrate these approaches. System examples include HandTalk, which translates spoken words into hand motions using text-to-sign translation. To further improve the accuracy of hand gesture detection, several systems have additionally included wearable sensors, such as flex sensors in gloves or motion capture systems. Nevertheless, current systems still have a ways to go before they can fully comprehend complex words or conversational speech in context, execute accurately in real-time, or both.

IV.PROPOSED SYSTEM

To facilitate the real-time translation of spoken language into sign language, the suggested system for audio to sign language conversion incorporates state-of-the-art Natural Language Processing (NLP), Automatic Speech detection (ASR), and gesture detection.

V.SYSTEM ARCHITECTURE

The system design is composed of many interconnected modules that collaborate to translate spoken words into hand movements in sign language. The main parts are described below:

1.Audio Input Layer: At the very beginning, the system takes in sound from a recording device or microphone. To make the audio more clear and free of background noise, it is preprocessed.

Second, there's the speech-to-text layer, which takes in audio input and converts it into text using an Automatic Speech Recognition (ASR) module. The audio is transformed into correct text using advanced automatic speech recognition algorithms, such as DeepSpeech or Google's Speech API.

The third layer is the natural language processing (NLP) module, which processes the transcribed text. It is this part's job to decipher

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the language's syntax, semantics, and context. To get useful information out of the text, we'll use methods like named entity recognition, dependency parsing, and part-of-speech tagging.

After the processing of the text is complete, the fourth layer, the Text-to-Sign module, converts it into sign language motions. In order to translate words into sign language, this module will search a database for relevant animations or gestures.

Fifthly, a gesture recognition module may be used to detect and understand hand motions if the user wants to utilise their own. The movements will be recognised by computer vision algorithms like RNNs or CNNs that examine video data in real-time.

The sixth and last layer is the output, which might be a live video feed of the relevant movements or an animated depiction in sign language. This data may be sent to a wearable device or shown on a screen.

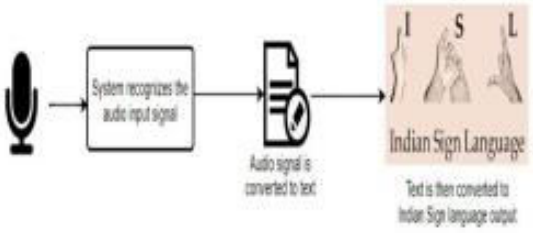
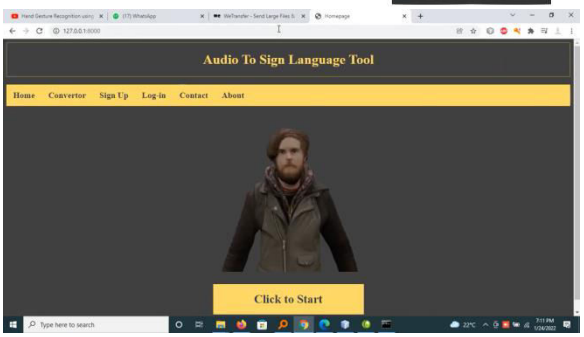
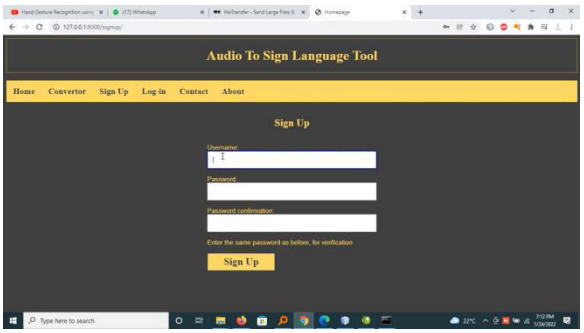
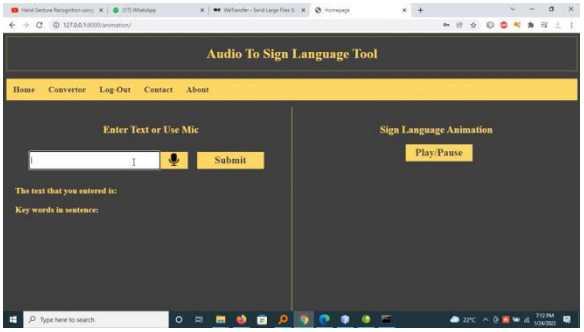


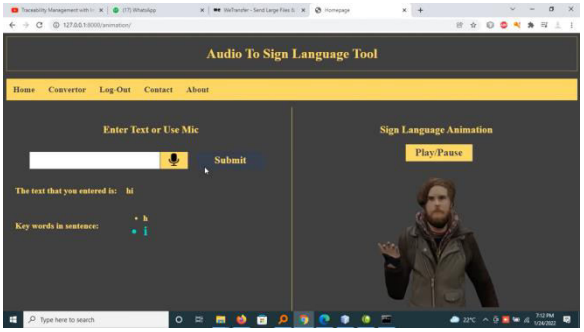
Figure 5.1 Architecture Diagram

VI. OUTPUT SCREENSHOTS









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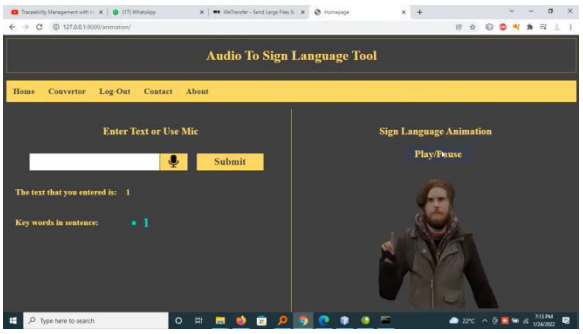

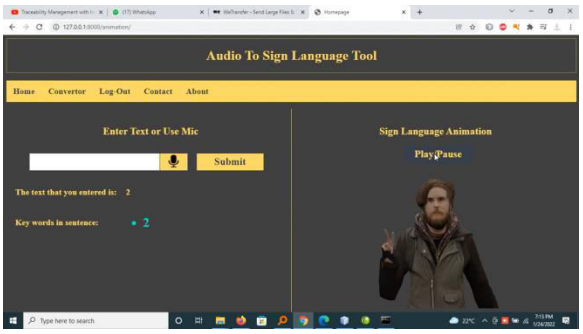

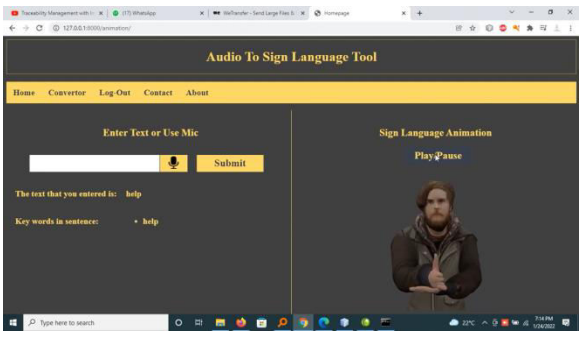

VII. CONCLUSION

A game-changer in communication for the hard-of-hearing and deaf might be a technology that converts audio to sign language. These systems are able to provide accurate sign language translations in real-time by integrating Automatic Speech detection (ASR), Natural Language Processing (NLP), and gesture detection. Improving translation accuracy, contextual awareness, and support for a wide variety of sign languages are all goals of the proposed system. There is still space for development in terms of speed, accuracy, and generalisation to other languages and dialects, even if current systems have made great progress. The overarching objective of this study is to aid in the creation of inclusive technology and to increase the accessibility of communication for the deaf population.

VIII. FUTURE SCOPE

Systems that can translate between spoken and sign languages have a lot of potential for growth in the years to come. The first is a chance to increase the system's functionality by adding support for multi-modal inputs including video, speech, and gestures. Because of this, the system would be able to adapt to various scenarios by functioning in more dynamic, real-world surroundings. Particularly in more involved and lengthy discussions, the system's responsiveness and accuracy might be enhanced with the addition of context-aware translation and real-time feedback methods. Improved performance in interpreting complex speech patterns and converting them into accurate sign language motions may also result from using deep learning models, like as models based on Transformers. The system's adaptability might be further enhanced by adding support for various sign languages used across the world. Last but not least, technological advancements in the future may allow for more immersive experiences with haptic feedback systems and wearable gadgets, resulting in a more accurate real-time depiction of sign language.

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