SignConnect: A seamless connection, from voice to sign

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Abstract—**Sign Connect is a transformative project aiming to bridge communication barriers between the deaf or hard of hearing individuals and the wider world. It focuses on developing a seamless connection between spoken language and sign language, leveraging cutting-edge technology such as Automatic Speech Recognition (ASR), Natural Language Processing (NLP), computer vision, and machine learning. The project comprises two main components: "Speech to Sign" and "Sign to Text". The "Speech to Sign" system converts spoken language into sign language, facilitating real-time communication for individuals with hearing disabilities. It includes features like Automatic Speech Recognition (ASR), Natural Language Processing (NLP), Sign Language Generation, Real-time Translation, User-Friendly Interface, Customization Options, and Accessibility Features. Conversely, the "Sign to Text" system empowers sign language users by providing a means to express themselves in spoken language. It incorporates computer vision and machine learning algorithms for sign language recognition, enabling individuals to communicate with those who do not understand sign language. The project aims to enhance accessibility, inclusivity, and equal opportunities for individuals with hearing disabilities, promoting sign language literacy, and fostering a more connected and inclusive society.**

Keywords— Speech to Sign, Sign to Text, NLP, ASR

1. INTRODUCTION

Sign language serves as the primary means of communication for the deaf and hard of hearing community, encompassing a rich array of hand movements, body language, and facial expressions. However, the disparity between spoken language and sign language poses significant challenges in communication and access to information for individuals with hearing disabilities. To address this issue, the SignConnect project emerges as a pioneering initiative to establish a seamless connection between spoken language and sign language SignConnect acknowledges the diversity of sign languages worldwide, focusing specifically on Indian Sign Language (ISL) for this project. With over 135 distinct sign languages globally, each reflecting the unique cultural and linguistic nuances of its community, the need for effective communication solutions becomes paramount. Through advanced technologies such as Automatic Speech Recognition (ASR), Natural Language Processing (NLP), computer vision, and machine learning, SignConnect seeks to bridge the gap between spoken language and sign language. By translating spoken language into sign language in real-time, the project aims to empower individuals with hearing disabilities to engage in meaningful communication across various domains, including education, healthcare, social interactions, and employment.SignConnect recognizes the educational value of sign language, offering opportunities for both deaf and hearing individuals to learn and understand sign language effectively. By promoting sign language literacy and awareness, the project advocates for a more inclusive and connected society where communication barriers are dismantled, and equal opportunities are extended to all individuals, regardless of their hearing abilities.

2. RELATED WORK

In our academic pursuits, we have engaged with a diverse array of papers, each shedding light on various techniques and technologies crucial to system development. This journey has provided us with a comprehensive overview of methodologies, from established principles to cutting-edge innovations.These papers have served as valuable guides, navigating us through the theoretical and practical aspects of system development. They have offered insights into algorithmic intricacies, architectural designs, and the dynamic relationship between traditional principles and modern advancements.

In literature [1], While many works have proposed promising isolated gesture recognition techniques, natural gestures which occur in sign language are continuous; therefore, sign language recognition requires the spotting of the gesture from continuous videos (i.e., determining the start and end points of a meaningful gesture pattern). An approach to dealing with continuous recognition is to use hidden Markov models (HMMs) for implicit sentence segmentation. Starner et al. [3] model each word or subunit with an HMM and then train the

HMMs with data collected from full sentences. A downside to this is that training on full sentence data may result in a loss in valid sign recognition accuracy due to the large variations in the appearance of all the possible movement epenthesis that could occur between two signs.

In literature [2], A hand free demonstration of Taiwanese data language which uses the wireless system to process the data. To differentiate hand motion, they have inner sensors put into gloves to show the parameters as given by, posture, orientation, motion, defined of the hand in Taiwanese Sign Language could be recognize in no error. The hand gesture is considered by flex inner sensor and the palm size considered using the g sensor and the movement is considered using the gyroscope. Input signals would have to International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Published by, www.ijert.org NCAIT - 2020 Conference Proceedings Volume 8, Issue 15 Special Issue - 2020 191 be consider for testing for the sign to be legal or not periodically. As the signal which was sampled can stay longer than the pre-set time, the legal gesture sent using phone via connectivity like Bluetooth for differentiating gestures and translates it. With the proposed architecture and algorithm, the accuracy for gesture recognition is quite satisfactory. As demonstrated the result get the accuracy of 94% with the concurrent architecture.

In Literature [3], method of using a synthetic named animation making approach they have converted Malayalam language to Indian sign language. The intermediate representation in this method for sign language is being used by HamNoSys. In this method the application accepts some sets of words, say, either one or more and forms It in animated portion. There's an interactive system which further converts the portion of words in to HamNoSys designed structure. Its application pars everything that has been designed as it used by Kerala government to teach about sign language and subtle awareness. Having to communicate between deaf people and normal public has become a difficult task now days and to implement a such as the society lacks a good translator for it and having an app for it in our mobile phones is like having a dream at day.

In Literature [4], In related works, a distinctive autonomous vehicle platform is introduced, presenting an innovative amalgamation of a Raspberry Pi mini-computer, an Arduino micro-controller, and a Zumo track-driven robot chassis. This platform stands out for its cost-effectiveness and functionality. The Arduino micro-controller facilitates the execution of control laws at hard real-time intervals, ensuring precise and responsive control. Complementing this, the Raspberry Pi contributes additional computing power, a user-friendly web interface, and supports wireless data-streaming, enabling efficient control tuning and debugging. The paper evaluates the efficacy of this integrated platform, particularly in the realm of controls education. The assessment involves employing the platform for demonstration purposes in a first course on feedback control, showcasing its potential as an effective tool for educational applications.

In Literature [5], The authors [6] have built a system which works in a continuous manner in which the sign language gesture series is provided to make a automate training set and providing the spots sign from the set from training. They have proposed a system with instance learning as density matrix algorithm that supervises the sentence and figures out the compound sign gesture related to it with a supervision of noisy texts. The set at first that they had used to show the continuous data stream of words is further taken as a training set for recognizing the gesture posture. They have experimented this set on a confined set of automated data that is used for training of them, identification for them and detection stored a subtle sign data to them. It has been stored around thirty sign language data that was extracted from the designed proposal. The Mexican Sign Language (LSM) is a language of the deaf Mexican network, which consists of a series of gestural symptoms and signs articulated thru palms and observed with facial expressions.

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3. PROPOSED MODEL

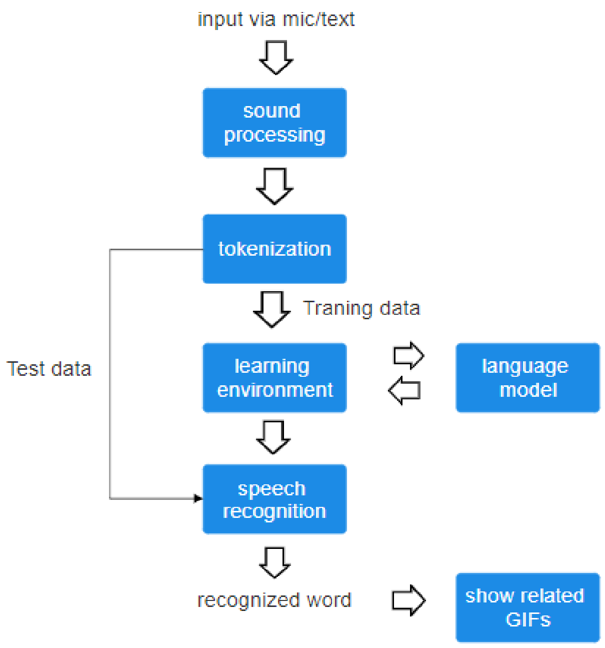

Fig-1: Block Diagram of Speech To Sign

The Diagram aims to facilitate seamless communication between individuals who use spoken language and those who rely on sign language by translating spoken input into sign language representations. It begins with users providing speech input through a microphone or audio file. This input undergoes sound processing to enhance clarity and reduce noise, ensuring optimal performance in subsequent steps. The processed sound is then tokenized, breaking it down into smaller linguistic units like phonemes or words, to prepare it for further analysis.

A language or learning model is then employed to recognize and interpret the tokenized speech. Leveraging techniques such as Automatic Speech Recognition (ASR) and Natural Language Processing (NLP), the model accurately transcribes the spoken words. Based on the recognized speech, the system retrieves corresponding sign language representations. These representations may take the form of animated gifs or images depicting sign language gestures relevant to the transcribed speech.The recognized sign language gestures are then displayed to the user, providing a visual representation of the input speech. Users can interact with the displayed sign language output, seeking clarification or providing additional input as needed. Additionally, the system may incorporate a feedback mechanism to improve accuracy over time. User feedback on the displayed sign language gestures can be utilized to refine the recognition model and enhance performance.

Overall, this structured flow aims to bridge the communication gap between individuals who use spoken language and those who rely on sign language, promoting inclusivity and accessibility in communication. Through sound processing, tokenization, speech recognition, and sign language display, the project endeavors to facilitate meaningful and effective communication for all users. By empowering individuals who rely on sign language and promoting understanding among diverse linguistic communities, the project contributes to a more inclusive and connected society.

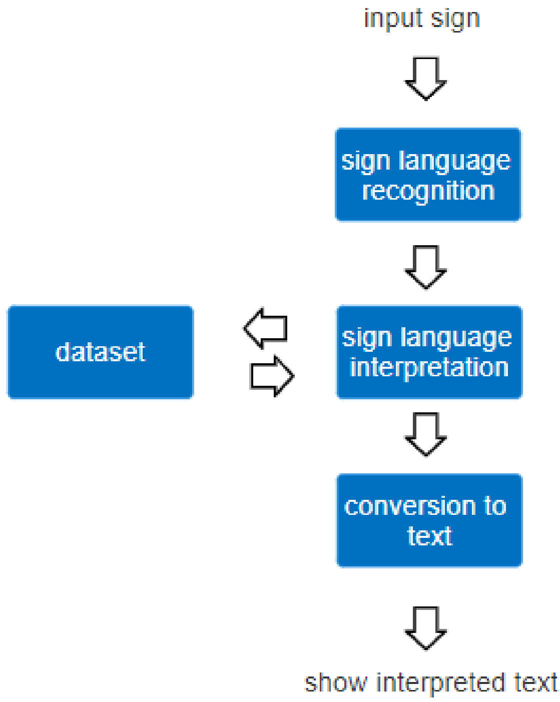

Fig-2: Block Diagram of Sign To Text

In the initial stage, sign language data is captured through various methods, such as video recordings from webcams or mobile devices in real-time scenarios, or pre-recorded videos for training purposes. This data then enters the sign language recognition module, which utilizes machine learning algorithms to identify and interpret specific signs based on hand shapes, movements, and facial expressions. Trained on labeled sign language data, these algorithms achieve high accuracy in recognizing and interpreting signs.

Once sign recognition is successful, the interpreted meaning is extracted and converted into text format for seamless integration with different applications. For instance, the text output can be displayed on a screen for hearing individuals or fed into a text-to-speech system for both deaf and hearing audiences. Finally, the interpreted text is presented clearly for the target audience, tailored to the application's needs. This approach ensures accurate and efficient sign language interpretation, fostering improved communication accessibility for deaf and hearing individuals across various contexts.

4. Results

Fig-3: Analyzing Decision Points

The "Speech to Sign" and "Sign to Text" projects represent a profound commitment to inclusivity, accessibility, and breaking down the communication barriers that have long separated individuals with hearing disabilities from the broader world. These projects harness the power of technology, combining Automatic Speech Recognition (ASR), Natural Language Processing (NLP), computer vision, and machine learning to create comprehensive solutions for both spoken-to-sign and sign-to-spoken language translation.

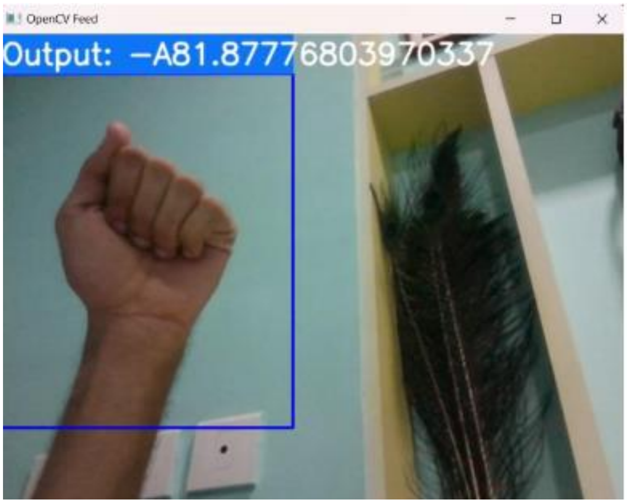

Fig:4- Recognizing Sign

The "Speech to Sign" project pioneers a system that not only translates spoken language into sign language but also offers a rich educational experience, enabling users to learn and understand sign language effectively. On the other hand, the “Sign to Speech" project empowers sign language users by providing them with a means to express themselves in spoken language, thus promoting mutual understanding.

5. Conclusion

In combination, these projects are transformative. They foster inclusivity, empower individuals with hearing disabilities to communicate fluently and naturally and promote sign language literacy among the broader population. Moreover, they advocate for a more inclusive society, one where communication barriers dissolve, and individuals of all hearing abilities can connect, learn, and thrive together. These projects are more than technological endeavors; they are powerful tools for change and progress, bringing us closer to a world where communication is
truly universal and boundless

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