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Review on ISL Bridge Audio -Visual Translator for Indian Sign Language

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ABSTRACT: Effective communication is a crucial life skill, particularly for individuals with pain or speech limitations. This project introduces a solution to enhance interactions with the deaf and mute communities by leveraging Indian Sign Language (ISL). The proposed system utilizes a microphone and camera to capture spoken language, which is then translated into ISL. This ISL translation system interprets audio input, converts it into text, and displays corresponding ISL images or GIFs. The system addresses the communication barrier faced by deaf individuals in various settings, including communication, gaming, seminars, and video conferences. By translating audio messages into sign language, this project aims to facilitate seamless communication between hearing and deaf individuals, making interactions more accessible and inclusive. The technology utilizes Automatic Speech Recognition for processing, ultimately bridging the communication gap.

KEY WORDS: Indian Sign Language Translator, Automatic Speech Recognition

I.INTRODUCTION

Many people consider sign language to be the deaf community's principal language. It includes a range of components, such as body language, facial emotions, and hand gestures. There are roughly 135 different sign languages in the world. Among the notable instances are ASL, ISL, BSL, and Auslan are some examples of sign languages. Indian Sign Language is specifically used in this project. The designed method allows the deaf community to participate in daily activities and obtain information just like hearing people. Deaf people communicate via sign language, which relies on facial expressions, hand movements, and eye gestures rather than vocalization.

A sign language recognition tool can understand deaf individuals' signs. Gesture recognition is challenging to discern between objects in complex backgrounds, making it an important topic of study. Humans and computers see images differently. Humans can easily recognize image elements while computers struggle to do so. This disparity adds to the difficulty in computer vision. people and computers see images differently, with people effortlessly identifying elements while computers struggle to do so. This disparity adds to the continued challenges of computer vision. Sign language is a set of hand motions, facial expressions, and body postures used by deaf or hard-of-hearing individuals to communicate effectively. Sign language is essential for the deaf community's emotional, social, and linguistic development.

II. LITERATURE SURVEY

Hitesh Bharambe et al., Hearing loss impacts communication for many, especially in India, where access to care is limited. This disparity silences individuals, highlighting the need for accessible solutions and the right to be heard.

ISSN: 2350-0328
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Vol. 12, Issue 3, March 2025

Thad Eugene Starner et al., This research pioneers the use of hidden Markov modeling and a single camera to visually interpret full American Sign Language (ASL) sentences. This surpasses previous systems that relied on electronic gloves and recognized only letters or words.

Morguet et al., Continuous gesture recognition in videos requires detection and classification. Earlier methods used motion detection and HMMs, later improved with single-stage HMMs and implicit duration modelling.

DeSantis et al., The All India Federation of the Deaf found urban and rural Indian Sign Language differ. Rural sign relies on shared knowledge, while urban sign uses more illustrations. Both follow core linguistic rules.

Mohamed Jemni et al., This research focuses on developing new theories and algorithms for American Sign Language (ASL) processing and translation. The goal is to create a free, online ASL learning tool using the Gutenberg Project corpus.

Anbarasi Raja mohan et al., Gesture-based sign languages like ASL are crucial for making audio accessible to those excluded by complex acoustics. ASL allows deaf and mute people to communicate effectively through hand gestures.

Lopez-Ludeña et al., User-centered design involves four steps: analyzing needs, creating a corpus, adapting technology, and system evaluation. This process identifies technical and user needs and uses the generated corpus to train language translation modules.

Shruti Sawant et al., This mobile app breaks down communication barriers for people with hearing and speech impairments. It translates ASL into text/speech and vice-versa, using the device's camera and audio for seamless interaction.

Anil Kumar Singh et al., A prototype system translates English to Indian Sign Language using animations. It parses sentences, reorders them based on ISL grammar, removes superfluous words, and lemmatizes the text.

A. M. Raina et al., This study focuses on building a sign language translation system, aiming to overcome corpus size limitations. Future development will enlarge the corpus, redesign the system, and maintain the integrity of established sign structures.

Gede Putra Kusuma et al., Sign language is vital for deaf-mute communication, using visual gestures to overcome barriers. Advancements in recognition exist, but challenges remain in accurately distinguishing hand and face regions in segmentation.

Nagpure et al., Communication is crucial, especially for those with hearing and speech impairments. A 2019 IEEE INDICON paper presented an end-to-end system translating English voice to Indian Sign Language, fostering convenient communication.

L Goyal et al., Indian Sign Language (ISL) is unique with varied forms. Current ISL websites offer video transcripts, but we aim to create an ISL dictionary. This dictionary will utilize virtual avatars in a dedicated library environment, distinct from human agency videos.

Sourav Gupta et al., India faces a critical need for accessible resources for its 1.3 million hearing-impaired individuals. Platforms promoting self-education and sign language learning can empower the community and bridge communication gaps.

Sanmeet Kaur et al., This system translates English to Indian Sign Language using an ISL parser and 3D avatar. User testing demonstrated high accuracy, scoring 4.2 for words and 3.8 for sentences, proving its effectiveness.

Dhanush V et al., This NLP translator converts spoken English to sign language, aiding communication for the hearing and speech impaired. It bridges communication gaps, fostering inclusivity and accessible information for all.

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 12, Issue 3, March 2025

Muskan Ahuja et al., Indian Sign Language (ISL) conversion to text is lacking. Despite advancements in other sign languages, ISL research is behind, creating a crucial need for further exploration and development to bridge this communication gap.

Maria Papatsimouli et al., Recent advances in sign language translation technologies, like animated text, are empowering deaf individuals with richer communication and information access. These innovative tools are becoming increasingly popular, fostering understanding and connection.

Swapna Johnny et al., propose a system using 5DT gloves and machine learning to translate sign language into words. This technology aims to help deaf-mute individuals communicate more easily without relying on human interpreters.

Hemantha G et al., propose a web program translating spoken words into Indian Sign Language (ISL) images. This technology empowers the deaf community, promoting inclusivity and overcoming communication barriers.

III. METHODOLOGY

The methodology integrates Automatic Speech Recognition (ASR) technology, which effectively transforms spoken words into text, and leverages 3D modeling techniques to generate corresponding sign language motions.

A) Module1
Automatic Speech Recognition, also called ASR, is the first module. This is the pipeline's first step and confirms that the spoken language is accurately captured on digital media for further examination.

Sound Input: The system collects sound input generally from a microphone or speech interface. The user can speak in any supported language or dialect.

Speech-to-Text Conversion: The core of this game is on the skills of exactly transcribing spoken language into text. To do this, an effective ASR system should be developed which takes into account varied speech patterns and acoustic features

Contextual Models: The system can use context-based models, for example, Language Models to make the transcription more accurate when homophones or ambiguous words have been used in the transcription

B) Module2
Natural Language Processing This module aim is to Analyze and comprehend text structure and meaning by the NLP Module after transcribing speech into text through the ASR module.

Text Parsing: It breaks an input text into its syntactic units (words, phrases, and clauses) by means of procedures such as part-of-speech (POS) tagging and syntactic parsing as the first steps in NLP.

Sentence Structure: NLP algorithms provide the grammatical structure of the sentence, i.e., what time it denotes-past, present or future; and how a subject is in relation with verb or object.

Contextual Understanding: It goes beyond syntactic analysis as it also takes into account the context-dependent factors of human language, such as tone, sentiment and formality in its understanding of utterances.

Named Entity Recognition (NER): The system recognizes the important entities (like names, locations, dates) to translate the relevant signs correctly.

C) Module3
Sign Language Translation It translates the entire component output of the NLP module into sequenced Indian sign language (ISL) signs as per the requirements

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Vol. 12, Issue 3, March 2025

Lexical Mapping: This is the mapping of each word/phrase in the processed text to its corresponding ISL sign.

Verb Conjugation: ISL might change the shape of its verb depending on the tenses, and so the translation engine will have to string the verbs in accordance with past, present, or future action.

Grammar Mapping: The actual translation module should also consider these grammatical differences between the source language (e.g. English) and ISL.

Disambiguation: Whereby a particular word might have more than one sign, for example, the word run has to be shown by different signs depending on the context, the system resolves it based on the following words and surrounding context given by the NLP module.

IV. EXPERIMENTAL RESULTS

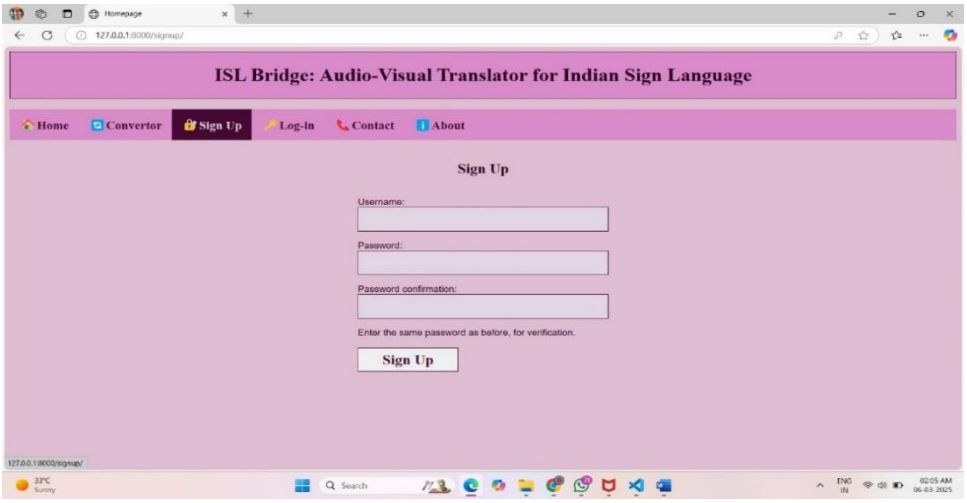

Fig1. Sign Up Page

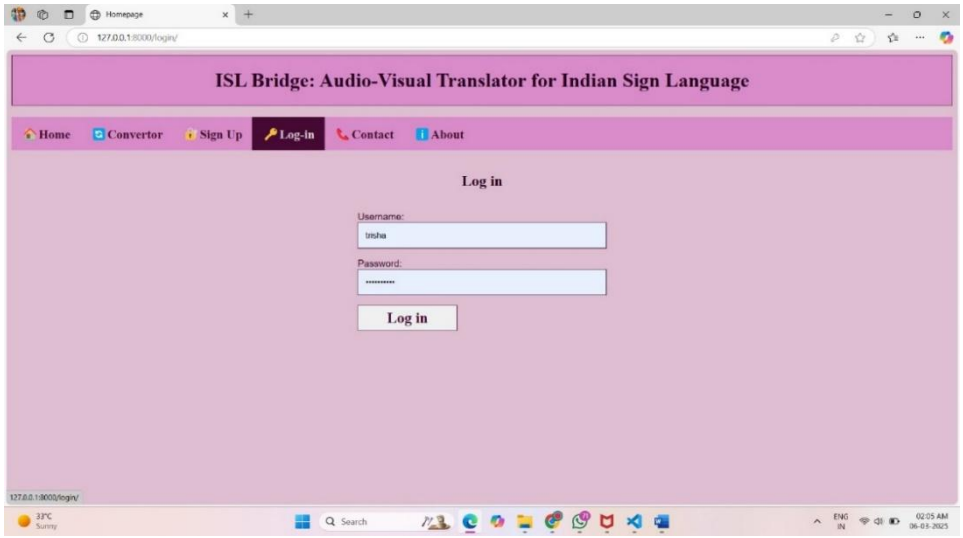

Fig2. Log In Page

ISSN: 2350-0328
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Vol. 12, Issue 3, March 2025

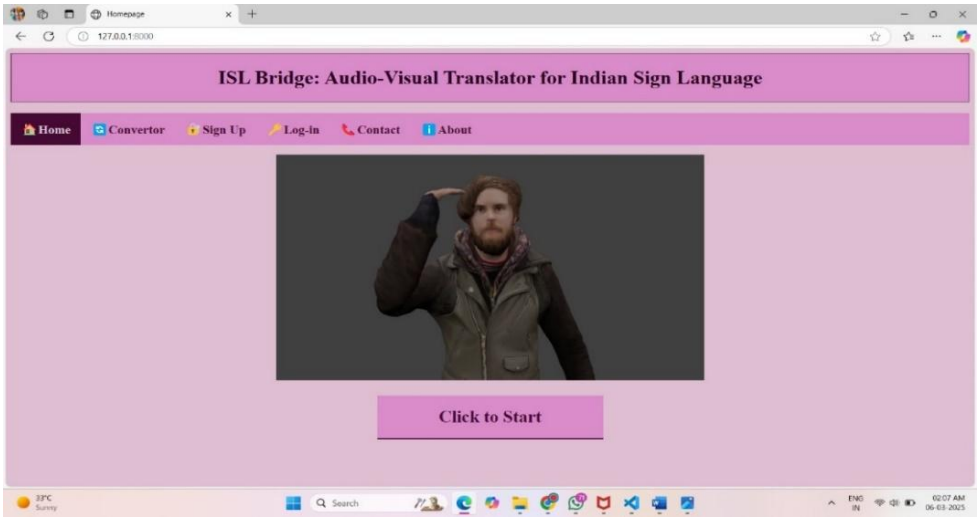

Fig3. Home Page

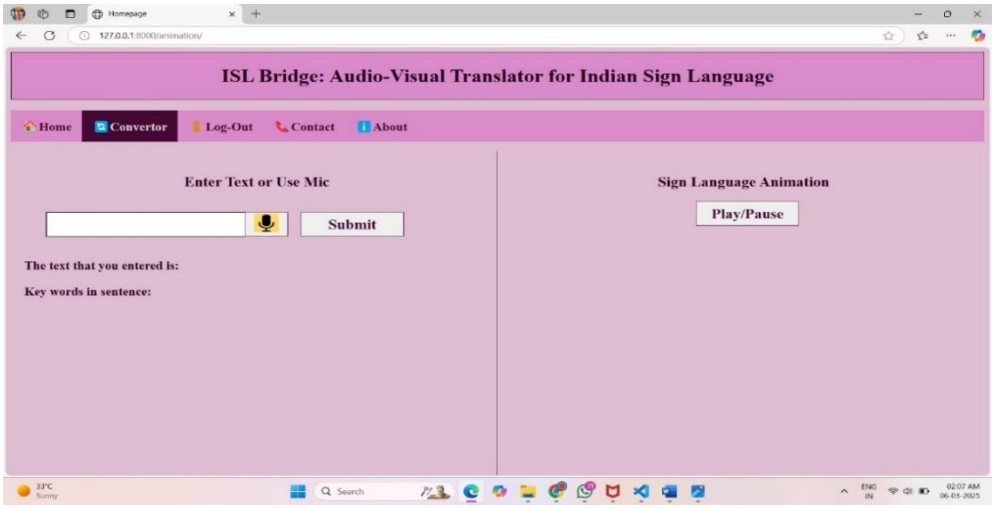

Fig4. Output 1

ISSN: 2350-0328
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Vol. 12, Issue 3, March 2025

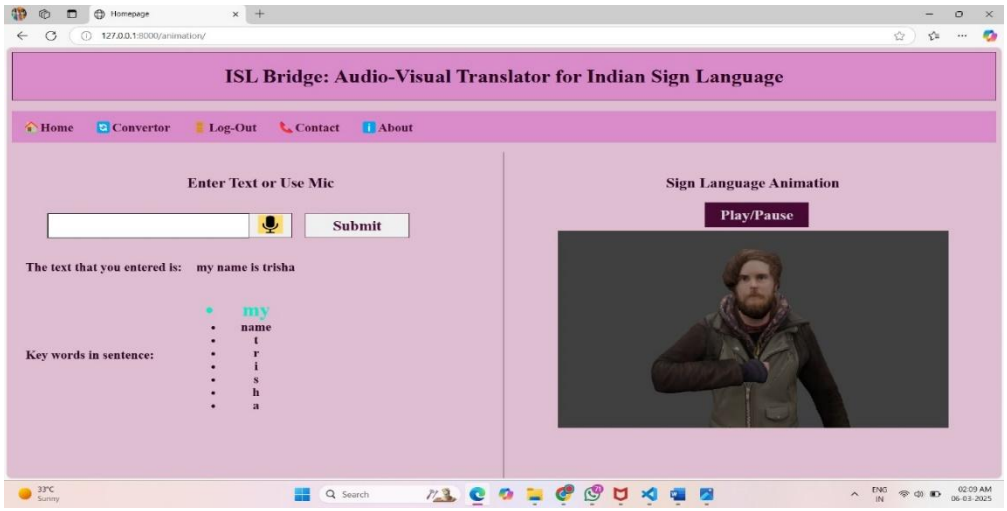

Fig5. Output 2

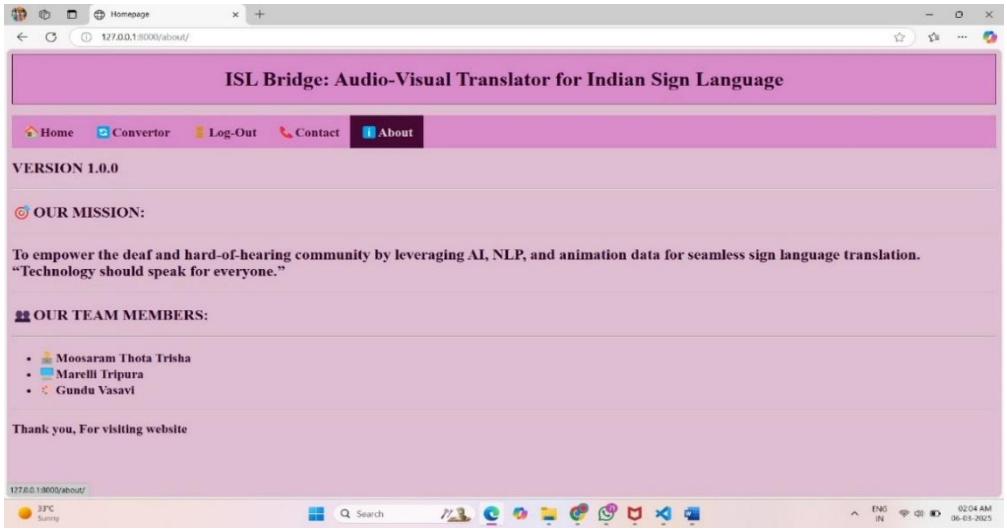

Fig6. About page

V. CONCLUSION

From the research papers on sign language recognition and translation, it can be seen that there has been remarkable progress in both Indian and American Sign Language (ISL/ASL) over time. Most of these research papers are concerned with enhancing accuracy via different methodologies like NLP, machine learning, HMM, and gesture recognition methods, for which accuracy has been between 82% to 97%. These developments seek to fill the communication gap for the deaf and mute society, with specific focus on real-time sign-to-speech translation and gesture-based recognition.

Although the encouraging results, most of the studies are limited by small corpora, computational complexity, the difficulty in processing non-manual features, and the absence of standardization.

There are also issues in translating complex or multi-sign gestures, which indicates the necessity for more advanced systems and larger corpora to achieve higher accuracy and flexibility. Some systems also have difficulties with real-time processing because of high computational requirements, which suggests a need for optimization in future work. Generally,

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despite the advancements that have been achieved, more must be done in order to bring about more effective and pragmatic implementation in day-to-day communication, particularly towards enhancing flexibility, decreasing computational costs, and facilitating standardization among varying sign language systems.

VI. FUTURE WORK

Future enhancements for the ISL Bridge Audio-Visual Translator app will focus on improving AI-powered gesture recognition to enhance accuracy and real-time processing. Speech-to-ISL translation will be integrated with advanced noise reduction, allowing seamless communication.

The app will also support text-to-ISL conversion with multilingual input and AI-driven avatars for sign language display. Real-time ISL interpretation in video calls will enable better accessibility, while augmented reality (AR) features will provide on-screen virtual sign interpreters. An offline mode with a preloaded ISL dictionary will ensure usability without internet access. Cloud-based learning will keep the ISL database updated with new signs, incorporating user feedback for continuous improvement. UI and UX enhancements will make the app more accessible with customizable interfaces, gesture-based navigation, and dark mode options.

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