Talking Fingers: A Multilingual Speech-to-Sign Language Converter

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ABSTRACT

Communication is a basic human need, but thousands of people with hearing and speech impairments face limitations in everyday communication "Talking Fingers" is a modern assistive technology tool that transfers spoken or written language to Indian Sign Language (ISL). With multilingual capabilities, the tool provides technologies such as Google ML Kit for language recognition, MyMemory API for translation, ISL grammar services for more than one language and several languages accessible at a time Translated ISL will, a it provides a simple and powerful communication channel. The system outlines the ability to blend artificial intelligence (AI) and language generation to promote inclusion and empower individuals with disabilities.

I. INTRODUCTION

More than 430 million people international live with hearing disabilities, many of whom rely upon signal language to communicate. In India, Indian Sign Language (ISL) is the number one way of verbal exchange for individuals with hearing and speech impairments. However, those people face challenges due to a loss of technological gear to bridge the gap between sign language customers and non-signers. This creates challenges in schooling, health care, and regular communique.

The predominant goal of "Talking Fingers" is to be an clean-to-use, multilingual machine that interprets spoken or written text into ISL. Key targets encompass:

1. Real-time speech recognition and speech reputation.
2. Comprehensive multilingual text translation in ISL grammar.
3. Illustration of ISL indicators the use of static pics.
4. Developing user-friendly systems for one of a kind customers.

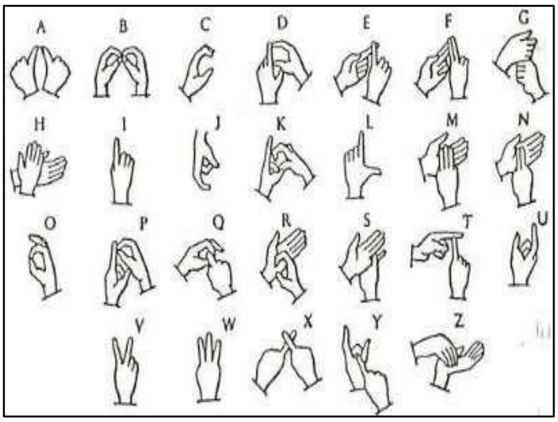

Fig 1. Indian Sign Language Alphabets

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This venture has a extensive software:

- Education: Help college students with hearing loss by means of converting spoken words into ISL.
- Healthcare: Supportive communication between hearing-impaired patients and physicians.
- Public services facilitating communication in government offices and other public places.
- Social Inclusion to foster greater understanding and interaction between individuals with hearing loss and the community.

Utilizing advances in natural language processing (NLP) and artificial intelligence (AI), "Talking Fingers" aims to provide scalable, efficient solutions for communication that affects everyone around**.**

II. RELATED WORKS

Available Existing Systems:

1. **Text-to-Sign Language Systems**:
    - Such systems convert English texts into ASL without having any ISL-specific features, for example, ""signall"".
    - There are applications like "Sign Language Tutor" which provide static learning sources, but do not provide any real-time capabilities.
2. **Speech-to-Text Systems**:
    - Google translate helps by converting audio into text, but it doesn't work on ISL grammar and visualization.
3. **Sign Language Systems with Static Images**:
    - Some systems offer static representation of ISL for individual words or letters. It fails to provide advanced grammar compliance and multilingual input.

Vacuum in the Existing Gaps in Technologies:

- No ISL specific grammatically processing.
- Very limited multilingual input capability.
- Very few focus on real-time end-user-friendly resolutions.

What "Talking Fingers can" :

1. **Multilingual Input**: Processes speech and text in multiple languages.
2. **ISL Grammar**: Ensure compliance with ISL syntax rules in translations.
3. **Static Image Visualization**: Display for clarity and simplicity the ISL signs.
4. **User-Centric Design**: Accessibility ensured to non-technical users.

III. PROPOSED SYSTEM

This is the platform, which unites advanced speech recognition, multi-lingual translation, ISL grammar processing, and static ISL image visualizations. So, keeping modularity and adapt the design defines all requirements of users.

Components are:

1. **Speech-to-Text Conversion**:
   - Google ML Kit converts speech to text in multi-language with various accents.
2. **Language Detection**:
   - Detects the input automatically so that user does not have to select the language at all.
3. **Text Translation**:
   - Translate input text to English and restyle to ISL grammar.
4. **ISL Sign Visualization**:
   - Displays a static ISL sign view for letters or words in a given structured layout.
5. **User Interface**:
   - Features are:
     - Manual text input.
     - Language selection spinner.
     - Speech recognition and translation buttons.
     - Output display area for ISL signs.

Workflow:

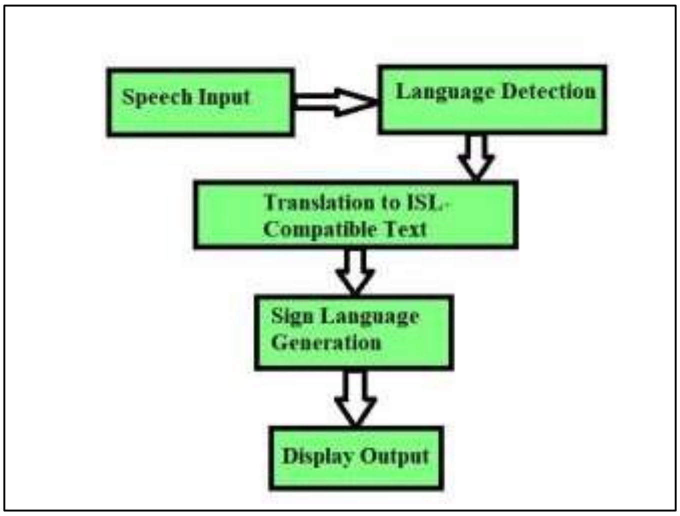

Fig 3.2 Block Diagram

1. The user inputs either speech or text format.
2. The system detects the language and translates such into ISL-compatible form in English.
3. ISL grammar rules are applied.
4. Static ISL images are displayed in organized format.

IV. EXPERIMENT AND RESULT ANALYSIS

Methodology:

1. **Speech-to-Text Conversion**:
   - The inputs were tested in 6 languages including, Hindi, Tamil, Kannada, and Telugu.
   - The speech samples were reinforced with varying dialects, accents, and noise levels to create real-life conditions.
2. **Language Detection and Translation**:
   - Evaluated the part of the system to test how accurately it can determine an input language.
   - Evaluated the quality of the translated output in common phrases with complex sentences and idiomatic expressions.
3. **ISL Grammar Compliance**:
   - The proper English text was validated to have restructured according to the ISL syntax.
   - Verified the grammatical flow and sentence formation.
4. **Visualization Accuracy**:
   - The static images of ISL were cross- checked with the input text regarding correctness.
   - Layout and Alignment were judged in light of the readability and clarity.
5. **User Testing**:
   - Surveys were filled by hearing-impaired and non-technical users to derive results concerning the usefulness and efficiency of the system.

Results:

1. **Recognition by voice**:
   - Provided an output of 97%, where there could be occasional misinterpretations in noisy conditions.
   - It is able to withstand accent variations in regional pronunciations.
2. **Detection of Language**:
   - Achieved 95% as accuracy in identifying the correct input language without a manual selection.
3. **Accuracy of Translation**:
   - Attained 92% for structured sentences and 88% for complex or idiomatic phrases, with slightly differing accuracies in context-sensitive cases.
4. **Visualization in an ISL**:
   - Matched static ISL signs to input text with 99% accuracy.
   - Beyond that, founding users termed ISL images to have a clear layout which was easy to use.
5. **User Feedback**:
   - About 93% of the participants rated the system as intuitive and effective.
   - Suggested expanding libraries of ISL vocabulary and support for regional languages.

V. FURTHER WORKS

Regional Adaptations:

- Support for regional sign languages to be extended.
- Variations in grammar by dialect should also be reflected.

Bidirectional Communication:

- Features for converting ISL signs back into either text or speech.

Educational Tools:

- Modules for teaching ISL in schools and workplaces.Wearable Integration:

- A system for AR glasses for live ISL virtualizing.

Enhanced NLP:

- Strongly improve on contextual understanding for the idiomatic and complex phrases.

VI. CONCLUSION

The Talking Fingers are used to crank up communication challenges for persons with hearing and speaking disabilities by advanced technologies such as multilingual translation by speech recognition, processing grammar for ISL, and static ISL visualization. Intensive testing has confirmed the visibility of its possibilities, demonstrating accuracy in speech recognition, language detection, and ISL visualization.

This universal platform has opened up many applications in education, healthcare, public services, and individual communication. Talking Fingers will throw bridges between the hearing-impaired persons and the general community in the domain of social integration and empowerment.

A bidirectional translation and regional differentiation, possibly coupled with wearable technology, would further enhance the system's power and usability, making it a backbone for assistive communication technology.

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