

ABSTRACT

Bidirectional Sign Language Translation System for Regional Language

Communication plays a critical role in social inclusion, education, and professional environments, yet a significant barrier exists between the hearing-impaired community and the general public. The objective of this project is to develop a bidirectional sign language translation system capable of identifying hand gestures in real-time and converting them into Regional Language (Malayalam) text and audio, and vice versa. This innovation aims to address the challenges faced by the deaf community in expressing themselves effectively to individuals who do not understand sign language.

The need for precise, secure, and user-friendly communication tools is increasingly significant in applications ranging from personal conversations to assistive technology. Current solutions often rely heavily on cloud-based services, lack support for regional Indian languages, and raise privacy concerns by processing sensitive video data on external servers. These limitations leave gaps in usability, particularly for users requiring offline access or ensuring the confidentiality of private discussions.

The application captures video frames from a device's camera, processes the visual data using Python and OpenCV, and identifies hand gestures using MediaPipe Hands for efficient skeletal tracking. The extracted feature data is analyzed by a Deep Learning model (LSTM - Long Short-Term Memory) built with TensorFlow/Keras to recognize dynamic sign sequences accurately. The system maps these signs to regional text using a custom offline dictionary and converts them to audible speech using the pyttsx3 library, ensuring fully offline functionality. Its user-friendly interface, developed using Streamlit, enhances accessibility for individuals with disabilities and supports seamless interaction on laptops and mobile devices via local network hosting.