

Empowering Communication for the Deaf using AI-Powered Translation

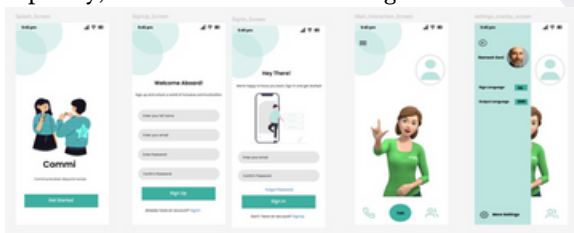
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Abstract

India is home to eighteen million deaf people, as estimated by the National Association of the deaf. Indian Sign Language (ISL) is the native language for people who are deaf or hard of hearing. ISL is used by the deaf community all over India. Interpreters are essential for communication between the deaf and hearing population, but fewer than three hundred certified-Indian ISL interpreters are available in India. This gap often leads to social exclusion and limits opportunities for the deaf community. Existing interpreter services are expensive, regionally constrained, and dependent on human availability. Our research proposed an AI-powered bi-directional application; the application's functionality ensures seamless two-way communication. When a deaf person uses the app, their mobile's camera turns on and captures the sign language gestures. The app's AI-powered backend processes these visual inputs and converts them into spoken voice output for the hearing person. On the contrary, when the hearing person speaks, it is translated into ISL using realistic 3D animated avatars generated via DeepMotion Animate 3D. This tech innovation solution can empower the deaf community to engage in education and employment and access public services without the dependence on interpreters. The assistive tech market is growing rapidly in India, expanding the market segment within healthcare and tech organisations. Corporate and government organisations are under increasing pressure to adopt inclusive solutions.

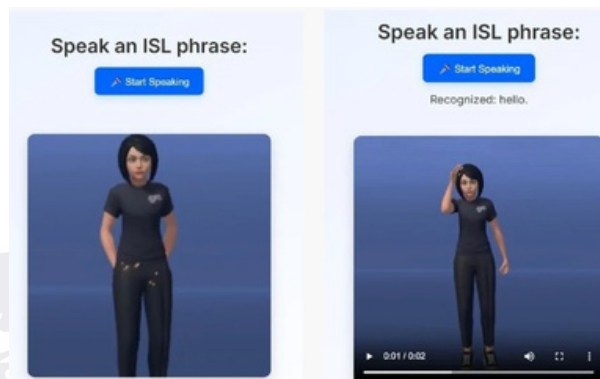
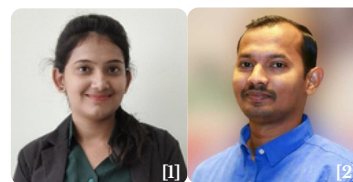
Design Methodology

The first step involved creating the initial design prototype of the mobile application using Figma. The focus was on building a user-centric interface that enables seamless communication between the deaf and hearing populations through intuitive navigation and accessibility features. Commi is a mobile application designed to empower the deaf and hard-of-hearing community by facilitating communication using sign language avatars and speech-to-sign translation. The app aims to bridge the communication gap with a focus on accessibility, simplicity, and human-centred design.

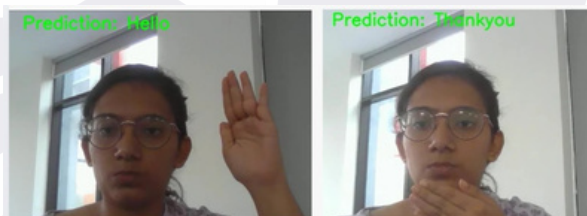


Prototype

The prototype comprised two core modules: Sign-to-Voice and Voice-to-Sign. For the Sign-to-Voice module, the model for the sign language to voice comprises three main components:



extraction of frames from input videos, key points extraction from hands, classification of gestures using a neural network, and creating real-time gesture recognition using text-to-speech output. This approach integrated certain libraries in computer vision, deep learning, and speech synthesis to bridge the gap in communication between the deaf and hearing populations. The model for the voice-to-sign language used an open-source dataset of Indian sign language, which consists of more than 10,000 words. The sign language gestures are converted to 3D animated avatars using Deep Motion 3D animator. To make it functional, JavaScript and HTML are used for front-end and back-end. A speech recognition Windows kit is used to detect the voice and display an animated video for the corresponding gestures.



Future Scope of the Work

Assistive technologies using AI can transform the lives of individuals with disabilities and improve overall quality of life. There have been innovations for individuals with speech impairment, such as enhanced communication devices for the physically disabled and AI-driven robotics intelligent wheelchairs that can give them personal support. The proposed solution could be implemented in hospitals, public places, and educational institutions. Assistive technologies are continuously developing, catering to many individuals in India, promoting inclusiveness and an accessible environment.

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