

Sign Language Detection System for differently abled people



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INTRODUCTION

Sign languages (also known as **signed languages**) are languages that use the visual-manual modality to convey meaning. Sign languages are expressed through manual articulations in combination with non-manual elements. Sign languages are full-fledged natural languages with their own grammar and lexicon. Sign languages are not universal and they are not mutually intelligible with each other, although there are also striking similarities among sign languages.

Wherever communities of deaf people exist, sign languages have developed as useful means of communication, and they form the core of local Deaf cultures. Although signing is used primarily by the deaf and hard of hearing, it is also used by hearing individuals, such as those unable to physically speak, those who have trouble with spoken language due to a disability or condition (augmentative and alternative communication), or those with deaf family members, such as children of deaf adults.

NEED FINDING

There have been several advancements in technology and a lot of research has been done to help the people who are deaf and dumb. Aiding the cause, Deep learning, and computer vision can be used too to make an impact on this cause.

This can be very helpful for the deaf and dumb people in communicating with others as knowing sign language is not something that is common to all, moreover, this can be extended to creating automatic editors, where the person can easily write by just their hand gestures.

PURPOSE

The Sign language is very important for people who have hearing and speaking deficiency generally called Deaf And Mute. It is the only mode of communication for such people to convey their messages and it becomes very important for people to understand their language.

Sign language relies on sign patterns, i.e., body language, orientation and movements of the arm to facilitate understanding between people. In all around the world about 9.1 billion peoples are deaf and dumb. In their day to day life they faced a lot more problems with their communication. This project is used to reduce the communication gap between the normal people and disabled people.

Some of the major issues faced by the deaf and dumb people are

- They are deprived from various social activities
- They are under-estimated to our society

PROCESS

Pattern recognition and Gesture recognition are the developing fields of research. Being a significant part in nonverbal communication and gestures are playing a key role in our daily life. Hand Gesture recognition system provides us with an innovative, natural, user friendly way of communication with the computer which is more familiar to human beings. By considering the similarities of human hand shape with four fingers and one thumb, the software aims to present a real time system for recognition of hand gesture.

The following are brief steps on how the project can be deployed.

1. Collect images for deep learning using your webcam and OpenCV
2. Label images for sign language detection using Labelling
3. Setup Tensorflow Object Detection pipeline configuration
4. Use transfer learning to train a deep learning model
5. Detect sign language in real time using OpenCV

INTERVIEW

We have interviewed a person named Araz Ahmed. He has a cousin ,Umar, who is mute. This interview helped us understand out how life is for someone like his brother Umar. The highlights of the interview are as follows:

1. How long has your cousin been mute for?

He was born with this disability. Umar is mute from birth.

2. How do you communicate with your cousin?

We usually use hand gestures when we try to tell him something general. If it is something specific then we write it down on a paper for him and so does he.

3. Do you understand whatever he tries he is trying to convey?

Most of the times we try really hard to understand what he is trying to express, it is really difficult for both him and us to understand him. And because of this he feels left out when he is with normal people.

HEURISTIC EVALUATION

1. Aesthetic and minimalist design.

Interfaces should not contain information which is irrelevant or rarely needed. Every extra unit of information in an interface competes with the relevant units of information and diminishes their relative visibility.

2. Flexibility and efficiency of use.

Shortcuts — hidden from novice users — may speed up the interaction for the expert user such that the design can cater to both inexperienced and experienced users. One such example in our system would be where a user can click on someone's profile and directly send a text to them instead of going to the messaging tab and searching their name.

HEURISTIC EVALUATION

3. Error prevention.

Good error messages are important, but the best designs carefully prevent problems from occurring in the first place. The system is designed to show error messages for things like bad network, camera failure, sign language detection failure, etc. This notifies the user of the discrepancies in the user experience.

4. Consistency and Standards.

Users should not have to wonder whether different words, situations, or actions mean the same thing. Hence we follow platform and industry conventions like using universally recognized logos and symbols. The system will also provide the user to select between languages.

HEURISTIC EVALUATION

5. User control and freedom.

When it's easy for people to back out of a process or undo an action, it fosters a sense of freedom and confidence. Users often perform actions by mistake. They must have the freedom to undo such actions or get out of them. Our system provides such features like ending a video call, deleting a text message sent by mistake, allowing replay of video/image messages, etc. This allows users to remain in control of the system and avoid getting stuck and feeling frustrated.

6. Help and Documentation-

It's best if the system doesn't need any additional explanation. However, it may be necessary to provide documentation to help users understand how to complete their tasks. The system will provide a help option which will be provided in every page. The user can read the section and learn how to use the different features of the system.

HEURISTIC EVALUATION

7. Recognition rather than recall-

The system minimizes the user's memory load by making objects, actions, and options visible. This is possible because the menus and options are uniform across all the interfaces and easily visible.

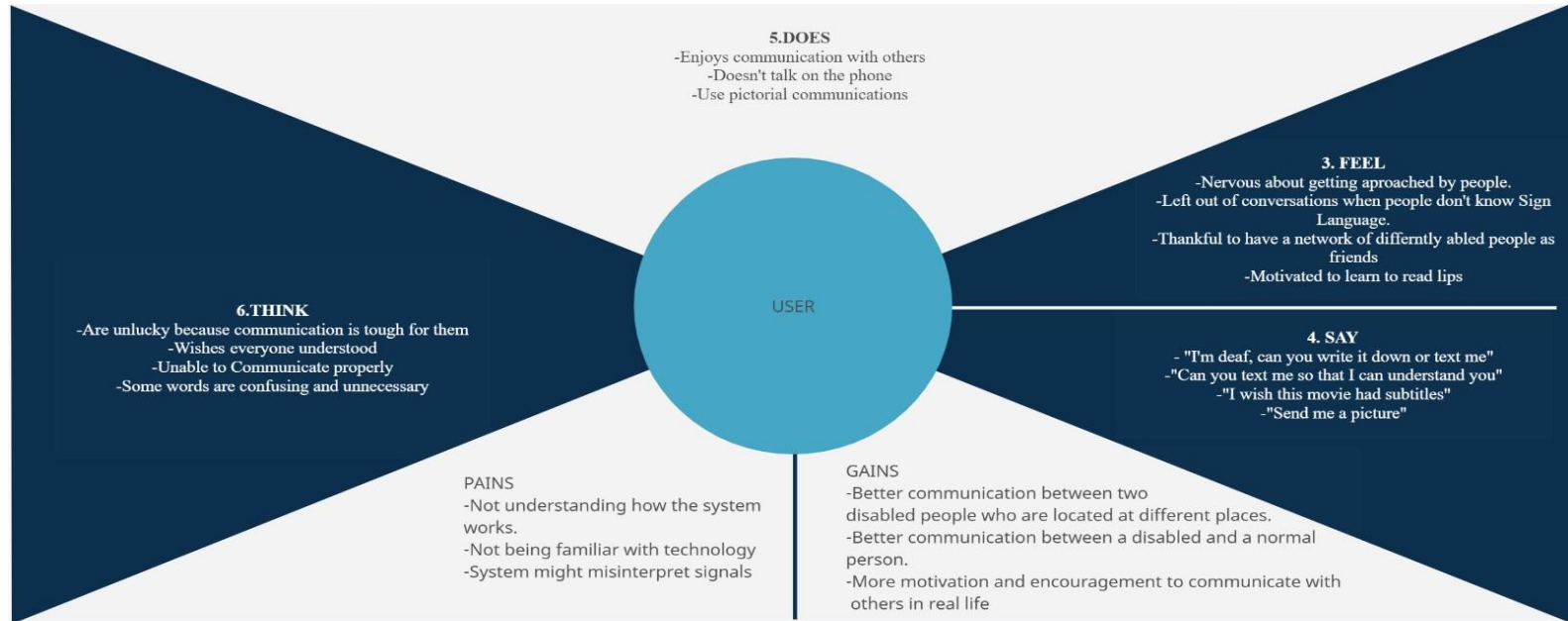
LOW-FIDELITY PROTOTYPING

Low-fidelity (lo-fi) prototyping is a quick and easy way to translate high-level design concepts into tangible and testable artifacts. The first and most important role of lo-fi prototypes is to check and test functionality rather than the visual appearance of the product.

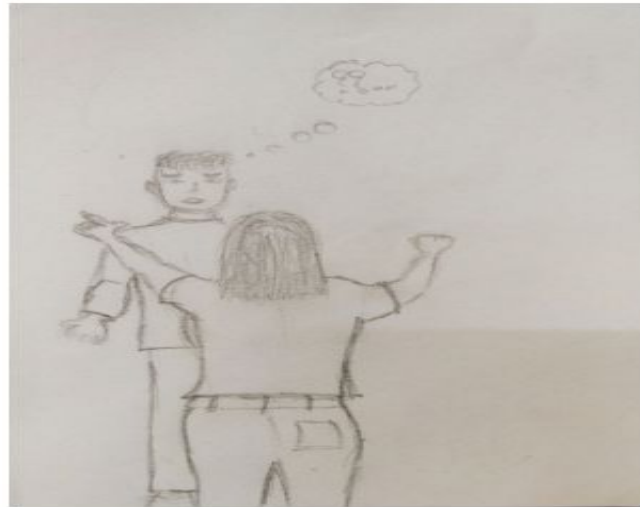
Here are the basic characteristics of low-fidelity prototyping:

- **Visual design:** Only some of the visual attributes of the final product are presented (such as shapes of elements, basic visual hierarchy, etc.).
- **Content:** Only key elements of the content are included.
- **Interactivity:** The prototype can be simulated by a real human .During a testing session, a particular person who is familiar with design acts as a computer and manually changes the design's state in real-time. Interactivity can also be created from

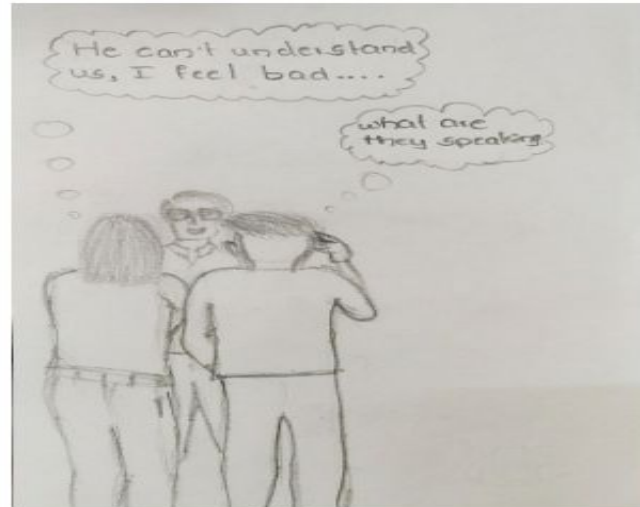
EMPATHY MAP



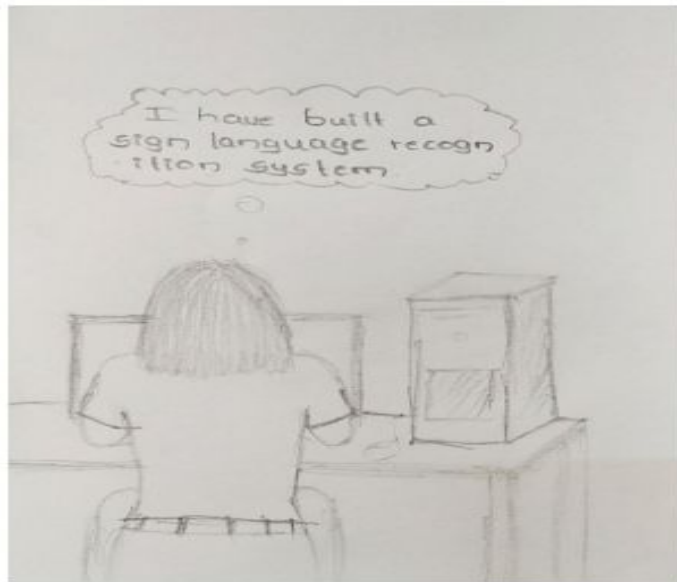
STORYBOARDING



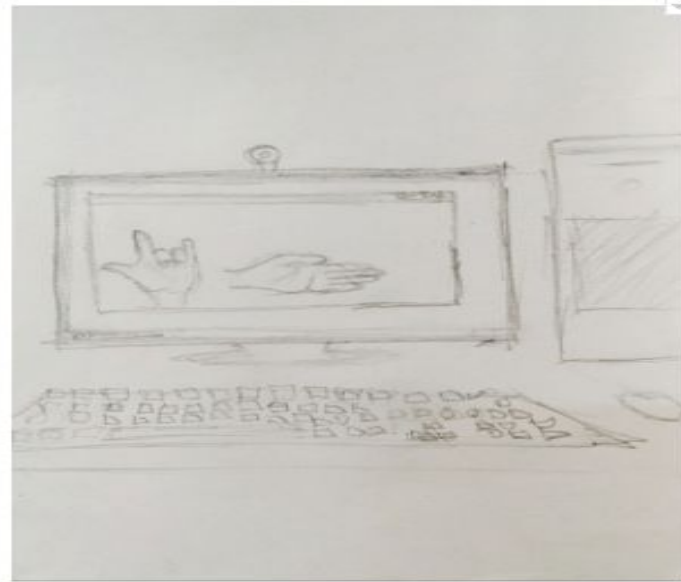
This shows the life of Aarav, a boy who is differently abled. He is hearing impaired and has trouble understanding what Esha is talking about.



His friends feel bad that Aarav can't understand what they are speaking about. They also don't know sign language and neither can they write everything down for him.



Esha, being empathic, designs a system for her friend which can help him communicate better with others.



It has various features like Sign Language Recognition, Video calling, Texting and others.

HIGH FIDELITY PROTOTYPE

The main goal of the system is to provide a simple and minimalistic UI design. This will provide better user experience and easy of use. It will also be user friendly and aesthetic to improve responsiveness and efficiency.

Features of the system:

1. **Sign Language Recognition-** The system will detect sign language with the use of a video camera of the user. This will help two people communicate with each other, where either or both of them may be differently abled. Text/Audio to Sign Language and vice versa are both possible to make sure there is an improved This is the key feature of the system.

Text/Audio to Sign Language: -writehere- This feature translates the Text or audio to a sign language for the differently abled person to understand.

Sign Language to Text/Audio: -writehere- Sign languages are detected by the system with the help of software and converted to text/audio for a person who doesn't understand any sign language.

2.Enhanced Text Messaging- With this feature, the users can access the messaging tab. In this tab, users can access their contacts, recent chats, and features that optimize the communications experience for deaf individuals.

Messaging- Scroll through the contacts tab to send a friend a message, or view active messages, through your notification tab. Here you will find your most recent conversations.

Selecting on a friend's profile will bring up the option to contact them through a Video Call, Text message or a SLA message(Sign Language Assistant).

Pre-written messages- The pre-written message function will allow users to send pre-written messages saved on the app and add their own to streamline quick and clear communication. The purpose of this feature is to provide the user with clearly written text messages ready to send.

Suggested Reply- Suggested responses will aid the user with responding to messages. This feature can come into play when a user is confused about the delivered message.

Sentence Simplifier- The sentence simplifier feature will detect perplexing/confusing words and simplify them to digestible language for a clear understanding for individuals of all reading levels. This feature will also incorporate emojis to visualize the context more clearly.

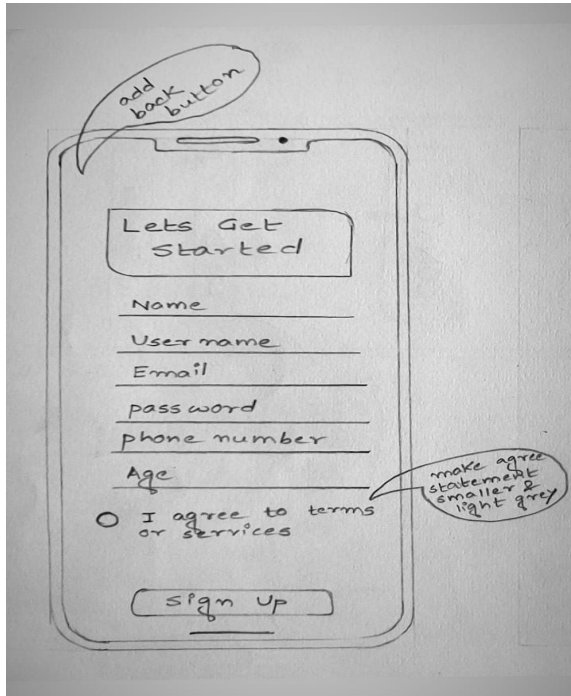
3. Enhanced Video calling

Speech to Captions- Users can turn on the speech to caption setting on the system/application to transcribe verbal communication and implement captions for a sharper communication experience.

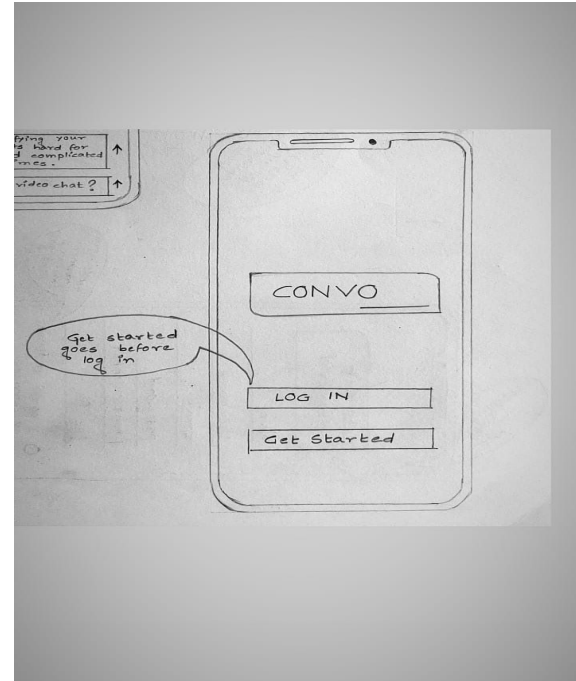
Video Call Messaging- Users can send written messages during a video call to streamline conversations between both individuals.

VRS Phone Calls- With this feature, users can contact hearing individuals through phone calls with video relay services and American Sign Language Interpreters.

User Interfaces

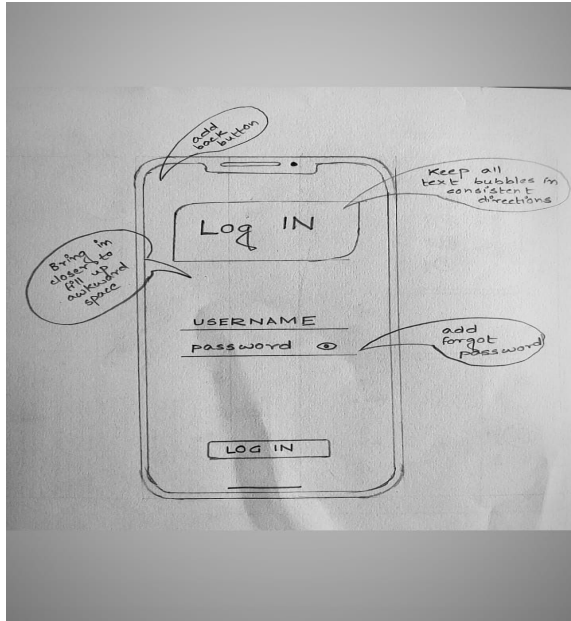


This is how the UI looks like when the application is opened for the first time.



This page helps you get started by either logging in or signing up (for new user).

User Interfaces

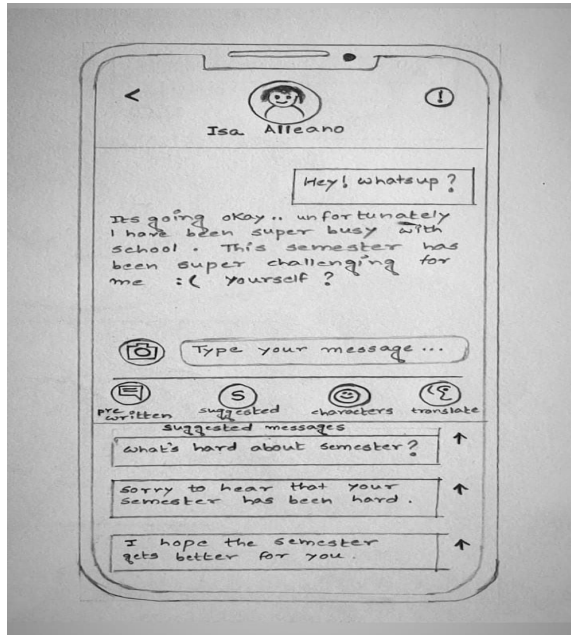


This is how the login interface looks like.



The pre-written messaging feature stores frequently used messages and saves time for the user.

User interfaces



The suggested messages helps the user save time and effort by suggesting them with the most likely reply.

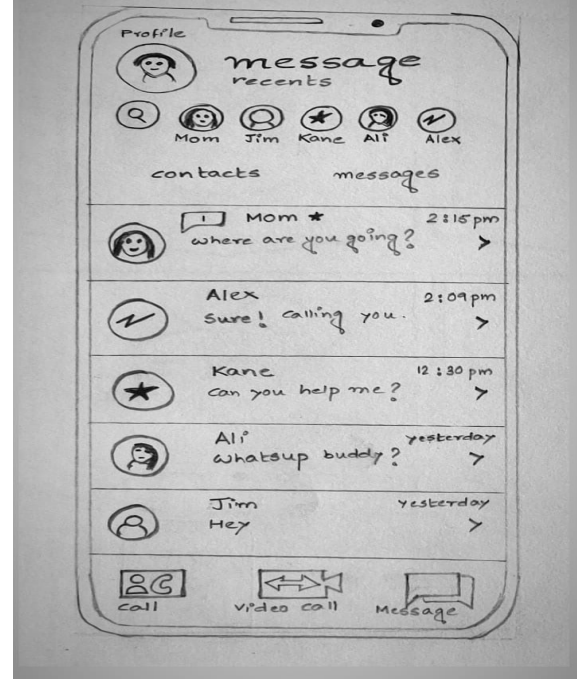


This is the Sign Language Detection video calling feature which helps differently abled people communicate.

User Interfaces

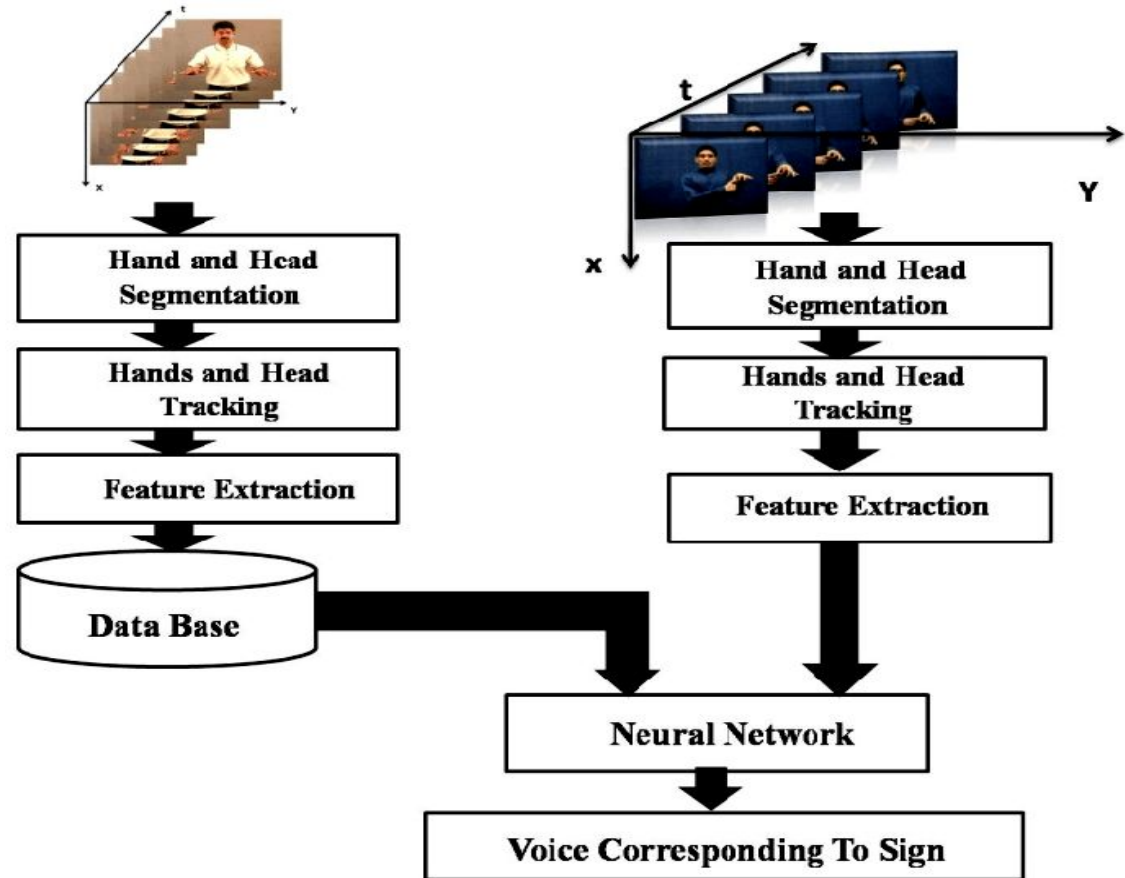


This is a video calling feature with audio to text feature.



This is how the inbox of the user looks like.

System Backend



Use cases:

1. **Help desks:**

The sign language recognition system can be used in help desks in some public and private places like airport, hospitals etc. In this way it might help ease the life of people who are mute or hard of hearing.

2. **Communication platforms:**

This system can be integrated with communication platforms/social media so that differently abled people can use it normally just like normal people.