

**GOVERNMENT COLLEGE OF ENGINEERING
THANJAVUR
B.E – COMPUTER SCIENCE AND ENGINEERING**

**REAL-TIME COMMUNICATION SYSTEM
POWERED
BY AI FOR SPECIALLY ABLED
PROJECT REPORT**

Submitted by

TEAM ID : PNT2022TMID47231

TEAM MEMBERS:

RAIHANA BHEGAM H	19CS40
PAVITHRA N P	19CS37
SHERANSHEELA R	19CS44
BHUVANA J	19CS305

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ABSTRACT

Deaf and mute people use sign language to communicate. Unlike acoustically conveyed sound patterns, sign language uses hand gestures, facial expressions, body language and manual communication to convey thoughts. Due to the considerable time required in learning Sign Language, people find it difficult to communicate with specially-abled people, creating a communication gap. Hence conventionally, people face problems in recognizing sign language. Moreover, different countries have their respective form of sign gesture communication which results in non-uniformity. The ISL (Indian Sign Language) used in India is largely different from the American Sign Language used in the US, mostly because of the difference in culture, geographical and historical context. Somewhere between 138 and 300 different types of sign language are currently being used throughout the world. Sign language structure varies spatially and temporally. We have identified these as a major barrier in communication with a significant part of society. And hence, we propose to design a system that recognizes different signs and conveys the information to people. The component of any sign language consists of hand shape, motion, and place of articulation. When combined, these three components (together with palm orientation) uniquely determine the meaning of the manual sign. For sign language identification, sensorbased and vision-based methods are used. In vision-based gesture recognition technology, a camera reads the movements of the human body, typically hand movements and uses these gestures to interpret sign language, whereas in sensor-based methods, real-time hand and finger movements can be monitored using the leap motion sensor. We aim at developing a scalable project where we will be considering different hand gestures to recognize the letters and words. We plan to use different deep learning models to predict the sign. This may be developed as a desktop or mobile application to enable specially abled people to communicate easily and effectively with others. However, this project can later be extended to capture the whole vocabulary of ASL (American Sign Language) through manual and non-manual signs.

Keywords: Sign language, ASL, ISL, Dynamic hand gesture recognition

1.INTRODUCTION

1.1Project Overview

Real-time communications (RTC) is any mode of telecommunications in which all users can exchange information instantly or with negligible latency or transmission

delays. In RTC, there is always a direct path between the source and the destination. Although the link might contain several intermediate nodes, the data goes from source to destination without being stored in between them. In contrast, asynchronous or time shifting communications, such as email and voicemail, always involve some form of data storage between the source and the destination. In these cases, there is an anticipated delay between the transmission and receipt of the information.

1.2 PROBLEM STATEMENT

The Deaf and mute community can only communicate using sign language. Sign language involves simultaneously combining hand shapes, orientations, gestures and movement of the hands, arms, or body to express the speaker's thoughts. Because of cultural, geographic and historical differences, there exists over 300 different types of sign languages around the world. The ISL (Indian Sign Language) used in India is very different from the American Sign Language used in the United States. This causes inconsistency of sign languages around the world. Moreover, learning sign language requires significant amount of time and effort. This makes it difficult for the conventional world to learn and hence interact with the deaf and mute community. According to a recent study, out of every thousand kids born, 2 to 3 of them are deaf or hard-of-hearing, and, as degrees of hearing loss go, there are 16 to 30 times more children who are identified as Deaf (having a Profound 91+dB hearing loss) than hard-of-hearing. For those deaf or hard of hearing children, only 10% of parents & family learn sign language to communicate with them. We identify this as a major barrier in communicating with a significant part of the society.

1.2 Purpose

Real-time communication (RTC) refers to any communication that happens between two (or more) individuals in real-time – with minimal latency and without transmission delays. Some examples of real-time communication include landline phones, mobile calls, instant messaging, VoIP, and video conferencing.

OBJECTIVE AND MOTIVATION

The objective of our project is to bridge the gap and ensure the inclusion of deaf and mute community into the conventional society meanwhile ensuring an easy and effective mode of communication. We aim at designing a real time system that recognizes the sign language and expresses the same in an easy language, like English. Currently, extensive work has been done on American sign language recognition, but Indian sign language differs significantly from American sign language. ISL uses two hands for communicating (20 out of 26) whereas ASL uses single hand for communicating. Using both hands often lead to obscurity of features due to overlapping of hands. In addition to this, lack of datasets and variance in sign language with locality has resulted in restrained efforts in ISL gesture detection. Our project aims at taking the basic step in bridging the communication gap between normal people and deaf and dumb people using Indian sign language. Effective extension of this project to words and common expressions may not only make the deaf and mute people communicate

faster and easier with outer world, but also provide a boost in developing autonomous systems for understanding and aiding them.

Communication between Deaf and Mute People and Normal People Chat applications have become a powerful media that assist people to communicate in different languages with each other. There are lots of chat applications that are used different people in different languages but there is not such a chat application that has facilitated to communicate with sign languages. The developed system is based on Sinhala Sign language. The system has included four main components as text messages are converted to sign messages, voice messages are converted to sign messages, sign messages are converted to text messages and sign messages are converted to voice messages. Google voice recognition API has used to develop speech character recognition for voice messages. The system has been trained for the speech and text patterns by using some text parameters and signs of Sinhala Sign language is displayed by emojis. Those emojis and signs that are included in this system will bring the normal people closer to the disabled people. This is a 2-way communication system, but it uses pattern of gesture recognition which is not very reliable in getting appropriate output.

Intelligent Sign Language Recognition

Using Image Processing Computer recognition of sign language is an important research problem for enabling communication with hearing impaired people. This project introduces an efficient and fast algorithm for identification of the number of fingers opened in a gesture representing an alphabet of the Binary Sign Language. The system does not require the hand to be perfectly aligned to the camera. The project uses image processing system to identify, especially English alphabetic sign language used by the deaf people to communicate. The basic objective of this project is to develop a computer based intelligent system that will enable dumb people significantly to communicate with all other people using their natural hand gestures. The idea consisted of designing and building up an intelligent system using image processing, machine learning and artificial intelligence concepts to take visual inputs of sign language's hand gestures a generate easily recognizable form of outputs. Hence the objective of this project is to develop an intelligent system which can act as a translator between the sign language and the spoken language dynamically and can make the communication between people with hearing impairment and normal people both effective and efficient. The system is we are implementing for Binary sign language, but it can detect any sign language with prior image processing.

Sign Language Recognition Using Image Processing One of the major drawbacks of our society is the barrier that is created between disabled or handicapped persons and the normal person. Communication is the only medium by which we can share our thoughts or convey the message but for a person with disability (deaf and mute) faces difficulty in communication with normal person. For many deaf and dumb people, sign language is the basic means of communication. Sign language recognition

(SLR) aims to interpret sign languages automatically by a computer in order to help the deaf communicate with hearing society conveniently. Our aim is to design a system to help the person who trained the hearing impaired to communicate with the rest of the world using sign language or hand gesture recognition techniques. In this system, feature detection and feature extraction of hand 23 gesture is done with the help of SURF algorithm using image processing. All this work is done using MATLAB software. With the help of this algorithm, a person can easily train a deaf and mute

2.LITERATURE SURVEY

2.1 Existing Problem

In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communication between deaf-mute and a normal person has always been a challenging task. It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used. Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired person in any language.

2.2 REFERENCES

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2.3 Problem Statement Definition

In our society, we have people with disabilities. The technology is developing day by day but no significant developments are undertaken for the betterment of these people. Communications between deaf-mute and a normal person has always been a challenging

task. It is very difficult for mute people to convey their message to normal people. Since normal people are not trained on hand sign language. In emergency times conveying their message is very difficult. The human hand has remained a popular choice to convey information in situations where other forms like speech cannot be used. Voice Conversion System with Hand Gesture Recognition and translation will be very useful to have a proper conversation between a normal person and an impaired person in any language. The project aims to develop a system that converts the sign language into a human hearing voice in the desired language to convey a message to normal people, as well as convert speech into understandable sign language for the deaf and dumb. We are making use of a convolution neural network to create a model that is trained on different hand gestures. An app is built which uses this model. This app enables deaf and dumb people to convey their information using signs which get converted to human understandable language and speech is given as output.

3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation & brainstorming

3.3 PROPOSED SOLUTION

The motive of our application is to make deaf-dumb people communicate easily with the people by the help of real-time system.

S.No	Parameter		Description
1	Problem statement (problem to be solved)		To solve the issues of deaf-dumb people to communicate with the people to make them feel confident
2	Idea/Solution description		Converting sign language into voice and text in the desired language (two-way communication) using Convolutional Neural Network technology.
3	Novelty/Uniqueness		Upgrading our solution by implementing an alert system using Big Panda algorithm for improvement
4	Social Impact/Customer Satisfaction		To reduce the risk of losing their lives. It increases the scope for career development. It will smash all the barriers and will help to enhance their skills in a positive manner.
5	Business Model(financial Benefit)		We will collaborate with multi deaf-dumb organizations to outspread the application. Here we give most of the basic features at free cost but they have to pay if they need more advanced features.
6	Scalability of Solution		It has very less complexity for the user Encoding the errors and decoding with better accuracy.

3.3 PROBLEM SOLUTION FIT

4 REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

- System is presented as black box
- Hearing impaired is the person that performs the signs
- Normal hearing is the passive user of the system The System Requirements Can Be Specified
- Hearing impaired person should be able to perform sign that represent digit number
- Hearing impaired person should be able to perform sign that represent alphabet letter
- 29
- Hearing impaired person should be able to perform sign that represent word
- Hearing impaired person should be able to perform sign that represent sentence
- Hearing impaired person should be able to see the translation of sign to text
- Hearing impaired person should be able to change the component (number/alphabet or word/sentence) for which translation to speech is provided

NORMAL FLOW

- User comes in front of camera and performs the alphabet letter
- System analyzes the performed sign
- System shows the sign meaning as text and speech

ALTERNATIVE FLOWS

System indicates that user is not within field of view of Kinect

- System shows that user is not detected
- User enters the field of view
- System shows that user is detected

Sign not recognized

1. System does not react to indicate that sign was not recognized 2. User performs again the alphabet letter until it is recognized

Enabling speech for this component:

1. Enable speech component

4.2 NON FUNCTIONAL REQUIREMENT

FRNo.	Non-FunctionalRequirement	Description
NFR-1	Usability	The designed system is easy to use for speciallyabledpersonsasitisportableand platformindependent.
NFR-2	Security	Convertedinformationusingsignsintospeechis accessed only by the user.
NFR-3	Reliability	Systemistestedwithlargenumberofdataand Providesinsight into issues.
NFR-4	Performance	QuickLaunchtimeofapplicationandfasterinconverting signs into speech
NFR-5	Availability	Providesautomaticrecoveryand Useraccess.
NFR-6	Scalability	Standard network condition the device shouldconvertinformationwithinsecond.

5 PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

A data flow diagram is a traditional visual representation of the information flow within a system. It shows how data enters and leaves the system. It uses defined symbols like rectangles, circles and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination.

6 SPRINT DELIVERY PLAN

9 RESULTS

9.1 Performance metrics

PROJECT DEMO LINK

GITHUB LINK

<https://github.com/IBM-EPBL/IBM-Project-51371-1660978588>

https://drive.google.com/file/d/1Wqo6hKcUSW4Vnu2zV40vLrw1lQrXBx5D/view?usp=share_link