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Aiding Application of Speech-Hearing Impaired for Effective Social Contact

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Abstract— In this world many people suffer from hearing loss (deaf) and speech loss (dumb) that might have occurred since birth or during their lifetime later. It is tedious for the deaf & dumb people to talk with the ordinary people. Peoples with sensory disabilities use their hands, fingers to communicate and have access to the world. Sign language is an expressive way for communication between normal and deaf-dumb people and it is the symbolic representation of words by using hands and fingers in different positions. So ordinary people like us learn the sign language for the purpose of communication. The sign language of deaf and dumb is quite difficult to learn and it is not possible for everybody to learn that language. So every person cannot come and share their thoughts with these physically impaired people. Sign language has the major limitation as it is hard to understand by a normal people, only persons those who know the sign language can able to communicate. So it creates barrier in communication between the impaired and normal people. Hence there must a midway that would perform gesture detection, convert the gestures into speech format (gesture to voice translating module) and converts the speech of normal person to gesture (speech to image translating module) and it is displayed on display. So, the whole idea is to build an android application that enables two way communications between deaf-mute (speech-hearing impaired) person and a normal person. This application uses certain image processing techniques.

Keywords— Image processing, Gesture detection, Sign language.

1. Introduction

Humans know each other by conveying their ideas, thoughts, and experiences to the people around them. Through speech everyone can very convincingly transfer their thoughts and understand each other. Communication is a process of exchanging ideas, thoughts, feelings and information in form of verbal or non verbal message. For effective communication it is important that sender as well as receiver can understand it. The big reason behind the lack of communication is that deaf people are unable to listen and dumb people are unable to speak.

The only means of communication available to the deaf and dumb people is the use of Sign Language. Using sign language they are limited to their own world. This limitation prevents them from interacting with the outer world to share their feelings, creative ideas and Potentials. Very few people who are not themselves deaf and dumb ever learn to Sign language. These limitation increases the isolation of deaf and dumb people from the common society. So, deaf and dumb people use gesture to communicate with normal person. Gesture refers to any bodily motion or states particularly any hand motion or face motion (or) Gestures are various hand movement of specific shape. Normal people cannot understand the actual meaning of those gestures. Technology is one way to remove this hindrance and benefit these people.

Hand gesture recognition provides an intelligent and natural way of human computer interaction (HCI). Hand gesture recognition is an area in computer science and language technology that aims in defining human gestures via mathematical algorithms. With gesture recognition it is possible for humans to interact naturally with machines without the aid of any mechanical devices. Hand gesture is one of the most expressive and most frequently used among a variety of gestures. Applications of hand gesture recognition are varied from sign language to virtual reality. Gesture recognition is classified into two main categories i.e. vision based and sensor based. Vision based is capturing hand gesture using web camera whereas, Sensor based is capturing gesture using flex sensor and hand gloves. Some disadvantages of vision based techniques such as it includes complex algorithms. Another challenge in image processing includes variant lighting conditions, backgrounds and field view constraints and occlusion.

The aim of this paper is to present an application that can efficiently convert sign language gesture to speech. The only way to enhance the communication between dumb-deaf people and normal people is recognition of sign language and converting it to the corresponding voice signal. A webcam is placed in front of the physically impaired person. The physically impaired person would be performing hand gestures using his fingers. When he makes the gestures, the webcam will capture the exact positions of the fingers and perform image processing to determine the co-ordinates of the displacements. The co-ordinates captured will be mapped with the one previously stored and accordingly exact gesture will be captured. Continuing in this way physically impaired person will be able to go through the entire speech that he wants to communicate. Later on this gesture will be converted into voice so that it would be audible to everyone. Further the application aims

to convert the speech signals from the normal person to sign language and the equivalent gesture for that speech signal will be displayed to the impaired person. Hence the two way communication is possible. This application can also help the visually impaired people to communicate with speech impaired people. This project aims to bridge the gap by introducing an inexpensive android mobile in the communication path so that the sign language can be automatically captured, detected and translated to voice for the benefit of the blind people and people who cannot understand the sign language.

2. Literature Survey

Table 1: Articles with its advantages and disadvantages

S. No	Title	Author Name	Publication Journal/Date	Disadvantage	Advantage
1	Gesture-controlled user interfaces, what have we done and what's next?	Moniruzzaman Bhuiyan , Rich Picking	Proceedings of the Fifth Collaborative Research Symposium on Security, E-Learning, Internet and Networking (SEIN 2009), Darmstadt, Germany. 2009.	Some users are uncomfortable with the common input devices.	We present a review of the history of Gesture controlled user interface (GCUI), and identify trends in technology, application and usability.
2	Hand Gesture Recognition Based on Karhunen-Loeve Transform	Joyeeta Singha, Karen Das	Mobile & Embedded Technology International Conference, pp. 365-371, 2013.	Continuously focusing on hand gestures by manual is very difficult.	we propose an easy approach to recognize different hand gestures based on KL Transform.
3	Approach to Hand Tracking and Gesture Recognition Based on Depth-Sensing Cameras and EMG Monitoring	Ondrej Kainz, František Jakab	Acta Informatica Pragensia, Vol:3, No:1, pp.104–112, 2014.	Nature of gesture can be not only static but also dynamic, so it is difficult to notice.	A new approach for hand tracking and gesture recognition based on the Leap Motion device and surface electromyography (SEMG) is presented.
4	Lessons Learned in Exploring the Leap MotionTM Sensor for Gesture-based Instrument Design	Jihyun Han, Nicolas Gold	Proceedings of the International Conference on New Interfaces for Musical Expression, pp. 371-374, July 2014.	The problem is that the methods are called on every frame so MIDI messages were being triggered for every consecutive frame where the fingers moved faster than a certain speed	It presents lessons learned from work-in-progress on the development of musical instruments and control applications using the Leap MotionTM sensor.
5	The Leap Motion controller: A view on sign language	Leigh Ellen Potter, Jake Araullo, Lewis Carter	Proceedings of the 25th Australian Computer-Human Interaction Conference: Augmentation, Application, Innovation, Collaboration, pp. 175-178. ACM, 2013	We find less accuracy in the existing system.	This paper presents an early exploration of the suitability of the Leap Motion controller for Australian Sign Language (Auslan) recognition.
6	Wireless Hand Gesture Capture Through Wearable Passive Tag Sensing	Rachel Bainbridge, Joseph A.Paradiso	International Conference on Body Sensor Networks, pp. 200-204, 2011	Most issues faced in fielding this system were related to power needed by the small passive tags and limited by transmit power and antenna efficiency, due to the constraints on the size of the passive tags.	The paper presents the first implementation of an HCI finger gesture tracking system built from passive RFID tags.

7	Vision Based Hand Gesture Recognition	Pragati Garg, Naveen Aggarwal and Sanjeev Sofat	International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:3, No:1, pp. 186-191, 2009	Recognizing the temporal start and end points of meaningful gestures from continuous motion of the hand. This problem is sometimes referred to as "gesture spotting".	This paper illustrates a 3D application where you can move and rotate objects simply by moving and rotating your hand - all without touching any input device.
8	A Communication System for Deaf and Dumb People	Shraddha R. Ghorpade, Prof. Surendra K. Waghmare	International Journal of Science and Research (IJSR) Volume 4 Issue 9, pp. 1914-1917, September 2015	The nature of the background, existence of other objects (occlusion), and illumination must be considered.	An easy approach for image acquisition and image segmentation is presented in this paper.
9	Image Processing Based Language Converter for Deaf and Dumb People	Koli P.B., Chaudhari Ashwini, Malkar Sonam, Pawale Kavita & Tayde Amrapali	IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) , e-ISSN: 2278-2834, p-ISSN: 2278-8735, pp. 25-30, 2015	In this system, coloured rings are used. This should be worn in fingers to give gestures. This is not affordable by the poor people.	This method is tested on different gestures. It produces a stable and good results. It helps to communicate with everyone using language converter.
10	Gesture Vocalizer For Deaf And Dumb	Kshirasagar Snehal P., Shaikh Mohammad Hussain, Malge Swati S., Gholap Shraddha S., Mr. Swapnil Tambatkar	International Journal Of Engineering Sciences & Research Technology, Volume: 5, Issue: 4, pp. 547-553, April 2016	AVR controller is used. It is a RISC(Reduced Instruction Set Computing) which is a CPU design strategy.	Flex sensors and accelerometer are mounted in gloves. It gives most promising result with high accuracy and sensitivity.
11	Gesture Detection For Deaf And Dumb People	Sangeetha, K. And Barathi Krishna, L.	International Journal Of Development Research Vol. 4, Issue 3, pp. 749-752, March, 2014	This system has skin detection problem because there is no threshold set for Skin probabilities. So it has low accuracy rates.	This system doesn't require any gloves and devices for detecting hand movements. This can be used by people by spending less cost.
12	Full Duplex Communication System for Deaf & Dumb People	Shraddha R. Ghorpade, Surendra K. Waghamare	International Journal of Emerging Technology and Advanced Engineering Volume 5, Issue 5, pp. 224-227, May 2015	Using Flex sensors are so costly. To convert voice to image .wav files are needed.	It facilitates two way communications. The system overcomes the necessary time difficulties of dumb people and improves their manner.

3. Methodology Used

Deaf and mute are facing the communication problem with everyone they interact and the key solution is the Sign language. Communication between the deaf and non-deaf has always been a very cumbersome task. Finding an expert interpreter for the day to day activities is a difficult task and is also unaffordable. Since communication is the fundamental aspect of human survival, various measures have been taken to technically improve the ease of communication for the deaf. This paper describes the system that overcomes the problem faced by the speech and hearing impaired. The main objective is to establish the communication process between Deaf & Dumb and the normal person. The modules includes

- Mobile application
- Voice to Image Conversion
- Gesture to Speech Conversion

3.1 Mobile Application

One of the most popular handicaps is the deaf and dumb type, which prevent person from listening and talking. The number of deaf and dumb in the world continuously

increasing and they are introverted closed society. In this paper, we introduce an integrated android application to blend uneducated Deaf-Dumb people within society, and help them to communicate with normal people. The mobile application is proposed to recognize the sign language. Android based mobile application is deployed in the deaf & dumb person for communication purpose. Once the application is installed in the user's android mobile using .apk file, the user can open an android application. The user is asked to enter the mobile number and the logical address. Then, the application takes the user to the section where he/she has to select either gesture input or voice input. Generally, the gesture input is provided by the impaired person and the voice input is given by normal people. This is the main model to obtain the gesture inputs and to process them. In this mobile application, camera is automatically initiated and captures the gesture input image provided by the deaf & dumb person. Then the stored pre-recorded voices are generated as the output for input gestures. Normal person will speak through an android application, it recognizes the voice input which is converted into text and corresponding image is displayed to the Deaf & Dumb person. So this application can be implemented from the both the end.

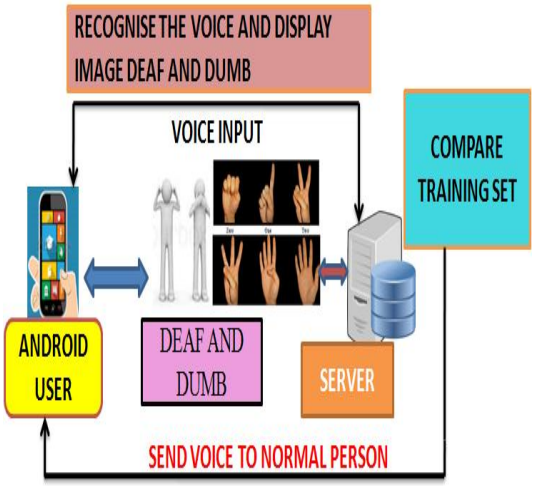

Fig.1: Architecture Diagram

3.2 Voice to Image conversion

In this module, the translation of the voice input to the hand gesture images is illustrated. When the user chooses voice input, he/she will be asked to speak by clicking a specific button in an application. Once the user's voice is recognized using speech recognition functions, it is converted into text. If not recognized, application will trigger an automatic toast message. The converted text is taken as an input. The text obtained is compared with the pre-defined set of texts. As the text matches, the corresponding and the equivalent image or the hand gesture frame is displayed as a message to the impaired user. The hearing impaired person can easily understand what the normal person speaks. The conversion of voice to image is shown in the fig.2.

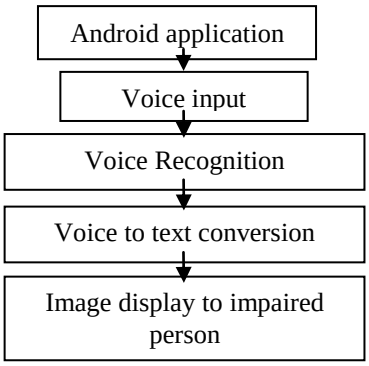

Fig.2: Flow diagram for voice to image conversion

3.3 Gesture to Speech Conversion

In this module, the translation of the hand gesture input to the speech is explained. This module includes sub modules image acquisition, image preprocessing and gesture recognition. From the hand gesture image captured, the background is eliminated and converted into voice and the flow chart for the image to speech conversion is shown in the fig.3 and fig.4 respectively.

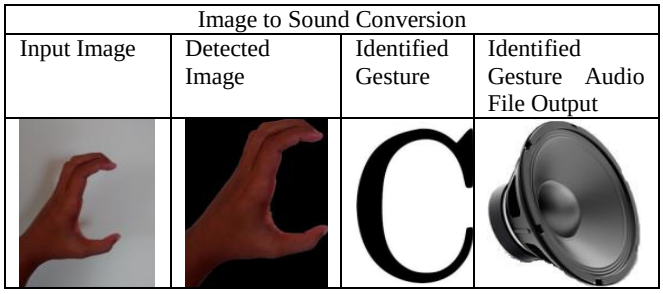

Fig.3: Background is eliminated from image and converted to voice

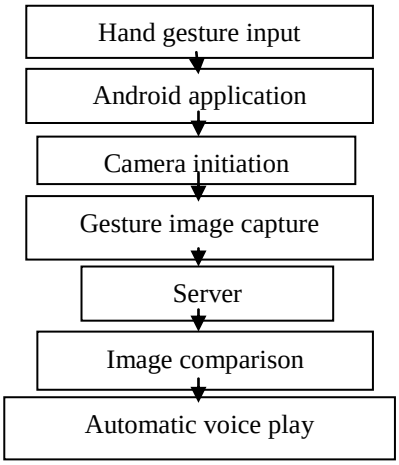

Fig.4: Flow diagram for gesture to voice conversion

3.3.1 Image Acquisition

The first stage of any vision system is the Image acquisition stage. Image acquisition is the creation of photographic images, such as of a physical scene or of the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images. Image acquisition is the process to capture the hand gesture images which represents different signs. The resolution of various image capturing devices may not be the same.

This results in different resolution of the captured images. For accurate comparison of the features and to reduce the computational effort needed for processing, all the images should be scaled to a uniform size. Thus the images for training and testing are captured with web camera and database is created. This database consists of hand gesture. An image acquisition android camera is used, after that frames are send to the server which is followed by thinning that reduce the noise. The module briefly describes the schemes of capturing the image from android device, image detection, and processing the image to recognize the gestures.

3.3.2 Image preprocessing

A pre-processing is very much required task to be done in hand gesture recognition system. Pre-processing is applied to images before we can extract features from hand images. Segmentation is the classification of the input coloured image into skin and non-skin pixels based on skin colour information. Preprocessing also includes the background subtraction algorithm. The object or hand gesture focused is considered as dark pixels and the background is considered as light pixels. The light pixels are eliminated and the gesture is segmented. Features of the segmented image can be extracted in different ways according to particular application. Under different scene conditions, the performance of different feature detectors will be significantly different. The nature of the background, existence of other objects (occlusion), and illumination must be considered to determine what kind of features can be efficiently and reliably detected.

3.3.3 Gesture Recognition

Gesture recognition is a growing field of research among various human computer interactions; hand gesture recognition is very popular for interacting between human and machines. It is nonverbal way of communication and this research area is full of innovative approaches. This module aims at recognizing basic hand gestures. The main features used are centroid in the hand, presence of thumb and number of peaks in the hand gesture. That is the algorithm is based on shape based features by keeping in mind that shape of human hand is same for all human beings except in some situations. The recognition approach used in this project is artificial neural network in Machine learning algorithm. For each gesture, two or more images should be stored in the database. The application is trained to recognize the pre-stored gestures under varying conditions like differing angles, orientation and illumination. An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process.

4. Conclusion

The main aim of our project is to provide a helping hand to the deaf and dumb people. We as normal human beings too find it difficult to communicate our feelings with them. This paper proposes a simple and efficient sign language recognition system to eradicate the communication gaps between the deaf and dumb people with normal people. Our method doesn't require any gloves and devices for detecting the hand movements, owing to this cost of the system is reduced by great margin. This system can be used by people by spending less cost when compared to the existing system, since the latter requires additional devices to detect hand gestures. There are reasons for poor performance of testing data. The huge variation in images also played a part in low accuracy rates. This includes different sizes of gestures in the images, different background of images, different orientations and angle of gestures, etc.

The proposed method is tested on different gestures. It produces fairly stable and good results using Image Processing Technique. Sign language is a useful tool to ease the communication between the deaf person and normal person. The application aims to lower the communication gap between deaf people and normal world, since it facilitates two way communications.

The projected methodology interprets sign language gesture into speech and the speech of normal person is converted into text and corresponding hand gesture is displayed, so the communication between them can take place easily. Our intention in this project is that we make our end users, the deaf and dumb and the normal people happy and satisfied while using this application for communication.

Future work will address extraction of frame from live video feed using and applying frame filtering techniques such as blurring, RGB to HSV conversion and removing noise so that the image so obtained would make the gesture detection simpler. After getting the gesture, the database is matched with the gesture and corresponding speech is given out.

References

[1] Bhuiyan, Moniruzzaman, and Rich Picking, "Gesture controlled user interfaces, what have we done and what's next.", Proceedings of the Fifth Collaborative Research Symposium on Security, E-Learning, Internet and Networking (SEIN 2009), Darmstadt, Germany. 2009.

[2] Singha, Joyeeta, and Karen Das, "Hand gesture recognition based on "Karhunen-Loeve transform.", Mobile & Embedded Technology International Conference, pp. 365-371, 2013.

[3] Kainz, Ondrej, and František Jakab, "Approach to Hand Tracking and Gesture Recognition Based on Depth-Sensing Cameras and EMG Monitoring.", Acta Informatica Pragensia, Vol:3, No:1, pp.104–112, 2014.

[4] Han, Jihyun, and Nicolas Gold, "Lessons Learned in Exploring the Leap Motion TM Sensor for Gesture-based Instrument Design", "Proceedings of the International Conference on New Interfaces for Musical Expression, pp. 371-374, July 2014.

[5] Potter, L. E., Araullo, J., & Carter, L. "The leap motion controller: a view on sign language", Proceedings of the 25th Australian Computer-Human Interaction Conference:Augmentation, Application, Innovation, Collaboration, pp. 175-178. ACM, 2013

[6] Rachel Bainbridge, Joseph A. Paradiso, "Wireless Hand Gesture Capture through Wearable Passive Tag Sensing", International Conference on Body Sensor Networks, pp. 200-204, IEEE 2011.

[7] Pragati Garg, Naveen Aggarwal and Sanjeev Sofat ,"Vision Based Hand Gesture Recognition", International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:3, No:1, pp. 186-191, 2009.

[8] Shraddha R. Ghorpade, Prof. Surendra K. Waghmare,"A Communication System for Deaf and Dumb People", International Journal of Science and Research (IJSR) Volume: 4, Issue: 9, pp. 1914-1917 September 2015.

[9] Koli P.B., Chaudhari Ashwini, Malkar Sonam, Pawale Kavita & Tayde Amrapali, "Image Processing Based Language Converter for Deaf and Dumb People", IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), e-ISSN: 2278-2834, p-ISSN: 2278-8735 pp.25-30, 2015

[10] Kshirasagar Snehal P., Shaikh Mohammad Hussain, Malge Swati S., Gholap Shraddha S.,Mr. Swapnil Tambatkar, "Gesture vocalizer for deaf and dumb", International Journal Of Engineering Sciences & Research Technology, Volume: 5, Issue: 4, pp. 547-553, 2016.

[11] Sangeetha, K. and Barathi Krishna, L., "Gesture detection for deaf and dumb people", International Journal of Development Research, Vol. 4, Issue. 3, pp. 749-752, March, 2014.

[12] Shraddha R. Ghorpade, Surendra K.Waghamare, "Full duplex communication system for deaf and dumb people", International Journal of Emerging Technology and Advanced Engineering, Volume: 5, Issue: 5, pp. 224-227, 2015.