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Survey on sign language recognition and translation device for speech impaired people based on image processing

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***Abstract*— Communication is a major role in the society. Gesture is a non-verbal communication where deaf/dumb people use hand gestures to communicate with the normal people. Since normal people don't have idea about the hand gesture, it is very difficult for the normal people to understand the sign language and communicate with them. For each sign language there will be a specific meaning by the mute people. The main purpose of this survey paper is to overview the techniques for recognition and conversion system for mute people.**

Index Terms— ***Gesture, sign language, mute people***

I. INTRODUCTION

The dumb/deaf people convey their message , ideas and thoughts to the outside world using sign language instead of words. No standard sign language is there for mute people in the world since it differs from place to place or region to region. The need of the hour is to design a mechanism that converts the sign language made by the mute people into a form which is understood by the normal people.

In recent years, mainly the researchers had focused on hand gestures recognition and converting them into human hearable voice and readable text. Vision based and sensor based approach are the sign language approaches. In vision based approach, images are captured using camera as an input and in sensor based; data glove sensors are used to recognize the input. In 1977, first data glove was developed.

During 2019 census of India, there was around 1.6 million speech impaired people in India. Disability prevalence is more in males than females. Many researchers have invented various technologies that enhance to help the speech impaired people. These technologies used to remove barriers and communicate independently with their feelings and thoughts. Translator is the main device for mute people to convert their sign language into human hearable voice and text.

Some of the technologies are converting sign language to voice and voice into text. Technologies not only convert voice into human understandable language but also convert it into some readable form. It also coverts voice into sign language and text into sign language. This technology uses various sensors, accelerometer, text to speech conversion module, wearable devices and microcontroller etc. The main objective of this paper is to survey on the technologies that are made easy for speech impaired people to minimize the communication gap between deaf/dumb and normal people and also helps them to convey their messages with outside world. Technologies include voice to sign, voice to text, text to sign and text to voice

II. LITERATURE SURVEY

Many researches have done there research paper on sign language conversion into voice and text messages. Some of them are Nabil Drawil et al developed a system called Data Acquisition Control system that translate a sign language into human hearable voice and readable text. They developed Sign Language Translator and Gesture Recognition [1]. Here data glove is fixed with sensors and to represent the each alphabet each finger will be captured and after capturing the gesture will be converted into text and voice. The advantages here is that the message can be sent to smart phone in wireless network. Disadvantage is that here only 20 alphabets can be recognized out of 26 alphabets.

Vaibhav Mehra et al developed a system called Gesture to speech conversion using flex sensors, MPU6050 and python [2]. Here prototype is used to convert the sign language into speech and text using flex sensor and image processing method. Speech impaired people uses this wearable device i.e. data glove attached with flex sensors, accelerometer, gyroscopic which converts hand gesture into human hearable voice while image processing method is used to capture hand gesture and converts into prerecorded voice. Arduino Uno microcontroller which is used with interfaced python language to get better and accurate result.

Archana S Ghotkar et al developed prototype called Hand gesture recognition for Indian sign language [3]. Here Genetic algorithm is used for gesture recognition. This project is developed for recognizing both hands accurately i.e. single hand and double hand gestures. This system recognizes hand gesture, real time hand tracking, hand segmentation and extraction. The major method in this system is cam shift method which gives accurate result and it has inbuilt camera and is inexpensive.

Vigneshwaran et al developed hand gesture recognition and voice conversion system for dumb people [4] which are used to convert the sign language into voice and text by using raspberry pi microcontroller. Vision and non- vision method are used in this project but vision based does not give

accurate result and one drawback is that to recognize sign language each time dumb people should show their hands in front of the camera.

Lin-jen kau et al developed a portable as well real time system prototype called a real time portable sign language translation system [5] deals with recognizing the hand gesture wirelessly for converting Taiwanese sign language using data glove. This system uses the sensors told in [2] for conversion. Inertial sensor is attached to palm back position which is used for detecting hand motion and palm orientation. The accuracy in this project is 94% and it can only detect sign language.

Gesture language is a way of communication for dumb people. B.G Lee et al developed smart wearable hand device for sign language interpretation system with sensors fusion

[6] project to help the mute people to communicate independently by using sensor, processing and mobile application module in their project. In their first version sign language conversion are having only 65% accuracy without any pressure sensors. In the second version of wearable device it has overcome the drawback of previous version and the output is with 98% accuracy. It has overcome by using the pressure sensor of fusion to recognize the correct sign language with best result. Vision based is a drawback of this system.

To help both deaf and dumb people to communicate with outside world an electronic speaking system for speech impaired people: speak up system is developed by Safayet Ahmed et al [7] where a smart glove with five flex sensors are used. Here arduino nano microcontroller is used for conversion. In this prototype prerecorded data will be stored in the secondary memory. For specific sign language the prerecorded data will be converted into voice message and text message will be displayed in LCD. In addition to existing system an amplifier is connected to increase the volume of the voice message.

To fill the communication gap between the normal people and deaf/dumb people there is a bridge like system called glove-based hand gesture recognition sign language translator using capacitive touch sensor [8] developed by Kalpattu S Abhishek et al for converting American Sign Language. This device is easily portable and it is very low cost. It can detect all 26 alphabets. The language detection accuracy in this system is about 92% when compared with existing system.

Sign language is main factor for communication with normal and deaf/dumb people. The sign languages are different from region to region and nation to nation. Sometimes it is very difficult to make translation for each sign language of different languages into voice and text. So the L.Jayatilake et al proposed a prototype called communication between deaf/dumb people and normal people: chat assist [9]. Sinhala sign language is used in this method. There is not any chat assisting device in existing system for the deaf/dumb people. In this paper a chat assist application is developed to help the different people with different language and trained with Sinhala sign language and text. Also, developed API of Google voice recognition to recognize the speech and convert into voice messages. Advantage in this system emojis are used which helps the normal people to understand the sign language easily. The objective in this project is to make dumb people communicate easily by using this chat assist tool. One drawback is that there should be internet connection and design only for few words. Advantage is that it has 90%accuracy.

In existing system the system was developed only for deaf/dumb people. In this project the K Naveen Kumar et al developed a assistive device for Blind, deaf and dumb people using raspberry pi [10]. It is very difficult to develop a single system that is useful for three types of impaired people. All these are done through Raspberry pi microcontroller. In this system, the voice and sign language will be converted into text messages using LCD which are understandable by the deaf people. The text messages are converted into voice and image to voice by using Tesseract OCR. Dumb people can send a text message or sign language which is translated into hearable voice messages by using speaker. These project does all of three and provided a solution for all three type of impaired people. Opencv method is used for face recognition or object recognition. Advantages are the images are converted into voice for blind people, texts are converted into voice for dumb people and voice messages are converted into text for deaf people. Drawback is that need to use simple coding language to reduce complicated coding method.

III. OVERVIEW OF THE SYSTEM

The necessary components that are required for developing existing systems specified above and their description is as follows:

A. FLEX SENSOR AND DATAGLOVE:

Bend sensor or flex sensor [1][2] is a device which is used to detect the flexing or bending of a finger. It is placed at back of the palm and gives the readings for each finger. As the human gesture is made at particular movement corresponding information is translated. Hence flex sensor are directly connected to microcontroller. Data glove consist five flex sensor attached to each finger, contact sensor and accelerometer of 3 dimensions (ax, ay, az) and gyroscope of 3 dimensions (gx, gy, gz).

$V_0 = V_t$

B. MICROCONTROLLER

It consists of different types of arduino board [1][2] to control the entiresystem. LCD display, analog to digital conversion pin, SD card etc. are all connected to the single microcontroller hence called system brain.

C. LCD DISPLAY:

It is connected to arduino and it is of 16x2 displays. The prerecorded data for specific gesture will be displayed on the LCD screen [7] [10].

D. RASPBERRY PI:

Raspberry pi [4] [10] uses a python language. It is in credit card size and easily attached to the monitor or a TV. It works as a computer where we can play games, surf on internet etc., It is a processor and it is a small single board computer.

E. LOGITECH CAMERA:

Logitech camera [3][4] is simple as plug and play setup. It is used for detection of motion and has 256kbps broadband for uploading. The storage size of RAM is 512MB or more and hard disk space is 200MB.

TABLE 1: COMPARISON OF EXISTING SYSTEMS

Parameter	Gesture recognition using gloves	Real-time portable sign language translation	Smart wearable hand device with sensors fusion
Sensors	Touch sensors	Flex and Inertial sensor	Pressure sensor
Translates sign language into speech	Yes	Yes	Yes
Translates sign language into text	Yes	Yes	Yes
Vision based (with camera) to recognize sign language	No	No	Yes
Non–vision based (without camera) to recognize sign language	Yes	Yes	Yes
Accuracy	92%	94.56%	98.2%
Drawback	Large storage energy	Require Bluetooth technology	Large sized printed circuit board

IV. CONCLUSION

The final conclusion of this survey gives detailed description of various technologies of each survey paper. The number of technologies used here is to reduce the communication gap between dumb, deaf and blind people to communicate with the normal people in the outside world. Gloves are important so they are developed carefully and can use by dumb/deaf people. Python languages are used to get accurate and reliable result and it also provides a method to alleviate the difficulties of mute community. Based on these surveys proposed method is used to reduce the communication gap between impaired people with outside world. Our proposed prototype is less weight, easy to carry and less, simple coding. Image processing methods are used to capture the image and convert or translate it into human hearable voice and readable text.

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