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Vocal and gesture based communication for/by disabled persons.

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Corresponding Author:	KARTHIKEYAN A, M Tech Panimalar Engineering College INDIA
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	Panimalar Engineering College
Corresponding Author's Secondary Institution:	
First Author:	KARTHIKEYAN A, M Tech
First Author Secondary Information:	
Order of Authors:	KARTHIKEYAN A, M Tech
Order of Authors Secondary Information:	
Abstract:	In our country 6% of people are visually impaired person and 2.78% of people are not able to speak. The Vision and voice are the major defects for these two persons. Sign language is the language of communication for deaf and dumb people. Most of these physically impaired communities are dependent on sign language translators to express their thoughts to rest of the world. This causes a communication struggle for them in the society. Hence, Sign language recognition is one of the most essential requirements today. The various gestures which are performed by physical movement of our body parts like a facial expression or hand gestures composes a sign language. In this project, the sign language gestures which are performed by person is analyzed for effective communication. Vocal and gesture based communication system provides a device which acts as bridge between two persons by converting the sign language to a vocal output and by converting the voice input into sign language image. The communication between the dumb and visually impaired person are made only by their hand gestures. This project presents various methods of hand gesture and sign language recognition for blind and dumb person.
Suggested Reviewers:	
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Vocal and gesture based communication for/by disabled persons.

[1.]A Karthekeyan [2.]Riyaz Udeen S, [3.]Milind Kumar M, [4.]Srinivasan M

[1]keyanmailme@gmail.com, [2]mohamedriyazpsbb@gmail.com, [3]milindkumar3099@gmail.com, [4]nishantm2000@yahoo.com

Panimalar Engineering College, Chennai

Abstract

In our country 6% of people are visually impaired person and 2.78% of people are not able to speak. The Vision and voice are the major defects for these two persons. Sign language is the language of communication for deaf and dumb people. Most of these physically impaired communities are dependent on sign language translators to express their thoughts to rest of the world. This causes a communication struggle for them in the society. Hence, Sign language recognition is one of the most essential requirements today. The various gestures which are performed by physical movement of our body parts like a facial expression or hand gestures composes a sign language. In this project, the sign language gestures which are performed by person is analyzed for effective communication. Vocal and gesture based communication system provides a device which acts as bridge between two persons by converting the sign language to a vocal output and by converting the voice input into sign language image. The communication between the dumb and visually impaired person are made only by their hand gestures. This project presents various methods of hand gesture and sign language recognition for blind and dumb person.

1. Introduction

Humans are social beings that rely on one another in their surroundings and are interrelated with other individuals. Communication, both verbally and nonverbally, is the only tool that can connect with other people in their environment. Through communication, we speak to ourselves, know and assess ourselves. Through communication, we get to understand and communicate with others and communicate our emotions towards others and through interaction, we solve all types of issues, create fresh thoughts, and share experiences and expertise with others.

Body gestures are often used to clarify the intent of a conversation. However, for systems without the ability to communicate verbally, body gestures can also stand alone to express certain intentions. The most used parts of the body to communicate are the hands and palms. The combination of hand and palm movements is a way to send information or order a purpose, for example, the gesture of waving goodbye, ordering to stop and call.

There is a huge communication gap between a normal and a differently-abled person, our project mainly aims to provide an efficient communication method between them. It is really difficult for us to understand what they are trying to say exactly and vice versa in case of deaf and dumb. To avoid this complexity in understanding each other we develop a Vocal and Gesture based Companion for disabled persons. This product is used for two-way communication.

For Differently abled ->Normal person

We use Deep Learning to analyze sign language shown by the disabled person and the analyzed result is computed and a conversion to text happens and produced as vocal output.

In case of a Normal person-> Differently abled

The person speaks the content like (ONE, TWO, ALL THE BEST, etc...) and this will get converted into sign language using NLP and is fed as a sign language on the display screen. It is decrypted by users who have the appropriate qualities to determine the access structure.

2. LITERATURE SURVEY

HOG-based Hand Gesture Recognition Using Kinect is used to build interactions between humans and computers using hand gestures. The hand gesture is recognized by the palm of the hand

which is obtained from the results of human skeleton segmentation through camera Kinect. Recognition of palm gestures is performed on a series of RGB Kinect output frames. Dynamic Time Warping (DTW) is used as a classifier that will compare the description of the input gesture with the template gesture description. Based on the results of the experiment, the performance of the hand gesture recognition system reached 76.7%. [1]

The proposed design makes use of hand gloves mounted with flex sensors which recognize the characters and commands. The gestures recognized will be displayed as audio and visual output through LCD and Bluetooth speaker. The Optical Character Recognition is used for the blind people in order to recognize the text-based images for audio and LCD display. This system consists of live tracking as one of the modules for tracking the physically challenged people. The purpose is to enhance and improve the system for detecting sign language. The device not only converts sign languages to speech but also has incorporated modules like Optical Character Recognition (OCR) and live tracking. [2]

Smart Hand Gloves help disable people to live with normal people. As dumb person cannot speak then this smart glove helps him to convert his hand gesture into text and pre-recorded voice. This also help normal person to understand what he is trying to say and reply accordingly. This Smart Gloves has facility of Home Appliance control from which a physically impaired person become independent to live. The main objective of the implemented project is to develop a reliable, easy to use, light weight smart hand gloves system which can minimizes the obstacles for disable people where they can stand with the race. [3]

Virtual talk for deaf, mute, blind and normal humans describes a new method of developing wearable sensor gloves for detecting hand gestures which uses British and Indian sign language system. The outputs are produced in the text format using LCD and audio format using APR9600 module. The hand gesture or the hand signs are converted to electrical signals using flex sensor. These electrical signals are processed to produce appropriate audio and text output. Previously designed devices were not accurate in tracing the hand gestures. The paper employs method of tuning in order to improve the accuracy of detecting hand gesture. [4]

The main purpose of this paper is to confer the system that converts a given sign used by disabled person into its appropriate textual, audio, and pictorial form using components such as Arduino Mega, Flex sensors, Accelerometer, which could be understood by a common person. A wearable glove controller is designed with flex sensors attached on each finger, which allows the system to sense the finger movements, and a Gy-61 accelerometer, which are uses to sense the hand movement of the disabled person. The wearable input glove controller sends the collected input signal to the system for processing. The system uses Random forest algorithm to predict the correct output to an accuracy of 85% on current training model. [5]

Communication is the only medium by which we can share our thoughts or convey the message but for a person with disability (deaf and dumb) faces difficulty in communication with normal person. Because of this, a person who lacks in hearing and speaking ability is not able to stand in race with normal person. Communication for a person who cannot hear is visual, not auditory. Generally dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. So there is a barrier in communication between these two communities. This work aims to lower this barrier in communication The main aim of the proposed project is to develop a cost effective system which can give voice to voiceless person with the help of Smart Gloves. It means that using smart gloves communication will not be barrier between two different communities. With the help of these gloves disabled person can also get chance to grow in their respective carrier. Using such devices by disabled person also makes nation grow. [6]

Hand gesture recognition system received great attention in the recent few years because of its manifoldness applications and the ability to interact with machine efficiently through human computer interaction. In this paper a survey of recent hand gesture recognition systems is presented. Key issues of hand gesture recognition system are presented with challenges of gesture system. Review methods of recent postures and gestures recognition system presented as well.

Summary of research results of hand gesture methods, databases, and comparison between main gesture recognition phases are also given. Advantages and drawbacks of the discussed systems are explained finally. [7]

This paper reviews the technology for using hand, body and facial gestures as a means for interacting with computers and other physical devices. It discusses the rationale for gesture based control technology, methods for acquiring and processing such signals from human operators, applications of these control technologies, and anticipated future developments. Today, there is a growing interest in research and development of new human-machine interaction systems that are more natural and ergonomic for the users. Gesture recognition plays an important part of human-machine interaction systems. The focus is done in systems that are based on accelerometers, and on glove based equipment. Based on several papers, the process for different types of approach of gesture control is described. Some applications of these technologies are also presented. [8]

3. Proposed system

There are very few Existing systems/devices for disabled persons (deaf and dumb) and one among them is the **Smart glove to Capture Gesture.** Even though it's existing, it's not affordable for real time utilization because of the following drawbacks: Both the user should have a device, Bulky to wear and difficult to handle, consist of dedicated components which are quite expensive.

The existing Smart glove to Capture Gesture system consist of two gloves (devices) for both the users to wear which makes it difficult to be used at every circumstances. The size of the device is huge and difficult to handle due to which it can only be used with proper handling and care and not eco-friendly to use. It cannot be affordable for real-time utilization due to dedicated and sensitive components. When compared to the typical system of smart gloves for gesture, we build a single wearable device for disabled people to wear. The device consists of embedded camera, mike and speaker. The other user does not need a device. A normal person just needs to speak to the mike, so that the vocal input is recorded and converted into a sign language, which is viewed in a screen by differently abled to understand. Similarly, when a disabled person tried to communicate with hand gestures, it is captured using an embedded camera and the gestural reply is analyzed and converted to vocal format which is fed into the speaker which makes it understandable for the normal user.

This is how the two-way communication between a disabled and a normal person takes place.

3.1. System Architecture:

A disabled person performs gesture through sign language. This sign language is captured by the RPI camera, the image is converted from raw content into a processed image. This image is sent into the Mongo database for further development where it is Compared using CNN (Convolutional Neural Network) with the images in the database, the matched images are retrieved from the database as a text. Then this text is converted into speech using NLP (Natural language processing), this text is then fed into the speaker. Thus, the communication between the disabled and normal person is achieved.

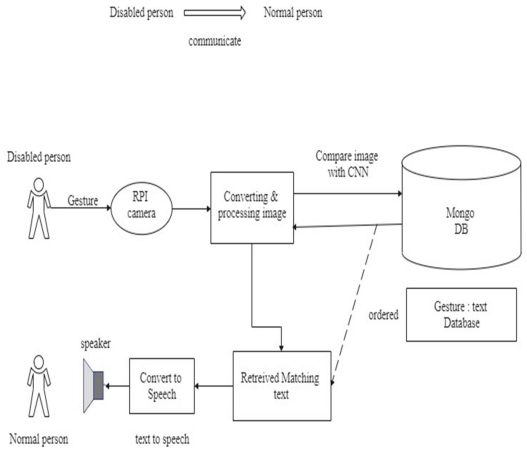

Fig 3.1.1 Disabled ->Normal Architecture

The normal person speaks through the mike to communicate. Then the vocal input is recorded

which is analyzed and transformed into narrative using NLP (Natural Language Processing), then this raw data goes under various process to turn it into a processed data this process undergoes segmentation, tokenization, text cleaning, lemmatization and stemming. Now the unprocessed input is converted into a processed text, this processed text is compared with the text contained in 0the mongo database. The corresponding gesture images of the matched text are retrieved. The retrieved text is displayed through a screen to make it understandable for the disabled person. Thus, the communication between the normal and the disabled person is achieved.

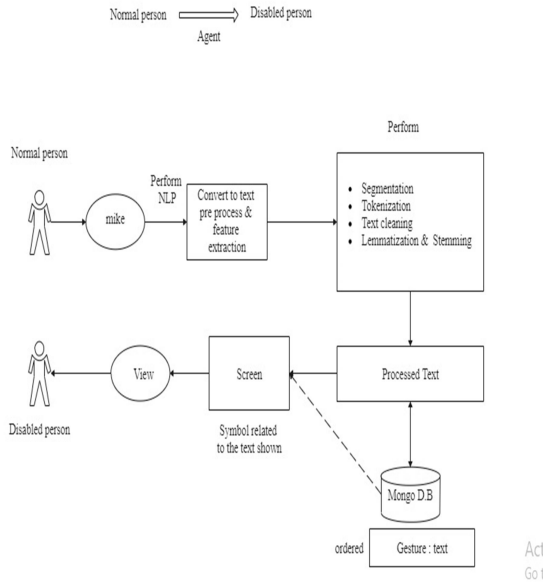

Fig 3.1.2 Normal ->Disabled Architecture

3.2. Modules in Description:

As the communication in the device is happened, the modules developed for the system includes

1) Training of Sign Language

2) Implementation of Sign Language using IOT

3) Training and Implementation using NLP

3.2.1. TRAINING OF SIGN LANGUAGE:

In this module, the image captured during the sign language communication is trained using CNN for image dataset, then using convolution neural network and artificial neural network the image is partitioned into pixels which is stored in layers. Then this image is recorded so that It can be matched with texts in the database to achieve accuracy. The voice captured during communication is trained for vocal dataset using NLP and RNN. Natural language processing is used to convert the text into a vocal format by performing segmentation, tokenization, and text cleaning. Now the processed vocal output is fed into the speaker. We also use ISTM for immediate recovery of data and to prevent false prediction. Recurrent neural network has a particular dataset for matching the text.

3.2.2. IMPLEMENTATION OF SIGN LANGUAGE IN IOT:

In this module, the RPI camera is used for capturing image with Azure IOT Hub with Azure ML Platform. IOT Hub is a managed service which is used for communication between attached devices and applications part of the IOT. It is a central message hub. Using this hub, we store the images of sign language gestures which are captured and trained to produce the vocal output. We match the gesture captured by our camera with the pre-defined images in the cloud for results. The hand gestures of sign language is captured and sent to the cloud for processing. Results after processing are fetched and data is stored in LSTM. For every wrong prediction it one step back and reiterates the prediction. For the right prediction the sample data is stored in LSTM. Long Short-Term Memory (LSTM) is an algorithm which is capable of learning by itself based on the problems and respective predictions of a sequence. They are a type of recurrent neural network. Using this, we predict the accurate gestures and its vocal output

3.2.3. TRAINING AND IMPLEMENTATION USING NLP:

In this module, Natural Language Processing is done over cloud in Azure. Natural Language Processing is used for the automatic manipulation of natural language, like speech and text, by software. Using NLP, we convert text into vocal output or vocal input to text. Auto correction is done on the vocal input and converted to text using RNN. RNN has a particular dataset for the matching text.

String stripping, stemming and keyword identification is done in processed text to detect accurate sign language. Stemming is the process of producing morphological type of a word. This is done by reduction of words from their word stem or root form. The original word may not be identical to the stem. Keyword extraction is a methodology to automatically detect important words for representation of a particular text. This is a very efficient way to get insights from a huge amount of unstructured text data.

3.3. Algorithm:

3.3.1 CNN:

Step 1: Convolution Operation

Step 1(b): ReLU Layer

Step 2: Pooling

Step 3: Flattening

Step 4: Complete Connection

3.3.2 NLP

Step 1: Lexical Analysis

Step 2: Syntactic Analysis (Parsing)

Step 3: Semantic Analysis

Step 4: Discourse Integration

Step 5: Pragmatic Analysis

4. Implementation

4.1 Screenshots

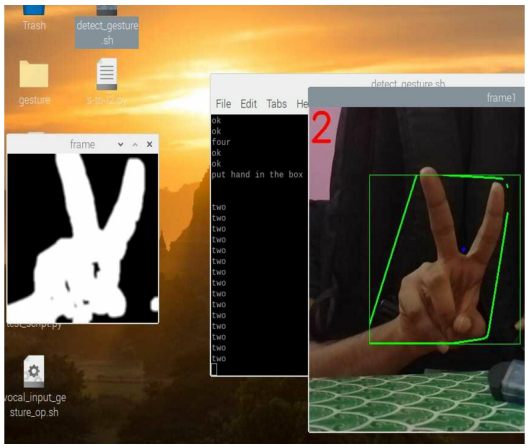

Fig 4.1.1 Sign Language Input

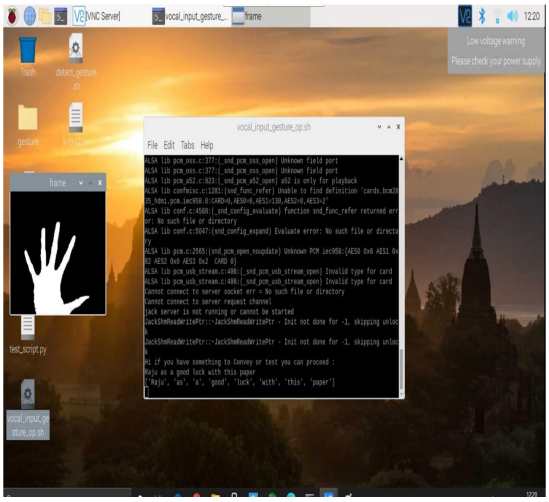

Fig 4.1.2 Terminal

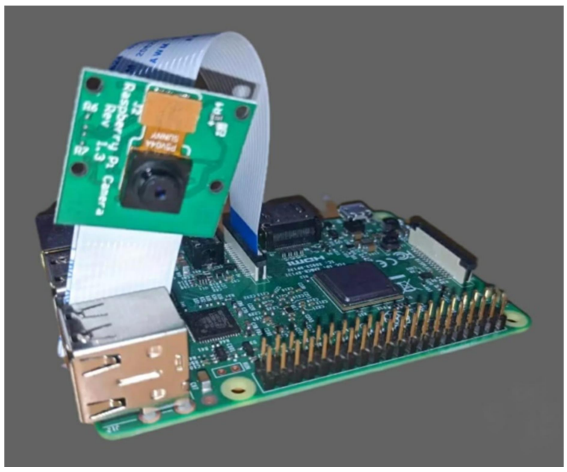

Fig 4.1.3 IOT Device

5. Conclusion

This device solves one of the major problems of communication between the differently-abled and a normal person by making the process easier and portable. However, our project also overcomes the obstacles faced by the existing system in which the device has to be carried by both parties and is expensive and cannot be mass produced.

This process is made hassle-free as a normal person doesn't have to know sign language to communicate. This device can be mass produced as it is cost efficient and can be used by many people to overcome everyday problems of communication. This device uses NLP and CNN to convert the speech-to-sign

and sign-to-speech and displays it through a screen and outputs the speech through a speaker efficiently.

Thus the main problem of bridging the ineffective communication between the normal and differently-abled is solved.

6. Future Work

There are few who can neither see nor hear. For them, in the future we decide to enable touch sensitivity in the device which could help them communicate with others, so they won't have the communication gap. Thus, some of our future goals are to implement touch sensors in the device so it can be used by anyone with any disability.

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