ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 4, April 2018

Hand Gesture Recognition Using Image Processing for Visually Impaired and Dumb Person

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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 defect for these two persons. Sign way of communication indicates sign languages used by dumb person. 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 isolation of these people in society. Hence, Sign language recognition is one of the most growing fields of research today. A sign language is composed of various gestures formed by physical movement of body parts i.e. hand, arms or facial expressions. In this project, a method is proposed that makes the use of hand gestures for recognition of indian sign language. Hand gesture recognition system provides us an innovative, natural, user friendly way of interaction with the computer which is more familiar to the human beings. The communication between the dumb and visually impaired person are made only by their expressions and their hand gestures. This project presents various methods of hand gesture and sign language recognition for blind and dumb person.

Keywords: Gesture recognition, sign language, Image processing technique.

I. INTRODUCTION

Approximately 285 million people are judged to be visually impaired worldwide in which 39 million are blind and 246 are said have low vision. Approximately 90% of this world's visually impaired is from the dispirited income people and 82% of people living with blindness aging persons and above. The numbers of people visually impaired from eye related diseases have been brought down in the past 20 years according to global estimated work. In which 80% of all visual restitution can be prevented or cured. India is considered to be the home for the world's largest act of blind people. In this world, about 37 million are blind, in which 15 million are from India. There are so many researchers have been getting along in this universe, but the visual impairment could not be broken for good. In lodge to facilitate these people we have developed the assistive device for blind people who do not want the assistance of other neighbours. The development our project helps the multitude to experience loose and go independently. In all around the world about 9.1 billion people are mute. In their daily life they face plenty of problems on their communication. Sign language is a linguistic process which is employed for communication among the normal people and handicapped people. Sign language relies on sign patterns such as body language of the person and movements of the arm to facilitate the discernment between the great unwashed. The vocally impaired people don't simply have to learn the customized sign language, but the core issue is that they can communicate with the usual sort of multitude in the society. It is similarly not possible for all the masses to learn the sign language to understand whatever is said through gestures. Therefore, the communication gaps still exist between the blind and dumb people. Dumber people can simply tilt the message by sign language which could not be understandable by other people. In resolving these difficulties with visually and vocally impaired people we proposed a device using Arduino. By this device we provide the solution for blind and dumb people. For blind people the image is converted to voice by using MATLAB software and APR voice recorder, The dumb persons conveyed their message through sign language.

II. METHODOLOGY

In this paper, A device is specially designed to make effective communication between the dumb and visually impaired person. The major defects between these two persons are vision and voice. In an emergency situation and in need of any

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usable things, the dumb person cannot communicate, for this purposes this system has been proposed. The visually impaired person cannot visualize things but they can communicate with the voice whereas for the dumb person, they can visualize but they can't speak. When these two persons are living in a same room, there won't be any interaction between them and communication lags. According to dumb people for every motion there will be a separate meaning whose message templates will be taken and kept in a database. The gestures are taken as a snap and that were compared to gestures which are stored in a database. The training sign is an input and testing sign are present at the output side. First the images are taken as a snap and compare with gestures stored in the database and finally for the matched gestures, the voice will be generated.

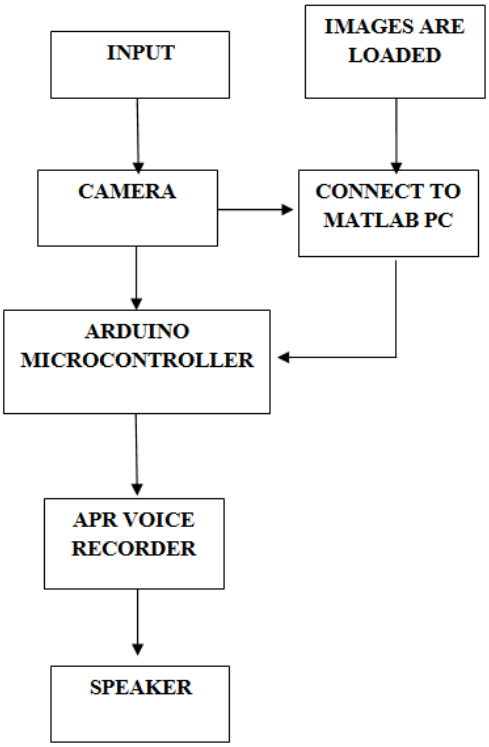

Fig 1: Block diagram of hand gestures recognition using image processing for the visually impaired and dumb people

Sign languages are languages that use manual communication to convey meaning. This includes simultaneously employing hand gestures, movement, orientation of the fingers, arms or body, and facial expressions to convey a speaker's ideas. Sign languages often share significant similarities with their respective spoken language. Linguists consider both spoken and signed communication to be types of natural language, meaning that both emerged through an abstract, protracted aging process and evolved over time without meticulous planning. Sign language should not be confused with "body language", a type of nonverbal communication.

Wherever communities of deaf people exist, sign languages have developed, and are at the cores 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, or those who have trouble with spoken language due to disability or condition. So that, the proposed device will be helpful for the visually impaired person and dumb persons. The effective communications can be made between these two persons by using sign languages of the dumb person.

A. Hardware implementation of proposed system

The interconnection between different components is explained using architecture diagram of the system. The architecture is shown in figure . The digital pins are connected to 8 pins of the APR voice module. The power supply to the Arduino board was given by the pc or serial port. Direct supply of 5v is given to the APR voice module. The GND – GND connection of both the circuit are interconnected for power back circuit.

The speaker was connected to the APR voice module. A Webcam is kept separately or placed on the laptop or other devices. It is used to capture the gestures from the people and this is done to match it with the gestures stored in the database. The voice output for the matched gestures is generated via APR voice module. The speaker produces the voice output.

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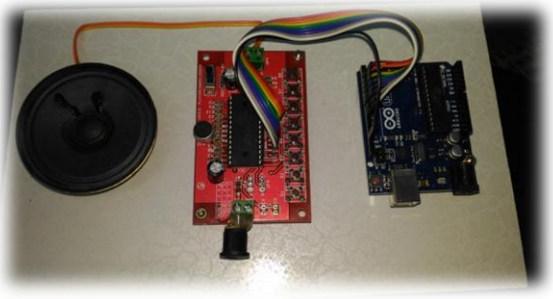

Fig 2. Hardware implementation of proposed system

The design of this system is divided into two parts: Hardware and Software components.

B. Hardware components

1) **Arduino Atmega (328P):** It is an open source computer hardware and software company, project, and user community that designs and manufactures single board microcontroller and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The Atmel 8-bit AVR RISC based Microcontroller Computer 32KB 1SP Flash Memory with read-while-write capabilities, 1KB EEPTOM, 2KB SRAM, 23 general purpose register , 3 flexible Timer/Counter with compare modes, Internal and External interrupts, serial programmable USART, a byte oriented 2-wire serial interrupts. SPI serial port, 6 channel 10 bit A/D converter programmable watch dog timer with internal oscillator and five software selective power saving modes. The device operates between 1.8-5.5V.

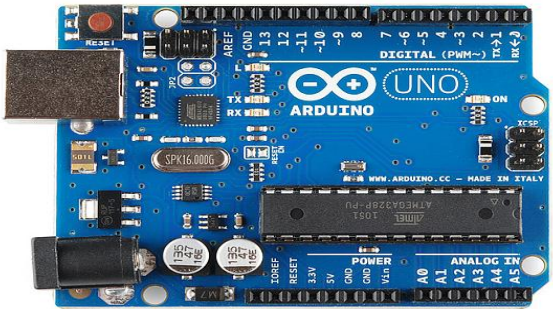

Fig 3.Atmega 328P

2) **APR voice recorder**: It is a voice recording and play back circuit using the available IC APR 33A3. The circuit can record and play back the voice up to 30s. It can be used in automatic answering devices, door, phones etc. The APR 33A3 is provided with the circuitry capable of storing and reproducing the sound without any microcontroller or some or some other software. No external ICs are required in the operation of the voice recording.

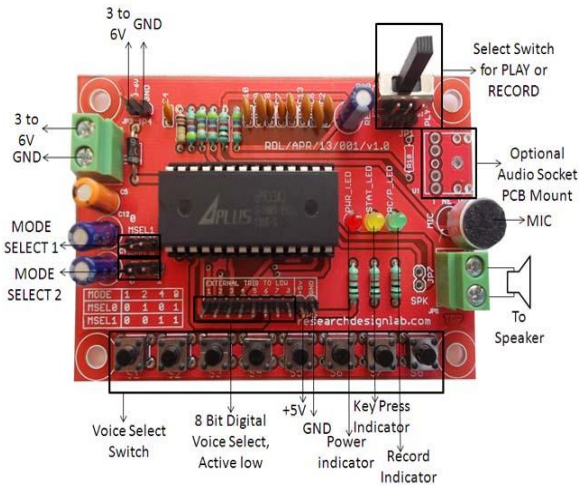

Fig 4.APR voice recorder

3**) Speaker**: Speakers are one of the most common output devices used with computer system. The purpose of speaker is to produce audio output that can be heard by the listener.

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4) **Webcamera** : A webcam is a video camera that feeds or streams its image in real time to or through a computer to a computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and emailed as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

Fig 5.Webcamera

C. Software

1) MATLAB: It is used for Image Acquisition technique. The feature extracted images from Image Acquisition process matches it with the trained gestures stored in database.

2) Arduino: In this MATLAB is interfaced with an Arduino Software. For the matched gestures the voice will be generated in this programming application. The pins are configured and voice which are recorded in a APR voice module will produce the voice for the matched gestures.

III. LITERATURE SURVEY

Pradeepa U et. al[1] proposed a device for the deaf and dumb person. The communications with others are made only by using the motion of their hands and expressions. Some people can easily understand the information from their motions, but the remaining cannot understand it. In order to overcome the complexity, the artificial speech system is introduced. An artificial speech system will be very helpful for them to convey their thoughts to others. The system is based on motion sensor. According to dumb people, for every motion there is a separate meaning, whose message templates will be taken and kept in the database. In real time, the template database is fed into the microcontroller and the motion sensors are fixed on their hand. For every action the motion sensor gets accelerated and passes the signal to the microcontroller. The microcontroller matches the motion sensor signal with the database and produces the speech output in the speaker. By properly updating the database the dumb will speak like a normal person using the artificial mouth.

Arpita Das et. al [2] attempted to figure out the degree of metastasizing cancer of mind cancers using synthetic intellect. The dubious areas in mind as recommended by the radiologists have been segmented using unclear c-means clustering strategy. Fourier descriptors are used for accurate removal of border functions of the growth area. As Fourier descriptors present a huge number of feature vectors that may encourage the problem of over learning and chance of misclassifications, the recommended analysis system effectively search the significant border functions by inherited criteria and nourish them to the flexible neuro-fuzzy centered classifier. In addition to shape centered functions, textural arrangements are also integrated to achieve advanced level of precision in analysis of cancers. The research includes 100 mind pictures and has shown 86% correct category rate.

Alaa Eleyan et. al[3] have described a Dual Neural Network (DNN) approach was proposed to implement the kWTA process. Compared to the conventional approach, the DNN approach has much less number of interconnections. A rough upper bound on the convergence time of the DNN-kWTA model, which is expressed in terms of input variables, was given. This brief derives the exact convergence time of the DNN-kWTA model. With our result, we can study the convergence time without spending excessive time to simulate the network dynamics. We also theoretically study the statistical properties of the convergence time when the inputs are uniformly distributed. Since a non uniform distribution can be converted into a uniform one and the conversion preserves the ordering of the inputs, our theoretical result is also valid for nonuniformly distributed inputs.

Q. Liu et. al[4] reported a new recurrent neural network with a one-layer architecture and a discontinuous hard-limiting activation function for solving quadratic programming problems. The global convergence of the neural network with reduced model complexity is proven based on the Lyapunov theory and non smooth analysis method. The neural network is capable of solving general quadratic programming with strictly convex objective function over the set defined by equality constraints. In addition, a sequential quadratic programming approach to general nonlinear

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programming is developed based on the proposed quadratic programming neural network. Three simulation examples are given to illustrate the results for quadratic programming, nonlinear programming, and SVM learning.

Neha V et. al[5] proposed a method that makes the use of hand gestures for recognition of Indian Sign Language. Hand Gesture recognition system provides us an innovative, natural, user friendly way of interaction with the computer which is more familiar to the human beings. The proposed method is able to identify the images of the signer which are captured dynamically during testing phase. To implement this approach we have utilized a simple web camera to capture hand gesture images. Artificial neural network is used for recognizing different signs and translate them into text and voice format.

S. A. Mehdi[6] examined the possibility of recognizing sign language gestures using sensor gloves. Previously sensor gloves are used in games or in applications with custom gestures. He explores the use in sign language recognition. He implemented a project called "Talking Hands", and studying the results. This project uses a sensor glove to capture the signs of sign language performed by a user and translates them into sentences of English language. Artificial neural networks are used to recognize the sensor values coming from the sensor glove. These values are then categorized in 24 alphabets of English language and two punctuation symbols introduced by the author. So, mute people can write complete sentences using this application.

IV. RESULT AND DISCUSSION

Problem definition of the underlying system which is basically useful for the visually impaired person and dumb person and generate voices for gestures simultaneously.

The entire operation of the project is given by the flow chart and is explained.

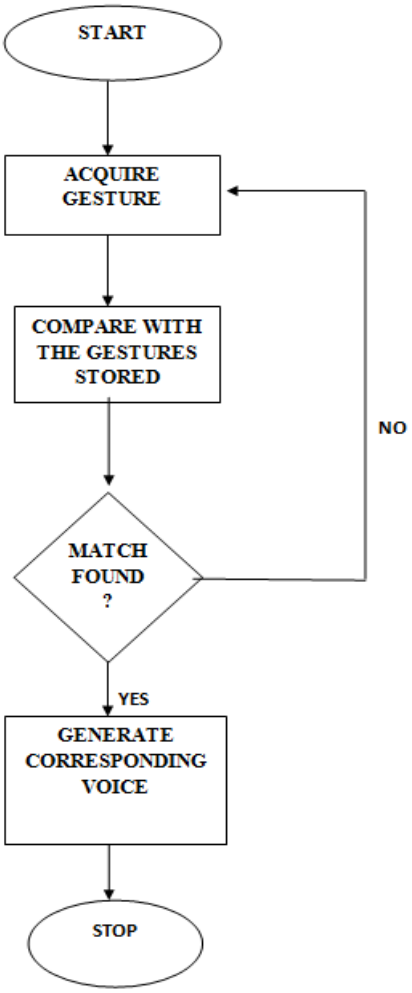

Fig 6.Flowchart

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Above flow chart is explained as follows that the gestures are acquired from user or image taken as a snap, with the help of the snap comparison is made between an input gestures and loaded gestures. When gestures matched, the voice will be generated. If gestures didn't match then it will start acquiring the gestures.

In this paper, we have designed the prototype model for blind and dumb people by employing a single compact device. The primary advantage is that the device can be taken away easily and is of about less weight.

To further this project can be followed out with any other advanced devices by using simple coding language to get it less complicated. The complication can be reduced by a tiny gadget which could be more useful those people in this electronic world.

The output of the propose system is present below. It also consist of the three segmentation and one dialogue box for the displaying gesture meaning is shown in fig.5.4 The voice will be heard by the visually impaired person via speaker.

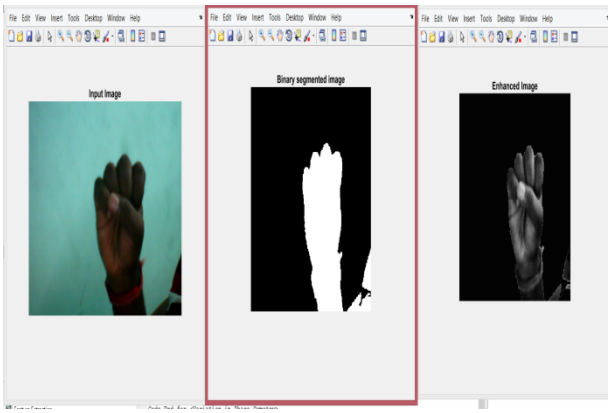

Fig.7 MATLAB feature extracted image

The fig 7 shows that the feature extraction of Image Acquisition work. Through this feature extraction, exact positions of gestures are taken as white and it removes other obstacle and background will be in black color.

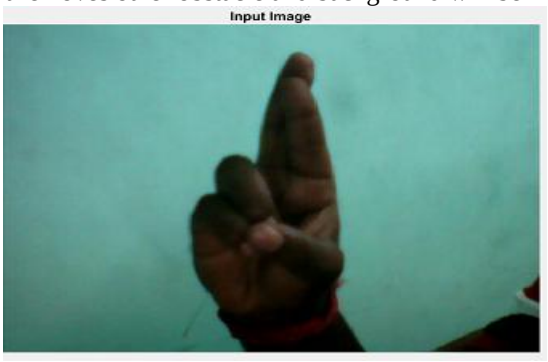

Fig.8 Input image.

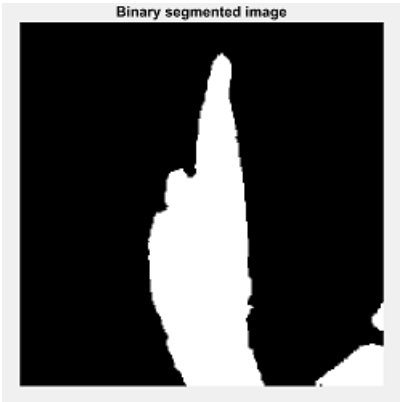

Fig.9 Binary segmentation image.

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Fig.10 Enhanced image

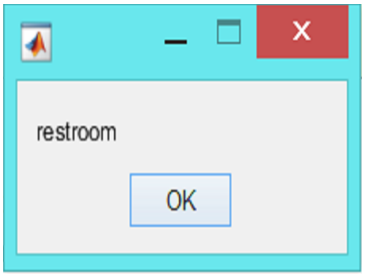

Fig.11 message box shows the gesture meaning.

If the training and testing gestures are matched, the corresponding voice will be generated. The gestures are viewed in the display is shown in the fig 11. The voice will be heard through the speaker.

V. CONCLUSION

Human hand gestures provide the most important means for non-verbal interaction among people. At present, artificial neural networks are emerging as the technology of choice for many applications, such as pattern recognition, gesture recognition, prediction, system identification and control. ANN provides good and powerful solution for gestures recognition in MATLAB. The ability of neural networks to generalize makes them a natural for gesture recognition. Gesture recognition is very challenging and interesting task in terms of accuracy and usefulness in computer vision. Rotation, illumination change, background variations and pose variations of hands makes the problems are more challenging. Most important advantage is that physically challenged persons can efficient interact without any physical restriction. The implementation of the proposed system aims to translate gestures into speech (voice). The scope of the project is to enhance the recognition capability for various lightning conditions and achieving more accuracy. Implementing and identifying the more number of gestures. The miniature of the system should be done.

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