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A Research and Development of A Real time Visual-Audio translator for Differently Abled (Disabled) People to Communicate using Human-Computer Interface System.

[1] Mr. Dikshant B. Patil, [2] Prof. G. D. Nagoshe
[1]M.E. student, [2]Assistant Prof. at P.R. Pote (Patil) College of Engg.
[1,2]Department of Electronics and Telecommunication, Amravati University
[1,2]P.R.Pote (Patil) College of Engineering, Amravati, Maharashtra, India.

Abstract: In this paper, we derive a concept from the study of the various ideas and put forward a concept to help differently abled means disabled person to communicate by using a real-time visual-audio translator human computer interface, as by this the difficulty is to be removed. As the human evolved through the ages the communicating factors and medium can as they learn that it is important to communicate as to develop, to express the thoughts and convey the ideas, innovation, imagination and creativity with the fellow beings. As by the ages the modes changes naturally first non-verbal then verbal it was all in nature be we have to progress, but by this a little but the significant population of people is been barred, as in this only country about at the most 3% people cannot speak as they are dumb or they cannot listen as by this they are deaf, and at the least 2% of the population is blind that is they cannot see. Hence the gestures and sign language is the non-verbal mode of communication for deaf or dumb people but by this all the people who have not familiar with this knowledge with them the communication can be barred by this means there have been to remove this barrier, a medium is develop by this the hand gesture is taken as input from the camera and then the image is been processed this is called image processing (with tensorflow) and the after that the gesture is recognized and text on the screen is been displayed and as for output the gesture which is recognized is been given out in the form of the sound (voice) from the speaker by this a dumb or deaf person can communicate with blind person. For another conversation from blind person to dumb or deaf person, as the blind person can speak in this the input is taken as speech from the microphone and then the speech recognition takes place and then the text is given out as on the screen which can be read by the dumb or deaf person as they can see, in this Speech processing is used. By this application interface our aim which is to have communication between two disabled person and also between disabled person and other person can be done, as the system provide us the new innovation, been natural, user friendly and not so complicated in the way of interaction between computer interface and human beings.

Index Terms **- Python, open source CV, Image processing, tensorflow, Speech (voice) processing and Laptop (computer).**

I. INTRODUCTION

In this research paper we here explain about how we can help the disable people to communicate with the world around themselves without the hectic of using to learn different types a communicating methods such as a human interpreter, as we know in many cases they just blend the meaning and also the true conversation between two persons can be lost due to this misconception barrier.

As human beings develop its brain capacity, its starts to communicate using hand gestures, body gestures, drawing before the humans can talk because of this the gestures are very natural in the occurrence by this we here define two types of communication system verbally and non-verbally. And also in the non-verbal communication there is also having two types static and dynamic conversation. As we the created various languages to communicate but for the disabled person to communicate is very difficult as we know that for the deaf person, they use hand gesture and sign language to communicate, but as some they can talk but not all of them and also if someone is talk not all of them can lip read what the other person are talking. For the dumb person also to speak is not possible so they are dependent on non-verbal communication, for the blind they cannot see but they can listen so they have to be told (or talk) for to communicate. And if a condition is develop when this two person have to talk or communicate with each other then there have been a massive problem and hence there comes the human interpreter which can cause communication to be blended or the real true meaning can be lost in conversation.

To solve this problem here we develop a real-time visual-audio communicator using human computer interface. As blind can listen and deaf or dumb can see, so here in this interface we create a system in which blind to communicate with deaf or dumb person sound(voice) is to be taken as input and text is given as output on screen. And for deaf or dumb person to communicate to blind person the input is taken as image of hand gesture and the output is given in form of speech (voice) from the speaker. This human-computer interface can also use by those who are not disabled by the birth but recently lost the voice or can see due to some accident which happen, as for this it can gave some time to them from the trauma of recovery from this situation and adjust in it.

II. LITERATURE REVIEW

[1] Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang, and Yu-Bo Yuan; in their paper, the interface first detect the hand then the region of interest framework extract the hand and then background is detected and then subtracted from the frame, output is binary detection of hand while the background is in black and the detected hand is in white.

[2] Hsiang-Yueh Lai, Han Jheng Lai; in their paper detected and recognize eleven kind of hand gestures with the help of convex defect character points as it's extract the hand which is detected using YCbCr color transformation and hand contours. And as for in this the YCbCr color transformation and hand contours are clearly defined. This hand contours are used also with the finger angle, fingertip position and then colour transformation is done.

[3] Thang B. Dinh in the paper along with convex defect character points also use array of boosted cascade of classifiers to recognize the hand gesture, it detected 24 basic signs of American Sign Language (ASL). In this the use of software Adaboost and also of the Haar wavelet the performance is increase and training is done of hand gestures and because of this 84% correctness rate is achieved. Histogram and the orientation are also used but it makes the classifiers inaccurate with one another.

[4] S. Ahmad, V, use the Bayesian technique to recognize the 3D gestures but it has large amount of noise or missing data input. Then planned algorithm which is vision based is used consist of segmentation and also skin colour and motion are used. This is also shown in the study of Murthy which covers details of computer vision fundamental technique of HCI under various condition.

[5] Khan R.Z.; on the other hand presented a recognition system concerned and also a through this study recall the issue of feature extraction, gesture classification, and considered the application area of the studies.

[6] Suriya R. also survey a specific study on hand gesture recognition for mouse to control the application and presents methodologies and algorithms used for human–machine interaction.

[7] For the purpose of the speech recognition there are papers presented by Furui 1986; Guyon 2008; Hirsch and Pearce 2000 which gave us the information about the abstract, speech features extraction, raw signal analysis and how to compare with the data which is compiled by the process.

[8] To learn about the speech features recognition and extraction and also to know how to rescue for turning the high dimensional signal to a lower dimensional, a more informative paper is given by D. Yu and Deng 2016; Rabiner and Juang 1993, and in addition also told us about the linguistic characteristic of the input raw signal which cannot be ignored.

[9] Campbell 1997 also gave a study of speaker recognition which is given a task to extract solely voice associated information from raw signal and extract features and map them into lower dimensions and by this pattern classification investigation takes place because of this prevention of dimensionality is removed. Also some information theory are suggested by theory by Amisina Torfi, So- leymani, and Vakili 2017; Shannon 2001 which can be further applied to multimodal signals and demonstrated promising results by Gurban and Thiran 2009 because of this two general types of features are come to know acoustic and second linguistic.

[10] For the purpose of speech recognition various packages are there and as the library of open source python is consider PyAudioAnalysis (Giannakopoulos 2015), which is the comprehensive and complex.

[11] For the purpose to learn about the hand gestures and different sign languages the papers related to them have in 1998 researcher from Germany named Dr. Ulrike Zeshan compared signs from many different regions across the Indian subcontinent, including suburbanand urban part regions such as Orissa, Kerala, Jammu and Kashmir, Bhopal, Chennai, Bangalore and Darjeeling. She also found that on an average about 75.25 % of the signs are similar across different regions though the language are changing, as this study has the roots in 1970 as a team from America headed by Vasishta found out as by studying ISL and created four dictionaries between 1977 and 1982. It was found that 75.25% signs are same across the region. Further Zeshan joins the team and they carried out different courses of ISL, teaching them ISL grammar and giving training to people after that approved by Rehabilitation Council of India in 2002. Following this Ali Yavar Jung National Institute for Hearing Handicapped, Mumbai released "Basic course in INDIAN SIGN LANGUAGE". After this varius surveys are done and found out that at time there have been 2689 deaf and dumb schools are there and then also various NGO's help them. By this data it helped to bridge the communication gap between them and we can be interpreted the amount of various hand gestures used commonly across the India.

[12] Further for image processing in this we uses tensorflow, for knowing this the study done by Qiya Niu a, Yunlai Teng b, Lin Chen on design of gesture recognition system based on Deep Learning and their previous work they studied various concepts such as evaluation method in this the generating training sets and test of the validation of single database, also does the work on the performance method measurement for the error rate and accuracy, as by obtaining the average accuracy and precision accuracy to calculate the multilevel object detection parameters. Alongside further more studies by Zhihua Zhou, and team of Liu, W., Anguelov, D., Erhan, D., Szegedy, C., Reed, S., Fu, C.-Y., and Berg, A. C with Andrew G. Howard work done on the tensorflow by their study they come to know that Tensorflow also works on the numerical computation as to make the machine learning faster, efficient and easy uses neural networking models and their algorithm which works on the frame work of front end API and constructed by C++ for high performance.

III. OVERVIEW OF PROPOSED METHODOLOGY AND IT'S WORKING

As in this proposed system there is having two parts, first, the image processing and voice or speech processing as we know that in this system first of all in this the hand gesture is to be recognized by the system this is done by the help of the camera by which the hand gesture image is given as input and from that by this there is having after that the image is pre-processed as we here use to train the model and there have been a vast database is been placed, after that comparison of that image taken is been applied various techniques such as HOG classifiers and also there is having taken some sort of help of SVM in this to learn and recognize the input image. In this after pre-processing there is having to firstly, the palm and fingers of a person is detected, as there are hand is then separated with the background then the segmentation is takes placed, as this is done from this the ring nodes of a figures are to be determined as because of this as we have in this nodes are to be recognized, it becomes easier to calculate or to be separate the figures from palm and also with one another. Also in this the distance between the fingers and also the finger tips can easily be determine. Also in this the image segmentation of fingers and also separation of background with respective technique is used.

Figure: Shows the conversion of image or video into text.

When the hand is recognized then the image processing takes place as here the system can have a limited database or due to the use of machine learning they can increase the database, as by this the image is then compared and tally to the images in database and then the appropriate text is generated and be displayed on the screen, in this the image to text conversion takes place. Here in this the Tensorflow is used as it is a software library for numerical computation using data flow graphs. Despite its extended library for deep learning functions, the system is general enough to be used for many other domains. And after this when the text is displaced the text is then converted into speech with the help of the speech processing. Hence this is the total one part in which there is having the hand gesture is converted into speech because of this a dumb, deaf person can communicate with the blind person.

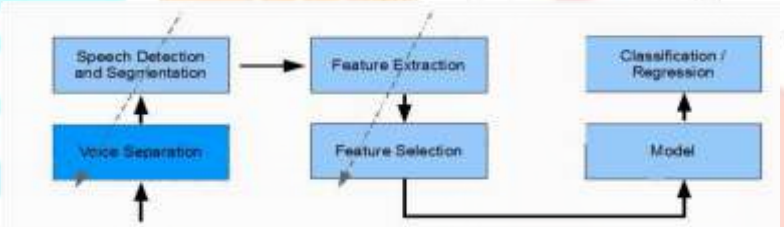

Figure: Process of Speech Recognition.

In another process, when a blind person speaks, here the voice or sound is then recognized to the system as input through the microphone as we know here that because of this the respective process is performed on the speech input. After when the speech is recognized then there is having to be converted into text using speech to texted conversion, by this the speech is converted into text which is displayed at the screen as output. By this the blind person can communicate with deaf or dumb person as, they can read what is on the screen.

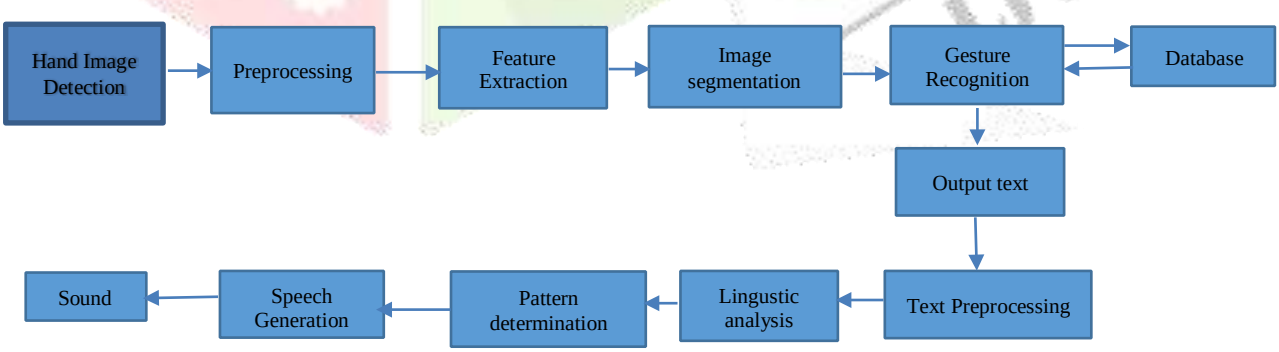

Figure: Flowchart of hand gesture image detection to speech (voice) conversion process.

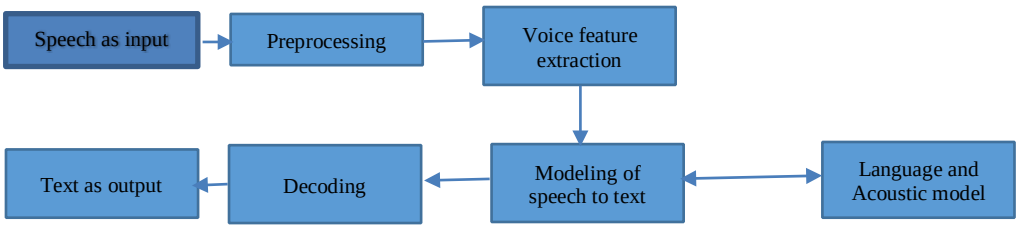

Figure: Flowchart of speech to text conversion process.

In this the process, converts the received audio into text as it applies robust neural network models in a convenient API. It enables voice command and control and transcribes audio. The accuracy is unparalleled as the most advanced deep learning neural network algorithms.

IV. THE RESULTS.

In this project we here develop a system which is used to communicate between the disable persons and to the other persons which does not know the sign languages and gestures which the many disabled persons do to communicate. As the blind person cannot see but it can hear, so if a dumb person do the hand gestures and sign language, this interface which uses the tensor-flow for the recognition of the hand gestures and give text as output on the screen and sound as output from speaker, whatever the gesture which is allocated by collecting the images of it and forming the database. This database have different images of a gestures from different angles, lighting conditions and hence the feature extraction is done so that correct information is have to be given as output and the sound output pronunciation is also to be correct and to be understandable.

Below are the results of the image processing which is done on the input hand gestures on behalf of:

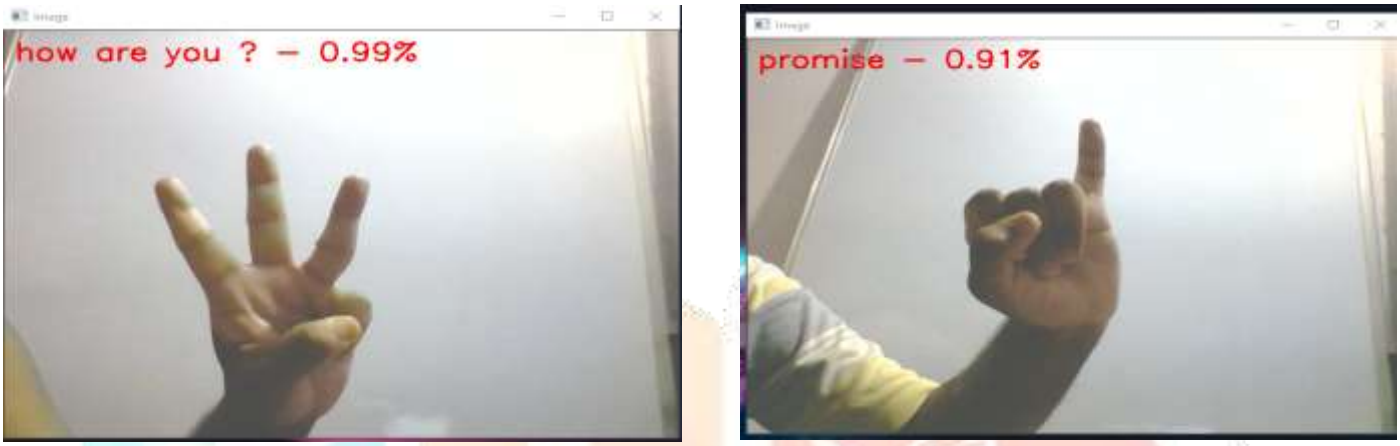

Figure: Shows the interface windows of hand gestures recognition of both "How are you?" and "Promise".

In this above here the program is executed shows the hand gestures of ""How are you?" and "Promise". This above gave us the hand gestures recognition and sign language detection, in the another process if a blind person who can talk, if have to communicate with the deaf person, hence for this purpose speech recognition is used to communicate as well as it is also useful for those who does not know the sign language.

In this another process speech (voice) of a person is converted into the text and is displayed on to the screen, in here the speech recognition API is used and so by detection of the voice or speech the interface then convert it to the text which can be Romanized and be displayed on the screen, in this speech feature extraction and also speech language and dialect are recognized.

Below are some of the results of speech recognition:

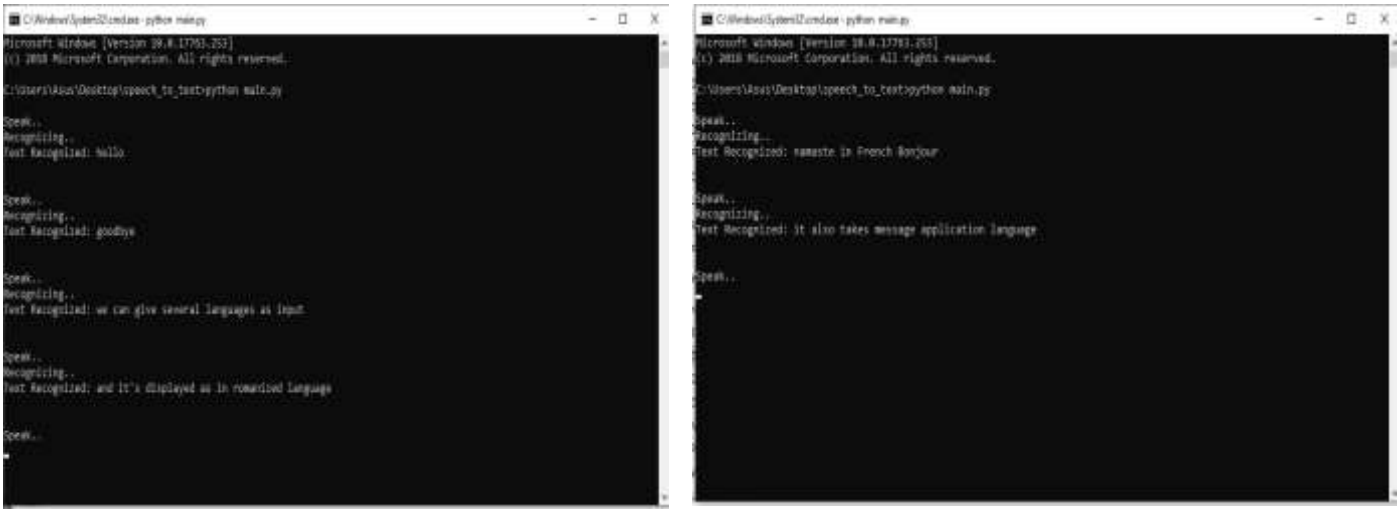

Figure: Shows the interface windows of speech recognition and converting it to text.

Here in this above we have seen the results of both the hand gestures recognition and also speech recognition separately.

So to sum up our interface as at the same time to take both inputs; image as well as speech or voice we can also gave and the output is given. This gave us the interface as shown below:

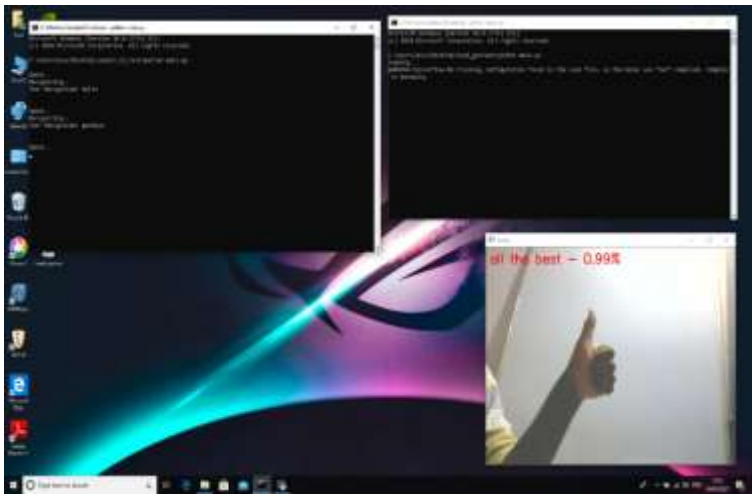

Figure: Shows the interface window of both Hand Gesture Recognition and Speech Recognition.

The right side of the interface shows us the gesture recognition and the output and on the left side it shows us the speech recognition process. As here the results of this project which is undertaken to help disabled persons to communicate and develop an environment of Human-Computer interface has been done.

V. ADVANTAGES, DISADVANTAGES AND APPLICATIONS.

Advantages:

1. As here the proposed system can detect the hand and the background seperately more efficiently than the other previous system.
2. This system can better at comparing the database images, it is fast and accuracy is good, because of which we are using the ring nodes of the fingers and also other features of the hand.
3. The database can be updated easily and various languages can be incorporated in it as for user convenience.

Disadvantages:

1. This system uses different modes to select which input to be taken, both input simultaneously can be done but because of this the process becomes slow as compared to the separately using the process by individual.
2. The system cannot be used to differentiate between the dialects of the same language and the pronunciation can be correct, to be recognized by system.
3. The system scans a huge amount of data, and also the frame rate is different for various signs and gestures.

Applications:

1. Now-a-days there are having assistive automatic teller machine and food centre drive through so if a dumb or deaf person comes and supposed to order a food for it, then this system is very useful for the person.
2. Many public video social services can take the useful advantages of this system as there are having to produce subtitles and input from people to search, which can be generated by this system software.
3. This hand gestures are also used in controlling robots and also various tasks are done is we designate a special hand gesture to the each action required, so that there have been perform it.
4. As there are also used for the construction sites, graphic design as they can be used to control the various graphic instruments in both three dimensional and two dimensional world. As it can track hand movement and also draw shapes and commands for editing graphic system.
5. It is very useful for the architectures to apply to various field as the 3D technology increases, also useful for controlling traffic and also in the field of public services such as disaster management.
6. It can be used in virtual environment for natural human computer Interaction HCI in a real-time from binocular views.
7. It can be used for television control, home automation, for gaming purposes and to do specific tasks assigned to personal computers and tablets.
8. It can be also used for the 3D modelling and moulding, as some system used hand silhouette.

VI. CONCLUSION AND FUTURE SCOPE.

In this modern world , where there are many technologies are at the peak, there are many facilities are available for offering the input to any application which are running on the computer systems, some of the inputs can be as the image or as the voice. Here in this given system the hand gestures are used to take as input and gave voice as output, and it can also take sound as input and gave text displayed on screen as output. In this world it gave the facility for the disabled person to communicate with other person and also other disable persons. The present system which we have implemented although seems to be user friendly as compared to modern device or command based system. As it is a new system but it contents various drawbacks, but in future we can improve this system, try to build more robust algorithm for both recognition and detection evenly in any condition which can be helpful. By this paper, an easy to use prototype of a public convenience has been created to aid the visually, vocally and audibly differently abled person. According to this project not just focuses on fulfilling the communicating empowering and facilitating the differently abled, it is also compact and resource saver both environment and time. Implementing and purchasing overall cost has been cut down by eliminating braille books and the energy and time spent in understanding them. It is a less costly solution, as all the components used in the device are cost effective and efficient. By the recent time latest and most trending technology makes this device portable, adaptable, more useful interface and convenient. By applying above method the device proposed in this paper can be a major help in solving a few of the many challenges faced by the differently abled. To further extend the project, the device can be made more compact and wearable to make it easy for the user to use.

As this proposed method and its working gave us information about how the system can be work and how it is useful by all this means it can be improved by using better sensors and as this technique uses the python language and open CV over the MATLAB, this system can also be improve by adding various other sensors and further can be develop for all body movement detection, facial detection and also some other gestures, also know from time to time the non-verbal gestures are changes and can be integrated. The device can be integrated as wearable and also wrist fitted and also by using the locater sensor to locate a person where geographical region is in by this various sign languages and hand gestures which are there in that location can be integrated in the device.

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