SMART COMMUNICATION FRAME WORK FOR DEAF DUMB AND BLIND PEOPLE USING RASPBERRY-PI

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Abstract - *One of the expensive gifts for the human beings is capability to speak, see, listen and react according to the situations. There are some persons are lacking of this. Preparing a single compatible device for such people with Hearing, Visual and Vocal impairment is a difficult task and communication of these people with normal people has been always the toughest job. This proposed system induces a new creative personal communication system frame for dumb, deaf and blind people in a single adaptable device. This proposed device provides a technique for dumb people using text-to-voice conversion through which visually impaired people are able to read the words using Tesseract OCR (online character recognition), online and dumb people communicate through to text which is read out by e-speak, for the deaf people it facilitates a way to read a text by voice or speech-to-text conversion (STP) and for a blind people to read a text or Paragraph and can be available by scanning an image through Logitech camera which transforms scanned picture to text and text-to-speech (TTS).*

*Key Words***:** *STT, TTS, e-speak, OCR.*

1. INTRODUCTION

In this technological epoch with the advancement in information and communication technology. Symbol language is the hardest form for the communication between deaf dumb people and the extraneous world to provide the improved and easy lifestyle of dumb, deaf and blind people the proposed system is designed and developed. Approximately 290 million people are visually impaired in the world. Out of 290 million people, 60millions are blind and 255millions have low vision. Blind people can only read Braille script. To improve the learning process of blind people this innovative device is developed for them which capture the image through a camera and convert the image not only into text but also into speech form. By using this device a blind person can easily be able to read the text. In this digital era about approximately 9.1 billion peoples are deaf and dumb. These deaf, dumb and blind peoples face plenty of problems in communication with normal people in daily life. These peoples are not involved with this digital world because of their disabilities. Presently they are using symbolic language skills to express their messages using gestures. This is a well-designed symbolic gesture, each gesture has a different meaning assigned to it. The gesture is a non-vocal communication skill by using the movement of the hand, head and other body parts. There is 2 main symbolic language recognition technique. They are image-based technique1and sensor-based technique. The image-based method doesn't require any outward peripheral like hand gloves etc. due to this benefit lot of investigation is going on the picture-based technique, but sensor-based technique disabled persons need to wear devices. Symbols sign recognition device gaining significance in most of the solicit subjects such as multimedia, human-interface- communication and security. Disabled persons face problems in communicating with normal peoples because normal people cannot understand the symbolic language. There are fewer sign language organization in our nation, due to this, many dumb people use the usual type of symbolic conversation language to convey their message or news to the external world and they don't have personalized symbolic vocabulary. Therefore, a large number of communication gap still exists between the deaf, dumb, blind and world. In spite of the huge number of deaf and dumb people very little research is done to overcome the communication obstructions. The proposed system helps ordinary and deaf dumb people to communicate with each other effectively and smoothly. To resolve these barriers with visually and vocally impaired people, the proposed system is designed by making use of a tiny credit-card-sized computer named Raspberry-Pi 3 model B. This proposed system provides the technique for the deaf, dumb and blind people to communicate each other as well as with the normal peoples. For blind people, the image is scanned using Logitech web camera which is translated into text using Tesseract OCR, the converted text is stored into the folder with WordPad format and resulted text is converted into speech using an e-speak technique which is read out by speaker and the converted text is also displayed in WordPad. When the dumb people communicating

with normal people, the text written by dumb is spelled out by the speaker which can be readable by normal people. For deaf people, the voice/speech is converted into text by using a website called speechtexter.com.

The SHAROJAN Frame of reference will make usage of the Wearable evolvement, Texas Instrumentation apparatus, and Arduino Circuit Sheets to give a device for consistency to all of a sudden abled people having one or the majority of the above say disabled. It is recognized that a person who needs a listening component is congruity bonehead yet the other way around isn't honest to goodness[2].

Generally, on a daily basis presence correspondence is principle case for about tough of hearing, dumb peoples and for shock isolated it is hard to take notes of particular things. Thus, to oust the obstruction of correspondence a glove is normal for quiet individuals with biased messages and a Braille embosser for Trance individual to look at notes in Braille's tongue. The control center of this paper is to chart a supportive and sensibly measured contraption that is certainly not hard to utilize. The outline for this Device was made recalling all unprecedented sort of hindrance. This paper is basic to a challenged person individual who is experiencing issues in conversing with others. The equipment finished in this paper can be utilized remotely to offer notes to stupor by carving on Braille Embosser. To understand this paper the main parts are PIC18F886, APR33A3, Bluetooth Handset HC- 05, Flex Sensor, Servo engines SG-903 [4].

In this age, the writer proposed in addition structure show called the SHAROJAN Extension with a sincere goal to cross any limit in the midst of the time spent correspondence between the externally debilitated, in need of a hearing aid and unfit to talk individuals. The SHAROJAN extension will make use of the Wearable Headway, Texas Instrumentation Equipment and Arduino Circuit Sheets to give approaches for correspondence to in an unpredictable way abled individual having one or the enormous majority of the above say disables. It is recognition that a man who is unable of hearing is additionally imbecile, however, the other course around isn't important [3].The system is has been used to beat any obstacle of correspondence among externally undermined, deaf and imbecile individual. Accordingly, the framework makes uses of the

Arduino circuit, sensor glove containing sensor. Sensors are utilized to see the hand signals and in like the way it is changed over to sound or substance as showed by the point of confinement of the client. With the assistance of the proposed structure individuals with different material incompetence's would be able to analyze among themselves and with the standard individuals extravagantly [5].

The proposed device which can make over hand advancement into a voice, the apparatus includes a Remote Glove, contains accelerometer and flex sensors. Those sensory systems will perceive the movements of fingers and hands. The proposed system embeds the discussion synthesizer circuit which changes over these improvements of hand into on-going talk yield and a show will give the substance for the taking a gander at development. The substance and voice yield being in English. Along these lines, this device gives a effective technique for congruity for both practically tough of hearing uncouth and normal individual [6].

300 million need a hearing device and 1 million are gauche, as shown by the world, the Sharon Extension with a unique goal to beat any catch in the mid of the time spent correspondence between the evidently blocked, not sharp people; in this task, we will propose another framework exemplify. To give a system for correspondence to certainly gifted humans having one or, of course the enormous great majority of the above say in-limits, the Trojan extension will make utilizes of the Sensor Glove for correspondence utilizing signals6. It is viewed as that a man who needs an amplifier is also dumb however the other way around isn't possible [7].

This proposed system is to develop a compact device to determines the Symbolic Language, which expedites the communication between people with uttered impairment and normal individuals the symbols to the voice system, S2V, has been applied by using the skin color thresholding. This proposed system contains a web-camera furnished to the personal computer that will take and scan the picture of hand gestures. Feature Extraction and Image Segmentation Algorithm is used to identify the hand gestures of the people. As per to recognized characters, corresponding preinstalled soundtrack will be played, thereby this proposed system come over the communication gap between vocally

disruptive people and normal persons (Arm, Face, Head, an Body) [9].

Symbolic Language is an effective tool to overcome the communication gap between people with hearing impairment and normal people. The main objective of the proposed system is to reduce the communication gap between people with hearing impairment and normal people since it allows interactive communication. The proposed system approach converts the language into voice. The system removes the required time complications of peoples with vocally impaired people and develop their communication. With this proposed system, the hearing impaired persons can use the gloves to perform gesture language and it will be converted into voice and the speech of a normal persons is translated into text and corresponding hand symbols, so the communication between the deaf, dumb and blind people place quickly [10].

2. SYSTEM REQUIREMENTS

Hardware and Software Requirements:

a) Raspberry Pi

The model we are using is Raspberry Pi-3 model B which is a micro-sized computer. It has a Bluetooth version of 4.1, Ethernet of 10/100 base and has Wi-Fi with 802.1x in IEEE standard and provides a 2.4GHz frequency range.
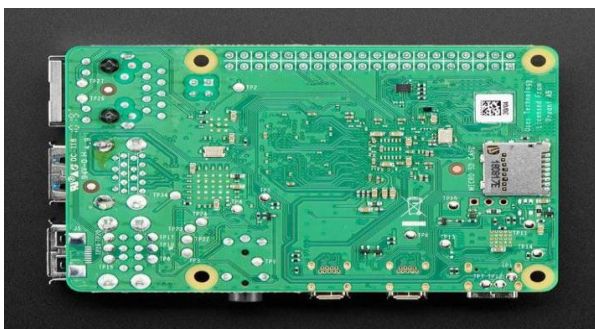
Source: http://thingbits.in/
Fig -1: Raspberry Pi-3 Model B Back view

Source: http://thingbits.in/
Fig -2 : Raspberry Pi-3 Model B Front view

Specification of Raspberry Pi-3 Model B

- SoC-Broadcombcm2837.

- Processor- 4* ARM cortex A53 of 1.2 GHzspeed.
- RAM- 1GB lpddr2 of 900MHZfrequency.
- Networking- Wireless Ethernet of 10/100 base with the 2.4GHz 802.11 standard.
- Bluetooth- 4.1 classic Bluetooth.
- Storage- MicroSD ranging from 8GB to128GB.
- GPIO- 40 digital input-output pins.
- Ports- 3.5mm audio and video jack, HDMI, 4* USB ports of version 2, CSI ports and DSI port to connect touch screen displays.

b) Camera

A Logitech C270 model web-cam is used in the proposed model. It has a 5-megapixel resolution with built-in mikes and background noise cancellation technology. XVGA video recording system is used which has 1024x768resolution.

c) Tesseract OCR engine

Tesseract OCR is a free software for optical character recognition (OCR) that can be used for various operating systems. It uses a process to electronically extract text from pictures and then, the converted text can be reused in multiple ways for document editing, text-to-speech conversion. OCR technique can be used for converting documents such as scanned papers, PDF files and captured images into editable data. Tesseract can be used on operating systems like Windows, Linux and Mac OS. The programmers are able to extract texts that are typed or printed from the images by making use of an API. The process of installing the Tesseract OCR includes two parts, the engine and the training data for a language. Tesseract can be obtained directly from Linux distributors for Linux OS. The latest version of Tesseract OCR available is 4.1.1.

d)Open CV

OpenCV is a library, a cross-platform and is an open-source tool of various programming functions that focus mainly on real-time computer vision. The Intel research

center developed it and was later supported by Willow Garage and is currently maintained by Itseez. The C++ programming language is used for coding and also for primary interface of OpenCV. Its binding is in JAVA, Python, and MATLAB. Open CV can run on multiple platforms like Windows, Linux, MacOS, Open BSD, IOS and Blackberry. It can be used for various purposes such as face recognition, gesture recognition, object identification, mobile robotics, segmentation, etc. It is a combination of Open CV, C++ API and Python programming language.

e) eSpeak

eSpeak is an open source software by google. It is used for text-to-speech translation and supports many languages mainly English. For platforms like windows and Linux, "formant synthesis" technique is used by e-Speak. This technique facilitates many languages to be provided in a smaller size. The voice that is converted is fairly clear and has higher accuracy, but it is not as smooth or natural as in case of larger synthesizers which are based on human voice recordings.

f) VNC Viewer

VNC or Virtual network computing is a graphical system for desktop sharing. It uses a Remote Frame Buffer (RFB) communication protocol. The mouse and keyboard events are transmitted from one computer to another. VNC is platform-independent and a software that can be remotely accessed as per our requirement. VNC technology with a VNC server application is used to connect to a remote computer. The inputs collected by the VNC Viewer is sent to the VNC Server for achieving remote control access.

3. IMPLEMENTATION AND METHODOLOGY

Block Diagram

Fig1. represents the block diagram of the proposed model. In this system, the microphone and camera are the input devices. The microphone is used to take voice input and camera is used to take image as input. Speaker or earphone and the monitor are used as output devices. The speaker is used to get speech output and monitor to display text and image output. RaspberryPi-3 is used to control all these devices.
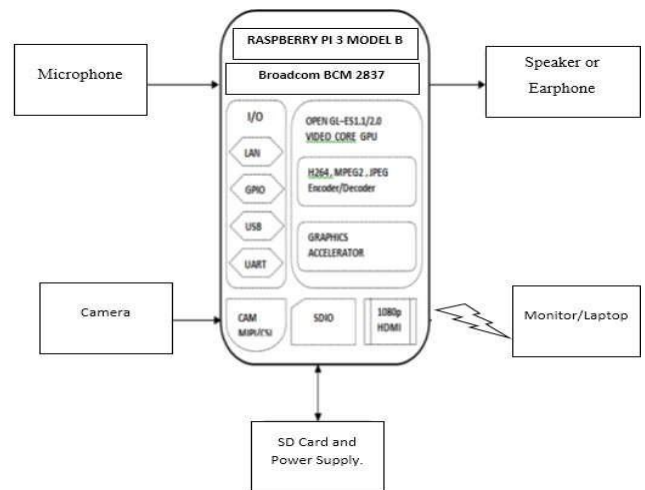

Fig-3 : Block diagram of the proposed system.

This proposed model acts like a portable device such as a cellphone through which the user can send and receive text messages. When the user uses this device to interact with others, input is taken through the microphone. The device does speech-to-text (STT) conversion and text is displayed on the LCD screen of the device. The user can type a reply to the text message on the screen and the system will convert that text-to-speech (TTS) and the converted speech is given as output from the speaker.

The data flow diagram of the proposed system is as given below. The model has 4 options to select the required conversion technique.

- Text to Speech(TTS)
- Image to Speech or Text (ITST)

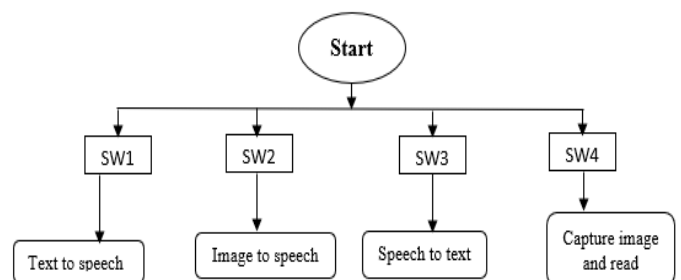- Gesture to Speech(GTS)
- Speech to Text(STT)

Fig-4 : Data flow diagram of the proposed model

1. Text-To-Speech

The next translational operation Text-to-Speech conversion technique is helpful for the vocally disabled people who do not have the ability to speak like other people normally. The dumb people convey their message or information in text format which is converted into voice signals. The converted voice signal is given as output. The output is read out using Google synthesizer through the earphone or speaker.
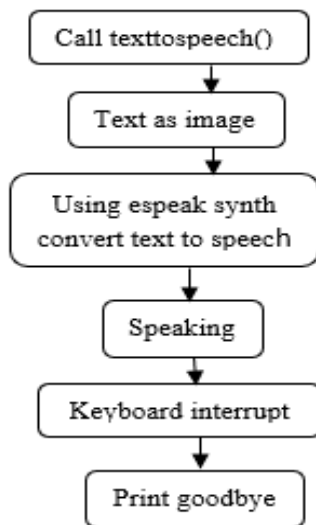
Fig -5 : Data flow diagram of the text-to-speech

2. Text-to-Speech using Camera

This type of conversion is designed for visually impaired people who do not have the ability to see normal text. For the help of these disabled people, the system is interfaced with a webcam which captures the image with text and the image is scanned using the OpenCV image processing tools and image processing library package. The image that is scanned is converted into text using the Tesseract OCR technique and a text file with .txt extension is created and saved. It will re-phrase the paragraph into shorter sentences before saving. In OCR, the adaptive linear thresholding techniques are used for changing the text image to binary mapped image and that is transferred to character outlines. The converted text is read out using the e-speak and the output can be heard through the speaker or earphone.
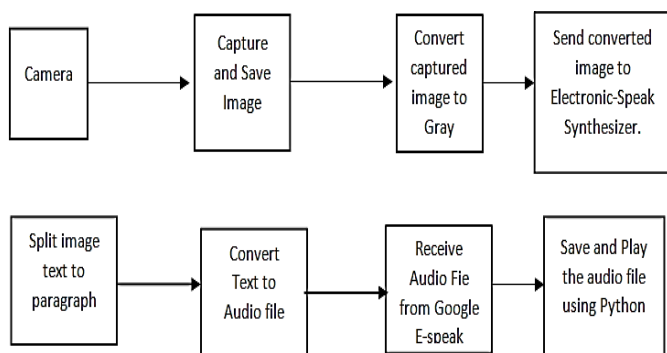

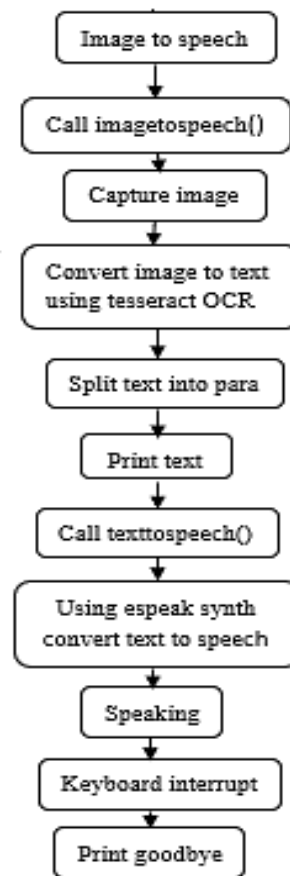**Fig - 6 :** Block diagram for text-to-speech conversion using camera.

Fig - 7 : Data flow diagram of the image-to-speech

3. Speech-to-Text

This conversion technique is to help people with inability to hear or cannot identify the voice. To help them, the proposed model is equipped with a speech to text converter. It translates the voice of normal people into text. The microphone is used to take voice as input and conversion to text format is made using API.
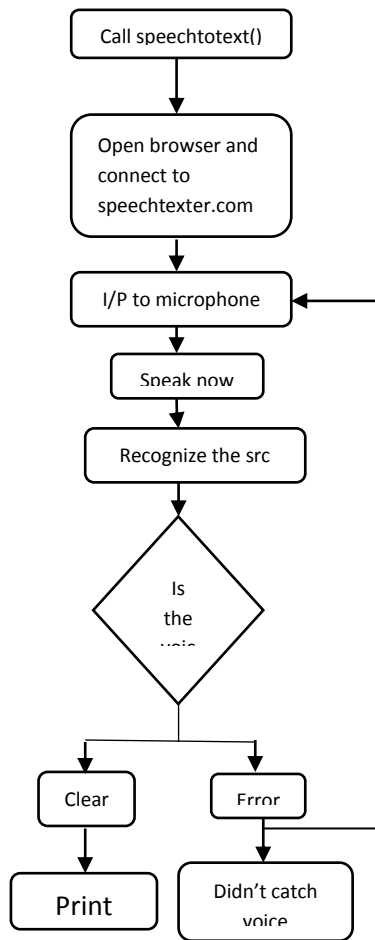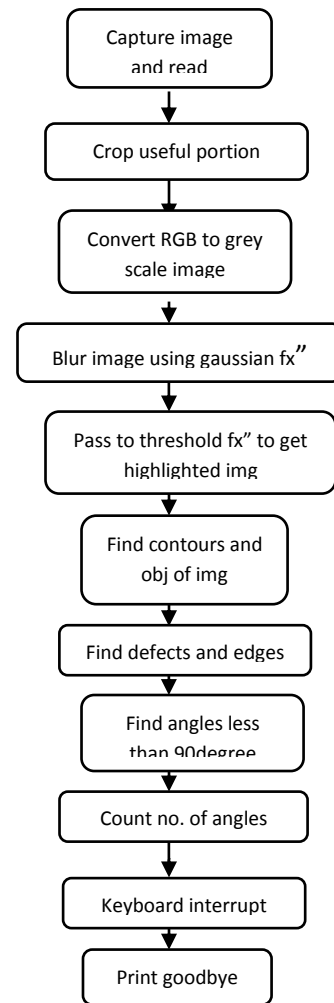
Fig-8: Data flow diagram of the speech-to-text

Fig-9: Data flow diagram of the image-to-text

4. Gesture control

The gesture conversion is to convert gesture language to text or voice. This technique is employed to help vocally impaired people who use symbols to convey their message or information to other people. The image of the gesture shown is captured, scanned, cropped and converted to a grey scale image for enhancing the features and then the resized image is blurred by using the gaussian threshold function for blurring, to get a concentrated area of the figure. The contours and angles between the fingers are identified. The number of angles that are less than 90 degrees are counted and the number of defects are identified. Based on the total number of defects, the message or text is determined and displayed on the device screen and the same is given as speech output through the speaker.

4. CONCLUSION

The different prototype models for deaf, dumb and blind people are all developed into a single easy to use device. The main merits of the designed model is, it is a small compact device and can be easily carried anywhere. It also supports hand gesture recognition with certain limitations. It can be further improved by implementing gesture recognition for numbers and alphabets. It can be advanced to take videos as input and segment them into frames from which text readings can be scanned and translated to text or speech format.

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