Research Article

IMPLEMENTATION OF A NEW METHODOLOGY FOR PERSONAL COMMUNICATION SYSTEM USING RASPBERRY-PI

Yogeesh M* and Sivakumar B

Department of Telecommunication Engineering, Dr. Ambedkar Institute of Technology, Bangalore

ARTICLE INFO	ABSTRACT

One of the precious gifts of the human being is the ability to speak, see, listen and respond according to the situations. But some people are deprived of this. Making a single compact system for such people with Hearing, Visual and Vocal impairment is a tough job and communication of these people with normal people has been always the toughest job. This proposed system proposes a new innovative personal communication system framework for dumb, deaf and blind patients in a single flexible device. This proposed system provides a technique for a blind person to read a text or paragraph and it can be provided by scanning an image through logi-tech camera which converts a scanned picture to text and text-to-speech (TTS), for the deaf people it facilitates a way to read a text by voice or speech-to-text conversion (STP) and it also provides a technique for dumb people using text-to-voice conversion through which blind 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.

INTRODUCTION

In this digital era with the advancement in information and communication technology. Symbol language is the toughest way for the communication between deaf dumb people and the external 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, 60 million are blind and 255 million 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 technique doesn't require any external peripheral like hand gloves and helmet etc. due to this advantage lot of research is going on the picture-based technique approach, but sensor-based technique disabled persons need to wear devices. Symbolic sign recognition system gaining importance in most of the application 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 institutions in our country, due to this, many dumb people use the usual type of symbolic communication language to cony their message or information to the world and they don't have any customized symbolic language. Therefore, a huge amount of communication gap still exists between the deaf, dumb, blind and external world. Despite the huge number of deaf and dumb people very little research is done to overcome the communication obstructions. The proposed system helps normal and deaf dumb people to communicate with each other effectively and easily. 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

Corresponding author: **Yogeesh M**
Department of Telecommunication Engineering, Dr. Ambedkar Institute of Technology, Bangalore

translated into text using Tesseract OCR, the converted text is stored into the folder with WordPad format and the 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 understandable by normal people. For deaf people, the voice/speech is converted into text by using a website called speechtexter.com.

The SHAROJAN Framework will make utilization of the Wearable Development, Texas Instrumentation Equipment, and Arduino Circuit Sheets to give a system for correspondence to all of a sudden abled individual having one or the majority of the above say handicaps. It is recognized that a man who needs a listening device is correspondingly bonehead yet the other way around isn't honest to goodness (Kanika Rastogi *et al*, 2016).

In this errand, the author proposed another structure show called the SHAROJAN Extension with a genuine goal to cross any limit in the midst of the time spent correspondence between the outwardly weakened, in need of a hearing aid and unfit to talk individuals. The SHAROJAN Augmentation will make use of the Wearable Headway, Texas Instrumentation Equipment and Arduino Circuit Sheets to give strategies for correspondence to in an unanticipated way abled individual having one or the vast majority of the above say handicaps. It is recognized that a man who is hard of hearing is additionally imbecile, however, the other course around isn't significant (K.V Fale, 2007).

In general day by day presence correspondence is principle issue for about hard of hearing, doltish individuals and for Stun solitary it is hard to take notes of specific things. Thus, to oust the obstruction of correspondence a glove is normal for quiet individuals with preloaded 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-90^3 (Rohith raslogi *et al*, 2015).

This structure is utilized to beat any obstruction of correspondence among outwardly weakened, deaf and nitwit people. Consequently, the framework makes utilization 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 exorbitantly (ATA-UR-Rehman *et al*, 2008).

The proposed gadget which can change over hand developments into a voice, the contraption includes a Remote Glove, contains accelerometer and flex sensors. Those sensors will sense the movements of fingers and hands. The proposed system incorporates the discussion synthesizer circuit which changes over these enhancements 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 contraption gives a beneficial technique for correspondence for both practically hard of hearing uncouth and ordinary citizens (Vikram Pradeep Sharma *et al*, 2013).

300 million need a listening device and 1 million are inept, as shown by the world, the Sharon Extension with a genuine target to beat any snag in the midst of the time spent correspondence between the apparently blocked, not sharp individuals; in this task, we will propose another framework illustrate. To give a system for correspondence to unmistakably gifted individuals having one or, of course the vast majority of the above say in-limits, the Trojan Expansion will make utilization of the Sensor Glove for correspondence utilizing signals^6. It is viewed as that a man who needs an amplifier is also doltish however the other way around isn't conceivable (Nikitha Praveen *et al*, 2014).

This proposed system is to develop a compact device to identifying the Symbolic Language, which facilitates the communication between people with vocal impairment and normal people the symbols to the voice system, S2V, has been implemented by using the skin color thresholding. This proposed system contains a web-camera equipped 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 users. As per to recognized symbols, corresponding pre-loaded soundtrack will be played, thereby this proposed system overcome the communication gap between vocally impaired people and normal people (Arm, Face, Head, an Body) (Prof. R R.Itkarkar *et al*, 2013).

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 methodology converts the language into voice. The system eliminates the required time difficulties of peoples with vocally impaired people and improves 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 people is translated into text and corresponding hand symbols, so the communication between the deaf, dumb and blind people place easily (Shraddha R Ghorpade *et al*, 2018).

MATERIALS AND METHODS

Block Diagram

The block diagram of the proposed system is as shown in Figure 1. This system contains two main blocks they are input condenser microphone and the output speaker section, camera to capture the images. All these input-output devices are controlled by the use of Raspberry Pi-3.
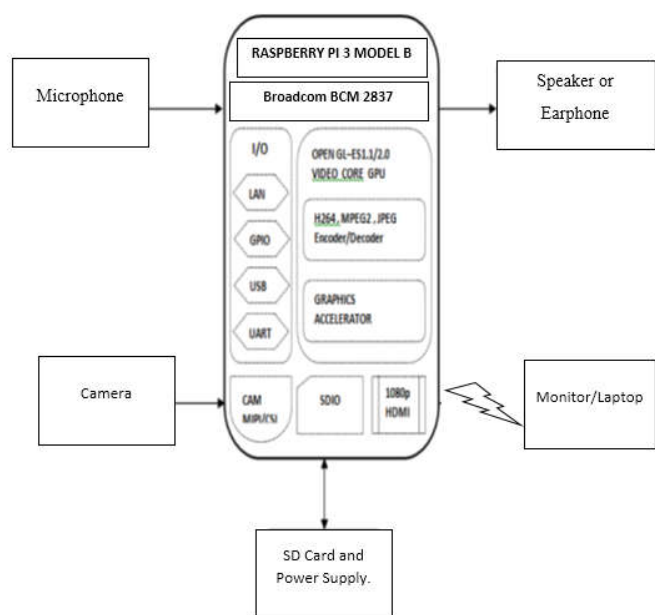
Figure 1 Block diagram of the proposed system.

The proposed system is a portable device where the user sends and receive a message as a text. The device acts as a mobile phone. When people try to interact with others using this device, it takes input from the microphone. Then the device converts speech-to-text (STT) and displays it on the device screen based on the conversation. The user replies to the text message and the system convert text-to-speech (TTS) conversion and output is read-out by the speaker.
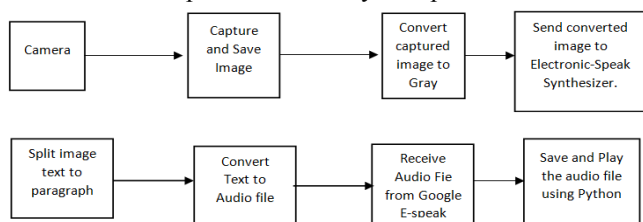

Figure 1 Block diagram of the GTTs (Google Text to Speech Converter).

Text To Speech using Camera

The first conversion technique is designed for peoples who are not able to see the normal text. To help these disabled persons, the proposed system is interfaced with the Logitech webcam to capture and scan the picture by using the OpenCV image processing tool image processing library package. The scanned picture is translated into text using the Tesseract OCR technique and saves the text to file sample.txt and then open the saved text file, re-phrase the paragraph into smaller sentences and save it. In OCR, the adaptive linear thresholding techniques are used to change the picture into binary mapped images and they are transferred to character outlines. The translated text is read out by the e-speak through the speaker or earphone.

Speech to Text

The second conversion technique is developed for the people who are the inability to hear the voice and cannot identify the voice of normal people. To help such inabilities, the proposed system is equipped with a speech to text conversion technique which is used to translate the voice of the normal people to text

format. The microphone on is used to detect the input which is converted into a text format using API.

Gesture control

The third and last conversion is gesture language to text or voice. Within this process, vocally impaired people use symbols to convey their message or information to normal people in an understandable manner. The image is scanned, cropped and converted to a grayscale picture for enhanced features and then blur the resized picture by using the gaussian blur thresholding function to get the concentrated area of the picture. After, identify the angle and contours between 2 fingers. Count the number of angles which is less than ninety degrees and identify the number of defects. According to the total number of defects, the message or text is displayed on the monitor or screen and read out by the speaker.

Text-To-Speech (TTS)

The fourth operation is text to speech translation technique is for the dumb peoples who cannot able to speak as normal peoples. The vocally impaired people convert their information or message to text format which could be converted into a vocal signal. The converted voice signal is read out by e-speak or Google synthesizer through the earphone or speaker.

Bellow figure 3 shows the flow diagram of the proposed model. The proposed model has 4 choices for selecting the necessary translation.

- Text To Speech (TTS)
- Image or Picture To Speech using Camera (ITSC/PTSC)
- Gesture or Symbol To Speech (GTS/STS)
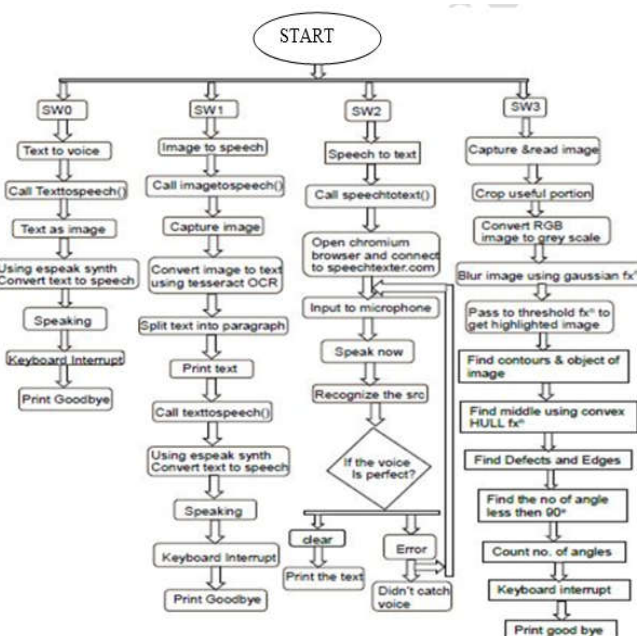- Speech or Speech To Text (STT)

Figure 1 Flow diagram of the system.

Hardware and Software

Raspberry Pi

The Raspberry Pi-3 model B is a micro-sized computer with Bluetooth of version 4.1, Ethernet of 10/100 base and has Wi-

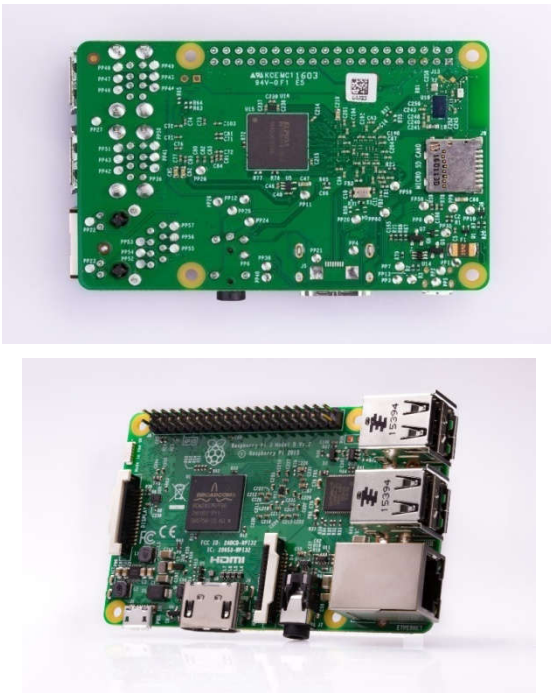Fi with 802.11n IEEE standard provides a 2.4GHz frequency range.

Figure 3 Raspberry Pi3 Model B Back and Front view

Specification of aspberry Pi-3 Model B

- SoC- Broadcom bcm2837.
- rocessor- 4* ARM cortex A53 of 1.2 GHz speed.
- RAM- 1GB lpddr2 of 900MHZ frequency.
- Networking- Ethernet of 10/100 base with the 2.4GHZ 802.11n wireless standard
- Bluetooth- 4.1 classic Bluetooth.
- Storage- MicroSD ranging from 8GB to 128GB.
- GPIO- 40 digital input-output pins.
- Ports- HDMI, 3.5mm audio and video jack, 4* USB ports of version 2, CSI ports and DSI port to connect touch screen displays.

Logitech Camera

The proposed system has a Logitech C270 model web-cam which has a 5-megapixel resolution. It has built-in mikes with background noise reduction technology. XVGA video recording system has a reach of about 1024x768 resolution.

Tesseract OCR

Python Tesseract OCR is an online character recognition (OCR) tool can be used on the various OS platform. Tesseract OCR is the process of electronically extracting text from pictures and reusing the converted text in a variety of ways such as document editing, text-to-voice conversion. OCR is a technology that is capable of converting documents such as scanned papers, PDF files and captured image into editable data. Tesseract can be used for Linux, Windows and Mac OS. It can be used by programmers to extract typed, printed text from images using an API. Tesseract can use GUI from the available 3rd party page. The installation process of Tesseract OCR is a combination of two parts, the engine and training data for a language. For Linux OS, Tesseract can be obtained directly from many Linux distributors. The latest stable version of Tesseract OCR is 4.0

Open CV

OpenCV is a library tool of different programming functions mainly aimed at real-time computer vision. The Intel research center has developed it and subsequently supported by Willow Garage and it is now maintained by itseez. The coding language used is C++ and the primary interface of OpenCV is also C++. Its binding is in JAVA, Python, and MATLAB. Open CV runs on various platforms like Windows, Linux, MacOS, Open BSD, IOS and Blackberry. It is used in the diverse purpose for facial recognition, gesture recognition, object identification, mobile robotics, segmentation, etc. It is a combination of Open CV C++ API and Python language.

eSpeak

eSpeak is an open source google software for text-to-speech conversion, which supports English, and other languages. For windows and Linux e-Speak uses a "formant synthesis" technique. This facilitates many languages to be provided in a smaller size. The converted voice is very clear and has high accuracy, but it is not as smooth or natural as larger synthesizers which are based on human voice recordings.

VNC Viewer

Virtual network computing (VNC) is a simple ready to use desktop remote access or a sharing system which uses an RFB communication protocol. It shares keyboard and mouse events to another computer over a network. VNC is a platform-independent remote access software for commercial and personal use. It uses VNC technology to connect to a remote computer using a VNC server application. VNC Viewer collects input and sends it for VNC Server to achieve remote control.

CONCLUSION

The prototype model for hearing-impaired, visually-impaired and vocally-impaired people into a single compact device is developed. The main advantage of the designed prototype model is, it can be easily portable due to its less size and weight. This paper fulfills the hand gesture recognition operation with some disadvantages. The proposed project can be further implemented for the Numbers, Alphabet in gesture control. The readings can be also taken in the form of videos and segmented into frames and can be translated into text format.

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