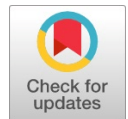# Raspberrypi Based Assistive Communication System for Deaf, Dumb and Blind Person

Suvarna Nandyal, Shireen Kausar

Abstract: Assisting to the people with visual, hearing, vocal impairment through the modern system is a challenging job. Nowadays researchers are focusing to address the issues of one of the impairment but not all at once. This work is mainly performed to find the unique solution/ technique to assist communication for the people with visual, hearing, vocal impairment. This system helps the impaired people to have the communication with each other and also with the normal person. The main part of the work is Raspberrypi on which all the activities are carried out. The work provide the assistance to visually impaired person by letting them to hear what is present in the text format. The stored text format is spoke out by the speaker. For the people with hearing impairment the audio signals are converted into text format by using speech to text conversion technique. This is done with the help of AMR voice app which makes them to understand what the person says can be displayed as the text message . And for people with vocal impairment, their words are conveyed by the help of speaker.

Index Terms: Raspberrypi, Tesseract OCR(optical character recognition technique), epeak, speech to text, Bluetooth device, LCD display, AMR voice app.

I. INTRODUCTION

Highlight With the advancement and rapid development of computer technology, contemporary Human-Computer Interaction (HCI) devices/ techniques have become essential in individuals daily lives. HCI devices/techniques such as computers, consumer electronics, mobile devices, electronic gadgets etc, have also dramatically affected our living habits. The ease with which an HCI device/ technique can be understood and operated by users has become one of the major considerations while selecting such a device. Therefore, it is necessary for researchers/ the developers to introduce enhanced and user-friendly HCI technologies which are able to translate user's requirements into corresponding commands without necessary to users to learn or accommodate to the device. In the population of 7.4 billion humans on our planet, there are 285 million are visually impaired out of whom 39 million people are completely blind, i.e. have no eyesight at all, and 246 million people have complete visual impairment (WHO, 2011). It has been predicted that by the year 2020, these count will rise to 75 million visual and 200 million people with visual impairment. Since ordinary people can not understand sign language, they have difficulty communicating with people with disabilities. There are several sign language interpretation agencies in our society. Thus, many dumb people communicate using common types of sign language and do not need custom sign language. It is also impossible for others to learn sign language. As a result, there are still many communication gaps between dumb, deaf, and normal people. Although there are many deaf and dumb people, little research has been done to reduce the communication deficit. We provide a system that helps normal, deaf, dumb, and blind people communicate effectively. We used a small credit-card-sized computer called Raspberry Pi to address these hearing, visual and speech impairments and worked to provide solutions for the blind who are deaf. For the visually impaired, the pre-captured image is saved to a site converted to text using Tesseract OCR, and the resulting text is converted to speech using text-to-speech. The resulted text is displayed on the LCD display. When the dumb people communicating with normal people, the pre stored text will be selected by dumb is spelled out by the speaker and also displayed on the LCD display which can be understandable by normal people. Deaf people, can be able to communicate with normal people by the help of LCD display which presents the text message of the second person. So the main purpose of this work is to provide the ease of communication for the people with hearing impairment, vocal impairment and visual impairment among themselves and also with the normal person.

II. LITERATURE REVIEW

To address the problems of deaf, dumb and blind person's the following authors carried out the work as follows

Chucai Yi et al. have developed a camera-based help text reading frame. (2013) to help visually impaired people read text labels and handheld product packaging in their daily lives. This article describes a scheme that reads text printed on portable objects to aid the visually impaired person. They provide a text-to-text support framework to help the visually impaired in their daily lives. You can create custom images for your images with easy-to-use and easy-to-use tools. This method selects a region of a moving object as a background subtraction method using a mixture of Gaussian. Location and text recognition are performed to obtain textual information in a separate ROI. They proposed a new text localization algorithm, an object-oriented image processing algorithm. Text characters in the restrained text area are binarized and recognized by commercial software OCR. Recognized text is sent to users with visual impairments.

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Shraddha R et al. Proposed a "full duplex communication system for the hearing impaired" (2015) A useful tool to facilitate communication between deaf and dumb people. Planned methodologies interpret gestures as voices and vice versa. Executes the activity using the HMM (Hidden Markov) model. Sign language is a very good tool to facilitate communication between deaf and normal people. This system is designed to reduce the communication gap between people and the normal world because it facilitates two-way communication. Planned methodologies translate language into speech. This system overcomes the time limit of people with speech impairments and improves behavior. This system converts audio signals into speech signals that can be easily explained by humans. Through this project, hearing-impaired people can use terrestrial signals as sign language and are converted into speech. The speech of the normal person of the voice form is converted into the gesture of the text and the hand, so that the communication can be made easily.

"Assistive Translators for the Deaf and Dumb people" **S.B Shroke et al.** (2014) This article models communication between the deaf and the public. The project targets people through glove-based deaf-mute communication systems. Gloves are designed internally with five bending sensors, touch sensors and accelerometers. For each distinct gesture, the bending sensor develops a proportional resistance difference and the accelerometer reads the direction of the hand. The sensor output is analogous to the digitally converted value. The output from the sensor is analog values it is transformed to digital. The transform of these hand gestures is in ARM processor. Processor compares the input signal with predefined voltage levels reserved in memory. According to that required output sound is produced which is saved in SPI memory with the help of speaker. In such a way it helps for deaf and dumb too.

Communicate with normal people. **Pankaj Pathak (2012)** proposed **"**Speech Recognition Technology: Applications & Future," paper discussed about : Voice or speech recognition is the used technology with the help of audio, words or phrases spoken by any person are converted into electrical signals, and these signals are transformed into coding patterns to which meaning has been assigned. Speech recognition technology has oppressed throughout many industries. Some companies have developed a robust system that performs as expected and sends the call to their intended destination. This technology would have to be suitable with all software and hardware. This technology would require the CPU to concurrently process voice input and data access.

"Visual Assistance Systems for Label Detection via Voice Output" proposed by **Vasanti.G and Ramesh Babu** (2014), they read additional text based on a camera that allows the visually impaired to read text labels and product packaging in their daily lives They have developed a framework. The system consists of a webcam connected to a RaspberryPi that allows you to print pages of text. The Optical Character Recognition (OCR) package installed in Raspberry Pi represents schema, modification, and segmentation before it is scanned into a digital document and extracted for classification. Once categorized, the text is mounted on a RaspberryPi by a spatial speech converter (TTS engine). The output is given before playing the audio amplifier.

Hence as per the above survey it is found that the solutions for deaf, dumb and blind person is not carried out in a single device. So this work has been carried out to address these three impairments in a single device.

III. PROPOSED WORK

We are developing an efficient text to speech conversion technique by using the Raspberry Pi 3 processor. When the text image was captured by the camera, and stores it to the cloud, the synthesizer used to separate the text from the image and then the Optical Character Recognition algorithm was implemented to recognize the characters in the text and then the Raspberry Pi 3 was the responsible to convert that text into speech by using the OpenCV libraries. And for deaf person the voice signals are converted into text format by using AMR voice app and HC-05 device.

Here it offer with three stairs
- Image to Voice (For BLIND)
- Text to Voice (For DUMB)
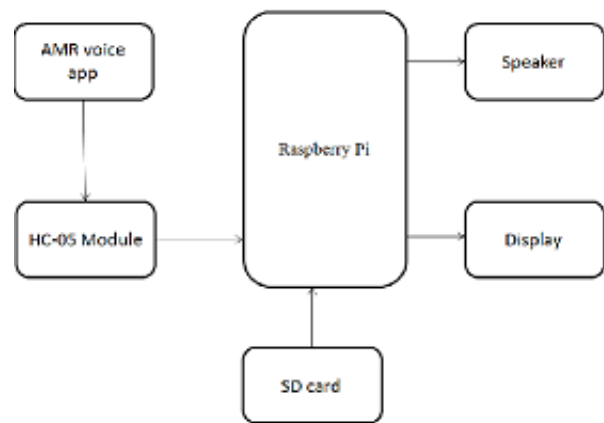- Voice To Text (FOR DEAF)

Fig 1: System Block Diagram

IV. HARDWARE REQUIREMTS

A. Raspberry pi:

RaspberryPi is a credit-card sized computer that connects to a computer monitor or TV and uses input devices like keyboard and mouse. It is capable of performing various functionalities such as surveillance system, military applications, surfing internet, playing high definition videos, live games and to make data bases. The paper is implemented using a Raspberry pi 3B board and their specifications are as follows.

1) Memory:1 GB LPDDR-900 SD-RAM (i.e. 900MHz)

2) Processor: Raspberry Pi has a Broadcom BCM2837 system on1chip module. It has quad core ARMv8 CPU. It can run at 1.2 GHz video core for multimedia GPU.

3) OS: Boots from SD card and running a version of Linux Raspbian OS.

4) Power: The Pi requires a 5v power supply. It is powered by a micro-USB charger or GPIO header.

5) GPIO (General Purpose Input-Output): GPIO is a generic pin1on an integrated circuit which can be configured as input and output pin. The Raspberry Pi board has 40 pins, 2.54mm expansion header. In this paper, we have used GPIO pin 4, 17, 27 and 18 to their respective switches.

6) SD card: Raspberry Pi has no storage on board so an external memory is required to store the OS.

7) Connections: 4 USB ports,10/100 Mbps Ethernet and 802.11n wireless LAN connections,3.5mm jack for audio out,BCM43438 Wi-Fi, Bluetooth low energy(BLE).
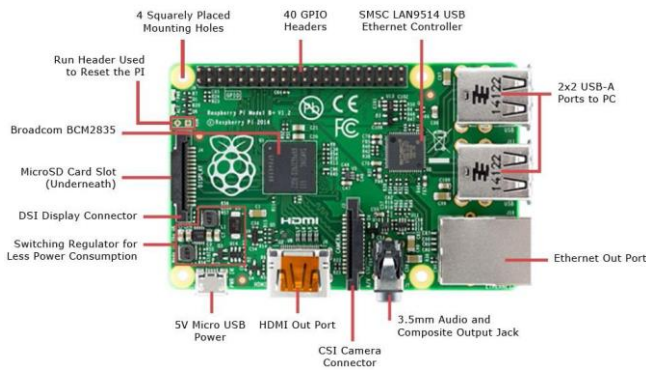

Fig 2: Raspberrypi Module

B. Bluetooth-HC05:

Module HC - 05 module is an SPP (Serial Port Protocol) Bluetooth module that can be used directly with the other devices. It is designed to exchange data through a transparent wireless serial connection. Bluetooth can be used to transfer data from fixed mobile devices and also can be used to build personal area networks (PAN) Bluetooth connectivity ranges approximately 10 meters. Bluetooth uses short-wavelength ultra high frequency radio waves in the ISM band in the range 2.4 to 2.485 GHz.

V. SOFTWARE REQUIREMTS

In our project, Raspberry Pi is interfaced with the computer monitor by using the 5V power cable. Through this line, we operate the kit with the following software.

A. Tesseract OCR

Python Tesseract is an optical character recognition (OCR) engine for different Operating Systems. Tesseract OCR is the process of electronically obtaining text from images and reusing text in a variety of ways, such as editing documents and searching for free text. OCR is a technology which is capable of converting documents into modified data. Tesseract is effective 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 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 distributers.

In our project Tesseract is used to convert the captured image text into text format.

Tesseract Features:
1) Page layout analysis.
2) More languages are supported.
3) Improve forecast accuracy.

4) Add UI.

B. Espeak

It is small and open source speech synthesis software for English and other languages for Linux and Windows platforms.It is used to convert text to voice Many languages are supported by it in small size. The programming1for espeak software is done using rule files with feedback. It supports SSML. Voice transitions can be edited through it. This file is a text file that allows you to always adjust the frequency to change features such as the pitch range, add effects such as echo, whisper, and irregular voice, or to change the sound. the voice. The default speaking speed of 180 words per minute is too fast to be intelligible. In our project Espeak is used to convert the text to voice signal.

C. WinSCP

WinSCP (Windows Secure Copy) is a gratis and unblocked source SFTP, FTP, WebDAV and SCP is a patron for Microsoft Windows. Its most important role is to hand over the file in a secure manner between a local and a remote computer. Beyond this, it offers the indispensable file manager and file harmonization functionality. For sheltered transferring, it uses Secure Shell (SSH) and hold up with the SCP protocol in addition to SFTP. To use SFTP for protected connections, the server you are connecting to must also hold SFTP. WinSCP is a Windows application for transmitting documentation by means of FTP and SFTP. The WinSCP main window displays the documents and folders as of from our PC on the left side of the main window and the files and booklets on the remote SFTP site on the fitting point. WinSCP has the following features as
  • Discretionary stores session data
  • Selectively import session information from Putty settings in the register
  • The capacity to upload files and retain associated original date/time stamps, unlike FTP clients.

D. AMR voice app

AMR Voice app takes the voice as input from android phone and converts it into text string using Android mobiles internal voice recognition (Google Voice App) and sends this converted text serially over Bluetooth. Here android mobile phone is used as internal voice detection to pass voice input commands to your system that communicates with Bluetooth Serial HC05-Modules and sends in the recognized voice as a string of data. This HC05 received string is displayed on the terminal screen of LCD connected through raspberry pi3 controller.

VI. DESIGN AND IMPLEMENTATION

A. Image to voice:

The first process is for the blind people, in this process, the picture which is captured and stored in cloud is being first converted to text by Tesseract OCR. In this OCR, we apply the adaptive thresholding techniques to change the image to binary images.

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And so they were transferred them to character outlines and these characters outlines were converted into speech. And the group of words forms the text and it has been spoke out by the espeak.

B. Text to voice:

The second process gets on for the vocally impaired persons who cannot speak and they convey their thoughts by text, which are already captured and stored cloud (the stored data may vary depending upon the developer's choice) that could be converted into the audio signal. The converted voice message is sent over the espeak.
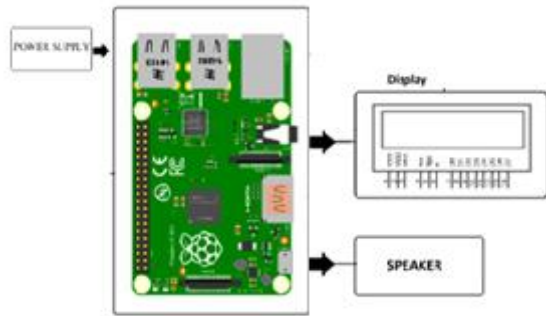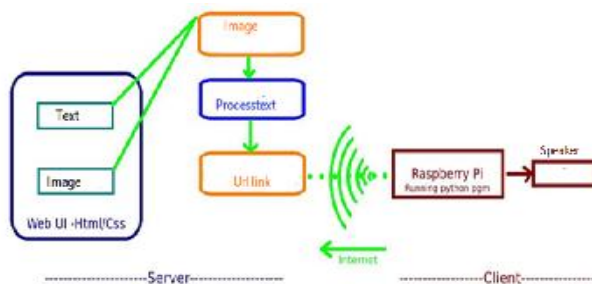

Fig 3: Image/ Text to Speech Conversion

Fig 4:Raspberry Pi web processing Block Diagram

On the client side is Raspberry Pi with a relay circuit linked to the GPIO pin. RaspberryPi uses urllib2 to run a Python program that is used to "post" URL links. That is, RaspberryPi continuously reads the contents of the URL link. The URL link here is another PHP file called process.php. This PHP file acts as an Application program interface to know the contents of a text file named Status.txt. After reading the data, the Python program analyze whether the output string is "image" / "text" based on the downloaded URL of the current image to be processed.

Adapting the HTML and PHP Files:

First, you need to arrange the server side of the system. If you have a domain, you can use the File Manager service to store files on the server and control the IoT system from anywhere in the world. The files to place on the server are some files, and the images are stored in the text.php, image.php, and process.txt files. The program commenced here is raspbi.py which is a Python program and should be copied to Raspberry Pi. The HTML file has a basic user interface with two buttons. When the button is pressed, a PHP program is executed that writes a string to the process.txt file based on the pressed button. The .txt file stores the last URL information for the button. C. Voice to text: The third process we provide for difficult hearing that others can not learn. In order to help them in accordance with the Parliamentary Act,

we have used this auxiliary device for the deaf. This procedure recognizes the voice signal and assigns a minimum voltage threshold that begins to input the voice signal through the voice application AMR, and then retrieves and maintains the converted text on the LCD. First the Bluetooth connection must be setup between the AMR voice app and the HC-05 module by entering the default password 1234/0000. After the connection setup the person can be able to give the voice input, the AMR voice app converts the voice to the text format. The converted text string is send to the Raspberrypi module using Bluetooth. Upon receiving the text string it displayed on the LCD display.
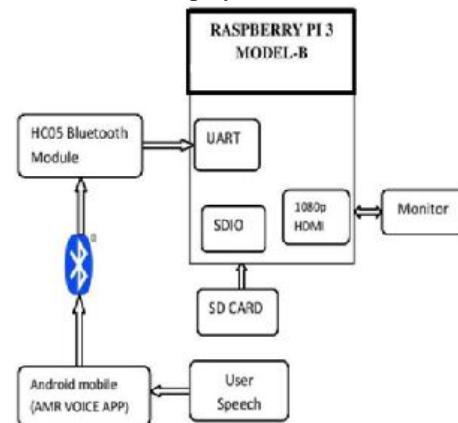

Fig 5: Voice to Text Conversion

VII. RESULT AND DISCUSSION

The connected Raspberrypi module with Bluetooth, LCD display and speaker, when turned on the image / text to voice conversion can be selected by using the buttons.

Fig 6: System connection setup

When the person selects the particular image or the text on the mobile device the same text will appear on the LCD display and also will be spoke out as a audio output from the speaker. For the voice to text method the user has to setup the Bluetooth connection in AMR voice app then he has to give the voice input the app which is then converted into the text format and the text string is sent to the

Raspberrypi module using Bluetooth further the text is displayed on the LCD display. Here in the figure we can see the connection setup for the project and the person can easily handle the device. The main purpose of this work is to assist the communication for deaf, dumb and blind person so that they can easily communicate with each other and also with the other normal person. Hopefully we have achieved the results to the expected way.

VIII. CONCLUSION AND FUTURE WORK

By this proposed work, we have designed the prototype model for visually impaired, hearing impaired and vocally impaired people by using a single compact device. The important key factor of this system is to facilitate these people and to fix them more confident to manage their sites by themselves and allow the communication between themselves and also with normal persons. The main advantage of this system is its less weight and size due to which it can be easily portable. To continue with this project, you can use a simple coding language to make it less complex with other advanced devices. This electronics can reduce complications due to small devices that can be more useful to people in the world.

REFERENCES

1. Asha G. Hagargund, Sharsha Vanria Thota, Mitadru Bera, Eram Fatima Shaik, "Image to Speech Conversion for Visually Impaired", International Journal of Latest Research in Engineering and Technology, Volume 03, Issue 06, June 2017.
2. Chucai Yi, Student Member, IEEE , Yingli Tian, Senior Member, IEEE , and Aries Arditi "Portable Camera-Based Assistive Text and Product Label Reading From Hand-Held Objects for Blind Persons" 2013 IEEE.
3. K. Lakshmi, Mr. T. Chandra Sekhar Rao, " Design and Implantation Of Text To Speech Conversion Using Raspberry PI", International Journal of Innovative Technology and Research, Volume No. 4, Issue No. 6, October-November, 2016.
4. Martin Goldberg CUNY Graduate Center New York, NY. USA for "Assisting Visually Impaired People with Mobility through Technology in the Age of Context" in 2015.
5. Nagaraja L., Nagarjun RS, Nishanth M Anand, Nithin D, Veena S Murthy, "Vision based Text Recognition using Raspberry Pi", International Journal of Computer Applications, National Conference on Power Systems & Indutrial Automation.
6. Pankaj Pathak Dept. of CSE Shri Vaishnav Institute of Computer science Indore, India," Speech Recognition Technology: Applications & Future," International Journal of Advanced Research in Computer Science Vol. 1, No.4, Nov-Dec 2012.
7. Rithika H., B. Nithya Santhoshi, "Image Text To Speech Conversion In The Desired Language By Translating With Raspberry Pi".
8. S.B.Shroke, Nandar Dehpande, Prashant Deshmukh, Sanjay Kumar Mathapati. "Assistive Transulator For Deaf And Dumb People"-in July-2014.
9. Shraddha R. Ghorpade, Surendra K. Waghamare, "Full Duplex Communication System for Deaf & Dumb People," International Journal of Emerging Technology and Advanced Engineering (IJETAE), Volume 5, Issue 5, May 2015, ISSN 2250-2459.
10. Shwan Hadi and Oğuzhan Özdemir for "Development of Learning Software for Deaf: A Sample of Language Learning Material" Software Engineering Department,College of Technology, Computer Education and Instructional Technology Department, College of Education, Firat University, Elazig, Turkey Vol. 6 Issue 06, June – 2017.
11. Srilakshmi S, Dr. Shabana Sultana for "Interactive Gesture Based System with Email Access and Voice Command for the People with Visual, Hearing and Speech Impairment Using IoT" International Research Journal of Engineering and Technology (IRJETVolume: 05 Issue: 05 May-2018.
12. Vasanthi.G and Ramesh Babu.Y Department of ECE, DMI College of Engineering, Chennai, India."Vision Based Assistive System for Label Detection with Voice Output"Jan-2014.

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