

Raspberry-Pi Based Assistive Device for Deaf, Dumb and Blind People

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ABSTRACT

Addressing the issues of People with Visual, Hearing and Vocal Impairment through a single aiding system is a tough job. Many modern day researches focus on addressing the issues of one of the above challenges but not all. The work focuses on finding a unique technique that aids the visually impaired by letting them hear what is represented as text and it is achieved by the technique that captures the image through a camera and converts the text available as voice signals. The paper provides a way for the people with Hearing impairment to visualize / read which is in audio form by speech to text conversion technique and we also provides a way for the vocally impaired to represent their voice by the aid of text to voice conversion technique. All these three solutions were modulated to be in a single unique system. All these activities are coordinated with the use of Raspberry Pi. The visually impaired people are helped by the process in which the image to text and text to speech is given by the Tesseract OCR (online character recognition). The deaf people help with the process of an app which makes them to understand what the person says can be displayed as the message. Vocally impaired people can convey their message by text so the other persons can hear the message in a speaker.

Keywords: Raspberry-pi, Assistive device, Tesseract Optical Character Recognition OCR, espeak, OpenCV, Google API.

I. INTRODUCTION

Approximately 285 one thousand thousand 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 researches 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 does not want the assistance of other neighbors. The development our project helps the multitude to experience loose and go independently.

In all around the world about 9.1 billion people are deaf and 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 deaf and 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 deaf 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 have used the tiny credit card sized computer named raspberry pi. By this device we provide the solution for blind, deaf and dumb people. For blind

people the image is converted to voice by using Tesseract software, the deaf people received their content by message as soon as the opposite person speaks out it displayed as a message. The dumb persons conveyed their message through text instead of sign language which is delivered via espeak. We have provided necessary steps to resolve the problems of those masses.

II. METHODS AND MATERIAL

Existing System:

In the earlier days the blind people are catered with the basic learning's of the Braille system.

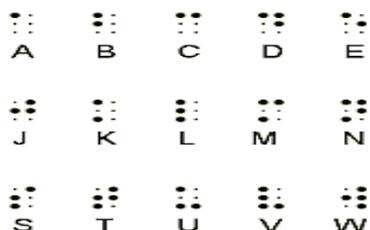


Figure 1

Braille is a scheme of raising symbols which the great unwashed who are blind or partially- sighted have been employed worldwide for over 150 years. The language in the Braille will go from left to right across the page, just like printed words. The symbols which represent each letter are prepared up of between one and six dots based on the figure of six dots which we would pick up on a dice or a domino. Later in the evolution of the Braille system, there exists a system of screen reader which is a computer program that enables the blind masses to interpret what is shown on the screen through speech.



Figure 2

Using the keyboard, he/she moves using the arrow keys and a screen reader interprets what is displayed on the cover. In the presence of screen reader there also exists another reader which makes the blind masses to read text easier which is known as finger reader.



Figure 3

The finger reader is a device that helps visually impaired users with understanding texts and language. It is essentially a ring type model usually wears on their index finger, which houses a tiny camera and some haptic actuators for feedback. People with vision impairment who set up 2.8% of the population, which naturally rely on tactile feeling through their fingers to learn Braille and gather data about the surroundings. On applying the finger –wearable device that is ready to use and gives them real time feedback which would fix their lives more comfortable. With the elongation of these gimmicks, there exists a Bar code scanner for blind people.



Figure 4

The Bar code consists of bars and spaces that differ in width. The bars and spaces of a bar code keep in touch to numbers and letters that epitomize the evocative data. Human existence is a social being that can interact with other people to shares to their estimates, judgments, views and information in the form of verbal and non-verbal message. But communication for a soul is difficult who cannot hear is visual, but not auditory. In

order to communicate with the masses, the dense and deaf people in earlier days have used the sign language to communicate.

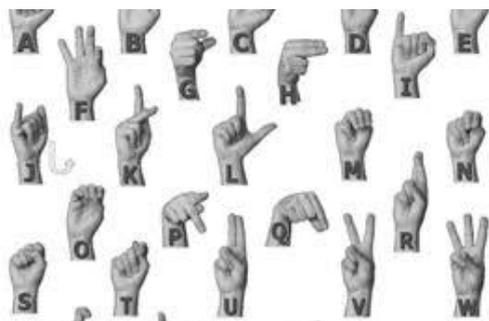


Figure 5

The sign language has developed through smart devices like sign language translator with the help of gloves which is processed by gesture recognition. This is the basic form of all deaf and dumb people who can convey their information through sign languages with the help of different scientific devices.

In the above said existing system has certain disadvantages which are as listed beneath In Braille system, it can induce harm to the surface which would be like scribbling with permanent marker over visual writing, and any injury to the finger would be like experiencing an eye patch on to a seeing person. So, Braille is slightly, more susceptible to problems preventing any reading.

- In Screen reader visually impaired people only take heed to a screen reader reading the text displayed on the cover, and they don't hold the opportunity to recognize the correct spelling of certain words like medical terms and other scientific terms.
- In Finger reader the chief defect is it can only access to only English languages and could not able to make out.
- In Bar code reader the main causal agents are that it could be that they are easily broken, if so void and also it is sometimes hard for the scanner to recognize the words.

For the people with deaf and dumb the sign languages are the frequently used ones, but it could not be easily understandable by normal people. It doesn't suitable for all people communicate with the vocals and deaf people

using sign language. Using of sign languages is the difficult task for all real time communication.

Proposed System:

- The visually impaired people can able to understand the words easily by Tesseract software.
- The vocally impaired people can communicate their message through text which can be read out by espeak.
- The deaf people can able to hear others speech from text.

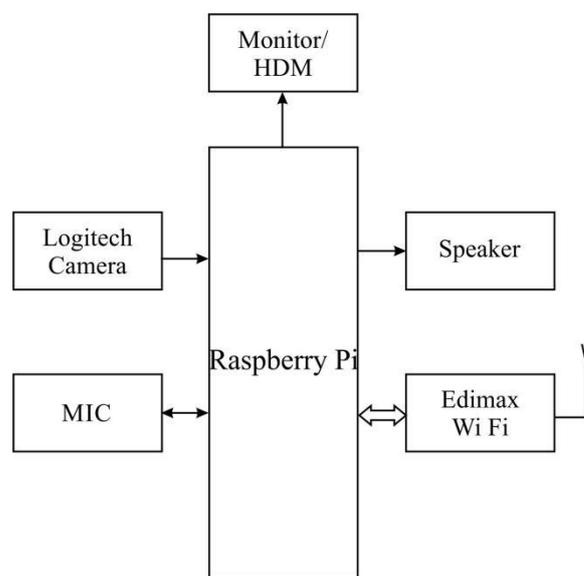


Figure 6

A. Raspberry PI:

The Raspberry Pi is a bargain basement priced, credit-card sized computer which can be easily plugged into a computer monitor or TV. We utilize a standard keyboard and black eye. It is a minute device that enables people of all ages to research computing, and to learn how to program in languages like Scratch and Python. It is capable of doing everything we would expect a desktop information processing system to perform, surfing from the net and playing high-definition videos, to making databases, word-processing, and live games. Raspberry pi has the capability to intercommunicate with the exterior world, and has been used in a spacious array in digital projects, from music equipment and sensors to weather stations and chirping birdhouses with infrared cameras. In this project we are using the Raspberry Pi 1B board and those specs are as follows

A.1) Memory: 512 MB RAM

A.2) Connections: 2 USB ports Ethernet port of a socket 3.5mm and jack for audio out. It includes HDMI, component and composite video outputs.

A.3) Processor: SoC is a Broadcom BCM2835. It can run at 700MHz, with a Video core 4 GPU.

B. Benefits of SoC

This high level of integration reduces overall system cost

- Increase performance,
- Low power consumption yields increased reliability,
- Trim size.

A.4) OS: Boots from SD card, running a version of the Linux (Rasbian) operating system

A.5) POWER: Micro USB socket 5V, 2A 26 GPIO pins

In parliamentary law to disappear down the operating system, plans and storing multimedia content, an SD card 8 GB Class 10 Regarding the RAM used by each module was used, tests were conducted and it was found out that the media center used 70 MB while a movie format 1080p H.264 hardware decoding and reproduced, while the authentication system with all modules and arrays came to utilize up to 6 MB, and server using 1 MB. This confirmed that the 512 MB available were sufficient, hence the final system memory was partitioned and then that the GPU could use 256 MB and go forth the balance to the CPU.

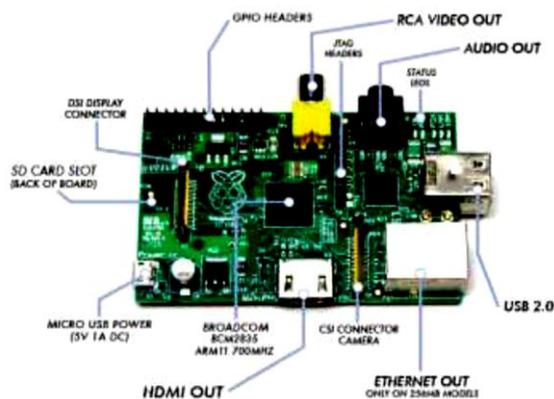


Figure 7

For Connecting a Display and Audio the raspberry pi is provided with HDMI (High definition multimedia Interface). Through this we can send a digital video signal and audio signal. The DVI (Digital Visual

Interface) cannot carry audio signals. It can accommodate up to a range of 1920x1200 resolution display signals. Composite RCA (Radio Corporation of America) it delivers both audio and video out channels. They are in the shape of an analogue signal with a range of 480i, 576i resolution. It is of length approximately 3.5 millimeter jack.

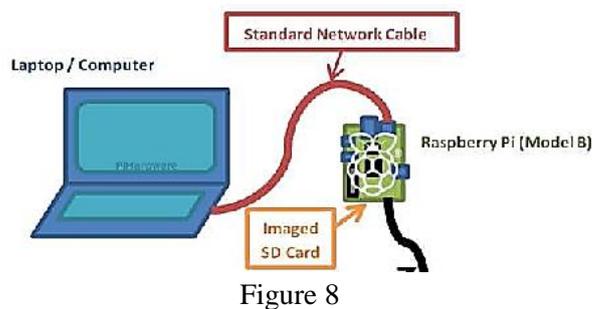
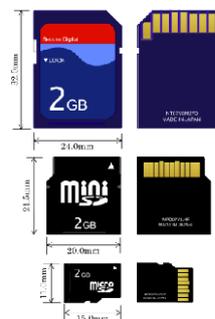


Figure 8

C. Secure Digital Storage:

In raspberry pi the required details can be stashed away in the form of SD, Mini SD, Micro SD. The storage levels depend upon the storage cards.

- Types of Card
 - SDSC (SD): 1MB to 2GB
 - SDHC: 4GB to 32 GB
 - SDXC up to 2TB



The card should be at least 2GB in capacity to store all the required files

Figure 9

D. Logitech Camera:

Logitech camera is a plug and play setup and soft to apply. With simple plug and play arrangement, we can make video calls in no time on most IMS and Logitech video in sky-scraping definition. With this camera VGA sensor the video captured appears in natural color. It has a 5MegaPixel camera with high results. Arrangement The camera selects the built in Mic with noise reduction.



Figure 10

XVGA video recording system has a reach of about 1024*768 resolutions. It is a camera with motion detection and universal clip and has a broadband of 256 kpbs for uploading. It is provided with 512 MB RAM or more and 200MB hard drive space. We can interfaces hi-speed USB to other devices for easy utilities.

E. Ediax Wi-Fi:

E.1) Hardware

Edimax Wi-Fi is a tiny sized USB wireless adaptor which would support enormous speed, range and velocity. Despite the size, the infinitesimal USB chains elevated data rate of up to 150Mbps while concerning to the wireless device. It is 3 times quicker. We can just plug it into computer's USB port and enjoy incredible high-speed wireless network access. The power consumption can be reduced up to 20% ~ 50%. The adaptor does not merely provide you with the best wireless technology in the universe; it also cares for the environment by using less energy and your pocket by keeping up on your electric bills.



Figure 11

The software used was the Debian squeeze package debian and image plus a replacement driver module available here. It is tar size file and desired to be unpacked twice. No other modifications were needed in the software

E.2) Power supply

There have been reports that wireless adapters take a great wad of ability, but the Raspberry Pi with an adapter which runs on a Samsung charge, which can be associated to the laptop also..

E.3) Accessing RPi

It is possible to configure the adapter using ssh over Ethernet, but it is a good deal more comfortable to understand error messages if a display cover is immediately tied.

F. Software Requirements:

In our project the Raspberry Pi is interfaced with computer monitor by using the 5v power cable. Through this line, we operate the kit with the following softwares. They are divided into categories as listed below

- Putty
- WinSCP
- Tesseract OCR
- Open CV.

F.1. Putty:

Putty is a secluded and unwrapped-source mortal emulator, serial comfort network file transfer application. It backs up a variety of network protocols, together with SCP, SSH, Telnet, and raw socket connection. It can link up to a serial port. The “Putty” has no determinate meaning. Putty was formerly printed for Microsoft

Windows, but it has been ported to various other operating systems.

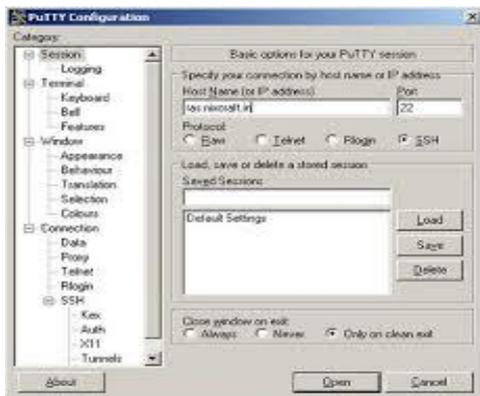


Figure 12

F.2. 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. SFTP is a completely different protocol from FTP. To use SFTP for secure connections, the server you are connecting to must also support SFTP. The course web server and streaming servers both support SFTP. WinSCP is a Windows application for transmitting documentation by means of FTP and SFTP.

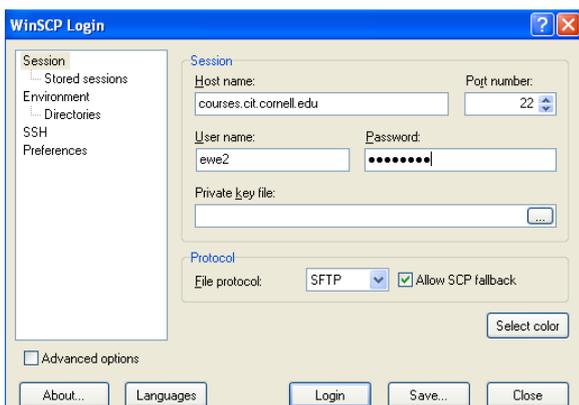


Figure 13

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 capability to upload files and retain associated original date/time stamps, unlike FTP clients.

F.3. Tesseract OCR

Python-Tesseract is an optical character recognition (OCR) contrivance for python. It will be familiarized and understand the text embedded in icons. It is a binding for google's OCR. It is too functional and a stand-alone incantation script to Tesseract, as it can read all facsimile types reinforced by the Python Imaging collections and others, whereas Tesseract-occur by default, it ropes tiff and bmp. To boot, if practiced as a script, Python-Tesseract will print the recognized text instead of writing it to a file.

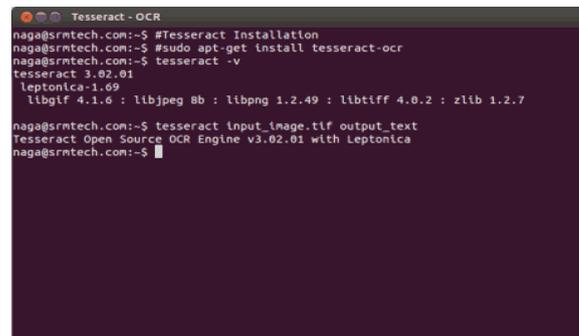


Figure 14

Tesseract Features:

- Page layout analysis.
- More languages are supported.
- Improve forecast accuracy.
- Add UI.

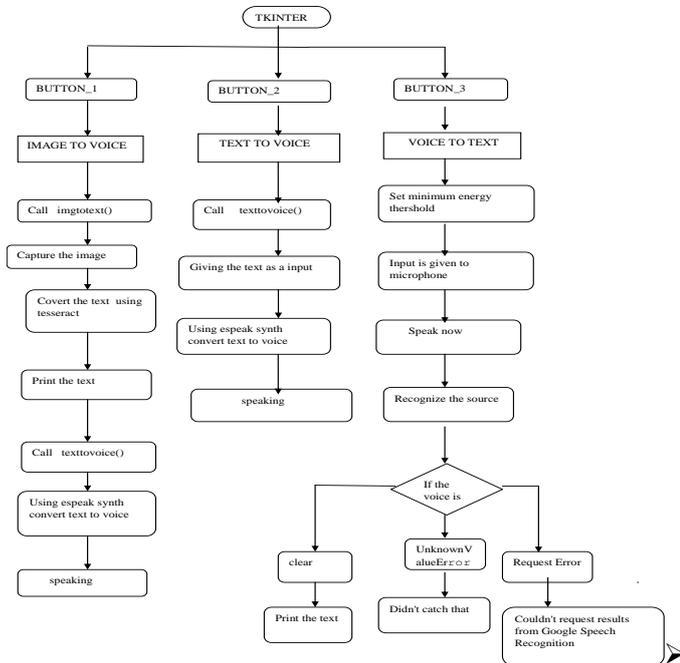
F.4. Opencv:

OpenCV (Open Source Computer Vision) is a compilation of encoding functions primarily aimed at factual-time computer vision, originally shaped by Intel research and subsequently supported by Willow Garage and now maintained by Itseez. It is the collection of cross-platform and free for use under the open source. OpenCV includes foremost changes to the C++ interface, aiming at ease, more case-safe designs, and better implementations for existing ones in terms of execution. It is used in diverse purposes for Facial recognition system, Gesture recognition, Motion understood.

III. RESULTS AND DISCUSSION

A. Flow Chart

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



B. Project Overview

In our task we have identified the above software which has been initially employed in the procedure before it has taken into account. The putty is a terminal window which is used to serially transmit the data to another window by way of commands through command prompt window. After this the WinSCP takes place which moves as a remote desktop between the raspberry pi and Putty. It transmits the files in a safe way. Here, that the visually and vocally impaired people are catered with the raspberry pi based assistive devices and the system follows three important processes for blind, deaf and dumb people.



The total project is catered with the source code of Python. It is the easiest programming language to interface with the raspberry pi. The total project is run by the source code of python to assisting the blind, deaf and dumb masses in a single device which is so compact and easy for them to manage. The output window is termed as LXTerminal or TKINTER. It exposes the entire output screen to the user and which process is to run out in a childlike way. Here they are offered with three stairs

- Image to Voice (For BLIND)
- Text to Voice (For DUMB)
- Voice To Text (FOR DEAF)



Figure 15

C. IMAGE to VOICE

The first process is for the blind people, in this process, the visually impaired people have to buy some products or any wordings in the image, in order to help them, we have interfaced the Logitech camera to capture the image by openCV2. The picture which is captured is

being first converted to text by Tesseract OCR. In this OCR, they apply the adaptive thresholding techniques to change the image to binary images. 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 read out by the espeak.

D. TEXT TO VOICE

The second process gets on for the dumb masses who cannot speak and then they convert their thoughts by text which could be transferred to voice signal. The converted voice message is sent over the espeak.

E. VOICE TO TEXT

The third process, we supply for the hard of hearing people who cannot learn the words of others. In parliamentary law to help them we have used this assistive device for deaf people. This procedure is held out by assigning the minimum threshold voltage to recognize the voice signal and begin entering the voice signal through the microphone and later obtaining the signal it convert them into message to other individuals.

IV. CONCLUSION

By this paper, we have designed the prototype model for blind, deaf and dumb people by employing a single compact device. The important key factor of this project to facilitate these people and to fix them more confident to manage their sites by themselves. The primary advantage is that the device can be taken away easily and is of about less weight.

V. FUTURE WORK

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.

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