Vision Based Indoor Assistive Navigation For Blind, Deaf And Dump People

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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 Raspberry pi on which all the activities are carried out. The works 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 voice module 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.*

Keywords- Raspberrypi, Tesseract OCR(optical character recognition technique), speak, speech to text, Bluetooth device, LCD display, AMR voice app. DG-Data Gloves, RGB-Red Green Blue, LCD-Liquid Crystal Display

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 cannot 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 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. THE EXISTING MODEL

In the block diagram we will be having the component like flex sensor, ADC converter ADC0804, microcontroller such as PIC, Arduino and speaker. Here the flex sensor used for detecting the hand motion. Flex sensor is

also called as bending sensor, based upon the bending of sensor their resistance of the sensor get varied. Then their voltage also varied, according to the voltage value the command will be provided. So this flex sensor is exactly act as a variable resistor. Flex sensor is analog in nature. This input is directly given to Arduino. Because an Arduino has inbuilt analog to digital converter. This will convert the analog sensor input into digital input to Arduino. But in the case of raspberry pi we have to use ADC IC externally.
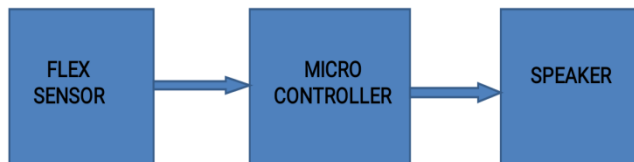

Figure 1: Existing System Block Diagram

Flex Sensors:

Flex sensor is also known as bend sensor it can measure the amount of deflection. The flex sensor will stuck to the surface and its resistance is varied while bending the surface.The resistance is directly proportional to the amount of bend.

Microcontroller:

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip. A microcontroller is embedded inside of a system to control a singular function in a device. It does this by interpreting data it receives from its I/O peripherals using its central processor. The temporary information that the microcontroller receives is stored in its data memory, where the processor accesses it and uses instructions stored in its program memory to decipher and apply the incoming data. It then uses its I/O peripherals to communicate and enact the appropriate action. Microcontrollers are used in a wide array of systems and devices. Devices often utilize multiple microcontrollers that work together within the device to handle their respective tasks.

Speaker:

The speaker gives the audio output of the text recognized by the controller. The controller uses Text-To-Speech to convert the recognized text and pass it on to the speaker.

Drawbacks of the existing systems:

1. The solutions for the three impairments person is not carried out in a single device.
2. Human dependency is necessary for every activity
3. Possible to wrongly understand the information.

III. PROPOSED SYSTEM

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. 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 speak.

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. 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, Raspberry Pi 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.
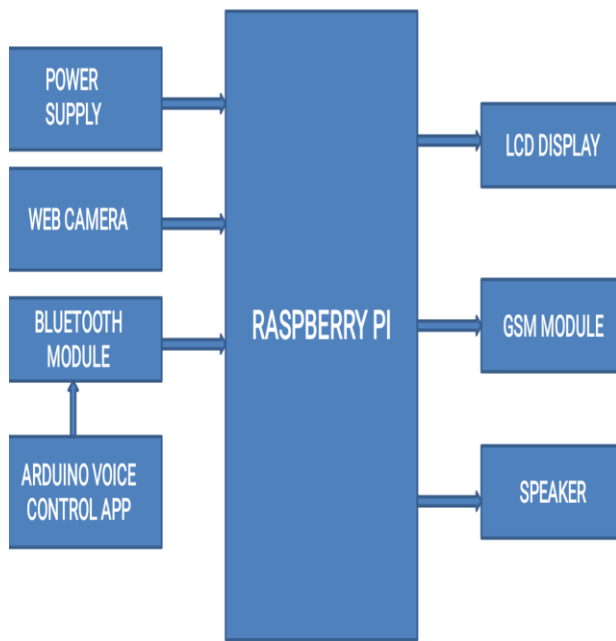
Figure 2: Proposed System Block Diagram

IV. HARDWARE REQUIREMTS

A. Raspberry pi:

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs. With its built-in wireless connectivity, the new Raspberry Pi is clearly positioned as a low-cost hub for Internet of Things devices, or as the flexible, low-cost basis of new types of connected gadgets. The new bump to a 2.5 amps power source means it will be able to power more complex USB devices without the need for a second power cable.The paper is implemented using a Raspberry pi 3B board and their specifications are as follows.
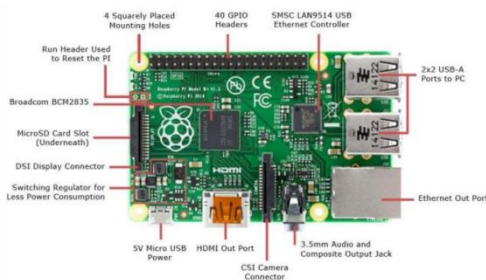

Figure 3: Raspberry pi module

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).

B. GSM module

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.

A GSM Module is basically a GSM Modem (like SIM 900) connected to a PCB with different types of output taken from the board – say TTL Output (for Arduino, 8051 and other microcontrollers) and RS232 Output to interface directly with a PC (personal computer). The board will also have pins or provisions to attach mike and speaker, to take out +5V or other values of power and ground connections. These types of provisions vary with different modules3.For our project of connecting a GSM modem or module to arduino and hence send and receive SMS using arduino – it's always good to choose an arduino compatible GSM Module – that is a GSM module with TTL Output provisions.

C. Power Supply

Almost all basic household electronic circuits need an unregulated AC to be converted to constant DC, in order to operate the electronic device. All devices will have a certain power supply limit and the electronic circuits inside these devices must be able to supply a constant DC voltage within this limit. That is, all the active and passive electronic devices

will have a certain DC operating point (Q-point or Quiescent point), and this point must be achieved by the source of DC power. The DC power supply is practically converted to each and every stage in an electronic system. Thus a common requirement for all this phases will be the DC power supply. All low power system can be run with a battery. But, for long time operating devices, batteries could prove to be costly and complicated. The best method used is in the form of an unregulated power supply –a combination of a transformer, rectifier and a filter.As shown in the figure above, a small step down transformer is used to reduce the voltage level to the devices needs. In India, a 1 Ø supply is available at 230 volts. The output of the transformer is a pulsating sinusoidal AC voltage, which is converted to pulsating DC with the help of a rectifier. This output is given to a filter circuit which reduces the AC ripples, and passes the DC components. But here are certain disadvantages in using an unregulated power supply.

D. LCD DISPLAY

The principle behind the LCD's is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and also cause a change in the angle of the top polarizing filter. As a result a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to other. The LCD works on the principle of blocking light. While constructing the LCD's, a reflected mirror is arranged at the back. An electrode plane is made of indium-tin oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD has to be enclosed by a common electrode and above it should be the liquid crystal matter. Next comes to the second piece of glass with an electrode in the form of the rectangle on the bottom and, on top, another polarizing film. It must be considered that both the pieces are kept at right angles.When there is no current, the light passes through the front of the LCD it will be reflected by the mirror and bounced back. As the electrode is connected to a battery the current from it will cause the liquid crystals between the common-plane electrode and the electrode shaped like a rectangle to untwist. Thus the light is blocked from passing through. That particular rectangular area appears blank.

E. WEB CAM

Webcam is a compact digital camera which works same as conventional digital camera but is designed to interact with the web pages and other internet pages. It captures the real time images through a tiny grid of light-detectors, known as charge-coupled device (CCD) from the location where it is placed. The CCD converts the image into digital format so that computer can access this data. Webcams don't have the internal memory to store the images so it transmits the data immediately to the host device through the USB or other analog cable. Some of these devices also come with built in microphone for video calling. Webcam does two things, capturing the image or video and to transfer it to the predestined device. Along with the digital camera these also come with the appropriate software to interact with the host device. Software allows the user to edit the images and to record the videos for particular duration. This software grabs the digital data from the camera at certain intervals of time. Depending on the frame rate, the number of pictures or video streaming is displayed on the computer or other display systems. Software receives the image frame from digital camera, converts it into JPEG file and finally sends it to the web server using the file transfer protocol (FTP). So before using this webcam, while working with the web, we need to do some configuration steps to upload the images and videos.

F. 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.

B. 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. 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.
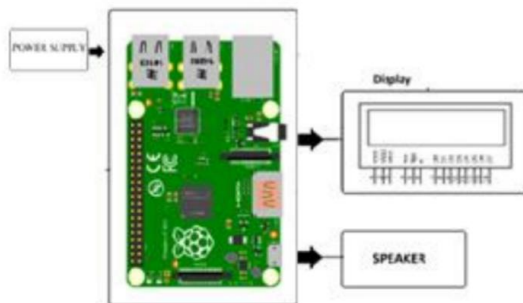

Figure 4: Image to speech conversion

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. 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.
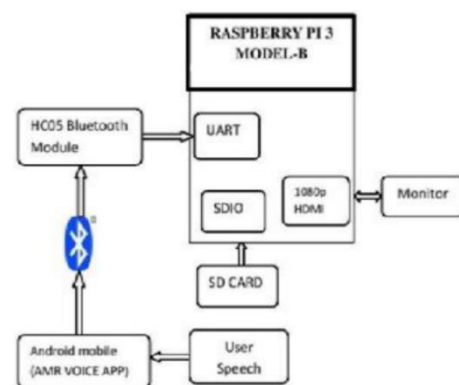

Figure 5: Voice to text conversion

VII. RESULT AND DISCUSSION

The connected Raspberrypi module with Bluetooth, LCD display, Arduino, GSM module, and Web cam.
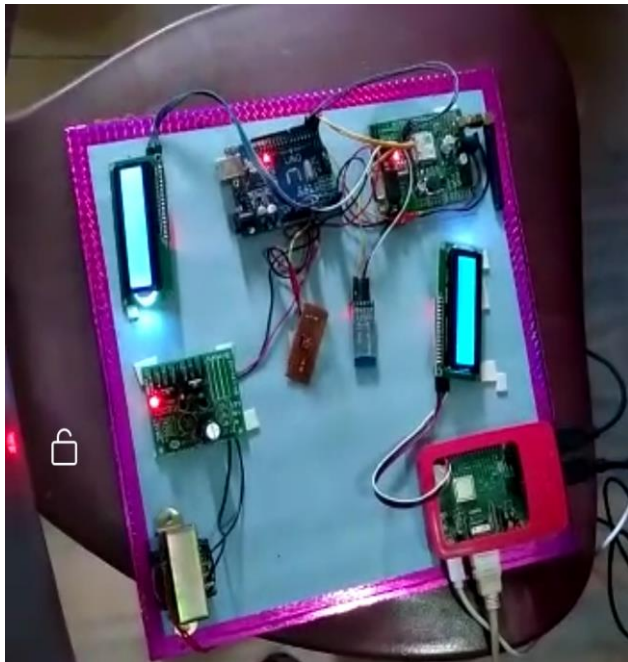
Figure 6: System connection setup

By this paper we are used the hardware components for raspberry pi 3, GSM module, web camera, bluetooth module, arduino uno, LCD display and software components for pythons. When raspberry pi is used has a main component, it is used as a basic computer. They are connected with LCD display, web cam, GSM module, head set. First the motion will be captured by the web camera and the image will be converted into binary value with help of histogram technique and the value is transferred. Then the character outlines are converted into speech and text format. It has been spoke out by the speaker and the group of words display by the LCD display, The second part of work is the with help of mike the spoken words are converted into text format . In this work we are used to AMR voice control app with help of Bluetooth the voice is display by the LCD display.The GSM can be used as the location tracking. If any emergency situation the message can be sent to the relative and friends by the click on button. They can be used the python program for raspberry pi .they can used this components with help of deaf, dumb and blind people.

VIII. CONCLUSION

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.

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