

ANDROID BASED AID FOR THE DEAF

Apeksha Khilari¹, Manasi Marathe², Aishwarya Parab³, Manita Rajput²

^{1,2,3,4}Electronics And Telecommunication Engineering Department, F.C.R.I.T, Vashi.
Navi Mumbai, India

¹apeksha.khilari@gmail.com, ²manasimarathe169@gmail.com

³parabaisht@gmail.com, ⁴rajputmanita@yahoo.com

Abstract— Communication refers to exchange of information by speaking, writing or through any other medium. Communication and dependence in today's world go hand in hand. A person who is disabled in his cochlear abilities, generally need to rely on people, so as to live independently in this society. Thus, the subject 'deaf' has piqued us to develop a system, which would be android application based, and would aid the disabled to communicate with normal people, easily. A real time online speech to text converter is proposed for the same. This converter application would lie with the normal person, and the converted stream would be sent to the Central server using Bluetooth. Also, home sensor assembly has been proposed in order to inform the user about the on-goings in the house. This can be implemented by using sound sensors in various locations and transmitting the data through ZigBee transmitters. The android application with the deaf would be the central server, receiving all the notifications from the sound sensors using ZigBee receiver and the text stream from the normal person, using Bluetooth.

Index Terms— communication, real time speech, online, sound sensors, Bluetooth, ZigBee, android application

I. INTRODUCTION

A. Overview of the project

Hearing loss is the most common sensory deficit in humans today. As per WHO estimates in India, there are approximately 63 million people, who are suffering from Significant Auditory Impairment; this places the estimated prevalence at 6.3% in Indian population. As per NSSO survey, currently there are 291 persons per one lakh population who are suffering from severe to profound hearing loss (NSSO, 2001)[1]

While some people are deaf since birth, others lose their hearing ability in the later course of their life. Language, as we know, is an aggregation of words. These words can be in the spoken or signed form, and need to be comprehended properly. When a person is impaired in his cochlear senses, even day-to-day normal communication becomes difficult for him. As a result of which, the deaf person needs a constant assistance, thereby making him dependent and reliant. One of the remedial measures include, using hearing aids. Hearing aids amplify the incoming sound, and are generally used by people with mediocre to weak hearing abilities. Thus, they prove to be ineffective in the case of acute or complete hearing loss.

Our prototype is one of the attempts to provide a solution to the above scenario. It consists of two portions- speech to text

converter and home sensor assembly. To help the disabled to communicate easily with the normal person, we have created a real time speech to text converter, using Google API. The converters that are presently available are generally software based and are specific to their usage. In order to help the deaf survive independently, we have created one complete application, which would integrate both the proposed ideas. The converter would be in the form of an android application. The person attempting to communicate with the deaf person would have this app installed on his android phone. The central server, that is the deaf individual, would have another application installed on his phone, to receive the spoken text, through his phone's Bluetooth. The second part of our prototype is a part of home sensor assembly system. For this purpose, we've introduced sound sensors at several locations inside the residence. These sound sensors are amplitude variable, with a particular threshold set for a particular type of sound. The sensors could be located at different parts of the house. For instance, a sound sensor to implicate the ringing of doorbell when a person arrives, or another sound sensor in the kitchen to indicate whether the food is cooked or not etc. The notifications related to assembly procedure, would be shown on the same Central server application, with ZigBee being the wireless communication standard used.

As future scope, a provision can be made to translate sign language to speech or vice versa. Also, an android application can be developed to give the feedback commands to the home assembly system, so as to take necessary actions and improvise it into an automated system.

Aim

The main aim of our project is:

- To design the home sensor assembly system, based on several speech inputs inside the residence.
- To help the disabled converse easily with a normal person.

B. Objective

- To create a low cost, handheld and fail-safe prototype.
- To make the deaf person independent and less reliant.
- To achieve the wireless communication procedure for the sensor assembly, using ZigBee technology.

- To make use of widely available Android platform, thereby making the system as simple as clicking a button on his phone.

C. Project scope

- Controlling the devices inside a residence using voice commands
- A speech to sign language converter, and vice versa.
- A system to help the deaf take part in telephonic conversations.

II. RELATED WORK

A. Speech to text conversion using Raspberry pi

Speech is an exceptionally attractive modality for human computer interaction: it is “hands free”; it requires only modest hardware for acquisition (microphones); and it arrives at a very modest bit rate. Recognizing human speech, especially continuous speech, without burdensome training (speaker independent), for a vocabulary of sufficient complexity (60,000 words) is very hard. However, with modern processes, flow diagram, algorithms, and methods, it has been possible to process speech signals easily and recognize the text spoken by the talker. As per the paper [2], the system acquires speech at run time through a microphone and processes the sampled speech to identify the uttered text. The process for converting speech to text by using Raspberry pi and on the terminal of Raspbian image installed on raspberry pi. The recognized text can be stored in a file. It can supplement other larger systems, giving users a different choice for data entry. The paper [3] says that, the searching and matching of the voice is done using Google API. The prime difficulty lies in building the API which is based on voice search. To accomplish this purpose, a speech browser is made by using Embedded/QT creator tool which is available in raspberry pi tool library. This speech browser contains several buttons such as a record button. By pressing this button any person can input a speech and the result based on voice search will be shown in the window same as like the way it is shown in Google search.

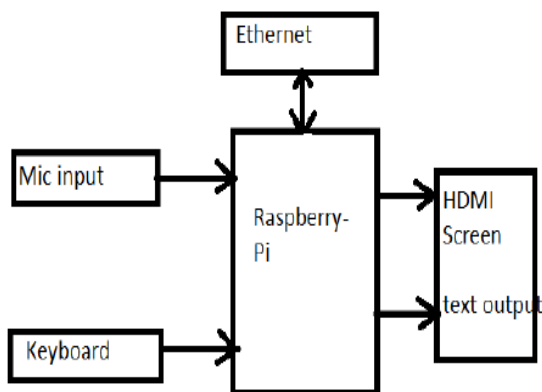


Fig.1. Speech to text conversion[2]

B. USING DIGITAL SIGNAL PROCESSING

During the course of literature survey, we’ve learnt that using Digital Signal Processing could be used speech processing applications. However, due to their accuracy and cost issues, they seem inappropriate. The speech recognition is called as Automatic Speech Recognition (ASR) or simply speech recognition.

Automatic speech recognition systems operate in two phases. First, a training phase, during which the system are trained to learn the reference patterns corresponding to different speech inputs (e.g. phrases, words, phones) that constitute the vocabulary or the database of the application. Each reference is learned whenever the user speaks into the microphone and is stored either in the form of templates based on some averaging methods or models that represents the statistical properties of pattern. Second is the recognition phase, during which a real time speech input spoken into the microphone, is precisely identified by searching the database that was earlier stored as the reference template during the training phase[4].

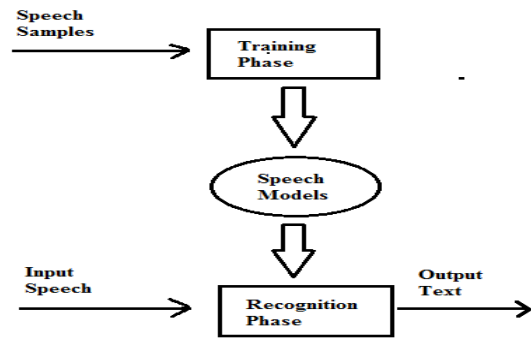


Fig.2. Basic principle of ASR[4]

C. Using Android platform

The App Inventor for Android is a new visual programming platform to create mobile applications for Android based smart phones, for most of the recent versions. The author in paper [5] describes about GSM based secured device control system using App Inventor for Android mobile phones. Also, an 8 bit microcontroller based relay driver circuit with GSM Modem is used, which is able to communicate with the Home Appliances over GSM Network. The system is based on serial data transmission using SMS over GSM Network in order to facilitate the appliances control in a global network environment. A user interface (UI) on the Android enabled mobile phone offers system connection and control utilities. ULN 2803 relay driver and Serial 900 type GSM Modem as well as Arduino IDE for compiling C Language Code and burning HEX file into microcontroller was used for the development.

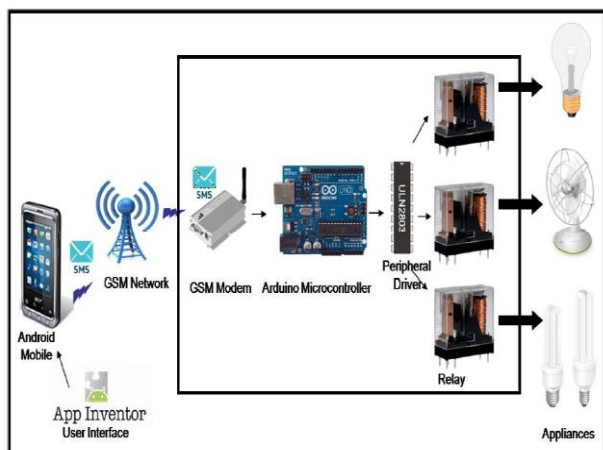


Fig.4. System Architecture[5]

D. Using ZigBee transceiver

The Wireless Home Automation System is an integrated system to aid elderly and disabled people with an easy-to-use home automation system that can be fully operated based on speech commands.

These applications are such designed that they are compatible with each other and contains a central control unit. The project demonstrates a system that can be integrated as a single portable unit and allows one to wirelessly control lights, fans, air conditioners, television sets, security cameras, electronic doors, computer systems, audio/visual equipment's etc. and turn on or off any appliance and to get the status of different sensors and take decisions accordingly[6].

The system consists of a microphone which is connected to a HM 2007 speech recognition chip. This chip sends the voice commands in the form of a binary sequence to the connected microcontroller. The base station unit takes the sensor/voice command input and sends to the remote station with the help of a ZigBee transceiver. The remote system receives the commands through ZigBee transceiver and performs the requested function. The sensors unit detects when the person enters or leaves the room by measuring the change in signals strength between the access point and can accordingly turn on or off appliances such as lights and fans and in the meantime send its status back to base station.

III. PROJECT METHODOLOGIES

A. System overview

Although home automation today is not a new thing, the existing proposals require variant change in the home infrastructure, thereby making them costly. So, we intended to develop a home sensor assembly system, with the idea of helping the deaf community, without causing them a hard pinch at their pockets; and also assisting them to converse easily with the normal people.

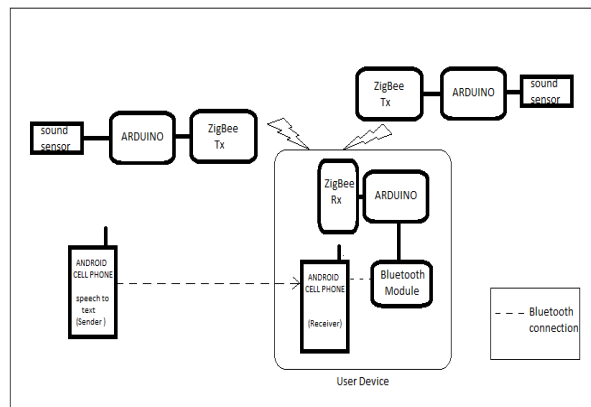


Fig.5. Functional block diagram

The typical model that we've created consists of ZigBee technology that reports the triggering of the various devices in the house, which normally requires the deaf person to hear them. For this purpose, we've created a ZigBee mesh network, wherein there will be two remote stations, and one central station, to help the user understand various happenings in the house. The circuitry for both the remote stations would be separate and will be placed at different locations in the house, for example, in the kitchen, at the door bell etc. The central station/server would be an android based mobile application and would lie with the disabled user. Sound sensors that take the incoming speech inputs at the respective remote stations control the overall system. These sensors send the voice commands to the microcontroller Arduino. The microcontroller unit takes decision and send the commands to the android phone using a pair of ZigBee transceivers and eventually through Bluetooth. The android phone receives the commands and notifies the user.

The second part of the project consists of a speech to text converter. An android application is built for the same, using MIT App Inventor 2. This application could be installed on the client's phone that is the person who wishes to communicate with the user. Also, a receiving screen for the STT conversion is inserted in the home automation android application of the deaf, for him to understand the spoken language. The speech to text conversion takes place at the client side using Google API, and the converted stream is sent through Bluetooth. This text stream could be received on the user's side, via Bluetooth and therefore can be seen on the inserted screen, as mentioned earlier.

Thus, in this way, we've integrated both, the sensor assembly part and the assistive translator part, into one android application, which was created using the platform MIT App Inventor 2.

B. Communication standards

ZigBee is a kind of transceiver, used to create local personal area networks using low power radios. It is based on IEEE 801.15.4 protocol and is mainly used for home automation system where there is single transmission of input from a sensor. The ZigBee modules can be used as a

transmitter, as well as a receiver; depending on the way they're configured. It is used to create star networks(AT mode) or mesh topologies(API mode) and can extend its range up to 10-100 meters.

Bluetooth is a networking technology aimed at low-powered, short range applications. It is generally used as a wire replacement that can connect to several devices at once, such as android phones, computers etc. This technology allows the user to communicate/ share in audio/video/text information, in real time.

The main reason we have involved ZigBee for the home assembly part instead of Bluetooth is, the range extension comparison between the two. ZigBee provides a larger range than Bluetooth. Also, the power consumption is much low and the battery life is relatively better. As a result of which, ZigBee proves to be a perfect suit for our application. However, for reception of the commands on the android phone, a Bluetooth is required. Hence, we incorporated a HC-05 module at the receiving ZigBee station, which would lie with the user, for instance in the form of his waist belt, and thus range issue between the receiving ZigBee and the Android phone do not occur here.

C. Sound sensor



Fig.6. FC-04 Sound Sensor

As the Block diagram shows, one of the sound sensors precisely suited for our application is FC-04 sound sensor. This sensor can easily be programmed with any ordinary microcontroller to detect the sound received on its input. It can be used as, sound detection module, microphone module, voice whistle switch, sound trigger module etc. the following are the features of FC-04:

- Detects the intensity of the sound environment.
- Adjusts threshold using the digital potentiometer (blue).
- The working voltage of 3.3 V to 5 V.
- The output form Digital switch output (1 s and 0 s).
- Has a fixed bolt hole, convenient installation.

D. Bluetooth Module

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and

mobile devices and building personal area networks (PANs) [7].



Fig.7. HC-05 Bluetooth Module

The Bluetooth module that we've decided to use for our prototype is HC-05. HC-05 is a simple Bluetooth module based on Bluetooth SPP(Serial Port Protocol). It is designed for transparent wireless serial communication setup. Some of its key features are[8]:

- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- Range: upto 30ft(9 metres)
- UART interface with programmable baud rate like 9600,19200,38400(default) etc
- With integrated antenna
- HC-05 is a more capable module that can be set to be either Master or Slave
- 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband
- Permit pairing device to connect as default.

E. MIT App Inventor 2

The App Inventor allows Android Apps to be built and programmed highlighted colorful building blocks easy to understand. First user has to add interface elements to their application such as buttons, images and sounds. Then secondly, user has to add logic and actions with plain language instruction blocks that snaps together like puzzle building blocks [5].

The App Inventor for Android is an open-source web application firstly given by Google, and at the present sustained by the Massachusetts Institute of Technology (MIT). It permits beginner to create mobile application for the Android based smart phones without writing programming codes. The App Inventor provides a graphical user interface, which allows users to drag-and-drop visual objects to develop an application that can run on Android based smart phones.

IV. CONCLUSION

Design and implementation of the home assembly system, using ZigBee technology in API mode, so as to create a mesh network, has been established properly. The threshold set of the sound sensor at the two remote stations, was achieved using the sound sensor, FC-04. Online Speech to Text converter (STT) was built as an android application in MIT App Inventor 2, at the client side. The application to be used by the deaf user containing an aggregation of both the proposed ideas was successfully completed. Further modifications and refining of the project is still underway.

ACKNOWLEDGMENT

We, as the authors of this paper, would like to thank our Principal, Dr.Khot, The Head Of Department of Electronics and Telecommunication Engineering branch, Dr. KTV Reddy, all the teachers and lab assistants of F.C.R.I.T, Navi Mumbai for their valuable support and constant share of information throughout the course of literature survey, and implementation of the project, and also for guiding us well during the preparation of this technical paper.

REFERENCES

- [1] www.mohfw.nic.in/WriteReadData/1892s/8616338852nppcd.pdf
- [2] Miss PrachiKhilari, Prof. Bhope V. P. ,'A REVIEW ON SPEECH TO TEXT CONVERSION METHODS', International Journal of Innovative Research in Science, Engineering & Technology (IJIRSET) Volume 4 Issue 7, July 2015
- [3] Ms.Sneha K. Upadhyay, Mr. Vijay. N. Chavda,' INTELLIGENT SYSTEM BASED ON SPEECH RECOGNITION WITH CAPABILITY OF SELF-LEARNING', International Journal For Technological Research In Engineering Volume 1, Issue 9, May-2014
- [4] Miss PrachiKhilari, Prof. Bhope V. P. ,'A REVIEW ON SPEECH TO TEXT CONVERSION METHODS', International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 4 Issue 7, July 2015
- [5] Mahesh N. Jivani,'GSM BASED HOME AUTOMATION SYSTEM USING APP-INVENTOR FOR ANDROID MOBILE PHONE', International Journal of Advanced Research in Electrical, Electronics & Instrumentation Engineering(IJAREEIE) Volume 3 Issue 9, September 2014
- [6] Dhawan S. Thakur, Aditi Sharma, 'VOICE RECOGNITION WIRELESS HOME AUTOMATION SYSTEM BASED ON ZIGBEE', IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735. Volume 6, Issue 1 (May. - Jun. 2013), PP 65-75 www.iosrjournals.org
- [7] <https://arduino-info.wikispaces.com/BlueTooth-HC05-HC06-Modules-How-To>
- [8] www.electronica60norte.com/mwfls/pdf/newBluetooth