Indian Institute of Information Technology Design and Manufacturing Kancheepuram

SUBJECT

PRODUCT DESIGN PRACTICE

Module 4 - 1

GROUP:B2-30

ESD18I009 - K BHARATH-esd18i009@iiitdm.ac.in
EDM18B022 - J RANGA RAKESH-edm18b022@iiitdm.ac.in
EDM18B024 - K SAI THILAK-edm18b024@iiitdm.ac.in
MDM18B020 - K MANOHAR SAI KRISHNA-mdm18b020@iiitdm.ac.in

VEAR

Product:

VEAR is an assistive device for deaf (all the levels of deafness).It is basically a smart watch which makes the daily life of deaf more comfortable and communicative.It gives unique haptic patterns for different sounds and also shows the direction and type of sound.It also converts the speech to text for face to face communication and also has the recorded sounds to play when needed.

Work Breakdown:

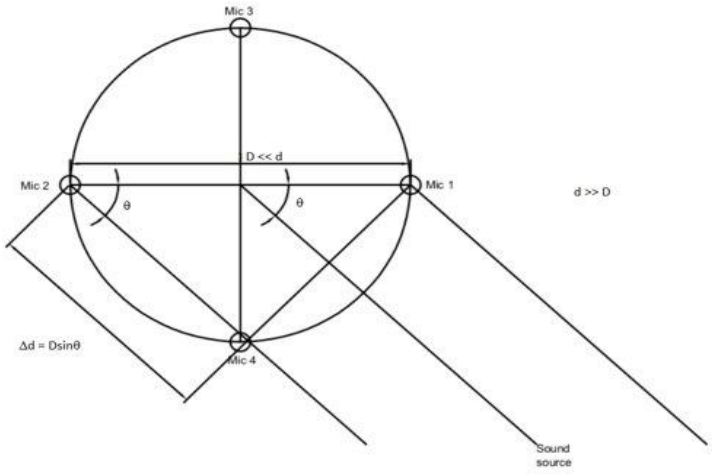
- Sound source localization
- Sound Enhancement
- Sound detection
- Sound to text conversion

- Sound visualization

Sound source localization

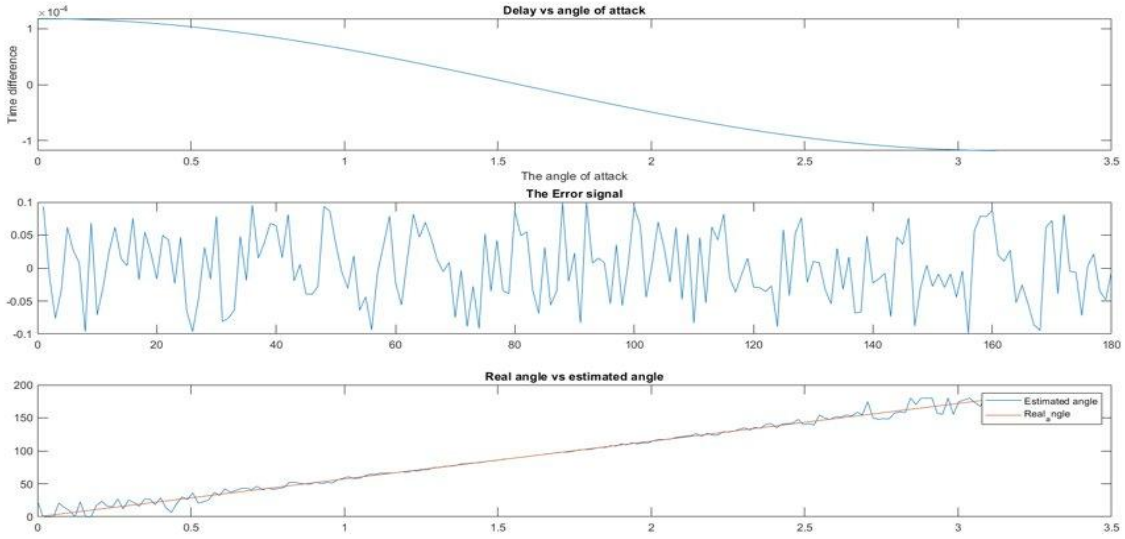
It is a process of determining the direction of the incoming sound with respect to the receiver.The process we are going to use is similar to humans detecting the direction of the incoming sound.Human brain can detect the direction of the incoming sound by determining the difference in arrival time of the sound.Similarly, we use 4-mic configuration and determine time difference to estimate the angle of the arrival.

Development:



- Let the distance between the microphones be 'D' and the distance between the center of array and sound source be 'd'.
- Since we place the mics very close, we can assume that d >> D.
- Let the angle of arrival be q.
- Then the difference between distance can be approximated as Δd = Dsinq.
- Let the speed of sound be v = 340m/s.
- Δτ =Δd/v
- Then q = acos[vΔτ/D].

Testing using matlab:



Sound detection

It is the process of determining the type of sound (ex: car horn, fire alarm dog bark, door bell). Continuing sample analysis and if that fits a specified pattern of any kind then could be said to the user.And that can make them notice that in their surroundings and take necessary actions accordingly.

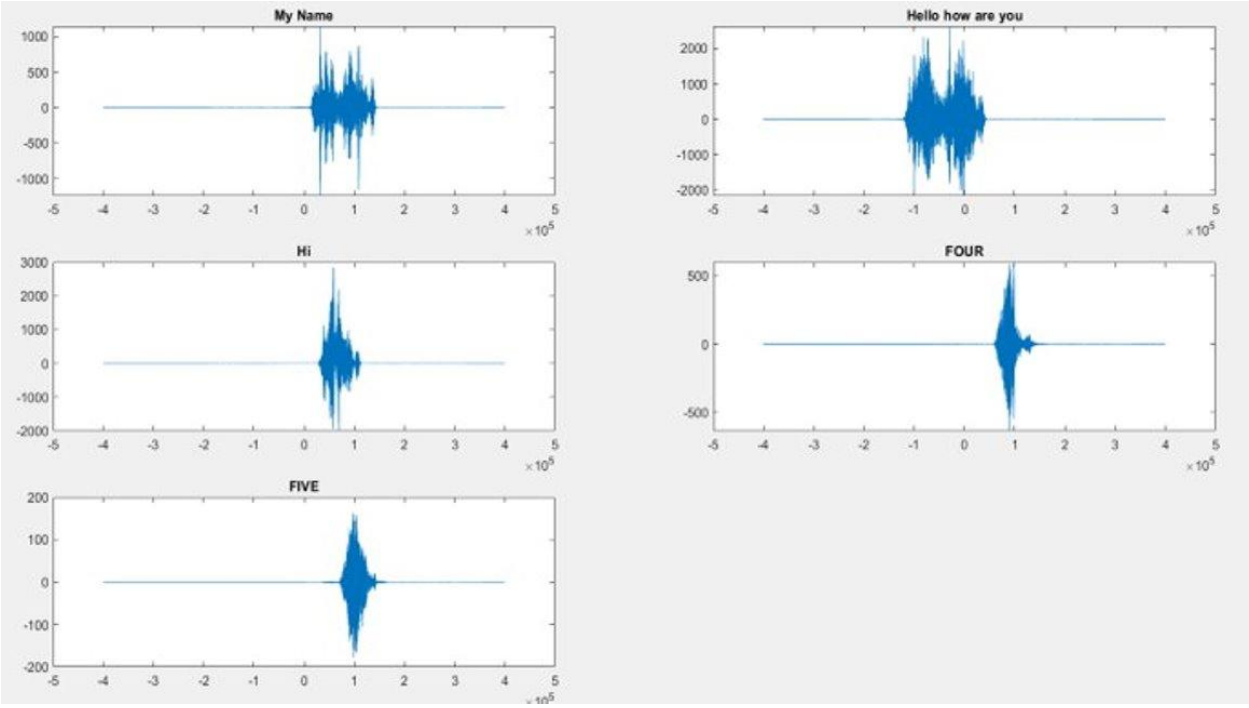
Development

MATCHING THE SOUND USING CROSS-CORRELATION

The input sound given will be cross-correlated with all the existing audio files to find the similarity between them and then matching the maximum value of the correlation to identify the sound given.

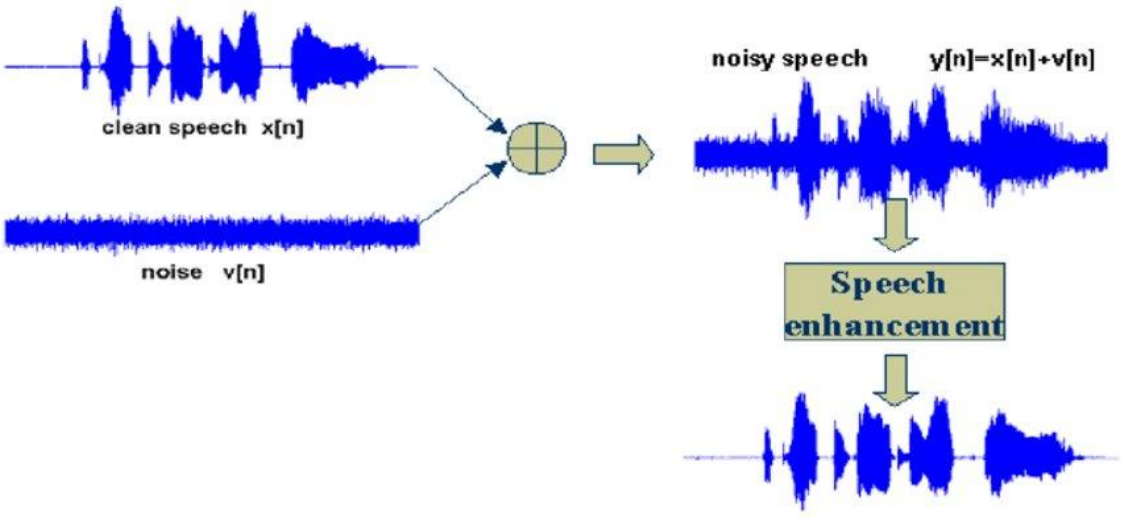
Testing using matlab:

We tried to match a simple word “Hi” so maximum value is observed to be for word Hi.



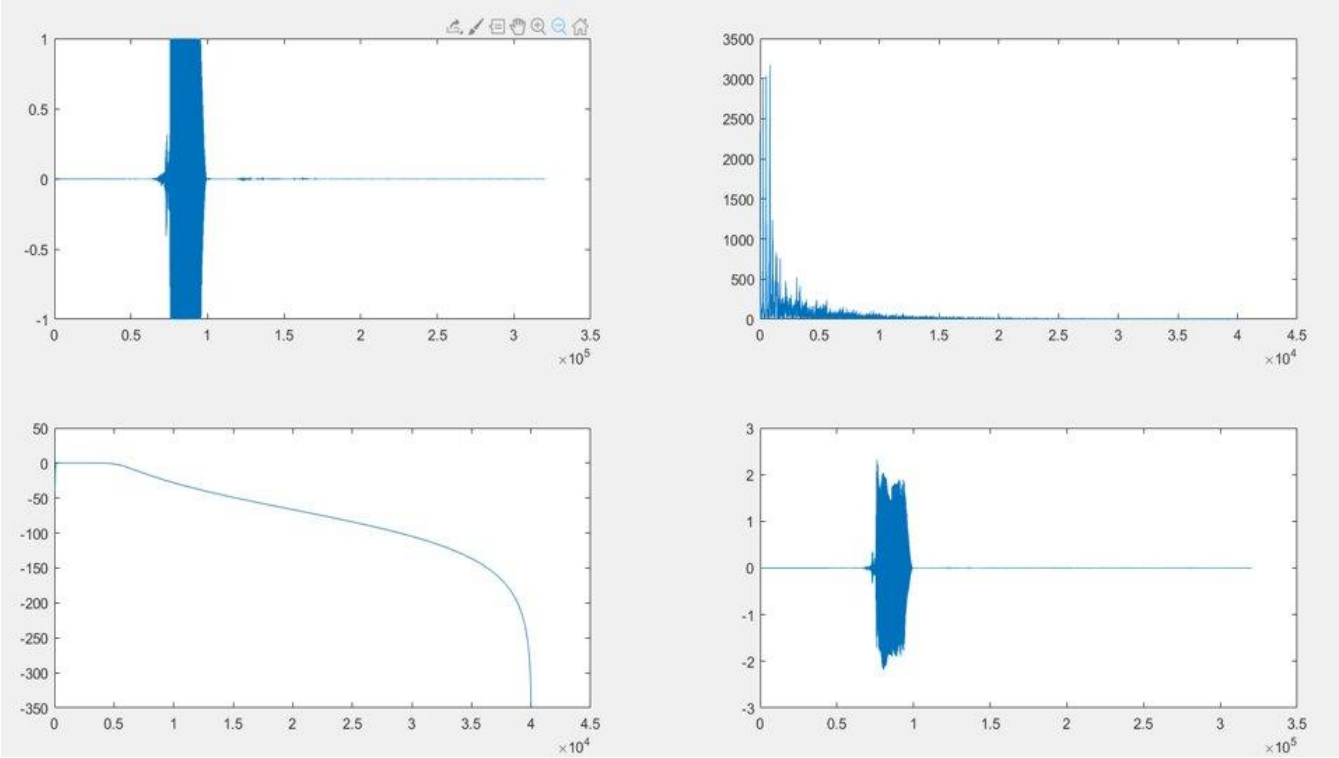
Sound Enhancement:

Sound Enhancement is the process of reducing the noise before processing the sound.



Development and testing:

Here we have taken a recorded speech signal and done spectral analysis to it to find the range of frequencies present in it and then designed the filter to remove the noise and then applied the filer to the original speech signal.



Sound to text conversion

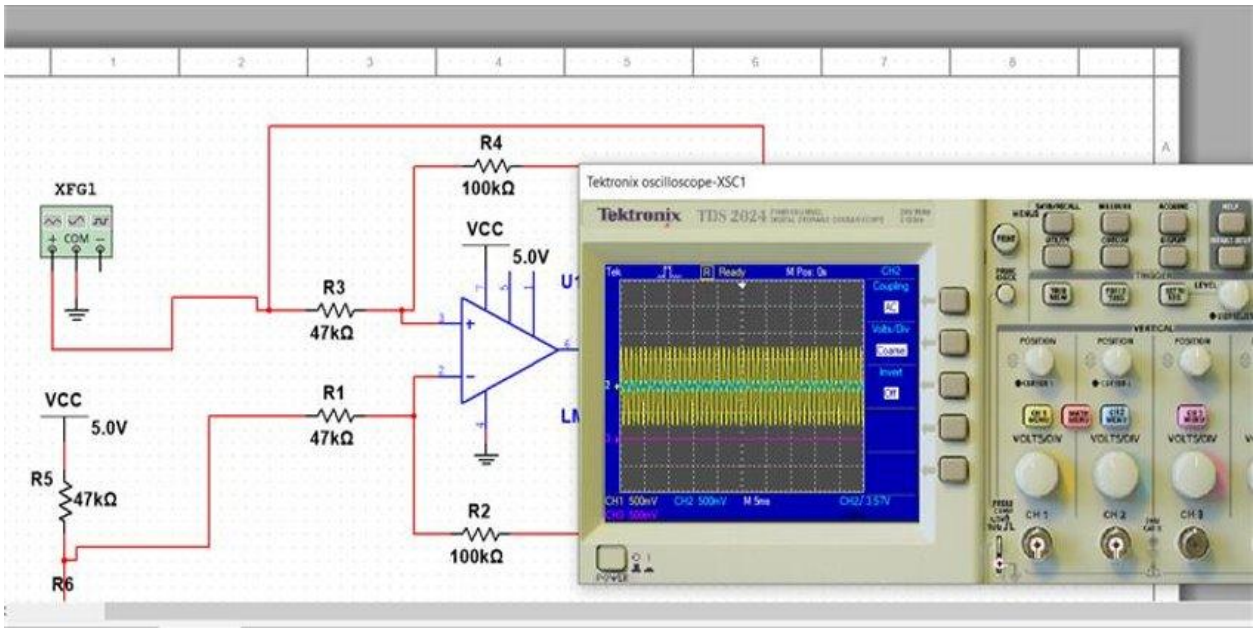
It is what it sounds like,the user is deaf and if a speaker wants to communicate with the user the speech is then converted to text and is displayed on the display screen.And it lets the user(deaf) to be involved in conversation first place.of course It is done by an application.

Sound visualization

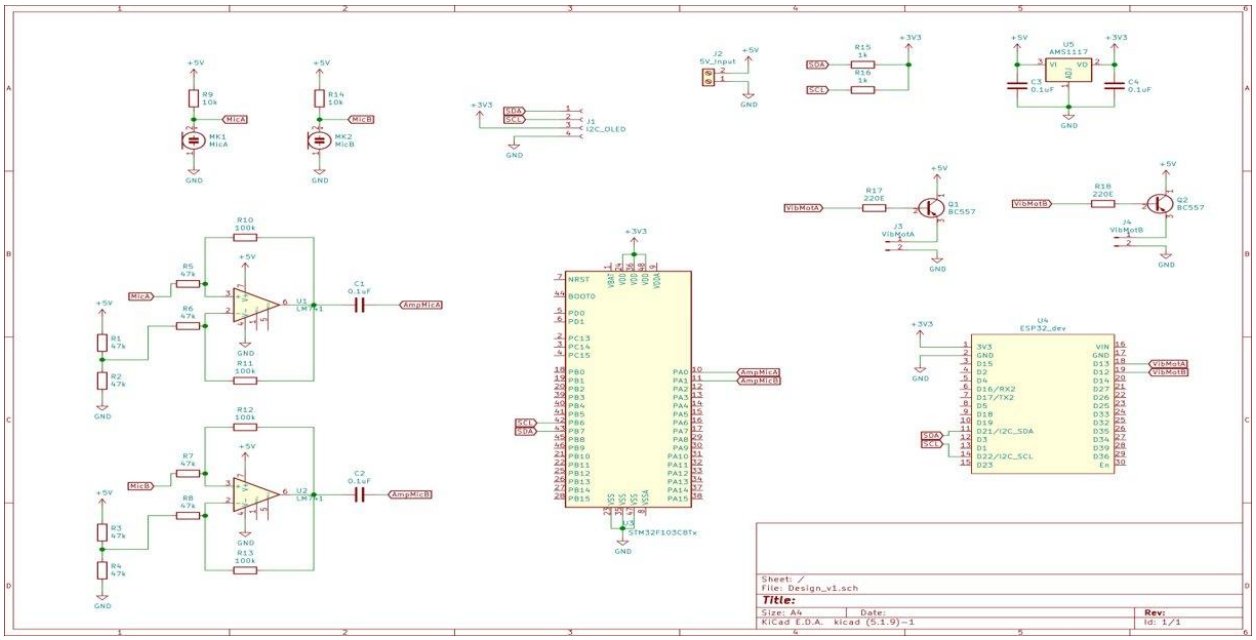
The loudness of the sound or the intensity of the sound can be known. For picking up that particular sound and that should be able to be processed.

Product development:

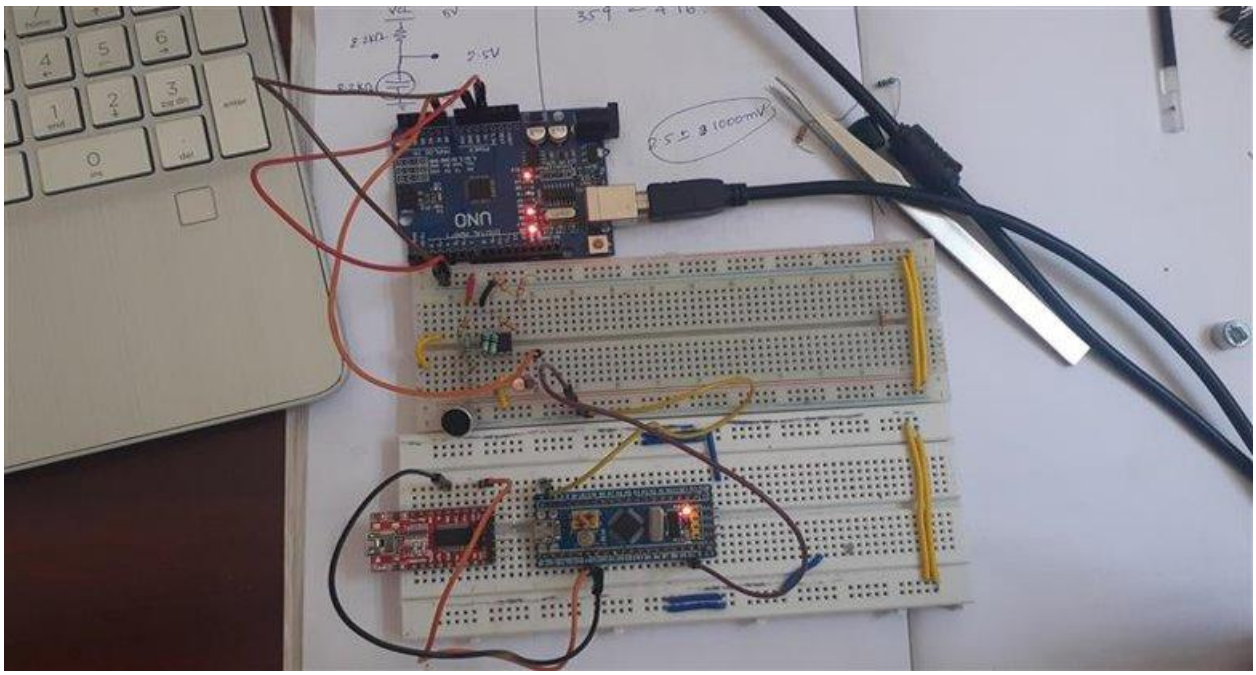
SIMULATION CIRCUIT FOR SOUND AMPLIFICATION



Schematic of connections in microcontroller smt32f4



Hardware implementation of the above



Product packaging:

As our product is a smart assistive device similar to a smartwatch the size is the main restriction it.We are now trying to work with 4-microphones but later we will try to do with 3 microphones only to reduce the size as there will also processor along with the microphones.

Communication design

The product consists of a connective system with smartwatch and a smartphone.

Input (the audio samples) is taken through microphones in smart watch and the following Sound source localization,Sound Enhancement,Sound detection and Sound visualization are processed within the watch and respective output is displayed or sensed.for,Speech to text conversion and for playing the record sounds the smartphone is where the processing is done and output will also be shown on phone.