

Silent Sound Technology

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Abstract: *Silent sound technology SST has be introduced to put end to noise pollution and help the people that have lost their voice and cannot speak on mobile phone. This device is developed at Karlsruhe institute of technology and expected to be see in near feature. This device will notice the lip movement inform of electrical impulse and transfer it to sound speech that can be understood. It will be useful for people that want to make a silent call by just receiving the electrical impulse from lips movement and neglect all other surrounding noise and convert it to sound speech at the receiver ends. It can be used for languages like English, German and French but it cannot be used for language like Chinese because a different tone means different meaning. It will be useful for secrete calling because the caller don't need to utter a word loudly just the lips movement. Silent sound technology (taking without talking) work base on two methods which are electromyography (EMG) and image processing.*

Keywords: silent sound Technology, electromyography (EMG), Electromagnetic, Image processing, Pre processing, Information extraction, ultrasound transducer

1. Introduction

What is silent? According to Wikipedia, Silent is lack of audible sound or presence of sound with very low intensity. Silent sound technology is developed in German at Karlsruhe institute of technology. Is a technology that transmit sound without using vocal folds or vocal cord(a pair of muscle in larynx), which it just receive electrical impulse by noticing the muscular movement of lips since it has been proved that the articulation muscle (Jaws and lips muscle) become active whether air passes through it or not, according to the research that proved that articulation muscle always remain active whether air passes through it or not(if you tense these muscle slightly, and release a little air, the vocal cords vibrate. This is called phonation and also called fundamental frequency of voice, try to place the finger across your throat when you talk or hum).Then it convert the electrical impulse into sound signal which it will be transmitted to the listener and hear it inform of speech.

Silent sound technology(talking without talking) will put end to unwanted sound that phone pick up from surrounding when making call especially in the noisily environment like movies theater, market place, train station etc. The technology will be useful for those who have lost their voice as a result of accident or illness or old age and what to make a phone call. Anytime you want to use the technology you will just activate the silent sound mode and start receiving the electrical impulse from the articulation muscle and neglect all others sounds from surrounding and transmitted it which will now be converted to sound that the listener will understand.

Silent sound technology can happen in these scenarios where different people are talking in the same place without disturbing each other.



Silent sound technology can help in this situation. Old woman talking on phone and the listener is hearing it clearly.



Silent sound technology can happen in this scenario. Student making a phone call in student conference without making noise.



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Silent sound technology allow her by Making phone call in the nosily environment without disturbance.

2. What Happen When Will Speak

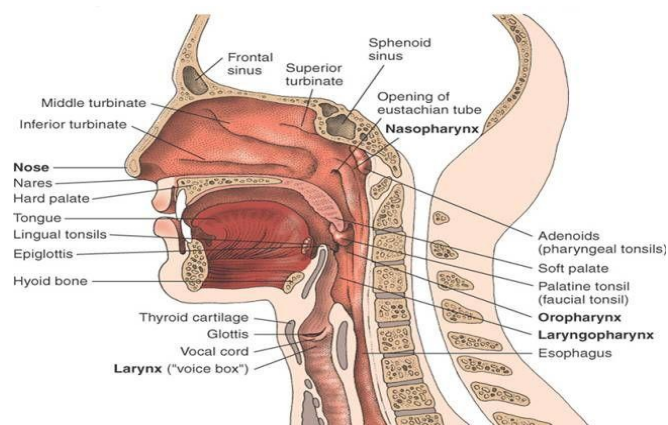


Figure 1.0

If will speak loudly or silently air will pass through the larynx and tongue then the word are produced using articulation muscle in the jaws and mouth region, our ability to speak relies on the presence of two folds tissue called vocal cord in the larynx(voice box) at the top of the trachea. As air passes between the cords when will speak loudly or silently or even breathe out they vibrate and this are modified into meaningful speech by movement of lips, cheeks and tongue.

Speech Interface

The speech interface consist of four transducer

1. Pressure sensor
2. Vibrator sensor
3. Electromagnetic sensor
4. Motion sensor

How Silent Sound Technology Work

There are two method that are used in silent sound technology

1. Electromyography (EMG)
2. Image processing

Electromyography

Electromyography (EMG) is a study of muscles functions through analysis of electrical activity produced from muscle. This electrical activity which display in form of signal is the result of neuromuscular activation associate with muscle contraction. This method is been use in silent sound technology SST, it will notice the muscular movement when we speak silently and converted it to electrical impulse signal. The EMG surface consists

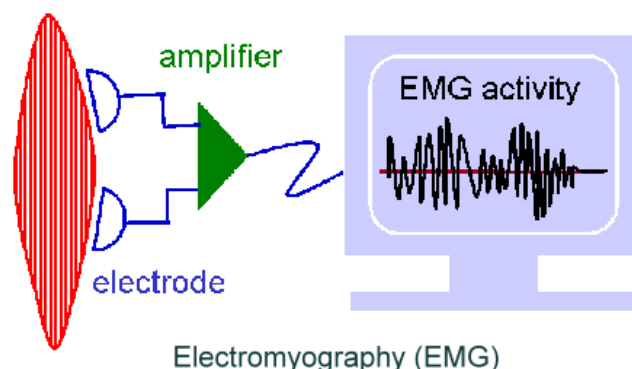
1. Pressure sensor
2. Vibrator sensor
3. Electromagnetic sensor
4. Motion sensor



Figure 1.1

Electromyography contain of fine wired electrode which is attached to the face (fig 1.1) and the electrical signal produced by facial muscle is been recorded and compare with the recorded signal of the spoken words which are the same. It proved that electrical signal produced match with spoken words then the electrical signal can now be transmitted and convert to the same sound signal at the listener side.

Images of Electromyography



Electromyography (EMG)

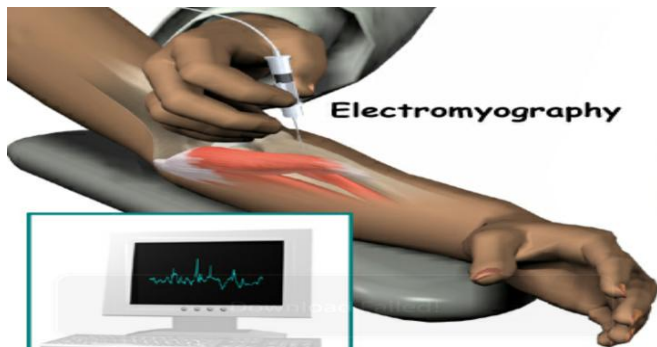


Figure 1.2

Image Processing

Image processing is another way to obtain direct information from vocal tract configuration via imaging technique.

There two types of image processing;

1. Analog image processing
2. Digital image processing

Analog image processing technique is applied to hard copy of data such as photograph or print out.

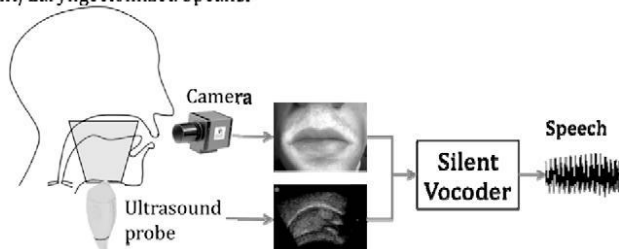
Digital image processing: Digital image processing is been used in silent sound technology, is the processing of converting the image into image, video or audio but in Silent sound Technology (talking without talking) the output is audio with minimal corrections and calibration.

The interface will contain ultrasound transducer, high resolution optical camera, lips reader and silent vocal. Ultra sound device which couple with high resolutions optical camera which will capture image of the lips and tongue movement. The image will be send to lips reader and the lips reader compare the earlier spoken words with the present lips and tongue movement and the matched Image of lips and tongue will generate a visual speech signal.

Image processing undergoes three steps;

1. Pre processing
2. Display and enhancement
3. Information extraction

Silent/Laryngectomized Speaker



Application of Silent Sound Technology

- i. It will help people who have lost their voice as a result of accident or cannot speak loudly again as result of old age
- ii. It can be use a military for communication of secrete or sensitive information.
- iii. It is applicable if you want to make a call in conference meeting or library without disturbing the others
- iv. Speaker can speak his native language like German and listener can listen to it in his native language like English
- v. It is applicable for those who want to make a call in nosily environment e.g. people working in train station, Movies Theater, market etc.
- vi. As we know in space there is no medium for sound to travel therefore this technology can be best utilized by astronauts.

3. Limitation of this Technology

It cannot work for language that different tones means different meaning like Chinese.

It is working perfect only if electrode inserted into face.

There won't be emotional feeling the speech because it will be talking like robot.

4. Future Research

In the feature the silent sound technology will be incorporate into mobile phone or headset which headset would decipher the movement of the lips and jaws and received electrical impulse which will be convert into sound signal before transmitted. See fig 1.3

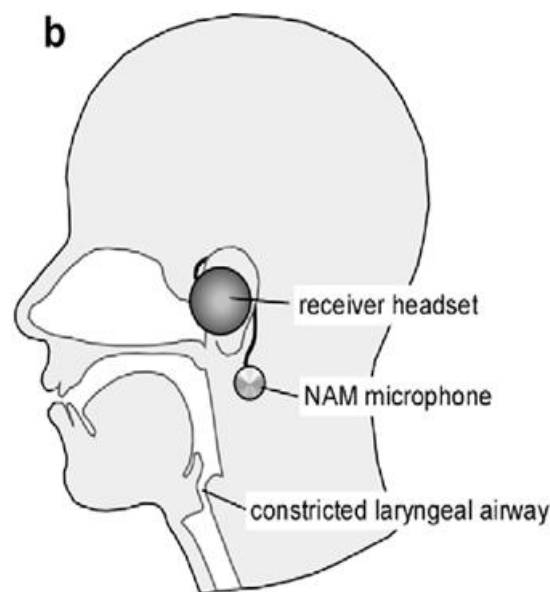


Figure 1.3

5. Conclusion

The silent sound technology that notice movement of lips and received it inform of electrical impulse which transform into sound signal and the technology will be a benefit for those have lost their voice and they want to speak on mobile phone this technology will gives solution to that problem. The headset would be decipher the movement of the lips and convert it into sound signal at listener sides in future.

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