A

Seminar report

On

Silent Sound Technology

Submitted in partial fulfillment of the requirement for the award of degree
Of ECE

SUBMITTED TO:

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Acknowledgement

I would like to thank respected Mr…….. and Mr. ……..for giving me such a wonderful opportunity to expand my knowledge for my own branch and giving me guidelines to present a seminar report. It helped me a lot to realize of what we study for.

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Next, I would thank Microsoft for developing such a wonderful tool like MS Word. It helped my work a lot to remain error-free.

Last but clearly not the least, I would thank The Almighty for giving me strength to complete my report on time.

Preface

I have made this report file on the topic **Silent Sound Technology;** I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to ……..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

CONTENT

INTRODUCTION

Silence is the best answer for all the situations …even your mobile understands!

- The word Cell Phone has become greatest buzz word in Cellular Communication industry.
- There are lots and lots of technology that tries to reduce the Noise pollution and make the environment a better place to live in.
- I will tell about a new technology known as Silent Sound Technology that will put an end to Noise pollution.

You are in a movie theater or noisy restaurant or a bus etc where there is lot of noise around is big issue while talking on a mobile phone. But in the future this problem is eliminated with ”silent sounds”, a new technology unveiled at the CeBIT fair on Tuesday that transforms lip movements into a computer-generated voice for the listener at the other end of the phone.

It is a technology that helps you to transmit information without using your vocal cords . This technology aims to notice lip movements & transform them into a computer generated sound that can be transmitted over a phone . Hence person on other end of phone receives the information in audio.

In the 2010 CeBIT's "future park", a concept "Silent Sound" Technology demonstrated which aims to notice every movement of the lips and transform them into sounds, which could help people who lose voices to speak, and allow people to make silent calls without bothering others.

The device, developed by the Karlsruhe Institute of Technology (KIT), uses electromyography, monitoring tiny muscular movements that occur when we speak and converting them into electrical pulses that can then be turned into speech, without a sound uttered.

‘Silent Sound’ technology aims to notice every movements of the lips and transform them into sounds, which could help people who lose voices to speak, and allow people to make silent calls without bothering others. Rather than making any sounds, your handset would decipher the

movements your mouth makes by measuring muscle activity, then convert this into speech that the person on the other end of the call can hear. So, basically, it reads your lips.

"We currently use electrodes which are glued to the skin. In the future, such electrodes might for example by incorporated into cellphones," said Michael Wand, from the KIT.

Figure1.1-common people talking at same place without isturbance

The technology opens up a host of applications, from helping people who have lost their voice due to illness or accident to telling a trusted friend your PIN number over the phone without anyone eavesdropping — assuming no lip-readers are around.

The technology can also turn you into an instant polyglot. Because the electrical pulses are universal, they can be immediately transformed into the language of the user's choice.

"Native speakers can silently utter a sentence in their language, and the receivers hear the translated sentence in their language. It appears as if the native speaker produced speech in a foreign language," said Wand.

The translation technology works for languages like English, French and Gernan, but for languages like Chinese, where different tones can hold many different meanings, poses a problem, he added.

Noisy people in your office? Not any more. “We are also working on technology to be used in an office environment,” the KIT scientist told AFP.

The engineers have got the device working to 99 percent efficiency, so the mechanical voice at the other end of the phone gets one word in 100 wrong, explained Wand.

“But we’re working to overcome the remaining technical difficulties. In five, maybe ten years, this will be useable, everyday technology,” he said.

NEED FOR SILENT SOUND

Silent Sound Technology will put an end to embarrassed situation such as-

- An person answering his silent, but vibrating cell phone in a meeting, lecture or performance, and whispering loudly, ‘ I can’t talk to you right now’ .
- In the case of an urgent call, apologetically rushing out of the room in order to answer or call the person back.

ORIGINATION:

Humans are capable of producing and understanding whispere speech in quiet environments at remarkably low signal levels. Most people can also understand a few unspoken words by lip-reading The idea of interpreting silent speech electronically or with a computer has been around for a long time, and was popularized in the 1968 Stanley Kubrick science-fiction film ‘‘2001 – A Space Odyssey ” A major focal point was the DARPA Advanced Speech Encoding Program (ASE) of the early 2000’s, which funded research on low bit rate speech synthesis ‘‘with acceptable intelligibility, quality , and aural speaker recognizability in acoustically harsh environments”,

When you add lawnmowers, snow blowers, leaf blowers, jack hammers, jet engines, transport trucks, and horns and buzzers of all types and descriptions you have a wall of constant noise and irritation. Even when watching a television program at a reasonable volume level you are blown out of your chair when a commercial comes on at the decibel level of a jet.

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METHODS

Silent Sound Technology is processed through some ways or methods. They are

- Electromyograpy(EMG)
- Image Processing

Electromyography :

- The Silent Sound Technology uses electromyography, monitoring tiny muscular movements that occur when we speak.
- Monitored signals are converted into electrical pulses that can then be turned into speech, without a sound uttered.
- Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced by skeletal muscles.
- An electromyography detects the electrical potential generated by muscle cells, when these cells are electrically or neurologically activated.
- Electromyographic sensors attached to the face records the electric signals produced by the facial muscles, compare them with pre recorded signal pattern of spoken words
- When there is a match that sound is transmitted on to the other end of the line and person at the other end listen to the spoken words

Image Processing:

- The simplest form of digital image processing converts the digital data tape into a film image with minimal corrections and calibrations.

- Then large mainframe computers are employed for sophisticated interactive manipulation of the data.

- In the present context, overhead prospective are employed to analyze the picture.
- In electrical engineering and computer science, image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or, a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.

ELECTROMYOGRAPHY

Electromyography (EMG) is a technique for evaluating and recording the electrical activity produced by skeletal muscles. EMG is performed using an instrument called an electromyograph, to produce a record called an electromyogram. An electromyograph detects the electrical potential generated by muscle cells when these cells are electrically or neurologically activated. The signals can be analyzed to detect medical abnormalities, activation level, recruitment order or to analyze the biomechanics of human or animal movement.

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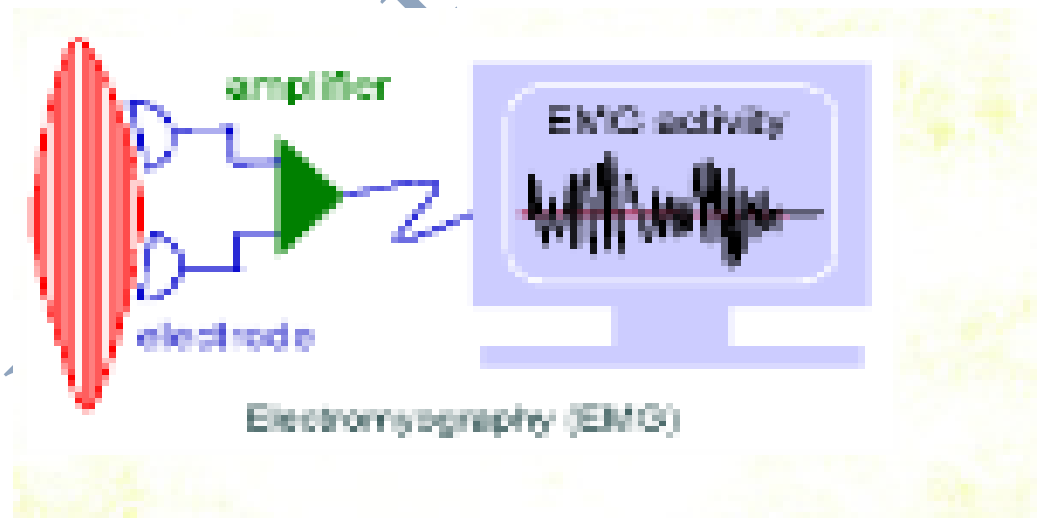

Figure-4.1 :Electromorphography signal generation

ELECTRICAL CHARSTICSRACTE

The electrical source is the muscle membrane potential of about -90 mV. Measured EMG potentials range between less than 50 μV and up to 20 to 30 mV, depending on the muscle under observation.

Typical repetition rate of muscle motor unit firing is about 7–20 Hz, depending on the size of the muscle (eye muscles versus seat (gluteal) muscles), previous axonal damage and other factors. Damage to motor units can be expected at ranges between 450 and 780 mV.

History:

The first documented experiments dealing with EMG started with Francesco Redi's works in 1666. Redi discovered a highly specialized muscle of the electric ray fish (Electric Eel) generated electricity. By 1773, Walsh had been able to demonstrate that the Eel fish's muscle tissue could generate a spark of electricity. In 1792, a publication entitled *De Viribus Electricitatis in Motu Musculari Commentarius* appeared, written by Luigi Galvani, in which the author demonstrated that electricity could initiate muscle contractions. Six decades later, in 1849, Dubois-Raymond discovered that it was also possible to record electrical activity during a voluntary muscle contraction. The first actual recording of this activity was made by Marey in 1890, who also introduced the term electromyography. In 1922, Gasser and Erlanger used an oscilloscope to show the electrical signals from muscles. Because of the stochastic nature of the myoelectric signal, only rough information could be obtained from its observation. The capability of detecting electromyographic signals improved steadily from the 1930s through the 1950s, and researchers began to use improved electrodes more widely for the study of muscles. Clinical use of surface EMG (sEMG) for the treatment of more specific disorders began in the 1960s. Hardyck and his researchers were the first (1966) practitioners to use sEMG. In the early 1980s, Cram and Steger introduced a clinical method for scanning a variety of muscles using an EMG sensing device.

It is not until the middle of the 1980s that integration techniques in electrodes had sufficiently advanced to allow batch production of the required small and lightweight instrumentation and

amplifiers. At present, a number of suitable amplifiers are commercially available. In the early 1980s, cables that produced signals in the desired microvolt range became available. Recent research has resulted in a better understanding of the properties of surface EMG recording. Surface electromyography is increasingly used for recording from superficial muscles in clinical or kinesiological protocols, where intramuscular electrodes are used for investigating deep muscles or localized muscle activity.

There are many applications for the use of EMG. EMG is used clinically for the diagnosis of neurological and neuromuscular problems. It is used diagnostically by gait laboratories and by clinicians trained in the use of biofeedback or ergonomic assessment. EMG is also used in many types of research laboratories, including those involved in biomechanics, motor control, neuromuscular physiology, movement disorders, postural control, and physical therapy.

PROCEDURE:

There are two kinds of EMG in widespread use: surface EMG and intramuscular (needle and fine-wire) EMG. To perform intramuscular EMG, a needle electrode or a needle containing two fine-wire electrodes is inserted through the skin into the muscle tissue. A trained professional (such as a neurologist, physiatrist, or physical therapist) observes the electrical activity while inserting the electrode. The insertional activity provides valuable information about the state of the muscle and its innervating nerve. Normal muscles at rest make certain, normal electrical signals when the needle is inserted into them. Then the electrical activity when the muscle is at rest is studied. Abnormal spontaneous activity might indicate some nerve and/or muscle damage. Then the patient is asked to contract the muscle smoothly. The shape, size, and frequency of the resulting motor unit potentials are judged. Then the electrode is retracted a few millimeters, and again the activity is analyzed until at least 10–20 units have been collected. Each electrode track gives only a very local picture of the activity of the whole muscle. Because skeletal muscles differ in the inner structure, the electrode has to be placed at various locations to obtain an accurate study.

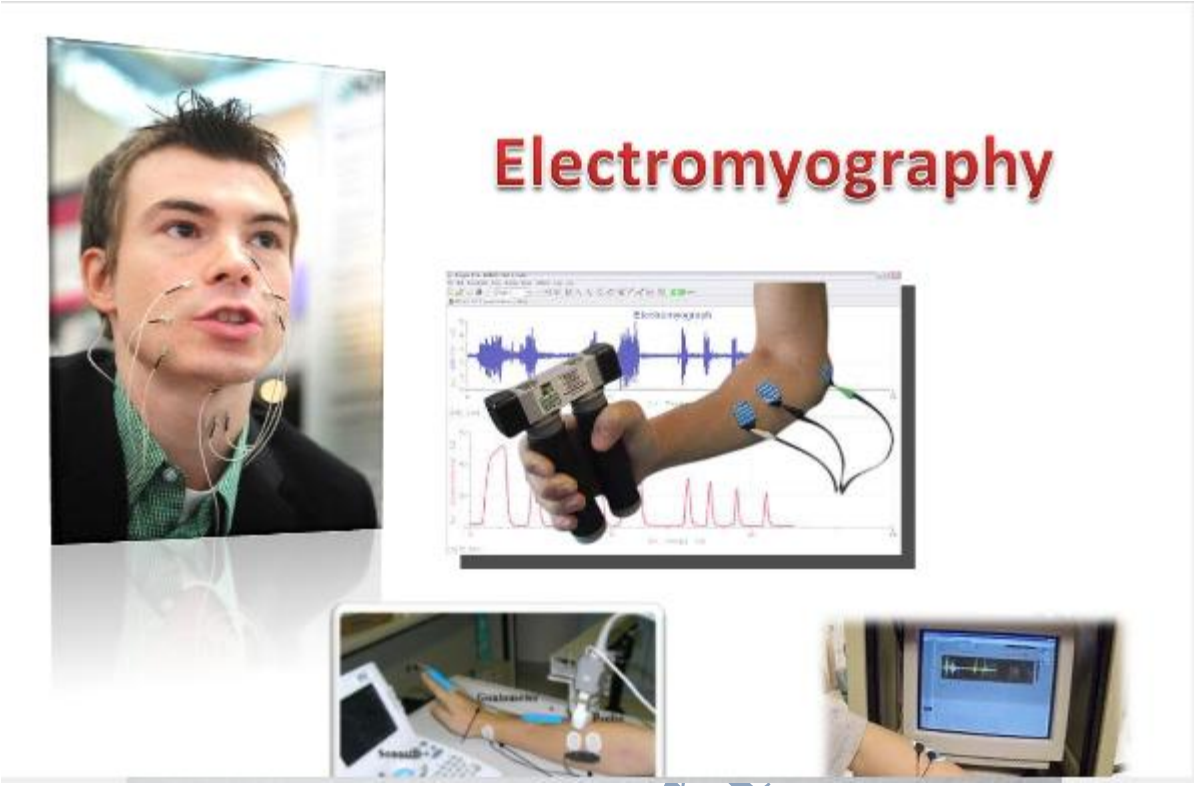

Figure4.2-:Electromyography istruments

Intramuscular EMG may be considered too invasive or unnecessary in some cases. Instead, a surface electrode may be used to monitor the general picture of muscle activation, as opposed to the activity of only a few fibres as observed using an intramuscular EMG. This technique is used in a number of settings; for example, in the physiotherapy clinic, muscle activation is monitored using surface EMG and patients have an auditory or visual stimulus to help them know when they are activating the muscle (biofeedback).

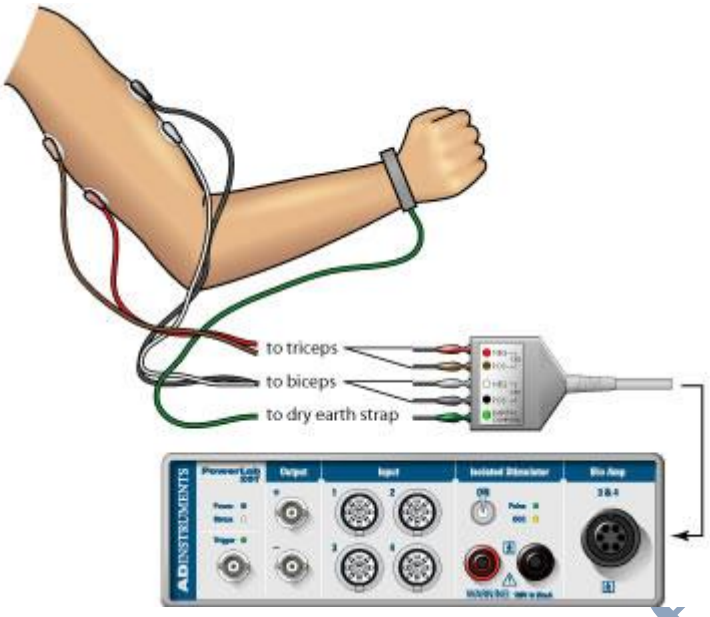

Figure4.3-:Interfacing with electromyographer and body:

A motor unit is defined as one motor neuron and all of the muscle fibers it innervates. When a motor unit fires, the impulse (called an action potential) is carried down the motor neuron to the muscle. The area where the nerve contacts the muscle is called the neuromuscular junction, or the motor end plate. After the action potential is transmitted across the neuromuscular junction, an action potential is elicited in all of the innervated muscle fibers of that particular motor unit. The sum of all this electrical activity is known as a motor unit action potential (MUAP). This electrophysiologic activity from multiple motor units is the signal typically evaluated during an EMG. The composition of the motor unit, the number of muscle fibres per motor unit, the metabolic type of muscle fibres and many other factors affect the shape of the motor unit potentials in the myogram.

Nerve conduction testing is also often done at the same time as an EMG to diagnose neurological diseases.

Some patients can find the procedure somewhat painful, whereas others experience only a small amount of discomfort when the needle is inserted. The muscle or muscles being tested may be slightly sore for a day or two after the procedure.

Normal results:

Muscle tissue at rest is normally electrically inactive. After the electrical activity caused by the irritation of needle insertion subsides, the electromyograph should detect no abnormal spontaneous activity (i.e., a muscle at rest should be electrically silent, with the exception of the area of the neuromuscular junction, which is, under normal circumstances, very spontaneously active). When the muscle is voluntarily contracted, action potentials begin to appear. As the strength of the muscle contraction is increased, more and more muscle fibers produce action potentials. When the muscle is fully contracted, there should appear a disorderly group of action potentials of varying rates and amplitudes (a complete recruitment and interference pattern).

Abnormal results:

EMG is used to diagnose diseases that generally may be classified into one of the following categories: neuropathies, neuromuscular junction diseases and myopathies.

Neuropathic disease has the following defining EMG characteristics:

- An action potential amplitude that is twice normal due to the increased number of fibres per motor unit because of reinnervation of denervated fibres
- An increase in duration of the action potential
- A decrease in the number of motor units in the muscle (as found using motor unit number estimation techniques)

Myopathic disease has these defining EMG characteristics:

- A decrease in duration of the action potential
- A reduction in the area to amplitude ratio of the action potential
- A decrease in the number of motor units in the muscle (in extremely severe cases only)

Because of the individuality of each patient and disease, some of these characteristics may not appear in every case.

EMG signal decomposition:

EMG signals are essentially made up of superimposed motor unit action potentials (MUAPs) from several motor units. For a thorough analysis, the measured EMG signals can be decomposed into their constituent MUAPs. MUAPs from different motor units tend to have different characteristic shapes, while MUAPs recorded by the same electrode from the same motor unit are typically similar. Notably MUAP size and shape depend on where the electrode is located with respect to the fibers and so can appear to be different if the electrode moves position. EMG decomposition is non-trivial, although many methods have been proposed.

Applications of EMG:

EMG signals are used in many clinical and biomedical applications. EMG is used as a diagnostics tool for identifying neuromuscular diseases, assessing low-back pain, kinesiology, and disorders of motor control. EMG signals are also used as a control signal for prosthetic devices such as prosthetic hands, arms, and lower limbs.

EMG can be used to sense isometric muscular activity where no movement is produced. This enables definition of a class of subtle motionless gestures to control interfaces without being noticed and without disrupting the surrounding environment. These signals can be used to control a prosthesis or as a control signal for an electronic device such as a mobile phone or PDA.

EMG signals have been targeted as control for flight systems. The Human Senses Group at the NASA Ames Research Center at Moffett Field, CA seeks to advance man-machine interfaces by directly connecting a person to a computer. In this project, an EMG signal is used to substitute for mechanical joysticks and keyboards. EMG has also been used in research towards a "wearable cockpit," which employs EMG-based gestures to manipulate switches and control sticks necessary for flight in conjunction with a goggle-based display.

Unvoiced speech recognition recognizes speech by observing the EMG activity of muscles associated with speech. It is targeted for use in noisy environments, and may be helpful for people without vocal cords and people with aphasia.

FEATURES OF SILENT SOUND TECHNOLOGY

Some of the features of silent sound technology are

- Native speakers can silently utter a sentence in their language, and the receivers can hear the translated sentence in their language. It appears as if the native speaker produced speech in a foreign language. The translation technology works for languages like English, French and German, except Chinese, where different tones can hold many different meanings.
- Allow people to make silent calls without bothering others.
- The Technology opens up a host of application such as mentioned below
- Helping people who have lost their voice due to illness or accident.
- Telling a trusted friend your PIN number over the phone without anyone eavesdropping — assuming no lip-readers are around.
- Silent Sound Techniques is applied in Military for communicating secret/confidential matters to others.

RESEARCH

With all of the millions of phones in circulation, there is great potential for increasing earnings by saving 'lost calls' - telephone calls that go unanswered or uninitiated because the user is in a situation in which he or she cannot speak - not just in business meetings, but everyday situations. According to research, these 'lost calls' are worth $20 billion per year worldwide. For the cellular operator, these are potential earnings that are currently being left on the table. When these 'lost calls' become answerable, and can be conducted without making a sound, there is a tremendous potential for increased profits. Now the research is going on technology that can be used in Office Environment too.

APPLICATIONS

The Technology opens up a host of application such as mentioned below :

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- Telling a trusted friend your PIN number over the phone without anyone eavesdropping — assuming no lip-readers are around.
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- Allow people to make silent calls without bothering others.

CONCLUSION

- Thus Silent Sound Technology,one of the recent trends in the field of information technology implements ”Talking Without Talking”.
- It will be one of the innovation and useful technology and in mere future this technology will be use in our day to day life.

‘Silent Sound’ technology aims to notice every movements of the lips and transform them into sounds, which could help people who lose voices to speak, and allow people to make silent calls without bothering others. Rather than making any sounds, your handset would decipher the movements your mouth makes by measuring muscle activity, then convert this into speech that the person on the other end of the call can hear. So, basically, it reads your lips.

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