ELECTRONICS & COMMUNICATION ENGINEERING

TECH
CONNECT
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ECG R
NORMA

ELECTROENCEPHALOGRAM
(EEG)

LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
MYLAVARAM

Contents

Editorial Board Members

The main objective of this magazine is to only educate the student community to advances in technology and has no commercial benefit in this

1.Electrocardiogram

An Electro Cardio Graph (ECG) is a digital recording of the electrical signals in the heart it is also called as electrocardiogram or an EKG. The ECG is used to determine heart rate, heart rhythm and other information regarding the heart's condition. ECG'S are used to help diagnose heart arrhythmias, heart attacks, pacemaker function and heart failure.

Fig: ECG basic equipment

Purpose of test:

An ECG machine detects your heart's electrical rhythm and produces what's known as a tracing, consists of representations of several waves that recur with each heartbeat, about 60 to 100 times per minute. The wave pattern should have a consistent or if they do not appear as standard waves, this is indicative of heart diseases.
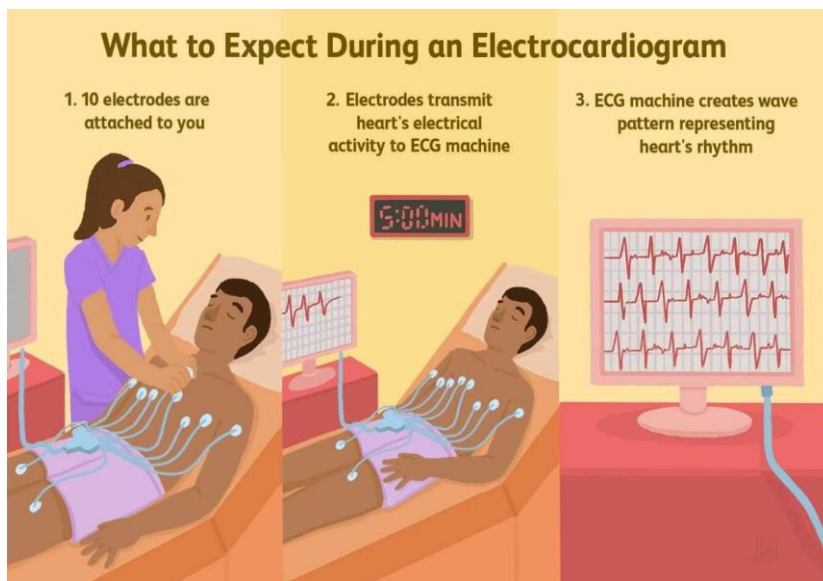
Fig. Recording Procedure

Uses of ECG:

- To find the orientation of the heart.
- To determine the heart rate and working mechanisms of the heart.
- To diagnose cardiac, rhythm disorders
  Eg:- Heart block.
- To detect electrolyte in balance
  Eg:- Hyperkalaemia
- To determine the thickness of the heart muscles.

Limitations of ECG:

- ➢ To provides a snapshot view of a highly dynamic process.
- ➢ ECG is not very sensitive test and should always be considered a supplement to rather than a substitute for physician judgement.
- ➢ Lack of perfect detection in areas of nyocardium it supplies
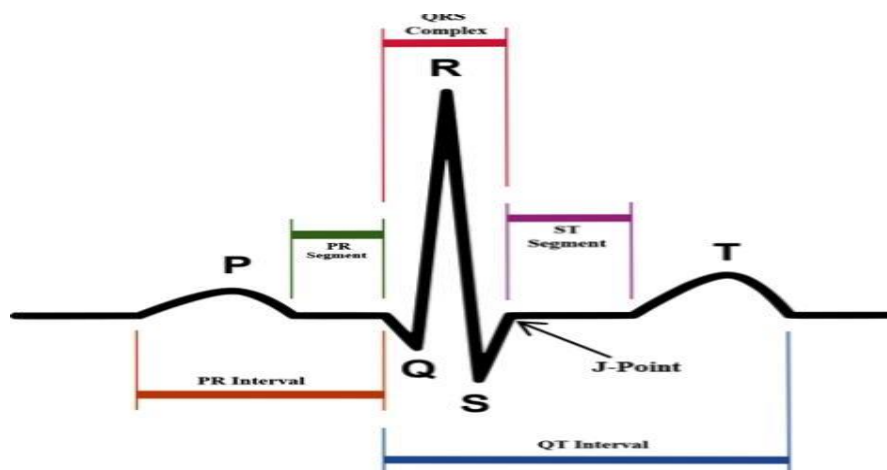
Future scope:

❖ Multiple parameters like retinal size, age and weight can be included as controlling parameters in the future

Conclusion:

▪ Electrocardiograph shares the same basic circuit use to analyse the signal from patient heart and produce the result in graphical output.

▪ This is the most important device which can help the doctor to identify the problems in certain heart failure.

Life is like a ECG machine some time the beats are high and low

but,

Life works both high and low are balanced

~P. Sathwik(17761A0447)

2.Electromyography

Electromyography (EMG) is an electrodiagnostic medicine technique for evaluating and recording the electrical activity produced by skeletal muscles.[1] EMG is performed using an instrument called an electromyograph to produce a record called an electromyogram. An electromyograph detects the electric potential generated by muscle cells[2] when these cells are electrically or neurologically activated. The signals can be analyzed to detect medical abnormalities, activation level, or recruitment order, or to analyze the biomechanics of human or animal movement.

Generally EMG is used to record the electrical activity in muscle. When electrical signals are transmitted, contraction and relaxation of muscles happens. An EMG translates these signals into graphs or numbers which is helpful for doctors to make a diagnosis.Doctors prescribe EMG when patient is showing symptoms regarding muscle or nerve disorder, tingling, numbness, muscle weakness, muscle pain or, cramping, paralysis.

Two components are needed to perform EMG they are the nerve conduction study and needle EMG. The nerve conduction study is used to place small sensors called surface electrodes on the skin to assess the ability of the motor neurons to send electrical signals. Needle EMG also uses sensors to evaluate electrical signals. The sensors are called needle electrodes, these are directly inserted into muscle tissue to evaluate muscle activity when the muscle is at rest and at contract position.

Electrodes are inserted to the surface of skin especially at the place where patient is experiencing symptoms during nerve conduction study which is performed first. These electrodes check that how well motor neurons communicate with muscles. Once this process is completed electrodes can be removed. Next step in this process is needle EMG. After the affected area is cleaned with an antiseptic, electrodes are inserted into the muscle tissue by using a needle. This causes pain. These needle electrodes are used to evaluate the electrical activity of muscles. The electrodes are removed after this process.

During the above procedure, the electrodes will deliver tiny electrical signals to the nerves, which are converted into graphs or numerical values by computer. This

process takes around 30 to 60 minutes.

If EMG shows any electrical activity when muscle is at rest position then the patient is suffering from muscle disorder affecting the nerves that connect to the muscle inflammation caused by an injury. If EMG shows any electrical activity when muscle is at contract position then the patient is suffering from herniated disc such as ALS or carpal tunnel syndrome.

~M.Reshma(IIECE)

Reference(s):

1.healthline.com

3. Nanorobots in Medicine

Advancement in technology has really manipulated the world around us on an ever decreasing scale. **Robots** play a key role in the field of biomedicine. Nano Robotics is the technology of creating machines or <u>robots</u> close to the microscopic scale of a nanometer (10^{-9} meters). Nano robotics refers to <u>nanotechnology</u> – an engineering discipline for designing and building nano robots. Nano robots can be used in different application areas such as medicine and space technology. Nowadays, these nano robots play a crucial role in the field of Bio-Medicine, particularly for the treatment of cancer, cerebral Aneurysm, removal of kidney stones, elimination of defected parts in the DNA structure, and for some other treatments that need utmost support to save human lives. Nano robots are nano devices used for the purpose of maintaining and protecting the human body against pathogens.

Medical nano robots are used for the purpose of diagnosis, testing and monitoring of microorganisms, tissues and cells in the blood stream. These nano robots are capable of noting down the record, and report some vital signs such as temperature, pressure and immune system's parameters of different parts of the human body continuously. The current stages of medical technologies and therapy tools are used for the successful treatment of cancer. Nano robots with embedded chemical biosensors are used for detecting the tumor cells in early stages of cancer development inside a patient's body.

Nano robots are helpful in desensitizing tooth, oral anesthesia, straightening of irregular set of teeth and improvement of the teeth durability, major tooth repairs and improvement of appearance of teeth. Nano robots can also be used as ancillary devices for processing different chemical reactions in the affected organs. These robots are also useful for monitoring and controlling the glucose levels in diabetic patients. Nano robots used for drug delivery is Pharmacytes which will transport the drug to the targeted point. The dosage of the drug will be loaded into the payload of the pharmacyte.

Genes are like the command code for the how body and its collection of cells, limbs, and organs are supposed to behave and perform. In some cases due to age, sickness, disease or damage, an area of the body can either suffer from a breakdown of the gene or stop responding to the gene.

This is characteristic in cancer patients, where the tumor cell stops the proper reproduction of cells and leads to the cancer. Gene therapy is a technique for treating these bodily malfunctions by administering new DNA codes in the form of genes into the affected area

of the body to regulate and normalize the reproductive pattern and function of the body. Genetic disease can be treated by nano robots by comparing the molecular structure of both proteins & DNA found in the cell.

Nano robots used to detect brain aneurysm follows the process as explained. At first, nano robots enter the vessel and flow with the bloodstream, the nano robots are moving through the vessel with the fluid **then** the aneurysm saccular bulb begins to become visible at the vessel wall, nano robots move closer to the vessel deformation and get mixed with the plasma, NOS (nitric oxide synthase) signals can be detected as the chemical gradient changes, denoting proteomic over expression, the same workspace viewed without red cells **and** the nano biosensor is activated as the nano robots move closer to the aneurysm, emitting RF signals sent to the cell phone as the nano robots keep flowing, the chemical signals become weaker, deactivating the nano robot transmission, the red cells and nano robots flow with the bloodstream until they leave the vessel. Also in many medical applications, Nano robotics are widely used.

~M.Durga Bhavani(15761A0425)

4.Magnetic Resonance Imaging

An invasive imaging technology that produces 3D anatomical pictures without using of any harmful or damaging or ionizing radiation in today's world what we called as "**Magnetic Resonance Imaging**". It uses a technology that detects the change in direction of rotational axis of protons in water that makes up the living tissues. In this way it is used for disease detection and diagnosis treatment.

In order to obtain a MRI image the person is kept inside a strong magnet. The person must remain very concentrate without any movements in the body not to blur the image. Contrast agents like elements containing gadolinium are given to the patient during or before the imaging to increase the speed at which the protons realign on magnetic field. The faster the realign the brighter the image . Physicians are able to tell the difference between various tissues based on these magnetic properties only.

MRI is well suited for imaging the non bony parts or soft tissues in the body. It is different from computer tomography (CT), because they does not use any kind of harmful radiation. MRI often used to see the knee and shoulder injuries. In brain it is used to detect the difference between grey matter and white matter further it can recognize the tumors. As MRI using strong magnets and producing a clear image it is quite expensive than ordinary x-ray imaging and computer tomography.

People having implants, iron , pacemakers , vagus nerve stimulators, implantable cardioverters-defibrillators etc., should not enter the MRI scanning room.
During the first trimester of pregnancy , it is recommended that MRI scans are avoided because during that stage the fetus forms it's organs. When we give contrast agents it may enter the fetus blood stream leading to severity.

Efforts in recent years have been focused on design of MRI contrast agents (MRI-CAs), which either target biomarkers, or take advantage of the different physiology of cancerous cells. MRI-CAs based on gadolinium complexes, or other metallic nanoparticles have been investigated. This review will focus on the recent progress in the application of MRI to the imaging of breast and ovarian cancers, and present a possible role for molecularly-targeted contrast agents in enriching the context for MRI-based diagnosis.

~Divya varikuti (17761A04H6)

5. *Atmospheric Wind Profiler*

Wind Profiler is a generic term for ground based remote probing instrument used to study the dynamics of the earth's atmosphere. The atmospheric radars are coherent pulsed Doppler radars operating in VHF or UHF bands. They transmit radio frequency pulses in vertical and off-vertical directions. Backscatter from atmospheric and other targets is received by sensitive receivers. These echoes are digitized. Subsequently, echoes from the targets in the same region are combined and subjected for Doppler analysis to get a Doppler Power Spectrum for each range-bin. On this processing, the primary products such as Signal Power, Doppler Shift and Spectral Width for each range bin are generated. From these primary products, atmospheric parameters like target density, wind speed and turbulence intensity etc., can be derived. These parameters are very useful for atmospheric modeling and predictions. The Doppler Power Spectra is conventionally considered as the basic form of data from which all products and weather parameters are derived. However, obtaining backscattered signal from atmospheric target is very difficult as the echoes are too weak (power around -140dBm). Also, the signal could be contaminated with clutter, echoes from non-atmospheric targets, precipitation and radio frequency interference (RFI) and so on. Discontinuous coverage in range and time is also observed occasionally. Consistent and reliable extraction of atmospheric parameters is possible by applying appropriate post processing methodology to analyze the Doppler power spectra.

Modeling and Simulation of the wind profiler Doppler Power spectra:

This involved mathematical formulation of the backscattered signal as output from the RF receiver of the radar, performing mathematical operations of digital signal processing and creating Doppler power spectra. By this process one can make spectral data with user defined features. This data could be used as a test bench to evaluate the performance of various processing techniques and algorithms.

Preprocessing of the Doppler Power Spectra:

This activity involves estimation of noise power and identification of the echoes from non-atmospheric targets and removal of all the unwanted signals. This way the data is made suitable for the next stage of profile

extraction.

Estimation of the Doppler profile:

This activity mainly deals with Doppler profile tracing. The algorithm developed can be used for most type of data without change of parameters. Such an algorithm is expected to be used for automated processing of huge data generated by WP radars.

Target classification from Doppler Power Spectra:

Automated processing of the radar data also require the data to be classified based on the atmospheric targets.All the algorithms have been implemented on the data of Indian MST radar at Gadanki, India. The functionality of the algorithm has been tested repeatedly and found consistent. The performances of algorithms are compared with some of the established methods currently in being used for the same purpose. It is observed that the newly developed algorithms show improvement over the existing methods in Clutter and RFI removal and profile tracing. The algorithms show consistent results in classification of the spectral data along with less computational complexity.

~M.SivaSankara Rao (Sr. Assistant Professor)

6.Free Space Optics

Communication is nothing but exchange of information between two points. Transmission of information (Audio, Video or data) in the form of light pulses generally termed as "Optical Communication". Free space optics is an optical communication technology where the information is transmitted in free space through light. This technology is useful where physical connections are not possible or impractical due to high cost or other considerations. In FSO (Free Space Optics) there is no need of optical fiber cable and the working of FSO is similar to optical fiber cable network but the only difference is that the optical beams are sent through the air instead of fiber cable mediums such as glass or plastic.

FSO system consists of an optical transmitter at both ends (One end is at ground and other end is in free space) to provide full duplex communication. An FSO system must have the capability to operate at higher power levels for long distance. For high speed FSO systems, proper modulation technique must be chosen for data transmission. FSO system must have the ability to operate over high temperature. FSO links can be used by the telecommunication service providers for communication and it requires no license. But, license is required in case of microwave band.

High band width or high data rate can be achieved with FSO since light has higher frequencies (Optical frequencies). FSO links are used for inter satellite communication (Communication between two satellites which are in different orbits). Last mile problem can also be reduced with FSO. The FSO limitations may include absorption of light beam by water molecules present in atmosphere. Trees and buildings may obstruct the light beams when they come in the line of sight path of FSO system.

~Ch.V.NagaBhaskar(Assistant Professor)

7.Headless Raspberry Pi Health Monitor for Paraplegics

A headless project needs to get its IP, send results to the cloud for analysis on a phone. It also needs a way to update the software. The project is about a health monitor for a paraplegic person who has a spinal cord injury above T6. It works by monitoring some bodily signs and hopefully predicting accurately when to automatically call the caregiver to help.

These paraplegic people suffer from Autonomic Dysreflexia (AD) when there is a stressor in their body that they cannot feel because their spinal cord is broken. The parasympathetic pathway which normally clears the stress is unavailable because it goes through the spinal column. The AD is a splitting headache with sweating and feeling very ill. The most common cause is that the urinary catheter got twisted or plugged with gunk from a bladder infection and the bladder is overfull. They have no sensation from the bladder or other parts innervated below the spinal cord lesion. Urine flows pretty steadily into the bladder, and in this case out into the collection bag.

The AD Monitor works by weighing the urine collection bag every couple of minutes using a Load Cell and Hx711 digitizer to a Pi Zero w. It also reads up to 2 Moisture and temperature sensors to detect the profuse sweating. When the urine weight does not increase it means that perhaps the catheter is blocked or has fallen out. The doctor can come and clear the problem and avoid the pain and stress of a visit to the Emergency. The Moisture monitors detect the sweating and show that an episode of AD is in progress.

The AD Monitor sends its data to the cloud. The Android app picks up this data every 20 minutes and will raise an alarm for the doctor. This remote alarm is important in this application since the doctor may be at home miles away.

The project breaks down into several parts.

- Get the IP address of a headless Pi

- Get the new user to register the home wifi ssid and password by filling in a web form on his phone or computer

~ Sai Abhishek(IV ECE)

8.Crack detection on railway track using ultrasonic sensor

Indian Railways is the fourth largest railway network in the world. Although there is a tremendous growth in Indian Railways, this system is still plagued by number of problems which require immediate attention. The rail accidents are increasing day by day and this is because of improper maintenance of rail roads which leads to crack in railway tracks hence the proper maintenance should be provided and cracks should be detected to avoid such bad situations. But this is difficult to determine manually hence the solution is provided here. For reducing the derailments, the crack detection systems were designed using various techniques.

Major problems include obstacles entry on to the track and cracks on the tracks. To overcome this , a testing train which uses ultrasonic sensor with a range of 100cms and delay is 30 cm. Based on the distance between obstacle and the train, the train slows down. When the train is at a distance of 20cm we increase the delay in order to slow down the train and finally when it reaches to a distance of 15cm the train automatically stops. During summer and winter seasons the tracks may expand and contract due to which cracks may occur. The LED and photodiode setup is placed to testing train to detect cracks. Here we are using arduino microcontroller. After detecting the crack the message is send to nearest station with location of crack. This system is simple in operation and advantageous over both day and night crack detection. There are several different techniques to detect the cracks but this technique of crack detection has less costing and gives more accurate result.

~S. Nagalakshmi(15761A0447)

9.Eye Writer

The eyes play an important role both in perception and communication. Technical interfaces that make use of their versatility can bring significant improvements to those, who are unable to see. Eye writer uses low cost eye tracking glasses and open source software to allow people suffering from any kind of neuromuscular syndrome and write and draw by tracking their eye movement and translating it to lines on a screen.

This devices use eye tracking technology, to capture the eye movements and position of the eye. Eye tracking is the process of measuring either the point of gaze(where we are looking) or motion of the eye relative to the head. The studies of eye movement reveals that reading does not involve a smooth sweeping of the eyes along the text to be read. The eyes do not move continuously along a line of text, but make short rapid movements(saccades) intermingled with short stops(fixations). Our visual attention is always slightly(100 to 250 ms) ahead of the eye. But as soon as attention moves to a new position, the eyes will want to follow. Eye tracker measures rotations of the eye in several ways, but principally they fall into three categories, a special contact lens with an embedded mirror, video based eye tracker, Electro Oculogram(EOG).

Eye writer is a video based eye tracker that use contrast to locate the center of the pupil and use infrared and non-infrared collimated light to create a corneal reflection. Foveated imaging is a digital image processing technique in which the image resolution or amount of detail varies according to one or more fixation points which indicate the highest resolution region of the image and corresponds to the center of the eye's retina, the fovea. By examining fixations, saccades, pupil dilation, blinks and a variety of other behaviors, this device can determine a great deal about the effectiveness of a given image or product. This device uses PS3 eye camera, IR illuminators and a software to tack the position of the user's pupil. A wide variety of applications use eye tracking techniques, including cognitive science, psychology, human- computer interaction (HCI) and medical research.

~N. Mahalakshmi(15761A0431)

10.Red Tacton

Red Tacton technology is an electronic future where information can be accessible whenever and wherever needed at our finger tips. Some of the communication equipment that is required to provide this immediate access to information will be incorporated into our attire. Justas a quick look at today's wristwatch saves a trip to the nearest clock; a glance at tomorrow's wristwatch will replace finding a terminal to check e-mail.
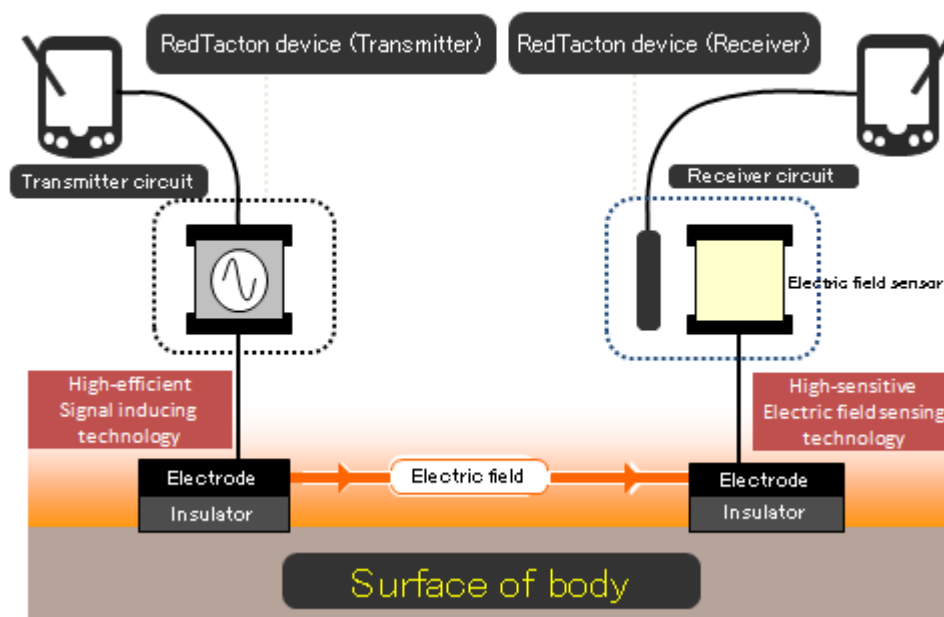
Red Tacton Technology was introduced by Nippon Telegraph and Telephone Corporation (NTT). TACTON- meaning "action triggered by touching" and RED - It is an auspicious color according to Japanese culture for warmth. It is a technology that uses the surface of the human body as a safe, high speed network transmission.

- Red Tacton uses the minute electric field emitted on the surface of the human body. It is completely distinct from wireless and infrared.

- A transmission path is formed at a part of the human body which comes in contact with a Red Tacton transceiver. Physically separating ends the contact and thus ends communication.

- Using Red Tacton, communication starts when terminals carried by the user are linked in several combinations according to the user's natural, physical movements. Communication is possible using any body surfaces, such as the hands, fingers, feet, face, legs, skin or torso. Red Tacton works through shoes and clothing as well.

Features

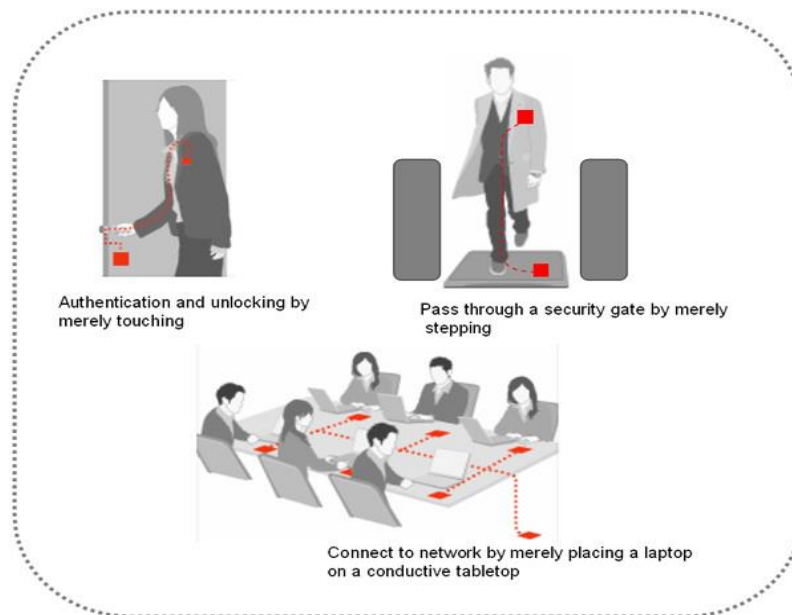Red Tacton Technology has three main functional features:

i.)   Touch: Touching, sitting, walking, stepping, gripping and other human movements can be the used as triggers for unlocking or locking, starting or stopping the equipment, or obtaining data.

ii.)   Broadband & Interactive: Bandwidth does not deteriorate even with duplex operations and also simultaneous access by many users. Duplex, interactive communication is possible at a maximum speed of 10Mbps. This is because the transmission path is on the surface of the body; transmission speed of red tacton does not deteriorate in congested areas where many people can communicate at the same time.

iii.)   Any media: In addition to the human body, there are various conductors and dielectrics can also be used as transmission media. Conductors and dielectrics may also be used in combination.

An Alarm   Touch Advertising   Printing Application   Data Exchange
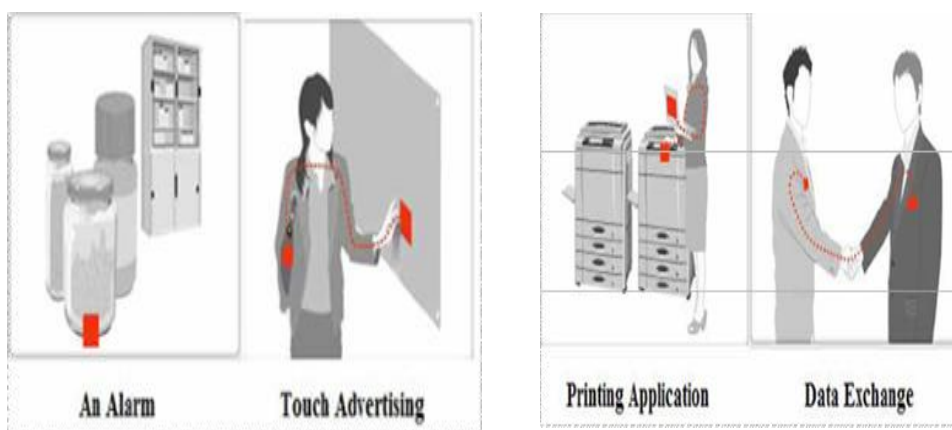
ADVANTAGES :-

i.)   Red Tacton does not require the electrode to be in direct contact with the skin.

ii.)   High-speed communication is possible between any two arbitrary points on the body.

iii.)   Body-based networking is more secure than other broadcast systems, such as Bluetooth which have high range of about 10m.

iv.)   Network congestion due to fall in transmission speed in multiuser environments is avoided.

v.)   Superior than Infrared technology.

vi.)   Superior than Wi-Fi.

Authentication and unlocking by merely touching

Pass through a security gate by merely stepping

Connect to network by merely placing a laptop on a conductive tabletop

Security Applications

i.)   Automatic user authentication and log-in with just a touch.

ii.)   ID and privileges are recorded in a mobile Red Tacton device.

iii.)   Corresponding Red Tacton receivers are installed at security check points.

iv.)   The system can provide authentication and record who touched the device.

Conclusion:-

This technology definitely stands out with perfection, when transfer of data is fast, feasible and more importantly reliable. So, in few years from now everything is going to fall under this super technology.

"FUTURE BELONGS TO RED TACTON"

~ G.Poorna Sasank (17761A0409)
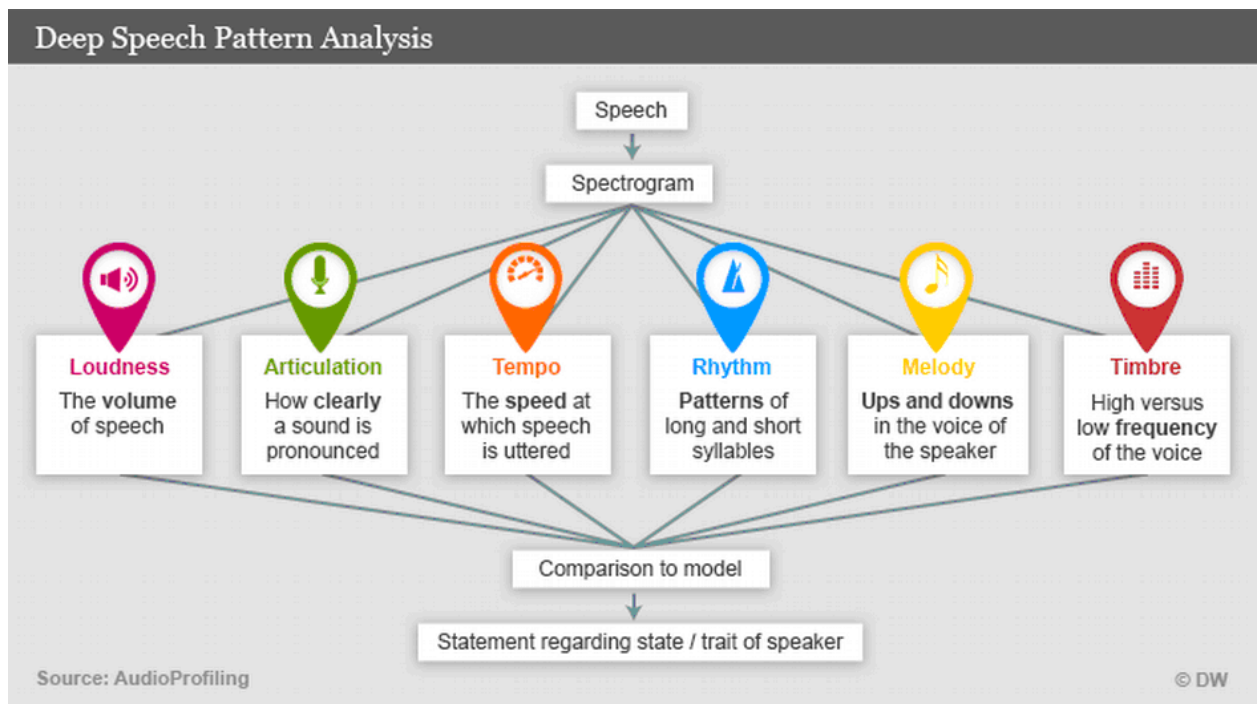
11.Speech analysis

INTRODUCTION

Speech analysis is the process of analyzing the voice and the speech patterns of people. Some approaches of speech analysis are focused on speech recognition - understanding the speech content. Other approaches are focused on speech prosody - understanding the speech "melody" or the pronunciation patterns, typically analysing speech aspects of intonation, rhythm, stress, emphasis.

Speech prosody is strongly related to the physiology of voice and speech production, involving the vocal cords, breathing, pitch, loudness, air flow patterns and other acoustic features. Prosody is used to express the speaker's attitude, similar to facial expressions – serious, light, dramatic, warm, childish, ironic, urgent etc. Based on physiology and focused on attitude rather than content, speech prosody is generally language independent.

SPEECH PROFILING – A UNIQUE BIOMETRIC CONCEPT

Voice Sense introduces a new biometric concept – personal profiling through speech analysis. The concept is based on measuring typical speech patterns within a person's natural interactions. These patterns reflect emotional responses and behavioral tendencies such as temperament, determination, sociability, openness, adaptability. When measured in a given interaction, these patterns reflect the emotional sentiment and the current state of mind of a person. When measured consistently over time, they reflect personality and well-being.

By extracting the generic speech prosody features, we provide not only a language independent analysis but also a speaker independent tool (no need for training or calibrating to the specific voice) for understanding people's emotions and attitudes (state of mind).Addition of characteristic prosodic speech patterns of an individual, it is possible to provide personality profiling.

Deep Speech Pattern Analysis

Source: AudioProfiling   © DW

HIGHLIGHTS OF SPEECH ANALYSIS

Typical methods for sentiment and personality measurement are subjective and often culturally biased as they are based on self-administered questionnaires or evaluations by other people. Since the Voice Sense analysis is based on prosodic speech patterns, which are common to all humans beyond language and culture, our analysis is objective, language and culture independent. [Scoring all people on one objective scale enables true personalization].

~A.V. Anoora Reddy(17761A0401)