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Brain Machine Interface

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***Abstract*— Last past decade, in India lot of peoples are control all the application by using only hand and legs. but in many developed countries laboratories have start to explore mind machine interface or brain machine interface technology as a radically new communication option for those with neuron muscular impairments that prevent them from using conventional improvement communication method. Brain machine converts neuron activity generated from brain cells into electrical signal. BMI's provide these users with communication channels that do not depend on peripheral nerves and muscles. Current BMI's use electroencephalographic (EEG) activity recorded at the scalp or single-unit activity recorded from within cortex to control of speed of ac or dc motor, control on and off condition of bulb, operation of wheelchair. The main element in each bran machine interface is a translation algorithm that converts electrophysiological input from the user into output that controls external devices. Brain machine interface is depends on concentration power and data interface. Current BMI's have maximum information transfer rates of 5–30 b/min. Achievement of greater output and speed depends on improvements in signal processing, effectively interfacing, translation algorithms, and user concentration and training. This type of human efforts can be reduced by using this brain machine interface.**

Definition of the Problem

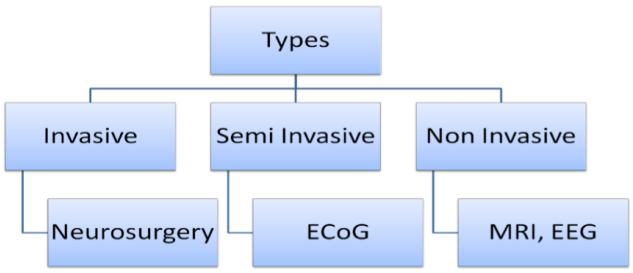
In a brain machine interface, by using various brain activities we can control the electrical application. Brain machine interface is the direct communication between the brain and external device. We know our brain is generate voltage and brain activity .we can't control the external device using the brain voltage but we control the external device using the different brain activity, but first upon this brain activity is converted into the proper signal and after using the signal to control the all external device. This technique is known as brain machine interface. We know the in India lots of people are handicap. They can't do anything without hand and legs. But they have brain so using brain concentration power controls any electronic and electrical device. Also it use for different field for example industrial, commercial, domestic and educational field.

I. INTRODUCTION

Brain Machine Interface (BMI) is a domain concerning recording, collect, communication, interpretation of the electroencephalogram. Electroencephalogram (EEG) is a one type of method it uses for the measure the brain activity and it is converted into electrical signal. Electroencephalogram is a record of the electric signal generated by the different corporative action of brain cells. EEG can be measured by means of electrodes placed on the outer side of scalp or directly on the outer side of cortex. It also called electrocorticogram (ECoG).In simple language EEG use for measurement the different type of brain voltage fluctuations as detect from outer side of scalp electrodes. In the EEG is a process depends upon six electrodes have been studied during the performance of five mental state (calculation, body moment, mental task, imagination, geometrical figure rotation, for which poor results had been obtained with autoregressive models before, were the principal objective of this project. brain computer interface (BCI) is used for reduce the human effort .in our project we design circuit for speed control of motor .only we can control the speed of brain concentration power. also we are control all home appliance by brain concentration power. we know the in India five Lakh people are totally handicap .they are not doing anything without hand and legs ,so we are design one prototype wheelchair ,it is control by only concentration power. Brian machine interface technique is used for all field electrical, mechanical, medical, and civil, computer and so on.

The work presented here is a part of a larger project, whose goal is to classify EEG signals belonging to a varied set of mental activities in a real time Brain machine Interface, in order to investigate the feasibility of using different mental tasks as a wide communication channel between people and computers.

II. METHOD FOR BRAIN SIGNAL MEASUREMENT



Three types of brain signal measurement method .first is invasive method ,in this method electrode placed inside of the scalp so surgery is required .this method very costly ,so invasive method not used in this project

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Next method is partially invasive method .We are here used electrocorticogram .In this method some electrode placed inside of the scalp and some is outer side of scalp ,so here also surgery required as well as maintainers' is required .this method is very costly ,so it also not used in this project.
Last method is non invasive method .We are here used electroencephalogram .In this method electrode placed outer side of scalp ,so here also surgery is not required .This method is cheaper as compare the other methods ,so it is used in brain machine interface project.

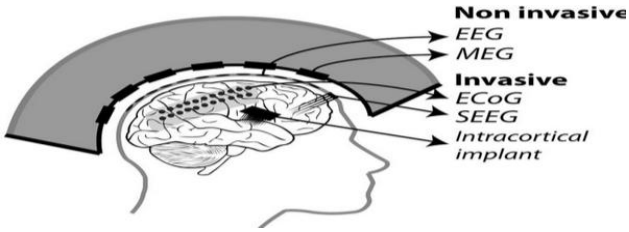

Figure 1.1 Method for brain signal measurement

***Electrocorticography* (ECoG)** is measures the brain activity of the brain taken from inside of scalp in a similar way to non-invasive electroencephalography but this is the electrodes are embedded in a type of thin plastic pad that is placed above the cortex.

Electroencephalography in conventional scalp EEG, in this method can measure the brain activity directly outside of scalp. The recording is obtained by placing electrodes on the scalp with a conductive gel or paste, usually after preparing the scalp area by light abrasion to reduce impedance due to dead skin cells.

fMRI = Functional Magnetic Resonance Imaging fMRI exploits the changes in the magnetic properties of hemoglobin as it carries oxygen. Activation of a part of the brain increases oxygen levels there increasing the ratio of oxyhemoglobin to deoxyhemoglobin.

Magnetoencephalography (MEG) MEG detects the tiny magnetic fields created as individual neurons "fire" within the brain. It can pinpoint the active region with a millimeter, and can follow the movement of brain activity as it travels from region to region within the brain.

III. THEORETICAL BACKGROUND

Neurons is one block of brain, neuron is consist of different types of cell. This cell sends and received the electrochemical signal. Neurons in the brain can operate all things of human life including completing motor activities and cycle, performing mental action, memories, and dreaming, body moment. The electroencephalogram (EEG) is a measuring from the surface of the scalp generated by many biopotentials in the cerebrum of the brain. More specifically, it is a measuring and recording of the postsynaptic potentials and action potentials of cortical cells. Since we are recording from the surface of the skull, we are measuring potentials from many cells at the at time. The energy of the neurons in the brain can vary as a function of the emotional, mental, or physiological state of the person .At initially stage, EEG data is not proper ,not accurate, unstructured, non-stationary, also noise is present. However, so we are here using different types of advanced signal processing techniques can be used to separate different components of the brain waves. These separate components can then be associated with different brain areas and functions. EEG is divide signal in different waveform it is also called as rhythms and rhythms are depends on the mental condition, mental state of the person. shown in the table 2.1. Alpha waves are generally found in the EEG when the individual is awake in a quiet, resting state with their eyes closed. Delta waves are the very low frequency components of an EEG. Deep sleep and certain brain diseases give rise to delta waves. Theta waves occur mainly in the parietal and temporal regions. These occur sometimes during emotional stress and often in degenerative brain states. The alpha wave can be detected primarily from the occipital lobe but also from the parietal and frontal regions of the cerebral cortex. During sleep, however, the alpha waves disappear. Beta waves are recorded from the parietal and frontal lobes. They appear when the individual performs some specific type of mental activity or are attentive to an external stimulus. They are lower in amplitude than the alpha rhythms, but this is not due to there being less electrical activity. Instead, desynchronization, also known as alpha block, occurs, reducing the amplitude of the net signal recorded from the scalp.

Brain Wave Type	**Frequency range**	**Brain anatomical location**	**Mental states and conditions**
Delta	0.1 to 3	Frontal lobe in adults	dreamless sleep
Theta	4 to 7 Hz	Not located in position relate to activity	Intuitive, creative, recall
Alpha	8 to 19 Hz	Posterior head regions	Relaxed, but not drowsy
Low Beta	20 to 24 Hz	Right side	aware of self & surroundings
High Beta	25 to 35 Hz	Left side	Alertness, Agitation

Table 2.1. EEG Brain Rhythms

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Mention previously ,non-synchronized potentials tend to cancel each other, resulting in a lower amplitude signal. Figure 2.1 shows the generation of EEG signal through a neuron.

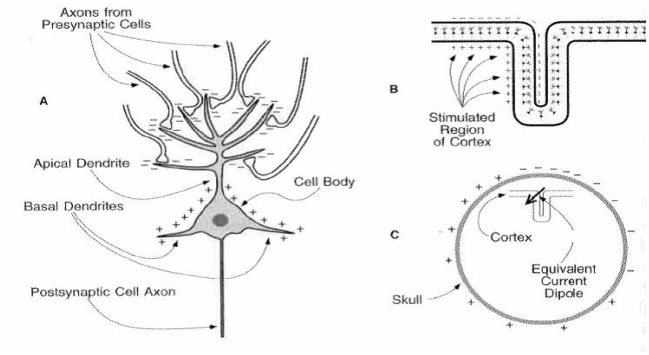

Figure 2.2 Potential generation through neural activity

What is EEG

Electroencephalography is a medical imaging concept that recording outrside from scalp electrical activity generated by brain. The electroencephalogram (EEG) is defined as brain activity of an alternating type recorded from the outer side of scalp surface after being picked up by different electrodes and sensor. The EEG measured directly from the sclap surface is called electrocortiogram while when using depth probes it is called electrogram. We will refer only to EEG measured from the cortex or sclap .EEG is one type of method for which is used to measure the brain activity and it is converting into different type of signal. Since we are the recording from the surface of the scalp, we are measuring potentials from many cells at time. Non-invasive methods such as EEG are portable, less expensive, insensitive to movement and easy to use.EEG is the most economical method for measuring electrical activity of brain. An electroencephalogram is a measure of the brain's voltage as well as brain activity as detected from outer side scalp electrodes. this brain activity produce of neurons .

Design Concept and Block Diagram

- In this model the brain machine interface derived from six block brain, electroencephalogram, signal acquisition, signal processing, application, feedback etc. we know the brain produce different activity.
- This activity measure by using electroencephalogram and after it is converted into different rhythms.EEG is output give to the signal acquisition.
- In signal acquisition method amplify the signal using amplification and after we use digitalization processes to convert signal analog to digital form.
- signal preprocessing, Is this block two modules are consist one is pre-processing and second is feature extraction. Pre-processing Module used for removing the artifacts/noise from the recorded EEG signal and improve the signal to noise ratio. Feature extraction Module used for extracting the hidden information from the pre-processed signals.
- Classification Unit: Identifies the intention of BCI user from the extracted features.
- Translational Unit: Translates the identified intentions into specific control signals for various BCI based applications.
- Feedback Unit : Feedback in BCI allows the user to self – regulate his EEG to get the desired output.

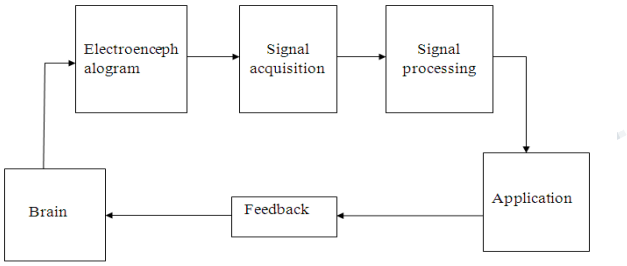

Figure 3.1. Block Diagram of Brain Machine

Applications

- EEG signal processing and analysis in diagnosis of brain diseases.
- Robotic limb controlling for paralyzed people.
- Mainstream robotics devices controlling.
- Mind controlled gaming using assisted modules.
- Produce biofeedback situations.
- Control the on off condition of the bulb.
- Control speed of the motors.
- To automatic control of the electrical arm.

Advantages of BCI

- Allow paralyzed people to control prosthetic limbs with their mind
- Transmit visual images to the mind of a blind person, allowing them to see
- Transmit auditory data to the mind of a deaf person, allowing them to hear
- Allow gamers to control video games with their minds

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- Allow a mute person to have their thoughts displayed and spoken by a computer

IV. CONCLUSION

The field of BMI research is growing and developing at great speed. This research has shown that it is possible to develop a reliable, cost effective and efficient in home application. From all this things we conclude that instead of remote control we can used brain control for controlling various types of application but we are electrical engineers so, we will control electrical application.

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