BRAIN COMPUTER INTERFACE

S.Amrutha,
B.Sc(Computer Science),
Department of Computer Science,
Sri Krishna Adithya College of Arts and Science,
Coimbatore-641042,Tamil Nadu,India.

K.Merlin Rathina Priya,
B.Sc(Computer Science),
Department of Computer Science,
Sri Krishna Adithya College of Arts and Science,
Coimbatore-641042,Tamil Nadu,India.

Abstract: Artificial intelligence has a pivotal role in enhancing the generation of technology .This ability to understand ,apply knowledge and improve skills has played an important role in the evolution of technologies.As the whole world has been grown in terms of technology, the power of computers has also grown alongside our understanding of human brain.we could imagine when the cursor of a computer can be controlled using our thought,it would be the best transformation of technology advancement to intelligence.Thus the brain computer interface is a technology where we use the neural signals to implement an action.This could be the most important technological breakthrough in decades.The main aim of this paper is to know about the implementation of brain computer interface and also to know future of brain computer interface in evolution of technology.

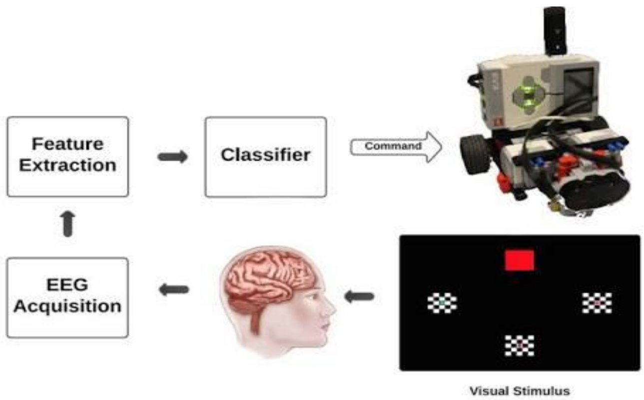
Keywords: Brain Computer Interface(Bci),Information Transfer Rate(Itr),Cortex Neural Signals,Eeg Based Brain Computer Interface

I. INTRODUCTION

Brain Computer Interface (BCI) technology is a powerful communication tool between users and systems. It does not require any external devices or muscle intermediation to issue commands and complete the interface.The research community has initially developed BCIs with biomedical applications in mind, leading to the generation of assistive devices.They have simplifiedreturning the movement ability for physically challenged or locked-in users and replacing lost motor functionality .The encouraging future predicted for BCI has encouraged research community to study the involvement of BCI in the life of non-paralyzed humans through medical applications.However, the scope of research has been further extended to include non-medical applications. More recent studies have targeted ordinary individuals by discovering the use of BCIs as aoriginal input device and investigating the generation of hands-free applications.The problem of poor information transfer rate (ITR) of BCIs and its effect on reducing the commands user can give has been addressed as one of those issues. It has been demanded that this problem restricts BCI consumption for locked-inpersons as it will not be able to keep up withordinary communication ways or even existing human computer interfaces.

II. OVERVIEW OF BRAIN COMPUTER INTERFACE (BCI)

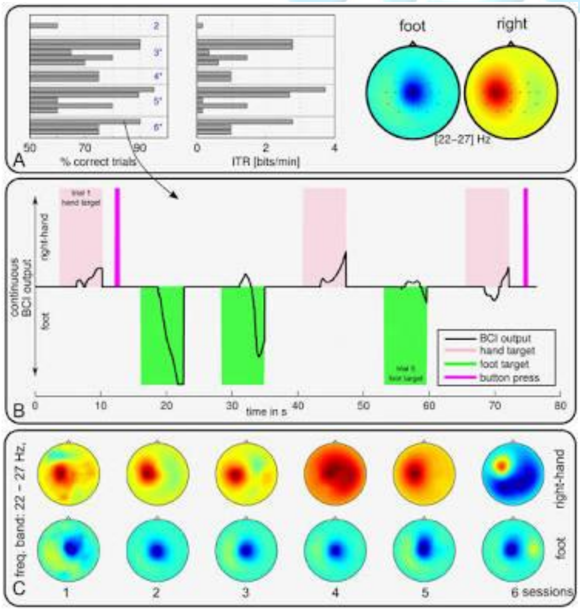
A Brain–Computer Interface (BCI), often called a Mind-Machine Interface (MMI), or sometimes called a direct neural interface or a Brain–Machine Interface (BMI), is a direct communication network between the brain and an external device. Brain-computer interface (BCI) is an upcoming technology which aims to convey people's intentions to the outside world directly from their thoughts,augmentingreasoning capabilities. BCIs are often directed at supporting,augmenting, or repairing human thinking or sensory-motor functions. The BCI can be used for people who are unable to express through speech. Normally these people are "locked in" meaning they can't move their face orany of their attachments. The field of BCI research and development has been focused onneuroprosthetics applications. This aims at renovating damaged hearing, sight and movement.



III.BCI PERFORMANCE

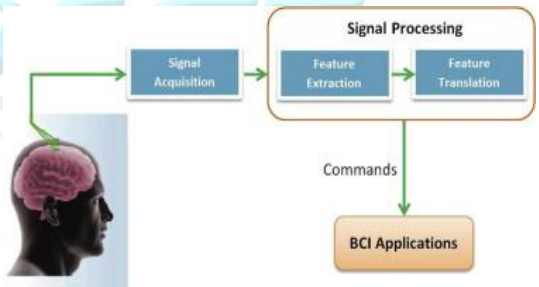
The performance of a BCI can be measured in various ways. A simple measureis classification performance (also termed classification accuracy or classificationrate). It is the ratio of the number of correctly classified trials (successful attempts to perform the required mental tasks) and the total number of trials. The error rate is also easy to calculate, since it is just the ratio of incorrectly classified trials and the total number of trials.Although classification or error rates are easy to calculate, application dependent measures are often more meaningful. For instance, in a mental typewriting application the user is supposed to write a particular sentence by performing a sequence of mental tasks. Again, classification performance could be calculated, but the number of letters per minute the users can convey is a more suitable measure. Letters per minute is an application reliant measure that assesses (indirectly) not only the classification performance but also the time that was necessary to perform therequired tasks.A more general performance measure is the so-called information transfer rate(ITR) .It depends on the number of different brain patterns (classes) used, thetime the BCI needs to classify these brain patterns, and the classification accuracy.ITR is measured in bits per minute.

Since ITR depends on the number of brain patterns that can be constantly and quickly noticed and classified by a BCI, the information transfer rate depends on the mental approach employed.Typically, BCIs with selective attention approaches have higher ITRs than those using, for instance, motor imagery. A major reason is that BCIs based on selectiveattention usually provide a larger number of classes (e.g. number of light sources).Motor imagery, for instance, is typically delimited to four or less motor imagery tasks. More imagery tasks are possible but often only to the expense of reducedclassification accuracy, which in turn would decrease in the information transfer rate as well.There are a few papers that report BCIs with a high ITR, reaching from 30 bits/min to slightly above 60 bits/min and, most recently, over 90 bits per minute. Such performance, however, is not typical for most users in real world settings.In fact, these record values are often obtained under laboratory conditions by individual healthy subjects who are the top performingsubjects in a lab. In addition,high ITRs are usually reported when people only use a BCI for short periods. Ofcourse, it is interesting to push the limits and learn the best possible performance of current BCI technology, but it is no less important to estimate accurate performance in more practical settings. Unfortunately, there is currently no study available that investigates the average information transfer rate for various BCI systems over a larger user population and over a longer time period so that a general estimate of average BCI performance can be derived. It has important applications for the most severely disabled. There are also newdeveloping applications for less severely disabled or even healthy people.



IV. APPLICATIONS OF BCI

BCI is one of the exiting areas of research. This device has been developed to control the thoughts of the different users. Some of the applications of this technology may seem interesting such as the ability to control a video game by thought. If you think a remote control is suitable channels could be controlled by our mind. This device would allow severely disabled people to work independently without anybody's support and also offers the paralyzed patients to improve the quality of life. BCI is well suited for patients who are paralyzed or locked-in and because of that they have very limited options of communication with other people, such as ALS (Amyotrophic Lateral Sclerosis) patients on aopening. BCIs are being developed for a variety of applications reaching from assistive technologies for patients with motor disabilities to entertainment devices .Possible applications of an EEG-based BCI are, e.g., to move a cursor by mental control, which allows the patient to select letters or words and to control a functional electrical stimulation device for patients with spinal cord lesions. These applications can be controlled by at least one binary output signal of the BCI, which is obtained, for example, by classification of EEG patterns during thoughts of left and right handmovements.Several laboratories have managed to record signals from monkey and rat logical cortices in order to operate BCIs to carry out movement. Monkeys have navigated computer cursors on screen andcommanded robotic arms to perform simple tasks simply by thinking about the task and without any motor output. Schmidt, Fetz and Baker in the 1970s established that monkeys could quickly learn to voluntarily control the unit of individual neurons in the primary motor cortex. In the 1980s, ApostolosGeorgopoulosat Johns Hopkins University found a mathematical relationship between the electrical responses of single motor-cortex neurons in rhesus macaque monkeys and the direction thatmonkeys moved their arms(based on a cosine function).



V. CONCLUSION AND FUTURE WORK

The use of EEG signals as a path of communication between man and machines represents one of the current challenges in signal theory research. The principal element of such a communicationsystem is known as "Brain Computer Interface". BCI is the interpretation of the EEG signals related to the characteristic parameters of brain electrical activity. This is the new emerging area which is mainly for the patients in the treatment bed (those have lost their speech due to accident or with any reason). Over the past few years, numerous proof-of-concept experiments have shown that people unable to move can use simple EEG-based BCI systems for point-and-click, robot control, and evenspelling at rates as fast as 20 words per minute.However it has its own drawbacks. EEG measures tiny voltage potentials where signal is weak and prone to interference. Signals have to be recorded from brain in a clinical condition where there are noexternal (noise free environment), users have to be trained to perform various tasks with full concentration and Handling high dimensional data.Future work in this regard would be exploring different approaches which can increase the reliability of scalp EEG recordings, exploring some more dimension reduction algorithms which helps in reducing the size of the EEG features. We can also say as detection techniques and experimental designs improve, the BCI will improve as well and would provide wealth alternatives for individuals to interact with their environment.

VI.REFERENCES

[1]. http://www.techradar.com/news/computing/the-future-of-brain-computer-interfaces-revealed-1101287
[2]. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2862632/
[3]. http://whatis.techtarget.com/definition/brain-computer-interface-BCI
[4]. https://googleweblight.com/i?u=https://en.m.wikipedia.org/wiki/Brain%25E2%2580%2593computer_interface&grqid=S_Xkr22S&s=1&hl=en-IN