

BRAINGATE: A Review

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Abstract— BrainGate is a brain implant system developed by the bio-tech company Cyberkinetics in 2003 in conjunction with department of Neuroscience at Brown University. The device was created to help those who have lost control of their limbs, or other bodily function, such as patients with ALS (Amyotrophic Lateral Sclerosis) or SCI (spinal code injury). The computer chip, which is fixed into the brain, monitors brain activity in the understanding and converts the objective of the user into computer commands. Cyberkinetics define that “such applications may include novel communications interfaces for motor broken patients, as well as the check and medication of certain defect which hold themselves in patterns of brain activity, such as epilepsy and depression”.

Keywords— Brain Gate, Quadriplegic, Cyber Kinetics, Neuroscience

I. INTRODUCTION

BrainGate is a brain embeds system advanced by the bio-tech association Cyber Kinetics in 2003 in agreement with advanced of Neuroscience Brown University. This system is accomplish to help of those who have lost charge of their body apportionment, or other actual function, such as patients with Amyotrophic Lateral Sclerosis (ALM) and Spinal Code Injury (SCI) to operate various gadgets like TV, Computer, Light, Fan etc. BrainGate is Nero prosthetic device that convert brain activity into computer command. This use to control a robot arm or cursor on a display.

People who are paralyzed have been given fear hope by the stem cell research championed by the late Chris toper Reeve P’02. But researchers in neuroscience are style at other less controversial ways of restoring independence to people with disabilities. The BrainGate system is based on cyber kinetics platform techonology to sense, transmit, analyse, and apply the language of neurons. The system consists of a sensor that is

implementing on the motor cortex of the brain and a device that reads brain signals.

The BrainGate aim at establishing a fast, reliable connection b/w the brain of a severely unabled person & a personal Computer. The BrainGate Neural Interface Device (NID) is a proprietary brain Computer Interface that uses an internal sensor to detect brain activity and external processors that convert these brain signals into a Computer output under the person’s personal control.

II. WORKING

A. Chip:

1.6 meter silicon chip read approx 100 of hair-thin microelectrodes is embedded in the primary motor deep area of the brain anwerable for adminitrate motion.

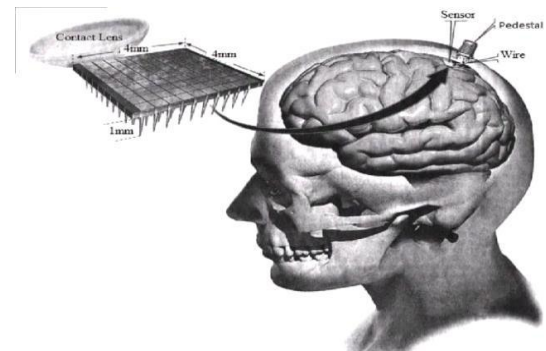


Fig- 1: Silicon chip

B. Connector: - This connector is attached to the skull of the patient & it towards the signals to the converter which are taking up by the clip.

C. Converter: - The signal passes to an amplifier where it is converted to digital data and up-down by fiber optic cable to a computer. The Electro Encephalon Gram is responsible for the convert

into the brain signal into digital signal and digital signal into brain signal.

- D. *Computer:* - BrainGate knowledge to partner's patterns of brain activity with particular futuring movements left, right, up, down & to connect those movements to a cursor.
- E. *Sensor:* - A device deep in the brain that data commands directly related to futuring body parts crusade.

III. BRAIN-COMPUTER INTERFACE: -

It is direct communication pathway between a brain or brain cell culture and a device (computer). A brain-Computer uses electrophysiological signals to control remote devices; most current BCIs are not invasive. They consist of electrodes applied to the scalp of an individual or worn in an electrode cap such as the one shown in 1-1 (Left). These electrodes pick up the brain electrical activity and carry it into amplifiers such as the ones shown in 1-1 (Right). These amplifiers amplify the signal approximately ten thousand times and then pass the signal via an analog to digital converter to a computer for processing the computer processes the EEG signal and uses it in order to accomplish tasks such as communication and environmental control BCIs are slow in comparison with normal human action because of the complexity and noisiness of the signal used as well as the time necessary to complete recognition and signal processing.

The phrase brain-computer interface (BCI) when taken literally means to interface and individual electrophysiological signal with a computer. A true BCI only use signal from the brain and as such must treat eye and muscle movements as artefacts or noise. On the other hand, a system that uses eye, musical or other body potential mixed with EEG signal, is a brain-body actuated system.

Scheme of an EEG –based brain computer interface with on-line feedback the EEG is recorded from the head surface, signal processing techniques are used to extract features. These features are classified, the output is displayed on a computer screen. This feedback should help the subject to control its EEG patterns.

The BCI system uses brain computer oscillatory electroencephalogram (EEG) signals, recorded during specific mental activity, as input and provides a control option by its output. The obtained output signals are presently evaluated for different purposes, such as cursor control, selection of letters or words, or control of prosthesis.

BCI is based on two ways.

- A. *One way BCIs:* - Information passes from brain to computer or computer to brain.
- B. *Two way BCIs:* - Information is exchanged between brain and computer.

IV. METHODOLOGY

In BrainGate, sensing techniques are used for methodology. Two methods are used to sense the signals sent by the neurons:

A. *ECoG*

ECoG is a Invasive method and ECoG means ElectroCorticography. This measures the electrical activity of brain taken from beneath the skull. Here the electrodes are embedded in a thin plastic pad that is placed above the cortex, beneath the durameter. ECoG is a very promising intermediate BCI(Brain computer interface) modality because it has higher spatial resolution, better signal to noise ratio, wider frequency range, and lesser training requirements than scalp recorded EEG(Electroencephalography), and at the same time has lower technical difficulty, lower clinical risk, and probably superior long term stability than intra cortical single neuron recording. This allows for much more direct reception of electric signals and allows electrode placement in the specific area of the brain where the appropriate signals are generated. This approach has many problems, however. It requires invasive surgery to implant the electrodes, and devices left in the brain long term end to cause the formation of scar tissue in the gray matter. This scar tissue ultimately blocks signals

B. *EEG:* -

EEG is a Non invasive method and EEG means Electroencephalography. The easiest and least invasive method is a set of electrodes — a device known as an electroencephalograph (EEG) — attached to the scalp. The electrodes can read

brain signals. However, the skull blocks a lot of the electrical signal, and it distorts what does get through. It is the most studied potential noninvasive interface, mainly due to its fine temporal resolution, ease of use, portability and low setup cost. A substantial barrier to using EEG as a brain computer interface is the extensive training required before users can work the technology. Signals recorded in this way have been used to power muscle implants and restore partial movement in an experimental volunteer. They are easy to wear, noninvasive implants produce poor signal resolution because the skull dampens signals, dispersing and blurring the electromagnetic waves created by the neurons. Although the waves can still be detected it is more difficult to determine the area of the brain that created them or the actions of individual neurons.

V. APPLICATIONS

- A. The brain gate neural interface system is an investigational medical device that is being developed to improve the quality of life for physically disabled people by allowing them to quickly and reliably control a wide range of devices by thought, including computers, environmental controls, robotics and medical devices.
- B. One of the most exciting areas of BCI research is the development of devices that can be controlled by thoughts. Some of the applications of this technology may seem frivolous, such as the ability to control a video game by thought
- C. Once the basic mechanism of converting thoughts to computerized or robotic action is perfected, the potential uses for the technology are almost limitless. Instead of a robotic hand, disabled users could have robotic braces attached to their own limbs, allowing them to move and directly interact with the environment.
- D. Cyber kinetics is also developing products to allow for robotic control, such as a thought controlled wheelchair. Next generation products may be able to provide an individual with the ability to control devices that allow breathing, bladder and bowel movements.
- E. The brain gate system has allowed people with paralysis to operate a computer in order to read email, control a wheelchair and operate a robotic hand.
- F. The device can be used in an interactive environment; Activity surrounding the patient will not affect the accuracy of the device.

VI. CONCLUSIONS

The technology driving this breakthrough in the Brain Machine Interface field has a myriad of potential applications, including the development of human augmentation for military and commercial purposes. The primary goal of this technology and devices like brain gate is to help those who are paralyzed to perform routine activities that are part of normal human existence. The brain gate can be used to replace the memory centre in patients affected by strokes, epilepsy or Alzheimer's disease. The „Brain Gate“ device can provide paralyzed or Moto rim paired patients a mode of communication through the translation of thought into direct computer control. Normal humans may also be able to utilize Brain Gate technology to enhance their relationship with the digital world provided they are willing to receive the implant.

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