



A Study on Brain Gate Technology for Bio Medical Applications

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ABSTRACT: The Brain Gate System is established on Cyber kinetics stage technology to sense, transfer, examine and put on the language of neurons. The principle of operation behind the Brain Gate System is that with intact brain function, brain signals are generated even though they are not sent to the arms, hands and legs. The signals are interpreted and translated into cursor movements, offering the user an alternate Brain Gate pathway to control a computer with thought, just as individuals who have the ability to move their hands use a mouse. The 'Brain Gate' contains tiny spikes that will extend down about one millimeter into the brain after being implanted beneath the skull, monitoring the activity from a small group of neurons. It will now be possible for a patient with spinal cord injury to create brain signals that convey the intention of moving the paralyzed limbs, as signals to an implanted sensor, which is then output as electronic impulses. These impulses assist the user to work mechanical devices with the help of a computer cursor. Matthew Nagle, a 25-year-old Massachusetts fellow with unadorned spinal cord damage, has been paralyzed from the neck down since 2001[1]. After taking part in a clinical trial of this system, he has opened e-mail, switched TV channels, turned on lights [2]. He even moved a robotic hand from his wheelchair. This character the first time that neural movement signals have been recorded and decoded in a human with spinal cord injury. The system is also the first to permit a human to regulate his nearby situation using his mind.

I. INTRODUCTION

Brain Gate system was established via the bio-tech company Cyber kinetics in 2003 in Combination with the department of Neuroscience Brown University [3].

The device was designed to help those who have lost control of their limbs or other body function. The computer chip which is fixed into the brain, monitors brain action in the patient and adapt the intension of the user into computer hands. Currently the chip used 100 hair-thin electrodes that hear neurons firing in specific area of the brain. For e.g.: the portion that regulate the arm movement the action is interpreted into eclectically

Charged signals and are then set and translated using a program thus affecting the arm. According to the Cyber kinetics website, two patients have been implanted with the Brain Gate. In November 2011, researchers from the Stanford University Neural Prosthetics Translational Laboratory joined the trial as a second site. [4][5].

The Brain Gate System is based On “Cyber kinetics” platform technologies to sense, transmit, analyze and apply the language of neurons. The System comprises of a sensor that is fixed on the motor cortex of the brain and a device that examines brain signals. The principle of operation behind the Brain Gate System is that with intact brain function, brain signals are generated even though they are not sent to the arms, hands and legs. The signals are understood and translated into cursor movements, offering the user a reformed "Brain Gate pathway." To control a computer with thought, just as individuals who have the ability to move their hands use a mouse.

II. NEUROMOTOR PROSTHETIC DEVICE

A neuro prosthetic device known as Brain gate changes brain action into computer guidelines. A sensor is secure on the brain, and electrodes are hooked up to wires that handy to a pedestal on the scalp. From there, a fiber optic cable transfers the brain movement data to a neighboring computer.

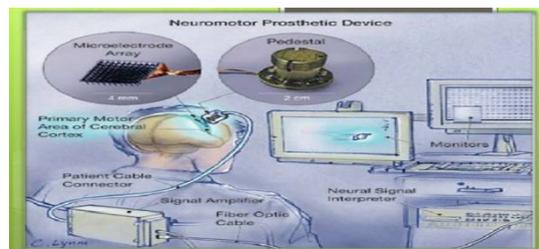


Fig:1: NEUROMOTOR PROSTHETIC DEVICE

III. PRINCIPLE

The principle of procedure of the Brain Gate Neural Interface System is that with whole brain function, neural signals are produced even though they are not sent to the arms, hands and legs. These signals are understood by the System and a cursor is shown to the user on a computer screen that offers a substitute "Brain Gate pathway". The operator can use that cursor to regulate the computer, just as a mouse is used [6].

HARDWARE COMPONENTS AND SOFTWARE TOOLS

HARDWARE COMPONENTS USED:

- THE CHIP
- THE CONNECTOR
- THE CONVERTER AND
- THE COMPUTER

THE CHIP:

A 4-millimeter square silicon chip dotted with hundred hair-thin, microelectrodes is embedded in brain primary motor cortex.

The chip, around the magnitude of a baby aspirin, holds 100 electrode sensors, each thinner than a human hair. The sensors sense minute electrical signals produced when a user visualizes, for example, that he's affecting the arrow, its manufacturer speaks.

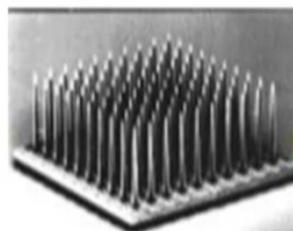


Fig .2:chip

Though paralyzed, a quadriplegic quiet has the capacity to produce such signals -- they just don't acquire past the injured portion of the spinal cord. With Brain Gate, the signals in its place mobile through a wire that comes out of the skull and links to a computer, Cybernetics says.

Brain Gate uses technology similar to cochlear implants that help deaf people hear and deep-brain simulators that treat Parkinson's disease. Those devices cost \$15,000 to \$25,000. Brain Gate will be "at least that expensive, and perhaps more", Surgeon said.

THE CONNECTOR:

It is devoted resolutely to the skull of the patient and it permits the signals received by the chip to the converter.

Most handicap people are satisfied. If they can get a basic connection to the safe world. Brain Gate enables them to achieve far more than that. Through checking the computer cursor, patients can access internet statistics, TV entertainment, and regulate lights and utilizations —with just their thoughts [7][8].

And as this amazing technology advance% researchers believe it could enable brain signals to bypass damaged nerve tissues and restore mobility to paralyze limbs. "The goal of Brain Gate is to develop a fast, reliable, and unobtrusive connection between the brain of a severely disable person and a personal computer" said Cyber kinetics Leader team Surgeon.

Brain Gate may sound like science fiction, but it's not. The device is negligible than a dime and comprises 100 wires smaller than human hairs which connect with the portion of the brain that controls motor activity. The wires sense when neurons are excited and directs those signals through a minute connector mounted arranged the skull to a computer.



Fig .3:CONNECTOR

THE CONVERTER:

The signal travels through a shoebox-sized amplifier where it's changed to Digital data and recoiled by fiber-optic cable to a computer.

THE COMPUTER:

Brain Gate studies to assist intention of brain movement with particular imagined movements-up, down, left, right and to connect those movements to a cursor [9].

A brain computer interface utilizes electro physiological signals to regulate isolated devices [10]. Most current BCIs are not invasive. They consist of electrodes applied to the scalp of an individual or damaged in an electrode cap such as the one shown in 1-1 (Left). All these conductors pick up the braincases electrical activity (at the microvolt level) 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 permit the signal through an analog to digital converter to a computer for processing. The computer Processes the EEG signal and uses it in command to bring about tasks such as communication and environmental control. Bps is slow in comparison with normal human actions, because of the complexity and-noisiness [11].

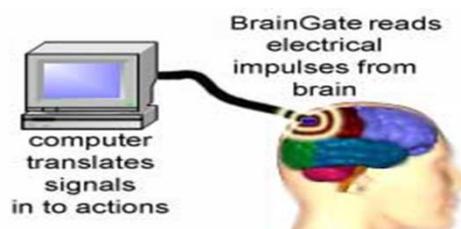


Fig.4:COMPUTER

IV. SOFTWARE BEHIND BRAINGATE

Software on which BRAINGATE System works uses algorithms and pattern-matching methods to facilitate communication. The algorithms are written in C, JAVA and MATLAB. The signal processing software algorithms

examine the electrical movement of neurons and interpret it into control signals meant for usage in various computer-based applications. One participant, cathy Hutchinson, was able to use the arm to drink coffee from bottle [12].

V. WORKING

The common structure of a Brain-Computer Interface is the following:

- 1) Signal Gaining: the EEG signals are obtained from the brain through invasive or non- invasive methods [13] (for example, electrodes).
- 2) Signal Pre-Processing: once the signals are attained, it is compulsory to clean them.
- 3) Signal Grouping: once the signals are cleaned, they will be processed and classified to find out which kind of mental task the subject is accomplished.
- 4) Computer Communication: once the signals are classified, they will be used by a suitable algorithm for some application.

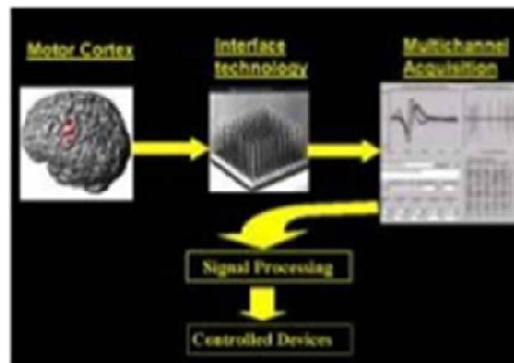


Fig .5: STRUTURE OF BRAIN GATE

APPLICATIONS

- Navigate Internet
- Play Computer Games
- Turn Lights On and Off
- Control Television
- Control Robotic Arm

ADVANTAGES:

The brain gate system is built on cyber kinetics stage technology to sense, transfer examine and apply the language of neurons [14].

The Brain Gate Neural Interface System is being designed to one day allow the interface with a computer and / or even faster than, what is possible with the hands of a person. The Brain Gate System may offer substantial improvement over existing technologies [4].

Currently obtainable assistive device has substantial boundaries for both the peers and caregiver. For e.g., though simple switches must be adjusted frequent that can be time consuming. In addition, these devices are frequently conspicuous and user from being able to simultaneously use the device and at the equivalent period contact or carry on conversations with others.

Potential advantages of the Brain Gate System over other muscle driven or brain computer interface approaches include:

It's potential to interface with a compute weeks or months of training; its potential to be used in an interactive environment users ability to operate the device is not affected by their speech.

Eye movement noise.

The capacity to provide significantly more usefulness and utility than other approaches by connecting directly to the part of the brain that controls hand gestures.



DISADVANTAGES

The U.S. Food means that it has been approved for pre-market clinical trials. There are no evaluates on cost or insurance at this time and drug management (FDA) has not permitted the Brain Gate non interface System for wide-ranging use. But has been approved for IDE status

Sources: The Brain Gate System is an investigational device in the United States, and is position (Investigational Device Exemption). In the United States, this examine can only be used in pre-marketing medical trials permitted by the FDA.

VI. CONCLUSION

The knowledge of moving robots or prosthetic devices not by physical control, but by meager "thinking" (i.e., the brain activity of human subjects) has been a captivated method. Therapeutic treatments are inaccessible for numerous resources of neural and muscular paralysis [15]. The fear of the arrears caused by paralysis is a robust motivation to follow BMI solutions. So this indication supports numerous patients to regulate the prosthetic devices of their separate by simply thinking about the task.

This technology is well supported by the latest fields of Biomedical Instrumentation, Microelectronics;signal-processing, Artificial Neural Networks and Robotics which has overwhelming developments. Expected these systems will be effectively applied for many biomedical applications.

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