Brain Gate Technology For Differently Abled Person

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***Abstract*— Brain-Gate is a brain implant system developed by the bio-tech company, Cyber kinetics in conjunction with the Department of Neuroscience at Brown University. The development of the brain-gate system brain-computer interface is to enable those with severe paralysis and other neurological conditions to live more productively and independently. The computer chip, which is implanted into the brain, monitors brain activity in the patient and converts the intention of the user into computer commands.**

IndexTerms*— electro-magnetic, neurons, limb, electrodes.(keywords)*

I. INTRODUCTION

The development of the brain-gate system brain-computer interface is to enable those with severe paralysis and other neurological conditions to live more productively and independently. The computer chip, which is implanted into the brain, monitors brain activity in the patient and converts the intention of the user into computer commands. Currently the chip uses about 100 hair-thin electrodes that sense the electro-magnetic signature of neurons firing in specific areas of the brain. The activity is translated into electrically charged signals and is then sent and decoded using a program, which can move a robotic arm, a computer cursor, or even a wheelchair.

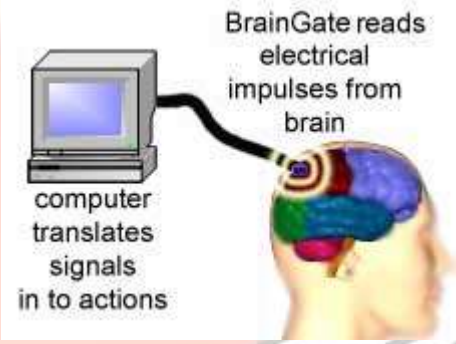

Fig. I Read computer signals

II. HOW IT WORKS

The Brain-Gate system is based on specialized technology developed to sense, transmit, analyze and apply the language of neurons - in essence, interpret brain signals. The system consists of a sensor that is implanted on the motor cortex of the brain and a device that analyzes the brain's output.

Neurons are cells that use a language of electrical impulses to communicate messages from the brain to the rest of the body. Brain-Gate can sense, transmit, analyze and apply the language of neurons. We are developing products to restore function, as well as to monitor, detect, and respond to a variety of neurological diseases and disorders. Brain-Gate offers a systems approach which applies the language of neurons in both short and long-term settings.

The platform technology is based on the results of several years of research and development at premier academic institutions such as Brown University, the Massachusetts Institute of Technology, Emory University, and the University of Utah.

1. Sense

Brain-Gate's unique technology is able to simultaneously sense the electrical activity of many individual neurons. Our sensor consists of a silicon array about the size of a baby aspirin that contains one hundred electrodes, each thinner than a human hair. The array is implanted on the surface of the brain. In the Brain-Gate Neural Interface System, the array is implanted in the area of the brain responsible for limb movement. In other applications the array may be implanted in areas of the brain responsible for other body processes.

2. Transmit and Analyze

The human brain is a super computer with the ability to instantaneously process vast amounts of information. Brain-Gate's technology allows for an extensive amount of electrical activity data to be transmitted from neurons in the brain to computers for analysis. In the current Brain-Gate System, a bundle consisting of one hundred gold wires connects the array to a pedestal which extends through the scalp. The pedestal is connected by an external cable to a set of computers in which the data can be stored for off-line analysis or analyzed in real-time. Signal processing software algorithms analyze the electrical activity of neurons and translate it into control signals for use in various computer-based applications.

3. Apply

By using the Brain-Gate Neural Interface System, a person may be able to use his thoughts to control cursor motion and/or replicate keystrokes on a computer screen. In another example, a doctor may study patterns of brain electrical activity in patients with epilepsy before, during and after seizures.

Fig. II Apply Brain Gate

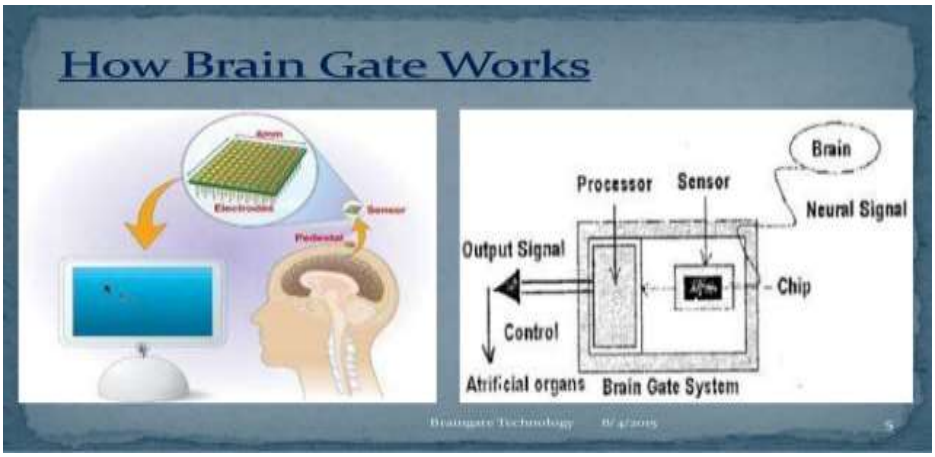

Fig. III Brain Gate Works

The brain-gate neural interface device is a propriety brain-computer interface that consist of an Inter neural signal sensor and external processor. The sensors consist of a tiny chip containing 100 microscopic electrodes that detect brain cell electrical activity. The chip is implanted on the surface of brain in the motor cortex area that control movement.

III. ADVANTAGES

The ability to help the paralyzed move again or people born with defects move is a major advantage in itself. There are a lot of different people that become paralyzed or lose their feeling in limbs for a variety of reasons. What makes things easier is the learning curve. It does not take much to use the chip. The training is very minute and simple. All a person has to do is use their brain and think it and it happens.

Another possible advantage of Brain-gate is that it may also be able to help people that have lost their voice. Because the chip uses the electrical pulses your brain gives transmits, there is the possibility of talking again via a robotic voice or translate thought to text on a screen.

IV. DISADVANTAGES

One disadvantage is that the brain gate chip does require to be inserted inside the patient's brain. This is a major disadvantage because of if the procedure does not go as plan or if the doctor slips up because no human is perfect, then a person could possibly die or obtain brain damage. An alternative could be using an electromagnetic cap for the person to wear even though it is not nearly as good as the chip. The development could have been further researched.

Another disadvantage of this technology would be because it if not wireless compatible yet, each person that has this brain-gate chip implanted into the brain will have to be connected to a chair via a cable that has the computer built into it.
So brain-gate is not yet free movement nor is it bodily movements yet. A person uses a robotic arm to do all of their movements currently.

Another possible disadvantage is possible side effects of the chip being in the brain. What happens if the chip over heats or outputs/inputs too much of an electrical current from the chip. It is apparent from the above paragraphs that there are advantages to the brain-gate technology but at the same time there are disadvantages. This is a cycle that will continue to go on as long as new technology is invented.

V. TOOLS USED

1. Brain Chip

- The Brian chip technology is associated with a brain computer interface chip, computer and brain.
- Brain Chip consists of both biological and electronics terms.
- Brain chips can enhance memory of human beings, help paralysed patients and are intended for military purposes.
- It acts as sensors that may soon assist failing memory, but even provide fluency in a new language.
- A chip in the Brain-gate system is of 100 hair thin electrodes.
- It senses electromagnetic signature of Neutrons.

The Brain chip provides fast and reliable connection between the brain of a severely disabled person and personal computer.

Fig. IV Brain Gate Chip

2. The Connector

The signal from the brain is transmitted through the pedestal plug attached to the skull.

Fig. V Brain Gate Connector

3. The Converter

The signal travels to an amplifier where it is converted to optical data and bounced by fibre-optic cable to a computer.

Fig. VI Brain Gate Converter

VI. SOFTWARE BEHIND BRAIN GATE

Software behind Brain-Gate System uses algorithms and pattern matching techniques to facilitate communication. The algorithms are written in C, JAVA and MATLAB. Signal processing software algorithms analyzes the electrical activity of neurons and translates it into control signals for use in various computer-based applications.

Fig. VII Software Name
(Matlab, Java, C Programming)

VII. BRAIN COMPUTER INTERFACE ARCHITECTURE

A brain–comput1er interface (BCI), sometimes called a direct neural interface or a brain-machine interface, is a direct communication pathway between a human or animal brain (or brain cell culture) and an external device. In one way BCIs, computer either accept commands from the brain or send signals to it (for example, to restore vision) but not both. Two-way BCIs would allow brains and external devices to exchange information in both directions but have yet to be successfully implanted in animals or humans.

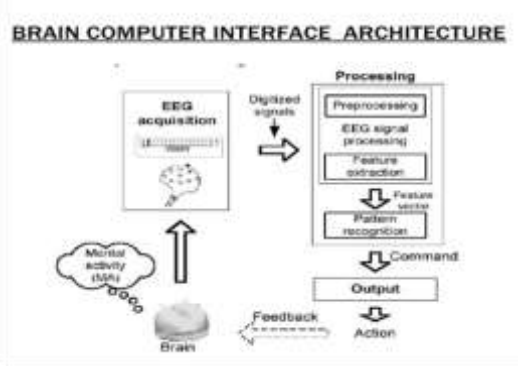

Fig. VIII Brain Gate Architecture

VIII. FUTURE SCOPE

- Current new advances include a second-generation interface software M*Power controller that will enable users to perform a wide variety of daily activities without assistances of technician.
- Smaller, wireless device.
- The user will have an improved control of respiratory system, limb with muscle stimulation or robotics.

IX. CONCLUSION

- The invention of Brain gate is such a revolution in medical field. The remarkable breakthrough offers hope that people who are paralyzed will one day be able to independently operate artificial limbs, computers or wheelchairs.
- The idea of moving robots or prosthetic devices not by manual control, but by mere "thinking" (i.e., the brain activity of human subjects) has been a fascinated approach.

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