

# Brain Chips Technology

Dr. Shruti Sneha Das

Rourkela, Odisha, India  
shrutisnehadas[at]gmail.com

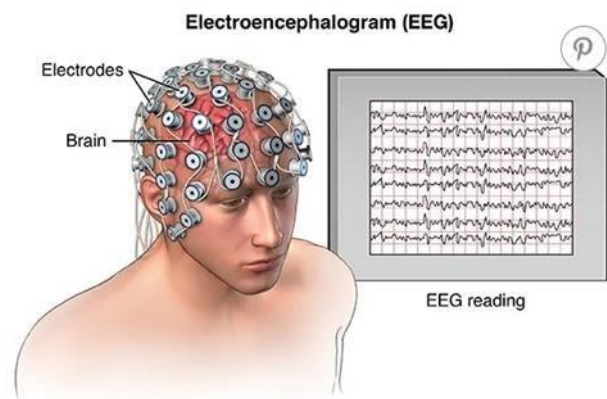
**Abstract:** *Brain Gate was developed by the bio-tech company named as Cyber kinetics in the year 2003 in conjunction with the Department of Neuroscience at the Brown University. The device was designed to help those who have lost control of their limbs or other any bodily functions. The computer chip, which is implanted into the brain, monitors the entire brain activity of the patient and converts the intention of the user into all computer commands. Currently the chip uses 100 hair-thin electrodes that 'hear' neurons firing in specific areas of the brain. For example, the area that controls the arm movement. The activities are translated into electrically charged signals and are then sent and decoded using a program, thus moving the arm. According to the Cyber kinetics' website, two patients have been implanted with this Brain Gate system.*

## 1. Introduction

Brain Gate was developed by the bio-tech company named as Cyber kinetics in the year 2003 in conjunction with the Department of Neuroscience situated at the Brown University. The device was designed to help those who have lost control of their limbs, or other any kind of bodily functions. The computer chip which is implanted into the brain, monitors brain activity in the patient and converts the intention of the user into some computer commands. Currently the chip uses 100 hair-thin electrodes that 'hear' neurons firing in specific areas of the brain, for example, the area that controls arm movement. The activities are translated into electrically charged signals and are then sent and decoded using a computer program & thus moving the arm. According to the Cyber kinetics website, two patients have already been implanted with this Brain Gate system. In addition to real-time analysis of the neuron patterns to disseminate movement, the Brain-gate array is also capable of recording electrical data for later analysis. A potential use of this feature would be for a neurologist to study seizure patterns in a patient with epilepsy Brain-gate is currently now recruiting patients with a range of neuromuscular and neurodegenerative conditions for pilot clinical trials in the country United States. The whole technique of this system based on mind uploading.

### Electroencephalography (EEG)

Electroencephalography (EEG) is a device which records each and every single activity of the brain through electrical signals which is sent by the nerve cells of brain. They record each and every pattern and image of all neural connections and sends back to the computer via the chip.



There are many different electric signals in the neural networks of the brain making some different patterns for each activity a human brain does. If the patient says yes for a work, then there will be different patterns and if a patient says no through its thought again the computer receives a different unique pattern. After recording each and activity it converts the brain signals to digital data and sends it to the computer. EEG is all responsible to convert all the electrical signals of the brain nerve cells to digital data and vice versa. Researchers have invented an EEG cap which records the human brain functional signals.

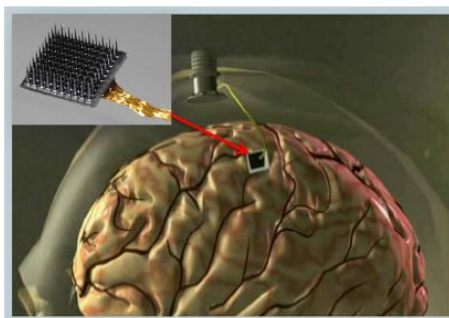
**Neural Network with the Brain Chips:** For learning about all the brain researchers first learn about how the neurons are formally structured and what is the requirement that we have neurons and a lot of neural networks. As we know brain has many areas for each and every activity we do. The brain functions are carried out by the neural networks which collects all the information from each and every individual cell body with the help of Nerve cell and connect each other forming a neural network in brain to process the activities a human does.



The neural network is linked with the brain chips electrically, the electrode sensors of brain chips are used for recording each signal sent by the brain. We can culture the brain cells directly on the top of chip and really exciting part is that they grow on the chip with a tight electrical coupling. It carries out algorithm through different networks to connect this we have synapses in the piece of brain like motor cortex, Spinal cord and the sensory organs. And in size of pin hair (very small) over about 40 million synapses that connect to 30,000 neurons. Nerve cells are the messengers between the cells which control the algorithm.

**Elementary Parts of Brain Chip Interface**

**The Pedestal with a chip:** The pedestal is 2 cm in which a 4mm micro electrode array (brain chip) is connected to it. Here the image is of the pedestal with a chip.



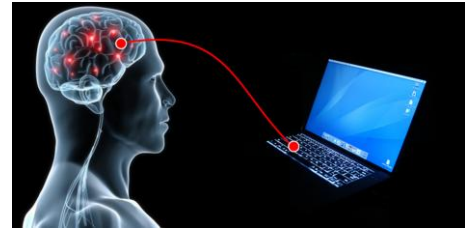
It records all the electric pulses of brain nerve cells and transfers it to a signal amplifier.

**Neural Signal Interpreter:** It converts all the brain signals to the digital signals and then sends it to computer so it can also convert digital signals into the brain signals.



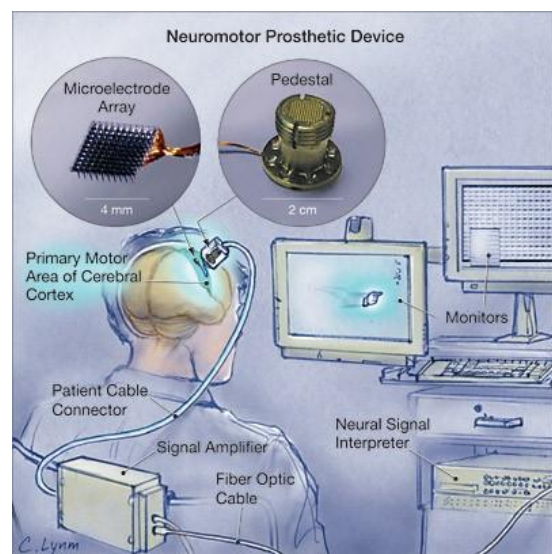
**The computer:** It learns all the patterns made by the nerve cells of each particular activity that human brain does with

the help of digital signals send by the neural signal interpreter.



**How does it work?**

The brain chip can be implanted in the human brain. The extension wire of chip is connected to pedestal connector that records all the patterns made by neural connections that controls all the activities of brain. Then this connector sends all the signals to neural signal interpreter through fiber optic cable.



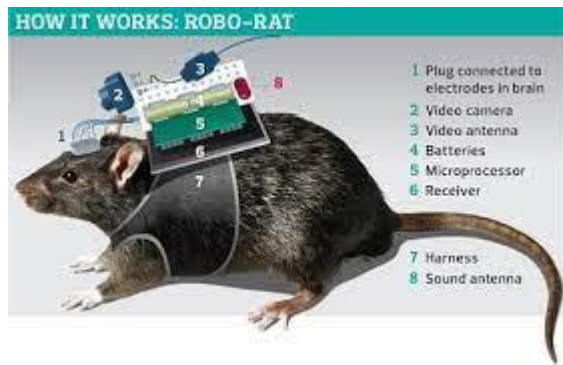
The neural signal interpreter then converts the brain signals into digital signals and then sends it to computer. The computer mimics all the functions of brain activities and then sends it to the prosthetic device which helps all the patients to do all the movements just by the thoughts of the patient's brain.

**Achievements and Applications in Various Sectors:**

**Remote Controlled Animals:**

These all are used for the animals like dog, rat, sharks etc. for military rescue missions. DARPA to neural implants in sharks. The shark's unique sensors can make use these implants providing the data in the relation to the enemy ship movement or under water explosives.

For Example:



Simply pressing keys on a computer 500m away will then steer the animal over an obstacle course, making it twist, turn and even jump on demand. The researchers responsible for this “Robo Rat” claim their work will give neuroscientists a better understanding of how mammals learned to navigate.

### Movement of Paralyzed Patients

The Brain chip implants helps in interaction of patients with the computer to read the patients mind which helps in the automatic movement of paralyzed part. The patients with complete paralyzed body can also interact by their thoughts process using this brain chip.



### Telepathy

Telepathy is the supposed communication of thoughts or ideas by means other than the known senses.



It can be denoted as the invisible communication between the two people with the use of this brain chip interface.

## 2. Advantages of Brain Chip

Despite Brain Chip Interface being in its initial stage of development, it is expected to provide several benefits to its users in various fields. Some of the major benefits of BCI are

**Smart Technology:** One of the biggest reasons why Brain Chip Interface is deemed as advanced technology because it can make previously passive devices into a smart and active-ones. An example of such devices is “prosthetics”. For instance, a prosthetics user can use this technology to hold a glass of water and drink using it just like using natural hands. Likewise, deaf and dumb people who want to communicate with each other can do so by utilizing this technology using Brain Chip Interface controlled communication devices.

**Telepresence:** Tele-presence is a technology that gives the ability to someone to make their presence felt, at a remote location, with the help of tele-robotics. Telepresence, with the incorporation of Brain Chips Interface, can give military personnel the ability to keep an eye on any suspicious activity that might take place at the border. Telepresence can thus detect any suspicious activity and help combat it.

## 3. Risks of Brain Computer Interface

The Brain Chip Interface system, being directly linked to the human brain, can have a negative impact on its users in the case it is not utilized properly. Some of the potential risks associated with BCI are

### Inaccuracy of results

The brain is a highly complex organ. Sometimes we ourselves are unable to understand what goes on in our minds. So, it is unfair to expect man-made Brain Chip Interface to correctly interpret all our brain signals. Brain Chip Interface can, sometimes, misinterpret the user’s intentions. For instance, a disabled person with a prosthetic who actually wants to raise his index finger is not correctly identified by the Brain Chip Interface and this might result in lifting up of the middle finger. Hence, the inaccurate result is a huge risk that is associated with the Brain Chip Interface technology.

### Bulky nature of the system

Since the Brain Chip Interface system involves the connection of several wires due to the interfacing between the brain and the computer, it can often result in an extremely uncomfortable user experience. This bulky nature of the Brain Chip Interface system, thereby, acts as one of the major cons of Brain Chip Interface technology since a lot of wiring involved could possibly put a lot of mental and physical stress on the user.

### Lack of security

Whenever you are buying or subscribing to a digital product or service, you expect security to be an essential requirement. In fact, in the case of Brain Chips Interface technology, the security of your data cannot be guaranteed. Due to the computerized system, anyone may actually decode what is going on in your mind and thus conquer your



privacy. For instance, in the case of Brain Chip Interface based military application, there might be a possibility that an attacker from a rival country may be able to hack into any military personnel's mind and can eventually leak all of the confidential information.

#### **4. Disadvantages of Brain Chips**

- It is difficult to afford it because of higher cost.
- Risk of Surgery

#### **5. Conclusion**

The invention of brain chip implant technology is an aid for patients with the neurological diseases and its revolution in the field of engineering and neuro science. Brain chip technology involves communication based on neural activity of the brain. The results are spectacularly wonderful and unbelievable. It will be effective for restoring limbs function of patients. Rehabilitations for patients. The advantage of brain chips with nano technology will allow the researchers for smaller and superior chips making brain chips technology less burdensome and more reliable option for people. Finally, it has amazing endless advantages.