Brain Machine Interface – BMI

Rangaiah L[1], Shubhaprada S[2], Apoorva N Raykar[3]

[1] *Professor, ECE Department,Rajarajeswari College of Engineering,Karnataka, India*
[2] *Student, ECE Department,Rajarajeswari College of Engineering,Karnataka, India*
[3] *Student, ECE Department,Rajarajeswari College of Engineering,Karnataka, India*

ABSTRACT

Human brain is the most valuable creation of God. The man is intelligent because of the brain. A brain–computer interface (BCI) is a direct communication pathway between an enhanced or wired brain and an external device. BCIs are often directed at researching, mapping, assisting, augmenting, or repairing human cognitive or sensory-motor functions. The main aim is to upload human brain into machine. So that man can think, take decision without any effort.

Keywords: *Electroencephalography (EEG), Neurons, Sensory System*

1. INTRODUCTION

A Brain–Computer Interface (BCI), sometimes called a Mind-Machine Interface (MMI), Direct Neural Interface (DNI), or Brain–Machine Interface (BMI), is a direct communication pathway between an enhanced or wired brain and an external device. It is a device that translates neuronal information into commands capable of controlling external software or hardware such as a computer or robotic arm. BMIs are often used as assisted living.

The history of Brain–Computer Interfaces (BCIs) starts with Hans Berger's discovery of the electrical activity of the human brain and the development of Electroencephalography (EEG). In 1924 Berger was the first to record human brain activity by means of EEG. Berger was able to identify oscillatory activity, such as Berger's wave or the alpha wave (8–13 Hz), by analysing EEG traces.

Berger's first recording device was very rudimentary. He inserted silver wires under the scalps of his patients. These were later replaced by silver foils attached to the patient's head by rubber bandages. Berger connected these sensors to a Lippmann Capillary Electrometer, with disappointing results. However, more sophisticated measuring devices, such as the Siemens double-coil recording galvanometer, which displayed electric voltages as small as one ten thousandth of a volt, led to success. Berger analysed the interrelation of alternations in his EEG wave diagrams with brain diseases. EEGs permitted completely new possibilities for the research of human brain activities.

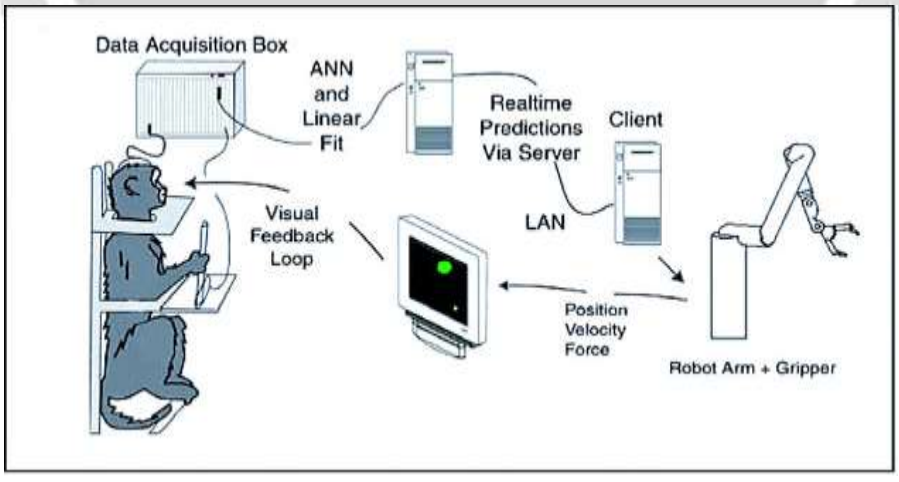

Fig-1: Basic BCI System

Jacques Vidal coined the term "BCI" and produced the first peer-reviewed publications on this topic. Vidal is widely recognized as the inventor of BCIs in the BCI community, as reflected in numerous peer-reviewed articles reviewing and discussing the field.

After his early contributions, Vidal was not active in BCI research, nor BCI events such as conferences, for many years. In 2011, however, he gave a lecture in Graz, Austria, supported by the Future BNCI project,

presenting the first BCI, which earned a standing ovation. Vidal was joined by his wife, Laryce Vidal, who previously worked with him at UCLA on his first BCI project. Prof.Vidal will also present a lecture on his early BCI work at the Sixth Annual BCI Meeting, scheduled for May–June 2016 at Asilomar, California.

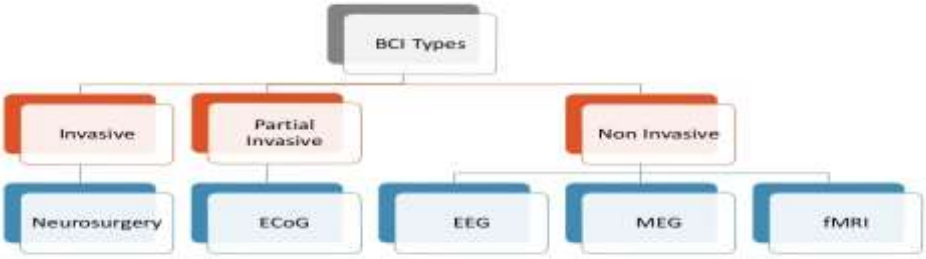

Fig.2 Approaches in Brain Machine Interface

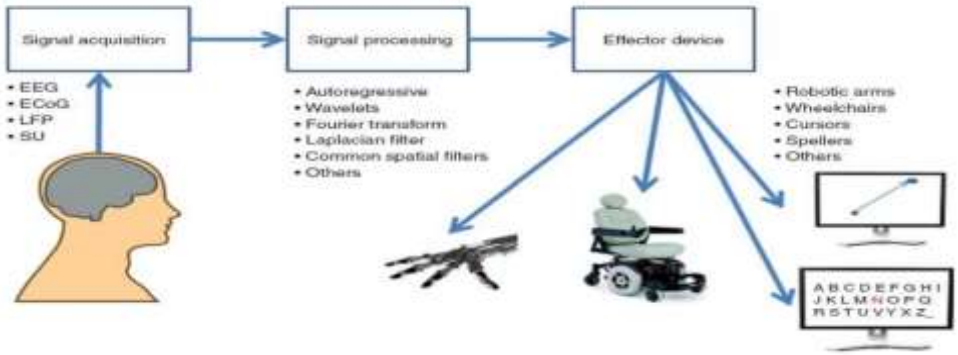

Fig-3 : Block diagram of BCI System

2. METHODOLOGY

Devices for individuals with motor or sensory impairments. This technology is based on to sense, transmit, analyze and apply the language of neurons. It consists of a sensor that is implanted in the motor cortex of the brain and a device that analyses brain signals. The signals generated by brain are interpreted and translated into cursor movement on computer screen to control the computer. It consists of a silicon array about the size of an Aspirin tablet that consists about 100 electrodes each thinner than a human hair.

2.1 WORKING OF BRAIN TO BRAIN SYSTEM

The BCI reads the sender's thoughts — in this case, the sender thinks about moving his or her hands or feet. Thinking about feet is equivalent to binary 0, while hands is binary 1. With a little time/effort, whole words can be encoded as a stream of ones and zeroes. These encoded words are then transmitted (via the internet or some other network) to the recipient, who is wearing a TMS. The TMS is focused on the recipient's visual cortex. When the TMS receives a "1" from the sender, it stimulates a region in the visual cortex that produces a phosphene — the phenomenon whereby you see flashes of light, without light actually hitting your retina (when you rub your eyes, for example). The recipient "sees" these phosphenes at the bottom of their visual field. By decoding the flashes — phosphene flash = 1, no phosphene = 0 the recipient can "read" the word being sent.

Fig-4: Steps involved in Brain Machine Processing

You would be right in thinking that this is a rather complex and long-winded way of sending messages from one brain to another — but for now, this is truly the state of the art. As you can see, this method very neatly sidesteps the fact that we really don't know how the human brain encodes information — and so, for now, instead of importing a "native" message, we have to use our own encoding scheme (binary) and a quirk of the visual cortex.

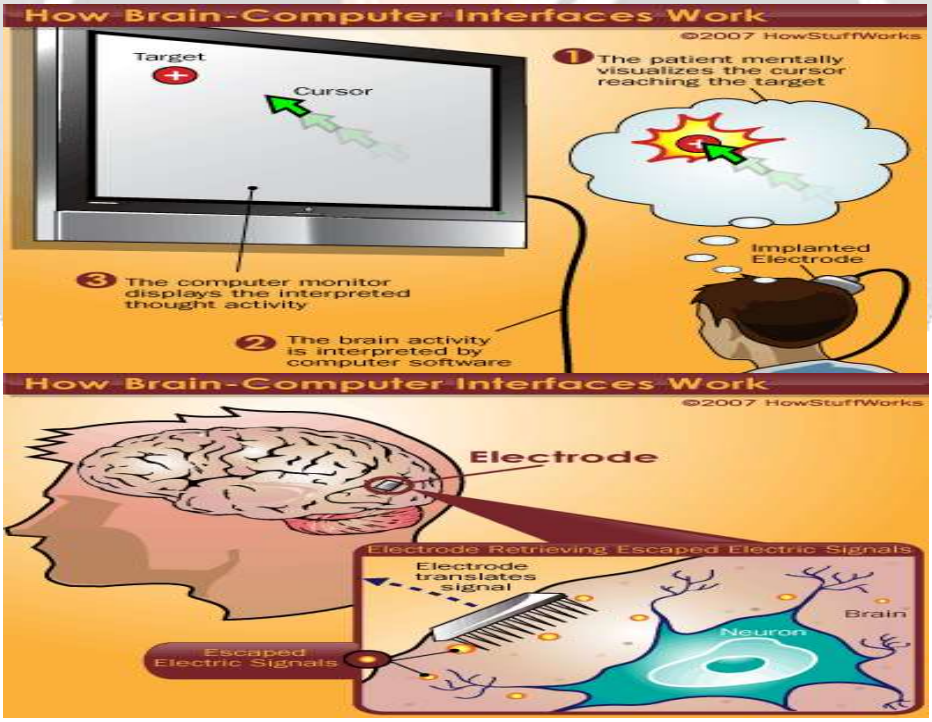

Fig-5 : Working of Brain Machine Interface

3. APPLICATIONS

a. Provide disabled people with communication, environment control and movement restoration.
b. Provide enhanced control of devices such as wheelchairs, vehicles or assistance robots for people with disabilities.
c. Provide additional channel of control in computer games.
d. Monitor attention in long distance drivers or aircraft pilots, send out alert and warning for aircraft pilots.
e. Develop intelligent relaxation devices.
f. Control robots that functions in dangerous or inhospitable situations.
g. Create a feedback loop to enhance the benefits of certain therapeutic methods.

h. Develop passive devices for monitoring functions, such as monitoring long term drug effects, evaluating psychological state,etc.
i. Monitors stages of sleep, Bionics/Cybernetics, Memory upload/download, dream capture,etc.
j. Brain as Computer.

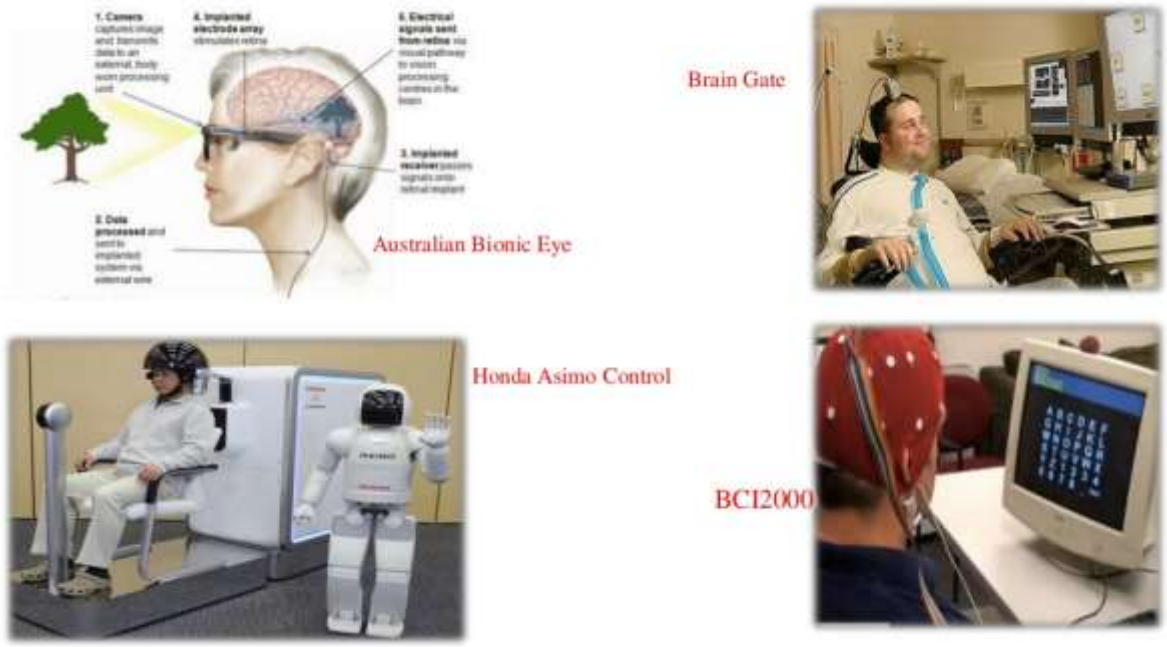

Fig-6 : Implementing BCI System in neurology

4. ADVANTAGES OF BCI

Eventually, this technology could

1. Allow paralyzed people to control prosthetic limbs with their mind.
2. Transmit visual images to the mind of a blind person, allowing them to see.
3. Transmit auditory data to the mind of a deaf person, allowing them to hear.
4. Allow gamers to control video games with their minds.
5. Allow a mute person to have their thoughts displayed and spoken by a computer.

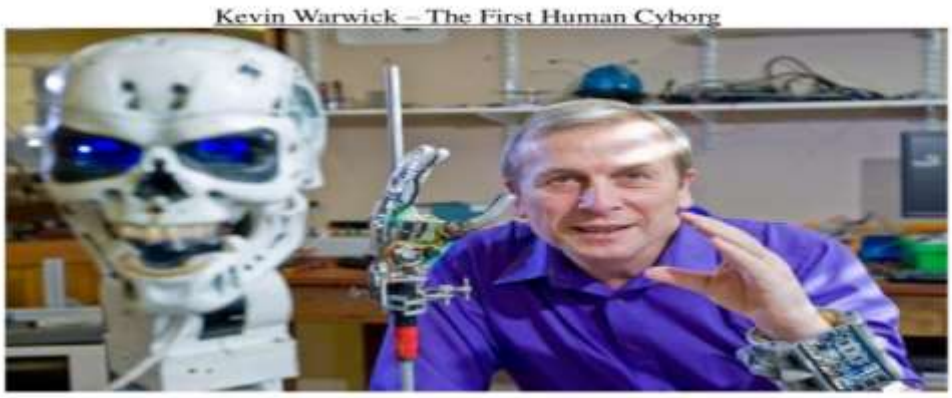

Fig-7 : The First Human Cyborg

Fig-8: Wireless BCI System

5. CONCLUSION

As BCI technology advances, brain tissues may one day give way to implanted Silicon Chips thereby creating a completely computerised simulation of human brain that can be augmented at will.
Futurists predict that from there, Superhuman artificial intelligence won't be far behind.

6. REFERENCES

[1] Research Journal of Computer and Information Technology Sciences, ISSN 2320 – 6527 Vol. 3(2), 1-5, May (2015) Res. J. Computer and IT Sci. International Science Congress Association 1 Blue Brain - The Future Generation Priya Babel AIM and ACT Department Banasthali Vidyapith Jaipur, INDIA
[2] Brain Computer Interface technologies in coming decades By Brent J.Lance, Member IEEE, Scott E, Kerick, Anthony J.Ries, Kelvin S. Oie and Kaleb McDowell, Senior Member IEEE
[3] Machine learning and BCI By Klas-Robert Miller
[4] DOI: 10.1371/journal.pone.0105225,Conscious Brain-to-Brain Communication in Humans Using Non-Invasive Technologies