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Implementation of Brain Computer Interface for Security System.

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ABSTRACT

Security and defence of a country is of utmost importance. In this technique of providing security, this work proposed to make the use of Brain-gate technology implanted on dogs' brain. This technique is very reliable, accurate and is very less risky compared to conventional techniques of brain-gate interface with computers. The proposed approach emerges brain-gate technology to revolutionize the automated computer based security system where the trained dogs can be utilized as a spy using the state of art brain gate technology.

Keywords: Brain-gate, nano robot, blood stream, receiver, axon, neurotransmitter, cortex, acetyl colane.

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INTRODUCTION

The brain-gate is used to make brain to receive signals from outside and by transforming it into electrical impulses so that brain can understand it and vice-versa [1-3]. Dogs are the most faithful animal in the world. That is why, this work had implemented brain-gate technology on dogs. Initially, dogs should be given adequate training and they should be trained how to control computer cursors, how to decode instructions using brain signals. In the proposed approach, an integrated circuit (IC) chip is embedded on dog's brain. The chip consists of more number of electrodes for the purpose of the transmission and reception of the signal from dog's brain[10, 11]. Though it is risky and difficult to implant the chip in the interior of dog's brain, it is possible to gather more information and control the targets. Figure 1 shows the proposed approach for the implementation of brain computer interface for security purpose. The information collected from dog's brain is preprocessed to remove the unnecessary and unclear information and also the small but most important information can be further enhanced by the process of enhancement. The next step is the feature extraction where the collected information had separated based on its characteristics using some algorithm. In this work, the information had splitted into audio, visual, temporal and spatial and other information. The audio information includes sounds and music. Image,color, video,light are few example for visual information. The spatial and temporal information may include acceleration, movement, tactile, shape,texture, thermal, electrical, and vibration. The other information like scent and odours also considered. These information also feedback to the dog's brain for futher decision making. It is very dangerous to use human instead of dog for this brain computer interface security system because the chip may have an effect on functioning of the brain when a malfunction or crash occurs in the system. In addition, it is complicated and dangerous to operate and take out the integrated chip from the humans' brain.

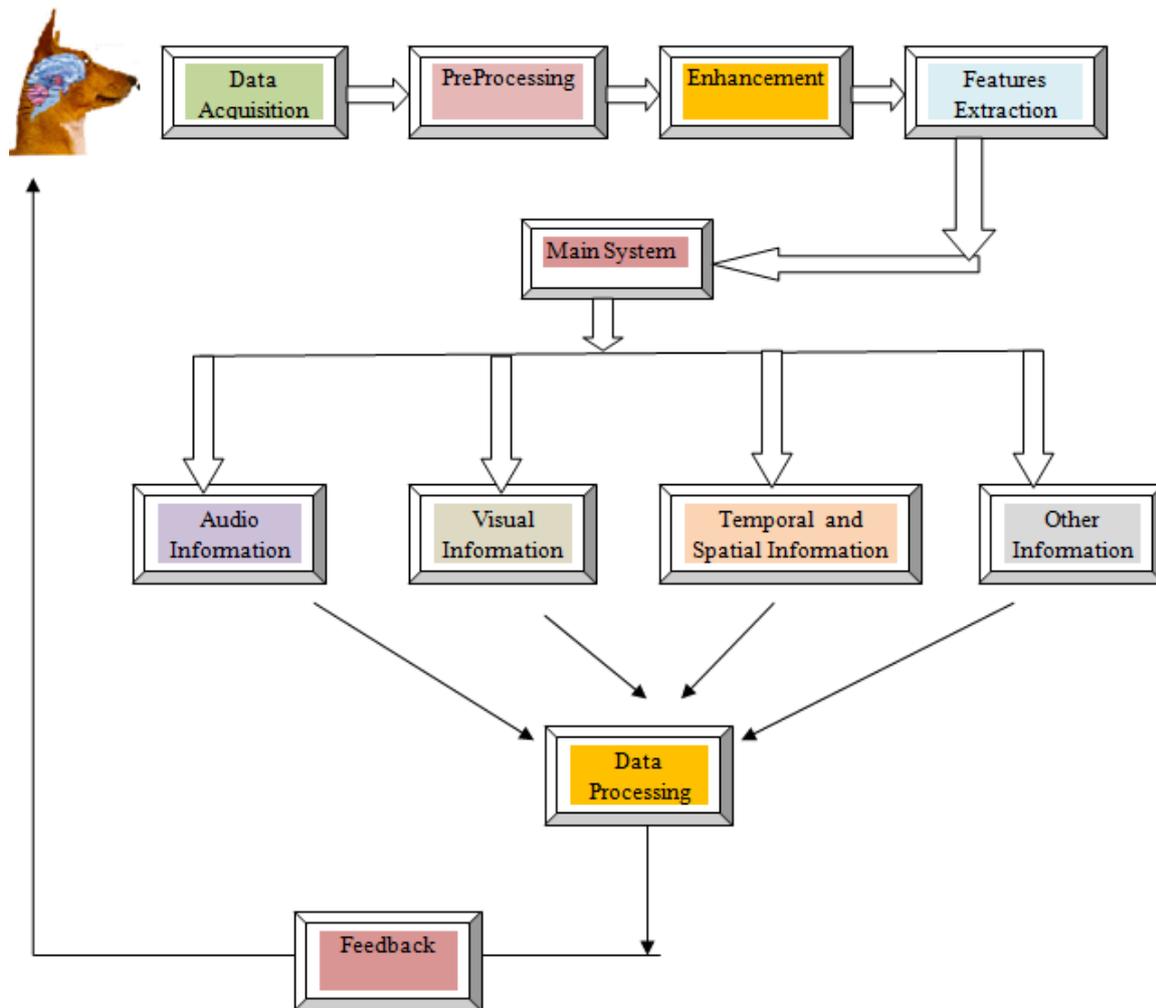


Figure 1: The proposed approach for implementation of brain computer interface for security system

TRANSMISSION AND RECEPTION OF SIGNAL

Neurons are unique-looking cells. Like all animal cells, a neuron has a cell body called soma, where the DNA carrying nucleus is located, given that instructions for the cell to make more number of proteins. On one end, the soma sprouts branch-like dendrites for the reception of electrical signals, while a long axon of up to a meter stretches in other direction, branching out into multiple axon terminals for sending signals [4][6]. Figure 2 shows the structure of basic neuron and the transmission of signal through it.

The terminals of axon are situated very near to the another neuron's dendrites, forming a connection known as synapse. Any given neuron will have a thousand synapses with neighbouring neurons, connecting the cells and allowing them to send signals from neuron to neuron [5]. Signals sent through dendrites cause chemical changes that result in an electrical signal in the cell body. Nerve impulses are carried through axons away from the neuron's cell body. The signal is passed by transmitters like structures of neuron from the synaptic bulbs on the neurons to muscle fibres. The muscle fibres then react to the signals [7][8].

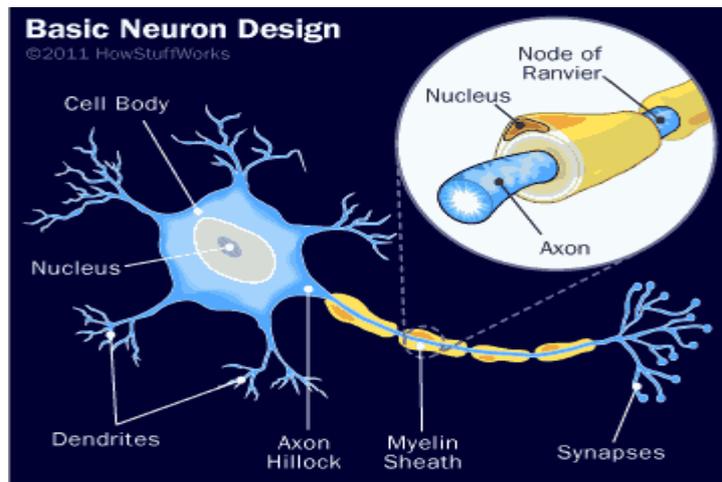


Figure 2: The structure of basic neuron and the transmission of signal through it.

NANO BRAINGATE

Nano brain-gate eliminates the problem of high risky operations. The nano brain-gate uses nano robots which has the brain gate chip in it. In this work, guide the nano robot to go to its destination the brain 'Cortex'. Sensing, actuation, signalling, intelligence and manipulation information processing, at nano-scale are the basic characteristics of nano robots. Figure 3 shows the nano brain gate system.

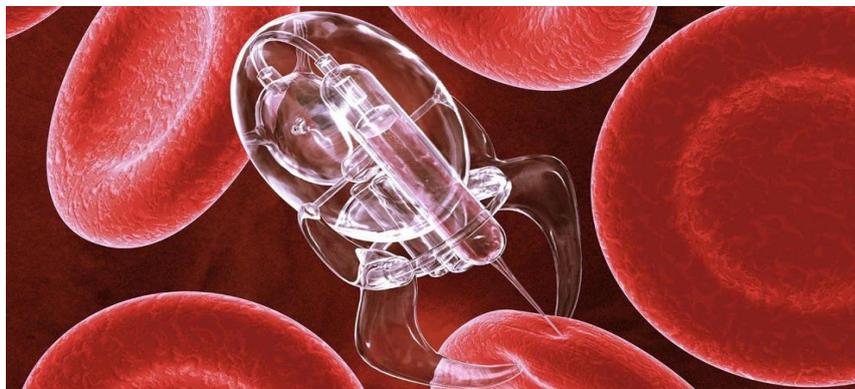


Figure 3: The nano brain gate system.

CONSTRUCTION AND IMPLEMENTATION

The brain-gate has a transmitter and a receiver in it. It implements wireless machinery for both the transmission and reception of the necessary information. For implanting it is passed into the dogs' blood stream [9]. Though the blood stream it will pass through the brain cortex and will get attached to the nerves by forming link with them. It is very easy to distinguish between the different orders(signals) to different organs using this high level intelligence. In addition, it is helpful to make a distinction between normal signals and order signals. The required level of power is very less and generates the power itself from the movement of blood stream. There is a small storage place when the nano-robot can store the acetyl colane which is used to make the neural links. The nano-robot is programmed in such a way that in case of a failure, it will remove itself from the brain causing no harm to the person or animal. The nano brain-gate is a hollow, spherical medical nano robot of exactly 1 micron in diameter.

WORKING MECHANISM

The nano-robot once inserted into the blood stream moves towards the destination by the routing map. It gets linked with the nerves in the brain by using acetyl colane. It sends a signal to us as soon as it starts to move in the blood stream. Now it is possible to follow its movement. When it passes to the dog's brain, it produce the neural links with the nerves in the cortex region. Power in the range of pico Watt is enough to function the nano robot. In this, the required power can be produced by merging oxygen drawn from internal storage with glucose absorbed from the bloodstream.

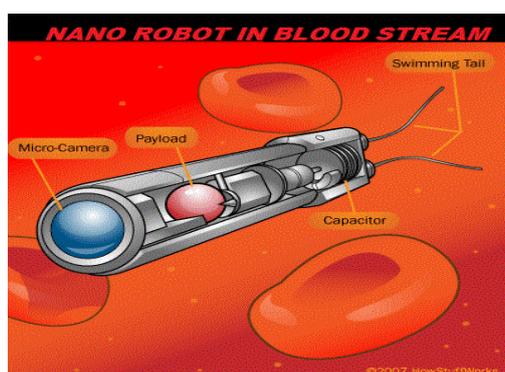


Figure 4: Nano robot in blood stream

The Payload is nothing but the brain-gate. It consists of the following:-

The CHIP:- A micro-meter range square silicon chip with around 96 microelectrodes is embedded in the primary motor cortex- the region of the brain controlling the movement.

The CONVERTOR:- A small electronic circuit to increase the level or volume of signal or information along with converting the signal from analog to digital or vice versa.

The TRANSMITTER AND RECIEVER:- The thinking of the dog i.e. the signal transmitted by the brain will be received by the receiver in the brain-gate and that signal will be transmitted by the transmitter. The transmitted signal is sent via the internet to any specified location. And, hence we can act accordingly.

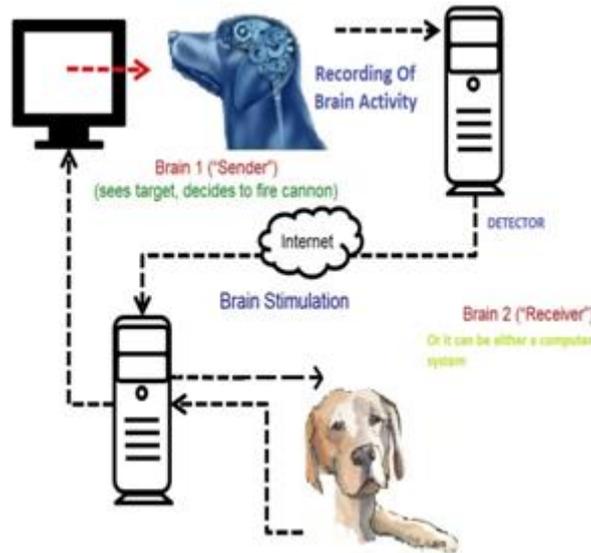


Figure 5: Communication in brain computer interface

SOFTWARE FOR BRAINGATE SYSTEM

OpenVIBE is a software which opens the way to innovative technologies and major interests for human beings to interact with computer system. Signal processing software algorithms analyze the electrical activity of neurons and convert it into control signals for use in various computer based application [16]. ActiveTwo, BCI2000 are some of the softwares working as a stage for brainGate.

FEATURES OF THE PROPOSED APPROACH

As dogs are the most faithful animals, we basically rely on them because we can control them as per our requirement which is not applicable in case of humans. Another problem of not utilizing human brain is that the undercover agents (spy) turn into a double agent as a result of which the whole mission fails. The benefit of using dogs is that most of the time, the opponents (humans) don't notice them or they underestimate them. So, we can accomplish our task by sending dogs in those areas where defence people cannot reach. Dogs' can sense upto nano-scale and they can detect the object and if they think, the signal from brain can be passed over the network from one place to another. The salient features of the proposed approach is listed as follows

- No need to perform risky operation of brain.
- It is a wireless technology.
- The data (information) transfer rate is fast in comparison to conventional techniques.
- Initial cost of installation is very expensive.
- Working of the system is complex.

CONCLUSION

The proposed Brain Gate technology can incorporate the future and a step towards learning to interpret information from brain and make use of computers and algorithms to decipher the information into the necessary action. It has been proved that people can actually use this system to switch a television on and off, to control the volume and to control the robotic hand and wheel chair. The knowledge acquired from this technology will consent the advancement of systems that present improved communication and environmental control for paralysis people. If this system works well, then it will be possible to upload information to the brain and also download information from the brain.

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