ADROIT LIMB - BRAIN CONTROLLED ARTIFICIAL LIMB

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I.ABSTRACT

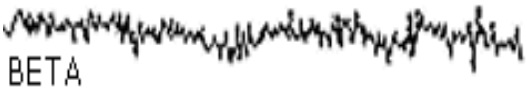
Necessity is the mother of all inventions. Brain-The Master of our body generates signals in accord with our thoughts and decrees every part to perform the desired actions. This paper is a boon to the amputees since it can decrease their encumber. This paper targets in trapping the signals by the use of Brain wave sensor (Sensors that are attached to the scalp in order to monitor the Brain Wave activity in different parts of the brain) and feed the signals to the so designed artificial hand. Adroit limb is different from the already existing ones. It can encompass activities like peeling; feel things as our normal human hand. The existing models can provide only support but the proposed prototype for this paper can respond to External Stimulus. Brain waves are obtained from a special analysis of EEG (Electro Encephalo Gram). These brain waves show us the brain's response to an external stimulus or event. Brain activity before, during, and after a stimulus presentation is recorded. This allows us to observe where, when, and how the brain responds to a given stimulus.

The need for an artificial hand plays a very important role in the life of Amputees and physically challenged. Such people are given an external attachment of an artificial hand which gives a look similar to that of a normal hand which cannot perform all the desired acts. The existing models cannot stimulate actions as per our thought. The signals are directly obtained from the brain without any pre existing sensor for this purpose. The problems faced by the amputees are also increasing day by day. The proposed prototype is a panacea for all such problems faced by them to a greater extent.

II.WORKING PROCEDURE

A.WORKING STATE OF BRAIN

BETA STATE: Our brain usually operates at Beta wave state. Around 13 to 40 Hz A person in this state has acute concentration.



ALPHA STATE: Our brain is said to be in alpha state at 7 to 12 Hz.

Fig. 1 Alpha

At this state our body and mind relaxes. Our mind reaches the gate way to creativity .

THETA STATE: The frequency in this state is around4to7Hz

Fig.2 Theta

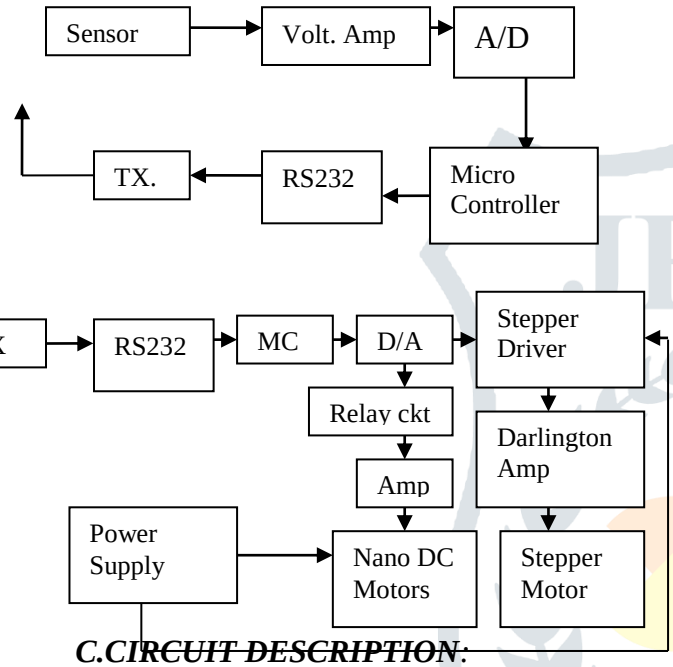
Our creativity and intuition shoots through the roof and we are approaching the gateway to enhanced learning and memory.

DELTA STATE: In this state a person has magnetic memory and increased learning capability. The frequency of the signal generated by the brain is less than 4 Hz. A person can remember things. .

Fig.3 Alpha

B.BLOCK DIAGRAM:

The block diagram of our proposed project can be divided into sections:
Transmitter Section: The signal generated by the brain is captured, processed and finally converted to digital signal for transmission. The transmitter serves this purpose.
Receiver Section: The processed signals are obtained by the receiving end and the signals are matched with actions that are programmed in the microcontroller and the action as per thought is performed by the proposed prototype.



C.CIRCUIT DESCRIPTION:

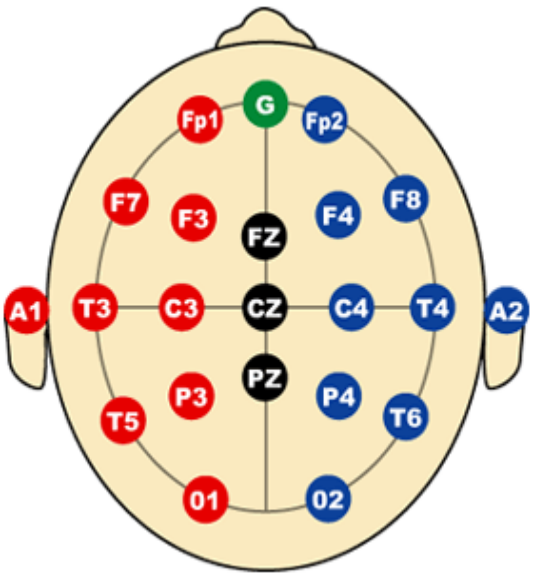
The components mentioned in the block diagram can be explained briefly as follows:

Sensor**:** In order to capture the thought of a person the mind reader/Brain wave sensor is used.

Fig 3: A person wearing electrode cap

Electroencephalography (EEG) is the measurement of electrical activity produced by the brain as recorded from electrodes placed on the scalp. In this paper we report the results from first human experiments using a new electrophysiology sensor called **ENOBIO**, using carbon nanotube arrays for penetration of the outer layers of the skin and improved electrical contact. These tests, which have included traditional protocols for the analysis of the electrical activity of the brain--spontaneous EEG and ERP--, indicate performance on a par with state of the art research-oriented wet electrodes, suggesting that the envisioned mechanism--skin penetration--is responsible.

Microcontroller: The micro controller is programmed using mat lab which would be the front end. The microcontroller is programmed for specific actions.



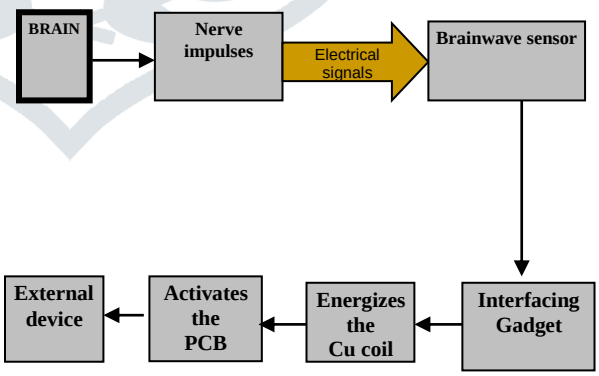
So that when the signal generated by the brain is encountered by, it action is performed as per thought. The micro controller works in the range of 4.85 to 5V.It comprises of five ports and eight slots, different programs can be stored in these slots. It is programmed at its ports numbered 18 and 19 where the read and write operation can be performed. The purpose of using MAX232 is for level shifting. The program from the system is encoded in the microcontroller. Voltage amplifier: Because the signal strength of the biological signal is so low, the signal will also have to be amplified via a power amplifier with good SNR. This module modifies the signal in order to drive the rest of the device. Converters**:** In order to drive the microcontroller, the signal that is generated by the brain which is in analog form is converted to digital using A/D converter RS232: In telecommunications, *RS-232* (Recommended Standard 232) is a standard for serial binary data signals connecting between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. RS-232 devices may be classified as Data Terminal Equipment (DTE) or Data Communications Equipment (DCE); this defines at each device which wires will be sending and receiving each signal. The RS-232 standard defines the voltage levels that correspond to logical one and logical zero levels. Valid signals are plus or minus 3 to 15 volts. The range near zero volts is not a valid RS-232 level; logic one is defined as a negative voltage, the signal condition is called marking, and has the functional significance of OFF. Darlington amplifier**:** the Darlington transistor (often called a Darlington pair) is a semiconductor device which combines two bipolar transistors in a single device so that the current amplified by the first is amplified further by the second. This gives a high current gain (written β or h_{FE}), and takes less space than two discrete transistors in the same configuration. Integrated packaged devices are available, but it is still common also to use two separate transistors. A Darlington pair behaves like a single transistor with a high current gain (the product of the gains of the two transistors):

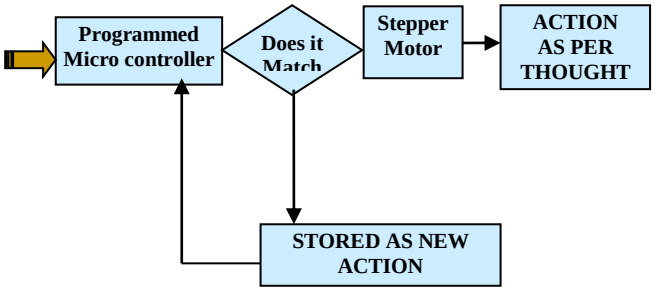
$$\beta_{darlington} = \beta_1 X \beta_2$$

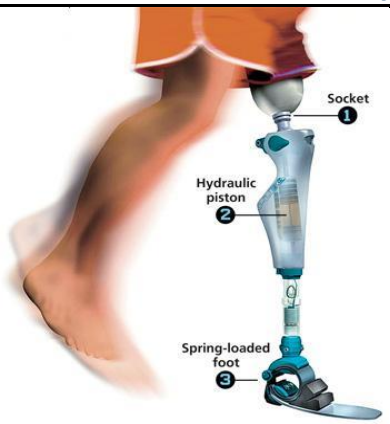
Relays**:** One simple method of providing electrical isolation between two circuits is to place a relay between them. Stepper motor**:** Since fingers need to perform precise actions. The use of stepper motor is incorporated at the joints. Unlike conventional motor, Stepper motor can perform accurate motions by rotating at specific degrees Stepper motors operate much differently from normal DC motors, which rotate when voltage is applied to their terminals. Stepper motors, on the other hand, effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external control circuit, such as a microcontroller.

D.WORKING:

Brain, the source of all thoughts produces impulses according to the thoughts we make. These impulses are always analog in nature. These analog signals are sent through nerves to all parts of the body. These signals are of constant amplitude and of frequency modulated type. The impulse is of constant amplitude for one thought with varying frequency. For another thought there will be a sharp difference in the amplitude. The energized copper coil produces current. This current activates the printed circuit boards (PCB) at the other end. A transmitter/receiver device placed externally to the body, is connected to the PCB's. The connecting wires are through the tiny hair pores. The transmitter/receiver device, placed externally to the human body now takes the entire command. This acts as a secondary brain outside the body. This device relays the message, according to the information obtained from the brain to the computer or any robot that can act according to the instructions from the device. Also the robot may be connected through a computer. To operate a computer the instructions must be in the form of digital signals. But the brain, as already stated always produces analog signals only. Hence this analog signal has to be converted to machine understandable digital signals. So we incorporate an analog to digital signal converter. The transmission medium from the transmitter/receiver device may be designed according to the convenience. It may be a wire. But wire can be used only up to a limited range. So for the convenience of human radio waves are used for transmission. The micro controller is programmed for certain actions to be performed. Any action to be performed is received from the brain. These actions are matched in with the already programmed actions in the micro controller. If the action given in by the brain does not match with the programmed one then it is stored in as a new action. This is in turn fed in to the stepper motor.







E.STAGES OF OUR PROTOTYPE:

First module**:** The first module in our prototype would be designing the model that will be attached (wrapped) to our hands and movements are made as per our thoughts, the actions produced by the model are viewed in the monitor.

Second module**:** The second module would be developing an artificial hand and making it perform actions as per the thought by fixing it either in the hands of physically challenged or normal people.

Final module**:** The final outcome would be our objective that is to make the hand perform normal actions such as making it to peel oranges and so on and this will be attached to physically challenged people. Thus it functions similar to normal hands.

PROPOSED MODEL:

Fig 5: Proposed Model of the artificial legs

Difference between the Brain Controlled Artificial legs and the Normal Artificial Legs:

Brain Controlled Artificial Legs	**Normal Artificial Legs**
Ease of Construction	Complex in construction
Cost is not more than Rs.5,00,000	Cost is about $80,000-$90,000(Rs.35,00,000 to Rs.40,00,000)
User can have full control over the artificial leg.	User cannot have full control over the artificial leg.
Semi-Automatic	Fully Automatic
Sensors are absent.	Sensors are present
Requires simple control unit.	Requires complex control unit.

F. ADVANTAGES:

Performs action similar to normal hand. Any actions can be performed as per thought. Simple construction and light weight. Capable of performing activities like peeling. Low cost. Respond to external stimulus.

III.CONCLUSION:

This paper is for the physically challenged people who love to live like the ordinary men and women they can perform all works in a much effective manner than a normal human. This technology definitely is a boon to special community. This model is subjected to battery weakness and cannot lift heavy object. This could be enhanced in future.

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