Brain Wave Controlled Wearable Robotic Arm Using EEG

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Abstract- *There are number of disabled people, who are suffering from various Neuromuscular and other disabilities. If something is broken and can't be fixed that means technology is broken, but technology has a solution on it so that the disabled people can express themselves and can provide alternative communication for them. For that BCI is used, in this project the assumption is to develop a replica of human hand that will work like one. The brainwaves which will be generated are alpha, beta and gamma and will be sensed using a gaming device called Force Trainer II.*

Keywords*- BCI(Brain Control Interface), Arduino UNO, TI Launch Pad, EEG(Electroencephalogram),*

I. INTRODUCTION

The movements of non-living components like robot and prosthetic device can be done by just "thinking", is the concept of BCI. In 1970 this brain interfacing technology is introduced, up till now there is a lot more development is done in BCI technology. The BCI is first developed to study the working and performing actions of the brain, later on it is been use to sense and transmit the thoughts of disabled people.

BCI works with the EEG pulses the main source of the EEG is the synchronous activity of thousands of cortical neurons. The waves which are generated are Alpha, Beta, Gama. In this paper this wave are taken in consideration.

The evolution in the prosthetics is a very slow process because the disability is never taken in to consideration. But now the scenario is different only in India there are about 5 million disabled people. The old prosthetic products were like hooks and pegs, they were used for support purpose only. Later on semi movable prosthetics came in market. Although it provides a huge aid the prosthetics were but they looked very different from human hand. The new technology came called Myo-electric prosthetic, this technology uses the muscles movement sensor as a input to control unit of robotic arm. It senses the muscle movement but if the muscle is dysfunction because of some injury the Myo-electric useless and hence EEG based BCI comes in the picture. The BCI is composed of signal acquisition and signal processing. The block of BCI
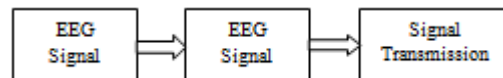

Fig. 1: BCI action

II. METHODOLOGY

1. System design

The design is divided in to two parts first part is transmitter and the second part is the receiver. The first part consist of BCI head set(Force Trainer II) and the receiver which is second part consist of robotic Arm.
Transmitter

The transmitter consist three main component the first one is BCI(Force Trainer II) the second one is the Arduino UNO development board and last part in the transmitter section is the Zigbee as transmitter.
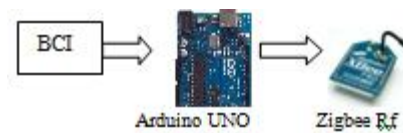

Fig. 2 Transmitter Part

The BCI senses the senses the alpha beta and gamma waves and using an in build analog to digital converter it convert that data into digital data this data is then received by the Arduino UNO.

Brain wave type	Frequency range
Theta	3.5 to 7.5 Hz
Alpha	7.5 to 13 Hz
Beta	Above 14Hz
Gamma	Above 31Hz

Table 1 Brain Wave Types and Frequency Range

Theta: It is classified as a moderate movement. It is perfectly typical in children of the age up to 13 years old.

Alpha: It is found in the back district of the head on every side it is one of the important of concern in designing the BCI design.

Beta : It is a quick action pulse, it can be sensed in both sides in　symmetrical conveyance and can be get in most clear form in frontally.

Gamma : It's the wave which we can measure at time of awareness or in other terms it's a mirror instrument of awareness.

Receiver

There is three main component in the receiver end the bionic arm or prosthetic arm TI Launch pad as controller and the Zigbee as Rf receiver.
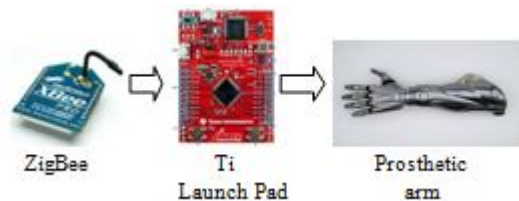

Fig. 3 Receiver Bionic Arm

The signal is receved by the xbee for the arduno uno and the data is compered in the Ti Launch pad then the commands are given to the as per the instuctions.

Ti Launch pad is a develepment bord of Texas Instuments , this helps in making the multiple changes in the code. Using Ti Launch Pad the performance is change very much.Robotic arm is hardwere design having DC motors as driving object,

III. DESIGN FLOW

The flow diagram of BCI and Robotic arm unit is shown in Fig.4. It shows all the step by step functions of arm and BCI, how it will initialize and the headset will start sensing the neurons signal.
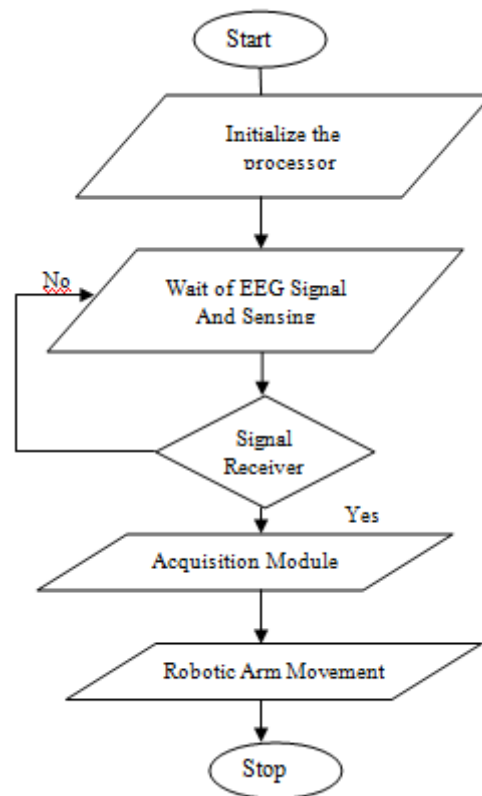

Fig.5 Design Flow

IV. CONCLUSION AND FUTURE SCOPE

The research and development of brain-controlled prosthetic arm or prosthetic limbs have received a great deal of attention because they can help bring mobility back to people. This paper gives and suggests a design for bionic prosthetic arm the working is still on very low level but it can be developed more by using upgraded technology.

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