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Triggered Activity of Robot with Acquired and Analysed Brainwaves

N Kripa, R Vasuki

Abstract**:** ***One of the most thriving applications of medical field in the recent days is the Brain Control Interface (BCI). It is a bewitching aspect to prospect the usage of bioelectrical signals from our body to control, monitor or even trigger the external environment. Brainsense is a wireless Electroencephalogram (EEG) monitoring headband, with wireless sensor transferring system. Raw EEG data is been captured with the help of Brainsense headband. A threshold value is been identified with repeated detection of EEG raw data which occurs during attention and concentration of brain. This research paper is based on the cognitive science bridging between the human brain signals with a machine basically in external environment. A wireless movable robot is been used for this purpose which is been triggered with the fixed threshold value, working on the embedded code platform. The packed EEG data has been transmitted to the embedded core to convert it into motion data as per the designing of the algorithm. This research paper emphasis on how the brain waves could be used to control a machine in external environment which could be an enhanced help for the injured or bed ridden individual and for the old aged people.***

Index Terms**:** ***Brain Control Interface (BCI), Brainsense headband, Electroencephalogram (EEG), Robot, Wireless transmission.***

I. INTRODUCTION

The unique features of the living being are the bio signals which are usually referred to as bioelectrical signals. Electroencephalogram (EEG) is one among the bioelectrical signals which are more special and more complicated the same time when compared to other bio signals. The electrical activity of the EEG waveform varies with frequency, amplitude, spatial distribution, acting to different stimuli, etc. Though initially Brain Control Interface (BCI)[1-4] was used in gaming and computer fields, in recent years it has reached a tremendous height in medical field. A bridge is made to form between the brain waves and the robotic machine environment. This research paper provides up to the achievement of controlling the robot in an external environment with the brain waves acquired form wireless brain sense EEG system.

II. BRAINWAVE ACQUISITION

Neurons which are found in hundred billion in numbers are the nerve cells which are found in brain. Due to neuron interaction, chemical changes occurs which results in electrical impulses.

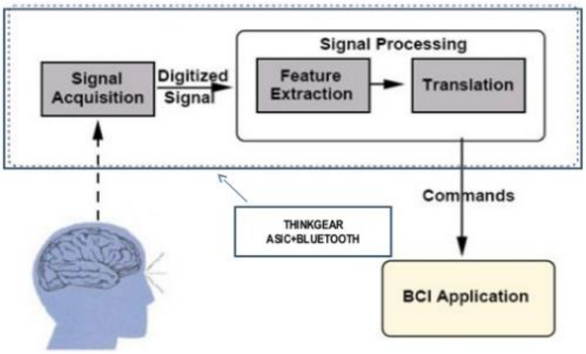

Fig.1 EEG Data Acquisition

A. Bainsense Headband

Brainsense wireless EEG head band which works with Neurosky technology is been used to measure the brain waves.

Fig.2 Brainsense Wireless Headband

EEG is been taken from the subjects through Brainsense headband which is a single wireless Electrode Encephalogram (EEG)[5-7]. It has wireless paring Bluetooth with iOS and Android support. The Bluetooth Module HC-05 has two operating modes which can receive and send data from other devices as well. As it operates with single protocol it is helpful in easy paring with other modules. ThinkGear ASCI Module (TGAM) is been used as the sensor for EEG technology. The signals from the brain is been measured with the help of this sensor which are all EEG raw data. The ASCI within the TGAM[8] is an embedded chip along with wave amplification, noise filtering, Analog to Digital converter, etc. The Brainsense Headband works with the help of AAA Battery. It has an on and off switch by which we can on when ever needed and keep it off other times. A reference electrode is been used here which is been clipped in the ear.

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B. EEG Data

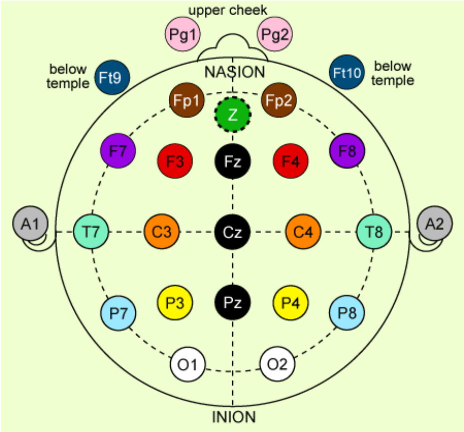

Fig.3 Electrode Placement in EEG

10-20 system is the internationally known placement of surface electrodes on the scalp for EEG measurement. The electrodes used on the scalp may range from single to maximum of around even 256 electrodes in EEG. As this research involves single electrode which is been attached in the headband, it is placed on Fp1 (Frontal Parietal)[9-11] which is measured from front to back. The Reference electrode is been placed on A1 clipped on the left ear.

Among the four waves of EEG like Alpha, Beta, Theta and Delta, the Fp1 measures Beta waves as per many researches done before with frequency range of 13-30Hz.

III. MOVABLE ROBOT

There are various types of robot in medical field but as in the cognitive kind of robot is used in brain control interface. The main aim of this research is to develop an interface of the brain waves with the external environment. In fig 4 Robot is a movable type with 4 wheels, a pick and place gripper and 6 gear motors.

IV. PERFORMANCE OF MACHINE CONTROL INTERFACE PROTOCOL

The Think Gear ASCI Module has values ranges from 0 to 200 which are otherwise called as eSense values. For each different type of eSense values the meter value differs for example like attention, meditation, hypertension, etc.

These eSense values are the EEG signals which are given as raw EEG data as output. Various eSense values are been fed to the robot through programme for its movement. With many trials, value 170 is been fed to the Robot in order to start moving. This eSense value is obtained in the range during concentration and alertness of the brain. Again the Robot stops and lowers the pickup gripper when the eSense value is 170. And again the Robot starts to move and drops the picked up object after getting the 170 eSense value.

V. RESULTS AND DISCUSSION

Fig.4 Movable Robot

Movement of the Robot which is placed in an external environment is been achieved successfully by a single electrode. Compared to the multiple electrode EEG instruments[12] this EEG headband of single electrode is very comfortable, portable and the most important is cheap cost which could be affordable for the normal people too at home who are bed ridden or for elderly people. But as the age factor plays a role in this interface control depending on the EEG acquired, future scope and study could be done for the different criteria and how the robot works for each of it.

VI. CONCLUSION

Brain control interface is a wide area wherein here the brain waves are solely utilized in order to move a robot in an external environment with wireless transmission of data. This is a basic work which is done keeping in mind that it could be used in medical field. For the benefit of old age people and to the bed ridden people this Biorobot will be helpful by acting as a fetch and drop robot moving in accordance of the EEG brain waves. This could not be restricted to medical field but can be extended in various fields by doing some little changes for the desired environment where the robot is. Thus through this research a wireless, single EEG electrode acquired brainwaves could make a robot move in an external environment is been achieved.

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