Brain Computer Interface

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Abstract— In the field of bio-medical, the brain interface is to create and adapt methods of human-computer interaction. This is BCI. A variety of application domains to compare and validate BCI interaction, including communication, environmental control, neural prosthetics and creative expression. EEG signals acts as a communication between men and machines.The BCI-based control system for robots using the EEG has been suggested for mobile robots and humanoids, and some other machines to control. In this project we do, the control interface to translate human thoughts into appropriate motion commands for robotic systems.The experimental procedures consist of extraction of EEG signals, optimizing the exact signal, wireless transmission and machine control.

Key words: Brain–computer interface (BCI), electroencephalograph (EEG), wireless communication,

I. INTRODUCTION

ONE of the most challenging goals of neural engineering is the development of Brain-Machine Interfaces (BMIs).Then a novel interfacing technique used between humans and machines was intensively studied based on neural responses to stimulation or thought, which is called brain–computer interface (BCI) . There exist diseases of the nervous system that gradually cause the body's motor neurons to degenerate, Example: Amyotrophic Lateral Sclerosis (ALS). Eventually causes total paralysis. The affected individual becomes trapped in his own body, unable to communicate.

A Brain-Computer Interface (BCI) enables communication under such circumstances. Using data recorded from the brain, the BCI processes it, interprets the intention of the user, and acts on it. The BCI has a robust and flexible design that can be expanded in the future to encompass more complex communication schemes. An electroencephalogram (EEG) is a measure of the brain's voltage fluctuations as detected from brain signals.It is an approximation of the cumulative electrical activity of neurons. BCI research programs have began and encouraged new understanding of brain functions.The advances in mechanics, electronics and computer science technology have allowed the development of machine control. In this proposal extracted EEG signal can transmit human intentions into machines as a form of appropriate command.

The BCI methods using Electroencephalogy (EEG) have been extensively examined, because they are applicable to healthy subjects for general purpose. The various types of extraction of signals from brain are in vasive techniques, ECOG (Electrocarticography), Functional MRI, EEG . The best way for extraction of brain signals are EEG based method. The EEG-based BCI system for robots has been suggested in robotics and neural engineering fields because some elderly or disabled people can control robots naturally and intuitively by merely thinking while using this system. After extraction of EEG signals digital version of EEG can be optimized by suitable optimization algorithm. After extraction of optimized signals, it is given to Controller for transmission. ATmega16 processor. The signal is transmitted from UART through wireless for controlling the machine in receiver side. The wireless transmission used in this proposal is Blutooth or RF.The transmitted signal is received and it is given to controller for machine control.

II. ELECTROENCEPHALOGRAPHY

Electroencephalography (EEG) is the recording of electrical activity along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within the neurons of the brain. In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a short period of time, usually 20–40 minutes, as recorded from multiple electrodes placed on the scalp. There are many types of materials used for manufacturing of electrodes which may be dry electrodes, nickel electrodes, Ag/Ag Cl. For this system electrodes used is Ag/Ag Clwhich may be more effective than any other types of electrodes. Number of leads used for this system is only three electrodes. The two leads are placed on forehead and another lead which is ground is placed in the right side of the neck. Diagnostic applications generally focus on the spectral content of EEG, that is, the type of neural oscillations that can be observed in EEG signals. Despite limited spatial resolution, EEG continues to be a valuable tool for research and diagnosis, especially when millisecond-range temporal resolution (not possible with CT or MRI) is required.

III. BRAIN-COMPUTER INTERFACE (BCI)

This technology is a new and fast evolving field that seeks direct interaction between the human neural system and machines, aiming to augment human capabilities by enabling people(especially disabled) to communicate and control devices by mere "thinking" or expressing intent.

The increasing success of BCI systems is partially due to a better understanding of the dynamics of brain oscillations that generate EEG signals. In the brain, networks of neurons form feedback loops responsible for the oscillatory activity recordeding the EEG.Normally the frequency of such oscillations becomes slower with increased synchronization.

Sensorimotor activity such as motor movements or motor imagery (e.g. imagining hand/feet movement) changes the oscillatory patterns resulting in amplitude suppression (Event Related Desynchronization - ERD) or amplitude enhancement (Event Related Synchronization - ERS) on the Rolandic mu rhythm (7-13 Hz) and the central beta rhythms above 13 Hz. A second reason for the increased interest in BCI is the improved resolution and lower cost of recording equipment.Current research aims at developing systems that use dry electrodes instead of the cumbersome golden or Ag/AgCl electrodes, that require gel, glue and skin preparation. This technology, together with making the devices more mobile, will allow BCI systems to be available for controlling the machine, humanoids, etc for various commands through our thought.In the brain computer interface system is the, People speculated that Electro Encephalographic (EEG) activity or other measures of brain function might provide this new channel. BCI research programs have began and encouraged new understanding of brain functions. Immediate goal is to provide communication capabilities so that any subject can control the external world without using brain's normal output pathways of peripheral nerves and muscles. BCI's use EEG activity recorded at the signals. BCI operation depends on effective interaction between two adaptive controllers. Current BCI's have maximum information transfer rates.In this BCI has consists of the four types of main components (fig1 shown in their). They are Signal Acquisition,Signal Processing, wireless transmission and Control Devices.

In this system the signal is extracted from the brain and it requires some amplification for strengthening the signal.This module works as an interface between the recording device and the computer used for the recording. Then the informative signal is extracted and it is transmitted and the machine is controlled.

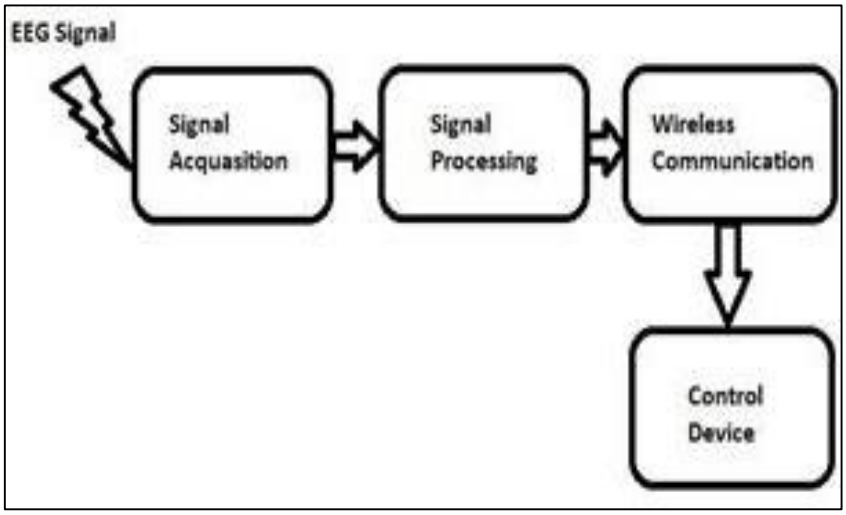

Fig. 1: Block Diagram

IV. AIM

Brain computer interface is a fast growing emergent technology in which researchers aims to build a direct channel between the human brain and the computer.It is collaboration in a brain accept and controls a mechanical device as a natural part of its representation of the body.The BCI can lead to many application especially for disable persons in which they can help them in a living as a normal people.In addition the BCI research aims to emulate the human brain.

V. OBJECTIVES

The main objective of this project is to control the external devices through human brain. The electrode we used here senses the brain waves send the signals to computer for processing.The computer sends the signal to relay through controller, which in response controls the operation of device.

VI. ADVANTAGES

- Transmit visual images to the mind of a blind person, allowing them to see.
- Transmit auditory data to the mind of a deaf person, allowing them to hear.
- Allow gamers to control video games with their minds.
- Allow a mute person to have their thoughts displayed and spoken by a computer.

VII. DISADVANTAGES

- Electrodes outside of the skull can detect very few electric signals from the brain.
- Electrodes placed inside the skull create scar tissue in the brain.

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