BCI System for Differently Abled Persons

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Abstract:
Thousands of people worldwide are suffering from syndromes like “Locked-in Syndrome” and “Akinetic Mutism” rendering them disabled and dependent on others for each and every thing in their lives. Additionally many are amputated due to injuries and lose their capabilities to move. They are mostly bed-ridden and have to be moved around in a wheelchair, always accompanied by atleast a person. Some might lose their capabilities to communicate and are only able to move their eyes. Brain-machine interface has been considered a salvation for such individuals. Considerable research has been done in this field both by private and government funded research centers. When we think or express emotions or any other feelings, the neurons are fired and this is captured from the scalp by EEG method using Brain Sensor. Each emotion has its own characteristic potential and it is used to differentiate between them. The output from EEG can be manipulated/processed to provide discreet set of values for each emotion/state of mind. The values are used to control machines and building a working Brain-Machine interface.

Keywords: vehicle-section; BCI; Brain-sensor; ZigBee; Programming; Arduino UNO

I. INTRODUCTION

The main theme behind this scheme is to build an interface between brain state and machines. The idea is to implement the interface in a system so as to maximise the individual capacity of paralysed subjects. The system allows motion of the subject with an instant messaging service and a binary communication system.

II. OBJECTIVES

With this model we propose a system with two working modes—Motion control with messaging service – Limited binary communication. The system can be used in either mode. This proposed model is an efficient solution for the problems faced by such individuals.

III. DESIGN STRATEGY

A. Brain Sensor
We use a Brain sensor headset developed by Neurosky. The headset measures and outputs the EEG power spectrums (alpha waves, beta waves, etc), NeuroSky eSense meters (attention and meditation) and eye blinks. It uses TGAMI module. It consists of a headset, ear-clip and a sensor arm. The sensor arm has an electrode and goes over the forehead. The ear clip acts as reference. The sensor captures the scalp potential and transmits the data via a Bluetooth module.

B. Data Processing
Each brain wave has a particular range of frequency. All frequencies above 100 Hz are filtered out. Laplace transform is applied to get the discreet values. These values are transmitted to the processor via Bluetooth module. We have programmed in MATLAB and python. We have implemented the code using Thinkgear library provided by Neurosky.

C. Transmitter
The transmitter section consists of a ZigBee transmitter and a GSM module. The Zigbee module transmits the output provided by the MATLAB program. Also a simulated output is produced in MATLAB window. The outputs from MATLAB are actually commands for the vehicle direction control. Additionally a GSM module is incorporated in the system. The module allows the subject to send a preset message to a predefined phone number instantly by mere blinking. The GSM module is interfaced in Python.

D. Receiver/Vehicle
The ZigBe receiver gets data from the ZigBe transmitter. Data and forwards them to Arduino. Arduino is programmed and controls the vehicle remotely.
**E. Communication**
The other mode of the system can be used for limited communication using YES or NO statements. The subject would be able to express his will between the two conditions by blinking of eyes. Even though only two words can be communicated it still helps the subject in day to day problems.

**Blink control**

<table>
<thead>
<tr>
<th>YES</th>
<th>Voice output</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>Voice output</td>
</tr>
</tbody>
</table>

**WORKING**

**Mode 1**
The subject with sensor blinks once for right turn, blinks twice for left turn, blinks thrice to send the preset message to fixed number. The vehicle moves forward if subject focusses and stops if calms down/meditates.

**Mode 2**
Subject blinks once to express yes and twice to express no. The output is a voice saying yes or no.

**IV. ACKNOWLEDGMENT**
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**V. REFERENCES**


