

EEG BASED BRAIN CONTROLLED STROLLER

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Abstract: There are more than five million disabled people who are affected by various neuromuscular disorder. In order to express their mobility, they need to express their thoughts by an alternative solution to prove themselves. To overcome neuromuscular disorder a Brain Controlled Interface system (BCI) has been developed to increase their independent mobility. In existing system they have used multiple number of electrode sensors for signal detection for constructing a wheelchair. Further, they have used the concept in which the sensor gets its signal through eye blinking, retinal movement, and muscular activities etc., The existing system has some limitations such as cost of the existing system is high. In existing system, wired connections where laptops play the major role. To overcome these limitations this paper has been developed. It describes the acquisition and analysis of brain signals for operating a wheelchair by obtaining the brain signals. The wheel chair is controlled automatically by the brain signals. The major objective is that the brain signals are sensed by Neurosky sensor in which variety of waves will be obtained and then they are categorised based on the values. The obtained signals are received and transmitted through Bluetooth module to the microcontroller where it is programmed for the movement of wheelchair. An acceleration sensor is used for the left and right movement. Patients who suffer from Neuromuscular disorder can be benefited using this wheelchair.

Keywords: Neurosky headset, Bluetooth module, Arduino, Wheel chair.

1. Introduction

Many people all over the world suffer due to some muscular disorders which affect their day to day life. Some of the disorders are held in spinal cord due to an injury, myasthenia, brain stem stroke, encephalopathy etc., Nowadays robot plays a major role in developing technologies in industrial applications as well as in human life. These robots can provide a support to disable people in their day today life. A brain controlled wheelchair is one of the step towards prime utilization of robot in human life. A healthy person can operate wheelchair with the help of joystick, keyboard

etc., But with a person who does not have control on their muscle are unable to use these kinds of external applications. For these kinds of disabilities some special technique has been proposed like eye tracking, muscle interfacing and many others for movement. The existing system has some limitations too . The are cost of the existing system is high. They have used wired connections where laptops plays the major role.

To overcome such these limitations Brain Computer Interface (BCI) system has been developed which bypass all conventional methods of communication. It directly interface with the brain of human being to the communication devices. In proposed system brain sends command directly to physical devices. Basically there are two types of Brain Computer Interface techniques, invasive and non invasive technique. In invasive technique the brain signals are recorded by an implanting electrode directly into cortex of brain. In non-invasive technique electrode placed on scalp of brain. Electroencephalography (EEG) is an example of non-invasive technique of detecting brain activity.

EEG is a technique of recording a electrical activity along the scalp produced by firing of neurons within the brain. EEG refers to the recording of the brain's spontaneous electrical activity over a short period of time as recorded from multiple electrodes placed on the scalp. EEG is generating due to neuron. This neurotransmitter activates receptor in dendrite. By combination of receptor and neurotransmitter electric signal is generated which can be measure at scalp. This voltage ranges from 1uV to 100uV.

This system has been developed with single electrode Neurosky sensor which enables the low cost with varieties of attention values which can be made through manual work. Basically human brain will let different waves in different frequencies; this is due to neurons firing at the timing of any thought arising, i.e. if a person wants to focus on any work, or in resting mentality. BCIs are systems that can bypass conventional channels of communication (i.e., muscles and thoughts) to provide direct communication and control between the human brain and physical devices by translating different patterns of brain activity into commands in real time.

The output signal from a BCI is limited and may not facilitate direct interfacing to technologies that are controlled using conventional means. The obtained signals are received and transmitted through Bluetooth module to the microcontroller where it has been programmed for the movement of wheelchair. A relay is been fixed with the motor for distribution purpose where the input and output of microcontroller is 5V. It is used as an high voltage connector to increase the rotation of wheel in which DC motor and the gear are fixed. An acceleration sensor has been used for the left and right movement and the forward movement is based on the EEG signals.

2. Existing System

EEG technique has been used by many of researchers for wheelchair control. Junichi Miyata proposed a system based on ψ - ϕ coordinates. Straight and corner movement of wheelchair are performed by it [1]. Brice Rebasamen developed a wheelchair based on P300 BCI system. In this system user select a destination amongst a list of predefine locations [2]. Naisan Yazdani used optimal electrode position for his proposed system. He has implemented 3D virtual environment for training evaluations [3]. Vijay Khare, Jayashree Santhosh EEG signals was captured by using eight electrodes and Wavelet Packet Transform(WPT) was used for feature extraction of relevant frequency band from EEG signals. This system achieved left, right, forward and backward movement [4]. Tom Carlson et al., 2012 proposed a wheelchair based on asynchronous protocols, mutual learning and shared control principles. He have undertaking trail with patients [5]. Rajesh Singhla developed a wheelchair based on steady state visual evoked principle in which he find Support Vector Machine(SVM) shows better accuracy than Artificial Neural Network(ANN) [6]. In 2014 Tabias Kaufmann proposed system which is based on tactually evoked event related potentials for controlling wheelchair [7]. Murali Krishnan used emotive EPOC signal acquisition unit for EEG signal cquisition. ANN and SVM were used for EEG classification [8]. Choi and coworkers, also used a BCI based on motor imagery to build a brain-controlled mobile robot [9].

3. Drawbacks of the Existing System

Number of electrodes used in a single system connection. Varieties are more in the existing systems, like operating all devices with may interfacing and electrodes. But not cost effective, more costly to develop even a single system. Mostly it has been used only in the hospitals and in richer environment. Common people can't use this technique in their home for their elderly people. Relatively low sensitivity and specificity.

4. Proposed System

A. Block Diagram

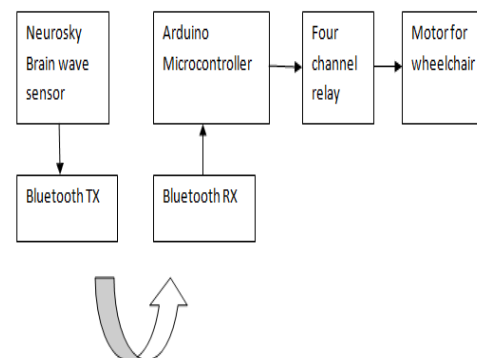


Figure 2.1 Block Diagram

B. Description

The block diagram of proposed system is shown in Fig 2.1, we have Controlled wheelchair via Bluetooth Module. The Mindwave Headset include a electrode on front part of scalp reference electrode and ground electrode which is connected to ear lobe. A Neurosky brain-wave sensor plays a vital role in managing the data's which is being transmitted and received through Bluetooth. The received data is sent to the arduino microcontroller where a program is fed into the system for further transmission of the received data into a wave form and the signal from the arduino is fed to the relay and DC motor for wheelchair. An accelerometer sensor is fixed with relay for left and right movement. For forward movement Neurosky sensor is used in which the signals are received from the brain. The wheelchair moves.

5. Methodology Used

In the proposed system, the module which comprises of the brainwave sensor which send the EEG signal through Bluetooth. The Bluetooth receiver receives the signal to arduino. The arduino signal is fed to the relay and DC motor for wheelchair movement.

A. Neurosky sensor

The human brain is formed up of billions of interconnected neurons; the patterns of interaction between the neurons are portrayed as thoughts and emotional states [10]. Each interaction between neurons creates associate discharge. On these charges are not possible to live from outside the skull. The activity created by many thousands of synchronic discharges aggregates into waves which may be measured. Totally

different brain waves square measure the results of different patterns of the neural interaction. These patterns cause waves characterized by completely different amplitudes and frequencies. The contraction of muscles is additionally related to distinctive wave patterns. Of these patterns is however some Neurosky devices observe waves.

B. Arduino

Arduino board design use a variety of microprocessors & microcontrollers [11]. The boards are equipped with sets of digital and analog input and output pins that may be interfaced to various expansion boards and other circuits. The microcontrollers are typically programmed using features from the programming languages C and C++.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input and output pins, 6 as analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or battery.

C. Bluetooth

HC serial Bluetooth items comprise of Bluetooth serial interface module and Bluetooth connector HC-05. The primary work of Bluetooth serial module is supplanting the serial line, such as:

1. One interfaces to Bluetooth ace gadget while the other one interfaces to slave gadget. Their association can be built once the combine is made. This Bluetooth association is identically preferred to a serial line association counting RXD, TXD signals. And they can utilize the Bluetooth serial module to communicate with each other.
2. When MCU has Bluetooth balm module, it can communicate with Bluetooth connector of computers and shrewd phones. At that point there is a virtual communicable serial harbour [12] line between MCU and computer or shrewd phone.
3. The Bluetooth gadgets in the showcase for the most part are balm gadgets, such as Bluetooth printer [12], Bluetooth GPS. So, we can utilize ace module to make match and communicate with them .

6. Results and Discussion

A. Graphical Representation

The graphical representation of a system is used for easy understanding of concentration level of a person when multiple data is taken and analysed. The different colours used in graphical form is to differentiate various data's when obtained. The following are the colours and their usage

YELLOW: Meditation Level

GREEN: Poor Quality

RED: Attention Level



Figure 3.1 Attention value above 40



Figure 3.2 When the user is in rest condition it represents zero

B. Hardware Model

In this, implementation an EEG signal with BCI is developed to control a wheelchair. The total design is based on all electric and to eliminate most of the mechanical parts which is shown in Fig 3.3. The conventional steering system that requires the user to control by hand is eliminated. The system is low cost, easy to control, and powered by Brushless DC motor and high performance battery system. The wheelchair movement is depends on attention values for forward movement. The termination of left and right movement is controlled with the help of accelerometer sensor. The design of the Neurosky sensor when paired with the wheelchair is shown in Fig 3.4. This project satisfies all the design objectives that we are considered before the design implementation.



Figure 3.3 Hardware model



Figure 3.4 Hardware model

7. Conclusion

This system is mainly used for disabled people who are affected by Neuromuscular disorder. This system works based on the Brain Controlled Interface system where the Neurosky sensor is used for signal detection from which the signal values are analysed and categorised based on the waves. An arduino is connected with the Neurosky sensor through Bluetooth for signal transmission. A motor and a relay is interconnected together with controller for the movement of wheelchair. This system will help for the disabled people to move from one place to another without any external help.

A. Future scope

In future, the paper will be improved by sensing the movement of eyeballs through "Blue Brain

Technology". The destination can be reached by seeing the location once where the user wants to move. It can also be fixed with a webcam to watch where the user is moving from one place to another with the help of wheelchair

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