Brainwave Controlled Wheelchair

Ms. Anushree Anant Kittur[1] Mr. Saket Raju Badge[2] Mr. Rohit Arvind Deshmukh[3]
Mrs. Varsha K Patil[4]
[1,2,3]BE Student [4]Assistant Professor
[1,2,3,4]Department of Electronics & Telecommunication Engineering
[1,2,3,4]All India Shri Shivaji Memorial Society's Institute of Information Technology India

Abstract— BCI is connecting the brain to the computer for getting the information, structure and working of brain. Electroencephalography (EEG) is type of making the connection between brain and computer; using EEG we are able to get the signals. Here in the project we used Electroencephalogram (EEG) sensor to make the connection with brain which is Neurosky brainwave sensor. Using Neurosky sensor we get the signals, after plotting and enhancing that signals we get the good form of the brain wave signals. These signals are used for making the movement of wheelchair. EEG headset is placed on the head to get the brainwave signals. From direct brain we get raw signals which are having very small amplitude so these signals are amplified and plotted in the sequence of the frequency using the MATLAB software. Connecting the software part of the signals to the hardware part of the wheelchair we used Arduino software, using that we are able to establish the connection. Brainwave controlled wheelchair is useful for the paralyzed and handicap people.

Key words: Electroencephalogram, Neurosky Sensor, Arduino, MATLAB, Wheelchair

I. INTRODUCTION

In past decades, the brain machine interface system is developed with the goal that allows partially or fully disabled person to control and communicates with the external parameter by processing the brain signal. The total disabled and paralyzed person requires non-muscular communication. The brain computer interface can provide the communication facility by using only the brain waves.

The common brain computer interface system use EEG electrodes for signal acquisition system. The brain generated electrical signal is acquired by these electrodes. The ionic current which flows in the neurons are measured through the electrons present on the scalp. The acquired signal is preprocessed by the series of filters and amplifiers. The high gain instrumentation amplifier is used because the EEG signals has very less energy which is in micro-volts. The filters used are selected as per the requirement of the processing system. For an activity of brain while sleeping, thinking, moving body parts, concentrating etc. various band of frequencies are generated. Brain generates the auditory and visual stimuli through the signals it is called as steady state evoked potential. For the completely disabled person the features used are slow cortical potential, sensorimotor rhythm potential and event related potential. Depending on the concentration of the human brain the speed of the wheelchair can increase the performance. By Fourier Transformation the feature extraction of signal is done. The statistical analysis is used with the wavelet transform for comparison of the two signals for classification purpose. The brain signal can be categories as band of frequency such as Alpha (7 to 13 Hz), Beta (12 to 20 Hz) and Gamma (20 to 45 Hz). In a human being, electrical activity of neurons produces currents spreading through the head. These currents reach the surface of the scalp, in the form of voltage changes and magnetic fields, both of which can be measured non-invasively. This measured voltage changes at the scalp are called the electroencephalogram (EEG) and the measured magnetic fields at the scalp are called the magneto-encephologram (MEG). There are diseases of the nervous system that gradually cause the body's movement to not function properly. Eventually causes total paralysis.

II. PROBLEM STATEMENT

Gives the motion and the direction to the wheelchair using the brainwaves. The Wheelchair speed will increases as the concentration of the person increases, we use Mind wave neurosky sensor for detecting the signals from human brain.

III. WORKING PRINCIPLE OF EEG

The EEG (electroencephalograph) measures brainwaves of different frequencies from the brain. Activities are measured on the scalp is called the electroencephalogram. The amplitude of the EEG is about 100 µV when measured on the scalp or on the brain, and about 1-2 mv when measured on the scalp. The bandwidth of this signal is from under 1 Hz to 50 Hz. The potentials are those components of the EEG that arise in response to a stimulus (which may be electric, auditory, visual, etc.) Such signals are usually below the noise level, and one must use a train of stimuli and signal averaging to improve the signal-to-noise ratio. Electrical activity of neurons produces the currents spreading through the head and get on the electrodes. These currents reach the surface of the brain in the form of voltage and magnetic fields, both of which can be measured non-invasively. Measured voltage changes at the scalp are called the electroencephalogram (EEG).

IV. TYPES OF BRAIN COMPUTER INTERFACE

There are many types of brain computer interfaces with help of that interfaces we are able to get the signals from the surface of scalp, in some of types have placement of electrodes is on the surface of head while in some types it is inside the brain. These electrodes are capable to catch signals.

A. Invasive Brain Computer Interfaces

Invasive brain computer interface devices are implemented inside the scalp and surface of brain. So they give highest quality of signals because they have direct contact with the brain so it catches the signals directly. Full type paralyzed persons use these types of electrodes. These types of electrodes have some disadvantages and cost is also high.

All rights reserved by *www.ijsrd.com*

B. *Partially Invasive Brain Computer Interfaces*

Partially invasive BCI devices are implemented half inside the brain and half are outside the brain. These electrodes have complex structure. The signals we get from these electrodes are weaker than the invasive electrodes. And have better signal quality those non-invasive type electrodes

C. *Noninvasive Brain Computer Interfaces*

Noninvasive type of brain computer interfaces is widely used in many systems. These types of electrodes are place on the surface of scalp. These electrodes catch low power of electric signals. They don't have direct contact with the brain. This technique is safest in brain computer interfaces types.

V. TYPES OF BRAIN FREQUENCIES

For obtaining basic brain patterns of recorded signals, person is instructed to close their eyes and relax. Brain signals form wave shapes that are sinusoidal in form. Usually, they are measured from peak to peak and normally range from 0.5 to 100 µV in amplitude, which is about 100 times lower than ECG signals. By means of Fourier transform power spectrum from the raw EEG signal is derived. In power spectrum contribution of sine waves with different frequencies are visible. Although the spectrum is continuous, ranging from 0 Hz up to one half of sampling frequency, the brain state of the individual may make certain frequencies more dominant. Brain waves have been categorized into four basic groups.

The best-known and most extensively studied rhythm of the human brain is the normal alpha rhythm. Alpha can be usually observed better in the posterior and occipital regions with typical amplitude about 50 µV (peak-peak). According to our experiences alpha was also significant between posterior and central regions in comparison to other regions. Alpha activity is induced by closing the eyes and by relaxation, and abolished by eye opening or alerting by any mechanism (thinking, calculating). Most of the people are remarkably sensitive to the phenomenon of "eye closing", i.e. when they close their eyes their wave pattern significantly changes from beta into alpha waves. The precise origin of the alpha rhythm is still not known. Alpha waves are usually attributed to summated dendrite potentials. Evoked potentials (e.g. generated in brain stem) often consist of fiber potentials (axonal) and synaptic components. EEG is sensitive to a continuum of states ranging from stress state, alertness to resting state, hypnosis, and sleep. During normal state of wakefulness with open eyes beta waves are dominant. In relaxation or drowsiness alpha activity rises and if sleep appears power of lower frequency bands increase. Sleep is generally divided into two broad types: no rapid eye movement sleep (NREM) and REM sleep. NREM and REM occur in alternating cycles. NREM is further divided into stage I, stage II, stage III, and stage IV. The last two stages correspond to deeper sleep, where slow delta waves show higher proportions. With slower dominant frequencies responsiveness to stimuli decreases. Various regions of the brain do not emit the same brain wave frequency simultaneously. An EEG signal between electrodes placed on the scalp consists of many waves with different characteristics. A large amount of data received from even one single EEG recording presents a difficulty for interpretation. Individual's brain wave patterns are unique. In some cases, it is possible to distinguish persons only according to their typical brain activity. For example, subjects who regard themselves as rational types or as holistic/ intuitive types may demonstrate certain higher activity in their frontal left and frontal right hemisphere respectively.

Beta	Alert / Working 14-20 waves per second
Alpha	Relaxed/ reflecting 8-13 waves per second
Theta	Drowsy/ meditating 4-7 waves per second
Delta	Sleep / Dreaming 3-4 waves per second
Delta	Deep & dreamless sleep 5-2 waves per second

Table 1: Brainwaves

VI. BLOCK DIAGRAM

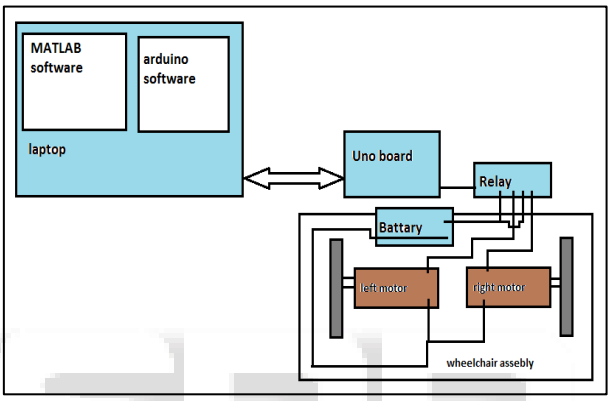

Fig. 1: Block diagram of system.

VII. METHODOLOGY

Above diagram shows the basic concept of project in the block manner. We divided the system into 2 parts, first part is the input part which consist of sensor. And the second part is about the output which contains the wheelchair. We are using two sensors and also there is provision for adding more sensors. The main part of the project is EEG sensor which is to be placed on head. Many EEG sensors are available in the market but we are using NEURO SKY brainwave sensor. Neurosky sensor is one phase sensor having only one electrode on frontal lobe of the brain and ground of the sensor is attached to the ear. Accelerometer sensor is used to give the direction to the wheelchair which is attached to the any part of human body. We can also add eye blink sensor to turn the system on and off.

Neurosky sensor has Bluetooth connectivity so it can be used to connect the sensor to the laptop but accelerometer does not have any wireless communication specification so wired communication is required. Accelerometer and the neurosky sensor are connected to the Arduino board. The Arduino board is used for connecting the computer and the hardware on the wheelchair. For this we need two Arduino board for the establishing good connection between hardware and the software using RF transmitter and receiver. For the movement of the wheelchair 2 DC motors are used. In this way the connection of the sensor to the hardware is established. We are using the MATLAB and the Arduino software. MATLAB is for getting the signals from the brain sensor and accelerometer. Signals are processed and

All rights reserved by *www.ijsrd.com*

the commands to the input are set in the MATLAB. The command then goes to the hardware part via the Arduino processing board. Arduino is useful for making the connection of hardware and the MATLAB.

VIII. EXPECTED RESULT

Our project is for the handicap people, paralyzed person, and all other types of persons that are not able to make any movements or are totally dependent on others.

Fig. 1: Expected Result

REFERENCES

[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (references)
[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.
[4] K. Elissa, "Title of paper if known," unpublished.
[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev, in press.
[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

All rights reserved by www.ijsrd.com