International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

# BRAINWAVE CONTROLLED WHEEL CHAIR USING EYE BLINKS

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**ABSTRACT**

*Brain Computer Interface (BCI) is field of research which has gained a lot of attention in these days. The main aim of this paper is to provide basic mobility for the elderly and incapacitate.Individuals who can't control an ordinary wheelchair. In this manner, brainwave controlled electrical wheelchair is the most reasonable guide. This exploration actualized eye squint as the order for controlling wheel seat to help the impaired individuals who can't utilize their legs or hands. The signal captured by NeuroSky sensor is transmitted wirelessly to the system through Bluetooth interface where the signal is simulated and processed. The processed data is transmitted to the Arduino board placed in wheel chair to control its mobility based on mind wave signal processed data. Further research is done on EEG signals and facial expressions to control computer-application oriented devices.*

***Keywords:****BCI (Brain Computer Interface), EEG (Electro Encephalography) headsets, Eye blink signals, Wireless Communication, Wheelchair.*

## I. INTRODUCTION

Recently, research on BCI is leading to new directions to have an interactive intelligent system that transform human brainwave to control signals of a computer – application oriented devices. BCI is field of study this gained a lot of attention towards neuro-science technology. Presently, there are several methods that able to possess the information of brain activity, for the most of the disabled people who travel their independent life face two biggest difficulties in their daily life. Wheelchair is a travelling tool for many disabled people that make's them to be independent and to reach their desired destination. In real life most of the wheelchairs are controlled manually. The use of brainwave interface technology enables them to be independent to make their life easy.

A perfect BCI framework depends on preparing of EEG signal. It provides an elective channel to communicate with any outside framework like a PC or a wheelchair. An approach where we use eye advancement area from EEG signs to control wheelchair has been viewed the improvement of an eye blink which offers climb to trademark signals, these exercises can be used to control an external structure.Our advantage lies in identifying and using the impact of eye related developments from the cerebrum wave sensor. The data of cerebrum movement is required for executing wheelchair controlling technique. Electroencephalography (EEG) is the most reasonable strategy for controlling wheelchair with cerebrum wave flags, this is an approach which records electrical waveform from the mind by utilizing terminals properly set on the head. The gadget utilized for this technique is convenient and non-invasive.

It quantifies voltage variances coming about because of ionic current inside the neurons of the mind, it records the cerebrum's unconstrained electrical action over some undefined time frame. Keeping in mind the end goal to actualize the controlling strategy, it is required to acquire the psychological order from the cerebrum and EEG signal must be pre-handled. Along these lines, it can translate the psychological charges that are detected by the mind, for instance forward, in reverse, left or right. At that point, the electrical controlling signs for electrical wheelchair are produced by this psychological summon. To beat the above disadvantage of EEG signals, which is an entangled waveform, requires a decent signal information handling.

Machine must get continuous signals as directions to translate and process the control framework in a wheelchair. This depicts the advancement of EEG study and calculation improvement for constant signal preparing to produce an unmistakable EEG signal design utilizing inner boosts. As this is a best arrangement, a business EEG headset gadget used to get signs, and after that a constant preparing calculation was composed to translate the information and present it progressively utilizing a Graphical User Interface (GUI), which is one of the arrangement that takes care of the issue for incapacities.

## II. RELATED WORK

In 2010, Jzua-Sheng Lin et al.[1], proposed a design of BCI(Brainwave-Computer Interface) based control for Electric wheelchairs. The proposed system uses EEG and Eye-blinking signals as input. The system uses a single electrode on forehead to capture EEG. The BCI works through Bluetooth for paralyzed patients. They have extracted Eye blinking signals from BCI. They have used Attention and Eye blinking as their primary input to control the wheelchair. The drawback here would be that people would not be able to pay attention all the time.

In 2012, SoumyaSen Gupta et al.[2], proposed a way of detecting the eye movements in EEG controlling devices. 1They proposed a machine learning approach to detect the eye movements. They have obtained the eye blinks and lateral eye movements by placing an electrode at the frontal region of the brain. They use these intents to control the devices like laptops and wheelchairs. They have used Electroculogram as the prime aspect to capture the intents. This system could obtain an accuracy rate of up to 95%.

In 2017, Swathi Ganesh et al.[3], proposed a pattern generation method for Brain to Machine communication. The proposed system delivers the real time capture, analysation, and visualisation of the brain signal patterns that could be used for smart medical applications. The system was mainly designed to generate active patterns for the communication. The visual and auditory stimuli were the things which generated the patterns according to will.

In 2017, Wang Zhi-Hao et al.[4], proposed a system to control dc motor by using EEG signals on LabVIEU. The proposed system works on EEG and EOG signals. This used NeuroSky Mind Wave to record the signals. It used myRIO for controlling dc motors and labVIEU for programming. They have proposed change in microcontroller and laptop with WIFI support and Bluetooth and WIFI module as additional modules.

In 2018, Li Yingda et al.[5], Proposed an intelligent wheelchair basing upon brainwave. The key components used here were brainwave module, multiple sensors, GPS, wireless transmission module, single chip microcomputer and android. The wearable device is equipped with brainwave control, automatic obstacle avoidance, navigation and positioning etc. The prime objective of this system was to solve the problem of disabled people's travel and mobility. The wearable device was based on ARM processor. The system was fast and stable, and was of high practical value.

## III. PROPOSED WORK

As shown in the Fig. 1, the architecture for the signal processing of EEGs with Bluetooth interface is expressed. The EEG signal was extracted from EEG acquisition. In this system, we used the NeuroSky headset to capture EEG and eye blinking signals. The dry electrode on the headset is used to read the brainwaves, the brain waves are transmitted by the Bluetooth wireless module. At the receiver side we have integrated a Bluetooth module in a personal computer with a software organised using of MATAB. This received EEG signal is used to convert electrical voltage is used to control the wheelchair.

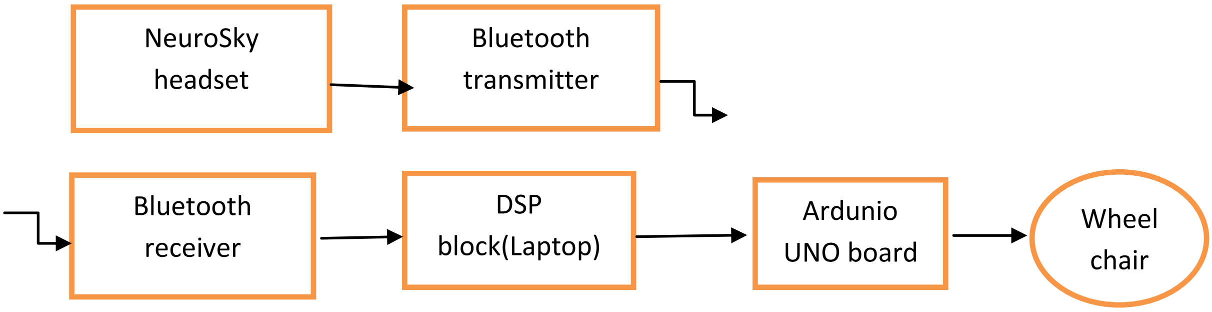



Fig.1: The Framework for the Signal Processing of EEG Signals with Bluetooth Interface

The NeuroSkymindwave sensor is a commercially available headset in a market having a sampling rate of 512 hertz, which contains single dry electrode. The headset is weared such that the dry electrode is kept on the forehead above the left eye and the reference that placed on the ear. Here the reference electrode acts has ground, so any activity in brain or some facial expression induces some voltage variations which are sensed by the electrode placed on forehead of disabled person. This varied voltage signals captured by the mindwave sensor is used to operate the wheelchair. In our model the signal generated by the eye blink only is used to control the wheelchair. The disabled person sitting on wheelchair carries computer, whichdisplay the direction command in simulated window allowing the person on chair to choose the direction in which wheelchair as to move. The selection of direction is triggered by just blinking his eyes at the right time of simulated direction displayed on the window. To check whether the user made a decision on direction selection the signal received from the brainwave sensor is compared with the threshold value. If the received value exceeds the threshold value then the direction displayed at the right time of simulation is chosen and the wheelchair moves in that direction. It is very important to train the person who is using this vehicle to have complete presence of mind, so that he will blink only when he wants to move in the direction displayed in simulated window. In real time the signal values from simulated wave will be used in arduino and a decision is made to control the mobility or action of wheelchair. This helps the disabilities to be less reliable or dependent on others.

## IV. RESULTS AND DISCUSSION

The Fig.2 shows the single peak value for one eye blink and Fig. 3shows two peaks for blinking eyes twice. In normal condition the waveform will be flattened with minute spikes. When the user blinks his eye then the value of signal captured from the sensor is compared with the threshold value, so based on the signal value whether it is high or low the direction decision is made. If the decision made is true then the simulated direction at the time of blinking is chosen and the wheelchair moves in that direction as shown in fig.3, but still the user is facing some problems with this model. The use of NeuroSky wave sensor introduced few issues likenoise and high frequency peaks are obtained in the waveform, which will sometime trigger the direction decision without the intent of user. These disturbances have to be minimized to increase the performance of the system, this can be done by introducing band limited filters which only allows the certain frequency range signals which are generated from eye blinking and restricts other frequency band signals.

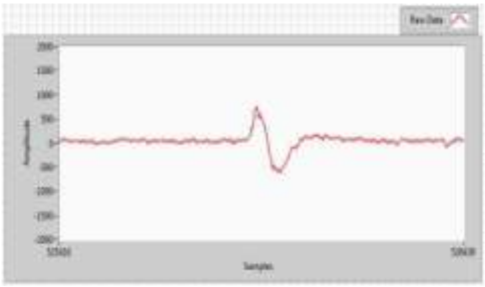
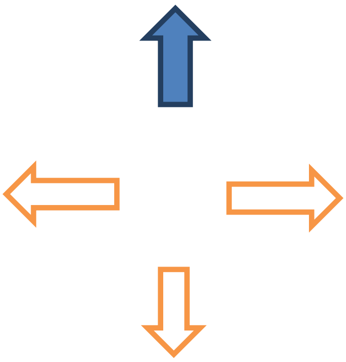


Fig.2: Single Eye Blink

IJARSE
ISSN: 2319-8354

Forward direction

selected



Left Right

Backward

Fig3: Simulated window of direction selection

## V. CONCLUSION

In this paper**,** EEG and Eye-Blinking signals from abrain through a BCIinterface based control for electric wheelchair with wireless communication medium is developed. IN traditional system, manual control of wheelchair is in use. In the proposed system, the simple unipolar electrode is used to record the EEG and Eye-Blinking signals from forehead and transferred to the computer through a Bluetooth interface. The brain and eye-blinking signals are processed and simulated by using the MATLAB tool. The generated control commands are sent to the wheelchair control system. The developed module is a low cost and simple to control with attention and eye-blinking signals

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