Brain Computer Interface Controlled Wheel Chair

Himanshu Sharma¹, Rahul Mahajan², Sakthivel G³*, Saravanakumar D⁴, Raghukiran N⁵.

¹,²,⁵School of Mechanical Engineering, Vellore Institute of Technology, Chennai, India
³,⁴Center for Automation, Vellore Institute of Technology, Chennai, India

E-mail: Sakthivel.g@vit.ac.in

Abstract. Brain computer interface wheel chair specially designed for paralyzed and disabled person who are not capable to operate normal wheel chair. This wheel chair is based on (BCI) Brain computer interface, it can control the wheel chair from brain neurons by the help of BCI. Brain computer interface (BCI) is a computer-based system that obtain brain signal that can be controlled by Neurosky Sensor which is an electrophysiological process to archive the electrical activity of the brain. A BCI system recognize users to grant their determination by study their brain signals. This technology is very helpful for paralyzed and disabled person they can easily moves wheel chair in any direction.

1. Introduction

These Brain computer interface wheel chair specially designed for paralyzed and disabled person who are not capable to operate normal wheel chair. This wheel chair is based on (BCI) Brain computer interface, it can control the wheel chair from brain neurons by the help of BCI system. BCI is a computer-based system that obtain brain signal that can be controlled by EEG “electroencephalography” which is an electrophysiological process to archive the electrical activity of the brain. A BCI system recognize users to grant their determination by study their brain signals. This technology is very helpful for paralyzed and disabled person they can easily moves wheel chair in any direction. The main objective of using this sensor because this sensor is portable and easy to use, old type EEG sensors are not portable and take more time to start for obtaining the data but Neurosky sensor more beneficial rather than old type EEG sensor. This prototype project deals the interfacing between brain and wheelchair with the help of Neurosky sensor or EEG technology.

Figure 1. Brain Computer Interface System.
2. Brain computer interface

A Brain Computer Interface (BCI) system contain the brain signals, after analyze and translate, it sends the command to relayed the output devices to carry the desired action. The brain computer interface (BCI) evaluates the signal which is processed by the (CNS) central nervous system. Brain produces a signal acquisition system which is digitally connected to the signal processing unit, that gives the command with the help of Neurosky Sensor.

3. Neurosky sensor

This sensor works on electroencephalography (EEG) system, this sensor calculates the Electrical activity from brain neurons.

4. EEG Works

The billions of cells in your cerebrum produce little electrical signs that structure non-straight examples called brainwaves. An EEG machine quantifies the electrical action in the cerebral cortex, the external layer of the mind, during an EEG test. EEG sensors are put on a member's head, at that point the cathodes non-obtrusively identify brainwaves from the subject. EEG sensors can record up to a few great many depictions of the electrical action produced in the cerebrum inside a solitary second. The recorded brainwaves are shipped off enhancers, at that point to a PC or the cloud to deal with the information. The intensified signs, which look like wavy lines, can be recorded on a PC, cell phone, or on a cloud information base.

![Image of EEG sensors](image_url)

**Figure 2.** Brain Computer Interface System.

![Image of fluctuated and constant brain waves](image_url)

**Figure 3.** (a) fluctuated brain wave, (b) constant brain wave.

Distributed computing programming is viewed as a basic advancement in EEG information preparing, as it takes into consideration continuous examination of chronicles at scale—in the beginning of EEG estimation, waves were essentially recorded on a diagram paper. This fig shows my brain waves. In figure 3 (a) the fluctuated graph is shown it mins my Brain has thinks something
continuously, In figure 3 (b) graph is constant for some times it mins on that time my brain is in attention mode.

5. Control system

In this prototype Neurosky sensor is connected to the wheel chair modal with the help of Bluetooth module which is interface on boardrate signal is 57600. This boardrate signal is generated by the help of Hyper Terminal. In this system I make microcontroller board which contains the pic microcontroller which is programmed by Arduino UNO and 5-volt power supply and L293D motor Driver.

![Figure 4. Control system of Wheelchair.](image)

In Configuration system used several codes for interfacing the Neurosky sensor with Bluetooth. Wheel chair operate on fixed attention level in this system a LED panel is attach with micron troller which is programmed according attention label this attention level can be measure by the help of Arduino Window.

![Figure 5. Attention Level Window.](image)

With the help of Visualizer app, we can also check attention level and different wave which is generated by our Brain these waves we can read by the help of EEG monitoring system.

![Figure 6. Visualizer.](image)
5.1. Controlling steps

- When we gave the power to wheelchair Bluetooth start pairing with EEG sensor.
- After Pairing we try to attention for control the wheel chair.
- If Attention Level is below 80 then wheel chair is not operated and Led start Glow according to attention level.
- When Attention level in between 80 to 100 the wheel chair operates in forward direction.
- When attention level is decrees wheelchair in stop mode.

For monitoring purpose, I have used a Camera which is mount on the Prototype wheelchair this came show the direction on laptop. with the help of this camera we can check, in which direction wheel chair is going.

6. Conclusion

This prototype wheelchair moves with the help of Neurosky sensor which collect the electrical data from the brain. This sensor is also helping in health monitoring system to record the meditation level and attention level. This prototype project deals the interfacing between brain and wheelchair with the help of Neurosky sensor or EEG technology. For future this technology is very helpful in artificial intelligence and GPS system for finding the maps for road hospitals and buildings.

7. References

[1]. Hongtao Wang, Yuanqing Li, Jinyi Long, Tianyou Yu and Zhenghui Gu, 2014, An asynchronous wheelchair control by hybrid EEG brain–computer interface, Cognitive Neurodynamics, 8, pages399–409
[2]. Jinyi Long, Yuanqing Li, Hongtao Wang, Tianyou Yu, Jiahui Pan and Feng Li, 2012, A Hybrid Brain Computer Interface to Control the Direction and Speed of a Simulated or Real Wheelchair, IEEE Transactions on Neural Systems and Rehabilitation Engineering, 20, 720 – 729

[3]. Dandan Huang, Kai Qian, Ding-Yu Fei, Wenchuan Jia, Xuedong Chen and Ou Bai, 2012, Electroencephalography (EEG)-Based Brain–Computer Interface (BCI): A 2-D Virtual Wheelchair, IEEE Transactions on Neural Systems and Rehabilitation Engineering, 3, 379 - 388

[4]. J.K. Chapin, K.A. Moxon, R.S. Markowitz, and M.A.L Nicolelis, 1999, Real-time control of a robot arm using simultaneously recorded neurons in the motor cortex, Nature Neuroscience, 2, 664 – 670

[5]. Tom Carlson, and Jose Del R. Millan, 2013, Brain controlled wheelchairs: A robotic architecture, IEEE Robotics and Automation Magazine, 1, 65 - 73

[6]. Butt, A. and Stanacevic, 2014, Implementation of Mind Control Robot, IEEE Long Island Systems, Applications and Technology (LISAT), 2, 978-1-4799-3850-6

[7]. B. Rebsamen, C. Guan, H. Zhang, C. Wang, C. Teo and M. Ang, 2010, A brain controlled wheelchair to navigate in familiar environments, IEEE Trans. Neural Systems and Rehabilitation Engineering 18, 590-598