

# LITERATURE SURVEY ON BCI CONTROLLED ROBOT

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## ABSTRACT

*In this world number of people are handicapped. Currently they use different technologies which give physically impaired the ability to move around. Using BCI communication has occur between the brain and an external device. BCIs are systems that can has conventional channels of communication (i.e., muscles and thoughts) that provide direct communication and control the human brain and physical devices that translating different patterns of brain activity in real time. This review paper covers the contribution from various researchers related to controlling the robot through brain signal. This paper covers with method for effective development of BCI based robot using various techniques such as alpha brain waves, Bluetooth visual p-300 based BCI, hybrid BCI etc.*

**Keyword—**EEG (Electroencephalograph) signal, brain computer interface, robotic control.

## 1. INTRODUCTION-

BRAIN-COMPUTER interface (BCI) system enables direct communication with an external device but does not use peripheral nerves or muscles and affordable. Multi-degree control is essential to operate a robot. For instance several control signals are required to control the direction (left and right) and speed (acceleration and deceleration) as well as to start and stop the motion. BCI can provide a new way of communications for special users who cannot communicate via normal pathways. A BCI system can send commands to the controller and be controlled by the brain activity and distinguished by EEG signal processing. The brain controlled robot basically works on the principle of capturing the

brain wave signals utilizing it for the movement of robot. It is also useful for disabled persons who can't speak or move their hands. The evolution of this technology provides significant changes in the way of users to use interactive systems. Work has been done and enable those members of the community who suffer from conditions like tetraplegia spinal injury and head trauma to enjoy improved quality of life required. Subsequent section covers various techniques used for implementation of BCI based robot system. Brain controlled interface system is described as follows

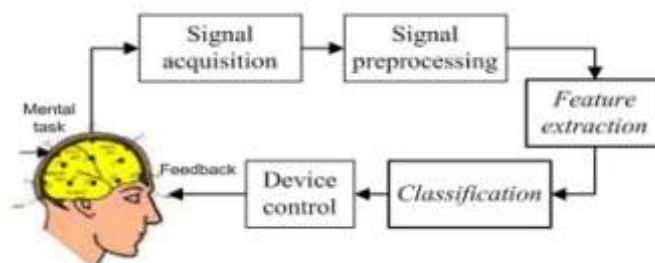


Fig. 1 BCI System

## 2.1.EEG BASED BRAIN CONTROLLED ROBOT

In this paper [1] author explain the brain controlled robot is based on Brain-computer interfaces (BCI).

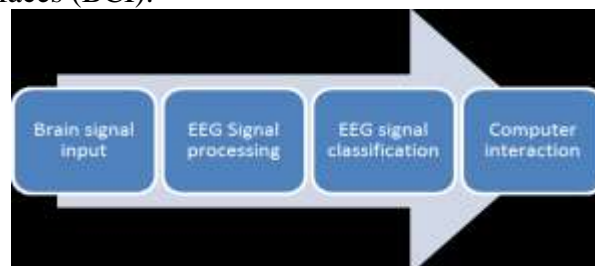


Fig. 2 Flow OF BCI

BCIs are systems that can bypass conventional channels of communication (i.e., muscles and

thoughts) which provide a direct communication and control between the human brain and physical devices that translate the different patterns of brain activity into commands in real time. With these commands a mobile robot can be controlled. The author has intention is to develop a robot that can assist the disabled people in their daily life to do some work independent on others .Here a single robot is used for multiple purposes thereby reducing cost for designing multiple robots.

## **2.2. BRAIN COMPUTER INTERFACE-CONTROLLING DEVICES UTILIZING THE ALPHA BRAIN WAVES**

In this paper [2] author explained the testing and development of brain computer interface system .using this technique one can control external devices using this voluntarily controlling alpha waves through eye movement. In the First session (testing period), subjects were asked to close and open their eyes and they were can control limited movements of a Robot and a prosthetic arm. In the Second session the eye movement was also considered (left-right, up-down) along with the opening and closure system during this time span and they were able to control more dimensions of the robot.

## **2.3. ROBOT CONTROL THROUGH BRAIN-COMPUTER INTERFACE FOR PATTERN GENERATION**

Author [3] explained the brain-computer interface (BCI) system processes and translates the neuronal signals mainly from electroencephalogram instruments into commands for controlling electronic devices. System can allow people with motor disabilities to control external devices through the real-time modulation in brain waves signals. An EEG-based BCI system that allows creative luminous artistic that representations is here. The system that has been designed and created and BCI2000 platform that performs on real-time analysis of EEG signal. Experiments are also presented.

## **2.4. BRAIN COMPUTER INTERFACE SYSTEM FOR MIND CONTROLLED ROBOT USING BLUETOOTH**

This paper [4] author covered the Mind Controlled Robot is based on Brain Computer Interface (BCI) and that will use brain waves. Using these commands a mobile robot can be controlled. The intention is to develop a mechanism for disable person they may assist in everyday life to do some work freelance on others. Human brain consists of innumerable interconnected neurons. The patterns of interaction between the neurons .The brain signals that are widely used to develop EEG-based BCIs using embrace P300 potentials that are a positive potential deflection on to the continuing brain activity .

## **2.5. BRAINWAVE CONTROLLED ROBOT**

In this paper [5] author explained the number of people is handicapped. Using this technique Currently they use different technologies for controlling the robot move around. In this paper author designed robot or wheelchair is fully automatic and controlled using Beta wave and sensor sense Mind wave which is detected from brain signal.

## **2.6. CONTROL OF A HUMANOID ROBOT BY A NON INVASIVE BRAIN-COMPUTER INTERFACE IN HUMANS**

This paper [7] author described a brain-computer interface for controlling humanoid robot and directly using brain signals obtained non-invasively from the scalp through electroencephalography .this interface based on EEG signal can be used to perform command partially and autonomous humanoid robot can perform complex for walking to specific locations and picking up desired objects .In this paper author explained navigation as per previous applications but also manipulation and transport of objects.

## **2.7.ELECTROENCEPHALOGRAM-BASED CONTROL OF AN ELECTRIC WHEELCHAIR**

This paper [9] author proposed the study on electroencephalogram (EEG) that based on control of an electric wheelchair. The objective is to control the direction of an electric wheelchair using only EEG signals. The BCI is a system that acquires and analyzes neural (brain) signals with has a goal of

creating a direct high-bandwidth communication channel between this brain and the computer. Such systems are envisioned to have huge potentials for a wide ranging areas of research and applications such as brain signal acquisition and processing, bioengineering.

### **2.8. ADAPTIVE EEG THOUGHT PATTERN CLASSIFIER FOR ADVANCED WHEELCHAIR CONTROL**

In this paper [10] author explained a real-time Electroencephalogram (EEG) classification system, with the goal of enhancing the control of a head-movement controlled power wheelchair for patients with chronic Spinal Cord Injury (SCI). Using a 32 channel recording device, mental command data was collected from 10 participants. This paper has shown that it is possible to achieve good results classifying at least three different signals from EEG, generated by mental commands. This brought the data from this subject back into line with what was being achieved initially. If these findings can be verified, they present implications to the area of BCI research.

### **2.9. VISUAL P300-BASED BCI TO STEER A WHEELCHAIR**

Author [11] explained a new P300 paradigm for brain computer interface. Visual stimuli consisting of 8 arrows randomly intensified are used for direction target selection for wheelchair steering. The classification algorithms were obtained offline from training and then validated offline and online. A P300-based visual paradigm is proposed for wheelchair steering. The experimental off-line and on-line validate ONLINE ISI compensation and artifact elimination are two relevant issues that have to be studied in future work. The first one was over come extending the number of events.

### **2.10. A self-paced BCI system to control an electric wheelchair evaluation of Commercial low-cost EEG device**

In this paper [20] author proposed the electrical cerebral activity has been already used in several applications and improving the condition of daily people life. In particular the Electroencephalogram

signals (EEG) can be used to provide new ways for communication and control. In this paper author explained the design and the realization of a self-paced BCI system but built in order to drive an electrical wheelchair with a motor imagery approach.

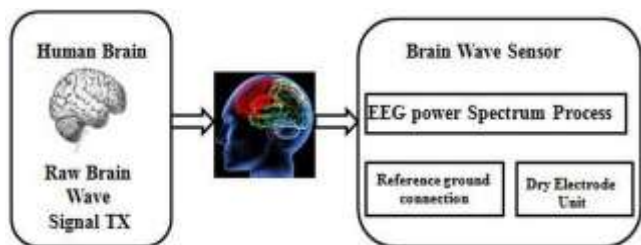
### **2.11. A HYBRID BCI SYSTEM COMBINING P300 AND SSVEP**

Author [21] proposed a hybrid brain-computer interface (BCI) system and combining P300 and steady-state visual evoked potential (SSVEP) to proposed and improve the performance of asynchronous control. In this paper author explained a hybrid asynchronous BCI combining P300 and SS As an application .author used hybrid BCI system for the “go/stop” control of a real wheelchair and demonstrated our system’s effectiveness in an online wheelchair control experiment.

### **2.12. EMG-BASED HANDS -FREE WHEELCHAIR CONTROL WITH EOG ATTENTION SHIFT DETECTION**

In this paper [22] author explained hands-free control system for the electric-powered wheelchair and which is based on EMG (Electromyography) signals. This EEG signal based on the eyebrow muscle activity. simple Cyber Link device one-dimensional continuous EMG signals are obtained. Analysis and translate this into multi-directional control commands that is forward, left, right for the wheelchair that can supports multi-directional control. At the same time, EOG (Electrooculography) signals detected from eye movements and are used to adjust wheelchair speed.

### **2.13. ELECTROENCEPHALOGRAM- BASED BRAIN CONTROLLED ROBOTIC WHEELCHAIR**



**Fig 3. BCI System.**

In this paper author[23] explained a Brain Computer Interface (BCI) stage for the development but the new significant improvement needs to be taken and bring back the quality of moving freely person with a disability. In this paper author explained EEG-based Brain controlled Wheelchair has to develop using BCI with the help of Neuro sky technology. The Event-Related Potential (ERP) offered the Neuro signal information and P300 component is commonly used. The signals will be processed by the Think Gear module in MATLAB.

#### **2.14. BRAINWAVE CONTROLLED ROBOT USING BLUETOOTH**

In this paper [24] author proposed and describes the brain controlled robot based on Brain-computer interfaces. BCIs systems that can bypass a conventional channels of communication (i.e., muscles and thoughts) that can provide direct communication and control between the human brain and physical devices by translating different patterns of brain activity in real time. This robot is self controlled with the ultrasonic sensor. The intention of the paper is to develop a robot that can assist the disabled people in their daily life to do some work independent on others this is the main goal.

#### **2.15. EEG-BASED BRAIN-CONTROLLED MOBILE ROBOTS: A SURVEY**

Author [25] explained EEG-based brain-controlled mobile robots that can serve a powerful aids for severely disabled people in their daily life. especially to help them for moving voluntarily. In this paper author provide a comprehensive review of the complete systems, key techniques, and evaluation issues of brain-controlled mobile robots related future research and development issues. author conclude in this paper with the current

challenges and future research directions are required.

### **3. CONCLUSION**

This paper reviewed several approaches to boost the performance of existing BCI controlled robot by using BCI systems. This survey will work as guideline for the practitioners to study different techniques and ways of BCI Techniques. Methods for assessing the performance of BCI based robot are explained briefly. It is concluded that with use of latest technologies and hybrid approach, a significant improved performance can be achieved. This area is having big scope for researchers and further research in this area will be helpful for benefit of needy persons and society at large.

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