

## **Brain Controlled Mobile Robot Using Brain Wave Sensor**

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**Abstract:** *In a brain controlled robot controller is based on Brain-computer interfaces (BCI). BCIs are systems that can bypass conventional channels of communication 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. With these commands a mobile robot can be controlled. The intention of the project work is to develop a robot that can assist the disabled people in their daily life to do some work independent of others. Here, we analyze the brain wave signals. Human brain consists of millions of interconnected neurons. The pattern of interaction between these neurons are represented as thoughts and emotional states. According to the human thoughts, this pattern will be changing which in turn produce different electrical waves. A muscle contraction will also generate a unique electrical signal. All these electrical waves will be sensed by the brain wave sensor and it will convert the data into packets and transmit through Bluetooth medium. Level analyzer unit (LAU) will receive the brain wave raw data and it will extract and process the signal using MATLAB platform. Then the control commands will be transmitted to the robot module to process. With this entire system, we can move a robot according to the human thoughts and it can be turned by blink muscle contraction.*

**Keywords:** *Braincomputerinterface, brainwavesensor, EEG, Bluetooth, Zigbee, matlab, brainwavevisualizer.*

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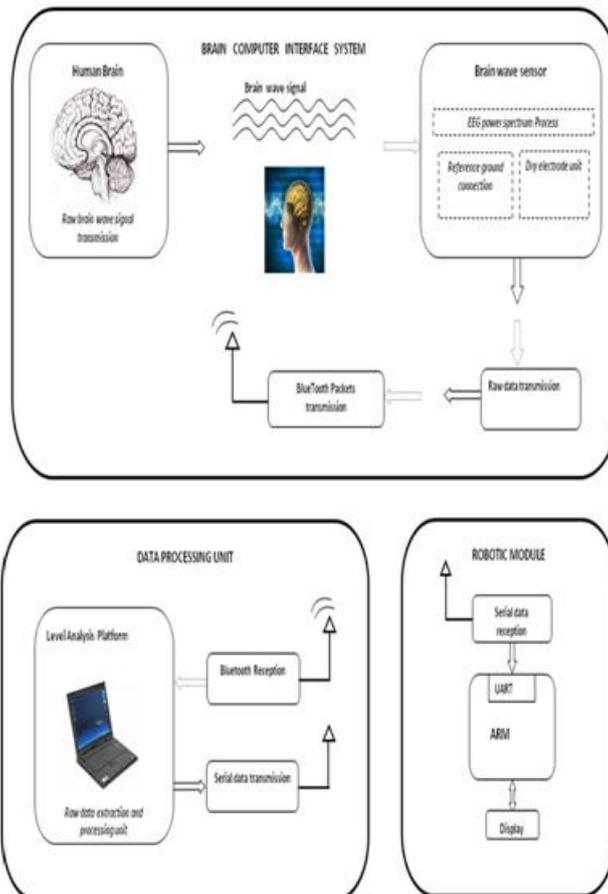
### **I. INTRODUCTION**

Human brain consists of millions of interconnected neurons. The patterns of interaction between these neurons are represented as thoughts and emotional states. According to the human thoughts, this pattern will be changing which in turn produce different electrical waves. A muscle contraction will also generate a unique electrical signal. All these electrical waves will be sensed by the brain wave sensor and it will convert the data into packets and transmit through Bluetooth medium. Level analyzer unit (LAU) will receive the brain wave raw data and it will extract and process the signal using MATLAB platform which is shown in data processing unit. Then the control commands will be transmitted to the robotic module which is the vehicle section. With this entire system, we can move a robot according to the human thoughts and it can be turned by blink thoughts and it can be turned by blink muscle contraction. Electroencephalography (EEG) is the measurement of electrical activity in the living brain. In this project we used a brainwave sensor to analyze the EEG signals. This design discuss about processing and recording the raw EEG signal from the Mind Wave sensor in the MATLAB environment and through Zigbee transmission control commands will be passed to the Robot section. Mind wave sensors are not used in clinical use, but are used in the Brain Control Interface (BCI) and neuro feedback. The BCI is a direct communication pathway between the brain and an external device 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. This project work consists of a Processor using ARM7 core, brain wave sensor and alert unit obstacle detection unit as hardware parts and an effective brain signal system using Matlab platform. In this project initially the person's attention level or else the driver's drowsy level should be found out by the Brainwave Sensor. Whenever a person is starting the car, the brain wave sensor unit will calculate the blinking level and it will compare with the minimum attention levels of human when ever not sleeping. Set point then automatically vehicle will move without any problem. In case if the blinking levels will cross the set point, then the vehicle will stop and vehicle driver will getting an alert. Most case, we can compare the owner's blinking levels with stored blinking levels. Now, the owner has to check whether the robot move or not. If he is a not walking then the robot will automatically start.. But if he is normal mode then the vehicle will run and there is no alert. Once the car received blinking command it will stop regardless the place. Further, if the owner wants to move the vehicle he has a need to come normal mode. This will help to avoid the movement during in person. The existing system is not having any remote control operation. Depend on others to operate and No muscle contraction sensing and the proposed system is having the Brain wave analysis for the signal which are taken from the human brain as shown in the block diagram, is having controlling of the robot using Human thoughts, Self controlled and operating facility for not to depend on others to operate and having Bluetooth communication between the operating system and brain wave sensor

**1. SYSTEM OUTLINE**

The brain controlled robot basically works on the principle of capturing the brain wave signals utilizing it for the movement of robot. This when equipped with the wheel chairs of disabled persons who can't speak or move their hands will be useful for their movement independently. Here the brain wave analysis is being performed, the brain thoughts is not being captured instead the brain concentration level is being measured. This robot can be utilized for multiple purposes. Here the User Interface can be developed in java & the robot can be serially controlled from PC. This can be done by wirelessly controlled using Bluetooth module, for increasing the range GSM module also can be used. If the API is developed in android then it also can be controlled using an android platform based embedded device. However, BCI development is no longer constrained to just patients or for treatment, there is a shift of focus towards people with ordinary health. Especially gamers are becoming a target group that would likely to be adaptive to use EEG as a new modality giving them advantages or new experiences in gameplay. It is not just treatment in mind, but entertainment also. This shift could benefit patients, because when EEG technology becomes more available, and the powerful gaming industry gets involved, they can become the same driver for improvements as they are for all silicon-based technology needing, and thus getting, faster processors and graphic engines so they can create better games. By taking BCI to the level of entertainment, the motivation for making more user friendly, faster, cheaper and public available systems will be totally different and become of a much higher priority. The targeted groups of users are not forced to utilize BCI systems, and thus needs better reasons for wanting to, other than it is cool to be able to control your computer with the mind. Current systems do not meet such standards. The motivating thought is that approaching this issue from an entertaining point of view could help getting BCIs to such standards faster.

**II. SYSTEM MODEL**



**Fig.1** BCI data processing and Robotic module system

The aim of this thesis work is to analyse the EEG data of normal ,voluntary and imagination of movements thereby studying how EEG activity changes with movements by differentiating the event related synchronisation and desynchronisation of rythms occuring in the sensory motor cortex. This work also aims to determine whether similar changes occur in both imagination and actual movements thereby determining

whether humans can control robot using their thoughts in EEG based Brain Computer Interface. The development of feature extraction and classification algorithm is not aimed in this thesis work, but the result in this system target for development of classifiers which will improve the speed and accuracy of EEG based BCIs.

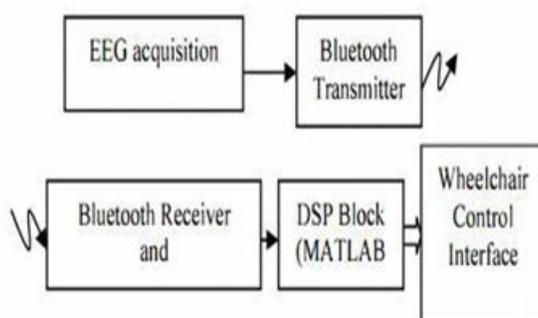
### III. PERIPHERAL DESCRIPTION

Brainwave Headset which is provided by Neurosky Technologies and those signals will be transferred by using Bluetooth which is there in the Mindwave headset, for this Mindwave headset need to give power using an AAA battery. The Mindwave headset comes with Power switch, a sensor tip, flexible ear arm and a ground connection Ear clip. In this Headset they use Non-invasive sensor that won't cause any pain to the User who were the headset. After inserting an AAA battery switch on the Mindwave headset using the power switch the LED indicator will blink and if the Red color light not blinking the headset is powered on but not connected to with the computer's Bluetooth. If the Blue color not blinking that means the headset is powered on and connected. If the red or blue color blinks it shows that the Battery getting low. Data transmitted by the Mindwave headset will be received by the Computer's Bluetooth receiver. After the analysis of this data, this data will be sent to the robot module using serial data transmission i.e. using XBee. In that robot module there will be an XBee receiver will receive the data which is transmitted by the XBee transmitter. According to the data received by the XBee the ARM processor will give the directions to the motors which are connected with a relay and a driver circuit. And all this information will be displayed on the LCD display.

#### 1.THINKGEAR

ThinkGear is the technology inside every NeuroSky product or partner product that empowers a device to interface with the wearers' brainwaves . It includes the sensor that touches the forehead, the contact and reference points located in the ear clip, and the on-board chip that processes all of the data. Both the raw brainwaves and the eSense Meters are computed on the ThinkGear chip.

To control the wheelchair, EEG and Eye-Blinking signals are needed. Here this paper describes EEG and Eye-Blinking signals through a BCI interface. In this system we have a tendency to use simple unipolar electrode to record EEG signal from the forehead to construct a Brain-Computer Interface (BCI) primarily controls electrical wheelchairs through Bluetooth for unfit patients. We have got two signals like meditation and attention. In addition, we also extract the eye-blinking signals from BCI. Therefore, attention and eye-blinking signals are collected as the management signals through a Bluetooth interface and therefore the electrically interface in electric chair. The experimental results confirmed that this system will offer a convenient manner to control an electrical wheelchair . The framework for the signal processing of EEG Signals with Blue-tooth interface.



**Fig 2** Framework for Signal Processing of EEG Signals with Blue-Tooth Interface

Framework for the signal processing of EEGs with Bluetooth interface is explained. The EEG signal was extracted from EEG securing. In this system, we use the NeuroSky's headset Mindset to record EEG and eye blinking signals with headphones on the sensor to read brain waves, the brainwaves are transmitted by the Bluetooth wireless modules. In the receiving part, we use a Bluetooth module in a personal computer with a software interface organized by using of MATLAB. Two types of EEG signal are classified, for example, raw EEG and long EEG. The raw EEG signal is used to convert electrical voltage to control the electric wheelchair. Then we classified two kinds of digital signal, for example, Attention and Meditation from long EEG brainwave.

#### 2.PRINCIPLE OF BCI

A BCI has an input (e.g. electrophysiological activity from the user), an output (i.e. device commands), components that translate input into output and a protocol that determines the onset,offset, and timing of

operation. Signals from the brain are acquired by electrodes on the scalp or in the head and processed to extract specific signal features (e.g. amplitudes of evoked potentials or sensory-motor cortex rhythms, firing rates of cortical neurons) that reflect the user's intent. These features are translated into commands that operate a device (e.g. a simple word processing program, a wheelchair, or a neuroprosthesis). Success of BCI operation depends on the interaction of two adaptive controllers, user and system. The user must develop and maintain good correlation between his or her intent and the signal features employed by the BCI and the BCI must select and extract features that the user can control and must translate those features into device commands correctly and efficiently.

### 3.SENSOR DESCRIPTION

It is an efficient means it has a tendency to divide brain-controlled mobile robots into 2 classes consistent with their operational modes. One class is termed "direct management by the BCI," which implies that the BCI interprets graphical record signals into motion commands to regulate robots directly United Nations agency first developed a brain-controlled robotic chair whose left or right turning movements are directly controlled by corresponding motion commands translated from user brain signals whereas imagining left or right limb movements, and tested this technique in real-world things. The robotic platform is illustrated also used a BCI based on motor imagery to build a brain-controlled mobile robot, as illustrated which might perform 3 motion commands which is blink, meditation and attention together with turning left and right and going forward, and valid this automaton during a planet.



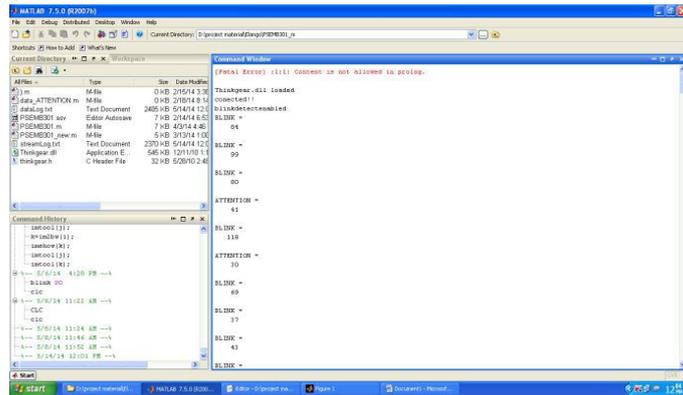
Fig 3 Mindwave Headset Provided by Neurosky

## IV. SYSTEM OUTPUT

### a) Simulation of BCI

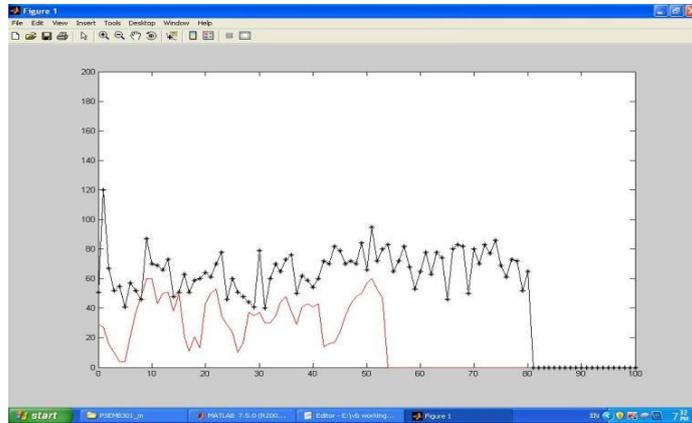
```
97  
98- if (calllib('Thinkgear','TG_GetValueStatus',connectionId1,TG_DATA_BLINK_STRENGTH) ~= 0) %if RAW has b  
99- } + 1;  
100  
101- data_BLINK (j)=calllib('Thinkgear','TG_GetValue',connectionId1,TG_DATA_BLINK_STRENGTH);  
102- disp('BLINK = ');  
103- disp(data_BLINK (j));  
104  
105- if(data_BLINK(j) > 55 )  
106- Blink = Blink+1;  
107- end  
108  
109- if(Blink == 3)  
110- Blink=0;  
111- Drive_mode =1;  
112- end  
113  
114- if(Drive_mode == 1)  
115  
116- if(Blink==1)  
117- helpdlg('Right Turn');  
118- fwrite(serialOne,'r');  
119- fclose(serialOne);  
120-
```

**b) Performance of Sensor**



brainwave is connected and blink is detected and after that it will show the attention values and Blink values of brain wave sensor.

**c) Analyze of signal**



Attention and blink values graph will be generated and the graph there will be two signals, the Black Signal is Blinking level and the red signal is Attention signal.

**d) Brain Wave Visualizer**



It visualize the brain wave signal and indicate the blink, attention level and meditation level and the sensing of brainwave sensor and connect the sensor and system by think gear connector.



## V. CONCLUSION AND FUTURE ENHANCEMENT

The signal generated by brain was received by the brain sensor and it will divide into packets and the packet data transmitted to wireless medium . Level analyzer unit (LAU) will receive the brain wave raw data and it will extract and process the signal using Matlab platform. Then the instructions will be sending to the home section to operate the module. The project operated with human brain assumption and the on off condition of home appliance is based on changing the muscle movement with blinking.. Then the control commands will be transmitted to the robotic module to process. With this entire system, we can move a robot according to the human thoughts and it can be turned by blink muscle contraction.

The research and development of brain-controlled mobile robots have received a great deal of attention because they can help bring mobility back to people with devastating neuromuscular disorders and thus improve their quality of life. Improving the BCI system performance to make brain-controlled mobile robots usable in real-world situations

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