EEG BASED MOBILE ROBOT CONTROL THROUGH ADAPTIVE BRAIN COMPUTER INTERFACE

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ABSTRACT

The implementation of brain-controlled mobile robots is to assist and incorporate mobility to patients suffering from debilitating degenerative muscular diseases. The proposed methodology is to acquire EEG signal with simple electrode, hardware implementation of robot. The proposed scheme maneuvering ability can be improved to navigate in uneven and obstacle ridden surfaces. The proposed system contains accuracy increased, compared to predetermined accuracy level. Hence the system has high efficiency with the disabled person. Thus the accuracy is 95%

Keyword:-*Electroencephalogram, Brain Computer Interface, accuracy, efficiency*

1.INTRODUCTION

A major challenge in two-class Brain Computer Interface (BCI) systems is the low bandwidth of the communication channel, especially while communicating and controlling assistive devices, such as a smart wheelchair or a robot, which requires multiple motion command options in the form of forward, left, right, backward, and start/stop [1]. Brain–computer interface technology provides a means of communication that allows individuals with severely impaired movement to communicate with assistive devices using the electroencephalogram (EEG) or other brain signals.

Brain-Computer Interfaces (BCI) allow for direct communication between a person's brain and technical devices with the need for motor control. BCIs thus constitute a promising assistive technology device for people with severe motion impairment[2]. BCI is also called as Mind-Machine interface, which provides a direct contact path between the human brain and the computer or external devices. The activities of electrical signals can be obtained by firing millions of neurons in the brain. Among many different applications, researchers suggested their use for wheelchair control, thus rendering BCIs of high value for people with severe paralysis who are not able to control a wheelchair by means of a joystick[3]. Among different input signals for BCI control, electroencephalography (EEG) appears viable for wheelchair control due to its high temporal resolution and portability.

The experiment results confirmed that this system can provide a convenient manner to real time control a wheel chair. Like any communication system a BCI has inputs (electrophysiological signals that result from brain activity monitoring) outputs (device actions), elements that transform inputs into outputs, and a protocol that determines its operation. The subject controls the active device by performing mental tasks which are associated with actions that are dependent on the BCI application.

The rest of this paper is organized as follows. Section II provides a detailed description about the proposed system, which provides explanation about the Brain Robot Control section. Section III provides the explanation about the obtained simulation results. Section IV deals with the conclusion and future scope.

2.PROPOSED SYSTEM

Electro Encephala Gram based Brain-Computer Interface mobile robots can help as powerful support for severely disabled people in their regular activities, especially to aid them to move voluntarily. This proposes and implements a brain signal controlled robot to yield four different directional movements. The schemes uses a three electrode acquisition scheme, PIC controller based driving unit and robot module.

It implements a brain controlled robot through the following modules, namely
i. Electro Encephala Gram (EEG) acquisition unit
ii. Electrode Signal Processing Connectivity Scheme
iii. EEG processing Algorithm
iv. Control Signal transfer from EEG processing unit to robot module
v. Robot module
Specifically, three electrodes are used to capture the signal from the brain, which makes the subject to move in respective directions. The electrical activity of brain can be acquired by BCI's in two broad methods namely invasive and non-invasive.Non Invasive methodology is based on the recordings of Electro Encephalo Graph (EEG) from the head [4].

Figure.1 shows the BCI system. The BCI system provides solutions for paralyzed people forsimple communications with the outside world.

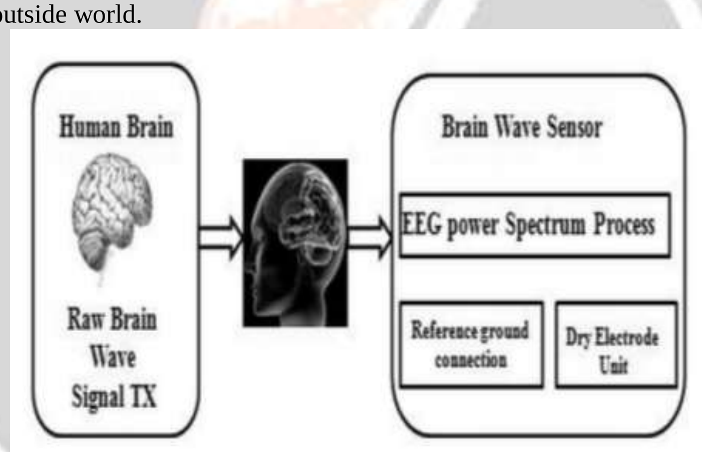

Fig-1:BCI system

The implementation of hardware and software improves the efficiency in real time. Accuracy of threshold values is attained. The proposal involves variation of threshold values. The threshold value varies from person to person. The overall interfacing is explained by the following block diagram .

The block diagram shown in figure 2 is the transmitter and reception section. It consists of sensors interfaced with the embedded controller along with the brain signals processed in the MATLAB [5]. The results are been displayed in the LCD screen. Initially three EEG sensors are placed in frontal lobe of head to capture the neural signals. The captured signals are analog in nature and it is send to microcontroller and operating frequency is 5V.The MATLAB is a programming language where with the help of algorithms and programs we can plot the electrode values. The embedded controller is for interfacing the signals from the various components and the signal taken from brain and processing them using MATLAB to produce the desired results. From the microcontroller UART is connected. Here UART is in serial communication and half duplex with microcontroller. The LCD display is used to display, which movement is to perform such as right, left, forward, backward and stop. We use a 16*2, 40 pin LCD system interfaced with the microcontroller unit. The MATLAB is plotted with time period and amplitude and fed to UART by half duplex communication.One of the most common inertial sensors is the accelerometer, a dynamic sensor capable of a vast range of sensing.

Accelerometers are available that can measure acceleration in one, two, or three orthogonal axes.The accelerometer sensor is used to locate the head position so the signals from brain and movement of head is matched then the motion is processed in wheel chair. Like any communication system a BCI has inputs (electrophysiological signals that result from brain activity monitoring) outputs (device actions), elements that transform inputs into outputs, and a protocol that determines its operation.

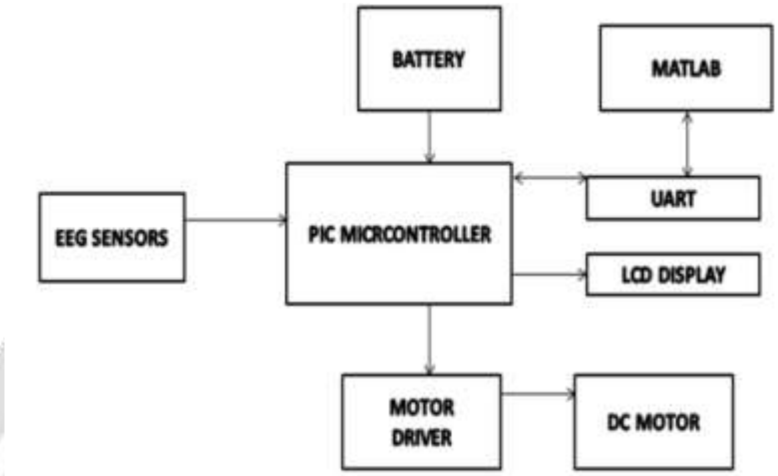

Fig-2: Block diagram of hardware design of measurement of signals

The key is to take BCI technology beyond the demonstration stage to the real world applications, so that the quality of life for paralyzed patients is improved.

We detected the changes in the EEG patterns due to mental tasks. The BCI technology performs simultaneous operations. Separate channels are assigned for the three separate electrode positioned signals.The different BCI groups have proposed numerous brain controlled wheelchair (BCW) models that incorporate various control strategies to ensure more safety, minimum uncertainty and reduced cost. The key is to take BCI technology beyond the demonstration stage to the real world applications, so that the quality of life for paralyzed patients is improved.

Fig-3: Brain Control Robot section

Figure 3 is the typical brain control robot section.The subject controls the active device by performing mental tasks which are associated with actions that are dependent on the BCI application.The dc driver circuit is used for the proper working of the dc motor connects at the wheels of the wheel chair model. It is used for enabling and stopping the motors present at the wheel chair. It helps the subjects with various neuromuscular disorders by providing them a way of communication to the world, through extracting informationabout their intensions.

3.SIMULATION RESULTS

Figure 4.represents the direction of left, right, forward, reverse according to the measurements of brain signals via ionic fluctuations. Here HIGH TECH technology is applied, the mode is available for unlicensed customers. The basic compiler operation, supported devices and available memory are identical across all modes.

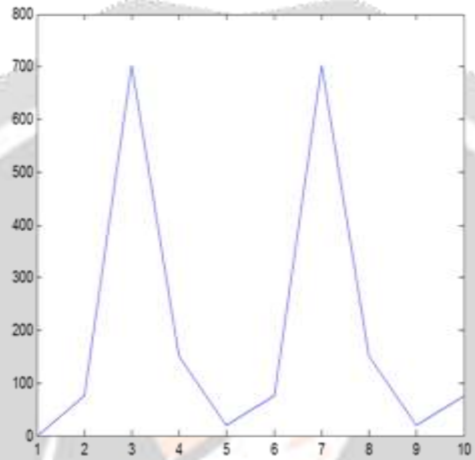

Fig-4:Output image of MATLAB

Figure 5 shows simulation of software module. Electrodes and action sensors are involved for motor operation.The two interfacing communication devices are com3 and com4.The decision making in the knowledge component is acquired from interference tools in proteus. The overall efficiency obtained is 95% in the section of signal capturing from brain. Hence the delay is totally absence and time consumption is higher in order to help the paralyzed person instantly.

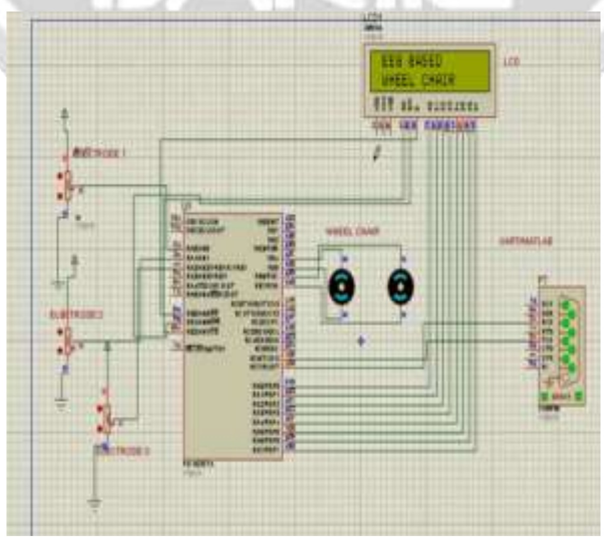

Fig-5:Simulation of software module by PROTEUS

4. CONCLUSION AND FUTURE SCOPE

The proposed system contains accuracy increased, compared to predetermined accuracy level. Hence the system has high efficiency with the disabled person. Thus the accuracy is 95%. The evaluation of brain–actuated wheelchair with motor–disabled patients in partnership with medical practitioners and rehabilitation clinics, but this is an arduous process that will take significantly longer than the initial trials with healthy subjects. This is for a number of reasons, not least that patients tend to take part in fewer sessions per week and generally tire more quickly than healthy participants. This leads us to another one of the exciting new challenges for the future of such shared control systems. Since each user's needs are not only different, but also change throughout the day (e.g. due to fatigue, frustration etc.), it is not sufficient that a shared control system offers a constant level of assistance.

5.REFERENCES

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