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Robotic Arm Control by Brain Computer Interface using LabVIEW

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Abstract. Brain computer interface (BCI) is the method of choosing the pathway other than brain's natural neural circuitry for delivering the impulses outside the body for control and processing, in order to interact with the external world. It is done by picking up signals from different regions of the brain through electroencephalography (EEG). This paper set up the use of BCI to control the simulation of a virtual robotic arm on software LabVIEW. It makes use of arbitrary simulated EEG signals to control the arm.

Keywords; 19-lead EEG waveform selector; alpha waves; International 10-20 System

1. Introduction

EEG is the recording of minute electrical signals generated by neurons in brain. It is done by placing electrodes on the scalp at the positions suggested by International 10-20 System. Particularly, C3 and C4 collect the signals from cortex for motor control. Different types of waves are generated by brain's electrical activity; we made use of alpha waves which range from 8Hz to 13Hz when person is awake and relaxed. Previous work on BCI done by Rajesh Singla signifies its use for paralyzed patients to control the position of bed [1]. Use of this interfacing technique to control a particular

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actions such as cursor on a computer screen for making choices, is elaborated by Wolpaw [2].This paper explains the approach of controlling the motors of virtually simulated robotic arm to rotate it at three joints using LabVIEW, for the people who have completely lost the control of motor muscle activity

2. Methods

As EEG signals are not collected on real-time, arbitrary signals are generated on LabVIEW using a 19-lead EEG waveform selector to control the movement of virtual robotic arm. Signals from this waveform selector are collected through a collector, and a band pass filter extracts the alpha waves from the EEG signal. This signal is converted to frequency domain by using spectral measurements as shown in Fig (1). Now, logic is set using peak detectors to distinguish whether the movement is baseline activity, right hand movement or left hand movement. A case structure is made with the increment for true condition through the continuous loop and zero value for false condition. When a movement is detected, increment starts, which is fed to the robotic circuit selected from examples of LabVIEW. Increment functions as increase in angle of robotic arm movement.

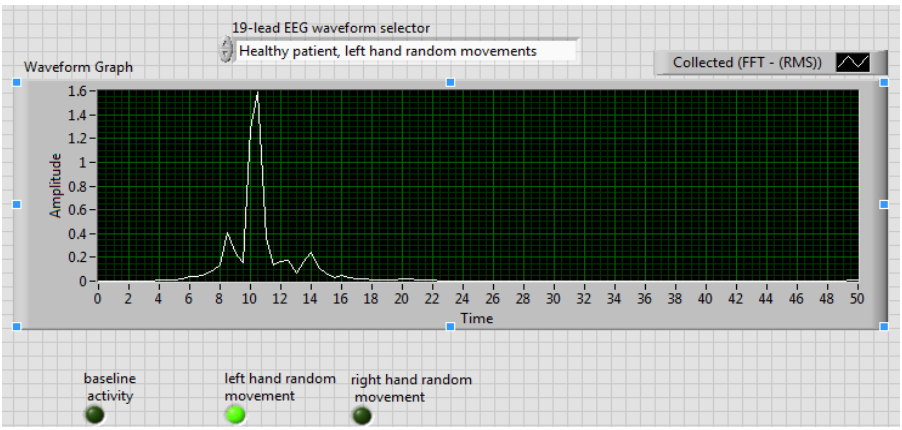

Fig. 1. Left hand random movement graph

3. Results

Fig (2) illustrates the movement of motors at joints of virtual robotic arm controlled by EEG signals.

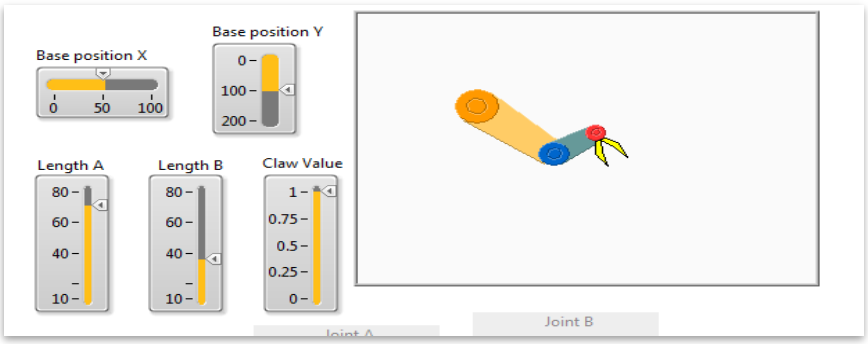

Fig. 2. Test

4. Conclusion

EEG signals are analyzed and processed to control robotic arm. If we get these signals from patient and interface it with software to control a real robotic arm, it can help the paralyzed to recuperate their normal muscular activity

References

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