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EMG Signal Acquisition and Classification System

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ABSTRACT

Measuring muscle activation via electric potential, referred to as electromyography (EMG). EMG has traditionally been used for medical research and diagnosis of neuromuscular disorders. However, with the advent of ever shrinking yet more powerful microcontrollers and integrated circuits, EMG circuits and sensors have found their way into prosthetics, robotics and other control systems. Electromyography (EMG) is the non–invasive recording of electrical muscle activity that is used to diagnose neuromuscular disorders, among other applications. Muscle fibers are activated by motor neurons and the resulting electrical signals produced by the muscle fibers can be detected by electrodes placed on the surface of the skin. Electromyography (EMG) measures the electrical impulses of muscles at rest and during contraction. As with other electrophysiological signals, an EMG signal is small and needs to be amplified with an amplifier that is specifically designed to measure physiological signals. When EMG is measured from electrodes, the electrical signal is composed of all the action potentials occurring in the muscles underlying the electrode. This signal could either be of positive or negative voltage since it is generated before muscle force is produced and occurs at random intervals. A method of pattern recognition of EMG signals of hand gesture using spectral estimation and neural network. The work proposed in this project is motivated by the need for stronger classifiers that would help to implement the human-machine interface. The electrical activity of skeletal muscle finds useful applications in many fields, such as biomechanics, rehabilitation medicine, neurology, gait analysis, exercise physiology, pain management, orthotics, incontinence control, prosthetic device control, even unvoiced speech recognition and man–machine interfaces.

Keywords: Electromyography (EMG), A/D Converter, PC, Neuromuscular

I. INTRODUCTION

Design of EMG signal acquisition and classification system project is use to get muscles signal and plot it on PC. Muscles signal are pick up from body with the help electrodes which are connect on hand or any other muscles of body and amplified. Frequently more than one amplification stages are needed, since before the signal could be displayed or recorded, it must be processed to eliminate low or high frequency noise, or any other factors that may affect the outcome of the data. The point of interest of the signal is the amplitude, which can range between 0 to 10 mill volts (peak-to-peak) or 0 to 1.5 mill volts (rms). The frequency of an EMG signal is between 0 to 500 Hz. However, the usable energy of EMG signal is dominant between 50-150 Hz. There are two reasons to amplify the signal. First, amplification increases the level of signal enough to protect an electrical interference during transmission. Second, the signal is amplified so that it could be stored in a storage device, or displayed by a measurement device like oscilloscope.

This signals wirelessly transmit to PC to analyse. The signals are modulated and transmit it to receiver. Receiver demodulate signal and convert it into digital form and fed to PC through microcontroller 8051. On PC software is used to analyse the EMG signal. It is helps to analyses moment of muscles. This project also use in measuring signals like oscilloscope. One signal

can be possible to receive by more than one receiver. It has two channels to analyse signal on PC therefore at a time we can able to observe two signals and compare it.

This project can then be used to design a new electromyography signal conditioning circuit that would have good performance characteristics, will be reduced in size and power and be possible to manufacture and maintain in an academic setting.

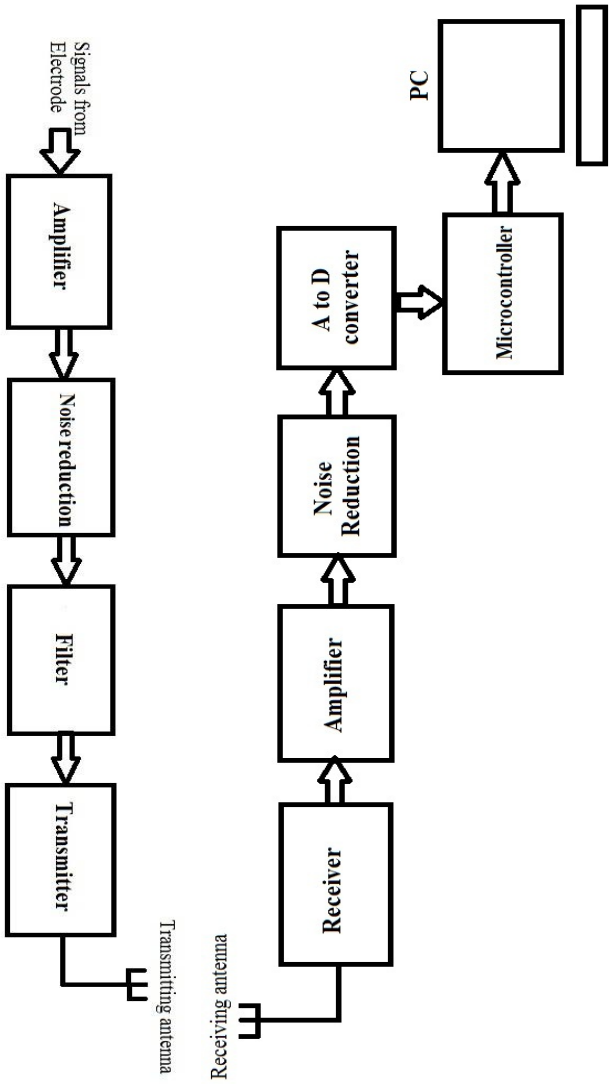
II. METHODOLOGY

Electrodes are connected to muscles. There is more than one electrode connected to analyse signal. It converts muscles vibration into electrical signal. Electrodes pick up the signal which is in analog signal and fed to amplifier.

Amplifier is voltage amplifier which increases the voltage of signal. It special amplifier which amplify signal of uV to desired level of modulation. Noise reduction process helps to remove noise signal from desired signal and filter allow only low frequency signal.

Amplified output signal is modulated to transmit it to receiver. Modulation is use to transmit signal to a large distance and to communicate with minimum noise. The signals are wirelessly transmit through antenna. (using zigbee technology) In transmitter part their battery power supply to all circuits. If this circuit is portable or place on body then battery should be light weighted required. It is rechargeable battery. There is possible that more than one receiver. It receives the signal through receiving antenna and demodulates it. After demodulation signal is in' original form.

Amplifier is voltage amplifier which increases the voltage of signal. It amplify signal to desired level of A to D converter. Noise reduction process helps to remove noise signal from desired signal and A to D converter convert analog signal into digital form. Microcontroller is interface with PC through USB port. Hence incoming data from A/D converter is converted into serial form and fed PC. Microcontroller is responsible for serial communication with PC.



On PC there is oscilloscope software which plot EMG signal according to received data. This signal helps to analyse EMG signal. It is two channel software hence there is possible to analyse two signal at a time. Also software have additional feature to presses on signal.

III. APPLICATIONS

1. Robotics:- This system will use to control robot by using human gesture.
2. Medical:- Biomechanics, orthotics, prosthetic device control, etc.
3. Athletes Strength Training:- It is use to monitor the muscles of Athletes when muscle fatigue.
4. Videogames:- It possible to give command for handling games.

IV. CONCLUSION

In this paper we proposed the emg signal acquisition and classification system using wireless technology that is zigbee. Using this wireless technology we can acquire the emg signal through the body at a time of motion. Due to this there is a flexibility in acquiring the emg signal for analysis from the body of a sportsperson. As the zigbee is a advance wireless communication technology there is very less error in the transmission of the signal from the transmitter to the receiver.

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