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Myoelectric Prosthetic Arm

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Abstract

A myoelectric prosthetic arm can replace the missing arm that has been lost due to accident or diseases. This physical impairment limits the motor abilities of human arm. Our project aims to develop a cost effective arm using surface EMG electrodes. The muscle signals are collected using a sensor, processed and given to a microcontroller to rotate the servo motors accordingly. The magnitude of voltage signal decides the servo motor to be operated.
Keyword- Action Potential, EMG Electromyography, EMG Signal Processing, Prosthesis

I. INTRODUCTION

In the present scenario, the prosthetic arm available in the markets are complex, heavy and costly. Our project has been an exploration in currently available prosthesis and came up with a low cost alternative .The prosthesis is designed with basic movements and other movements can be added in future.[1]The arm can be controlled using myoelectric (EMG) signals because the amputation will not affect neuromuscular system of amputees .

A. EMG Signal Generation and Acquisition

Under normal conditions, an action potential propagating down a motor neuron activates all the branches of the motor neuron; these in turn activate all the muscle fibers of a motor unit.[2] The motor unit action potential trains from concurrently active motor units superimpose to produce the resultant EMG signals.[2]Here ,non-invasive surface electrodes are used for collecting signals.

B. ARM Movement Controlling Section

There are three servo motors connected to the controlling unit .They are controlled by the output of EMG section .The EMG signal is converted to corresponding digital values by the ADC in the microcontroller. The motors are controlled by using these digital values. [3]

II. METHODOLOGY

The products already available on the market was carefully studied and the new design focused on the needs of the user. The positive and negative electrodes of the sensor is placed on the muscle of interest and the reference electrode at a bony part. The acquired signals are given to sensor modules which gives unipolar analog voltage output in millivolt range. [4]

The microcontroller converts it into digital values whose magnitude decides the motor to be operated .The prosthetic arm was developed by 3D printing.

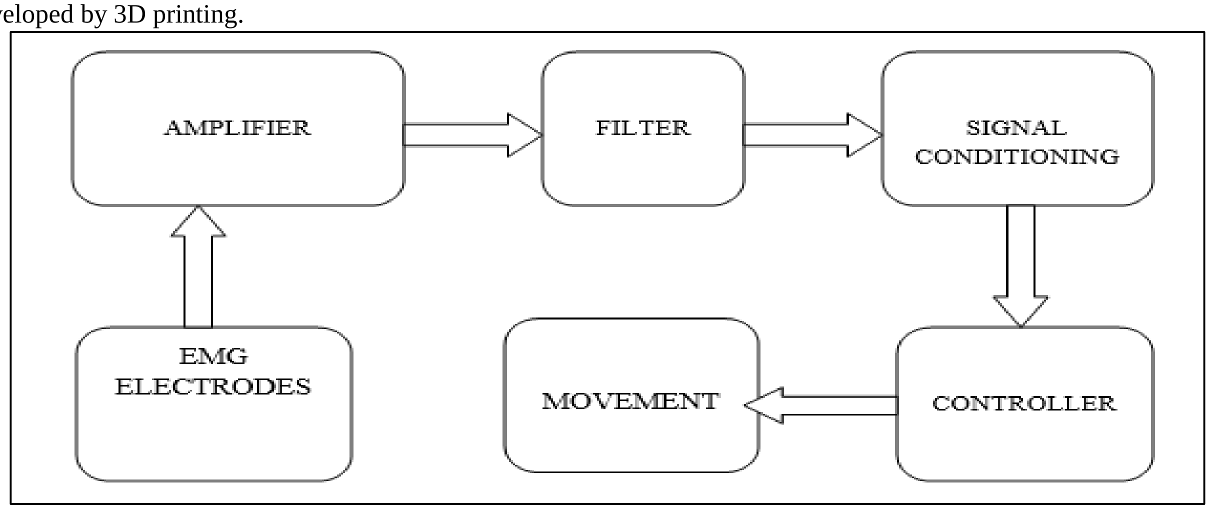

Fig. 1: Block Diagram

III. CONCLUSION

Amputees suffer from many difficulties due to their physical impairment .The primary objective to provide a "helpng hand "to them was done .The proposed model has to be trained to increase its flexibility .In some cases it was necessary to re-learn how muscle groups work. It is difficult to obtain more than two to three degrees of freedom. [5]

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