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Review of Software to Analyse the Physical Conditions of the Athletes using sEMG

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ABSTRACT

Electromyography measures muscle responses of a nerve's simulation of the muscle. EMG is generally measured or recorded through surface, needle or wired electrodes. The surface electromyography is a commonly used technique for measuring the muscle exhilaration. The purpose of this project is to evaluate the use of sEMG in the practical context and to translate the given context to the appropriate analysis. The sEMG are used on the athletes while they are running and respective results are being noted. By using this technique our project wishes to implement an android/iOS application to calculate the corresponding values which are being noted by the particular device which we have been made. The signals which are being given by the device is converted into the appropriate percentage values or graphs which can be determined into giving a complete overview about the person whom he is checking and can suggest the diets and exercises to make that person fit to the expectations. This software is mainly look forward for the development of the future athletes which can win the prizes. This platform provides immense forms of diets which are based on the values or results which have been depicted. Performance analysis in sports is considered to be an integral component of understanding the requirements of the optimal performance. Several measurement techniques have been used to inspect the performance of the best athletes today. it is mostly commonly done in laboratory where physiology and bio-mechanics can be analyzed. in this system first, the coaches conduct a study about the agility, strength and nutrition of the excellent players of the country. Then the coaches of the respective clubs or the schools check each and every student's physical condition and compare with the stored data in order to train them. The project has got direct advantage to the aspiring future athletes of the country and also to the health-conscious society by providing them a device to calculate on their body metrics and work around to improve on it.

KEYWORDS: *Electromyography, Surface Electromyography, Sports, Muscle analysis*

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1. INTRODUCTION

Healthy lifestyle is an important aspect in our life. The present-day food habits and lifestyle make it difficult to lead a healthy life. So, it is important to take care of our health by following diet plans which are suitable to our body. Our project aims to provide diet plans suitable for each individual by measuring muscle strength using the technic surface electromyography This technic will be more helpful for athletes. This present equipment Electromyography helps only to measure muscle strength. While the existing system of electromyography helps only to observe the variations in muscle strength Our software provides diet plans which are adequate for maintaining the muscle strength. Surface Electromyography is an improved version of electromyography. Electromyography is painful as it makes use of needles for measuring muscles. The improved version, Surface Electromyography is a non-obvious method to quantify the electrical muscle activity with multiple closely spaced electrodes overlying a restricted area of the skin. Our software converts the analog readings of surface electromyography into digital values. The database of our software consists of predefined diet plans prepared by doctors. When we upload the digitalized readings of muscle strength the software displays suitable diet plans apt for each individual.

2. OVERVIEW OF THE BASICS

2.1. Electromyography

Electromyography (EMG) is an electro-diagnostic procedure for the assessment of the health of muscles and the nerve cells that control them by recording the electrical activity produced by muscles of the EMG results can be used to show if the muscle is damaged by nerve dysfunction, muscle dysfunction or problems with nerve-to-muscle signal transmission.

Electromyography is recorded using an instrumental device with three specified sensors called an electromyograph to produce a documented report called an electromyogram. the electromyograph detects the electrical potential generated by muscle cells that control the muscles. when these cells are

electrically or neurologically activated by contraction and relaxation of the muscles the neurons transmit electrical signals. An EMG uses tiny sensors called electrodes to translate these electrical signals into corresponding information like graphs, sounds or numerical values that are then interpreted by a specialist. there are two types of electrodes

Needle and surface During a needle EMG, a needle electrode inserted directly into a muscle records the electrical activity in that muscle. The other part of an EMG uses electrode stickers like sensors applied to the skin (surface electrodes) to measure the speed and strength of signals traveling between multiple points.

2.2.1. Surface Electromyography

Surface EMG electrodes provide a non-interfering technique for measurement and detection of EMG signal. The theory of these electrodes is that they form a chemical balance between the detecting surface and the skin of the body through electrolytic conduction, so that current can flow into the electrode. These electrodes are simple and easy to implement. Application of needle and fine wired electrodes should require strict medical supervision. Surface EMG electrodes require no such formalities.

Surface EMG electrodes have found their use in several behavior studies, neuromuscular data documentation, sports medical appraisals and for subjects who is against to needle insertions such as children. Surface EMG is being increasingly used to detect muscle activity in order to control device augmentation to achieve prosthesis for physically disabled and sever population. Surface EMG accesses muscle function by recording muscle activity from the surface above the muscle on the skin.

Surface electrodes are able to supply only a limited estimation of the muscle activity (CatherineDisselhorst-Klug, 2009). Surface EMG can be put down by a pair of electrodes or by a more complex arrays of multiple electrodes. Three sensor electrodes are needed because of EMG recordings to display the potential difference (voltage difference) between two separate electrodes and one with references.

3. INTO THE SYSTEM

3.1. EXISTING SYSTEM

A. Electromyography for assessment of pain in low back muscles

In this study 60 subjects are separated in 2 groups; 30 subjects with low back pain and other 30 without lower back pain The subjects are asked to layover on exercise bench with the low back hips and knee securely strapped to bench. While in this position the subjects were asked to stretch the trunks. Given the impossibility of performing this moment this attempt led to an isometric contraction of the low back muscles The EMG activity recorded bilaterally from the L1 and L2 muscles the surface electrodes were placed on the bellies of the muscle and alignment of muscle fibers. The EMG signal is converted into a linear equation and graphs are plotted The resulting data shows that the subjects with lower back pain produce force values less than that of subjects without lower back pain. (Candotti, 2008, pp. 1061-1067)

B. Electromyography used to identify risk of injury for female athletes

In this study the EMG is used to determine whether female athletes sustain an anterior cruciate ligament (ACL) In this study 55 female football players aged between 25 to 30 with no history of ACL injury were tested for EMG pre-activity of vastus laterails(back of the thigh) and medialis (quadriceps muscles)reaches femori's semitendinosus, and biceps femoris During a standardized side cutting maneuver. Two match seasons were conducted and 5 the 55 has sustained ACL INJURY Before the injury these five players displayed neuromuscular pattern that differed from non-injured players characterized by the EMG preactivitty for the vastus laterails(VL) On the basis of this findings a high risk zone was one standard deviation above the mean VL-ST difference (Hewett, 2005, pp. 347-350)

C. Development of Electromyography Signal Signature for Forearm Muscle

Electromyography (EMG) measures muscle response or electrical activity in response to a nerve's stimulation of the muscle. EMG is generally acquired through surface and needle or wire electrodes. The needle or wire electrodes are usually used by clinicians in a clinical setting. This paper concentrates on surface electromyography (sEMG) signal that is acquired in a research laboratory since sEMG is increasingly being recognized as the gold standard for the analysis of muscle activation. The sEMG can utilized for establishing signal signature for forearm muscles that becomes an important input in development of rehabilitative devices This paper discusses the establishment of sEMG signal signature of female and male subjects for forearm muscles such as extensor carpi radialis, flexor carpi radialis, Palmaris. (Elamvazuthi, 2015, pp. 229-234)

D. The Practical Uses of Surface electromyography during running

Muscle surface electromyography (sEMG) is a commonly used technique for measuring muscle activation The purpose of this review is to evaluate the use of sEMG in the practical context and whether this can be translated to on-field testing The sEMG are used on the athletes while they are running and the respective results are noted down From the results outlined in this review, sEMG appears to provide inconsistent results when assessing neuromuscular activity during running The general trends of the sEMG activity appear to correlate with running velocity and muscle fatigue seems almost always the consequence of prolonged, dynamic activity. (Subbu, 2015).

3.2. PROPOSED SYSTEM

We are proposing a new system where the trainer's coaches and other respective personnel can use this system to understand the muscle activity and strength to make the athletes fit enough to play their respective sports. This system mainly focuses on muscle activity which helps us to know the physical conditions of the athletes with the help of the SEMG. In this system first, the trainers and coaches conduct a study about the agility, strength, and nutrition of the excellent and reputed players of the country. Then the coaches of the respective clubs or schools check every student's physical condition i.e. the muscle activity of the athletes and compare this result with the muscle activity data of the excellent players which is stored in the system. the result provided by the system is a set of instructions in

the form of daily diet and exercises to train the athletes collectively. The trainers and coaches can have an advantage in teaching the athletes on the basis of the best athletes of the country who does all the same exercises and follow the same strict diet which will only help the athletes to relate and can also afford the same food items as those of the excellent players as they are from same country since different athletes from different country have different set of diets based on the weather conditions. The project has got a direct advantage to the aspiring future athletes of the country and also to the health-conscious society by providing them a device to calculate on their metrics and work around to improve on it

The main modules are
A. Input
B. Conversion
C. Comparison
D. Output

A. Input:
A signal that is generated by the devices are given which is from the body muscles in order to measure the strength of the muscles. For that we are using an EMG which collects the information of the muscle activity of a person. The response of each person to the electrical pulse is different. The athlete's information is collected in the form of an analog signal. Using the Surface EMG, we receive the analog signals, from the person by moving the muscle to which the electrodes are connected. This signal will carry some noise with them which causes a disturbance to the values so the signals cleaned and then amplified to produce a proper value for the rest of the operations

B. Conversion:
This module is used to convert the extracted analog signals from the SEMG and then converted into graph or a numerical value which best befits the system. This conversion will only help the system to procure results much faster for each operation since analog signals will only complicate the operations and makes it difficult to understand the working and comparison of the data for the people who has less knowledge about the analog signals and its characteristics. This conversion is done within the hardware setup.

C. Comparison:
The noiseless digital data obtained from the SEMG will be compared with the pre-defined standardized data that consists of values which is ideal for the perfect health of muscles and its activity. This comparison is done on the basis of one muscle at a time as SEMG is only capable of measuring one muscle at a time. Different people will have different values as they have different bodies and different body structures.

D. Output:
After all the operations the system provides appropriate diet plans and exercises for the patient which is based on database formed by gathering information from the doctors, dieticians and physical trainers. Basis on the variation of the results the corresponding nutrition and diet are suggested to the athletes. So different results will have different set of exercises and diet for that athlete which improves their overall health and these are all stored in a file. From this file we get information of nutrition and diet.

3.3. HARDWARE AND SOFTWARE REQUIRMENTS

3.3.1. H/W Requirements
A. Minimum 4 channel system with optical isolation with Ethernet connection for connecting to either to desktop system or laptop system for portable use.
B. Repetitive nerve stimulation
C. Insertional/Spontaneous EMG recording for minimum 600 secs on hard disk or unlimited buffer storage
D. EMG replay of minimum 600 sec of stored data from hard disk with audio and store in AVI format for review on any Windows Media Player PC.
E. Single Motor unit Analysis.
F. Sympathetic skin response

3.3.2. S/W Requirements
1. MATLAB or EMG analysis software for the analyzing process
2. Operating system that supports .wav files.

4. FUTURE TRENDS
In future it can be developed in to an application so that it could be wireless and need not be connected to a system. The users or the physical trainers can calculate the values using smart phones. With using the Bluetooth or the WIFI module the trainers can take input analog signals and send the values through these modules. this can help a lot people in the poor regions and people having poor infrastructure to train the athletes without any difficulties and at a very low amount. By following the instructions provided by the system the athletes can work hard and can achieve better goals in their lives.

Another trend which can be developed from this system is that it can create a one big community where all the trainers and athletes can share their data to the community. This community can be an online website where the trainers and the athletes can share their experience, their progressive status and the different techniques to cope up with different exercises and diet. The government and other private cooperation's can check this website and can select candidates for different sports and fitness competitions and can send them to it based on the status of the athletes provided by the website.

Later this system will be used for research and study by the scientists and doctors in the medical field where they can use these data on muscle strength and muscle activity of the people and compare with different people who have deformities within the different muscles on the body. The real-life data will help to understand the muscle activity and its characteristics better.

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6. CONCLUSION

From the existing systems discussed we can understand how to measure muscle activity from the respective muscles. This allows the trainers and coaches as well as the athletes who are participating to understand about the different muscles in our body and how they are used for different movements in different sports. By using SEMG it will cost less and also harmless to the athletes who are participating the events. The project makes the measurement procedure easier by just uploading the digital value of muscle strength.by suggesting suitable diet plan our project can become different from the existing system. Earlier people would have to depend on doctors or trainers for diet plans. But with the help of this software people could easily find out diet plans in accordance with the muscle strength reading. It would be more helpful for those who cannot afford a personal doctor or dietitian of their own. This system will also help to find the defects within a muscle and other problems which causes deteriorating the health of the muscle and much worser health problems Moreover, the software help to compare the earlier muscle strength readings so that one can easily understand the progress of each muscle in the body for different sports. This project aims to produce a better result by not comparing with other athletes, by taking the facts from the inner muscles readings This would pave a way for the other athletes to come to the front to perform at his/her strength. At the further progress, the software will be available in all platforms like Android, IOS etc.

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