International Journal of Advance Research in Science and Engineering
Volume No.07, Issue No.06, June 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

A Review on Use of prostethics as biosensor

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ABSTRACT

Right now, surface electromyography (sEMG) prostheses are described by low control capacities and long preparing circumstances. This is in diverge from late advances in mechatronics, because of which mechanical hands have regularly numerous degrees-of-flexibility and power control. In this manner, there is a need of procedures ready to increment control abilities with sEMG signals. A few reasons decide contrasts in the flag examples, and make the order of sEMG signals a testing undertaking. One of the reasons is the situating of the cathodes on the subjects. This paper reviews the various use of sEMG signals for prosthetic limbs in different manner. The future work will be based on monitoring of temperature, pulsation, blood pressure in prostethics.

1. INTRODUCTION

Subjects with hand amputations often interface with prosthesis via surface electromyography (sEMG) but learning to control the device frequently a long and difficult process. Currently, prosthetics usually does not offer more than 2- 3 degrees of freedom (usually, open/close is the movement possible) and a very coarse control of the force. This is in contrast with recentadvances in mechatronics, thanks to which mechanical withmany degrees of freedom and fine-grained force control are being built. The Nina Pro Invasive Adaptive Hand Prosthetic http://www.idiap.ch/project/ninapro/) Project was started in January 2011 with the aim of fulfilling the need of easy and natural controls for the dexterous prostheses ,and the need to provide the scientific community with a large dataset of sEMG signals to test and evaluate the classification procedures.

The current NinaPro data set is stored in a database with a web interface: it consists of data from 27 healthy human subjects. Besides basic data on the subjects such as age, gender, etc., it also contains signal data in the form of 10 repetitions of 52 different hand/wrist movements.

For each subject, the sEMG signal was acquired using ten electrodes. Two electrodes were placed according to anatomical guidelines [1, 2]. The remaining eight electrodes were placed uniformly around the forearm following the main trend in pattern matching research [3, 4, 5]. In order to maintain a constant positioning among subjects, the electrodes were placed at a constant distance from the radio-humeral joint.

The inter- subject difference in the positioning of the electrodes was probably an important reason that contributed to make the classification of sEMG signals a challenging task. The sEMG signal classification had been treated in several publications [6,7, 8]. However less papers analyse the effect of positioning differences and the use of spatial co-registration methods for sEMG signals [9,10].

IJARSE
ISSN: 2319-8354

2. METHODS

The acquisition setup of the Ninapro data is shown in Fig. It is composed of: a laptop with a PCMCIA Slot (DELL Latitude E5520); a digital acquisition card (National Instruments DAQCard-6024E, PCMCIA); ten sEMG electrodes (Otto Bock 13E200); a Cyberglove II (CyberGlove Systems LLC) with 22 sensors; a 2-axes inclinometer (Kübler 8.IS40.23411); custom-made acquisition software implemented to acquire the data of allthe peripherals in a synchronized way; a password protected web- based interface to the database to store the data.Intact subjects wear the sEMG electrodes, the dataglove and the inclinometer on the right hand, while amputated subjects wear the sEMG electrodes on the stump and the dataglove and the inclinometer on the intact limb.

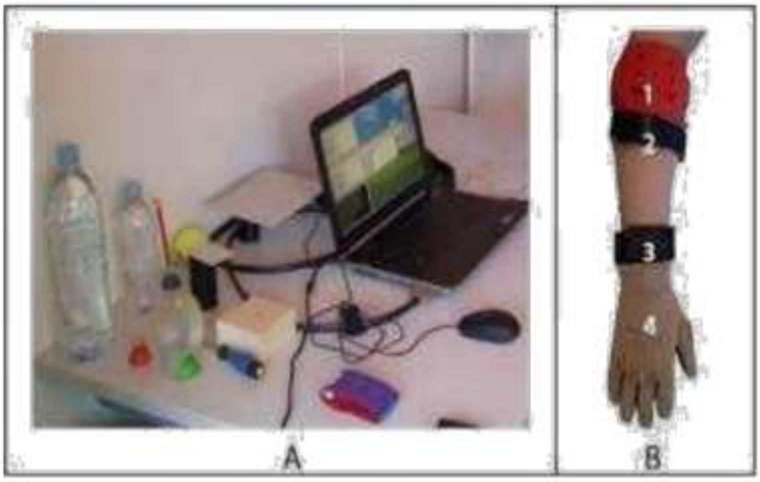

Figure 1. Acquisition setup: A) grasp and functional objects, laptop with the acquisition software; B.1) equally spaced electrodes; B.2) electrodes placed anatomically; B.3) inclinometer; B. 4) cyberglove.

The current NinaPro database includes 10 repetitions of 52 different movements for 27 intact subjects. The movements were based on therobotics and taxonomy literature such as the DASH (Disabilities of the Arm, Shoulder and Hand)protocol for functional movements. Each movement lasts 5 seconds, was followed by 3 seconds of rest and was repeated 10 times.

All data were synchronized by linearly interpolating all data to the highest recording frequency (i.e., 100Hz). Both sEMG and CXCyberglove signals were subsequently low-pass filtered at 1Hz using a zero-phase second order Butterworth filter.

To evaluate the sensation in protethics hand, a artificial protethics hand was used, in which controlling of that body part was done with the help of hand held pocket device.

The distance between each electrode and the axial coordinate of the armband on the forearm was assumed to be constant while the armband was considered liable to rotation.

3. PROSTHETICS

Prosthetics is an artificial device that replaces a missing body part, which may be lost through trauma, disease, or congenital conditions. Prosthetics are intended to restore the normal functions of the missing body part.

Prosthetic amputee rehabilitation is primarily coordinated by an orthopedic and an inter-disciplinary team of health care professionals including psychiatrists, surgeons, physical therapists, and occupational therapists. Prosthetics are commonly created with CAD (Computer- Aided Design), a software interface that helps creators visualize the creation in a 3D.

The socket is usually made from polypropylene. Lightweight (easily portable things) metals such as titanium and aluminum have replaced much of the steel in the pylon. Alloys of these materials are most frequently used. The newest development in prosthesis manufacture has been the use of carbon fiber to form a lightweight pylon.

A person's prosthesis should be designed and assembled according to the person's appearance and functional needs. For instance, a person may need a transradial prosthesis, but need to choose between an aesthetic functional device, a myoelectric device, a body-powered device, or an activity specific device. The person's future goals and economical capabilities may help them choose between one or more devices.

3.1 Limb prostheses

Limb prostheses include both upper- and lower-extremity prostheses.

3.1.1 Upper-extremity prostheses are used at varying levels of amputation: forequarter, shoulder disarticulation, transhumeral prosthesis, elbow ,disarticulation, transradial prosthesis, wrist disarticulation, full hand, partial hand, finger, partial finger. A transradial prosthesis is an artificial limb that replaces an arm missing below the elbow.

Upper limb prostheses can be categorized in three main categories: Passive devices, Body Powered devices, Externally Powered (myoelectric) devices. Passive devices can either be passive hands, mainly used for cosmetic purpose, or passive tools, mainly used for specific activities (e.g. leisure or vocational A passive device can be static, meaning the device has no movable parts, or it can be adjustable, meaning its configuration can be adjusted (e.g. adjustable hand opening). Despite the absence of active grasping, passive devices are very useful in bimanual tasks that require fixation or support of an object, or for gesticulation in social interaction. According to scientific data a third of the upper limb amputees worldwide use a passive prosthetic hand. Body Powered or cable operated limbs work by attaching a harness and cable around the opposite shoulder of the damaged arm. The third category of prosthetic devices available are myoelectric arms. These work by sensing, via electrodes when the muscles in the upper arm move, causing an artificial hand to open or close. In the prosthetics industry, a trans-radial prosthetic arm is often referred to as a "BE" or below elbow prosthesis.

3.1.2 Lower - extremity prostheses provide replacements at varying levels of amputation. These include hip disarticulation, transfemoral prosthesis, knee disarticulation, transtibial prosthesis, Syme's amputation, foot, partial foot, and toe. The two main subcategories of lower extremity prosthetic devices are trans-tibial (any amputation transecting the tibia bone or a congenital anomaly resulting in a tibial deficiency) and trans-femoral (any amputation transecting the femur bone or a congenital anomaly resulting in a femoral deficiency.

A) Transradial Prosthesis - A transradial prosthesis is an artificial limb that replaces an arm missing below the elbow. Two main types of prosthetics are available. Cable operated limbs work by attaching a harness and cable around the opposite shoulder of the damaged arm. The other form of prosthetics available are myoelectric arms.

These work by sensing, via electrodes, when the muscles in the upper arm moves, causing an artificial hand to open or close.

B) Transhumeral Prosthesis - A transhumeral prosthesis is an artificial limb that replaces an arm missing above the elbow. Transhumeral amputees experience some of the same problems as transfemoral amputees, due to the similar complexities associated with the movement of the elbow.

This makes mimicking the correct motion with an artificial limb very difficult.

C) Transtibial Prosthes is a transtibial prosthesis is an artificial limb that replaces a leg missing below the knee. Transtibial amputees are usually able to regain normal movement more readily than someone with a transfemoral amputation, due in large part to retaining the knee, which allows for easier movement.

D) Transfemoral Prosthesis A transfemoral prosthesis is an artificial limb that replaces a leg missing above the knee. Transfemoral amputees can have a very difficult time regaining normal movement. In general, a transfemoral amputee must use approximately 80% more energy to walk than a person with two whole legs. This is due to the complexities in movement associated with the knee. In newer and more improved designs, after employing hydraulics, carbon fiber, mechanical linkages, motors, computer microprocessors, and innovative combinations of these technologies to give more control to the user.

4. AUTHORS AND THEIR RESEARCH

[1996] P. L. Hudak et al researched for the handicaps of the arm, shoulder and hand (DASH) poll is a self-managed district particular result instrument created as a measure of self- evaluated furthest point incapacity and side effects. The DASH comprises basically of a 30-thing incapacity/side effect scale, scored 0 (no handicap) to 100. The fundamental reason for this examination was to survey the ongitudinal build legitimacy of the DASH among patients experiencing medical procedure. The second reason for existing was to evaluate self-appraised treatment adequacy after medical procedure.

[1998]C. J. De Luca in his paper reported a lesser decline of the fatigue- associated M-wave together with prolonged twitch times in the dominant side. Both results suggested the presence of a higher percentage of slow-twitc type fibers in the preferentially used muscle.

[2003]O. F. T. Tsuji et al proposed a paper on human- helping controller teleoperated by electromyographic (EMG) flags and arm movements. The proposed strategy understands another ace slave controller framework that used no mechanical ace controller. A man whose lower arm has been cut away can utilize this controller as an individual aide for work area work. The particular component of our framework is to utilize a novel measurable neural system for EMG design segregation.

[2008]H. Tsuji et al in his paper exhibited an example separation technique for electromyogram (EMG) signals for application in the field of prosthetic control. The technique utilized a novel repetitive neural system in view of the concealed Markov display. This system incorporates intermittent associations, which empower displaying time arrangement, for example, EMG signalss.

[2008]L. Hargrove et al in their paper They centered their work around researching the ideal interelectrode separate, channel design, acknowledgment within the sight of terminal move. Expanding interelectrode remove from 2 to 4cm enhanced example acknowledgment framework execution as far as order blunder and controllability ($p<0.01$). Furthermore, for a steady number of channels, a terminal design that included cathodes arranged both longitudinally and oppositely concerning muscle strands enhanced vigor within the sight of anode move ($p<0.05$). They examined the impact of the quantity of recording channels with and without terminal move and found that four to six channels were adequate for design acknowledgment control.

[2009]C. Castellini et al in their research paper broaden past work and explored the vigor of such fine control potential outcomes, in two ways: right off the bat, investigation on information acquired from 10 solid subjects, attempting to survey the general relevance of the method.

[2009]B. Crawford discussed that a 4-degrees-of-flexibility automated arm can be controlled continuously utilizing non-obtrusive surface EMG signals recorded from the lower arm. The inventive highlights of the framework incorporate a physiologically- educated determination of lower arm muscles for recording EMG signals, savvy decision of hand motions for simple characterization, and quick, straightforward element extraction from EMG signals. This determination of signals is intended to instinctively guide to suitable degrees of flexibility in the mechanical arm. These plan choices enable us to construct quick exact classifiers on the web, and control a 4-DOF mechanical arm continuously.

[2010]D. Tkach et al making Study of solidness of time area highlights for electromyographic design acknowledgment down to earth and accessible to patients with engine shortages requires beating genuine difficulties, for example, physical and physiological changes, that outcome in varieties in EMG signs and frameworks that are questionable for long haul utilize. In this examination, meant to address these difficulties by (1) exploring the soundness of time-area EMG highlights amid changes in the EMG signs and (2) distinguishing the capabilities that would give he most hearty EMG design acknowledgment.

The proposed work in the next paper will analyze the effect of temperature, pulsation, blood pressure in prostethics part of the subjects while recording the sEMG signals.

5. CONCLUSIONS

In INDIA a typical prosthetic limb costs anywhere between 1 lakh and 2 lakhs depending on the type of limb desired by the patient. With medical insurance, a patient will typically pay 10% – 50% of the total cost of a prosthetic limb, while the insurance company will cover the rest of the cost. The percent that the patient pays varies on the type of insurance plan, as well as the limb requested by the patient.

Low-cost above-elbow prostheses often provide only basic structural support with limited function. This function is often achieved with crude, non- articulating, unstable, or manually locking elbow oints. A limited number of organizations, such as the International Committee of the Red Cross (ICRC), Create devices for developing countries. Their device which is manufactured by CR Equipments is a single-axis, manually operated locking polymer prosthetic knee joint.

There is currently anopen design Prosthetics forum known as the "Open Prosthetics Project". The group employs collaborators and volunteers to advance Prosthetics technology while attempting to lower the costs of these necessary devices. Open Bionics is a company that is developing open-source robotic prosthetic hands. It uses 3D printing to manufacture the devices and low-cost 3D scanners to fit them, with the aim of lowering the cost of fabricating custom prosthetics. A review study on a wide range of printed prosthetic hands, found that although 3D printing technology holds a promise for individualized prosthesis design, it is not necessarily cheaper when all costs are included. The same study also found that evidence on the functionality, durability and user acceptance of 3D printed hand prostheses is still lacking.

The hand held pole with leather support band or platform for the limb is one of the simplest and cheapest solutions found. It serves well as a short-term solution, but is prone to rapid contracture formation if the limb is not stretched daily through a series of RoM (range-of motion). Cosmetic prosthesis has long been used to disguise injuries and disfigurements. With advances in modern technology, cosmesis, the creation of lifelike limbs made from silicone or PVC has been made possible. Such prosthetics, including artificial hands, can now be designed to simulate the appearance of real hands, complete with freckles, veins, hair, fingerprints and even tattoos. Custom-made cosmeses are generally more expensive while standard cosmeses come, premade in a variety of sizes, although they are often not as realistic as their custom-made counterparts. Another option is the custom-made silicone cover, which can be made to match a person's skin tone but not details such as freckles or wrinkles. Cosmeses are attached to the body in any number of ways, using an adhesive suction, form-fitting, stretchable skin, or a skin sleeve. For this, we require a deeper understanding of the data to take into account factors that can help to compare several persons. Here I had only reviewed the work of previous researchers utilizing the SEMG signals will able to do monitoring of temperature, pulsation, blood pressure with the use hand held pocket device (HHPD) in prostethics part in our body.

REFERENCES

1)H. Tsuji, H. Ichinobe, K. Ito, M.Nagamachi. "Discrimination of forearm motions from EMG signals by error back propagation typed neural network using entropy." *IEEE Transactions, Society of Instrument and Control Engineers*. 29(10):1213- 1220, 1993.

2)P. L. Hudak, P. C. Amadio, C.Bombardier. "Development of an upper extremity outcome measure: the DASH (disabilities of the arm shoulder and hand*)."The Upper Extremity Collaborative Group (UECG). American Journal of Industrial Medicine.* 29(6):602-608, 1996.

3)P. L. Hudak, P. C. Amadio, C. Bombardier. " Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand*)." The Upper Extremity Collaborative Group (UECG). American Journal of Industrial Medicine.*29(6):602-608, 1996.

4)C. J. De Luca. "The use of surface electromyography in biomechanics". *Journal of Applied Biomechanics.* 13(2):135-163, 1997.

5)J. A. K. Suykens, T. V. Gestel, J. D. Brabanter, B. D. Moor, J. Vandewalle. *Least Squares Support Vector Machines.* Singapore World Scientific Publishing Co., Pte, Ltd., 2002.

6)J. A. K. Suykens, T. V. Gestel, J. D. Brabanter, B. D. Moor, J. Vandewalle. *Least Squares Support Vector Machines.* Singapore: World Scientific Publishing Co., Pte, Ltd., 2002.

7)O. F. T. Tsuji, M. Kaneko, and A. Otsuka, "A human-assisting manipulator teleoperated by EMG signals and arm motions," *IEEE Transactions on Robotics and Automation.* 19(2):210-222, 2003.

IJARSE
ISSN: 2319-8354

8)T. V. Gestel, J. A. K. Suykens, B. Baesens, S. Viaene, J. Vanthienen, G. Dedene, B. D. Moor, and J. Vandewalle. "Benchmarking least squares support vector machine classifiers." *Machine Learning*, 54:5– 32, 2004.

9)T. V. Gestel, J. A. K. Suykens, B. Baesens, S. Viaene, J. Vanthienen, G. Dedene, B. D. Moor, and J. Vandewalle. "Benchmarking least squares support vector machine classifiers." *Machine Learning*, 54:5–32, 2004.

10) F. C. P. Sebelius, B. N. Rosen, and G. N.Lundborg. "Refined myoelectric control in below-elbow amputees using artificial neural networks and a data glove." *jourrnal of Hand Surgery*.30(4):780–789, 2005.

11) F. C. P. Sebelius, B. N. Rosen, and G. N. Lundborg." Refined myoelectric control in below-elbow amputees using artificial neural networks and a data glove." *Journal of Hand Surgery*.30(4):780–789, 2005.

G. C. Cawley," Leave-one-out cross- validation based model selection criteria for weighted ls-svms." *: roceedings of the International Joint Conference on Neural Networks,* Vancouver, BC, Canada, *JCNN-2006*

13) G. C. Cawley, "Leave-one-out cross-validation based model selection criteria for weighted ls-svms."
IJCNN-2006: Proceedings of the International Joint Conference on Neural Networks, Vancouver, BC, Canada, pp. 1661– 1668, 2006.

14) L. Hargrove, K. Englehart, B. Hudgins. "A training strategy to reduce classification degradation due to electrode displacements in pattern recognition based myoelectric control."*Biomedical Signal Processing and Control*. 3:175–180, 2008.

15) T. Feix. " Grasp taxonomy comparison."*Otto Bock GmbH, Technical Report.* Available at http://grasp.xief.net, 2008.

16) T. Feix. Grasp taxonomy comparison. *Otto Bock GmbH,Technical Report.*Available at ttp://grasp.xief.net, 2008.

17) L. Hargrove, K. Englehart, B. Hudgins " A training strategy to reduce classification degradation due to electrode displacements in pattern recognition based myoelectric control." *Biomedical Signal Processing and Control*. 3:175–180, 2008

18) C. Castellini, A. E. Fiorilla, and G. Sandini. "Multi-subject / dailylife activity EMG-based control of mechanical hands." *Journal of Neuroengineering and Rehabilitation*.6(41), 2009.

19) C. Castellini, A. E. Fiorilla, G. Sandini. " Multi-subject/ daily-life activity EMG-based control ofmechanical hands."*Journal of Neuroengineering and Rehabilitation*. 6(41), 2009.

20) C. Castellini, E. Gruppioni, "Fine detection of grasp force and posture by amputees via surface electromyography." *Journal of Physiology (Paris)*. 103(35): 255-262, 2009.

21) F. V. Tenore, A. Ramos, A. Fahmy, S. Acharya, R. Etienne-Cummings, N.V. Thakor." Decoding of individuated finger movements using surface electromyography." *IEEE Transactions in Biomedical Engineering*. 56(5):1427-1434, 2009.

22) C. Castellini, E. Gruppioni, A. Davalli, G. Sandini. "Fine detection of grasp force and posture by amputees via surface electromyography." *Journal of Physiology (Paris).* 103(3-5): 255– 262, 2009.

23) B. Crawford, K. Miller, P. Shenoy, and R. Rao. " Real-time classification of electromyographic signals for robotic control." *Proceedings of AAAI*. 523– 528,2009.

24) F. V. Tenore, A. Ramos, A. Fahmy, S. Acharya, R. Etienne Cummings, N. V. Thakor. Decoding of individuated finger movements using surface electromyography." *IEEE Transactionson Biomedical Engineering.* 56(5):1427–1434, 2009.

25) C. Castellini, A. E. Fiorilla, and G.Sandini. "Multi-subject / dailylife activity EMG-based control of mechanical hands."*Journal of Neuroengineering and Rehabilitation.* 6(41), 2009.

26)F. V. Tenore, A. Ramos, A. Fahmy, S. Acharya, R. EtienneCummings, N. V. Thakor. "Decoding of individuated finger movements using surface electromyography." *IEEE Transactions on Biomedical Engineering.* 56(5):1427–1431,2009.

27)D. Tkach, H. Huang, T. A. Kuiken ".Study of stability of timedomain features for electromyographic pattern recognition." *Journal of Neuro-Engineering and Rehabilitation.* 7:21, 2010.

28)D. Tkach, H. Huang, T. A. Kuiken. "Study of stability of timedomain features for electromyographic pattern recognition." *Journal of Neuro-Engineering and Rehabilitation.* 7:21, 2010.