DEVELOPMENT OF A NEW ROBUST HYBRID AUTOMATA ALGORITHM BASED ON SURFACE ELECTROMYOGRAPHY (SEMG) SIGNAL FOR INSTRUMENTED WHEELCHAIR CONTROL.

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I* hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy in Mechanical Engineering

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Kerusi roda beralat yang beroperasi berdasarkan elektromiografi di permukaan (sEMG) merupakan salah satu alternatif membantu golongan kurang upaya untuk bergerak. SEMG menjadi pilihan kerana ketepatan yang baik dan persediaan untuk meletakkan elektrod yang lebih mudah. Sel saraf menghantar isyarat yang mengandungi potensi elektrik ke otot untuk mengarahkan agar mengecut secare isometrik, sepusat dan eksentrik. Perubahan potensi elektrik ini disebut sebagai Potensi Tindakan Unit Saraf (MUAP)yang dapat diperoleh elektrod yang terletak diatas otot, diperkuat, dirakam dan dianalisa oleh peranti sEMG. Penyelidikan in bertujuan untuk mengembangkan kebolehan peranti pemerolehan data sEMG yang berasaskan Arduino yang merupakan sumber terbuka dengan algoritma automata hibrid bagi membezakan akttiviti MUAP semasa mengayuh kerusi roda. Penambahan algoritma automata hibrid untuk menjalankan kaedah kawalan berdasarkan pengecaman corak dan bukan corak merupakan kelebihan bagi meningkatkan ketepatan membezakan aktiviti kayuhan ke hadapan atau gerakan mengemablikan tangan. Elektrod diletakkan pada otot Biceps (BIC), Triceps (TRI), Extensor (EXT), Flexor (FIX) dan aktivitiy MUAP direkodkan bagi 30 peserta yang sihat tubuh badan. Kemudian, hasil eksperimen disahkan dengan hasil simulasi menggunakan perisian pemodelan bioperubatan OpenSim. Purata, standard deviation (SD) confidence interval (CI) dan titik maksimum berbeza (MPD) MUAP akan dikira dan digunakan sebagai penentu untuk kaedah kawalan pengecaman bukan corak untuk ekperimen pemilihan kaedah kawalan. Sementara itu, pengecaman corak menggunakan Fungsi Ketumpatan Kebarangkalian(PDF) untuk menentukan MUAP mengikut jenis aktiviti. Kaedah ambang ganda dan saluran melintang yang dilaksanakan untuk mengurangkan peralihan elektrod yang akan mempengaruhi kualiti isyarat sEMG dan meningkatkan ketepatan klasifikasi. Sebanyak sepuluh kaedah kawalan yang ditentukan daripada data populasi dan individu diuji terhadap 10 orang yang sihat untuk menilai prestasi algoritma. Penilaian setiap kaedah kawalan yang dilakukan oleh matrik salah klasifikasi melihat Positif Benar (TP) dan Negatif Salah(FN)untuk mengaktifkan sistem bantuan kuasa. Peranti pemerolehan data sEMG yang dibangunkan dikendalikan oleh Arduino MEGA 2560 dan sensor otot Myoware dengan kadar pengambilan sampel melebihi 400Hz untuk merekodkan MUAP dari otot lengan. Selanjutnya, 2.5ms kelewatan purata untuk peranti merakam, menganalisis, mengesahkan dan membuat arahan untuk mengaktifkan sistem bantuan kuasa. Data yang diperoleh dari peranti menunjukkan bahawa otot yang paling aktif semasa mengayuh kerusi roda adalah TRI, diikuti oleh BIC dan keputusan ini sepadan dengan hasil simulasi OpenSim. Dalam eksperimen pemilihan kaedah kawalan, 96.28% ketepatan purata dicapai dan kaedah kawalan yang berbeza dipilih oleh matriks salah klasifikasi untuk setiap orang. Kaedah yang terpilih ini akan menjadi kaedah kawalan untuk mengaktifkan sistem bantuan kuasa dan berdasarkan syarat yang ditetapkan dalam algoritma. Penemuan ini menunjukkan bahawa Arduino mampu menjalankan secara langsung kaedah kawalan berasaskan pengecaman corak dan tanpa corak dengan menghasilkan ketepatan klasifikasi hingga 99.48% walaupun ia hanya dikenali sebagai pengawal mikro yang mempunyai batasan untuk menjalankan pengklasifikasi yang kompleks. Pada masa yang sama, peranti yang berharga kurang dari USD200 memiliki 400 sampel kadar pensampelan per saat adalah sama baiknya dengan peranti sumber tertutup yang mahal harganya. Berdasarkan keputusan penilaian algoritma yang menunjukkan bahawa satu kaedah kawalan tidak sesuai untuk semua peserta seperti yang terbukti dalam eksperimen pemilihan kaedah kawalan. Individu yang berbeza mempunyai kaedah kawalan yang berbeza yang sesuai dengan mereka. Terakhir, BIC dan TRI boleh dijadikan otot rujukan untuk mengaktifkan alat bantuan di kerusi roda beralat yang menggunakan kayuhan untuk mengaktifkannya.

ABSTRACT

Instrumented wheelchair operates based on surface electromyography (sEMG) is one of alternative to assist impairment person for mobility. SEMG is chosen due to good in accuracy and easier preparation to place the electrodes. Motor neuron transmit electrical potential to muscle fibre to perform isometric, concentric or eccentric contraction. These electrical changes that is called Motor Unit Action Potential (MUAP) can be acquired and amplified by electrodes located on targeted muscles changes can be recorded and analysed using sEMG devices. But, sEMG device cost up to USD 2,100 for a sEMG data acquisition device that available on market is one of the drawback to be used by impairment person that most of them has financial problem due to unable to work like before. In addition, it is a closed source system that cannot be modified to improve the accuracy and adding more features. Open source system such as Arduino has limitation of specifications that makes able to apply non-pattern recognition control methods which is simpler and easier compared to pattern recognition. However, classification accuracy is lower than pattern recognition and it cannot be applied to higher number participants from different background and gender. This research aims are to develop an open-source Arduino based sEMG data acquisition device by formulating hybrid automata algorithm to differentiate MUAP activity during wheelchair propulsion. Addition of hybrid automata algorithm to run pattern and non-pattern recognition based control methods is an advantage to increase accuracy in differentiating forward stroke or hand return activity. Electrodes are placed on Biceps (BIC), Triceps (TRI), Extensor (EXT), Flexor (FIX) and MUAP activity recorded for 30 healthy persons. Then, experiment result was validated with simulation result using OpenSim biomedical modelling software. Mean, standard deviation (SD), confidence interval (CI) and maximum point different (MPD) of MUAP were calculated and to be used as thresholds for non-pattern recognition control method in method selection experiment. Meanwhile, pattern recognition is using Probability Density Function (PDF) to determine MUAP according to type of activities. Total of ten control methods determined from population and individual data were tested against another 10 healthy persons to evaluate the algorithm performance. Assessment of each control method done by misclassification matrix looking at True Positive (TP) and False Negative (FN) of power assist system activation period. Developed sEMG data acquisition device that is operated by Arduino MEGA 2560 and Myoware muscle sensors with sampling rate of above 400Hz successfully recorded MUAP from four arm muscles. Furthermore, 2.5 ms of average data latency for device to record, analyse, validate and creating commands to activate the power assist system. Data obtained from the device shows that most active muscle during wheelchair propulsion is TRI, followed by BIC and matched to OpenSim simulation result. In method selection experiment, 96.28% of average accuracy was achieved and different control methods were selected by misclassification matrix for each of persons. This method would be a control method to activate power assist system and selected based on conditions set in the algorithm. These findings indicated that open source Arduino board is capable of running real time pattern, non-pattern recognition based control methods by producing classification accuracy up to 99.48% even though it is known as just a microcontroller that has limitation to run complex classifiers. At the same time, a device that cost less than USD200 has 400Hz of sampling rate is as good as closed source device that is come with expensive price tag to own it. Based on algorithm evaluation, it shows that one control method couldn’t fit to all persons as per proven in method selection experiment. Different person has different control method that suit them the most. Lastly, BIC and TRI can be reference muscles to activate assistive device in instrumented wheelchair that is using propulsion as indication.

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LIST OF SYMBOLS

N	Total number of phases
$\bar{x}$	Mean
σ	Standard deviation
e	Euler's number 2.71828
π	Pi = 3.14159
μ	Mean for PDF calculation
X	MUAP reading

LIST OF ABBREVIATIONS

SBPWM	Simple Boost Pulse Width Modulation
ZSI	Z source inverter
MUAP	Motor unit action potential
BIC	Biceps
TRI	Triceps
EXT	Extensor
FIX	Flexor
SD	Standard Deviation
MPD	Maximum point different
TP	True Positive
FN	False Negative
TN	False Positive
IoT	True Negative
AR	Augmented reality
EEG	Electroencephalography
ECG	Electrocardiography
EMG	Electromyography
EOG	Electrooculography
CWA	Collaborative wheelchair assistant
SENIAM	Surface EMG for non-invasive assessment of muscles
DP	Door Passage Mode
GOA	General Obstacle Avoidance Mode
NNA	No Navigation Assistance
IW	Intelligent Wheelchair
FSPAC	Force sensor less power assist control
LZM	Left zygomaticus muscles
NI	National instrument
EEPROM	Electrically Erasable Programmable Read-Only Memory
SRAM	Static random access memory
I/O	Input/Output
PWM	Pulse Width Modulation

DC	Direct current
UE	Upper extremity
Pt	Platinum
Cr	Chromium
Ni	Nickel
AG	Silver
Ag/AgCl	Silver/silver chloride
TAC	Target Achievement Control
HD-Semg	High Density surface EMG
DT	Decision Trees
kNN	k-th Nearest Neighbor
MLP	Multi-layer Perceptrons
LDA	Linear Discriminant Analysis
SVM	Support Vector Machines
PDF	Probability Density Function
t	Processing time
d	Decision
MAV	Mean absolute value
RMS	Root mean square
WL	Wavelength length
VAR	Variance
ZC	Zero crossing (ZC)
BoB	Biomechnaics of Bodies
DOF	Degree of freedom
ADC	Analog-to-digital converter
Arduino IDE	Arduino integrated development environment
N	Number of cycle
CP	Contact phase
RP	Recovery phases
PCONTACT	Probability of contact phase
PRECOVERY	Probability of recovery phase
W	Weight/Load
F_f	Friction force

susun ikut alphabetical order.

AD	Average Deviation
s	Second
ms	Millisecond
μV	Microvolt
mV	Millivolt
V	Voltage
RM	Ringgit Malaysia
USD	US dollar

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REFERENCE

Abiyev, R. H., Akkaya, N., Aytac, E., Günsel, I., & Çağman, A. (2016). Brain-Computer Interface for Control of Wheelchair Using Fuzzy Neural Networks. BioMed Research International, 2016.

Afsharipour, B., Sandhu, M. S., Rasool, G., Suresh, N. L., & Rymer, W. Z. (2016). Using surface electromyography to detect changes in innervation zones pattern after human cervical spinal cord injury. Paper presented at the 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).

Afsharipour, B., Ullah, K., & Merletti, R. (2014). Spatial aliasing and EMG amplitude in time and space: simulated action potential maps. Paper presented at the XIII Mediterranean Conference on Medical and Biological Engineering and Computing 2013.

Ahmed, S. F., Ali, A., Joyo, M. K., Rehan, M., Siddiqui, F. A., Bhatti, J. A., . . . Dezfouli, M. (2018). Mobility assistance robot for disabled persons using electromyography (EMG) sensor. Paper presented at the 2018 IEEE International Conference on Innovative Research and Development (ICIRD).

Al-Mulla, M., Sepulveda, F., & Colley, M. (2012). sEMG techniques to detect and predict localised muscle fatigue. EMG Methods for Evaluating Muscle and Nerve Function, 157-186.

Al-Qaysi, Z., Zaidan, B., Zaidan, A., & Suzani, M. (2018). A review of disability EEG based wheelchair control system: Coherent taxonomy, open challenges and recommendations. Computer methods and programs in biomedicine, 164, 221-237.

Al Harrach, M., Boudaoud, S., Gamet, D., Grosset, J.-F., & Marin, F. (2014). Evaluation of HD-sEMG probability density function deformations in ramp exercise. Paper presented at the 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society.

Al Mamun, S., Suzuki, R., Lam, A., Kobayashi, Y., & Kuno, Y. (2016). Terrain Recognition for Smart Wheelchair. Paper presented at the International Conference on Intelligent Computing.

Amor, N. B., Taher, F. B., & Jallouli, M. (2016). A Novel and Robust Wheelchair Navigation System. International Journal of Computer Science and Information Security, 14(5), 273.

Andrews, A., Morin, E., & McLean, L. (2009). Optimal electrode configurations for finger movement classification using EMG. Paper presented at the 2009 Annual International Conference of the IEEE Engineering in Medicine and Biology Society.

Argall, B. D. (2016). Modular and adaptive wheelchair automation. Paper presented at the Experimental Robotics.

Arnet, U., van Drongelen, S., Scheel-Sailer, A., van der Woude, L. H., & Veeger, D. H. (2012). Shoulder load during synchronous handcycling and handrim wheelchair propulsion in persons with paraplegia. Journal of rehabilitation medicine, 44(3), 222-228.

Arnet, U., van Drongelen, S., Veeger, D., & van der Woude, L. H. (2013). Force application during handcycling and handrim wheelchair propulsion: an initial comparison. Journal of applied biomechanics, 29(6), 687-695.

Arruda, L. M., Calado, A., Boldt, R. S., Yu, Y., Carvalho, H., Carvalho, M. A., . . . Matos, D. (2019). Design and Testing of a Textile EMG Sensor for Prosthetic Control. Paper presented at the EAI International Conference on IoT Technologies for HealthCare.

Arva, J., Fitzgerald, S. G., Cooper, R. A., & Boninger, M. L. (2001). Mechanical efficiency and user power requirement with a pushrim activated power assisted wheelchair. Medical engineering & physics, 23(10), 699-705.

Bagade, P., Banerjee, A., & Gupta, S. K. (2017). Validation, verification, and formal methods for Cyber-Physical Systems Cyber-Physical Systems (pp. 175-191): Elsevier.

Balendra, N., & Langenderfer, J. E. (2017). Effect of hammer mass on upper extremity joint moments. Applied ergonomics, 60, 231-239.

Barreto, J. A., Lemos, V. A., Oliveira, D. M. d., Cerqueira, U. M. F., Meira, L. A., & Bezerra, M. A. (2020). Use of Arduino in the Development of a New and Fast Automated Online Preconcentration System Based on Double-Knotted Reactor for the Mn Determination in Tea Samples by Flame Atomic Absorption Spectrometry (F AAS). Journal of the Brazilian Chemical Society, 31(1), 15-24.

Bashton, D., Mandy, A., Haines, D., & Cameron, J. (2012). Comparison of activities of daily living in two different one arm drive wheelchairs: a controlled trial. Disability and Rehabilitation: Assistive Technology, 7(1), 75-81.

Beck, T. W., Housh, T. J., Johnson, G. O., Weir, J. P., Cramer, J. T., Coburn, J. W., & Malek, M. H. (2005). Comparison of Fourier and wavelet transform procedures for examining the mechanomyographic and electromyographic frequency domain responses during fatiguing isokinetic muscle actions of the biceps brachii. Journal of Electromyography and Kinesiology, 15(2), 190-199.

Benatti, S., Milosevic, B., Farella, E., Gruppioni, E., & Benini, L. (2017). A prosthetic hand body area controller based on efficient pattern recognition control strategies. Sensors, 17(4), 869.

Benazzouz, A., Guilal, R., Amirouche, F., & Slimane, Z. E. H. (2019). EMG Feature Selection for Diagnosis of Neuromuscular Disorders. Paper presented at the 2019 International Conference on Networking and Advanced Systems (ICNAS).

Bengacemi, H., Abed-Meraim, K., Buttelli, O., Ouldali, A., & Mesloub, A. (2020). A new detection method for EMG activity monitoring. Medical & Biological Engineering & Computing, 58(2), 319-334.

Berlia, R., Kandoi, S., Dubey, S., & Pingali, T. R. (2014). Gesture based universal controller using EMG signals. Paper presented at the International Conference on Circuits, Communication, Control and Computing.

Best, K. L., Kirby, R. L., Smith, C., & Macleod, D. A. (2006). Comparison between performance with a pushrim-activated power-assisted wheelchair and a manual wheelchair on the Wheelchair Skills Test. Disability and rehabilitation, 28(4), 213-220.

Bhardwaj, S., Khan, A. A., & Muzammil, M. (2016). Electromyography in physical rehabilitation: a review. Paper presented at the National Conference on mechanical engineering—ideas, innovations & initiatives. Excel India Publisher, Aligarh.

Bigland-Ritchie, B. (1981). EMG/force relations and fatigue of human voluntary contractions. Exercise and sport sciences reviews, 9(1), 75-118.

BK, M. S., & Muddi, M. V. (2019). EOG BASED HUMAN MACHINE INTERFACE TO CONTROL ELECTRIC DEVICES USING EYE MOVEMENT.

Bonato, P., D'Alessio, T., & Knaflitz, M. (1998). A statistical method for the measurement of muscle activation intervals from surface myoelectric signal during gait. IEEE Transactions on biomedical engineering, 45(3), 287-299.

Bonell, C., Tabernig, C., & Spaich, E. G. (2015). Evaluation of a double threshold algorithm to detect electromyographic activity in the healthy and paretic Tibialis Anterior muscle. Paper presented at the VI Latin American Congress on Biomedical Engineering CLAIB 2014, Paraná, Argentina 29, 30 & 31 October 2014.

Boninger, M. L., Baldwin, M., Cooper, R. A., Koontz, A., & Chan, L. (2000). Manual wheelchair pushrim biomechanics and axle position. Archives of physical medicine and rehabilitation, 81(5), 608-613.

Boudaoud, S., Allouch, S., Al Harrach, M., & Marin, F. (2015). On the benefits of using HD-sEMG technique for estimating muscle force. Computer methods in biomechanics and biomedical engineering, 18(sup1), 1890-1891.

Bourbakis, N., Ktistakis, I. P., Tsoukalas, L., & Alamaniotis, M. (2015). An autonomous intelligent wheelchair for assisting people at need in smart homes: A case study. Paper presented at the Information, Intelligence, Systems and Applications (IISA), 2015 6th International Conference on.

Bourhis, G., Moumen, K., Pino, P., Rohmer, S., & Pruski, A. (1993). Assisted navigation for a powered wheelchair. Paper presented at the Systems, Man and Cybernetics, 1993.'Systems Engineering in the Service of Humans', Conference Proceedings., International Conference on.

Boy, E. S., Teo, C. L., & Burdet, E. (2002). Collaborative wheelchair assistant. Paper presented at the Intelligent Robots and Systems, 2002. IEEE/RSJ International Conference on.

Bregman, D., van Drongelen, S., & Veeger, H. (2009). Is effective force application in handrim wheelchair propulsion also efficient? Clinical Biomechanics, 24(1), 13-19.

Bruning, T., McLaurin, C., & Henderson, J. (1976). Wheelchair Mobility. University of Virginia-Rehabilitation Engineering Center.(1976-1981), 107.

Bühlmeier, A., Manteuffel, G., Rossmann, M., & Goser, K. (1997). Application of a local learning rule in a wheelchair robot. Paper presented at the Third International Conference on Neural Networks and their Applications (Neurap97).

Butler, C., Okamoto, G. A., & McKay, T. M. (1983). POWERED MOBILITY FOR VERY YOUNG DISABLED CHILDREN. Developmental Medicine & Child Neurology, 25(4), 472-474. doi:10.1111/j.1469-8749.1983.tb13792.x

Caccavale, F., Natale, C., Siciliano, B., & Villani, L. (2005). Integration for the next generation: embedding force control into industrial robots. IEEE Robotics & Automation Magazine, 12(3), 53-64.

Caro, L. A., Silva, C., Peralta, B., Herrera, O. A., & Barrientos, S. (2015). Real-time recognition of arm motion using artificial neural network multi-perceptron with arduino one microcontroller and EKG/EMG shield sensor. Paper presented at the Ambient Intelligence for Health.

Caruthers, E. J., Thompson, J. A., Chaudhari, A. M., Schmitt, L. C., Best, T. M., Saul, K. R., & Siston, R. A. (2016). Muscle forces and their contributions to vertical and horizontal acceleration of the center of mass during sit-to-stand transfer in young, healthy adults. Journal of Applied Biomechanics, 32(5), 487-503.

Castroflorio, T., Farina, D., Bottin, A., Debernardi, C., Bracco, P., Merletti, R., . . . Bramanti, P. (2005). Non-invasive assessment of motor unit anatomy in jaw-elevator muscles. Journal of Oral Rehabilitation, 32(10), 708-713.

Castroflorio, T., Farina, D., Bottin, A., Piancino, M. G., Bracco, P., & Merletti, R. (2005). Surface EMG of jaw elevator muscles: effect of electrode location and inter-electrode distance. Journal of oral rehabilitation, 32(6), 411-417.

Catarino, A. P., Rocha, A., Carvalho, H., & Ferreira, F. N. (2017). Textile based electrodes for ECG and EMG measurements. Paper presented at the Proceedings of the ITMC2017-International Conference on Intelligent Textiles and Mass Customisation.

Champaty, B., Jose, J., Pal, K., & Thirugnanam, A. (2014). Development of EOG based human machine interface control system for motorized wheelchair. Paper presented at the Emerging Research Areas: Magnetics, Machines and Drives (AICERA/iCMMD), 2014 Annual International Conference on.

Chang, S.-S., De Luca, C. J., & Nawab, S. H. (2008). Aliasing rejection in precision decomposition of EMG signals. Paper presented at the 2008 30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society.

Chauhan, R., Jain, Y., Agarwal, H., & Patil, A. (2016). Study of implementation of Voice Controlled Wheelchair. Paper presented at the Advanced Computing and Communication Systems (ICACCS), 2016 3rd International Conference on.

Chen, H., Zhang, Y., Zhang, Z., Fang, Y., Liu, H., & Yao, C. (2017). Exploring the relation between EMG sampling frequency and hand motion recognition accuracy. Paper presented at the 2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC).

Chen, S., Fu, F.-f., Meng, Q.-l., & Yu, H.-l. (2017). Development of a Lower Limb Rehabilitation Wheelchair System Based on Tele-Doctor–Patient Interaction Wearable Sensors and Robots (pp. 211-223): Springer.

Chien, C.-S. (2014). Design and development of solar power-assisted manual/electric wheelchair. Journal of rehabilitation research and development, 51(9), 1411.

Chikh, S., Garnier, C., Faupin, A., Pinti, A., Boudet, S., Azaiez, F., & Watelain, E. (2018). Arm-trunk coordination in wheelchair initiation displacement: A study of anticipatory and compensatory postural adjustments during different speeds and directions of propulsion. Journal of Electromyography and Kinesiology, 40, 16-22.

Chowdhury, M. R., Mollah, M. N., Raihan, M., Ahmed, A. S., Halim, M. A., & Hossain, M. S. (2018). Designing a Cost Effective Prototype of an Automated Wheelchair Based on EOG (Electrooculography). Paper presented at the 2018 21st International Conference of Computer and Information Technology (ICCIT).

Chowdhury, R., Reaz, M., Ali, M., Bakar, A., Chellappan, K., & Chang, T. (2013). Surface electromyography signal processing and classification techniques. Sensors, 13(9), 12431-12466.

Cifrek, M., Medved, V., Tonković, S., & Ostojić, S. (2009). Surface EMG based muscle fatigue evaluation in biomechanics. Clinical Biomechanics, 24(4), 327-340.

Clancy, E. A., Martinez-Luna, C., Wartenberg, M., Dai, C., & Farrell, T. R. (2017). Two degrees of freedom quasi-static EMG-force at the wrist using a minimum number of electrodes. Journal of Electromyography and Kinesiology, 34, 24-36. doi:https://doi.org/10.1016/j.jelekin.2017.03.004

Clancy, E. A., Morin, E. L., & Merletti, R. (2002). Sampling, noise-reduction and amplitude estimation issues in surface electromyography. Journal of electromyography and kinesiology, 12(1), 1-16.

Claros-Marfil, L. J., Padial, J. F., & Lauret, B. (2016). A new and inexpensive open source data acquisition and controller for solar research: Application to a water-flow glazing. Renewable energy, 92, 450-461.

Connell, J., & Viola, P. (1990). Cooperative control of a semi-autonomous mobile robot. Paper presented at the Proc. IEEE Int'l Conf. on Robotics and Automation.

Cooper, R. A. (1998). Wheelchair selection and configuration: Demos Medical Publishing.

Cooper, R. A., Boninger, M. L., Spaeth, D. M., Ding, D., Guo, S., Koontz, A. M., . . . Collins, D. M. (2006). Engineering better wheelchairs to enhance community participation. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 14(4), 438-455.

Cooper, R. A., Corfman, T. A., Fitzgerald, S. G., Boninger, M. L., Spaeth, D. M., Ammer, W., & Arva, J. (2002). Performance assessment of a pushrim-activated power-assisted wheelchair control system. IEEE transactions on control systems technology, 10(1), 121-126.

Cooper, R. A., Fitzgerald, S. G., Boninger, M. L., Prins, K., Rentschler, A. J., Arva, J., & O'Connor, T. J. (2001). Evaluation of a pushrim-activated, power-assisted wheelchair. Archives of Physical Medicine and Rehabilitation, 82(5), 702-708.

Dalsaniya, A. K., & Gawali, D. H. (2016). Smart phone based wheelchair navigation and home automation for disabled. Paper presented at the Intelligent Systems and Control (ISCO), 2016 10th International Conference on.

Dao, D. M., Phước, P. D., Tuy, T. X., & Le, T. T. (2017). Research on reading muscle signals from the EMG sensor during knee flexion—Extension using the Arduino Uno controller. Paper presented at the 2017 International Conference on Advanced Technologies for Communications (ATC).

Day. (2002). Important factors in surface EMG measurement., 1-17.

De Groot, S., Veeger, H., Hollander, A., & Van Der Woude, L. (2002). Consequence of feedback-based learning of an effective hand rim wheelchair force production on mechanical efficiency. Clinical Biomechanics, 17(3), 219-226.

De Luca, C. J. (2006). Electromyography. Encyclopedia of medical devices and instrumentation. John Wiley Publisher, 98-109.

Delp, S. L., Anderson, F. C., Arnold, A. S., Loan, P., Habib, A., John, C. T., . . . Thelen, D. G. (2007). OpenSim: open-source software to create and analyze dynamic simulations of movement. IEEE transactions on biomedical engineering, 54(11), 1940-1950.

Devigne, L., Narayanan, V. K., Pasteau, F., & Babel, M. (2016). Low complex sensor-based shared control for power wheelchair navigation. Paper presented at the Intelligent Robots and Systems (IROS), 2016 IEEE/RSJ International Conference on.

Diez, P. F., Mut, V., Laciar, E., & Avila, E. (2010). A comparison of monopolar and bipolar EEG recordings for SSVEP detection. Paper presented at the 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology.

Dimitrova, N. A., Dimitrov, G. V., & Chihman, V. N. (1999). Effect of electrode dimensions on motor unit potentials. Medical engineering & physics, 21(6-7), 479-485.

Ding, D., & Cooper, R. A. (2005). Electric powered wheelchairs. IEEE Control Systems, 25(2), 22-34.

Dipietro, L., Krebs, H. I., Fasoli, S. E., Volpe, B. T., Stein, J., Bever, C., & Hogan, N. (2007). Changing motor synergies in chronic stroke. Journal of neurophysiology, 98(2), 757-768.

Drãgulinescu, A., Halunga, S., & Fratu, O. (2019). Anthropomorphic EMG-Driven Prosthetic Hand. Paper presented at the Future Access Enablers for Ubiquitous and Intelligent Infrastructures: 4th EAI International Conference, FABULOUS 2019, Sofia, Bulgaria, March 28-29, 2019, Proceedings.

Drapała, J., Brzostowski, K., Szpala, A., & Rutkowska-Kucharska, A. (2012). Two stage EMG onset detection method. Archives of Control Sciences, 22, 427-440.

Dressel, J., & Farid, H. (2018). The accuracy, fairness, and limits of predicting recidivism. Science advances, 4(1), eaao5580.

Eerden, S., Dekker, R., & Hettinga, F. J. (2018). Maximal and submaximal aerobic tests for wheelchair-dependent persons with spinal cord injury: a systematic review to summarize and identify useful applications for clinical rehabilitation. Disability and rehabilitation, 40(5), 497-521.

Ehrampoosh, A., Yousefi-koma, A., & Ayati, M. (2016). Development of myoelectric interface based on pattern recognition and regression based models. Paper presented at the 2016 Artificial Intelligence and Robotics (IRANOPEN).

El-Sherbiny, Y., Hasouna, A., & Ali, W. (2012). Friction coefficient of rubber sliding against flooring materials. J. Eng. Appl. Sci, 7(1), 121-126.

Engel, P., & Hildebrandt, G. (1974). Wheelchair design--technological and physiological aspects. Proceedings of the Royal Society of Medicine, 67(5), 409.

Englehart, K., & Hudgins, B. (2003). A robust, real-time control scheme for multifunction myoelectric control. IEEE transactions on biomedical engineering, 50(7), 848-854.

Englehart, K., Hudgins, B., & Parker, P. A. (2000). Time-frequency based classification of the myoelectric signal: static vs. dynamic contractions. Paper presented at the Proceedings of the 22nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (Cat. No. 00CH37143).

Englehart, K., Hudgins, B., & Parker, P. A. (2001). A wavelet-based continuous classification scheme for multifunction myoelectric control. IEEE Transactions on Biomedical Engineering, 48(3), 302-311.

Englehart, K., Hudgins, B., Parker, P. A., & Stevenson, M. (1999). Classification of the myoelectric signal using time-frequency based representations. Medical engineering & physics, 21(6-7), 431-438.

Fadheel, B. A., Mahdi, A. J., Jaafar, H. F., Nazir, M. S., Obaid, M. S., & Musa, S. H. (2020). Speed Control of a Wheelchair Prototype Driven by a DC Motor Through Real EEG Brain Signals. Paper presented at the IOP Conference Series: Materials Science and Engineering.

Falla, D., Dall'Alba, P., Rainoldi, A., Merletti, R., & Jull, G. (2002). Location of innervation zones of sternocleidomastoid and scalene muscles–a basis for clinical and research electromyography applications. Clinical neurophysiology, 113(1), 57-63.

Fan, J.-Z., Liu, X., & Ni, G.-X. (2014). Angular velocity affects trunk muscle strength and EMG activation during isokinetic axial rotation. BioMed research international, 2014.

Farina, D., Cescon, C., & Merletti, R. (2002). Influence of anatomical, physical, and detection-system parameters on surface EMG. Biological cybernetics, 86(6), 445-456.

Farina, D., & Merletti, R. (2001). Effect of electrode shape on spectral features of surface detected motor unit action potentials. Acta physiologica et pharmacologica Bulgarica, 26(1-2), 63-66.

Farrell, T. R. (2008). A comparison of the effects of electrode implantation and targeting on pattern classification accuracy for prosthesis control. IEEE Transactions on Biomedical Engineering, 55(9), 2198-2211.

Farrell, T. R. (2011). Determining delay created by multifunctional prosthesis controllers. J Rehabil Res Dev, 48(6).

Faupin, A., Gorce, P., Campillo, P., Thevenon, A., & Remy-Neris, O. (2006). Kinematic analysis of handbike propulsion in various gear ratios: implications for joint pain. Clinical Biomechanics, 21(6), 560-566.

Felzer, T., & Freisleben, B. (2002). HaWCoS: the hands-free wheelchair control system. Paper presented at the Proceedings of the fifth international ACM conference on Assistive technologies.

Feng, G., Guerra, T. M., Nguyen, A.-T., Busoniu, L., & Mohammad, S. (2019). Robust Observer-Based Tracking Control Design for Power-Assisted Wheelchairs. IFAC-PapersOnLine, 52(11), 61-66.

Ferris, D. P., & Lewis, C. L. (2009). Robotic lower limb exoskeletons using proportional myoelectric control. Paper presented at the 2009 Annual International Conference of the IEEE Engineering in Medicine and Biology Society.

Finley, F. R., & Wirta, R. W. (1967). Myocoder studies of multiple myopotential response. Archives of physical medicine and rehabilitation, 48(11), 598-601.

Finley, M. A., Rasch, E. K., Keyser, R. E., & Rodgers, M. M. (2004). The biomechanics of wheelchair propulsion in individuals with and without upper-limb impairment. Journal of rehabilitation research & development, 41.

Fiok, K., & Mróz, A. (2015). How does lever length and the position of its axis of rotation influence human performance during lever wheelchair propulsion? Journal of Electromyography and Kinesiology, 25(5), 824-832.

Flemmer, C. L., & Flemmer, R. C. (2016). A review of manual wheelchairs. Disability and Rehabilitation: Assistive Technology, 11(3), 177-187.

Fontana, J. M., & Chiu, A. W. (2014). Analysis of electrode shift effects on wavelet features embedded in a myoelectric pattern recognition system. Assistive Technology, 26(2), 71-80.

Fourth Industrial Revolution. (2020). World Economic Forum

Frampton, H., Potter, S., Smith, N., Hodgson, D., Dixon, J., & Ryan, C. G. (2013). The effect of unstable footwear on trunk muscle EMG and postural sway in healthy adults. OA Musculoskeletal Medicine, 1(2).

Fu, J., Xiong, L., Song, X., Yan, Z., & Xie, Y. (2017). Identification of finger movements from forearm surface EMG using an augmented probabilistic neural network. Paper presented at the 2017 IEEE/SICE International Symposium on System Integration (SII).

Gabriel, D. A. (2011). Effects of monopolar and bipolar electrode configurations on surface EMG spike analysis. Medical engineering & physics, 33(9), 1079-1085.

Gabriel, D. A., Lester, S. M., Lenhardt, S. A., & Cambridge, E. D. (2007). Analysis of surface EMG spike shape across different levels of isometric force. Journal of neuroscience methods, 159(1), 146-152.

Gaglio, A., Daigle, S., Gacek, E., Jahanian, O., Slavens, B., Rice, I., & Hsiao-Wecksler, E. (2017). Validation of an instrumented wheelchair hand rim. Paper presented at the 2017 Design of Medical Devices Conference.

GarcÍa, J. G., Robertsson, A., Ortega, J. G., & Johansson, R. (2008). Sensor fusion for compliant robot motion control. IEEE Transactions on Robotics, 24(2), 430-441.

Garcia, M. C., & Vieira, T. (2011). Surface electromyography: Why, when and how to use it. Revista andaluza de medicina del deporte, 4(1), 17-28.

Gebai, S., Hammoud, M., Hallal, A., Al Shaer, A., & Khachfe, H. (2016). Passive vibration absorber for tremor in hand of parkinsonian patients: Tuned vibration absorber for rest tremor. Paper presented at the 2016 3rd International Conference on Advances in Computational Tools for Engineering Applications (ACTEA).

Geddes, L. A. (1972). Electrodes and the Measurement of Bioelectrical Events. WILEY-INTERSCIENCE, 99-102.

Ghazali, A. S., Sidek, S. N., & Fatai, S. (2016). Development of Emotional State Model using Electromagnetic Signal Information for Rehabilitation Robot. International Journal of Computational Intelligence Systems, 9(1), 65-79.

Ghorbel, A., Amor, N. B., & Jallouli, M. (2019). A survey on different human-machine interactions used for controlling an electric wheelchair. Procedia Computer Science, 159, 398-407.

Gillham, M., Howells, G., Pepper, M. G., & Kelly, S. W. (2016). Developing Effective Intelligent Assistance for the Powered Wheelchair User.

Gligorijević, I., van Dijk, J. P., Mijović, B., Van Huffel, S., Blok, J. H., & De Vos, M. (2013). A new and fast approach towards sEMG decomposition. Medical & biological engineering & computing, 51(5), 593-605.

Golabchi, F. N., Sapienza, S., Severini, G., Reaston, P., Tomecek, F., Demarchi, D., . . . Bonato, P. (2019). Assessing aberrant muscle activity patterns via the analysis of surface EMG data collected during a functional evaluation. BMC musculoskeletal disorders, 20(1), 13.

Gorce, P., & Louis, N. (2012). Wheelchair propulsion kinematics in beginners and expert users: Influence of wheelchair settings. Clinical Biomechanics, 27(1), 7-15.

Gupta, P., Sharma, P., Singh, R. K., & Yadav, S. (2016). Accelerometer Based Hand Gesture Controlled

Wheelchair. Imperial Journal of Interdisciplinary Research, 2(11).

Hakonen, M., Piitulainen, H., & Visala, A. (2015). Current state of digital signal processing in myoelectric interfaces and related applications. Biomedical Signal Processing and Control, 18, 334-359.

Hara, S. (2007). A smooth switching from power-assist control to automatic transfer control and its application to a transfer machine. IEEE Transactions on Industrial Electronics, 54(1), 638-650.

Hardiansyah, R., Ainurrohmah, A., & Tyas, F. H. (2016). The electric wheelchair control using electromyography sensor of arm muscle. Paper presented at the 2016 International Conference on Information & Communication Technology and Systems (ICTS).

Hargrove, L., Englehart, K., & Hudgins, B. (2006). The effect of electrode displacements on pattern recognition based myoelectric control. Paper presented at the 2006 International Conference of the IEEE Engineering in Medicine and Biology Society.

Hargrove, L. J., Englehart, K., & Hudgins, B. (2007). A comparison of surface and intramuscular myoelectric signal classification. IEEE transactions on biomedical engineering, 54(5), 847-853.

Hargrove, L. J., Li, G., Englehart, K. B., & Hudgins, B. S. (2008). Principal components analysis preprocessing for improved classification accuracies in pattern-recognition-based myoelectric control. IEEE Transactions on Biomedical Engineering, 56(5), 1407-1414.

Harrington, T., & Murphy, G. (2004). Lever propulsion design for manual wheelchairs. Paper presented at the Bioengineering Conference, 2004. Proceedings of the IEEE 30th Annual Northeast.

Hartman, A., Gillberg, R., Lin, C., & Nandikolla, V. K. (2018). Design and development of an autonomous robotic wheelchair for medical mobility. Paper presented at the 2018 International Symposium on Medical Robotics (ISMR).

Hartman, A., & Nandikolla, V. K. (2019). Human-Machine Interface for a Smart Wheelchair. Journal of Robotics, 2019.

He, J., Sheng, X., Zhu, X., & Jiang, N. (2019). Electrode density affects the robustness of myoelectric pattern recognition system with and without electrode shift. IEEE journal of biomedical and health informatics, 23(1), 156-163.

He, J., Zhu, X., & Jiang, N. (2017). Effects of Electrode Configuration on Pattern Recognition Based Finger Movement Classification. Paper presented at the International Conference on Human-Computer Interaction.

Heales, L. J., Tucker, K., Vicenzino, B., Hodges, P. W., & MacDonald, D. A. (2018). A comparison of fine wire insertion techniques for deep finger flexor muscle electromyography. Journal of Electromyography and Kinesiology, 41, 77-81.

Henzinger, T. A., Kopke, P. W., Puri, A., & Varaiya, P. (1998). What's decidable about hybrid automata? Journal of computer and system sciences, 57(1), 94-124.

Heo, Y., Hong, E.-p., Chang, Y.-h., Jeong, B., & Mun, M.-s. (2018). Experimental comparison of torque balance controllers for power-assisted wheelchair driving. Measurement, 120, 175-181.

Herda, T. J., Trevino, M. A., Sterczala, A. J., Miller, J. D., Wray, M. E., Dimmick, H. L., . . . Fry, A. C. (2019). Muscular strength and power are correlated with motor unit action potential amplitudes, but not myosin heavy chain isoforms in sedentary males and females. Journal of biomechanics, 86, 251-255.

Herle, S., Man, S., Lazea, G., Marcu, C., Raica, P., & Robotin, R. (2010). Hierarchical myoelectric control of a human upper limb prosthesis. Paper presented at the 19th International Workshop on Robotics in Alpe-Adria-Danube Region (RAAD 2010).

Hermens, H. J., Freriks, B., Disselhorst-Klug, C., & Rau, G. (2000). Development of recommendations for SEMG sensors and sensor placement procedures. Journal of electromyography and Kinesiology, 10(5), 361-374.

Herrmens, H., & Freriks, B. (1999). European recommendations for surface electromyography, results of the SENIAM project (CDrom). Roessingh Research and Development, Enschede.

Hoffman, A. H., & Liadis, K. N. (2011). Design of a power-assist wheelchair for persons with hemiplegia. Paper presented at the 2011 IEEE Conference on Technologies for Practical Robot Applications.

Hossain, T., Sabbir, M. S.-U.-A., Mariam, A., Inan, T. T., Islam, M. N., Mahbub, K., & Sazid, M. T. (2019). Towards Developing an Intelligent Wheelchair for People with Congenital Disabilities and Mobility Impairment. Paper presented at the 2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT).

Howarth, S. J., Polgar, J. M., Dickerson, C. R., & Callaghan, J. P. (2010). Trunk muscle activity during wheelchair ramp ascent and the influence of a geared wheel on the demands of postural control. Archives of physical medicine and rehabilitation, 91(3), 436-442.

Howarth, S. J., Pronovost, L. M., Polgar, J. M., Dickerson, C. R., & Callaghan, J. P. (2010). Use of a geared wheelchair wheel to reduce propulsive muscular demand during ramp ascent: Analysis of muscle activation and kinematics. Clinical Biomechanics, 25(1), 21-28.

Huang, C.-K., Wang, Z.-W., Chen, G.-W., & Yang, C.-Y. (2017). Development of a smart wheelchair with dual functions: Real-time control and automated guide. Paper presented at the 2017 2nd International Conference on Control and Robotics Engineering (ICCRE).

Huang, T.-H., Yang, J., Pushaj, E., Silvanov, V., Yu, S., Yang, X., . . . Francisco, G. (2019). Soft Physiology Sensors and Machine Learning to Enhance Spinal Cord Injury and Stroke Rehabilitation Outcomes in Home Settings. Paper presented at the 2019 Design of Medical Devices Conference.

Hug, F., Hodges, P. W., & Tucker, K. J. (2013). Effect of pain location on spatial reorganisation of muscle activity. Journal of Electromyography and Kinesiology, 23(6), 1413-1420.

Inoue, W., Ikezoe, T., Tsuboyama, T., Sato, I., Malinowska, K. B., Kawaguchi, T., . . . Ichihashi, N. (2017). Are there different factors affecting walking speed and gait cycle variability between men and women in community-dwelling older adults? Aging clinical and experimental research, 29(2), 215-221.

Ishii, C., & Konishi, R. (2016). A Control of Electric Wheelchair Using an EMG Based on Degree of Muscular Activity. Paper presented at the Digital System Design (DSD), 2016 Euromicro Conference on.

Jaber, H. A., & Rashid, M. T. (2019). HD-sEMG Gestures Recognition by SVM Classifier for Controlling Prosthesis. IRAQI JOURNAL OF COMPUTERS, COMMUNICATION AND CONTROL & SYSTEMS ENGINEERING, 19(1), 10-19.

Jahanian, O., Gaglio, A., Daigle, S., Muqeet, V., Schnorenberg, A. J., Hsiao-Wecksler, E. T., & Slavens, B. A. (2018). Hand-rim biomechanics of geared manual wheelchair mobility. Paper presented at the Proceeding of the RESNA Annual Conference; 2018 July.

Jahanian, O., Schnorenberg, A. J., & Slavens, B. A. (2016). Evaluation of shoulder joint kinematics and muscle activity during geared and standard manual wheelchair mobility. Paper presented at the 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).

Jalal Abdullah, S., & Shaikh Mohammed, J. (2019). Low-cost low-tech obstacle pushing/gliding wheelchair accessory. Disability and Rehabilitation: Assistive Technology, 14(8), 849-858.

Jamal, M. Z. (2012). Signal acquisition using surface EMG and circuit design considerations for robotic prosthesis Computational Intelligence in Electromyography Analysis-A Perspective on Current Applications and Future Challenges: InTech.

Jamal, M. Z., & Kim, K.-S. (2018). A finely machined toothed silver electrode surface for improved acquisition of EMG signals. Paper presented at the 2018 IEEE Sensors Applications Symposium (SAS).

Jang, G., & Choi, Y. (2014). EMG-based continuous control method for electric wheelchair. Paper presented at the 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems.

Jang, G., Kim, J., Lee, S., & Choi, Y. (2016). EMG-Based Continuous Control Scheme With Simple Classifier for Electric-Powered Wheelchair. IEEE Transactions on Industrial Electronics, 63(6), 3695-3705.

Jerath, H., & Rohith, K. K. P. (2019). EMG Sensor based Wheel Chair Control and Safety System. Research Journal of Pharmacy and Technology, 12(6), 2730-2735.

Jones, M. L., & Sanford, J. A. (1996). People with mobility impairments in the United States today and in 2010. Assistive Technology, 8(1), 43-53.

Joraimee, M., Tarmizi, I., Redhwan, A., Hairy, B., & Azinee, S. (2018). Powered Electric Wheelchair Controlled by Real-Time Electromyography. Advanced Science Letters, 24(6), 4183-4187.

Kainz, H., Modenese, L., Lloyd, D., Maine, S., Walsh, H., & Carty, C. (2016). Joint kinematic calculation based on clinical direct kinematic versus inverse kinematic gait models. Journal of biomechanics, 49(9), 1658-1669.

Kaiser, M. S., Chowdhury, Z. I., Al Mamun, S., Hussain, A., & Mahmud, M. (2016a). A neuro-fuzzy control system based on feature extraction of surface electromyogram signal for solar-powered wheelchair. Cognitive Computation, 8(5), 946-954.

Kaiser, M. S., Chowdhury, Z. I., Al Mamun, S., Hussain, A., & Mahmud, M. (2016b). A Neuro-Fuzzy Control System Based on Feature Extraction of Surface Electromyogram Signal for Solar-Powered Wheelchair. Cognitive Computation, 1-9.

Karimi, M. T., Gutierrez-Farewik, L., & McGarry, A. (2019). Evaluation of the hip joint contact force in subjects with Perthes based on OpenSIM. Medical engineering & physics, 67, 44-48.

Kassa, E. Z., Tamiru, B., Yimam, A., & Sulieman, A. (2018). Design and Modification of One Arm Driven Manual Hemiplegic Wheelchair. Iranian Journal of Mechanical Engineering Transactions of the ISME, 19(1), 63-78.

Katevas, N. I., Sgouros, N. M., Tzafestas, S. G., Papakonstantinou, G., Beattie, P., Bishop, J., . . . Koutsouris, D. (1997). The autonomous mobile robot SENARIO: a sensor aided intelligent navigation system for powered wheelchairs. IEEE Robotics & Automation Magazine, 4(4), 60-70.

Kaufmann, P., Englehart, K., & Platzner, M. (2010). Fluctuating EMG signals: Investigating long-term effects of pattern matching algorithms. Paper presented at the 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology.

Kehri, V., Ingle, R., Thulkar, D., & Awale, R. (2018). A Machine Learning Approach for FEMG Pattern Recognition System to Control Hands-Free Wheelchair. Available at SSRN 3347101.

Khairuddin, I. M., Na'im Sidek, S., Majeed, A. P. A., Puzi, A. A., & Yusof, H. M. (2020). A Hybrid Automata Framework for an Adaptive Impedance Control of a Robot-Assisted Training System RITA 2018 (pp. 257-265): Springer.

Khushaba, R. N., Al-Timemy, A. H., Al-Ani, A., & Al-Jumaily, A. (2017). A framework of temporal-spatial descriptors-based feature extraction for improved myoelectric pattern recognition. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 25(10), 1821-1831.

Khushaba, R. N., Kodagoda, S., Takruri, M., & Dissanayake, G. (2012). Toward improved control of prosthetic fingers using surface electromyogram (EMG) signals. Expert Systems with Applications, 39(12), 10731-10738.

Kiran, K., & Uma Rani, K. (2017). Analysis of EMG signal to evaluate muscle strength and classification. in International Research Journal of Engineering and Technology (IRJET), 4(07).

Klotz, T., Gizzi, L., Yavuz, U. Ş., & Röhrle, O. (2020). Modelling the electrical activity of skeletal muscle tissue using a multi-domain approach. Biomechanics and modeling in mechanobiology, 19(1), 335-349.

Kokosy, A., Floquet, T., Howells, G., Hu, H., Pepper, M., Sakel, M., & Donze, C. (2013). SYSIASS? an intelligent powered wheelchair.

Kollmann, J., Lankenau, A., Bühlmeier, A., Krieg-Brückner, B., Röfer, T., & Krieg, B. (1997). Navigation of a kinematically restricted wheelchair by the parti-game algorithm. Paper presented at the Manchester University.

Koontz, A. M., Cooper, R. A., Boninger, M. L., Souza, A. L., & Fay, B. T. (2002). Shoulder kinematics and kinetics during two speeds of wheelchair propulsion. Journal of Rehabilitation Research and Development, 39(6), 635.

Koroniotis, N., Moustafa, N., Sitnikova, E., & Slay, J. (2017). Towards developing network forensic mechanism for botnet activities in the iot based on machine learning techniques. Paper presented at the International Conference on Mobile Networks and Management.

Krebs, H. I., Volpe, B. T., Williams, D., Celestino, J., Charles, S. K., Lynch, D., & Hogan, N. (2007). Robot-aided neurorehabilitation: a robot for wrist rehabilitation. IEEE transactions on neural systems and rehabilitation engineering, 15(3), 327-335.

Kumar, B., Paul, Y., & Jaswal, R. A. (2019). Development of EMG Controlled Electric Wheelchair Using SVM and kNN Classifier for SCI Patients. Paper presented at the International Conference on Advanced Informatics for Computing Research.

Kumar, S. L., Swathy, M., Vidya, M., Poojaa, K., Manikandan, G., & Jennifer, A. A. (2018). Wireless Bio signal Acquisition Electrode module for EMG. Paper presented at the 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT).

Kuncheva, L. I. (2002). A theoretical study on six classifier fusion strategies. IEEE Transactions on pattern analysis and machine intelligence, 24(2), 281-286.

Kundu, A. S., Mazumder, O., Lenka, P. K., & Bhaumik, S. (2017). Omnidirectional assistive wheelchair: design and control with isometric myoelectric based intention classification. Procedia Computer Science, 105, 68-74.

Kundu, A. S., Mazumder, O., Lenka, P. K., & Bhaumik, S. (2018). Hand gesture recognition based omnidirectional wheelchair control using IMU and EMG sensors. Journal of Intelligent & Robotic Systems, 91(3-4), 529-541.

Kuno, Y., Shimada, N., & Shirai, Y. (2003). Look where you're going [robotic wheelchair]. IEEE Robotics & Automation Magazine, 10(1), 26-34.

Kuriki, H. U., De Azevedo, F. M., Takahashi, L. S. O., Mello, E. M., de Faria Negrão Filho, R., & Alves, N. (2012). The relationship between electromyography and muscle force EMG Methods for evaluating muscle and nerve function: Intechopen.

Langholz, J. B., Westman, G., & Karlsteen, M. (2016). Musculoskeletal modelling in sports-evaluation of different software tools with focus on swimming. Procedia engineering, 147, 281-287.

Latif, S., Javed, J., Ghafoor, M., Moazzam, M., & Khan, A. A. (2019). Design and development of muscle and flex sensor controlled robotic hand for disabled persons. Paper presented at the 2019 International Conference on Applied and Engineering Mathematics (ICAEM).

Lee, G., Kim, K., & Kim, J. (2016). Development of hands-free wheelchair device based on head movement and bio-signal for quadriplegic patients. International Journal of Precision Engineering and Manufacturing, 17(3), 363-369.

Lee, I., & Lee, K. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. Business Horizons, 58(4), 431-440.

Lee, K.-m., Lee, C.-H., Hwang, S., Choi, J., & Bang, Y.-b. (2016). Power-Assisted Wheelchair With Gravity and Friction Compensation. IEEE Transactions on Industrial Electronics, 63(4), 2203-2211.

Lee, S., & Kruse, J. (2008). Biopotential electrode sensors in ECG/EEG/EMG systems. Analog Devices, 200, 1-2.

Levine, S. P., Bell, D. A., Jaros, L. A., Simpson, R. C., Koren, Y., & Borenstein, J. (1999). The NavChair assistive wheelchair navigation system. IEEE transactions on rehabilitation engineering, 7(4), 443-451.

Levy, C. E., Buman, M. P., Chow, J. W., Tillman, M. D., Fournier, K. A., & Giacobbi Jr, P. (2010). Use of Power Assist-Wheels Results in Increased Distance Traveled Compared to Conventional Manual Wheeling. American journal of physical medicine & rehabilitation/Association of Academic Physiatrists, 89(8), 625.

Levy, C. E., & Chow, J. W. (2004). Pushrim-activated power-assist wheelchairs: elegance in motion. American journal of physical medicine & rehabilitation, 83(2), 166-167.

Levy, C. E., Chow, J. W., Tillman, M. D., Hanson, C., Donohue, T., & Mann, W. C. (2004). Variable-ratio pushrim-activated power-assist wheelchair eases wheeling over a variety of terrains for elders. Archives of physical medicine and rehabilitation, 85(1), 104-112.

Li, G., Li, Y., Yu, L., & Geng, Y. (2011). Conditioning and sampling issues of EMG signals in motion recognition of multifunctional myoelectric prostheses. Annals of biomedical engineering, 39(6), 1779-1787.

Li, G., Li, Y., Zhang, Z., Geng, Y., & Zhou, R. (2010). Selection of sampling rate for EMG pattern recognition based prosthesis control. Paper presented at the 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology.

Lighthall-Haubert, L., Requejo, P. S., Mulroy, S. J., Newsam, C. J., Bontrager, E., Gronley, J. K., & Perry, J. (2009). Comparison of shoulder muscle electromyographic activity during standard manual wheelchair and push-rim activated power assisted wheelchair propulsion in persons with complete tetraplegia. Archives of physical medicine and rehabilitation, 90(11), 1904-1915.

Lighthall Haubert, L., Mulroy, S. J., Requejo, P. S., Maneekobkunwong, S., Gronley, J. K., Rankin, J. W., . . . Hong, K. (2019). Effect of reverse manual wheelchair propulsion on shoulder kinematics, kinetics and muscular activity in persons with paraplegia. The journal of spinal cord medicine, 1-13.

Lin, C.-J., Lin, P.-C., Guo, L.-Y., & Su, F.-C. (2011). Prediction of applied forces in handrim wheelchair propulsion. Journal of biomechanics, 44(3), 455-460.

Lin, Y.-T., & Kuo, C.-H. (2016). Development of SSVEP-based intelligent wheelchair brain computer interface assisted by reactive obstacle avoidance. Paper presented at the 2016 IEEE International Conference on Industrial Technology (ICIT).

Lin, Z., Ji, K., Kang, M., Leng, X., & Zou, H. (2017). Deep convolutional highway unit network for SAR target classification with limited labeled training data. IEEE Geoscience and Remote Sensing Letters, 14(7), 1091-1095.

Lolis, A. M., Falsone, S., & Beric, A. (2018). Common peripheral nerve injuries in sport: diagnosis and management Handbook of clinical neurology (Vol. 158, pp. 401-419): Elsevier.

Lopes, A., Rodrigues, J., Perdigao, J., Pires, G., & Nunes, U. (2016). A New Hybrid Motion Planner: Applied in a Brain-Actuated Robotic Wheelchair. IEEE Robotics & Automation Magazine, 23(4), 82-93.

Louis, N., & Gorce, P. (2010). Surface electromyography activity of upper limb muscle during wheelchair propulsion: Influence of wheelchair configuration. Clinical Biomechanics, 25(9), 879-885.

Lung, C.-W., Chen, C.-L., Jan, Y.-K., Chao, L.-F., Chen, W.-F., & Liau, B.-Y. (2017). Activation sequence patterns of forearm muscles for driving a power wheelchair. Paper presented at the International Conference on Applied Human Factors and Ergonomics.

Lyman, J., Freedy, A., & Prior, R. (1976). Fundamental and applied research related to the design and development of upper-limb externally powered prostheses. Bull. Prosthet. Res, 13, 184-195.

M. H. Muhammad Sidik, S. A. C. G., Meseret Nasir, Mahfodzah M Padzi. (2018). Innovation on Manual Wheelchair for Hemiplegic and Tetraplegic Patients Journal of Advanced Research in Dynamical and Control Systems, 10(13- Special issue), 1221 - 1235.

Maeda, Y., & Ishibashi, S. (2017). Operating instruction method based on EMG for omnidirectional wheelchair robot. Paper presented at the 2017 Joint 17th World Congress of International Fuzzy Systems Association and 9th International Conference on Soft Computing and Intelligent Systems (IFSA-SCIS).

Mahbub, M. (2019). Automated control signal reception acknowledgement system using nRF24L01P wireless transceiver module and Arduino. Journal of Applied Science & Process Engineering, 6(1), 329-339.

Mahendran, R. (2014). EMG signal based control of an intelligent wheelchair. Paper presented at the 2014 International Conference on Communication and Signal Processing.

Maki, K. C., Langbein, W. E., & Reid-Lokos, C. (1995). Energy cost and locomotive economy of handbike and rowcycle propulsion by persons with spinal cord injury. Journal of rehabilitation research and development, 32(2), 170.

Malik, N. K., & Singh, V. (2016). A human inspired cognitive wheelchair navigation system. International Journal of Human Factors Modelling and Simulation, 5(3), 263-284.

Mallik, S., & Dutta, M. (2017). A Study on Control of Myoelectric Prosthetic Hand Based on Surface EMG Pattern Recognition. International Journal of Advanced Research in Science and Engineering, 6(7), 635-646.

Mancebo, F. D., Cabral, H. V., de Souza, L. M., de Oliveira, L. F., & Vieira, T. M. (2019). Innervation zone locations distribute medially within the pectoralis major muscle during bench press exercise. Journal of Electromyography and Kinesiology.

Mandy, A., & Lesley, S. (2009). Measures of energy expenditure and comfort in an ESP wheelchair: a controlled trial using hemiplegic users'. Disability and Rehabilitation: Assistive Technology, 4(3), 137-142.

Marateb, H. R., Rojas-Martínez, M., Mansourian, M., Merletti, R., & Villanueva, M. A. M. (2012). Outlier detection in high-density surface electromyographic signals. Medical & biological engineering & computing, 50(1), 79-89.

Martin, S., & MacIsaac, D. (2006). Innervation zone shift with changes in joint angle in the brachial biceps. Journal of Electromyography and Kinesiology, 16(2), 144-148.

Matsumotot, Y., Ino, T., & Ogsawara, T. (2001). Development of intelligent wheelchair system with face and gaze based interface. Paper presented at the Robot and Human Interactive Communication, 2001. Proceedings. 10th IEEE International Workshop on.

Mazo, M. (2001). An integral system for assisted mobility. IEEE Robotics and Automation Magazine, 8(1), 46-56.

McGrath, R. P., Kraemer, W. J., Al Snih, S., & Peterson, M. D. (2018). Handgrip strength and health in aging adults. Sports medicine, 48(9), 1993-2000.

McPherson, A. P., Jack, R. H., & Moro, G. (2016). Action-sound latency: Are our tools fast enough?

Medola, F. O., Purquerio, B. M., Elui, V. M., & Fortulan, C. A. (2014). Conceptual project of a servo-controlled power-assisted wheelchair. Paper presented at the 5th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics.

Megalingam, R. K., Rangan, V., Krishnan, S., & Alinkeezhil, A. B. E. (2016). IR Sensor-Based Gesture

Control Wheelchair for Stroke and SCI Patients. IEEE Sensors Journal, 16(17), 6755-6765.

Merletti, R., Botter, A., Troiano, A., Merlo, E., & Minetto, M. A. (2009). Technology and instrumentation for detection and conditioning of the surface electromyographic signal: state of the art. Clinical Biomechanics, 24(2), 122-134.

Merletti, R., & Hermens, H. (2004). Detection and conditioning of the surface EMG signal. Electromyography: physiology, engineering, and noninvasive applications, 107-131.

Mesin, L. (2018). Optimal spatio-temporal filter for the reduction of crosstalk in surface electromyogram. Journal of neural engineering, 15(1), 016013.

Micera, S., Carpaneto, J., & Raspopovic, S. (2010). Control of hand prostheses using peripheral information. IEEE Reviews in Biomedical Engineering, 3, 48-68.

Miller, D. P., & Slack, M. G. (1995). Design and testing of a low-cost robotic wheelchair prototype. Autonomous robots, 2(1), 77-88.

Minati, L., Yoshimura, N., & Koike, Y. (2016). Hybrid control of a vision-guided robot arm by EOG, EMG, EEG biosignals and head movement acquired via a consumer-grade wearable device. Ieee Access, 4, 9528-9541.

Mithbavkar, S. A., & Shah, M. S. (2019). Recognition of Emotion Through Facial Expressions Using EMG Signal. Paper presented at the 2019 International Conference on Nascent Technologies in Engineering (ICNTE).

Mobarak, M. P., Guerrero, R. M., Salgado, J. G., & Dorr, V. L. (2014). Hand movement classification using transient state analysis of surface multichannel EMG signal. Paper presented at the 2014 Pan American Health Care Exchanges (PAHCE).

Mohr, M., Schön, T., Von Tscharner, V., & Nigg, B. (2018). Intermuscular Coherence Between Surface EMG Signals Is Higher for Monopolar Compared to Bipolar Electrode Configurations. Frontiers in physiology, 9, 566.

Montesano, L., Díaz, M., Bhaskar, S., & Minguez, J. (2010). Towards an intelligent wheelchair system for users with cerebral palsy. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 18(2), 193-202.

Moon, I., Lee, M., Chu, J., & Mun, M. (2005). Wearable EMG-based HCI for electric-powered wheelchair users with motor disabilities. Paper presented at the proceedings of the 2005 IEEE international conference on robotics and automation.

Moon, I., Lee, M., Ryu, J., & Mun, M. (2003). Intelligent robotic wheelchair with EMG-, gesture-, and voice-based interfaces. Paper presented at the Intelligent Robots and Systems, 2003.(IROS 2003). Proceedings. 2003 IEEE/RSJ International Conference on.

Morrow, M. M., Rankin, J. W., Neptune, R. R., & Kaufman, K. R. (2014). A comparison of static and dynamic optimization muscle force predictions during wheelchair propulsion. Journal of biomechanics, 47(14), 3459-3465.

Mundra, A., Mundra, S., Mathur, S., Sachdev, A., & Kumar, A. (2019). Gesture Recognition based on EMG Signals: A comparative study. Gesture, 28(12), 236-246.

Murakami, T., Yu, F., & Ohnishi, K. (1993). Torque sensorless control in multidegree-of-freedom manipulator. IEEE Transactions on Industrial Electronics, 40(2), 259-265.

Naerum, E., Elle, O. J., & Hannaford, B. (2012). The effect of interaction force estimation on performance in bilateral teleoperation. IEEE transactions on haptics, 5(2), 160-171.

Nazmi, N., Abdul Rahman, M., Yamamoto, S.-i., Ahmad, S., Malarvili, M., Mazlan, S., & Zamzuri, H. (2017). Assessment on stationarity of EMG signals with different windows size during isotonic contractions. Applied Sciences, 7(10), 1050.

Negi, S., Kumar, Y., & Mishra, V. (2016). Feature extraction and classification for EMG signals using linear discriminant analysis. Paper presented at the 2016 2nd International Conference on Advances in Computing, Communication, & Automation (ICACCA)(Fall).

Neuman MR, B. J. (2000). The Biomedical Engineering Handbook. 889-900.

Njah, M., & Jallouli, M. (2016). Fuzzy-EKF Controller for Intelligent Wheelchair Navigation. Journal of Intelligent Systems, 25(2), 107-121.

Noor, N. M., & Ahmad, S. (2013). Analysis of different level of eog signal from eye movement for wheelchair control. International Journal of Biomedical Engineering and Technology, 11(2), 175-196.

Noor, N. Q. M., Jamaludin, A. A., Azizan, A., Abas, H., Kamardin, K., & Yakub, M. F. M. (2018). Arduino vs Raspberry Pi vs Micro Bit: Platforms for Fast IoT Systems Prototyping. Open International Journal of Informatics (OIJI), 96-107.

Nowson, C. A., Appleton, J., & Grieger, J. (2018). The impact of dietary factors on indices of chronic disease in older people: A systematic review. The journal of nutrition, health & aging, 22(2), 282-296.

Odle, B., Forrest, G., Reinbolt, J., & Dyson-Hudson, T. (2011). Development of an OpenSim shoulder model for manual wheelchair users with tetraplegia. Paper presented at the ASME 2011 International Mechanical Engineering Congress and Exposition.

Odle, B., Reinbolt, J., Forrest, G., & Dyson-Hudson, T. (2019). Construction and evaluation of a model for wheelchair propulsion in an individual with tetraplegia. Medical & biological engineering & computing, 57(2), 519-532.

OER. (2015). Skeletal Muscle.

Oh, S., Kong, K., & Hori, Y. (2014a). Design and analysis of force-sensor-less power-assist control. IEEE Transactions on Industrial Electronics, 61(2), 985-993.

Oh, S., Kong, K., & Hori, Y. (2014b). Operation state observation and condition recognition for the control of power-assisted wheelchair. Mechatronics, 24(8), 1101-1111.

Ohba, Y., Katsura, S., & Ohishi, K. (2006). Sensor-less force control for machine tool using reaction torque observer. Paper presented at the Industrial Technology, 2006. ICIT 2006. IEEE International Conference on.

Ohba, Y., Sazawa, M., Ohishi, K., Asai, T., Majima, K., Yoshizawa, Y., & Kageyama, K. (2009). Sensorless force control for injection molding machine using reaction torque observer considering torsion phenomenon. IEEE Transactions on Industrial Electronics, 56(8), 2955-2960.

Ohishi, S., & Kondo, T. (2012). A proposal of EMG-based wheelchair for preventing disuse of lower motor function. Paper presented at the 2012 Proceedings of SICE Annual Conference (SICE).

Omnia-health. (2017). MYOLINE: EMG CONCENTRIC NEEDLE ELECTRODES.

Omrane, H., Masmoudi, M. S., & Masmoudi, M. (2016). Fuzzy Logic Based Control for Autonomous Mobile Robot Navigation. Computational Intelligence and Neuroscience, 2016.

Omrani, T., Rhouma, R., & Sliman, L. (2018). Lightweight cryptography for resource-constrained devices: a comparative study and rectangle cryptanalysis. Paper presented at the International Conference on Digital Economy.

Oskoei, M. A., & Hu, H. (2007). Myoelectric control systems—A survey. Biomedical signal processing and control, 2(4), 275-294.

Oskoei, M. A., & Hu, H. (2008). Support vector machine-based classification scheme for myoelectric control applied to upper limb. IEEE transactions on biomedical engineering, 55(8), 1956-1965.

Pancholi, S., & Joshi, A. M. (2018). Portable EMG data acquisition module for upper limb prosthesis application. IEEE Sensors Journal, 18(8), 3436-3443.

Parikh, S. P., Rao, R., Jung, S.-H., Kumar, V., Ostrowski, J. P., & Taylor, C. J. (2003). Human robot interaction and usability studies for a smart wheelchair. Paper presented at the Intelligent Robots and Systems, 2003.(IROS 2003). Proceedings. 2003 IEEE/RSJ International Conference on.

Pavlakis, A., Raftopoulos, V., & Theodorou, M. (2010). Burnout syndrome in Cypriot physiotherapists: a national survey. BMC Health Services Research, 10(1), 63.

Perez-Sanpablo, A. I., Ibarra-Zannatha, J. M., Cifuentes-Garcia, C. A., & Rodriguez-Cheu, L. E. (2016). Implementation of a shoulder and elbow musculoskeletal model in musculoskeletal modelling and simulation software (MSMS). Paper presented at the 2016 IEEE Colombian Conference on Robotics and Automation (CCRA).

Pérez, I. G., Godoy, A. J. C., Godoy, M. C., & González, J. F. G. (2019). Survey about the Utilization of Open Source Arduino for Control and Measurement Systems in Advanced Scenarios. Application to Smart Micro-Grid and Its Digital Replica.

Perry, J., Easterday, C. S., & Antonelli, D. J. (1981). Surface versus intramuscular electrodes for electromyography of superficial and deep muscles. Physical therapy, 61(1), 7-15.

Phinyomark, A., Phukpattaranont, P., & Limsakul, C. (2012). Feature reduction and selection for EMG signal classification. Expert systems with applications, 39(8), 7420-7431.

Phinyomark, A., & Scheme, E. (2018). EMG pattern recognition in the era of big data and deep learning. Big Data and Cognitive Computing, 2(3), 21.

Pickett, K., Kendrick, T., & Yardley, L. (2017). "A forward movement into life": a qualitative study of how, why and when physical activity may benefit depression. Mental Health and Physical Activity, 12, 100-109.

Piitulainen, H., Rantalainen, T., Linnamo, V., Komi, P., & Avela, J. (2009). Innervation zone shift at different levels of isometric contraction in the biceps brachii muscle. Journal of electromyography and kinesiology, 19(4), 667-675.

Prassler, E., Scholz, J., & Fiorini, P. (2001). A robotics wheelchair for crowded public environment. IEEE Robotics & Automation Magazine, 8(1), 38-45.

Puente, S., Úbeda, A., & Torres, F. (2017). e-Health: Biomedical instrumentation with Arduino. IFAC-PapersOnLine, 50(1), 9156-9161.

Qi, L., Wakeling, J., Grange, S., & Ferguson-Pell, M. (2012). Changes in surface electromyography signals and kinetics associated with progression of fatigue at two speeds during wheelchair propulsion. J Rehabil Res Dev, 49(1), 23-34.

Qing, T., Zhao-Bo, L., & Jinsheng, K. (2018). Evaluation of human upper limb motion comfort based on motion capture system. Paper presented at the 2018 24th International Conference on Automation and Computing (ICAC).

Qizhu, S., Yining, S., Xiangfeng, D., & Zuchang, M. (2005). Onset determination of muscle contraction in surface electromyography signals analysis. Paper presented at the 2005 IEEE International Conference on Information Acquisition.

Rabhi, Y., Mrabet, M., & Fnaiech, F. (2018). Intelligent control wheelchair using a new visual joystick. Journal of healthcare engineering, 2018.

Rahmatillah, A., Rahma, O. N., Amin, M., Wicaksana, S. I., Ain, K., & Rulaningtyas, R. (2018). Post-Stroke Rehabilitation Exosceleton Movement Control using EMG Signal. International Journal on Advanced Science, Engineering and Information Technology, 8(2), 616-621.

Raiyan, Z., Nawaz, M. S., Adnan, A. A., & Imam, M. H. (2017). Design of an arduino based voice-controlled automated wheelchair. Paper presented at the 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC).

Raj, R., & Sivanandan, K. (2015). Estimation of elbow joint angle from time domain features of SEMG signals using fuzzy logic for prosthetic control. Int journal of current engineering and technology, 5(3), 2078-2081.

Rakasena, E., & Herdiman, L. (2020). Electric wheelchair with forward-reverse control using electromyography (EMG) control of arm muscle. Paper presented at the Journal of Physics: Conference Series.

Rani, D., & Tagaram, R. (2019). EMG CONTROL OF A ROBOTIC ARM.

Rankin, J. W., Kwarciak, A. M., Richter, W. M., & Neptune, R. R. (2010). The influence of altering push force effectiveness on upper extremity demand during wheelchair propulsion. Journal of Biomechanics, 43(14), 2771-2779.

Rankin, J. W., Kwarciak, A. M., Richter, W. M., & Neptune, R. R. (2012). The influence of wheelchair propulsion technique on upper extremity muscle demand: a simulation study. Clinical biomechanics, 27(9), 879-886.

Rankin, J. W., Richter, W. M., & Neptune, R. R. (2011). Individual muscle contributions to push and recovery subtasks during wheelchair propulsion. Journal of biomechanics, 44(7), 1246-1252.

Raskin, J.-F. (2005). An introduction to hybrid automata Handbook of networked and embedded control systems (pp. 491-517): Springer.

Rechy-Ramirez, E. J., & Hu, H. (2013). Bi-modal human machine interface for controlling an intelligent wheelchair. Paper presented at the 2013 Fourth International Conference on Emerging Security Technologies.

Rechy-Ramirez, E. J., Hu, H., & McDonald-Maier, K. (2012). Head movements based control of an intelligent wheelchair in an indoor environment. Paper presented at the 2012 IEEE International Conference on Robotics and Biomimetics (ROBIO).

Requejo, P., Mulroy, S., Haubert, L. L., Newsam, C., Gronley, J., & Perry, J. (2008). Evidence-based strategies to preserve shoulder function in manual wheelchair users with spinal cord injury. Topics in Spinal Cord Injury Rehabilitation, 13(4), 86-119.

Requejo, P. S., Mulroy, S. J., Ruparel, P., Hatchett, P. E., Haubert, L. L., Eberly, V. J., & Gronley, J. K. (2015). Relationship Between Hand Contact Angle and Shoulder Loading During Manual Wheelchair Propulsion by Individuals with Paraplegia. Topics in spinal cord injury rehabilitation, 21(4), 313-324.

Resnik, L., Huang, H. H., Winslow, A., Crouch, D. L., Zhang, F., & Wolk, N. (2018). Evaluation of EMG pattern recognition for upper limb prosthesis control: a case study in comparison with direct myoelectric control. Journal of neuroengineering and rehabilitation, 15(1), 23.

Richter, W. M., & Axelson, P. W. (2005). Low-impact wheelchair propulsion: achievable and acceptable. Journal of rehabilitation research and development, 42(3), 21.

robslink. (2010). Weight of human body parts.

Rodriguez-Falces, J. (2017). A new method for the localization of the innervation zone based on monopolar surface-detected potentials. Journal of Electromyography and Kinesiology, 35, 47-60.

Rojas, A., Farfan, A., Ayavaca, M., Cardenas, V., Mora, E., Wong, S., & Minchala, L. I. (2018). Single-channel electromyography based on Arduino for analysis of the swing phase in normal gait. Paper presented at the 2018 IEEE XXV International Conference on Electronics, Electrical Engineering and Computing (INTERCON).

Ruhen, Y. L.-D. (2011). Atlas of Anatomy. 7th Edition.

Russo, R. E., Fernández, J., Rivera, R., Kuzman, M. G., López, J., Gemin, W., & Revuelta, M. Á. (2018). Algorithm of Myoelectric Signals Processing for the Control of Prosthetic Robotic Hands. Journal of Computer Science & Technology, 18.

Rusydi, M., Aryeni, I., Romadhon, Z., & Rusydi, A. (2019). Robot mobile control based on three EMG signals using an artificial neural network. Paper presented at the IOP Conference Series: Materials Science and Engineering.

Ruvalcaba, A., Altamirano, A., Toledo, C., Muñoz, R., Vera, A., & Leija, L. (2014). Multichannel EMG acquisition system for arm and forearm signal detection. Paper presented at the 2014 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings.

Sahoo, P. K., Mohapatra, S. K., & Wu, S.-L. (2016). Analyzing healthcare big data with prediction for future health condition. IEEE Access, 4, 9786-9799.

Saitou, K., Masuda, T., Michikami, D., Kojima, R., & Okada, M. (2000). Innervation zones of the upper and lower limb muscles estimated by using multichannel surface EMG. Journal of human ergology, 29(1-2), 35-52.

Samsudin, S., Abdullah, N., Ismail, N. S. A., Hassan, K., & Ahmad, U. A. (2019). Growing Old at Own Home: a Study Among Pre-Elderly Adults in Peninsular Malaysia. Economics & Sociology, 12(1), 115-366.

Sanders, D. A. (2016). Using self-reliance factors to decide how to share control between human powered wheelchair drivers and ultrasonic sensors. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 25(8), 1221-1229.

Sandoval-Gonzalez, O., Jacinto-Villegas, J., Herrera-Aguilar, I., Portillo-Rodiguez, O., Tripicchio, P., Hernandez-Ramos, M., . . . Avizzano, C. (2016). Design and development of a hand exoskeleton robot for active and passive rehabilitation. International Journal of Advanced Robotic Systems, 13(2), 66.

Santos, M. C., Barros, L., & Carolino, E. (2010). Occupational stress and coping resources in physiotherapists: a survey of physiotherapists in three general hospitals. Physiotherapy, 96(4), 303-310.

Sarabia, M., & Demiris, Y. (2013). A humanoid robot companion for wheelchair users. Paper presented at the International Conference on Social Robotics.

Sasaki, M., Onishi, K., Stefanov, D., Kamata, K., Nakayama, A., Yoshikawa, M., & Obinata, G. (2016). Tongue interface based on surface EMG signals of suprahyoid muscles. Robomech Journal, 3(1), 9.

Sasou, A. (2011). Powered Wheelchair Control Using Acoustic-Based Recognition of Head Gesture Accompanying Speech. Paper presented at the INTERSPEECH.

Sathish, S., Nithyakalyani, K., Vinurajkumar, S., Vijayalakshmi, C., & Sivaraman, J. (2016). Control of Robotic Wheel Chair using EMG Signals for Paralysed Persons. Indian Journal of Science and Technology, 9(1).

Scheme, E., Englehart, K., & Hudgins, B. (2010). A one-versus-one classifier for improved robustness of myoelectric control. Paper presented at the The 18th Congress of the International Society of Electrophysiology and Kinesiology.

Scheme, E. J., Englehart, K. B., & Hudgins, B. S. (2011). Selective classification for improved robustness of myoelectric control under nonideal conditions. IEEE Transactions on Biomedical Engineering, 58(6), 1698-1705.

Scopus. (1st May 2020). Analyze search results.

Seki, H., Ishihara, K., & Tadakuma, S. (2009). Novel regenerative braking control of electric power-assisted wheelchair for safety downhill road driving. IEEE Transactions on Industrial Electronics, 56(5), 1393-1400.

Seki, H., Kobayashi, S., Kamiya, Y., Hikizu, M., & Nomura, H. (2000). Autonomous/semi-autonomous navigation system of a wheelchair by active ultrasonic beacons. Paper presented at the Robotics and Automation, 2000. Proceedings. ICRA'00. IEEE International Conference on.

Shah, K., Shah, V., & Shah, C. (2016). Head Movement Based Wheelchair. Imperial Journal of Interdisciplinary Research, 2(5).

Sharma, S. K. (2017). Body Sensor Networks: In the Era of Big Data and Beyond. International Journal of Advanced Research in Computer Science, 8(4).

Sheean, G. L. (2012). Quantification of motor unit action potential energy. Clinical neurophysiology, 123(3), 621-625.

Shen, J., Xu, B., Pei, M., & Jia, Y. (2016). A low-cost tele-presence wheelchair system. Paper presented at the Intelligent Robots and Systems (IROS), 2016 IEEE/RSJ International Conference on.

Shi, W.-T., Lyu, Z.-J., Tang, S.-T., Chia, T.-L., & Yang, C.-Y. (2018). A bionic hand controlled by hand gesture recognition based on surface EMG signals: A preliminary study. Biocybernetics and Biomedical Engineering, 38(1), 126-135.

Shimono, T., Katsura, S., & Ohnishi, K. (2007). Abstraction and reproduction of force sensation from real environment by bilateral control. IEEE Transactions on Industrial Electronics, 54(2), 907-918.

Shino, M., Yamakawa, Y., Inoue, T., & Kamata, M. (2008). Longitudinal stability control of electric wheelchairs for persons with severe disability. Vehicle System Dynamics, 46(S1), 389-402.

Silva, A., Morére, Y., Naves, E., De Sa, A., & Soares, A. (2013). Virtual electric wheelchair controlled by electromyographic signals. Paper presented at the 2013 ISSNIP Biosignals and Biorobotics Conference: Biosignals and Robotics for Better and Safer Living (BRC).

Simpson, R. C., & Levine, S. P. (2002). Voice control of a powered wheelchair. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 10(2), 122-125.

Skármeta, N. P., Espinoza-Mellado, P., & Chana, P. (2018). Orofacial Dystonia and Other Oromandibular Movement Disorders Dystonia-Different Prospects: IntechOpen.

Slowik, J. S., Requejo, P. S., Mulroy, S. J., & Neptune, R. R. (2016). The influence of wheelchair propulsion hand pattern on upper extremity muscle power and stress. Journal of biomechanics, 49(9), 1554-1561.

Soh, H., & Demiris, Y. (2011). Involving young children in the development of a safe, smart paediatric wheelchair. Paper presented at the ACM/IEEE HRI-2011 Pioneers Workshop, Lausanne, Switzerland.

Son, J., Ryu, J., Ahn, S., Kim, E. J., Lee, J. A., & Kim, Y. (2016). Effects of 4-Week intensive active-Resistive training with an EMG-based exoskeleton robot on muscle strength in older people: a pilot study. BioMed research international, 2016.

Soni, G. K., Poddar, V., Sahu, Y., & Suryawanshi, P. (2016). Hand Gesture Recognition Based Wheel Chair Direction Control Using AVR Microcontroller. Hand, 5(3).

sparkfun. (2016). MyoWare Muscle Sensor Kit.

Staudenmann, D., Kingma, I., Daffertshofer, A., Stegeman, D., & Van Dieën, J. (2009). Heterogeneity of muscle activation in relation to force direction: a multi-channel surface electromyography study on the triceps surae muscle. Journal of Electromyography and Kinesiology, 19(5), 882-895.

Stegeman, D. F., Kleine, B. U., Lapatki, B. G., & Van Dijk, J. P. (2012). High-density surface EMG: techniques and applications at a motor unit level. Biocybernetics and biomedical engineering, 32(3), 3-27.

Stepp, C. E. (2012). Surface electromyography for speech and swallowing systems: measurement, analysis, and interpretation. Journal of Speech, Language, and Hearing Research.

Suryawanshi, S., Chitode, J., & Pethakar, S. (2013). Voice Operated Intelligent Wheelchair. International Journal of Advanced Research in Computer science and software engineering, 3(5), 1.

Symonds, A. (2018). The clinical application of a novel instrumented wheelchair pushrim. UCL (University College London).

Tamilselvi, R., Merline, A., Beham, M. P., Anand, R. V., Karthik, M. S., & Uthayakumar, R. (2018). EMG activated robotic arm for amputees. Paper presented at the 2018 2nd International Conference on Inventive Systems and Control (ICISC).

Tang, T. Y. (2017). Development of Hand Cycle for Children with Cerebral Palsy (Wheelchair Propulsion Motion). UTAR.

Tang, Z., Yang, H., Zhang, L., & Liu, P. (2018). Effect of shoulder angle variation on sEMG-based elbow joint angle estimation. International Journal of Industrial Ergonomics, 68, 280-289.

Taylor, S., Symonds, A., Gorjon, J., Smitham, P., & Holloway, C. (2019). A lightweight wheelchair propulsion dynamometer for improving user energy efficiency and mobility. Paper presented at the 2019 3rd International Conference on Bio-engineering for Smart Technologies (BioSMART).

Teikari, P., Najjar, R. P., Malkki, H., Knoblauch, K., Dumortier, D., Gronfier, C., & Cooper, H. M. (2012). An inexpensive Arduino-based LED stimulator system for vision research. Journal of neuroscience methods, 211(2), 227-236.

Teodorescu, C. S., Zhang, B., & Carlson, T. (2019). Probabilistic Shared Control for a Smart Wheelchair: A Stochastic Model-Based Framework. Paper presented at the 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC).

Thiamchoo, N., & Phukpattaranont, P. (2019). The Study of EMG Channel Reduction for Hand Grasping Classification. Paper presented at the 2019 16th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-CON).

Thongpanja, S., Phinyomark, A., Limsakul, C., & Phukpattaranont, P. (2015). A robust measure of probability density function of various noises in electromyography (EMG) signal acquisition. Paper presented at the 2015 7th International Conference on Knowledge and Smart Technology (KST).

Thongpanja, S., Phinyomark, A., Quaine, F., Laurillau, Y., Limsakul, C., & Phukpattaranont, P. (2016). Probability density functions of stationary surface EMG signals in noisy environments. IEEE Transactions on Instrumentation and Measurement, 65(7), 1547-1557.

Thongpanja, S., Phinyomark, A., Quaine, F., Laurillau, Y., Wongkittisuksa, B., Limsakul, C., & Phukpattaranont, P. (2013). Effects of window size and contraction types on the stationarity of biceps brachii muscle EMG signals. Paper presented at the Proceedings of the 7th International Convention on Rehabilitation Engineering and Assistive Technology.

Tod, G., Malburet, F., Gomand, J., Barre, P.-J., & Boudon, B. (2013). An Energetic Approach to Aeroelastic Rotorcraft-Pilot Couplings Analysis.

Tomari, M. R. M., Kobayashi, Y., & Kuno, Y. (2012). Development of smart wheelchair system for a user with severe motor impairment. Procedia Engineering, 41, 538-546.

Too, J., Abdullah, A. R., Saad, N. M., Ali, N. M., & Zawawi, T. N. S. T. (2019). Exploring the Relation Between EMG Pattern Recognition and Sampling Rate Using Spectrogram. Journal of Electrical Engineering & Technology, 14(2), 947-953.

Trinler, U., Schwameder, H., Baker, R., & Alexander, N. (2019). Muscle force estimation in clinical gait analysis using AnyBody and OpenSim. Journal of biomechanics, 86, 55-63.

Tryon, J., Friedman, E., & Trejos, A. L. (2019). Performance Evaluation of EEG/EMG Fusion Methods for Motion Classification. Paper presented at the 2019 IEEE 16th International Conference on Rehabilitation Robotics (ICORR).

Tsai, K.-H., Yeh, C.-Y., & Lo, H.-C. (2008). A novel design and clinical evaluation of a wheelchair for stroke patients. International Journal of Industrial Ergonomics, 38(3), 264-271.

Tsuchie, Y., & Ushio, T. (2006). Control-invariance of sampled-data hybrid systems with periodically clocked events and jitter Analysis and Design of Hybrid Systems 2006 (pp. 417-422): Elsevier.

Tyastuti, F. H., Muslimin, D., & Effendy, A. R. (2017). Classification of EMG signal on arm muscle motion using special fourier transformation to control electric wheelchair. Paper presented at the 2017 International Conference on Advanced Mechatronics, Intelligent Manufacture, and Industrial Automation (ICAMIMIA).

Utaminingrum, F., Fauzi, M. A., Wihandika, R. C., Adinugroho, S., Kurniawan, T. A., Syauqy, D., . . . Adikara, P. P. (2017). Development of computer vision based obstacle detection and human tracking on smart wheelchair for disabled patient. Paper presented at the 2017 5th International Symposium on Computational and Business Intelligence (ISCBI).

van den Akker, L. E., Holla, J. F., Dadema, T., Visser, B., Valent, L. J., de Groot, S., . . . group, W.-s. (2019). Determinants of physical activity in wheelchair users with spinal cord injury or lower limb amputation: perspectives of rehabilitation professionals and wheelchair users. Disability and rehabilitation, 1-8.

Van der Vlies, F., Gerritsma, C., & Veeger, H. (1999). Physiological responses in hubcrank and hand rim wheelchair propulsion using a computer controlled wheelchair ergometer, in van der Woude LHV, et al.(eds): Biomedical Aspects of Manual Wheelchair Propulsion: State of the Art II: Amsterdam, IOS Press.

Van der Woude, L., Maas, K., Rozendal, R., & Veeger, D. (1995). Physiological responses during Hubcrank and handrim wheelchair propulsion: a pilot study. JOURNAL OF REHABILITATION SCIENCES, 8, 13-13.

Van der Woude, L., van Krmen, E., Ariens, G., Rozendal, R., & Veeger, H. (1995). Physical strain and mechanical efficiency in hubcrank and handrim wheelchair propulsion. Journal of medical engineering & technology, 19(4), 123-131.

Van Der Woude, L. H., Bosmans, I., Bervoets, B., & Veeger, H. (2000). Handcycling: different modes and gear ratios. Journal of medical engineering & technology, 24(6), 242-249.

van der Woude, L. H., Dallmeijer, A. J., Janssen, T. W., & Veeger, D. (2001). Alternative modes of manual wheelchair ambulation: an overview. American journal of physical medicine & rehabilitation, 80(10), 765-777.

Van Peppen, R. P., Kwakkel, G., Wood-Dauphinee, S., Hendriks, H. J., Van der Wees, P. J., & Dekker, J. (2004). The impact of physical therapy on functional outcomes after stroke: what's the evidence? Clinical rehabilitation, 18(8), 833-862.

Van Rijn, A. M., Peper, A., & Grimbergen, C. (1990). High-quality recording of bioelectric events. Medical and Biological Engineering and Computing, 28(5), 389-397.

Vavrinský, E., Daříček, M., Donoval, M., Rendek, K., Horínek, F., Horniak, M., & Donoval, D. (2011). Design of EMG wireless sensor system. Paper presented at the 2011 International Conference on Applied Electronics.

Veeger, H., Rozendaal, L., & Van der Helm, F. (2002). Load on the shoulder in low intensity wheelchair propulsion. Clinical Biomechanics, 17(3), 211-218.

Veerubhotla, A., Kumar, S., Bachhal, S., & Kumar, A. (2015). Mobility assistance for patients with Quadriplegia. Journal of Scientific & Industrial Research, 74, 102-104.

Verellen, J., Theisen, D., & Vanlandewijck, Y. (2004). Influence of crank rate in hand cycling. Medicine and science in sports and exercise, 36(10), 1826-1831.

Vicuña, J. N., Castillo, F. R., Urgilés, F. L. E., & Ríos, J. M. (2017). Raspberry analysis in the teaching of computer sciences. International Journal of Applied Engineering Research, 12(7), 1182-1189.

Vieira, T. M., Loram, I. D., Muceli, S., Merletti, R., & Farina, D. (2011). Postural activation of the human medial gastrocnemius muscle: are the muscle units spatially localised? The Journal of physiology, 589(2), 431-443.

Vinereanu, D., Lopes, R. D., Bahit, M. C., Xavier, D., Jiang, J., Al-Khalidi, H. R., . . . Kamath, D. Y. (2017). A multifaceted intervention to improve treatment with oral anticoagulants in atrial fibrillation (IMPACT-AF): an international, cluster-randomised trial. The Lancet, 390(10104), 1737-1746.

Wang, L., Chen, C., Dong, W., Du, Z., Shen, Y., & Zhao, G. (2019). Locomotion Stability Analysis of Lower Extremity Augmentation Device. Journal of Bionic Engineering, 16(1), 99-114.

weekz2weekz. (2012). Piano staircase using Arduino and processing

Wei, L., Hu, H., Lu, T., & Yuan, K. (2010). Evaluating the performance of a face movement based wheelchair control interface in an indoor environment. Paper presented at the 2010 IEEE International Conference on Robotics and Biomimetics.

Wei, L., Hu, H., & Zhang, Y. (2011). Fusing EMG and visual data for hands-free control of an intelligent wheelchair. International Journal of Humanoid Robotics, 8(04), 707-724.

Wikipedia. (2020). Muscular system.

Wong, A. M. H., Furukawa, M., Ando, H., & Maeda, T. (2020). Dynamic Hand Gesture Authentication using Electromyography (EMG). Paper presented at the 2020 IEEE/SICE International Symposium on System Integration (SII).

Wu, H.-W., Berglund, L., Su, F.-C., Yu, B., Westreich, A., Kim, K.-J., & An, K.-N. (1998). An instrumented wheel for kinetic analysis of wheelchair propulsion. Journal of biomechanical engineering, 120(4), 533-535.

Xiong, M., Hotter, R., Nadin, D., Patel, J., Tartakovsky, S., Wang, Y., . . . Brandenberger, A. (2019). A Low-Cost, Semi-Autonomous Wheelchair Controlled by Motor Imagery and Jaw Muscle Activation. Paper presented at the 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC).

Xu, H., Bloswick, D., & Merryweather, A. (2015). An improved OpenSim gait model with multiple degrees of freedom knee joint and knee ligaments. Computer methods in biomechanics and biomedical engineering, 18(11), 1217-1224.

Xu, L., & Adler, A. (2004). An improved method for muscle activation detection during gait. Paper presented at the Canadian Conference on Electrical and Computer Engineering 2004 (IEEE Cat. No. 04CH37513).

Xu, X., Zhang, Y., Luo, Y., & Chen, D. (2013). Robust bio-signal based control of an intelligent wheelchair. Robotics, 2(4), 187-197.

Yanco, H. A. (1998). Wheelesley: A robotic wheelchair system: Indoor navigation and user interface Assistive technology and artificial intelligence (pp. 256-268): Springer.

Yang, D., Zhang, H., Gu, Y., & Liu, H. (2017). Accurate EMG onset detection in pathological, weak and noisy myoelectric signals. Biomedical Signal Processing and Control, 33, 306-315.

Yang, D., Zhao, J., Jiang, L., & Liu, H. (2012). Dynamic hand motion recognition based on transient and steady-state EMG signals. International Journal of Humanoid Robotics, 9(01), 1250007.

Yang, G., Deng, J., Pang, G., Zhang, H., Li, J., Deng, B., . . . Liljeberg, P. (2018). An IoT-enabled stroke rehabilitation system based on smart wearable armband and machine learning. IEEE journal of translational engineering in health and medicine, 6, 1-10.

Yang, X., Zhang, G., Lu, J., & Ma, J. (2010). A kernel fuzzy c-means clustering-based fuzzy support vector machine algorithm for classification problems with outliers or noises. IEEE Transactions on Fuzzy Systems, 19(1), 105-115.

Yanmin, L., Shujiao, J., Xiuli, G., Zhibin, F., Xiaoxue, X., & Limin, D. (2016). Research on automatic tracking caregivers of intelligent wheelchair. Paper presented at the Control and Decision Conference (CCDC), 2016 Chinese.

Yano, Y. (2013). An EMG Control System for an Ultrasonic Motor Using a PSoC Microcomputer Technological Advancements in Biomedicine for Healthcare Applications (pp. 11-17): IGI Global.

Yi, Z., Lingling, D., Yuan, L., & Hu, H. (2011). Design of a surface EMG based human-machine interface for an intelligent wheelchair. Paper presented at the IEEE 2011 10th International Conference on Electronic Measurement & Instruments.

Yi, Z., Xiaolin, F., & Yuan, L. (2015). Intelligent wheelchair system based on sEMG and head gesture. The Journal of China Universities of Posts and Telecommunications, 22(2), 74-95.

Yid, M. S. M., Suboh, M. Z., Abu, M. A., Yaakop, M., Talari, M., Malik, I. A., & Azhar, H. (2019). Development of wireless arm switch EMG control system for rehabilitation. Paper presented at the AIP Conference Proceedings.

Yoder, J.-D., Baumgartner, E. T., & Skaar, S. B. (1996). Initial results in the development of a guidance system for a powered wheelchair. IEEE Transactions on Rehabilitation Engineering, 4(3), 143-151.

Young, A. J., Hargrove, L. J., & Kuiken, T. A. (2011). The effects of electrode size and orientation on the sensitivity of myoelectric pattern recognition systems to electrode shift. IEEE Transactions on Biomedical Engineering, 58(9), 2537-2544.

Young, A. J., Hargrove, L. J., & Kuiken, T. A. (2012). Improving myoelectric pattern recognition robustness to electrode shift by changing interelectrode distance and electrode configuration.

IEEE Transactions on Biomedical Engineering, 59(3), 645-652.

Zaheer, F., Roy, S. H., & De Luca, C. J. (2012). Preferred sensor sites for surface EMG signal decomposition. Physiological measurement, 33(2), 195.

Zeng, Q., Burdet, E., Rebsamen, B., & Teo, C. L. (2007). Evaluation of the collaborative wheelchair assistant system. Paper presented at the 2007 IEEE 10th International Conference on Rehabilitation Robotics.

Zeng, Q., Teo, C. L., Rebsamen, B., & Burdet, E. (2006). Design of a collaborative wheelchair with path guidance assistance. Paper presented at the Proceedings 2006 IEEE International Conference on Robotics and Automation, 2006. ICRA 2006.

Zeng, Q., Teo, C. L., Rebsamen, B., & Burdet, E. (2008). A collaborative wheelchair system. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 16(2), 161-170.

Zhang, A., Gao, N., Wang, L., & Li, Q. (2018). Combined Influence of Classifiers, Window Lengths and Number of Channels on EMG Pattern Recognition for Upper Limb Movement Classification. Paper presented at the 2018 11th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics (CISP-BMEI).

Zhang, C., Peng, Y., Liu, Y., Li, S., Zhou, P., Rymer, W. Z., & Zhang, Y. (2017). Imaging three-dimensional innervation zone distribution in muscles from M-wave recordings. Journal of neural engineering, 14(3), 036011.

Zhang, M.-N. (2018). Wheelchair Control System Based on Electromyography. Paper presented at the Advances in Smart Vehicular Technology, Transportation, Communication and Applications: Proceeding of the Second International Conference on Smart Vehicular Technology, Transportation, Communication and Applications, October 25-28, 2018 Mount Emei, China.

Zhang, X., & Huang, H. (2015). A real-time, practical sensor fault-tolerant module for robust EMG pattern recognition. Journal of neuroengineering and rehabilitation, 12(1), 18.

Zhang, X., Wang, X., Wang, B., Sugi, T., & Nakamura, M. (2010). Meal assistance system operated by electromyogram (EMG) signals: Movement onset detection with adaptive threshold. International journal of control, automation and systems, 8(2), 392-397.

Zhang, X., & Zhou, P. (2012). High-density myoelectric pattern recognition toward improved stroke rehabilitation. IEEE Transactions on Biomedical Engineering, 59(6), 1649-1657.

Zhou, D., Fang, Y., Kubota, N., & Liu, H. (2017). Surface EMG based hand motion recognition using combined growing neural gas and linear discriminant analysis. Paper presented at the 10th International Conference on Human System Interaction (HSI2017).

Zuleta, J., Ferro, M., Murillo, C., & Franco-Luna, R. (2019). Identification of EMG activity with machine learning in patients with amputation of upper limbs for the development of mechanical prostheses. Paper presented at the IOP Conference Series: Materials Science and Engineering.

Zwart, D., Arjan, H., Dekker, J., Lems, W. F., Roorda, L. D., Van Der Esch, M., & Van Der Leeden, M. (2018). Factors associated with upper leg muscle strength in knee osteoarthritis: a scoping review. Journal of rehabilitation medicine, 50(2), 140-150.