

# **2013 IEEE International Conference on Body Sensor Networks**

**(BSN 2013)**

**Cambridge, Massachusetts, USA  
6 – 9 May 2013**



**IEEE Catalog Number: CFP1337A-POD  
ISBN: 978-1-4799-0331-3**

# TABLE OF CONTENTS

<b>Pattern Classification of Foot Strike Type using Body Worn Accelerometers</b> .....	1
<i>B. Eskofier, E. Musho, H. Schlarb</i>	
<b>Experts Lift Differently: Classification of Weight-Lifting Athletes</b> .....	5
<i>R Adelsberger, G. Troster</i>	
<b>A Long-Term Wearable Electrocardiogram Measurement System</b> .....	11
<i>M. Delano, C. Sodini</i>	
<b>Smartphones for Smart Wheelchairs</b> .....	17
<i>A. Milenkovic, M. Milosevic, E. Jovanov</i>	
<b>A Hidden Markov Model of the Breaststroke Swimming Temporal Phases Using Wearable Inertial Measurement Units</b> .....	23
<i>F. Dadashi, A. Arami, F. Crettenand, G. Millet, J. Komar, L. Seifert, K. Aminian</i>	
<b>A Study on Instance-based Learning with Reduced Training Prototypes for Device-Context-Independent Activity Recognition on a Mobile Phone</b> .....	29
<i>S. Thiemjarus, A. Henpraserttae, S. Marukatat</i>	
<b>A MAC Protocol for Implanted Devices Communication in the MICS Band</b> .....	35
<i>M. Islam, J. Khan, M. Yuce</i>	
<b>Functional Regression For Data Fusion And Indirect Measurements Of Physiological Variables Collected By Wearable Sensor Systems And Indirect Calorimetry</b> .....	41
<i>A. Gribok, W. Rumpler, R. Hoyt, M. Buller</i>	
<b>A Wearable Sensor Platform To Monitor Sweat pH And Skin Temperature</b> .....	47
<i>M. Caldara, C. Colleoni, E. Guido, G. Rosace, V. Re, A. Vitali</i>	
<b>Development of a Wireless Low-Power Multi-Sensor Network for Motion Tracking Applications</b> .....	53
<i>D. Comotti, M. Ermidoro, M. Galizzi, A. Vitali</i>	
<b>Towards Estimation of Front-crawl Energy Expenditure Using the Wearable Aquatic Movement Analysis System (WAMAS)</b> .....	59
<i>F. Dadashi, K. Aminian, F. Crettenand, G. Millet</i>	
<b>Macroscopic Porosity Generation in Outer Hydrogel Membranes to Offset Sensitivity Loss in Implantable Glucose Sensors</b> .....	65
<i>S. Vaddiraju, Y. Wang, L. Qiang, D. Burgess, F. Papadimitrakopoulos</i>	
<b>A Low Power Miniaturized CMOS-Based Continuous Glucose Monitoring System</b> .....	70
<i>R. Croce Jr, S. Vaddiraju, A. Legassey, Y. Wang, D. Burgess, F. Papadimitrakopoulos, F. Jain</i>	
<b>A Wearable Piezoelectric Rotational Energy Harvester</b> .....	74
<i>P. Pillatsch, E. Yeatman, A. Holmes</i>	
<b>Application Of A Pedometer In A Clinical Setting: Is The Number Of Walking Steps Predictive Of Changes In Blood Pressure? - Prediction Of Blood Pressure Changes In Blood Pressure By A Pedometer</b> .....	80
<i>T. Tammura, Y. Kimura, Y. Kimura, S. Maeno, T. Hattori, K. Minato</i>	
<b>D<sup>2</sup>MAC: Dynamic Delayed Medium Access Control (MAC) Protocol with Fuzzy Technique for Wireless Body Area Networks</b> .....	84
<i>N. Mouzehkesh, T. Zia, S. Shafiqh, L. Zheng</i>	
<b>Estimation of Prosthetic Knee Angles via Data Fusion of Implantable and Wearable Sensors</b> .....	90
<i>A. Arami, A. Barre, R. Berthelin, K. Aminian</i>	
<b>Emerging Spectrum Regulation for Medical Body Area Network</b> .....	96
<i>D. Wang, D. Smith, R. Krasinski, M. Ghosh, A. Batra</i>	
<b>Battery-less Microdevices for Body Sensor/Actuator Networks</b> .....	102
<i>A. Denisov, E. Yeatman</i>	
<b>Quantifying Timed-Up-and-Go Test: A Smartphone Implementation</b> .....	107
<i>M. Milosevic, E. Jovanov, A. Milenkovic</i>	
<b>Recognition of Sleep Dependent Memory Consolidation with Multi-modal Sensor Data</b> .....	113
<i>A. Sano, R. Picard</i>	
<b>Design Considerations for a Wearable Sensor Network that Measures Accelerations during Water-Ski Jumping</b> .....	117
<i>D. Boer, O. Rheenen, E. Zelm, R. Bergmann, J. Bergmann, N. Howard</i>	
<b>Profiling Visual and Verbal Stress Responses Using Electrodermal Heart Rate and Hormonal Measures</b> .....	122
<i>L. Bouarfa, P. Bemnowicz, B. Crewther, D. Jarchi, G. Yang</i>	

<b>WristQue: A Personal Sensor Wristband</b> .....	129
<i>B. Mayton, N. Zhao, M. Aldrich, N. Gillian, J. Paradiso</i>	
<b>Non-Invasive Measurement of Core Body Temperature in Marathon Runners</b> .....	135
<i>C. Boano, M. Lasagni, K. Romer</i>	
<b>Precise Indoor Altitude Estimation Based On Differential Barometric Sensing For Wireless Medical Applications</b> .....	141
<i>C. Bollmeyer, T. Esemann, H. Gehring, H. Hellbruck</i>	
<b>Automated Assessment of Gait Deviations in Children with Cerebral Palsy Using a Sensorized Shoe and Active Shape Models</b> .....	147
<i>C. Strohrmann, S. Patel, C. Mancinelli, L. Deming, J. Chu, R. Greenwald, G. Troster, P. Bonato</i>	
<b>Context-guided Universal Hybrid Decision Tree for Activity Classification</b> .....	153
<i>H. Chang, C. Chien, J. Xu, G. Pottie</i>	
<b>Identification of Sleep Apnea Events using Discrete Wavelet Transform of Respiration, ECG and Accelerometer Signals</b> .....	159
<i>K. Sweeney, E. Mitchell, J. Gaughran, T. Kane, R. Costello, S. Coyle, N. O'Connor, D. Diamond</i>	
<b>Synchronization Methods For Bluetooth Based WBANs</b> .....	165
<i>F. Casamassima, E. Farella, L. Benini</i>	
<b>Body Coupled Communication: The Channel and Implantable Sensors</b> .....	171
<i>G. Anderson, C. Sodini</i>	
<b>Robust Activity Recognition Combining Anomaly Detection and Classifier Retraining</b> .....	176
<i>H. Sagha, A. Calatroni, J. Millan, D. Roggen, G. Troster, R. Chavarriaga</i>	
<b>Singular Spectrum Analysis for Gait Patterns</b> .....	182
<i>D. Jarchi, G. Yang</i>	
<b>Arrhythmia Discrimination using a Smart Phone</b> .....	188
<i>J. Chong, D. McManus, K. Chon</i>	
<b>Parametric Analysis Of Meandered Inverted-F Antenna And Use Of A High Impedance Surface Based Ground Plane For WBAN Applications</b> .....	192
<i>O. Pradhan, K. Newman, F. Barnes</i>	
<b>Shimmer, Cooja and Contiki: A New Toolset for the Simulation of On-node Signal Processing Algorithms</b> .....	199
<i>P. Kugler, P. Nordhus, B. Eskofier</i>	
<b>Objective Assessment of Overexcited Hand Movements using a Lightweight Sensory Device</b> .....	205
<i>S. Lee, H. Ghasemzadeh, B. Mortazavi, A. Yew, R. Getachew, M. Razaghy, N. Ghalehsari, B. Paak, J. Garst, M. Espinal, J. Kimball, D. Lu, M. Sarrafzadeh</i>	
<b>Demo Abstract: Upper Limb Motion Imitation Module for Humanoid Robot Using Biomotion+ Sensors</b> .....	211
<i>K. Teachasrisaksakul, Z. Zhang, G. Yang</i>	
<b>Unsupervised Activity Clustering to Estimate Energy Expenditure with a Single Body Sensor</b> .....	214
<i>S. Chen, J. Lach, O. Amft, M. Altini, J. Penders</i>	
<b>Classification of Kinematic Swimming Data with Emphasis on Resource Consumption</b> .....	220
<i>U. Jensen, F. Prade, B. Eskofier</i>	
<b>Compressed Sensing of EEG Using a Random Sampling ADC in 90nm CMOS</b> .....	225
<i>R. D'Angelo, M. Trakimas, S. Sonkusale, S. Aeron</i>	
<b>Multi-Person Vision-Based Head Detector For Markerless Human Motion Capture</b> .....	230
<i>C. Wong, Z. Zhang, S. McKeague, G. Yang</i>	
<b>Self-Calibration of Sensor Misplacement Based on Motion Signatures</b> .....	236
<i>X. Wu, Y. Wang, C. Chien, G. Pottie</i>	
<b>Behavior Recognition Based on Machine Learning Algorithms for a Wireless Canine Machine Interface</b> .....	241
<i>R. Brugarolas, R. Loftin, P. Yang, D. Roberts, B. Sherman, A. Bozkurt</i>	
<b>Unsupervised Routine Profiling In Free-Living Conditions - Can Smartphone Apps Provide Insights?</b> .....	246
<i>R. Ali, B. Lo, G. Yang</i>	
<b>Forearm Functional Movement Recognition using Spare Channel Surface Electromyography</b> .....	253
<i>Z. Zhang, C. Wong, G. Yang</i>	
<b>FPGA-based Remote Pulse Rate Detection Using Photoplethysmographic Imaging</b> .....	259
<i>H. Liu, Y. Wang, L. Wang</i>	
<b>Multi-Modal In-Person Interaction Monitoring Using Smartphone and On-Body Sensors</b> .....	264
<i>Q. Li, S. Chen, J. Stankovic</i>	
<b>Using Textile Electrode EMG for Prosthetic Movement Identification in Transradial Amputees</b> .....	270
<i>H. Zhang, L. Tian, L. Zhang, G. Li</i>	
<b>Protect your BSN: No Handshakes, Just Namaste!</b> .....	275
<i>P. Bagade, A. Banerjee, J. Milazzo, S. Gupta</i>	

<b>An Efficient Fault-Tolerant Sensor Fusion Algorithm for Accelerometers</b> .....	281
<i>O. Sarbishei, B. Nahill, A. Fekr, M. Janidarmian, K. Radecka, Z. Zilic, B. Karajica</i>	
<b>Improving Accuracy in E-Textiles as a Platform for Pervasive Sensing</b> .....	287
<i>M. Rofouei, M. Ghodrat, Y. Huang, N. Alshurafa, M. Sarrafzadeh</i>	
<b>Robust Human Intensity-Varying Activity Recognition using Stochastic Approximation in Wearable Sensors</b> .....	293
<i>N. Alshurafa, W. Xu, J. Liu, M. Huang, B. Mortazavi, M. Sarrafzadeh, C. Roberts</i>	
<b>On the Characterization of Leg Agility in Patients with Parkinson’s Disease</b> .....	299
<i>M. Giubert, G. Ferrari, L. Contin, V. Cimolin, N. Cau, M. Galli, C. Azzaro, G. Albani, A. Mauro</i>	
<b>Smartphone-Based Detection Of Voice Disorders By Long-Term Monitoring Of Neck Acceleration Features</b> .....	305
<i>D. Mehta, M. Zanartu, J. Stan, S. Feng, H. Cheyne II, R. Hillman</i>	
<b>Multi-Channel Pulse Oximetry For Wearable Physiological Monitoring</b> .....	311
<i>Y. Mendelson, D. Dao, K. Chon</i>	
<b>Allowing Early Inspection of Activity Data from a Highly Distributed Bodynet with a Hierarchical-Clustering-of-Segments Approach</b> .....	317
<i>M. Kreil, K. Laerhoven, P. Lukowicz</i>	
<b>MET Calculations from On-Body Accelerometers for Exergaming Movements</b> .....	323
<i>B. Mortazavi, N. Alsharufa, S. Lee, M. Lan, M. Sarrafzadeh, M. Chronley, C. Roberts</i>	
<b>OBAN: An Open Systems Architecture for an On-Body Sensor Network</b> .....	329
<i>Anthony Lapadula, Jason Biddle</i>	
<b>On the Relative Importance of Vocal Source, System, and Prosody in Human Depression</b> .....	335
<i>R. Horwitz, T. Quatieri, B. Helfer, B. Yu, J. Williamson, J. Mundt</i>	
<b>Individualized Apnea Prediction in Preterm Infants using Cardio-Respiratory and Movement Signals</b> .....	341
<i>J. Williamson, D. Bliss, D. Browne</i>	
<b>Loaded and Unloaded Foot Movement Differentiation Using Chest Mounted Accelerometer Signatures</b> .....	347
<i>C. Clements, D. Moody, A. Potter, J. Seay, R. Fellin, M. Buller</i>	
<b>Wearable Sensors Can Assist in PTSD Diagnosis</b> .....	352
<i>A. Webb, A. Vincent, A. Jin, M. Pollack</i>	
<b>Calibration Of Kinematic Body Sensor Networks: Kinect-Based Gauging Of Data Gloves “In The Wild”</b> .....	358
<i>A. Vicente, A. Faisal</i>	
<b>Individualized Detection of Ambulatory Distress in the Field using Wearable Sensors</b> .....	364
<i>J. Williamson, K. Fischl, A. Dumas, A. Hess, T. Hughes, M. Buller</i>	
<b>PHASER: Physiological Health Assessment System for Emergency Responders</b> .....	370
<i>M. Batalin, E. Yuen, B. Dolezal, D. Smith, C. Cooper, J. Mapar</i>	
<b>Measurement, Instrumentation, Control and Analysis (MICA): A Modular System of Wireless Sensors</b> .....	376
<i>A. Spanbauer, A. Wahab, B. Hemond, I. Hunter, L. Jones</i>	
<b>Wearable Electronic Sensor for Potentiometric and Amperometric Measurements</b> .....	381
<i>P. Bembnowicz, G. Yang, S. Anastasova, A. Spehar-Deleze, P. Vadagama</i>	
<b>Multi-dimensional Signal Search With Applications in Remote Medical Monitoring</b> .....	386
<i>M. Moazeni, B. Mortazavi, M. Sarrafzadeh</i>	
<b>Novel Smart Sensor Glove for Arthritis Rehabilitation</b> .....	392
<i>B. O’Flynn, J. Sanchez, P. Angove, J. Connolly, J. Condell, K. Curran, P. Gardiner</i>	
<b>On-bed Monitoring for Range of Motion Exercises with a Pressure Sensitive Bedsheet</b> .....	398
<i>J. Liu, M. Huang, W. Xu, N. Alshurafa, M. Sarrafzadeh</i>	
<b>Author Index</b>	