

2015 IEEE 12th International Conference on Wearable and Implantable Body Sensor Networks (BSN 2015)

**Cambridge, Massachusetts, USA
9-12 June 2015**



**IEEE Catalog Number: CFP1537A-POD
ISBN: 978-1-4673-7202-2**

TABLE OF CONTENTS

| | |
|--|-----|
| A SMARTWATCH-BASED MEDICATION ADHERENCE SYSTEM | 1 |
| <i>Kalantarian, H. ; Alshurafa, N. ; Nemati, E. ; Tuan Le ; Sarrafzadeh, M.</i> | |
| ADAPTIVE CSMA/CA MAC PROTOCOL TO REDUCE INTER-WBAN INTERFERENCE FOR WIRELESS BODY AREA NETWORKS | 7 |
| <i>Wen Huang ; Quek, T.Q.S.</i> | |
| PULSE-GLASSES: AN UNOBTRUSIVE, WEARABLE HR MONITOR WITH INTERNET-OF-THINGS FUNCTIONALITY | 13 |
| <i>Constant, N. ; Douglas-Prawl, O. ; Johnson, S. ; Mankodiya, K.</i> | |
| WALKING ENERGY EXPENDITURE: A LOADED APPROACH TO ALGORITHM DEVELOPMENT | 18 |
| <i>Ludlow, L.W. ; Weyand, P.G.</i> | |
| AUTOMATED GUIDANCE FROM PHYSIOLOGICAL SENSING TO REDUCE THERMAL-WORK STRAIN LEVELS ON A NOVEL TASK | 23 |
| <i>Buller, M.J. ; Welles, A.P. ; Stevens, M. ; Leger, J. ; Gribok, A. ; Jenkins, O.C. ; Friedl, K.E. ; Rumpfer, W.</i> | |
| FLOGFS: A LIGHTWEIGHT FLASH LOG FILE SYSTEM | 29 |
| <i>Nahill, B. ; Zilic, Z.</i> | |
| BIOINSIGHTS: EXTRACTING PERSONAL DATA FROM “STILL” WEARABLE MOTION SENSORS | 35 |
| <i>Hernandez, J. ; McDuff, D.J. ; Picard, R.W.</i> | |
| DETECTING AND TRACKING GAIT ASYMMETRIES WITH WEARABLE ACCELEROMETERS | 41 |
| <i>Williamson, J.R. ; Dumas, A. ; Hess, A.R. ; Patel, T. ; Telfer, B.A. ; Buller, M.J.</i> | |
| ESTIMATING LOAD CARRIAGE FROM A BODY-WORN ACCELEROMETER | 47 |
| <i>Williamson, J.R. ; Dumas, A. ; Ciccarelli, G. ; Hess, A.R. ; Telfer, B.A. ; Buller, M.J.</i> | |
| WEARABLE CHEMICAL SENSORS: CHARACTERIZATION OF HEART RATE ELECTRODES USING ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY | 53 |
| <i>Deignan, J. ; Monedero, J. ; Coyle, S. ; O’Gorman, D. ; Diamond, D. ; McBrearty, M.</i> | |
| A METHOD FOR AUTOMATIC, OBJECTIVE AND CONTINUOUS SCORING OF BRADYKINESIA | 59 |
| <i>Martinez-Manzanera, O. ; Roosma, E. ; Beudel, M. ; Borgemeester, R.W.K. ; van Laar, T. ; Maurits, N.M.</i> | |
| TOWARDS A REAL TIME KINECT SIGNATURE BASED HUMAN ACTIVITY ASSESSMENT AT HOME | 64 |
| <i>Blumrosen, G. ; Miron, Y. ; Plotnik, M. ; Intrator, N.</i> | |
| ANTICIPATORY SIGNALS IN KINEMATICS AND MUSCLE ACTIVITY DURING FUNCTIONAL GRASP AND RELEASE | 70 |
| <i>Beckers, N. ; Fineman, R. ; Stirling, L.</i> | |
| RFID NETWORK DEPLOYMENT APPROACHES FOR INDOOR LOCALISATION | 76 |
| <i>Shumei Zhang ; McCullagh, P. ; Huiyu Zhou ; Zhe Wen ; Zhengcheng Xu</i> | |
| WEARABLE BIOMETRIC AUTHENTICATION BASED ON HUMAN BODY COMMUNICATION | 82 |
| <i>Zedong Nie ; Yuhang Liu ; Changjiang Duan ; Zhongzhou Ruan ; Jingzhen Li ; Lei Wang</i> | |
| NOVEL HUMAN COMPUTER INTERACTION PRINCIPLES FOR CARDIAC FEEDBACK USING GOOGLE GLASS AND ANDROID WEAR | 87 |
| <i>Richer, R. ; Maiwald, T. ; Pasluosta, C. ; Hensel, B. ; Eskofier, B.M.</i> | |
| SLEEPSENSE: NON-INVASIVE SLEEP EVENT RECOGNITION USING AN ELECTROMAGNETIC PROBE | 93 |
| <i>Yan Zhuang ; Chen Song ; Aosen Wang ; Feng Lin ; Yiran Li ; Changzhan Gu ; Changzhi Li ; Wenyao Xu</i> | |
| CLASSIFICATION OF SPASTICITY AFFECTED EMG-SIGNALS | 99 |
| <i>Lueken, M.J. ; Misgeld, B.J.E. ; Leonhardt, S.</i> | |
| TOWARD ROBUST AND PLATFORM-AGNOSTIC GAIT ANALYSIS | 105 |
| <i>Yuchao Ma ; Fallahzadeh, R. ; Ghasemzadeh, H.</i> | |
| IN-EAR PHOTOPLETHYSMOGRAPHY FOR MOBILE CARDIORESPIRATORY MONITORING AND ALARMING | 111 |
| <i>Venema, B. ; Blazek, V. ; Leonhardt, S.</i> | |
| SENSOR TECHNOLOGY FOR ICE HOCKEY AND SKATING | 116 |
| <i>Hardegger, M. ; Ledergerber, B. ; Mutter, S. ; Vogt, C. ; Seiter, J. ; Calatroni, A. ; Troster, G.</i> | |

| | |
|--|------------|
| WEARABLE SENSOR BASED STRESS MANAGEMENT USING INTEGRATED RESPIRATORY AND ECG WAVEFORMS | 122 |
| <i>Kemeng Chen ; Fink, W. ; Roveda, J. ; Lane, R.D. ; Allen, J. ; Vanuk, J.</i> | |
| A WEARABLE WIRELESS SENSOR FOR REAL TIME VALIDATION OF BOWLING ACTION IN CRICKET | 128 |
| <i>Ahmed, A. ; Asawal, M. ; Khan, M.J. ; Cheema, H.M.</i> | |
| ARRHYTHMIA CLASSIFICATION USING RR INTERVALS: IMPROVEMENT WITH SINUSOIDAL REGRESSION FEATURE..... | 133 |
| <i>Leutheuser, H. ; Gradl, S. ; Eskofier, B.M. ; Tobola, A. ; Lang, N. ; Anneken, L. ; Arnold, M. ; Achenbach, S.</i> | |
| ACTIVITY DETECTION IN UNCONTROLLED FREE-LIVING CONDITIONS USING A SINGLE ACCELEROMETER..... | 138 |
| <i>Lee, S.I. ; Ozsecen, M.Y. ; Della Toffola, L. ; Daneault, J.-F. ; Puiatti, A. ; Patel, S. ; Bonato, P.</i> | |
| PIEZOELECTRETS AND THEIR APPLICATIONS AS WEARABLE PHYSIOLOGICAL-SIGNAL SENSORS AND ENERGY HARVESTERS..... | 144 |
| <i>Peng Fang ; Qifang Zhuo ; Yanhu Cai ; Lan Tian ; Haoshi Zhang ; Yue Zheng ; Guanglin Li ; Liming Wu ; Xiaoqing Zhang</i> | |
| A MODEL-BASED METHOD TO EVALUATE AUTONOMIC REGULATION OF CARDIOVASCULAR SYSTEM..... | 150 |
| <i>Lang Wang ; Zhipei Huang ; Jiankang Wu ; Yu Meng ; Rongjing Ding</i> | |
| COMPARATIVE STUDY ON CLASSIFYING GAIT WITH A SINGLE TRUNK-MOUNTED INERTIAL-MAGNETIC MEASUREMENT UNIT | 156 |
| <i>Full, K. ; Leutheuser, H. ; Schlessman, J. ; Armitage, R. ; Eskofier, B.M.</i> | |
| IMU-BASED POSE DETERMINATION OF SCUBA DIVERS' BODIES AND SHANKS..... | 162 |
| <i>Groh, B.H. ; Cibis, T. ; Schill, R.O. ; Eskofier, B.M.</i> | |
| TOWARDS ROBUST ESTIMATION OF SYSTOLIC TIME INTERVALS USING HEAD-TO-FOOT AND DORSO-VENTRAL COMPONENTS OF STERNAL ACCELERATION SIGNALS..... | 168 |
| <i>Javaid, A.Q. ; Fesmire, N.F. ; Weitmauer, M.A. ; Inan, O.T.</i> | |
| NOVEL PEAK DETECTION TO ESTIMATE HRV USING SMARTPHONE AUDIO | 173 |
| <i>Misra, A. ; Banerjee, R. ; Choudhury, A.D. ; Sinha, A. ; Pal, A.</i> | |
| A CONFIDENCE-BASED APPROACH TO HAND MOVEMENTS RECOGNITION FOR CLEANING TASKS USING DYNAMIC TIME WARPING..... | 179 |
| <i>Kai-Chun Liu ; Chia-Tai Chan ; Hsu, S.J.</i> | |
| EVALUATING SQUAT PERFORMANCE WITH A SINGLE INERTIAL MEASUREMENT UNIT..... | 185 |
| <i>O'Reilly, M. ; Whelan, D. ; Chantialidis, C. ; Friel, N. ; Delahunt, E. ; Ward, T. ; Caulfield, B.</i> | |
| QUANTIFYING THE IMPACT OF SCHEDULING AND MOBILITY ON IR-UWB LOCALIZATION IN BODY AREA NETWORKS | 191 |
| <i>Guizar, A. ; Ouni, A. ; Goursaud, C. ; Chaudet, C. ; Gorce, J.M.</i> | |
| A REAL-TIME, MOBILE TIMED UP AND GO SYSTEM | 197 |
| <i>Williams, B. ; Allen, B. ; True, H. ; Fell, N. ; Levine, D. ; Sartipi, M.</i> | |
| DESIGN OF A SMART INSOLE FOR AMBULATORY ASSESSMENT OF GAIT | 203 |
| <i>Ashad Mustufa, Y.S. ; Barton, J. ; O'Flynn, B. ; Davies, R. ; McCullagh, P. ; Huiru Zheng</i> | |
| EMISSIVE PERFORMANCE OF WEARABLE RF TEXTILES MADE FROM MULTI-MATERIAL FIBERS..... | 208 |
| <i>Gorgutsa, S. ; Khalil, M. ; Belanger-Garnier, V. ; Viens, J. ; Messaddeq, Y. ; Gosselin, B. ; LaRochelle, S.</i> | |
| IMPACT OF SENSOR MISPLACEMENT ON ESTIMATING METABOLIC EQUIVALENT OF TASK WITH WEARABLES..... | 214 |
| <i>Alinia, P. ; Saedi, R. ; Mortazavi, B. ; Rokni, A. ; Ghasemzadeh, H.</i> | |
| APPLICATION OF A WIRELESS BSN FOR GAIT AND BALANCE ASSESSMENT IN THE ELDERLY | 220 |
| <i>Caldara, M. ; Locatelli, P. ; Comotti, D. ; Galizzi, M. ; Re, V. ; Dellerma, N. ; Corenzi, A. ; Pessione, M.</i> | |
| A LOW-POWER OPPORTUNISTIC COMMUNICATION PROTOCOL FOR WEARABLE APPLICATIONS | 226 |
| <i>Gaglione, A. ; Shanshan Chen ; Lo, B. ; Guang-Zhong Yang</i> | |
| EXTENDING OPTIMISTIC TRANSMISSION PROTOCOL FOR OTHER MOVEMENT PATTERNS..... | 232 |
| <i>Tiong Hoo Lim ; Bate, I.</i> | |
| NOVEL APPROACHES TO MEASURE ACOUSTIC EMISSIONS AS BIOMARKERS FOR JOINT HEALTH ASSESSMENT | 238 |
| <i>Teague, C. ; Hersek, S. ; Toreyin, H. ; Millard-Stafford, M.L. ; Jones, M.L. ; Kogler, G.F. ; Sawka, M.N. ; Inan, O.T.</i> | |

| | |
|--|-----|
| ROBUST ESTIMATION OF PHYSICAL ACTIVITY BY ADAPTIVELY FUSING MULTIPLE PARAMETERS | 244 |
| <i>Hormann, T. ; Christ, P. ; Hesse, M. ; Ruckert, U.</i> | |
| REAL-TIME ARM TRACKING FOR HMI APPLICATIONS | 250 |
| <i>Masters, M. ; Osborn, L. ; Thakor, N. ; Soares, A.</i> | |
| SAMPLING RATE IMPACT ON ENERGY CONSUMPTION OF BIOMEDICAL SIGNAL PROCESSING SYSTEMS | 254 |
| <i>Tobola, A. ; Streit, F.J. ; Espig, C. ; Korpok, O. ; Sauter, C. ; Lang, N. ; Schmitz, B. ; Hofmann, C. ; Struck, M. ; Weigand, C. ; Leutheuser, H. ; Eskofier, B.M. ; Fischer, G.</i> | |
| REAL-TIME AMERICAN SIGN LANGUAGE RECOGNITION USING WRIST-WORN MOTION AND SURFACE EMG SENSORS | 260 |
| <i>Jian Wu ; Zhongjun Tian ; Lu Sun ; Estevez, L. ; Jafari, R.</i> | |
| EXPLORATION OF INTERACTIONS DETECTABLE BY WEARABLE IMU SENSORS | 266 |
| <i>Kuni, R. ; Prathivadi, Y. ; Jian Wu ; Bennett, T.R. ; Jafari, R.</i> | |
| A WIRELESS CHARGING MECHANISM FOR A ROTATIONAL HUMAN MOTION ENERGY HARVESTER | 272 |
| <i>Pillatsch, P. ; Wright, P.K. ; Yeatman, E.M. ; Holmes, A.S.</i> | |
| ASSESSMENT OF THE E-AR SENSOR FOR GAIT ANALYSIS OF PARKINSON'S DISEASE PATIENTS | 277 |
| <i>Jarchi, D. ; Peters, A. ; Lo, B. ; Kalliolia, E. ; Di Giulio, I. ; Limousin, P. ; Day, B.L. ; Guang-Zhong Yang</i> | |
| A WEARABLE PRE-IMPACT FALL EARLY WARNING AND PROTECTION SYSTEM BASED ON MEMS INERTIAL SENSOR AND GPRS COMMUNICATION | 283 |
| <i>Mian Yao ; Qi Zhang ; Menghua Li ; Huiqi Li ; Yunkun Ning ; Gaosheng Xie ; Guoru Zhao ; Yingnan Ma ; Xing Gao ; Zongzhen Jin</i> | |
| CHARACTERIZATION OF INERTIAL MEASUREMENT UNIT PLACEMENT ON THE HUMAN BODY UPON REPEATED DONNINGS | 289 |
| <i>Vanegas, M. ; Stirling, L.</i> | |
| A RESTRICTED BOLTZMANN MACHINE BASED TWO-LEAD ELECTROCARDIOGRAPHY CLASSIFICATION | 295 |
| <i>Yan Yan ; Xibing Qin ; Yige Wu ; Nannan Zhang ; Jianping Fan ; Lei Wang</i> | |
| CAUSAL ANALYSIS OF INERTIAL BODY SENSORS FOR ENHANCING GAIT ASSESSMENT SEPARABILITY TOWARDS MULTIPLE SCLEROSIS DIAGNOSIS | 304 |
| <i>Jiaqi Gong ; Lach, J. ; Yanjun Qi ; Goldman, M.D.</i> | |
| ON THE CORRELATION BETWEEN UPDRS SCORING IN THE LEG AGILITY, SIT-TO-STAND, AND GAIT TASKS FOR PARKINSONIANS | 310 |
| <i>Parisi, F. ; Ferrari, G. ; Giuberti, M. ; Contin, L. ; Cimolin, V. ; Azzaro, C. ; Albani, G. ; Mauro, A.</i> | |
| EMI SPY: HARNESSING ELECTROMAGNETIC INTERFERENCE FOR LOW-COST, RAPID PROTOTYPING OF PROXEMIC INTERACTION | 316 |
| <i>Nan Zhao ; Dublon, G. ; Gillian, N. ; Dementyev, A. ; Paradiso, J.A.</i> | |
| A TETRAPOLAR BIO-IMPEDANCE SENSING SYSTEM FOR GASTROINTESTINAL TRACT MONITORING | 322 |
| <i>Kassanos, P. ; Ip, H.M.D. ; Guang-Zhong Yang</i> | |
| AUTOMATICALLY DETECTING ASYMMETRIC RUNNING USING TIME AND FREQUENCY DOMAIN FEATURES | 328 |
| <i>Mitchell, E. ; Ahmadi, A. ; O'Connor, N.E. ; Richter, C. ; Farrell, E. ; Kavanagh, J. ; Moran, K.</i> | |
| A FLEXIBLE TONOARTERIOGRAPHY-BASED BODY SENSOR NETWORK FOR CUFFLESS MEASUREMENT OF ARTERIAL BLOOD PRESSURE | 334 |
| <i>Xiaorong Ding ; Wenxuan Dai ; Ningqi Luo ; Jing Liu ; Ni Zhao ; Yuanting Zhang</i> | |
| A-WRISTOCRACY: DEEP LEARNING ON WRIST-WORN SENSING FOR RECOGNITION OF USER COMPLEX ACTIVITIES | 338 |
| <i>Vepakomma, P. ; De, D. ; Das, S.K. ; Bhansali, S.</i> | |
| MEASURING MUSCLE STIFFNESS BY LINEAR MECHANICAL PERTURBATION | 344 |
| <i>Mooney, L.M. ; Ku, S.L. ; Abromowitz, M. ; Mooney, J.A. ; Xu Sun ; Qifang Bao</i> | |
| TOWARDS MULTI-MODAL WEARABLE DRIVER MONITORING: IMPACT OF ROAD CONDITION ON DRIVER DISTRACTION | 349 |
| <i>Dehzangi, O. ; Williams, C.</i> | |
| MONITORING CARDIO-RESPIRATORY AND POSTURE MOVEMENTS DURING SLEEP: WHAT CAN BE ACHIEVED BY A SINGLE MOTION SENSOR | 355 |
| <i>Zhiqiang Zhang ; Guang-Zhong Yang</i> | |
| REAL-TIME FOOD INTAKE CLASSIFICATION AND ENERGY EXPENDITURE ESTIMATION ON A MOBILE DEVICE | 361 |
| <i>Ravi, D. ; Lo, B. ; Guang-Zhong Yang</i> | |

| | |
|--|-----|
| WEARABLE WIRELESS SENSORS FOR CHRONIC RESPIRATORY DISEASE MONITORING | 367 |
| <i>Dieffenderfer, J.P. ; Goodell, H. ; Bent, B. ; Beppler, E. ; Jayakumar, R. ; Yokus, M. ; Jur, J.S. ; Bozkurt, A. ; Peden, D.</i> | |
| IN SITU SENSOR-TO-SEGMENT CALIBRATION FOR WHOLE BODY MOTION CAPTURE | 373 |
| <i>Teachasrisaksakul, K. ; Zhi-Qiang Zhang ; Guang-Zhong Yang</i> | |
| AN INVESTIGATION ON MENTAL STRESS-PROFILING OF RACE CAR DRIVERS DURING A RACE | 378 |
| <i>Joosen, P. ; Exadaktylos, V. ; Berckmans, D.</i> | |
| LOW-COMPLEXITY ENERGY PROPORTIONAL POSTURE/GESTURE RECOGNITION BASED ON WBSN | 382 |
| <i>Aulery, A. ; Diguët, J.-P. ; Roland, C. ; Sentieys, O.</i> | |
| DEVELOPMENT OF AN INKJET PRINTED GREEN ANTENNA AND TWISTING EFFECT FOR WIRELESS BODY AREA NETWORK | 388 |
| <i>Mahmud, S. ; Honggang Wang ; Yong Kim ; Dapeng Li</i> | |
| A MULTI-SENSOR PLATFORM FOR MONITORING DIABETIC PERIPHERAL NEUROPATHY | 394 |
| <i>Ching-Mei Chen ; Onyenso, K. ; Guang-Zhong Yang ; Lo, B.</i> | |
| WEARABLE MOTION CAPTURE UNIT FOR SHOULDER INJURY PREVENTION | 400 |
| <i>Rawashdeh, S.A. ; Rafeldt, D.A. ; Uhl, T.L. ; Lumpp, J.E.</i> | |
| NOVEL TECHNIQUE FOR SLEEP APNEA MONITORING | 406 |
| <i>Sivaji, V. ; Bhatia, D.K. ; Prasad, S.</i> | |
| RATE-ADAPTIVE COMPRESSED-SENSING AND SPARSITY VARIANCE OF BIOMEDICAL SIGNALS | 411 |
| <i>Behravan, V. ; Glover, N.E. ; Farry, R. ; Chiang, P.Y. ; Shoaib, M.</i> | |
| RECOGNIZING ACADEMIC PERFORMANCE, SLEEP QUALITY, STRESS LEVEL, AND MENTAL HEALTH USING PERSONALITY TRAITS, WEARABLE SENSORS AND MOBILE PHONES | 417 |
| <i>Sano, A. ; Phillips, A.J. ; Yu, A.Z. ; McHill, A.W. ; Taylor, S. ; Jaques, N. ; Czeisler, C.A. ; Klerman, E.B. ; Picard, R.W.</i> | |
| NEEDLE-IMPLANTABLE, WIRELESS BIOSENSOR FOR CONTINUOUS GLUCOSE MONITORING | 423 |
| <i>Vaddiraju, S. ; Kastellorizios, M. ; Legassey, A. ; Burgess, D. ; Jain, F. ; Papadimitrakopoulos, F.</i> | |
| ON CONSTRUCTING INTERFERENCE FREE SCHEDULE FOR COEXISTING WIRELESS BODY AREA NETWORKS USING DISTRIBUTED COLORING ALGORITHM | 428 |
| <i>Wen Huang ; Quek, T.Q.S.</i> | |
| AN UNSUPERVISED APPROACH FOR GAIT-BASED AUTHENTICATION | 434 |
| <i>Cola, G. ; Avvenuti, M. ; Vecchio, A. ; Guang-Zhong Yang ; Lo, B.</i> | |
| EXPERIMENTAL ASSESSMENT OF HUMAN-BODY-LIKE TISSUE AS A COMMUNICATION CHANNEL FOR GALVANIC COUPLING | 440 |
| <i>Tomlinson, W.J. ; Abarca, F. ; Chowdhury, K.R. ; Stojanovic, M. ; Yu, C.</i> | |
| SMARTPHONE AS AN ULTRA-LOW COST MEDICAL TRICORDER FOR REAL-TIME CARDIOLOGICAL MEASUREMENTS VIA BALLISTOCARDIOGRAPHY | 446 |
| <i>Gavriel, C. ; Parker, K.H. ; Faisal, A.A.</i> | |
| KINEMATIC BODY SENSOR NETWORKS AND BEHAVIOURMETRICS FOR OBJECTIVE EFFICACY MEASUREMENTS IN NEURODEGENERATIVE DISEASE DRUG TRIALS | 452 |
| <i>Gavriel, C. ; Thomik, A.A.C. ; Lourenco, P.R. ; Nageshwaran, S. ; Athanasopoulos, S. ; Sylaidi, A. ; Festenstein, R. ; Faisal, A.A.</i> | |
| Author Index | |