The inaugural

i-CREATe

Singapore

23 - 26 April 2007

National Library Board Building
& Hotel Intercontinental

international Convention for Rehabilitation Engineering & Assistive Technology

In conjunction with

1st Tan Tock Seng Hospital Neurorehabilitation Meeting

Welcome

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i-CREATe 2007

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*i*nternational **C**onvention for **R**ehabilitation **E**ngineering & **A**ssistive **Te**chnology

in conjunction with

1st Tan Tock Seng Hospital Neurorehabilitation Meeting

23-26 April 2007
National Library Board Building &
Hotel Intercontinental
Singapore

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The Singapore Therapeutic, Assistive & Rehabilitative Technologies (START) Centre

Tan Tock Seng HOSPITAL

Technical Sponsor

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htx The Health Technology

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Welcome

Assistive Technology (AT) and Rehabilitation engineering are the systematic application of scientific and engineering principles to improve the quality of life for people with disabilities. Through the providing of enhancements to or changed methods of interacting with the technology needed to accomplish tasks that were formerly impossible or difficult to achieved, AT promotes independence through the use of assistive, adaptive, and rehabilitative devices and the appropriate process used in selecting, locating, and using them. An AT device can be loosely defined as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities". It has been long observed and reported that the use of AT devices by people with disabilities has increase vocational and independent living opportunities.

The people working in this traditionally neglected field are generally known as AT practitioners, Therapists (Occupational Therapists, Physiotherapists, Speech Language Pathologists, etc.), Rehab Technologists, and/or Rehabilitation Engineers. These professionals have long provided AT to people with disabilities, playing a vital role in the removal of barriers toward employability and independent living, and enhanced the employability, education, communication, daily functioning, and recreational activities of people with disabilities.

The importance of AT and Rehabilitation Engineering are well recognized and undeniable. Consulting with international and regional experts/professionals, there are common consensus that Asia lacks a professional platform in the field of Assistive and Rehabilitative Technology to provide information exchanges, knowledge-sharing, networking, publications of researches, and professional interactions, etc. It is with these goals of providing a comprehensive, international convention, where all technologies across all ages; disabilities; levels of education and training; employment; and independent living can be addressed, the inaugural international Convention for Rehabilitation Engineering & Assistive Technology (i-CREATe) has been initiated.

i-CREATe is currently being reviewed as one of the signatory to the Tokushima Agreement and i-CREATe has been accepted as the sister conference by the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA); RESNA is also the Technical Sponsor for i-CREATe 2007.

The Singapore Therapeutic, Assistive & Rehabilitative Technologies Centre also known as START Centre, and the Thailand's National Electronics and Computer Technology Centre (NECTEC), are the two main organizations that are jointly organizing i-CREATe 2007. This event is managed by the SingEx Group (Singex Exhibitions Pte. Ltd.). The event will be held at the Singapore National Library Board Building, and the Hotel Intercontinental, from 23rd – 26th April 2007.

The inaugural i-CREATe 2007 will be formally launched by Her Royal Highness (HRH) Princess Maha Chakri Sirindhorn, Kingdom of Thailand, and Dr. Vivian Balakrishnan, Ministry of Community Development, Youth and Sports (MCYS), Republic of Singapore, on 24th April 2007. This is the first joint efforts by the two countries to promote Assistive Technology for people with disabilities in Southeast Asia.

i-CREATe 2007 aims to provide a, previously lacking, platform for technical exchanges and exhibitions on the advanced technologies, equipments, techniques and materials applied in the field of Assistive & Rehabilitative Technology. This platform is meant for rehabilitation and education professionals working with or implementing use of Assistive Technology including Suppliers, Technologists, Physical Therapists, Occupational Therapists, Speech Language Pathologists, Rehabilitation Engineers, Educators, End-users, Caregivers, Governmental Officials, Policy Planning Staffs, Researchers, and Academicians, and others interested in AT.

We have assembled a comprehensive programme of 1 keynote session, 4 plenary sessions, 12 workshops, and 60 paper presentations from over 13 countries and regions covering the major topics of rehabilitation engineering and assistive technology.

We trust that i-CREATe 2007 will provide you with excellent opportunities to network and to acquire new knowledge in the field of AT and Rehabilitation Engineering.

We look forward to meeting with you in sunny island of Singapore!

Zen T. H. KOH
General Chair

Wei Tech ANG
Program Co-Chair

Wantanee PHANTACHAT
Program Co-Chair

Exhibition

DATE

24 to 26 April 2007

VENUE

National Library Board Building
Event Plaza, Ground Level

OPENING HOURS

9:00 am to 5:30 pm daily

ADMISSION

Open to trade and public. All visitors to register at Registration Counter to exchange for a visitor pass.

EXHIBITORS

Hitachi Asia Ltd

InSiPhil (S) Pte Ltd

Lab Rehab Pte Ltd

Lifeline Corporation

Thailand's National Electronics and Computer Technology Center (NECTEC)

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Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)

Singapore Therapeutic, Assistive & Rehabilitative Technologies (START Centre)

Tan Tock Seng Hospital

and more ...

Conference Organization

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Technical Program Overview – Day 1

23 April Mon	**Possibility Room (NLB 5th Floor)**
0830-0900	Registration
0900-1040	*WS-1* Fundamentals Course in Assistive Technology Session A Day 1
1040-1100	Tea Break
1100-1245	*WS-1* Fundamentals Course in Assistive Technology Session A Day 1
1245-1330	Lunch
1330-1530	*WS-1* Fundamentals Course in Assistive Technology Session A Day 1
1530-1550	Tea Break
1550-1730	*WS-1* Fundamentals Course in Assistive Technology Session A Day 1

Technical Program Overview – Day 2

24 April Tue	**Hotel Intercontinental Ballroom (2nd Floor)**	**Visitor Centre (NLB 5thFloor)**	**Function Room 3 (NLB 3rd Floor)**	**Function Room 2 (NLB 3rd Floor)**
0800-0830	Registration (Ballroom 2nd Floor)			
0830-0930	Plenary - L. Li		Registration (NLB 3rd Floor)	
0930-1000	TTSH Neurorehabilitation Meeting - "Stroke Rehabilitation"		Tea Break (NLB Plaza Ground Floor)	
1000-1030			*PP-1* Policy & Accessibility	*PP-2* Assistive Technology
1030-1050	Tea Break (NLB Plaza Ground Floor)			
1050-1230	"Stroke Rehabilitation"			
1230-1300				
1300-1330	Lunch (NLB Plaza Ground Floor)			
1330-1400				
1400-1530		Neurorehab Workshop 1A "Acupuncture & Acupressure"	Neurorehab Workshop 1B "Stroke Rehabilitation Nursing"	Neurorehab Workshop 1C "EMG biofeedback & motor recovery"
1530-1600		Tea Break (NLB Plaza Ground Floor)		
600-1730		"Acupuncture & Acupressure"	"Stroke Rehabilitation Nursing"	"EMG biofeedback & motor recovery"
1730-1800				
1800-2130	Keynote – **HRH Princess M. C. Sirindhorn** Plenary – **V. Balakrishnan** Banquet Dinner			

24 April Tue	**Function Room 1 (NLB 3rd Floor)**	**Imagination Room (NLB 5th Floor)**	**Possibility Room (NLB 5th Floor)**
0800-0830			
0830-0930	Registration (NLB 3rd Floor)		
0930-1000	Tea Break (NLB Plaza Ground Floor)		
1000-1030	*PP-4* Biomechanics	*WS-2* AAC Fundamental Workshop	*WS-1* Fundamentals Course in Assistive Technology Session A Day 2
1030-1050			
1050-1230			
1230-1300	Lunch (NLB Plaza Ground Floor)		
1300-1330			
1330-1400	*WS-3* Brain-Computer Interface	*WS-2* AAC Fundamental Workshop	*WS-1* Fundamentals Course in Assistive Technology Session A Day 2
1400-1530			
1530-1600	Tea Break (NLB Plaza Ground Floor)		
1600-1730	*PP-5* Best Student Paper Session	*WS-2* AAC Fundamental Workshop	*WS-1* Fundamentals Course in Assistive Technology Session A Day 2

Technical Program Overview – Day 3

25 April Wed	**Function Room 3 (NLB 3rd Floor)**	**Function Room 2 (NLB 3rd Floor)**	**Function Room 1 (NLB 3rd Floor)**
0800-0830	Registration (NLB 3rd Floor)		
0830-0930			
0930-1000	TTSH Neurorehabilitation Meeting - "Traumatic Brain Injury Rehabilitation"	Tea Break (NLB Plaza Ground Floor)	
1000-1030		*WS-4* Information & Communication Technology in Special Education Workshop	*PP-6* AAC & Hearing Technology
1030-1050	Tea Break (NLB Plaza Ground Floor)		
1050-1230	"Traumatic Brain Injury Rehabilitation"		
1230-1300			
1300-1330	Lunch (NLB Plaza Ground Floor)		
1330-1400			
1400-1530	Neurorehab Workshop 2A "Disability & Psychosocial Issues"	Neurorehab Workshop 2B "Spasticity in acquired brain injury"	Neurorehab Workshop 2C "Management of dysphagia"
1530-1600	Tea Break (NLB Plaza Ground Floor)		
1600-1730	"Disability & Psychosocial Issues"	"Spasticity in acquired brain injury"	"Management of dysphagia"

25 April Wed	**Imagination Room (NLB 5th Floor)**	**Possibility Room (NLB 5th Floor)**
0800-0830	Registration (NLB 3rd Floor)	
0830-0930	Plenary – A. Mak	
0930-1000	Tea Break (NLB Plaza Ground Floor)	
1000-1030	*WS-1* Fundamentals Course in Assistive Technology Session B Day 1	*WS-5* Policy Workshop – Education, Employment & Daily Living
1030-1050		
1050-1230		
1230-1300	Lunch (NLB Plaza Ground Floor)	
1300-1330		
1330-1400	*WS-1* Fundamentals Course in Assistive Technology Session B Day 1	*WS-6* AAC & Computer Access Workshop – Symbol-to-Speech Technology
1400-1530		
1530-1600	Tea Break (NLB Plaza Ground Floor)	
1600-1800	*WS-1* Fundamentals Course in Assistive Technology Session B Day 1	*WS-6* AAC & Computer Access Workshop – Symbol-to-Speech Technology

Technical Program Overview – Day 4

26 April Thu	**Function Room 3 (NLB 3rd Floor)**	**Function Room 2 (NLB 3rd Floor)**	**Function Room 1 (NLB 3rd Floor)**
0800-0830		Registration (NLB 3rd Floor)	
0830-0930			
0930-1000	Tea Break (NLB Plaza Ground Floor)		
1000-1100	*PP-3* Mobility Aids	*WS-7* AAC Workshop – Evidence Based Intervention	*PP-7* Technology for the Visually Impaired
1100-1130			
1130-1230			
1230-1300	Lunch (NLB Plaza Ground Floor)		
1300-1330			
1330-1400			*WS-9* Seating Workshop
1400-1530		*WS-8* AAC Workshop – Performance Measurement	
1530-1600		Tea Break (NLB Plaza Ground Floor)	
1600-1800		*WS-8* AAC Workshop – Performance Measurement	*PP-9* Seating, Pressure Sore & Pain Therapy

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(NLB 5th Floor)</th><th>Possibility Room
(NLB 5th Floor)</th><th>Nanyang Polytechnic
(Off Site)</th></tr>
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Biomechanics Workshop</td></tr>
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<tr><td>1300-1330</td></tr>
<tr><td>1330-1400</td><td rowspan="2">*WS-1*
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<tr><td>1530-1600</td><td colspan="2">Tea Break (NLB Plaza Ground Floor)</td></tr>
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Day 2</td><td>*WS-11*
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“Is Asia ready for Assistive Technology?”</td></tr>
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Keynote Speaker

Her Royal Highness Princess Maha Chakri Sirindhorn

Kingdom of Thailand

24 April 2007
Banquet Dinner (6:00 – 9:30pm)
Hotel Intercontinental 2nd Floor Ballroom

HRH has acquired first-hand experiences in working for Their Majesties the King and Queen's development projects in fields such as health and hygiene, education, water resource development, agriculture and cottage industry by regularly accompanying Their Majesties on visits to remote areas since the age of sixteen (in 1970). From these experiences, she has developed special interests in agricultural extension to improve school children nutritional conditions; supporting education from pre-school to tertiary levels; and mother and child care. She has also concentrated on helping the handicapped, especially in using information technology (IT) to develop independent living and learning skills.

HRH runs several philanthropic organizations and foundations. She is Executive Vice President of the Thai Red Cross Society since 1977; Executive Chairman of the Chaipattana Foundation (in charge of His Majesty's development and environmental preservation projects), Ananda Mahidol Foundation (to promote higher education), the King Rama II Foundation (to conserve and promote Thai Culture); President of the Sai Jai Thai Foundation (to support disabled veterans), Prince Mahidol Award Foundation (to award prizes annually to members of the international community for outstanding performances in the fields of medicine and public health); and Adviser of the Committee of Thai Junior Encyclopedia Project by Royal Command of H.M. the King.

HRH began her teaching career in 1979 when she started teaching General Education Program at Chulalongkorn University. A year later, she joined the Department of Law and Social Sciences, in the Academic Division of Chulachomklao Royal Military Academy. Presently, she is Director of the Department of History and has played an active part in revising its curriculum. She also supervises the Thai Music Club of the Academy. Occasionally, she will gives special lectures at several other institutions. She regularly attends academic conferences and seminars both within and outside of the country.

In addition, HRH represents Their Majesties in various royal functions. She also presides over ceremonies as well as other social and charity functions throughout the year.

In 1991, HRH was awarded the Magsaysay Award for Public Service.

Plenary Speakers

Vivian Balakrishnan

Minister for Community Development, Youth and Sports
Second Minister for Information, Communications and the Arts
MP for Holland-Bukit Timah GRC, Singapore

24 April 2007
Banquet Dinner (6:00 – 9:30pm)
Hotel Intercontinental 2nd Floor Ballroom

Vivian Balakrishnan was born in 1961. He was educated at the Anglo-Chinese School (1968-1977) and the National Junior College (1978-1979). In 1980, he was awarded the President's Scholarship to study Medicine at the National University of Singapore. He was elected President of the National University of Singapore Student's Union (NUSSU) from 1981 to 1983, and Chairman of NUSSU in 1984/1985. Subsequently, he pursued post-graduate specialist training in Ophthalmology and was admitted as a Fellow of the Royal College of Surgeons of Edinburgh in 1991. Between 1993 and 1995, he worked at Moorfields Eye Hospital in London. Upon his return, he was appointed Consultant Ophthalmologist at the Singapore National Eye Centre where he sub-specialised in Paediatric Ophthalmology. In January 1999, he assumed the post of Medical Director of the Singapore National Eye Centre. Subsequently, he was appointed Chief Executive Officer of the Singapore General Hospital from June 2000 till December 2001.

From 1999 to 2001, he chaired the Specialist Training Committee, which was responsible for the accreditation and training programme for all ophthalmology trainees in Singapore. He was the principal investigator for several clinical research trials to control the progression of myopia in children.

He was a Council Member of the Singapore Medical Association (1998 to 2001), member of the National Library Board (1997 to 2001), member of the Singapore Broadcasting Authority Programmes Advisory Committee (1998 to 2000) and the National Volunteer Centre Committee (1999 to 2001). He had significant exposure on national television, having been an active debater since the 70s, a host of the televised Singapore 21 series and presenter of health education programmes in the 90s.

Dr Vivian Balakrishnan was the Commanding Officer of the 2nd Combat Support Hospital of the Singapore Armed Forces from November 1999 to January 2002.

In the 2001 General Election, Dr Vivian Balakrishnan was elected MP for Holland-Bukit Panjang GRC. He was appointed Minister of State, (National Development) in January 2002 and Minister of State (Trade and Industry) in August 2003. He was also appointed Chairman of the "Remaking Singapore" committee in February 2002, and Chairman of the National Youth Council in July 2003. In August 2004, he was promoted to Acting Minister for Community Development, Youth and Sports and Senior Minister of State, Ministry of Trade and Industry. He became Minister for Community Development, Youth and Sports as well as Second Minister for Trade and Industry in April 2005. He was also the Minister responsible for entrepreneurship. In the May 2006 General Election, Dr Vivian Balakrishnan was elected MP for Holland-Bukit Timah GRC. He was re-appointed Minister for Community Development, Youth and Sports. In addition, he was also

appointed Second Minister for Information, Communications and the Arts.

He is a computer enthusiast and an avid reader. He is married with four children.

Leonard S.W. Li

Director, Rehabilitation Unit, Tung Wah Hospital
Hong Kong

24 April 2007
8:30 am
Hotel Intercontinental 2nd Floor Ballroom

Abstract

With the advancement of neuroscience and technology, widespread of medical disciplines have interests in research and management of patients with impairments and limitation in activities and participation from neurological disorders. These include the basic neuroscientist, radiologist, neurologist, rehabilitation physician, physiotherapist, occupational therapist, speech pathologist, neuropsychologists, nurse, social worker and etc.

Vast volume of research varied from cellular neuroplasticity to the clinical management of patients at the community level has been appeared in the literature. The requirement of knowledge and skills to be an expert in the field of neurorehabilitation is far more than the training from traditional medical specialties or rehabilitation professionals. The boundary of knowledge has been evolving beyond the model of traditional training. When translating this practical evolution of neurorehabilitation into our daily practice, a comprehensive management of patients with neurological disorders requires a team of experts that covers the whole spectrum of knowledge and skills in neurorehabilitation, but at the same time the individual team members need to share some common knowledge.

This will fit into the "Transdisciplinary Model" which involves cross training of team members and procedure development to allow the overlap of responsibilities between disciplines. Theoretically, it will enhance the flexibility in problem solving, closer interdependence of team members and case management.

Biography

Dr Leonard Sheung Wai Li has been the Head of Division of Rehabilitation Medicine, University Department of Medicine, and Tung Wah Hospital since 1994. Dr Li is concurrently holding appointments of Consultant in Rehabilitation Medicine at the McLehose Medical Rehabilitation Centre and Honorary Consultant at the Hong Kong ReHabAid Centre.
Dr Li is also serving academic appointments in several universities, which include: Honorary Clinical Associate Professor, Department of Medicine, The University of Hong Kong; Adjunct Associate Professor, Department of Rehabilitation Sciences, Hong Kong Polytechnic University; Visiting Professor, Department of Physical Medicine and Rehabilitation, Sun Yat-sen University, Gunagzhou, China; Coordinator, Undergraduate Teaching in Rehabilitation Medicine, Faculty of Medicine, The University of Hong Kong; External Expert, Committee of Postgraduate Master Degree Courses, Department of Rehabilitation Sciences, Hong Kong Polytechnic University; Honorary Consultant, The University of Hong Kong Clinical Centre for Teaching and Research

in Chinese Medicine, TWGHs Tung Wah Hospital.

Dr Li served as the Chairman of Specialty Subcommittee in Rehabilitation Medicine, Hong Kong College of Physicians (1998- 2002) and the President of Hong Kong Association of Rehabilitation Medicine (1997-2000). He is currently the Treasurer and Member of Executive Council, Hong Kong Neurological Society, Congress Chairman of World Federation for Neurorehabilitation, Honorary Consultant for the Division of Electrodiagnostic Medicine, Chinese Association of Rehabilitation Medicine, Secretary General of International Society of Physical and Rehabilitation Medicine, Interim Secretary General, Asian Oceania Society of Physical and Rehabilitation Medicine.

Leonard Li is an Associate Editor of many medical Journals, which include: Journal of Rehabilitation Medicine, Neurorehabilitation and Nerve Repair, Chinese Journal of Physical Medicine and Rehabilitation and WFNR Update.

Dr Li received his MBBS from the University of New South Wales, Sydney in 1983, and has been a member of the Royal College of Physicians of United Kingdom since 1987. His other qualifications include: Fellow of Australasian College of Rehabilitation Medicine (1992), Fellow of the Faculty of Rehabilitation Medicine of Royal Australasian College of Physicians (1993), Fellow of Hong Kong College of Physicians (1995), Fellow of Hong Kong Academy of Medicine (1995), Fellow of Royal College of Physicians of Edinburgh (1997), and Fellow of Royal College of Physicians of London (2001).

Arthur F.T. Mak

Associate Vice President (Academic Development)
Head, Department of Health Technology and Informatics
Director, Research Center for Musculoskeletal Bioengineering
Director, Jockey Club Rehabilitation Engineering Center
Chair Professor of Rehabilitation Engineering
The Hong Kong Polytechnic University
Harvard University

25 April 2007
8:30 am
National Library Board Building 5th Floor Possibility & Imagination Room

Abstract

External reaction forces acting via various body support surfaces are required to support the body under gravity and external locomotive forces. These biomechanical forces act on the skin in contact with the body support surface and concomitantly deform the associated subcutaneous tissues. Examples include the forces acting on the buttock tissues during wheelchair propulsion, the forces acting on the plantar foot tissues during standing and walking, and the forces acting on the residual limb tissues via the prosthetic socket during ambulation. In many contexts of rehabilitation, such as in the cases for patients who need to be bedridden for a long time, subjects who are wheelchair-bound because of spinal cord injuries, as well as subjects with neuropathic feet, excessive exposure to unwarranted forces at the body support interfaces can lead to

decubitus ulcer, which is commonly referred to as pressure sore. If these excessive epidermal loadings are not appropriately accommodated or relieved, either actively or passively, they can lead to extreme discomfort and serious clinical complications.

This presentation will highlight some of the major challenges in the pressure sore research and review our work on the biomechanics of body support interfaces since mid 90's. It summarizes our dynamic pressure measurement studies at the seating / buttock interfaces, the prosthetic socket / residual limb interfaces, and the insole / plantar foot interfaces under various conditions. It revisits a biomechanical criterion for pressure sore, proposed in term of tissue compaction following interstitial fluid flows under epidermal loading. This presentation describes the development of our tissue property assessment apparatus, namely the Tissue Ultrasound Palpation System (TUPS). It covers our recent work on assessing the subjective pressure tolerances of residual limb tissues. It also presents our recent experimental studies on the effects of externally applied epidermal loadings on cutaneous blood perfusion. This paper is relevant to the design of these body support surfaces such as prosthetic sockets, seat cushions and foot orthoses.

Biography

Professor Mak obtained his B.Sc. in Engineering Mechanics with highest honor from the University of Illinois at Urbana-Champaign in 1976 and earned his Ph.D. in Biomechanics at Northwestern University in 1980. After spending 3 years of postdoctoral fellowship in Tissues Mechanics under Professor Van Mow at Rensselaer Polytechnic Institute in New York, Prof. Mak took up an Assistant Professorship in Bioengineering and Orthopedics Research at the University of Pennsylvania.

Prof. Mak joined the Jockey Club Rehabilitation Engineering Centre at PolyU in 1988 and was promoted to full professorship in 1995. Prof. Mak became Chair Professor of Rehabilitation Engineering in 1997 and in the same year was appointed as the Head of Jockey Club Rehabilitation Engineering Centre. Prof. Mak is active in local, regional, and international professional bodies related to biomedical and rehabilitation engineering. He chairs the Committee of Vocational Training for People with Disabilities in 1998-2007 and served as a member of the Hong Kong SAR Government Rehabilitation Advisory Committee during 2000-2004. Prof. Mak was the Asia-Pacific Chair of the International Commission for Technology and Accessibility in Rehabilitation International in the period of 1998-2004. Prof. Mak is the Founding Chairman of the Biomedical Discipline Advisory Panel of the Hong Kong Institution of Engineers, a member of the Asia Pacific Working Group of the International Federation for Medical and Biological Engineering, the Honorary Secretary of the Executive Committee of the World Association for Chinese Biomedical Engineers, and a member of the World Council on Biomechanics.

Prof. Mak has held visiting/ adjunct faculty positions at Sichuan University and University of Pittsburgh. In 2005, Prof. Mak became the Founding Head of the Department of Health Technology and Informatics. The Department is the PolyU home for Biomedical Engineering, Biomedical Sciences, and Biomedical Radiation. Prof. Mak is serving in the editorial boards of a number of international journals on biomedical engineering and rehabilitation engineering.

His research interests cover tissue mechanics, biomaterials and tissue engineering, seating biomechanics, peripheral joint biomechanics, prosthetic and orthotic bioengineering. Prof. Mak became Associate Vice President (Academic Development) of the University in 2006.

Martin G. Helander

Professor
School of Mechanical and Aerospace Engineering
Nanyang Technological University

26 April 2007
8:30 am
National Library Board Building 5th Floor Possibility & Imagination Room

Abstract

Many R&D studies have attempted to design an ideal Smart Home for the Elderly. The interest has been driven by the realization that smart homes may offer a convenient and reliable solution for addressing Medical and Health Needs of the Elderly. Design features, such as a Medical Advisory System, can be used for Rehabilitation as well as Monitoring of Health status.

There are various needs of elderly. Some address directly the medical welfare of elderly, and some support daily activities, which indirectly promote good health.
Our study took a novel approach to identify and classify need or various smart design features. Projective Testing was used to identify the needs of elderly users for features such as: telemedicine, customized computer, teleconferencing, tele-shopping, event reminder, robot helper and smart pets.

Altogether 192 different user needs were identified. These needs were sorted in nine categories: Health Communication, Security, Mobility, Support for Mental Activities, Support for Physical Activities, Prestige, Independence and Dependence. These were compared to "deep" needs structures of older people that have been documented in the literature including: Transcendent, Optimization, Anti-Ageing, Dependency Avoidance and Nurturance Seeking.
Together the two sets of needs structures can be used as a point of departure for design of smart homes for the elderly. There is however one caveat: Needs are different among different users. While some elderly accept ageing, others do not; and while some seek an Independent Life, some prefer to depend on others. Therefore the design of a smart home must consider the special situation of individual users.

Biography

Professor Helander is involved in human factors research since 1969, first in studies of driver performance and road safety; later in ergonomics of the workplace. From 1975 to 1978, he was a Professor of Industrial Ergonomics at Lulea University in Sweden with responsibility to coordinate the establishment of the department, the first of its kind in Sweden.

In 1976, Professor Helander consulted the Mexican Government to set up industrial ergonomics research activities in Mexico. During his stay in USA from 1997 to 1994, he worked for Human Factors Research, Inc. in Santa Barbara, CA, and was a faculty member at State University of New York at Buffalo. He made visiting appointments at Virginia Tech and MIT, and research on driver performance and traffic safety, underground and surface mining, building and construction work, office automation, industrial automation and human-computer interaction.

From 1994-1999, he was a Professor of Industrial Ergonomics at Linkoping University and President of International Ergonomics Association. He was appointed the Founding Director of the Graduate School of Human-Machine Interaction, Founding Director of Swedish Centre for Human Factors in Aviation at Linkoping University. Currently, he is Professor at the School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore, and Director of Graduate Program in Human Factors Engineering.

Tan Tock Seng Hospital Neurorehabilitation Meeting

Symposium 1 – Stroke Rehabilitation

24th April, 09:30 – 17:30,
Hotel Intercontinental 2nd Floor Ballroom
NLB 3rd Floor Function Room 2 – 3
NLB 5th Floor Visitor Centre

09:30 -10:00
The Stroke Rehabilitation Nurse - Making a Difference to Care
Hotel Intercontinental 2nd Floor Ballroom

Rehabilitation has been identified as an important aspect of health care, which aims to maximize recovery and help patients return to their highest possible level of independence.

Nursing has an essential role in the provision of multidisciplinary rehabilitation for stroke patients. The nursing role in stroke rehabilitation is fundamentally concerned with the provision of care which is technical, therapeutic and managerial in nature. This care is aimed at a range of patient outcomes that include the maintenance and improvement of health and well-being, and the development of coping strategies.

Rehabilitation nurse has the most frequent and closest contact with the individual. They have the capacity to affect a great degree of change in both the quality of rehabilitation services, and the outcomes that stroke patients achieve, as a result of the quantity of interaction that they have with patients. The goals of rehabilitation nurse are not to cure the individual, but to improve the quality of life for people with disabilities. Rehabilitation nurses value the therapeutic aspects of nursing care, and are able to describe interventions which aimed to prevent further deterioration of patients' condition, to prevent harm, and to maintain safety as well as emotional well-being, coping skills and improvement in activities of living. Involving the patient in decision-making and encouraging an active participation in rehabilitation has also been strongly advocated.

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10:00 – 10:30
Management of the Hemiplegic Upper Extremity - What Is The Evidence?
Hotel Intercontinental 2nd Floor Ballroom

Impaired upper extremity function is a devastating lost for most of the stroke survivors and hence, a formidable challenge for attending therapists. Rehabilitation of the hemiplegic limb remains difficult to achieve, with only 5% of complete paralysis stroke survivors regaining functional use of their impaired arm and hand (Dombovy 1993, Gowland 1982, Kwakkel et al. 2001).

There are numerous techniques, technologies, strategies, medical management and orthoses used world wide in the management of the hemiplegic upper extremity. Some of them are training techniques that evolved from motor learning theories years back whereas some are novel and recent. Until recently, many therapists have employed a hypothetical, "experimental" approach in the rehabilitation of the hemiplegic upper limb. Hence, a good review at current developments in evidence-based practice for upper extremity management will help therapists to critically analyze these interventions and to facilitate their application appropriately and effectively when treating

the stroke survivors.
10:50 – 11:20
Achieving Ambulation in the Stroke Survivor - Novel Techniques
Hotel Intercontinental 2nd Floor Ballroom

Gait retraining after a stroke takes up a sizeable proportion of a patient's rehabilitation program. It is often a key factor in length of stay and discharge decision making. Fortunately, it is also one of the earliest motor functions that many patients do relearn during the first few months of their rehabilitation. However with an ongoing drive for shorter length of stay in today's healthcare resource management, the proportion of patients that could achieve early ambulation and the time taken to successfully achieve ambulation have been keenly contested in researches of post stroke gait retraining. With productivity and safety (of patients and therapist) being requisites of an efficacious training regime, has technology been successfully utilized to augment or replace existing traditional methods of gait relearning? It will be constructive to understand and consider the unique advantages of both traditional hands-on techniques and current gait training technology in meeting the needs of gait relearning so as to innovate new and better means of carrying out the works.

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11:20 – 11:50
Post-stroke Mood Disorders - Are We Providing Optimal Care?
Hotel Intercontinental 2nd Floor Ballroom

Neuropsychiatric conditions, such as Depression, Aggression, Personality Change and Cognitive Impairment, are common after stroke. Yet, they are often unrecognized, under-diagnosed or under-treated. This can result in poor Quality of Life for patients, stress for the caregivers, or sometimes even tragic consequences. More can be done to improve the care and community services to help patients after stroke. These include the education of medical personnel and caregivers, research into Post-Stroke Neuropsychiatric Disorders and their management and expansion of community services.

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11:50 – 12:20
Alternative Therapies in Stroke Rehabilitation in Singapore - What Do We Know?
Hotel Intercontinental 2nd Floor Ballroom

Alternative therapies can be defined as therapies or treatments which are not generally recognized by the medical community as standard or conventional. Use of alternative therapies is common in Singapore, given its predominantly Asian population. An outpatient survey of 119 patients with stroke and brain injury at Tan Tock Seng Hospital Rehabilitation Centre in 2002 revealed that almost 50% of patients had experience with at least 1 form of alternative medicine. The range of alternative treatments varied from acupuncture, herbal medicine (Traditional Chinese Medicine and Ayurvedic herbs), body massage, foot reflexology, aromatherapy to magnetotherapy. Given its popularity, it is surprising to note that, with the exception of acupuncture, there are very few studies evaluating the efficacy of alternative treatments. For clinicians managing stroke patients, apart from understanding the reasons and motivation for seeking alternative therapies, it will also be useful to have a basic understanding of the mechanism of action and possible side-effects of common alternative therapies used so that proper counseling and advice can be provided.

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12:20 – 13:00
Questions & Answers
Hotel Intercontinental 2nd Floor Ballroom

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Neurorehab Workshop 1A
Incorporating Acupuncture / Acupressure in Stroke Rehabilitation - An Experiential Approach
24th April, 14:00 – 17:30
NLB 5th Floor, Visitor Centre

Acupuncture is a Traditional Chinese Medicine-based treatment modality that has been used for since ancient times to treat a variety of illnesses. Increasingly, it has been used as an adjunct to standard treatment of stroke and there is evidence suggesting that it may facilitate functional recovery after a stroke. Furthermore, it is also useful in alleviating poststroke complications of pain and spasticity.

This workshop consists of didactics, case studies and hands-on demonstration on mechanisms of action of acupuncture in stroke recovery, commonly used acupuncture points and techniques of acupuncture/acupressure.

At the end of the workshop, participants will have a better understanding of mechanisms of acupuncture in stroke recovery and recognize acupoints commonly used for treatment of poststroke pain e.g. hemiplegic shoulder pain and spasticity.

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Neurorehab Workshop 1B
Stroke Rehabilitation Nursing - Current Practice and Future Challenges
24th April, 14:00 – 17:30
NLB, 3rd Floor, Function Room 3

Stroke is one of the leading causes of disability. More than fifty percent of stroke patients are left with moderate functional impairments with severe disability. Problems associated with each stroke are identified that may include paralysis, communication problems, swallowing difficulty, urinary incontinence, mental & emotional problems, fatigue etc.

These stroke survivals require extensive support to cope with and adjust to the consequences of stroke. An effective rehabilitation intervention initiated early after stroke can enhance the recovery process and minimize functional disability. Rehabilitation nurses play a key role in facilitating individual recovery. A range of strategies is adopted to prevent further deterioration in the patients' condition, to prevent harm, and to maintain safety.

This workshop aims to provide tips on maintenance of existing abilities and roles; promotion of health; prevention of further impairment; prevention and reduction of disability; restoration of function and roles; and minimization of handicap.

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Neurorehab Workshop 1C
Electromyography (EMG)-guided Biofeedback and Motor Recovery in Stroke
24th April, 14:00 – 17:30
NLB, 3rd Floor, Function Room 2

Electromyography (EMG)-guided biofeedback has been shown to facilitate motor and functional recovery after a stroke. Dr Tsirkin will discuss the indications for use of EMG-biofeedback in stroke and demonstrate the use of the BOSLAB neurobiofeedback on stroke patients.

This workshop is suitable for physicians, therapists and psychologists interested in understanding EMG-guided biofeedback in stroke recovery.

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Symposium 2 – Traumatic Brain Injury Rehabilitation

25th April, 09:30 – 17:30,
NLB 3rd Floor, Function Room 1 – 3

09:30 – 10:00
Facilitating Motor Recovery in Neurorehabilitation
NLB 3rd Floor, Function Room 3

There has been a better understanding of functional recovery after damage of brain cells in last 15 years with the invention of functional imaging including the functional magnetic resonance imaging (fMRI). The demonstration of recruitment of nerve cells adjacent to the damaged area and also from the contralateral side through fMRI studies has given us a strong basis how the neurorehabilitation can induce changes in the damaged brain. This conceptual basis of neuroplasticity has applied to the clinical practice that task-specific repetitive training can facilitate the functional recovery after brain damage.

Constrained Induced Movement Therapy (CIMT) is one of the good examples of the task-specific training for upper limb function. A recent published randomized Multicentre study confirmed the earlier studies about the effectiveness of CIMT on facilitating the functional recovery of paretic upper limb. Other newer modalities such as Mechanical Arm Trainer have been on the market with similar conceptual basis of task-specific training, but more research is required before it should be applied as routine clinical use. Equivalent task-specific training for lower limb is also available. Partial weight supported treadmill training (PWSTT) is the example. Despite that the systematic review showed that PWSTT could not make the non-ambulators to ambulate, but demonstrated that the functional walking of the ambulators improved after training by PWSTT.
Recent study in our centre and also Multicentre studies in Germany demonstrated the Mechanical Gait trainer could achieve similar results as the PWSTT. There are also other modalities of training can enhance the functional recovery. Functional electrical stimulation has been used for a long period of time but previous studies were of relatively low quality that the systematic review could not be conclusive. However, a recent published double-blind randomized controlled study from our centre showed that a programmed 4-leads FES can enhance functional recovery of ambulation in recent stroke patients.

Another interesting approach in recent research is to use mental imagery in training of post-stroke patients. Application of this training is not complex and will be cost-effective if further research confirms its effectiveness. During functional recovery of an upper motor neurone lesion,

spasticity can sometimes be the culprit.

Proper management of the spasticity can assist functional recovery in the selected patients. Alternative treatment such as acupuncture has not been evidence-based for its effectiveness. However, it has been a commonly used modality in the Eastern Culture for over a thousand years and further well-designed research is needed to evaluate its effectiveness. As a whole, we are nowadays having many more evidence-based modalities in addition to the traditional rehabilitation training to achieve a better functional recovery after neurological damage. Justification use of these new modalities in single or combination should be tailored according to the individual's condition and progress so that functional recovery can be maximized.

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10:00 – 10:30
Evidence For Traumatic Brain Injury Rehabilitation Across The Ages: What Do We Know?
NLB 3rd Floor, Function Room 3

Traumatic brain injury can lead to significant impairments and disabilities in multiple domains, including the physical, cognitive, emotional, behavioural and psychosocial. Rehabilitation is usually recommended to optimize function and aid in the recovery process. However, the goals of rehabilitation and the needs of the individual patient can vary greatly. In addition, the rehabilitation process is often labour intensive and costly. It is therefore important to evaluate the efficacy of various programmes in order to be able to provide the most appropriate, efficacious and cost-effective service to the patients.

In this talk, we provide an overview of the rehabilitation services and programmes available to brain-injured patients and review the evidence regarding their benefits and effectiveness. Parameters to be discussed include the organization of rehabilitation, the onset, setting and intensity of therapies, as well as specific therapeutic interventions

Although a significant amount of the available literature is focused on working-age adults, patients at both ends of the age continuum often have special issues and needs which differ from this group. We describe these differences and recommend evidence-based methods of meeting the needs of the very young as well as the elderly with brain injury.

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10:50 – 11:20
Assessing the Minimally Responsive Patient - Can We Do Better?
NLB 3rd Floor, Function Room 3

"Coma"."Consciousness"."Wakefulness"."Awareness". "Arousal"."Vegetative". These are just some of the terms commonly used to describe the condition of persons in varying states of impaired consciousness. Understanding the different states of impaired consciousness and the key differences between them allows the rehabilitation team to plan appropriate management strategies. How then do we assess persons with such conditions? What are the more commonly available tools currently being used to assess and how different are they? Is there a better approach from another and is there a best method?

In this presentation, we shall define the various states of impaired consciousness, in particular that of the minimally responsive state, and explore the issues raised above with reference to

assessment.

With advancement of medical technology and skill, more are surviving severe brain injuries. Management of persons with such conditions often involves high costs and labour-intensive measures. As such monitoring (small) changes in recovery has an impact on decisions with regards to medical management including rehabilitation.

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11:20 – 11:50
Dizziness and Balance in Brain Injury: Is It All In The Mind?
NLB 3rd Floor, Function Room 3

Dizziness is a common complaint after a traumatic brain injury (TBI). It has been reported to occur in 25% to 90% of TBI cases. Common vestibular disorders after TBI include benign paroxysmal positional vertigo (BPPV), vestibular hypofunction and central vestibular dysfunction. These disorders can affect eye-head coordination, balance abilities, gait and activities of daily living of TBI patients, thus affecting quality of life. Vestibular rehabilitation adopts an exercise-based approach in the management of dizziness and balance disorders associated with vestibular pathology.

This presentation will discuss common vestibular pathology after TBI and various treatment techniques used to manage those conditions. Outcomes of vestibular rehabilitation for TBI patients and prognosis will also be addressed.

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11:50 – 12:20
Emerging Therapies in the Rehabilitation of Traumatic Brain Injury (TBI): What Can We Learn?
NLB 3rd Floor, Function Room 3

Recent advances in TBI rehabilitation have centered on the remediation of cognitive disorders and new scales to measure arousal and attentional deficits. The time-honoured neurorehabilitation principles of task specific training and progression of difficulty have shown benefit in TBI-targeted therapies to improve attention. Memory retraining using implicit (procedural) learning including errorless learning techniques for patients in post-traumatic amnesia or those with chronic memory deficits show promise. Visual scanning techniques which assist the treatment of visual-spatial deficits through the use of useful field of view (UFOV) is increasingly being used for assessment and training. The use of robotic devices such as the Lokomat for body weight supported training for ambulation and MIT manus for the upper limb may promote recovery through increased repetitions of training with more objective and reproducible treatment.

Computer systems can be used as supplements to traditional pen and paper neuropsychiatric assessments due to their ease in documentation, unobtrusiveness and telerehabilitation possibilities. Virtual reality technology may offer a more naturalistic, controlled and interactive environment for cognitive remediation or training for independent living, vocational assessment or navigation. The efficacy of holinergic or nootropic augmentation for TBI memory deficits continues to be debated in the light of conflicting efficacy from small trials in chronic TBI survivors.

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12:20 – 13:00
Questions & Answers

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NLB 3rd Floor, Function Room 3
Neurorehab Workshop 2A
Coping With Disability and Psychosocial Issues after Acquired Brain Injury (ABI)
25th April, 14:00 – 17:30
NLB, 3rd Floor, Function Room 3

Facing the impact of an acquired brain injury is a challenging experiences for both patients and their significant others. There will be issues associated with the loss of functions, job and income, studies and aspirations, as well as financial and care issues. These are stresses on both the patients and their significant others, and they often require long-term support to help manage them. The presenters and facilitators of the workshop hope to discuss two models of intervention by the psychologist and medical social worker in facilitating the patient's and family's adjustment and coping. The role of the psychologist will be illustrated in the Neuropsychological model, which highlights the importance of assessing premorbid factors and current abilities, so as to facilitate achievement of realistic goals. The Case Management Model is used in social work assessment/intervention - and promotes provision of holistic support to patients and families, with the ultimate aim of community re-integration.

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Neurorehab Workshop 2B
Practical Approach to Spasticity in Acquired Brain Injury
25th April, 14:00 – 17:30
NLB, 3rd Floor, Function Room 2

Spasticity is a common consequence of stroke, head injury, multiple sclerosis, cerebral palsy or spinal cord injury. Management of spasticity includes medication, botulinum injection, alcohol neurolysis, range of motion exercise, splinting and electrical stimulation. However, these interventions may be inadequate for maintaining muscle length and joint range among patients with severe spasticity and contracture. The application of serial and inhibitory casting can be a useful adjunct in the overall management of patients with severe spasticity and contracture. In addition, toe spreader can also assist in reducing toe clawing spasticity and hence alter patients' gait pattern. Dynamic Lycra orthosis is also increasing used to achieve tone inhibition through biomechanical alignment of muscles and joints.

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Neurorehab Workshop 2C
Management of Dysphagia In Neurorehabilitation
25th April, 14:00 – 17:30
NLB, 3rd Floor, Function Room 1

Dysphagia, or swallowing problem, occurs in about 50% of the stroke patients. People with dysphagia may be at risk of developing aspiration pneumonia if the management of their swallowing impairment is not adequate. Thus, it is important to increase the awareness on the risks of aspiration, and the importance of aspiration prevention. The workshop is targeted for

nurses and aims to improve the participants' ability in managing dysphagic patients, especially those who are on transitional feeding and modified diets, or those who require safe feeding strategies for aspiration precaution. The workshop will address the following: risk factors for aspiration, swallowing tests, signs of aspiration, safe feeding strategies and simple compensatory strategies which may be recommended by the speech therapists. There will also be time allocated for discussion and role plays to ensure that the participants are able to apply their knowledge and learnt strategies into practice.

Workshops

WS-1
Fundamentals Course in Assistive Technology
Session A: 23rd April, 9:00 – 17:30 & 24th April, 10:00 – 17:30
NLB, 5th Floor, Possibility Room
Session B: 25th April, 10:00 – 18:00 & 26th April, 10:00 – 18:00
NLB, 5th Floor, Imagination Room

Glen ASHLOCK, MS, ATP, Rehabilitation Engineering & Assistive Technology Society of North America (RESNA)
Michelle LANGE, OTR, ABDA, ATP, Rehabilitation Engineering & Assistive Technology Society of North America (RESNA)

The Fundamentals Course in Assistive Technology is designed to provide individuals who are interested in the field of assistive technology an overview of the various areas of assistive technology. It also provides assistive technology providers with a review in breadth of knowledge of the various areas of assistive technology. Please note that this course is not designed as a review course for the ATS, ATP or RET Exams. This course is for rehabilitation and education professionals working with or implementing use of Assistive Technology including Suppliers, Technologists, Physical Therapists, Occupational Therapists, Speech Language Pathologists, Rehabilitation Engineers, Educators and Others interested in AT.

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WS-2
Alternative & Augmentative Communications (AAC) Fundamentals
24th April, 10:00 – 17:30
NLB, 5th Floor, Imagination Room

Katya HILL, PhD, CCC-SLP, University of Pittsburgh, USA
Jennifer LOWE, Executive Director, Support Helping Others Use Technology (SHOUT), USA

This full day workshop comprises of four modules which are the goal of Alternative & Augmentative Communications (ACC), language models and representation methods, Technology Options and Models and Making Evidence-Based Decisions respectively. These modules are designed to review the current state-of-the-science of AAC clinical practice for all AAC stakeholder groups. For participants who are new to AAC, this is an excellent platform to build a strong foundation of the key components of AAC service delivery. For experienced practitioners, this workshop provides information to instruct novice team members and a review of current research-base in supporting clinical interdisciplinary decision-making.

As a result of this workshop, participants will be able to establish an understanding on definition

of AAC, identify individuals who will benefit from the use of AAC, list and describe the three AAC language representation methods of single meaning pictures, alphabet-based methods and semantic compaction, identify and compare the categories and ranges of AAC assistive technology, identify and describe the language, interfaces, outputs, and access method features of AAC systems.

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WS-3
Brain-Computer Interface – An Emerging Assistive and Rehabilitative Technology
24th April, 13:30 – 15:30
NLB, 3rd Floor, Function Room 1

Haihong ZHANG, PhD, Institute for Infocomm Research, Singapore
Brice REBSAMEN, National University of Singapore

This workshop introduces the fundamental techniques used in detecting and classifying EEG signals (brainwaves) and the potential of brain-computer interface as assistive and rehabilitative applications. Live demonstrations of BCI will be shown during the workshop.

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WS-4
Using ICT for Teaching and Learning as Scaffolds for Enhanced Teaching Strategies in SPED Schools

25th April, 10:00 – 13:00
NLB, 3rd Floor, Function Room 2

Cyraine Marissa WETTASINGHE, Assistant Professor, National Institute of Education (Singapore)
Libby COHEN, Visiting Professor, National Institute of Education (Singapore)
Mazlan HASAN, Instructional Designers, National Institute of Education (Singapore)
Pratima MAJAL, Instructional Designers, National Institute of Education (Singapore)
Judy LEE, Corporate Community Relations, IBM Singapore

Cognitive psychology portrays learners as active processors of information (Bruning, 1995). Students learn better when they can invent knowledge through inquiry and experimentation. Vygotsky (1978) referred to the zone of proximal development, which he defined as the difference between the difficulty level of a problem a student can cope with independently and the level that can be accomplished with help from others. Here, the teacher's role is to coach the student by providing learning supports called scaffolding. ICT in the classroom can provide learning scaffolds for learners in various ways such as displaying keyword connections, providing compare-and-contrast summaries, generating concept maps that expose main ideas and supporting details, showing relationships between current and past events, and stepping learners through an active inquiry process designed to expose relationships (Hitchcock, 2001). This seminar session will explore the use of IT as scaffolds that SPED teachers can use for more interactive and engaging learning in class.

Agenda:
09:00 – 10.30
Supporting student learning with technology using universal learning design
Speakers:
Libby Cohen, Visiting Professor, National Institute of Education
Synopsis:
In the face of rapidly expanding capabilities of digital content, tools and networks, there are a range of possibilities of conceiving, designing and delivering lessons that will accommodate widely varying learners' needs. This session will cover issues related to universal learning design and educational technologies that can support learning processes more effectively.

10.30 – 11.45
Assistive Technologies & Community-based Projects
Dr Marissa Wettasinghe, Assistant Professor, National Institute of Education
Ms Judy Lee, Corporate Community Relations, IBM Singapore
Synopsis:
To create a truly inclusive society, information technology need to be more accessible otherwise our learners with disabilities will lose out in a big way. In this session, hear more about early learning programmes for disadvantaged children and assistive technology on the computer that can help increase accessibility to enhance learning via the computer.

11.45 – 13:00
Educational Technologies for e-learning
Marissa Wettasinghe, Assistant Professor, National Institute of Education
Mazlan Hasan & Pratima Majal, Instructional Designers, National Institute of Education
Synopsis:
This session will look at types of learning technologies that can motivate learners by tapping on the rich source of materials available on the Internet. Used together with appropriate teaching and learning strategies, these resources can greatly assist in enhancing the learning experience.

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WS-5
Policy Workshop: Education, Employment & Daily Living
25th April, 10:00 – 12:30
NLB, 5th Floor, Possibility Room

10:00 – 10:30
Integration in Mainstream Schools - TEACH ME's perspective
Sukitha KUNASEGARAN, Head of Educational and Psychological Dept, AWWA Teach Me
Anita YADAYA, Senior Occupational Therapist of Therapy Department, AWWA Teach Me

AWWA is a voluntary welfare organisation affiliated to the National Council of Social Services (NCSS). AWWA's HQ operates from ACCESS (AWWA Centre for Care, Education and Social Services) located at 9, Lorong Napiri (off Yio Chu Kang Road).

AWWA runs 5 main projects that cater to the different target groups in the community. These projects are: Elderly Services (Community Home, Seniors Activity Centre and READYCARE), Educational Services (Family Service Centre (FSC), Centre for Caregivers (CFC) and TM Integration Services.

TEACH ME Services is one of three programmes within TM Integration Services, the other two

being SMILES (a special before and after care programme) and TM Inc. (a transition programme for clients going from school to open employment).

TEACH ME (an acronym for Therapy and Educational Assistance to children in Mainstream Education) is an integration program that caters to the Educational, Rehabilitative and Social needs of children with physical disabilities in mainstream education. Our services are available to students starting from pre-school and continuing throughout their educational career, until they leave school. We currently serve about **280** clients from all over Singapore, attending about **150** schools. Our clients receive services from a transdisciplinary team of Social Workers, Therapists (Physiotherapists, Occupational Therapists and Speech Therapists), Educational Guidance Officers and Educational Psychologist.

10:30 – 11:00
IT Training for People With Disabilities
Fook Wai KONG, Deputy Director, Society for the Physically Disabled

Infocomm Technology (ICT) offers one of the higher value added work People With Disabilities (PWDs) are able to leverage on to improve on their living standards, independence and quality of living. This session explores how ICT is able to meet these requirements using devices, technology and training necessary for PWDs to take control of their lives and look forward to greater accessibility.

11:00 – 11:30
Employment of People with Disability in Singapore.
Roland TEO, Manager (Employment Placement Division), Bizlink

When we consider the future employment of people with disability we need to look at the following areas:-

- Legislation or incentive scheme
- Improving their skills
- Improving the educational qualifications
- Improving their attitude and inter-personal skill e.g., to be a team player

These areas, when properly developed, can enhance the employability of the PWD.

11:30 – 12:00
Design to Empower
Julie CHONG Cheng Harn, Hon Secretary, Handicapped Welfare Association

A home is the greatest asset most of us would own. Yet age or the onset of a disability could render a home into a prison cell or an unlivable (perhaps even dangerous) space to live in because of a change in physical or mental capabilities. Assistive technology and home modifications have the potential to increase independence, safety, and quality of life for individuals with disabilities by providing them the means to easy physical access to their home and to manage simple activities of daily living in an independent manner. A home that allows for "aging in place" for individuals with disabilities and the elderly is important to promote an active aging society within a community. Yet solutions for the home cannot come purely from the AT designers, engineers or occupational therapists. The end-users; the elderly and the disabled need to be greater involved in the design process.

12:00 – 12:30
Questions & Answers

WS-6
Alternative & Augmentative Communications (AAC) & Computer Access Workshop – Symbol-to-Speech Technology
25th April, 13:30 – 18:00
NLB, 5th Floor, Possibility Room

Kuo-Ping YANG, PhD, President, Assistive Technology Engineering Lab, Taiwan
Shu-Hua GUO, Principal Engineer, Assistive Technology Engineering Lab, Taiwan

This workshop introduces the AT products developed by Unlimiter (Assistive Technology Engineering Lab). Unlimiter has been involved in the research and development of AT products since 1997. It owns over 20 patents in AAC symbols library, Symbol-to-Speech hardware and software, and computer access systems.

Through a series of live demonstrations, the participants will see various Symbol-to-Speech AT products based on the world leading AAC symbols library. These include the Blue Bird Communication Board, Picture Write and Picture Master Language Software. To compliment these AAC devices, the speakers will also unveil the latest computer access products based on the wireless Bluetooth technology.

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WS-7
Alternative & Augmentative Communications (AAC) Evidence-Based Intervention
26th April, 10:00 – 13:00
NLB, 3rd Floor, Function Room 2

Katya HILL, PhD, CCC-SLP, University of Pittsburgh, USA

With the complexity of decision making on Alternative & Augmentative Communications (AAC) intervention, this workshop emphasizes the application of the principles of evidence-based practice to decision with an AAC language-based model. Through lecture, case study data and interactive activities, participants will be familiarized with the steps of evidence-based practice, the research and clinical data which resulted various intervention strategies and methods, the domains of communication competence used for developing intervention plans and outcomes, and the tools and resources which assist AAC teams in the collection of data to evaluate and monitor AAC interventions that result in effective communication.

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WS-8
Communication Performance Measurement and Individuals Who Use Alternative & Augmentative Communications (AAC)
26th April, 14:00 – 18:00
NLB, 3rd Floor, Function Room 2

Katya HILL, PhD, CCC-SLP, University of Pittsburgh, USA
Jennifer LOWE, Executive Director, Support Helping Others Use Technology (SHOUT), USA

Alternative & Augmentative Communications (AAC) evidence-based clinical practice requires the measurement of communication performance. As a result, automated tools are developed to support the collection and analysis of language samples of communication generated with the use

of speech-output AAC system.

This workshop comprises of a review on the basics of AAC performance and outcomes measurement, the identification, descriptions and comparison of existing manual methods and automated tools including the Single Switch Performance Test (SSPT), COMPASS, U-LAM (Universal Language Activity Monitor), and PeRT analysis software (Performance Report Tool) and lastly, the comparison of built-in automated logging features on AAC devices.

There will be also be a demonstration session whereby an AAC user will interact with the audience to obtain language sample. The AAC Performance Report of the collected language sample will then be generated and reviewed. From this demonstration, participants will understand the importance of this simple foundational practice.

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WS-9
Seating Workshop – Taking Special Seating into the Next Level
26th April, 13:30 – 15:30
NLB, 3rd Floor, Function Room 1

Susanna KOH, Senior Prosthetist / Orthotist, Tan Tock Seng Hospital
Carmen ORLANDI, Senior Prosthetist / Orthotist, Tan Tock Seng Hospital

This workshop is for clinicians, users and suppliers of varying level of knowledge of special seating. It covers briefly the main principles behind the science of seating and positioning and has an open discussion about the advantages and disadvantages of modular and customized seating solutions.

The second part of the workshop will focus on the Matrix Seating System. The Matrix generation 2 seating system is an answer to many of the challenged that we face in today's customized seating solutions. Participants would have the change to get hands on experience in molding the backs on each other to better understand how this system works.

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WS-10
Introduction to Rehabilitative and Assistive Robotics
26th April, 13:30 – 15:30
NLB, 5th Floor, Possibility Room

Wei Tech ANG, PhD (Robotics, CMU), Nanyang Technological University, Singapore
Etienne BURDET, PhD (Robotics, ETH-Zurich), Imperial College of Science & Technology, UK

This half day workshop introduces the state of the art robotics research in rehabilitation and assistive applications. The content is designed for robotics technology researchers, healthcare professionals, end users, and anyone interested in the field.

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WS-11
Discussion Forum – "Is Asia ready for Assistive Technology?"
26th April, 16:00 – 18:00
NLB, 5th Floor, Possibility Room

This discussion forum attempts to provide a platform for the conference participants from different countries to discuss the state of Assistive Technology in Asia and the journey ahead for Asia to widely adopt and embrace the benefits of Assistive Technology.

Who should attend:
Policy makers, practitioners, researchers, PWD, caregivers, merchants, teachers, and anyone interested in AT.

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WS-12
Biomechanics Workshop - The Scientific Analysis of Motion for Effective Rehabilitation
26th April, 10:00 – 17:30
Nanyang Polytechnic (Transport to Nanyang Polytechnic leave NLB at 09:30)

Bala S. RAJARATNAM, Manager / Projects, School of Health Sciences, Nanyang Polytechnic
Pavel BOGACHKO, Biomechanist, Qualisys AB

Motion analyses quantify kinematic and kinetic features of complex body movement to better display and understand salient biomechanical and muscular characteristics to be corrected. Stillman (1991) suggested that "motion analysis systems should become a major assessment and research tool in the future." Results of motion analysis studies allow implementation of evidence-based rehabilitation programs for patients for better patient outcomes. This one day workshop is organised by Nanyang Polytechnic, School of Health Sciences, Biofit Technology & Services (Singapore) and Qualisys AB from Sweden. Participants will be provided with hand-on exposure to collect and analyse human motion and electromyography activity of muscles during action among patients with movement disorders and during sports. The workshop will benefit Physiotherapists, Occupational Therapists, Bioengineers, Sports Scientists, Sports Trainers and Specialists in human movement studies. The workshop is limited to 15 participants and involves analysis of at least 3 different movement patterns of both upper and lower limbs and trunks. The workshop will be held at the Motion Analysis Lab of Nanyang Polytechnic.

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Paper Presentations

Tuesday, 24th April 2007

PP-1
Policy & Accessibility
NLB 3rd Floor, Function Room 3

10:00 – 10:20 PP-1-1	**Towards an Inclusive Society in Asia: The Invisible Helping Hand** H. G. Tan, W. T. Ang & C. Y. Shee *Nanyang Technological University, Singapore* Asia has come a long way in its laborious journey towards an inclusive society – one that allows full participation and equality for people with disability (PWD). The imminent aging population in Asia has injected a new-found urgency among the Asian legislators to get their countries prepared in anticipation of an explosive number of elderly people with geriatric disabilities. From the concluded Asian and Pacific Decade of Disabled Persons (1993-2002) to the Biwako Millennium Framework (2003-2012), the efforts led by the United Nation Economic and Social Commission for Asia and the Pacific have been predominantly focusing on using government policies to build the two pillars of an inclusive society: a barrier-free society and empowerment of the PWD. Notwithstanding that policy is the most powerful tool for solving the issues of the PWD, it cannot do it all by itself. The top-down nature of policy would better serve the cause in overcoming the barriers than in the empowerment of the PWD. In this paper, we advocate empowerment of the PWD through the use of technology. While policy provides the framework to integrate the PWD back into the mainstream society, technology can enhance their capability and give them a chance to compete in the real world. To popularize technology usage among the PWD, it is vital to develop an assistive and rehabilitative technology industry in Asia. Taking a leaf from philosopher Adam Smith's famed theory of the "Invisible Hand"; the authors believe the best way forward for the Asian assistive and rehabilitative technology industry is to grow it into a sustainable and profitable one without intervention and protection from the government. When there is money to be made, more players will enter the industry, thus providing better services and innovative products at more competitive prices and in consequence, the PWD will become the eventual winners.
10:20 – 10:40 PP-1-2	**An Experience on Wheelchair Bank Management** Hongyin LAU*, Eric W.C.TAM** & Jack C.Y. CHENG* * *The Chinese University of Hong Kong* ** *The Hong Kong Polytechnic University* In this paper, we described the wheelchair bank program at a local hospital and our experiences in managing the service over the past 10 years. This paper also reported statistical information related to the acquisitions of wheelchairs and adaptive components, including body support and pressure relief systems. The cost benefit of recycling seating and mobility equipments for use by children with neuromuscular

	diseases was revealed. With the reference of the reported data, the demands on specific types of wheelchairs and adaptive parts were disclosed to facilitate budget planning of similar services.
10:40 – 11:00 PP-1-3	**Implementing Assistive Technology Service Delivery System Internationally - A Complex Issue** Wantanee PHANTACHAT* & Penny PARNES** ** National Electronics and Computer Technology Center, Thailand* *** University of Toronto, Canada* Implementing assistive technology (AT) service delivery system is a complex task that goes well beyond finding and/or developing the appropriate technologies. It requires a concerted effort incorporating policies in nations and sub-sectors of that nation which may involve interaction with Ministries as including: Education, Public Health, Social Welfare, and Labor. It requires development of a delivery system which is compatible with the country and its infrastructure and it requires substantial professional training. It also must incorporate involvement of disabled persons organizations and NGOs. Above all it requires a commitment to the improvement of the lives of people with disabilities as seen from a human rights perspective and a true commitment to partnership. The authors share their experiences in developing and implementing a plan of establishing assistive technology service delivery system in Thailand based on a Canadian – Thai partnership that spanned 5 years. The networking among the AT development origin source to the target users, PWDs, are mentioned. Along the AT path, the policy making, the policy driven, the collaboration and the commitment of the responsible organizations, are also emphasized as the practical practice.
11:00 – 11:20 PP-1-4	**Establishment of Resource Portal of Assistive Technology in Taiwan** Shwn-Jen LEE, Tzyy-Jiuan WANG, Ya-Hsin YANG, Cheng-Kung CHENG & Ping-Chin HUANG *National Yang Ming University, Taiwan* In 2006, The Center of Assistive Technology Resources and Popularization (CATR@P), Taipei, Taiwan expands its original website function to become the Resource Portal of Assistive Technology (REPAT, http://repat.moi.gov.tw) through integrating information from all five Assistive Technology Resource Centers of Ministry of Interior and all the local Assistive Technology Resources Centers. CATR@P is in charge of managing, maintaining and updating the website information. Contents of this new portal are versatile and multifunctional. They contain archives of Taiwan assistive technology centers, international assistive technology centers information, Taiwan assistive technology products, overseas assistive technology products, professionals directory, international assistive technology information and websites linkage, full text of the Assistive Technology Companion Magazine, E-paper, on-line consultation services, frequently asked questions, and on-line questionnaires, and much more.

11:20 – 11:40 PP-1-5	**A Local Experience Sharing: How Assistive Technology can Enhance the Quality of Life for Severely Handicapped Persons** Jenny Ching-man FUNG *The Spastics Association of Hong Kong* With the advance development in technology, more and more handicapped persons can be benefited to improve their quality of life. With different degrees in handicap, these clients will have different needs in 3 concerns of domains, namely, self-care, work & leisure.
11:40 – 12:00 PP-1-6	**Web Accessibility: A Government's Effort to Promote E-accessibility in Thailand** Namnueng MITSAMARN, Waragorn GESTUBTIM & Sirilak JUNNATAS *National Electronics and Computer Technology Center, Thailand* "Web accessibility" was first officially introduced and studied in Ministry of Information Communication Technology in 2003. To support the idea of universal services (one stop for all), the government has been planning to develop an e-Government system that will provide all major services and official information on the internet (web based system). Since the issues to provide accessibilities for person with disabilities (PWDs) become a major concern for modern information society. Accessibility becomes an important feature for all government websites, especially for websites that service to PWDs. The preliminary survey on the government websites in 2003 showed a remarkably low standard of web accessibilities. Only 3 out of 267 government websites passed the test of World Wide Web Consortium (W3C) guidelines on web accessibility. To support the promotion of web accessibility in Thailand, Assistive Technology Center (ASTEC) plays the important roles to provide necessary information and tools of web accessibility development for the government. This paper presents our works from the past to the current state of the project including: a development of the national guideline on web accessibility that is agreeable among web developers, a development of web accessibility evaluation tool, and a preparation of policy planning to promote web accessibility in Thailand.

PP-2
Assistive Technology
NLB 3rd Floor, Function Room 2

10:00 – 10:20 PP-2-1	**Wearable Interface for the Physical Disabled** Y. L. CHI, S. K. ONG, M. L. YUAN, and A. Y. C. NEE *National University of Singapore* A novel wearable interface is developed to help the disabled fully interact with the computer and operate home appliances. It is practical, natural, and less prone to fatigue, and it can serve as a general-purpose interface. Compared with interfaces based on image processing, infrared, and laser techniques, the current interface is

	relatively insensitive to the surrounding conditions and is more flexible and robust. Since it is able to perform accurate and stable inertia motion measurement, it can move with the subject and measure the motion directly. Moreover, it allows the disabled to actively interact with the computer since the patient's body motions can be analyzed and converted into computer commands. A survey is conducted to evaluate the proposed system and the results are encouraging.
10:20 – 10:40 PP-2-2	**Creative Design of Assistive Products for the Elderly** K. T. LAU, I. GIBSON & C. Y. CHOW *National University of Singapore* This paper describes the development of a competition aimed at linking the creative talents of students from Hong Kong schools and universities with the elderly community. Students were asked to design and develop products that may benefit the elderly by assisting them in their everyday tasks. The competition runs from year to year and this paper describes the general processes that take place in its organization and running. The paper also presents some interesting projects that have successfully gone through the competition, showing how the students addressed different problems of the elderly. The paper also highlights some important lessons learnt during the process and how the project may develop in the future.
10:40 – 11:00 PP-2-3	**Assist Disabled to Control Electronic Devices and Access Computer Functions by Voice Commands** X. T. GAO, S. K. ONG, M. L. YUAN & A. Y. C. NEE *National University of Singapore* To assist people with certain physical disabilities, this paper presents an assistive system based on speech recognition. Through the proposed system, the disabled can control electronic devices such as TV, fan, etc., through simple voice commands. The proposed system includes a mouse emulator and a keyboard emulator to assist the handicapped in accessing computer functions, such as browsing the Internet, sending emails, editing a document, etc.
11:00 – 11:20 PP-2-4	**Blink and Click** W. SIRILUCK, S. KAMOLPHIWONG, T. KAMOLPHIWONG & S. SAE-WHONG *Prince of Songkla University, Thailand* In this project, we have developed the computer assisting tool for persons who have hand moving problems. This software tool will help them to use a computer for those who cannot use mouse and keyboard properly. The tool detects human eyes and face actions to control mouse and keyboard as a pointer and input devices. Our project uses inexpensive equipment, e.g. web cam. Face moving can control mouse pointing position in any directions on a computer screen. Eyes blinking can click a mouse: left or right. However, if face moving is too fast, the tool may not detect the right direction. Another problem, un-intention of eye blinking may make a mouse click.

11:20 – 11:40 PP-2-5	**Augmented Reality and Applications for Assistive Technology** Stephen J GAUKRODGER & Andrew LINTOTT *Industrial Research Limited, New Zealand* Augmented Reality (AR) adds information to the environment in order to facilitate human-computer and human-environment interactions. This paper describes AR and potential applications in Assistive Technology (AT).
11:40 – 12:00 PP-2-6	**Graphic User Interface and Front-end Operation on MS Windows** Pongkan KANSONG, Darika MANEECHAI, Pichaya TANDAYYA, Chatchai JANTARAPRIM & Wiraman NIYOMPOL *Prince of Songkla University & Mahidol University, Thailand* This work is the development of a Microsoft Windows Graphic User Interface and front-end operation program. This program integrates translation engines that translate between Braille Mathematical and Scientific texts and texts with the extensible markup languages, e.g. Chemical Markup Language and Mathematical Markup Language. This program has a graphical user interface and works on the Microsoft Windows operating system.

PP-4
Biomechanics
NLB 3rd Floor, Function Room 1

10:00 – 10:20 PP-4-1	**Measuring Uniaxial Joint Angles with a Minimal Accelerometer Configuration** Wei DONG, I-Ming CHEN, K. Y. LIM & Y. K. GOH *Nanyang Technological University, Singapore* This paper describes an approach to accurate measurement of human joint flexion-extension angles with four biaxial accelerometers. In this method, the absolute joint angle is calculated by comparing the readings of a pair of virtual accelerometers at the joint center of rotation. The simulation results show that the measurement has high accuracy compared to the reference system (correlation coefficient factor = 0.982). Given its portability, relative low cost and high accuracy proven by simulation results, the system can be applied to motion tracking for home-based rehabilitation
10:20 – 10:40 PP-4-2	**Destabilizing Effects of Time-Delay in Lambda-Model for Human Postural Control** Li LAN, Kuanyi ZHU *Nanyang Technological University, Singapore* The time-delay existing in the human postural control system will cause destabilizing effects and trajectory errors. The objective of this article is to investigate whether the physiological λ-model with co-contraction can compensate the influence of time-delay, and identify the input variables of the model. In the λ-model, two

	neurophysiological commands from the central nervous system and a characteristic factor maintain the posture, which are the reciprocal command (*R*), the coactivation command (*C*) and the damping factor (μ). It will be shown that if the time-delay in the feedback loop is within a limit, the intrinsic feedback control can provide a stabilized posture control. The acceptable time delay limit, under which the system remains stable, is determined through simulation. We also show that the reciprocal command *R* only predetermines the final equilibrium point, and there is no influence on the time-delay limit; however the coactivation commands *C* and the damping factor μ have the influence on the limit. Therefore, they must be selected properly to ensure the system stability.
10:40 – 11:00 PP-4-3	**Effect of Repetitive Loading on Tissue Oxygenation** Katy WS YUEN, Debbie ZY OU, Alex PK CHAN, Eric WC TAM *Hong Kong Polytechnic University, Hong Kong SAR* Pressure-induced tissue breakdown is a life-threatening complication for patients with diminished pain sensation and impaired mobility. In clinical situation, patients are encouraged to move regularly to avoid persisted tissue compression. However, there is little information concerning how frequent the act of pressure relief should take place. This study aims to examine the effect of repetitive loading on tissue oxygenation. A total of 14 healthy subjects (age ranged from 21 to 29 with BMI<25) were recruited to participate in this project. Tissue compression was performed by applying a pressure of 150mmHg over the greater trochanter and repeated with a cycle time of 10 minutes for 4 consecutive cycles. The changes in blood oxygenation were monitored using tissue reflectance spectrophotometry. The results indicated that there are no statistical significant differences in tissue oxygenation index (OXI) among the four loading cycles. However it was observed that the lowest OXI percentage change was being found in the second loading episode followed by a gradual decrease in the effect of loading on OXI reduction.
11:00 – 11:20 PP-4-4	**Lower Extremity Joint Moments during Symmetric Lifting: Squat vs Stoop** SeonHong HWANG*, YoungHo KIM*, SungJae HWANG**, YoungEun KIM* **Yonsei University, Korea* ***DanKook University, Korea* In this study, we analyzed joint moments during the symmetrical lifting in two different postures, using the three-dimensional motion analysis. Boxes weighing 5, 10 and 15kg were lifted by both squat and stoop techniques. The ankle moment in stoop was always larger than that in squat and the support moment was the largest at the end of the lifting in both techniques. The knee flexion moment played an important role in stoop lifting to support the lower limbs. In the end stage of the lifting, the hip joint showed less contribution on the support moment in both lifting techniques. However, the maximum hip extension moment in stoop lifting was larger than that in squat. In addition, the maximum waist moment in squat was larger than in stoop. Therefore, these results can support previous research done on squat lifting which shows that it is not the best strategy to avoid waist injury. It is expected that these results can provide basic information for the analyzing and proposing of an efficient lifting strategy.

11:20 – 11:40 *PP-4-5*	**Musculoskeletal Model of the Lower Extremity of Trans-tibial Amputee** Lidan FANG, Xiaohong JIA, Rencheng WANG *Tsinghua University, China* To predict and explain the patterns of muscle forces in the stump of a left trans-tibial amputee during walking, and to study the effects of walking speed, Musculoskeletal model is built with the combination of the computer simulation to calculate muscle forces in the trans-tibial stump during walking. Kinematic data and ground-reaction forces are simultaneously recorded by a gait analysis system and a force platform, respectively. The data are input into a three-dimensional model of the lower trans-tibial extremity and the corresponding muscle forces are predicted by a static optimization process. Muscles perform much more actively in stance than in swing phase. Most muscles appear very active around both heel-strike and toe-off. The bigger joint moments increased muscle forces. Muscle forces get weak because the joint moments reduced rapidly and look almost the same in later stance and swing phase. In addition, most flexors keep a little acting according to little joint moments exerted to prevent hyperextension.
11:40 – 12:00 *PP-4-6*	**An Electromyographical Comparison Between Over ground And Treadmill Running: A Pilot Study** Bala S. RAJARATNAM *Nanyang Polytechnic, Singapore* It is an age-old assumption that training on a treadmill is similar to over ground training, with all the added benefits of controlled environmental factors and no apparent physiological differences. Early studies by Arsenault (1986) and Schwab et al. (1983) reported similar in magnitude and timing of lower limb muscle activity. The biomechanics of running have been well documented, with available data comparing the kinetics and kinematics of these two modes of running, but relevant electromyographic (EMG) studies are rare. The present study aimed to find out whether there were any differences in muscle activation pattern between over ground and treadmill running among asymptomatic subjects.
12:00 – 12:20 PP-4-7	**EMG analysis of muscle activation pattern in the hemiparetic shoulder: implication for rehabilitation and assistive devise development** Bala S. RAJARATNAM *Nanyang Polytechnic, Singapore* Following a stroke which presents as a mild hemiparesis, muscle weakness, abnormal muscle tone, and movement synergies are commonly physical features observed. In-coordination and compensatory strategies during arm elevation among patients with upper limb hemiparesis suggested alteration in both temporal and magnitude characteristics associated with muscle dysfunction. However, most studies report alteration in magnitude characteristics of shoulder girdle anchored muscles only. The aim of this study was to quantify onset times of selected shoulder girdle muscles and identify pattern of muscle onset among patients with upper limb hemiparesis as they perform shoulder flexion and abduction during arm elevation

PP-5
Best Student Paper Session
NLB 3rd Floor, Function Room 1

16:00 – 16:20 PP-5-1	**Development of an Active Ankle-Foot Orthosis for Hemiplegic Patients** JungYoon KIM, SungJae HWANG & YoungHo KIM *Yonsei University, Korea* In this study, we developed an active ankle-foot orthosis (AAFO) which could control dorsiflexion/plantarflexion of the ankle joint to prevent foot drop and toe drag during walking. To prevent foot slap after initial contact, the ankle joint needs to be actively controlled to minimize forefoot collision with the ground. During late stance, the ankle joint also needs to be controlled to provide toe clearance and to help push-off. 3D gait analyses were performed on a hemiplegic patient under three different gait conditions: gait without AFO (NAFO), gait with the conventional hinged AFO without controlling ankle joint (HAFO), and gait with the developed AFO (AAFO). Results showed that AAFO could prevent not only foot drop by the proper plantarflexion during loading response but also toe drag by sufficient amount of plantarflexion in pre-swing and reasonable dorsiflexion during swing phase, enhancing all temporal gait parameters. The present results indicated that the developed AAFO might have more clinical benefits to treat foot drop and toe drag in hemiplegic patients, comparing with conventional AFOs.
16:20 – 16:40 PP-5-2	**Experiment on a Novel User Input for Computer Interface Utilizing Tongue Input for Severely Disabled** Andy Prima KENCANA & John HENG *Nanyang Technological University, Singapore* This paper introduces a novel passive tongue control and tracking device, which require no electrical object to be inserted to user's mouth. The device is intended to be used by the severely disabled or quadriplegic person. The device is able perform two main applications, the keyboard and mouse application. The results show that this device allow the severely disabled person to have some control in his environment, such as to turn on and control daily electrical appliances or to control the wheel chair movement. The LabVIEW programming is used for the software of this device. The system is still in the development and working prototype phase to determine the accuracy and viability of such a setup.
16:40 – 17:00 PP-5-3	**Design of a Wearable Walking-Guide System for the Blind** Chang-Gul KIM & Byung-Seop SONG *Daegu University, Korea* A wearable walking-guide system for blind people or visually handicapped is investigated and designed. The acoustic signal interface is employed for notifying the

	obstacle information to the user. For easy understanding, the front direction of user is divided to ten sectors and the system notifies the user to the sector in which the closest obstacle located. As a controller, the system has a microprocessor and a PDA. All of the information about obstacle in front of user is checked by three ultrasound sensor pairs and delivered to the microprocessor which analyzes the information and generates the acoustic signal for alarm. In order to avoid interference occurring by the alarm sound, the bone conduction(BC) headphone is used. It because it is set up behind ear and ear canal remained vacant to hear the environmental sound which the blind people use as one of essential signal for walking. In addition to the alarm signal, the system provides the user with guide voice using the PDA which has the text-to-speech (TTS) program for easy and safe guidance. Generally, almost of people who are blind has inclination to hide their disability, they reluctant to use the assistive device which reveals their disability. Therefore, we designed the wearable type of system and almost of the system are concealed in the clothes. We expect that blind people will use this system without any hesitation. According to the design concept, a prototype of the system was implemented and some experiments were carried out.
17:00 – 17:20 PP-5-4	**A Quantifiable Assessment Device for Stroke Patients** Shengwei CHUA*, Geok Hian LIM* & Dhanjoo N GHISTA** **Nanyang Technological University, Singapore* ***University of New South Wales Asia, Singapore* After a person suffers from a stroke, the most common disability that arises from it is paralysis. In order to assist the patient to return to his/her normal way of life as much as possible, a rehabilitation program is tailored for the patient. However, before any rehabilitation program could be given to the patient, assessment tests has to be carried out. Motor function assessments are basically assessment of human muscle strength. The objective of this project is to design and develop a quantifiable assessment device for stroke patients. For collection of data, the subject was asked to perform a muscle assessment which is a combination of isoinertial and isokinetic muscle assessment. The motion was then captured and analysed using a 2-Dimensional kinematic video analysis. The result of the assessment reveals that the fluidity of the motion is shown clearly. The data of two different set of performances could also be readily differentiated, albeit the progress of the patient may be just a little. This has shown that the assessment designed in this project for a stroke patient through kinematic analysis is able to assess the ability of the patient. However, this assessment has been carried out on one muscle group and no actual stroke patients are involved. The assessment could be conducted on stroke patients to ensure there is a direct correlation between assessment and clinical measures.

Wednesday, 25th April 2007

PP-6
Alternative & Augmentative Communications and Hearing Technology
NLB 3rd Floor, Function Room 1

10:00 – 10:20 PP-6-1	**Incorporated Speech Overlapped Factor (Φ) into Speech Clarity Index (Ψ): Method to Improve Dysarthric Speech Severity Evaluation** Prakasit KAYASITH*, Thanaruk THEERAMUNKONG** & Nuttakorn THUBTHONG*** ** National Electronics and Computer Technology Center, Thailand* *** Thammasak University, Thailand* **** Chulalongkorn University, Thailand* Dysarthria is a name given to a group of speech disorders. Our research focuses on developing an automated system for dysarthric speech assessment. Being different from traditional speech assessments which normally rely on human-perceptual analyses, this paper proposes an indicator called *modified speech clarity index (Ψ†)*. By incorporating a *speech overlapped factor (Ø)* into the previous version of the *speech clarity index (Ψ)*, the Ψ† achieves a better performance as a speech severity index and speech recognition rate predictor for people with dysarthria. A number of experiments are made to compare predicted recognition rates, generated by Ψ†, with the recognition rates from HMM and ANN system. The effectiveness of the indicator is evaluated in terms of (i) *rootmean-square distance*, (ii) *correlation coefficient*, and (iii) *rankorder inconsistency*. The experiments on a control set and an unknown set of eight dysarthric speakers show that Ψ† achieves the outstanding results when compared to the standard assessments
10:20 – 10:40 PP-6-2	**A Study of Low-Cost, Robust Assistive Listening System based on UHF Wireless Technology** Pasin ISRASENA* & Setha PAN-NGUM** ** National Electronics and Computer Technology Center, Thailand* *** Chulalongkorn University, Thailand* In this paper, we describe the development of a low cost wireless UHF broadcasting system prototype. It is designed for a short range application, with up to ten receivers, such as one used in a classroom for hearing impaired students. This system is intended to be a low cost alternative to an existing FM system, with additional capability in security with an encryption function. Additionally a multimode function including one-to-one, one-tomany and broadcast is added. Test results show that the system operating range is approximately ten metres, and the sound quality is close to telephone quality. The broadcasting mode and system range fit the requirements for small classroom use.
10:40 – 11:00 PP-6-3	**Stop Consonant Voicing Classification for Computer Assisted Speech Training of Patients with Cleft Lips and Palates** Budsamas PHOLKUL, Proadpran PUNYABUKKANA & Atiwong SUCHATO *Chulalongkorn University, Thailand*

	Cleft lips and palates (CLP) may cause functional disorders even after adequate surgical treatments, speech disorders being one of them. Automatic algorithms utilizing acoustic-phonetic knowledge are needed in developing computer-based tools for assisting the speech training of CLP patients. This work focuses on acoustic discrimination among voiced, voiceless unaspirated, and voiceless aspirated stop consonants with the same place of articulation and aims at revealing a set of acoustic measurements capable of discriminating a CLP patients' speech. Acoustic measurements based on duration and signal energy are proposed and studied. Analysis of variance and classification experiments demonstrate high potentials in using these acoustic measurements in developing automatic voicing classification algorithms for speech training tools. The overall classification accuracy of 92% is achieved in classifying non-CLP data, in which the best result obtained is 99% for the alveolar case. The proposed measurements can classify data from CLP patients with almost 90% accuracy even when the classifier is trained only on the non-CLP data.
11:00 – 11:20 PP-6-4	**The Effect of Pauses in Dysarthric Speech Recognition Study on Thai Cerebral Palsy Children** Supawat SUANPIRINTR & Nuttakorn THUBTHONG *Chulalongkorn University, Thailand* Dysarthric speech recognition (DSR) is continuously developed to improve the quality of life of people with speech impairment. This study aimed to investigate the effect of pauses in DSR. Speech corpus consists of 40 words including two subsets, (i) 20 bisyllabic words with specific design in order to contain all types of final consonant-initial consonant junction in Thai language and (ii) 20 monosyllabic words, which have some phoneme similar to that of the previous subset. Four cerebral palsy children with dysarthria and two normal children were participated. DSR was trained by using Hidden Markov Models (HMMs) in 3 approaches: phoneme-based (PSR), word-based (WSR), and pause reducing word-based (PRWSR). For the third approach, the pauses in words were automatically detected and reduced. The accuracy for PRWSR was compared with that of WSR by varying the duration of remaining pauses in PRWSR. Speech samples from the normal children were also recognized for comparing the accuracy. The results showed that PSR provided the highest recognition rate. The recognition rates of WSR and PRWSR are not significantly different but PRWSR grants a bit higher recognition rate than WSR. Comparing the remaining pause duration, 100 ms remaining pause duration is better than any other duration.
11:20 – 11:40 PP-6-5	**Dysarthric Speech Characteristics of Thai Stroke Patients Assessed by the Computerized Articulation Test** Sriwimon MANOCHIOPINIG*, Nuttakorn THUBTHONG** & Prakasit KAYASITH*** **Mahidol University, Thailand* *** Chulalongkorn University, Thailand* **** National Electronics and Computer Technology Center, Thailand*

	The dysarthric speech characteristics of 14 Thai stroke patients were assessed by the Computerized Articulation Test [1]. Speech accuracy and error pattern were analyzed. Vowels and tonal characteristics were the most intact characteristics, while reduction of the clusters was the most impaired feature. Both initial and final consonants were frequently substituted, followed by omission and distortion. Generally, low and mid tone, unaspirated consonants and final consonant, monophthong vowels were produced more precisely than the other features.
11:40 – 12:00 PP-6-6	**On An Approach in Implementing DSP Algorithms for Digital Hearing Aids; A Noise Reduction Core Case Study** Wasit LIMPRASERT*, Pasin ISRASENA**, Nitin AFZULPURKAR* & Lertsak LEKAWAT* **Asian Institute of Technology, Thailand* *** National Electronics and Computer Technology Center, Thailand* One of the major problems for hearing aid users is surrounding noise. The objective of the project is to design a noise reduction hardware (integrated circuit) for digital hearing aids. Instead of relying on separate algorithm and hardware (integrated circuit) developments, a design flow that integrates the developments of DSP algorithms and FPGA hardware to increase performance and reduce development time is illustrated. A noise reduction core using integrated adaptive beamformer and feedback control is designed and tested as an example.
12:00 – 12:20 PP-6-7	**Home Environmental Control System for the Disabled** David LIU Dao Xian *Singapore Polytechnic* This paper discusses the home environmental control system based on X-10 devices, self-designed and developed software, and tablet PC. Software is designed and developed under the visual studio.net 2005 platform and using visual basic programming, which can be installed and run in any PC under Operating System of windows 2000 or / and XP. A voice controlled, user-friendly user interface is carefully designed, so that user can use not only standard keyboard and mouse, but also the voice to control home environments including lights, TV, radio, VCD/DVD player, fan, and air conditioner. Furthermore, the self-deigned software applies home automation control idea to internet access and PC application software access with the features of surfing the internet, sending and receiving emails, using other PC software such as Microsoft office. Considering the disabled has difficulty to move around and control their hands and fingers, the system is more valuable and useful to these people and will provide great convenient to them. Testing has been demoed that the accuracy of voice commands can reach as high as over 90% under quiet environments

Thursday, 26th April 2007

PP-3
Mobility Aids
NLB 3rd Floor, Function Room 3

10:00 – 10:20 PP-3-1	**Experiments on Collaborative Learning with a Robotic Wheelchair** Qiang ZENG*, Etienne BURDET**, Brice REBSAMEN* & Chee Leong TEO* **National University of Singapore* ***Imperial College, UK* To generate a path that guides the wheelchair's motion faces several challenges: The path is located in the human environment, which is usually unstructured and dynamic, and thus is difficult or impossible to generate a reliable map and plan paths on it by artificial intelligence. In addition, the path of a wheelchair, whose task is to carry the human user, should be smooth and comfortable, and adapted to the users intentions, which may evolve with time. We propose a collaborative learning strategy corresponding to these requirements, according to which the human operator and the robot, using the provided path design tools, create and gradually improve a guide path, eventually resulting in ergonomic motion guidance. This paper reports experiments performed to investigate this collaborative learning strategy. To evaluate the path design tools, we analyzed features of the optimal paths and user evaluation in representative conditions. This was complemented by a questionnaire filled out by the subjects after the experiments. The results demonstrate the effectiveness of the collaborative learning strategy, and show the utility and complementarity of the path design tools.
10:20 – 10:40 PP-3-2	**Development of Intelligent Wheelchairs for Persons with Severe Disabilities - What I Can Do is Beautiful** Takenobu INOUE*, Katsuhiko SAKAUE** & Motoi SUWA* **National Rehabilitation Center for Persons with Disability, Japan* ***National Institute of Advanced Industrial Science & Technology, Japan* In this paper, we describe development of electric powered wheelchairs for persons with severe disability who can not drive currently commercialized wheelchairs. One of the important approaches of this development is closing the gap between persons with severe disability and advanced technologies; such as voice recognition, image recognition, EMG detection, stereovision technologies. Each advanced technologies was involved into human interface and security system of the electric powered wheelchairs. All of them were evaluated with actual users in real world of the use. In order to make success on development of orphan products, it was revealed that user participation is important
10:40 – 11:00 PP-3-3	**Microcontroller Based Voice-Activated Powered Wheelchair Control** J.Z. YI, Y.K. TAN, Z.R. ANG, S.K. PANDA *National University of Singapore* Most of the conventional electric powered wheelchairs are using joystick as a used

	input mode of control to maneuver the powered wheelchairs. The drawback of joystick control is that it is not suitable for physical disabled person who cannot control their movements especially the hands. The proposed voice-activated powered wheelchair supplementary with joystick control allows physically disabled person to maneuver the wheelchair easily without the need to use hands. The propelling of the powered wheelchair depends on the motor control and drive system which consists of Infineon microcontroller XC886 and Infineon DC chopper power module BTS7970B. Once the voice recognition system recognizes the voice commands in comparison to the pre-stored memory, the respective coded digital signals would be sent to the microcontroller which then controls the wheelchair accordingly. The prototype powered wheelchair is tested with a pay load of about 120kg. The motor drive circuit can deliver the current up to 37.5A at 12V. In this paper, the joystick control algorithm, closed-loop current control and voice recognition system would be discussed. With the implementation of closed-loop current control, the effect of jerk is reduced.
11:00 – 11:20 PP-3-4	**An Elastic Path Controller for a Collaborative Wheelchair Assistant** Longjiang ZHOU*, Chee Leong TEO* & Etienne BURDET** **National University of Singapore* ***Imperial College, UK* In this paper, we propose a new type of Elastic Path Controller (EPC), which is used to control and manipulate the Collaborative Wheelchair Assistant (CWA). The EPC is built on the basis of Brent's path planner and the control force is generated by balance between the internal restoring force and external normal force. Simulation results show that the new EPC can not only follow an arbitrary curve as a guideway but also deviate from the guideway with a normal force to avoid obstacles. This EPC can also work in the singularity area, which was not solved ever before.
11:20 – 11:40 PP-3-5	**Development of Head Gesture Interface for Electric Wheelchair** Ikushi YODA*, Katsuhiko SAKAUE* & Takenobu INOUE** **National Institute of Advanced Industrial Science & Technology, Japan* ***National Rehabilitation Center for Persons with Disability, Japan* For persons with severe disabilities who find it difficult to use the joystick of an electric wheelchair, we have developed an interface that enables an electric wheelchair to be operated by gestures such as head movements. By using a camera for visual sensing, we plan to implement a non-contact non-constraining interface, thereby making the interface much more convenient to use. We are keeping this study user-oriented by conducting clinical tests with the help of actual users to determine where the camera should be situated, how it should be used, and so on.
11:40 – 12:00 PP-3-6	**Study on the Development of Pedal Locomotory Air Mat for Assistive Mobility Equipment** Hirohisa MORIKAWA, Shunichi KOBAYASHI, Kenro SAKAI *Shinshu University, Japan* In order to develop an indoor assistive mobility equipment, we paid attention to the

	mechanism of locomotion in a snail. It is known that the snail moves by propagation of a pedal wave generating on a pedal surface of the snail and a pedal locomotion has flexibility for ground condition. An air matt with a function of a pedal-like locomotion mechanism has been developed. In this paper, the performance and the applicability of the pedal locomotory air matt as the mobility equipment was discussed.
12:00 – 12:20 PP-3-7	**Effects of Alignment on Interface Pressure for Transtibial Amputee during Walking** Xiaohong JIA, Shuangfu SUO & Rencheng WANG *Tsinghua University, China* Studies examining interface pressure between residual limb and prosthetic socket have been restricted to unsupported stance and natural gait. However, the mechanical behavior at interface for unilateral transtibial amputees during walking when the prosthesis is misaligned is unclear. One male subject with transtibial amputation volunteers for the study. Interface pressures over five sites are measured under three sagittal alignment settings. MP (mean peak interface pressure), TP_{90+} (time in which pressure exceeded 90% of peak pressure) and TPI_{90+} (time–pressure integral at the period of sustained sub-maximal load) are discussed for each alignment setting. compared with optimal alignment, the trend of interface pressure, the mean peak pressure do not change much, but the duration of sub-maximal pressure remarkably, except that at the patellar tendon, and finally the TPI_{90+} changes considerably with different alignment settings. The results offer the clinician and paramedical staff further insight in residual limb/socket interface mechanics in the transtibial amputation patients and provide potentially useful information for socket design and prosthesis fitting.

PP-7
Technology for the Visually Impaired
NLB 3rd Floor, Function Room 1

10:00 – 10:20 PP-7-1	**Touching Force Response of the Piezoelectric Braille Cell** Pruittikorn SMITHMAITRIE, Jinda KANJANTOE & Pichaya TANDAYYA *Prince of Songkla University, Thailand* Piezoelectric Braille display unit is a device that displays refreshable Braille characters for visually impaired people to read by touching. A Braille character consists of six or eight dots in a rectangular array 3×2 or 4×2. The height of the dot is controlled by a piezoelectric bimorph underneath. Electrical signals stimulate the piezoelectric bimorphs to bend up or down, consequently causing the dots to rise or fall, creating the Braille characters. In this work, design and analysis of the piezoelectric Braille cell are discussed. A field study of touching force of visually impaired people sensing the Braille characters is reported as information for material selection and design of the piezoelectric actuator in the Braille cell. The time response of the Braille cell is presented. Then, relationship between the dot height

	and applied voltage of the designed piezoelectric Braille cell is investigated, followed by the response of the Braille dots to the touching force. This work can serve as a useful guideline for design of piezoelectric Braille systems.
10:20 – 10:40 PP-7-2	**Linux User Interface and Front-end Operation for the Visually Impaired** Thanathip LIMNA, Chomphunut SAE-TANG, Chatchai JANTARAPRIM, Pichaya TANDAYYA & Wiraman NIYOMPOL *Prince of Songkla University, Thailand* *Mahidol University, Thailand* This paper presents a work that supports the visually impaired to be able to use the PSU Braille computer more easily. As the PSU Braille computer uses Linux as an operating system which can be unfamiliar to many users, this work focuses on the text-based user interface and front-end operation especially designed for the visually impaired and to support Braille devices including Braille printers, keyboards and displays. Along with the hardware development of the PSU Braille computer, the group has also developed translation software with Thai and English processing capability. The work in this paper also includes the integration of all translation programs, i.e. English, Thai, Math, Chemistry to Braille and vice versa, using the Extensive Markup Language (XML) and Braille Computer Code. In addition, the XML technology has also been applied extensively for classifying and collecting documents in the system.
10:40 – 11:00 PP-7-3	**Designing Auditory Kanji-Character Explanation for the Blind** Teruyoshi FUJINUMA*, Kazuo KAMATA** & Tetsuya WATANABE*** **Integral System Technology Advanced Laboratory, Japan* ***Utsunomiya University, Japan* ****National Institute of Special Education, Japan* In this paper, we describe the design issues for an auditory Kanji explanation system for blind and visually impaired people. The system helps them with understanding, and selecting an appropriate Kanji when they read, and write Japanese text with the use of a computer.
11:00 – 11:20 PP-7-4	**MusicXML to Braille Music Translation** Aphisada INTHASARA, Ladawan MIPANSAEN, Pichaya TANDAYYA, Chatchai JANTARAPRIM & Patimakorn JANTARAPRIM *Prince of Songkla University, Thailand* This paper presents the development of the Braille Music and MusicML Translation. The input can be from a keyboard instrument, a Braille music file or a MusicML file. It will also play music from the input file. The program runs on Microsoft Windows and provides a graphic user interface which works with the screen reader JAWS. This work will help the visually impaired and the sighted people in learning and teaching music.

11:20 – 11:40 PP-7-5	**Internet Explorer Smart Toolbar for the Blind** Jirasak CHIRATHIVAT, Jakkrapong NAKDEJ, Proadpran PUNYABUKKANA & Atiwong SUCHATO *Chulalongkorn University, Thailand* Accessing information on the internet is a very common task nowadays. However, the ability to do such a task is rather limited for the disabled, especially the visually-impaired. In order to serve this special group of users, a specially-designed web browsing application is needed. Having examined the need of the visually-impaired users from a major Thai school for the blinds in Bangkok, we propose a web browsing scheme in the form of a toolbar-styled plug-in for Microsoft Internet Explorer. This plugin enables the program to interact with users via Thai language speech interface utilizing Text-To-Speech and voice recognition technologies previously deployed in its predecessor which is, in contrary, a stand-alone web browser. One of the features of this toolbar is its support for arranging webpage contents into a hierarchical structure that better represents the relationship among contents on the page based on its visual layout using simple userdefinable XML templates. Additional features include website suggestion and web feed reader. This paper also presents some brief users' experience and discusses directions of improving this toolbar.
11:40 – 12:00 PP-7-6	**Real-time Online Multimedia Content Processing: Mobile Video Optical Character Recognition and Speech Synthesizer for the Visual Impaired** Shi-Yong NEO*, Hai-Kiat GOH*, Wendy Yen-Ni NG**, Jun-Da ONG*** & Wilson PANG*** * *National University of Singapore* ** *Ministry of Education, Singapore* *** *Kai Square Pte Ltd, Singapore* One of the common difficulties faced by the visually impaired is the inability to read and thus affecting their way of life. Existing portable reading devices (using character recognition and speech synthesis) have many limitations and poor in accuracy due to restrictive processing power. In this paper, we introduce our robust online multimedia content processing framework to alleviate the limitations of such portable devices. We leverage high transfer speed using existing wireless networks to send multimedia information captured from mobile devices to high-end processing servers and subsequently stream the desired output back to users. The resultant framework enables more complex processes as they are carried out on the servers and thus outperforms standard portable devices in terms of accuracy and functionalities. In addition, we describe a new approach to improve optical character recognition (OCR) results by using consecutive video frames for automatic character correction. Experiments using consecutive frames show an improvement in 25% accuracy over traditional OCR using a single image. The application is also trialed by several visually impaired personnel and the feedback obtained is encouraging.

PP-8
Rehabilitation Technology & Biomedical Applications
NLB 5th Floor, Possibility Room

10:00 – 10:20 PP-8-1	**Design and Development of a Novel Balancer with variable Difficulty for Training and Evaluation** U. X. TAN*, H. G. TAN*, T. MYO*, D. G. ZHANG*, W. T. ANG*,S. CHEAM** & K. L. KOH** ** Nanyang Technological University, Singapore* *** Singapore General Hospital* This paper proposes a novel, portable and cost-effective balance trainer with all necessary important features to improve the reach of rehabilitation to the masses. There are three factors that contribute to a person's ability to maintain standing balance–*proprioceptive feedback* (from the joints), *vision*, and the *vestibular system*. These systems can be affected by injury, infection, or brain damage caused by stroke. One example of such injuries is ankle injury. A large focus of the physiotherapy and sports medicine community is using postural-control tasks to prevent, assess and rehabilitate patients. Unfortunately, there are presently two extreme ends of balance training devices. On one end there are the high-end equipments which only large hospitals are capable of buying. On the other end are the simple balance boards which offer very limited features. Thus, the authors proposed a novel, portable and cost-effective balance trainer with most of the necessary important features to improve the reach of rehabilitation to the masses. The device has a small footprint, incorporating only the most important and frequently used functions. These functions include being able to provide different levels of difficulty, setting different difficulty in different directions, storing of patients' performance, real-time visual feedback to aid the patients and different types of modes for different purposes. Springs are used to vary the moments, which will actually vary the difficulty levels. This is due to the fact that balancing is actually about keeping the equilibrium moments to be zero.
10:20 – 10:40 PP-8-2	**Design and Implementation of a Mechatronic Device for Wrist Elbow Rehabilitation** M. AKSHAY**, T.L. WIN*, H.G. TAN*, U.X. TAN* & W.T. ANG* *** National Institute of Technology Jalandhar, India* ** Nanyang Technological University, Singapore* This paper presents a compact, portable and modular mechatronic device, which can be used for wrist and elbow rehabilitation in a user-friendly manner. Portability, modularity, compactness & degree of freedom are the main concerns of the device. Applied postoperatively, this device may be used on an inpatient or an outpatient basis. The designed device can be used for different exercises of wrist and elbow just by simply plugging in or out some of the links or by adjusting the position of some of the links. In addition, instead of going with the usual approach of using different actuators for different degrees of freedom, a single actuator is used in this project. By adjusting the links position, the patient can perform different exercises. The therapist or the patient will then select appropriate settings to run different exercises.

10:40 – 11:00 PP-8-3	**Surface EMG Topography: a New Assessment Tool in Low Back Pain Rehabilitation** Joseph NF MAK, Hu YONG & Keith DK LUK *University of Hong Kong* Among different pathologic conditions that give rise to Low Back Pain (LBP), abnormal back muscle contraction strategy was suspected to be a major contributory factor. However, studies in this area are few. The purposes of this study were to establish a reliable and objective assessment method which provide information on back muscles coordination during dynamic motion, and to testify the possible application of this method in LBP rehabilitation assessment. Back muscle surface electromyography (SEMG) was measured by an array of SEMG electrodes (7x3) during forward bending. The root mean square (RMS) of the SEMG signal was calculated as a function of both position and time to produce the SEMG topography. The SEMG topography of 30 healthy subjects served as the normal database and produced a reproducible activation pattern. SEMG topography of the 5 LBP patients presented varied activation pattern and were different from that of normal pattern. Corrective changes of contraction strategies revealed in SEMG topography patterns were found in some of the LBP patients after rehabilitation. In this study, the effectiveness of LBP rehabilitation was uncovered by SEMG topography, with a visible monitoring of rehabilitation progress. With this method, a practical and objective assessment for LBP rehabilitation is achievable.
11:00 – 11:20 PP-8-4	**Functional Electrical Stimulation in Rehabilitation Engineering: A Survey** Dingguo ZHANG, Tan Hock GUAN, Ferdinan WIDJAJA, and Wei Tech ANG *Nanyang Technological University, Singapore* Functional electrical stimulation (FES) is used widely in rehabilitation to restore motor functions for paralyzed patients. This paper makes a comprehensive review on current situation of FES. The content includes stimulation interface, applications, FES control, challenges and prospect of FES. Especially, combination FES with electromyography (EMG) and brain computer interface (BCI) is surveyed.
11:20 – 11:40 PP-8-5	**Design and Implementation of Blood Pressure Regulation Systems** L. LAN & K. Y. ZHU *Nanyang Technological University, Singapore* It is a known fact that postoperative hypertension is common in cardiac patients and untreated hypertension may result in severe complications. The aim of an automatic drug delivery system is to quickly reduce the oscillatory change in mean blood pressure through infusion of Sodium Nitroprusside (SNP). In this paper, design and implementation of such control systems using adaptive PI, and Fuzzy controllers will be presented. Simulation will also be carried out for demonstration.

11:40 – 12:00 PP-8-6	**Modeling of Non-invasive Xylocaine Delivery System for Dentistry** S. RAVICHANDRAN, Bong Xiu FENG, *Teo* Missie, LIM Celia & CHUA Pek Hup Heidi *Temasek Polytechnic, Singapore* Non-invasive method of delivering selected drugs to the target site for certain dental procedures is an emerging area in biomedical engineering and this paper summarizes the authors' research work in designing a portable drug pump for certain dental procedures. The system has been designed taking into consideration the target sites which are situated in the buccal cavity. The system has a disposable pump head, housed in the tip of the applicator containing a drug transport system for transporting the required drug to the applicator head. The discrete drug head contains embedded electrodes which are energized using an inbuilt stimulator of the applicator. This system has the advantage of transporting selected drugs in required doses to the drug holding cell and has the capacity to transport certain hydrophilic and hydrophobic drugs to the target site. The system has been designed mainly to provide local analgesic dose to the target site as a prelude for many dental procedures.
12:00 – 12:20 PP-8-7	**Monitoring Human Joint Range of Movement with a Novel Pre/rehabilitation Aid** Kannappan IYNKARAN, G.H. TAN & Y.S. TEO *Nanyang Polytechnic, Singapore* The purpose of the pre/rehabilitation aid was to accurately monitor and record the range of human joint movement electronically. Quantification of range of human movement is important to develop favourable prehabilitation and rehabilitation programmes. The unique device consists of a specially designed mobile sensor that monitored limb orientations in three dimensions. The device can be arranged in various configurations and to monitor back posture in health care workers , or monitor joint movements among stroke victims

PP-9
Seating, Pressure Sore & Pain Therapy
NLB 3rd Floor, Function Room 1

16:00 – 16:20 PP-9-1	**A Review of Positioning Systems used in Group Homes and in the Community** Yvonne de VRIES *Megalong Positioning Services, Australia* This paper examines the long-term impact of custom made inserts, sidelying and sleeping/positioning systems. MPS and its predecessor Greystanes Children's Home have been providing individually moulded positioning systems to their clients for over 10 years. At MPS we make three different types of positioning systems. Fully moulded, partially moulded and systems that are adjustable. A questionnaire has been sent to the users to analyse both short-term impacts and long-term benefits. Some 60 questionnaires have been sent out to the clients. A smaller number of these clients will be re-assessed to investigate changes in the range of motion and a possible effect on reflux in the more severely disabled clients.
16:20 – 16:40 PP-9-2	**Evidence-based Practice in the Jockey Club Rehabilitation Seating Service Centre** Walter POON Chung-wa, Loretta LIU Kit-ling & Jenny CHAN Suk-wai *The Spastic Association of Hong Kong* The current trend of assistive technology is to achieve optimum outcomes for its end-users. Emphasis has been directed to the establishment of an evidence-based practice in assistive technology. A pilot trial of evidence-based practice was conducted in the Jockey Club Rehabilitation Seating Service Centre in The Spastics Association of Hong Kong. It was founded on the objective outcome measures conducted by specialists together with the level of satisfaction as presented by its end-users. The 'Seated Postural Control Measure' (SPCM) and 'Quebec User Evaluation of Satisfaction with Assistive Technology' (QUEST) were employed as tools in this trial.
16:40 – 17:00 PP-9-3	**A Semi Autonomous Control and Monitoring System for Bed Sores Prevention** JAICHANDAR K.S, Mohan Rajesh ELARA, Sampath KUMAR & Adrian CHUA *Singapore Polytechnic* Bed sores, a common problem among immobile patients occur as skin to bed surface temperature increases in patient lying on same posture for prolonged period. If left untreated, the skin can break open and become infected. This paper introduces a semi autonomous system based on control and monitoring of patient's skin to bed surface temperature for bed sores prevention. The developed system consists of bed surface implanted temperature sensors interfaced with a microcontroller for sensing the temperature change in patient's skin to bed surface. Based on the amplified signal from temperature sensors, the microcontroller makes appropriate decision on the mode (heater / cooler) and speed of the fan module for blowing warm / cool air to the bed surface. Furthermore, an alarm module was implemented to alert the nurse to reposition the patient only if patient's skin to bed surface temperature exceeds a

	predefined threshold thereby saving human resources. Evaluation tests were completed and adequate results were obtained.
17:00 – 17:20 PP-9-4	**Experimental Investigation and Computer Simulation of Wheelchair Cushions** SEAH Kangyu Clara*, TAN En Si Ruth*, Ian GIBSON** & Gao ZHAN** **Raffles Junior College, Singapore* *** National University of Singapore* This project aims to investigate the properties of 4 types of commonly used wheelchair cushions – the Honeycomb (polymer), Roho (air), Jay (gel) and high density foam – with regards to their capability in pressure distribution and postural support from the biomechanical point of view. These are possibly the 2 most important characteristics of wheelchair cushions for wheelchair users. Presence of a cushion cover and type of support structure the cushion is placed on are the variables that will be investigated. Displacement of the cushion surface over a series of loads comparable to human masses was measured. Displacement of the cushion surface was measured using a 3-D digitizer (Minolta Vivid 900) and computer software Rapidform 2001. Simulation of cushion properties was then carried out using software CosmosWorks 2005. Results indicate that the foam cushion exhibits the best pressure distribution characteristic, while cushion covers tend to decrease deformation and increase pressure on bone protrusions. Simulations also indicated that a symmetrical cushion appeals not to be ideal for users with asymmetrical weight distribution.

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