Assistive Technology- For Personnel Wellness and Quality Living of Ageing Population

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- What is the most amazing result civilization has achieved, possibly the greatest achievement in the last century relating to human beings?
  - “Life Expectancy”
- It used to be 47 years in industrialized countries in the early 1900s and now in 2000s it is around 80 years – with women in an advantageous position.
Increased Life Expectancy - Active Ageing

• Increase in the life expectancy is represented by the conditions in which aging takes place which were inconceivable for the past generations such as level of education, the health status and economic resources.

• Population is quantitatively ageing and at the same time qualitatively getting younger – today’s senior citizens are far more educated and are aware of their potentials and personal aspirations and less resigned to decline in solitude and willing to actively contribute and play a significant role in society.
Aged but still active and contributing significantly to the growth of Singapore

President S R Nathan
3rd July 1924 – 84 yrs Old

Minister Mentor Lee Kuan Yew
16th September 1923 – 85 yrs Old
No. of residents with age more than 65 years will increase by 3 fold

Source: Singapore Department of Statistics (DOS), 2005
Active Aging

• The demographic reality of the over 65s who make almost 20% pose a significant challenges to the health and social care givers.

• Thus, issues related to ageing of the population are becoming more and more necessary to be addressed from different points of view i.e. political, social, clinical and technological.

• Technology can provide important solutions to these issues.
Intel’s Proactive Healthcare

1. Promoting Healthy Lifestyle
   • Provide support system that can help people to change behavior so that health related problems can be avoided at first place

2. Improved diagnostic and monitoring techniques for degenerative illness
   • Through sensors study disease process

3. Improved treatment compliance
   • How to ensure treatment compliance?

4. Support for care giving
   • Technology must leverage on existing support care of family members and build upon that
Why is it Necessary?

• Old Age ➔ Helplessness & Dependence
• Accessibility for Seniors
• Caring for Seniors
• Ageing means more than just staying at home
• Healthy ageing is linked to social participation
• Reduce overall costs of healthcare
3 M of ACTIVE AGEING

MOTIVATE

To be motivated allows you to face some difficulty without fear.

MANAGE
How can Technology help in Active Ageing?

- **MONITOR**
  - HEALTHCARE
    - Health Monitoring
    - Healthcare Delivery System
  - ASSISTIVE DEVICES
    - Motorized Wheelchairs
    - Weight Balancing Equipment
  - REHABILITATION
    - Stay at home Rehabilitation
How can Technology help in Active Ageing?

- MOTIVATE
  - ASSESSMENT AND REHABILITATION
    - Cognitive Functions
    - Learning Disabilities
  - TRAINING AND EDUCATION
    - Virtual Environment for individuals with Autistic Spectrum Disorders (ASD)
    - Ensure that they upgrade their skills as well as support the transition to retirement
How can Technology help in Active Ageing?

- **MANAGE**
  - COMMUNICATIONS
    - Wireless Sensor Networks
    - Internet
  - MOBILITY
    - Intelligent Interfaces and Gadgets
    - Assistive Public Transport Systems
  - COMMUNITY LIFE
    - Integrate Regional and Local Community Life
Health at Home

• Home is the primary platform for much of life’s activities influencing our health, wellness, independence and safety as we age.

• Integrated intelligent home health services should be developed to address the need of elderly.
Smart Living Environment

Source: IEEE, EMBS
In-home Tele-rehabilitation

• To minimize cost of health care, services from hospital centric-care to community centric care to home-care have increased.
• In-home tele-rehabilitation has been identified as promising avenue.
• Wireless body area sensor networks have been developed to increase telepresence.
Tele-Physiotherapy

Source: IEEE, EMBS
Wireless Body Area Network
E – Healthcare

Hospital
- MobiCare
- MiBank
- GHMPP
- MedRIA
- BCI

Home
- MobiCare
- AEMCVD
- BCI-REHAB
- GHMPP

Knowledgebase
- MobiCare
- MiBank
- MedRIA
- MDPD

E - Health

I2R
Mobile Healthcare

Mobile Healthcare Framework

1) Send raw ECG signals and motion data via Bluetooth

2) Detect abnormalities in the raw ECG data and inform relevant authorities

3) Hospitals determines the severity of the data and takes appropriate actions
BCI-based Robotic Rehabilitation for Stroke Patients

Source: I2R Singapore
Stroke Patients Rehabilitation using MIT’s MANUS – Robotics System
Smart Living Environment

- BRAIN COMPUTER INTERFACE (BCI)

Source: Biomedical Functional Imaging and Neuroengineering Laboratory, University of Minnesota
Smart Living Environment

- Fall detection
- Fall prevention
- Early warning

Source: I2R Singapore
Muscle Assistive Technology

• MUSCLE REHABILITATION/ MYOELECTRIC GLOVE
  ▪ An exoskeleton for the hand, used for rehabilitation of the patient
  ▪ Assist the patients in their day to day activities
  ▪ The glove’s motion, controlled by myoelectric signals, is initiated by the brain

• ARTIFICIAL MUSCLE
  ▪ Electro-Active Polymers for artificial muscle fibers
  ▪ Artificial Gloves to assist in hand movement
Source: Cybergrasp Exoskeletal device
Electric Powered Wheelchairs

• PERSONAL NAVIGATION SYSTEM
  ▪ JOYSTICK
  ▪ VOICE COMMANDS
  ▪ WIRELESS LOCATION DETERMINING SYSTEM
    ➢ Wi-Fi
    ➢ A-GPS
    ➢ Bluetooth
    ➢ Radio Frequency Sensor Network
Brain Controlled Wheelchair
Electric Powered Wheelchairs

• MOTORIZED FOOT RESTS
  ▪ Adjustable foot rest for wheelchair users
  ▪ Use of footrest for physiotherapy exercises
    ➢ Provide different pressure levels at the foot sole
    ➢ Up-down movement at the ankle
    ➢ Simulate walking by front-back movement
Weight Balancing and Control

- GAIT TRAINING
- POSTURE CORRECTION
Intelligent Medication Serving System

• **Who may require it?**
  - Elderly
  - Patients with dementia

• **Why is it required?**
  - Patient may forget to take medicine
  - Patient may forget the prescription
  - Patient may not respond to the reminder

• **Functions**
  - Resolve problem of proximity between patient and device
  - Making intelligent decision when the patient does not respond to the reminder
Conclusions

- Assistive technology can play a crucial role in providing some of the solutions if not all to personnel wellness and quality living for ageing population.