

TOWARDS A SMART NATION – SOLUTIONS FOR AN AGEING POPULATION

Smart designs for an ageing population

Demand for aged care is forecast to increase and smart designs are required to respond to the greying society

By Belinda Yuen and Chathura Withanage

The world's population is ageing fast. According to the United Nations, global population aged 60 and above is growing at a faster rate than the total population. Its number has quadrupled from 205 million in 1950 to 841 million in 2013. Further growth is projected.

The future world may see more than two billion older people in 2050. By 2047, for the first time in human history, older people are projected to outnumber children (age 0-14 years). The demographic shift is expected to have a big impact on many facets of human life like homes, community, services and infrastructure. The demand for aged care, social, health and technology services is forecast to increase. Smart designs are urgently required to respond to the greying society.

Singapore

A similar trend can be observed here. Singapore's life expectancy is one of the highest in the world. Its older population (age 60+) is projected to grow from 814,000 (15 per cent of population) in 2012 to 2,308,000 (38 per cent) by 2050 – faster than Japan. At this rate of growth, Singapore is anticipated to become the world's 4th 'oldest' country in the next three to four decades. Hence, it is no surprise that ageing is identified as a top priority of Singapore's Smart Nation vision.

Each successive cohort of older adults is expected to be increasingly healthier and more educated.

According to the 1995 National Survey of Senior Citizens in Singapore, 93 per cent of older population are independent and able to perform the basic activities of daily living (eg cleaning, washing, dressing, feeding, bathing, toileting). Data from the State of the Elderly in Singapore 2008/2009 Report indicates that the majority (70 per cent) of Singapore's older population is living in the community: in inter-generational households (eg with spouse and children or with children). However, an increasing proportion is living alone or with spouse only.

There is a strong preference to age in place. Older Singaporeans generally want to remain living independently in their homes well into old age. An expanding range of housing designs (eg studio

apartments, 3Gen flats, 2-room Flexi flats) and improvements (eg lift upgrading, home improvement, neighbourhood renewal, universal design) are being implemented to support this. The articulation of ageing in place parallels international development trends (eg Australia, UK, USA) where there have been a gradual transition from institutional care to community care in support of healthy longevity.

In today's technologically driven society, state-of-the-art technologies exist or are under development to enhance safety, security and surveillance. Smart home technologies are often suggested as a viable solution to encourage and enable older people to live longer in their own homes. Smart homes (homes with technologically advanced systems to provide electronically controlled security, conveniences and domestic task automation) can tackle daily domestic tasks, improve communication and enable health and well-being enhancement, among others. Such tasks would otherwise have been difficult or impossible to carry out without the convenience of technology.

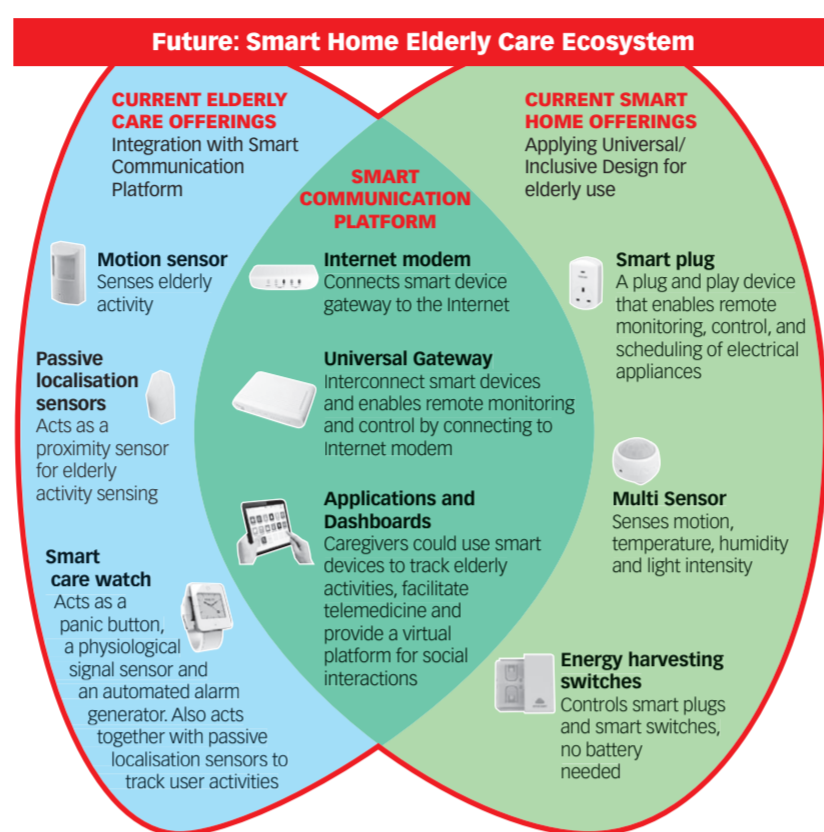
Smart solutions

A growing range of personal and smart home devices has been created to promote independent living in old age and improve the quality of life. For example, the Smart Elderly Monitoring and Alert System (SEMAS) from Singapore, has the capability of alerting caregivers of an elderly's abnormal behaviour through text messages and alarms via motion sensor feeds. A wearable panic button is also given to the elderly to use in emergencies. The system was tested in 12 HDB rental flats and received positive feedback including its user privacy.

In another project, a home based tele-rehabilitation service is under clinical trial to aid the recovery of post-stroke patients undergoing rehabilitation treatments. In this NUS-led initiative, patients connect with therapists through a virtual platform run on a tablet while videos and motion sensors guide and measure their rehabilitation exercises.

Global examples

Smart wearables with sensors to monitor physiological signals together with video conferencing means are used in Japan for tele-medicine practices such as tele-nursing and homecare. In Finland,



the Vivago Care watch is essentially an assistive wearable for the elderly. With over 50,000 users, this watch functions as a panic button. It has a physiological signal detector that automates the alarm when a user is unable to press the panic button. User generated or automatic alarms are sent to caregivers.

Originating from the United States, Lively presents an extended version of the above smart solution with some additional features. It consists of a gateway, a smart phone application, a safety watch, passive activity sensors (proximity sensors) and round-the-clock service by human operators. It is developed as a total solutions package where the elderly could be left to live independently but their pill taking, exercising, eating and other important behaviours could be monitored remotely.

The past two decades have seen more and more smart home technologies for older people being made available worldwide. They range from the Assisted Interactive Dwelling House in UK (1996) to Health Integrated Smart Home Information System in France (2002), Aware

Home (1999) and Gator Tech Smart House (2004) in USA and ROBOCARE Domestic Environment in Italy (2007).

Smart Grid for future elderly care

Arguably, Singapore is well positioned to take advantage of advanced technology. The nation has begun to test smart grid technology (eg intelligent energy system pilot, electric vehicle test bed, Pulau Ubin micro-grid test bed) and elderly support systems and services could easily fit into the smart grid ecosystem. The elderly support systems could be viewed as an extension or a customised version of a smart home controller system using smart grid enabled technologies and services to cater to elderly needs.

Smart home control systems are the basic building block of a smart grid. A basic smart home control system consists of a gateway and other smart devices such as smart meters, smart plugs, smart appliances, light controls and motion sensors. The gateway enables communication between devices, remote monitoring and control through the Internet.

Wearables and other devices could be

added to this system to make it more advanced with elderly care functions such as dynamic localisation and physiological signal monitoring. That is, with a few additional devices, smart home control systems could be modified to support the elderly and they could run on the existing smart grid communication infrastructure.

This scenario presents a win-win situation for the elderly, caregivers and service providers. The elderly and their caregivers will be able to control, monitor and schedule domestic activities and enjoy eldercare services. Service providers can take advantage of the communication infrastructure and focus their energy on customising the home sensor and device network to implement services that cater to the needs of the elderly.

Challenges and potential solutions

The journey towards a smart grid based elderly care system is, however, not a smooth ride. Despite its potential to generate benefits for older people, caregivers and service providers, this technologically assisted lifestyle innovation comes with risks and challenges.

For a start, the older population is not homogenous and there is no one single type of smart home for the elderly. The implementation of embedded household technologies for senior-friendly housing and living must, of necessity, vary according to user conditions, lifestyles and needs. This has implications for sustainable business models and comprehensive implementation.

Related to all this are the critical issues of accessibility and privacy/dignity. This includes financial accessibility and affordability, technical accessibility and user friendliness, psychological accessibility, trust and acceptance. Older people who are not born in the age of information technology may have less comfort and familiarity with the advanced technologies of smart homes. They may not fully understand what the technologies they use can and cannot do.

A solution to this is to involve older people (end users) in all stages of smart home development (its design, implementation and testing). Further research is needed on the technical and psychological accessibility to smart home technologies. Future development of smart home technologies must not lose sight of user benefit. More than technical innovations,

they should consider social, cultural and behavioural factors.

An emerging range of people-centric design techniques and tools are available, for example:

- ◆ User behaviour and preferences studies could be used to identify unique characteristics of older people and the different segments among them;
- ◆ User participatory design and user ideation techniques could be used to get an adequate representation of the older population in product development process;
- ◆ Universal or inclusive design methods could offer another potential set of tools to modify the devices and functions of ordinary smart home control systems to cater to the special needs of the elderly.

The Lee Li Ming Programme in Ageing Urbanism at the Lee Kuan Yew Centre for Innovative Cities, Singapore University of Technology and Design (SUTD), has been established to identify and investigate the changing needs and aspirations of an ageing population. It offers a platform for researchers across different domains to work together towards the common goal of finding sustainable innovations to enrich the trend of longevity.

At the SUTD-MIT International Design Centre, multi-disciplinary teams are working on facilitating the elderly population through smart technologies. Some of the projects include inclusive smart grid ecosystem and smart elderly support systems and services, in particular, as an opportunity to make smart grid services popular among the general public while fulfilling heterogeneous needs.

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This is the fifth of a six-part series brought to you by Hitachi, in collaboration with the Lee Kuan Yew Centre for Innovative Cities (LKYCIC), SUTD. The final part of this series will be published on Dec 15, 2015.



(Above) Proton Beam Therapy System installed in MD Anderson Cancer Centre. (Right) The Hitachi Clinical Analyzer: a state-of-the-art laboratory automation system.

Caring for patients all through the system

By Mint Kang

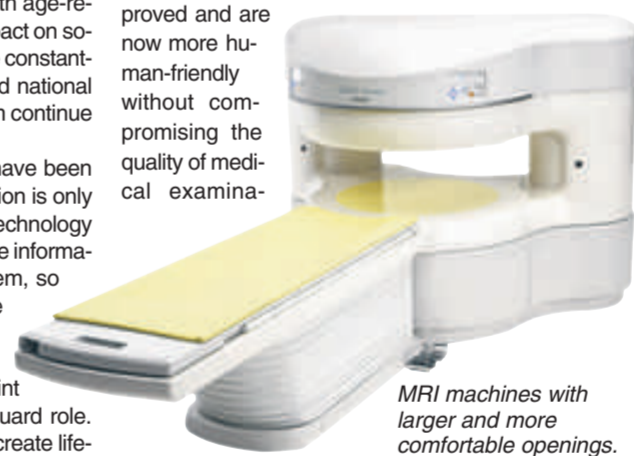
THE societies of the 21st century are wealthy and well cared for, but they face a trade-off for this affluence. People today eat better, have access to more luxuries and live longer – but lifestyle diseases, together with age-related ailments, are abundant as a result. The impact on society is significant. Healthcare expenditures are constantly rising at the individual, family, business, and national level, while demands on the healthcare system continue to increase.

Fortunately, today's healthcare solutions have been able to keep up with society's needs. Information is only the first step: enterprise data management technology can be applied to aggregate, share and analyse information across every part of the healthcare system, so that regardless of where a patient is on the care cycle, his or her records and treatment can be more effectively managed.

Solutions also exist for each individual point on the care cycle, with Hitachi taking a vanguard role. For example, data analytics can be utilised to create life-

style intervention programmes during the prevention and check-up phase, helping to reduce the incidence of patients developing lifestyle-related conditions later in life.

Diagnostic and screening technologies have also improved and are now more human-friendly without compromising the quality of medical examinations.



MRI machines with larger and more comfortable openings.

tions, like MRI machines with larger and more comfortable openings. Clinical analysis technology gets a boost too, with major manufacturers of clinical testing equipment like Hitachi incorporating an increasingly broad array of other technologies to optimise the precision and quality of testing processes.

Treatment and therapy, of course, has advanced significantly, not only in their effectiveness but in their impact on patients' well-being.

For example, more closely targeted and less invasive cancer treatments like Hitachi's proton beam therapy system, which has reduced side effects, are now available. And even forms of care that rely heavily on human intervention and attention, such as rehabilitative and elderly care, can benefit from adapting business support systems to meet the needs of daily nursing procedures.

Healthcare is still fundamentally a human activity, catering to vital human needs. But at the same time, technological development plays an important role in infusing the system with the comfort and peace of mind that make up the best quality of care.

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